

# PSYCHOLOGY

**FOR VCE**

UNITS

**3 & 4**

LEO HONG

MATTHEW ROCK

JODIE ALLEN

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# Using Psychology for VCE Units 3&4

## Key features of the Student Book

- » This Student Book combines complete coverage of the VCAA Psychology Study Design 2023–2027 with clear and engaging design.
- » Each print Student Book comes with complete access to all the digital resources available on Student eBook pro.

### Chapter opener

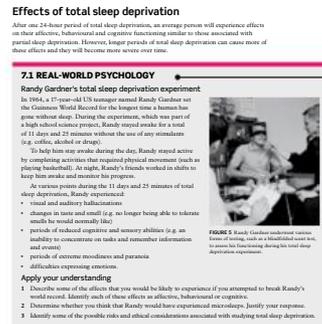
Each chapter begins with a chapter opener that includes:

- key knowledge from the Study Design
- a groundwork quiz to test and support students' prior knowledge
- a list of investigations to support key concepts.



### Topic-based approach

Content is structured in clear topics with key ideas signposted at the beginning.



**Real-world psychology**  
Real-life engaging examples that provide opportunities to apply key knowledge.

### Margin glossary

Literacy support is provided for key terms in the chapter with clear and concise definitions.



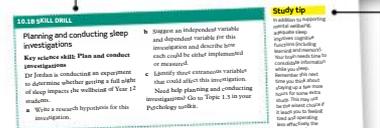
**Challenge**  
Extension questions to deepen understanding.

### Worked examples

Detailed worked examples take students through how to solve different problems.



**Study tips**  
Practical tips support student success in internal assessments and exams.



### Skill drills

Students can practise their key science skills in context.



### Check your learning

Activity boxes with questions and tasks organised using cognitive verbs according to Bloom's taxonomy.

## Exam essentials

Provides tips and strategies for maximising marks on exam responses.

### Part B - Exam essentials

Now that you have completed your revision for Unit 3, it is time to learn and practise some of the skills you will need to answer exam questions like this. To help you, our expert authors have created the following advice and tips to help you maximise your marks on the real-world examination.

#### Exam tip 1 - Referring to conscious and unconscious responses

When answering a question that mentions the nervous system and a specific response, you are expected to identify whether the response is conscious or unconscious. It is also important to justify your classification of "voluntary" or "involuntary" and "automatic" or "voluntary" when describing a response.

#### See it in action

Read the real exam question below and see how the tip has made a difference between the high-scoring and low-scoring responses.

##### QUESTION 2

Madda takes her new pet dog, Biscuit, for a walk along the same route every day. Children often stop Madda to ask her why she is walking Biscuit. (5 marks)

- a Identify which subdivision of the peripheral nervous system is responsible for the movement to put Biscuit and explain the sequence of biological processes that occurs.

Source: VCE 2022 Psychology Exam reproduced by permission of VCAA

##### High-scoring response

The somatic motor system is responsible for the movement to put Biscuit and the autonomic nervous system is responsible for the sequence of biological processes that occurs. The somatic motor system is responsible for the movement to put Biscuit and the autonomic nervous system is responsible for the sequence of biological processes that occurs.

Source: VCE 2022 Psychology Exam reproduced by permission of VCAA

##### Low-scoring response

I mark less for not identifying the subdivision of the nervous system that is responsible for the movement to put Biscuit and the autonomic nervous system is responsible for the sequence of biological processes that occurs.

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### Think like an examiner

To maximise your marks on an exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

#### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

##### QUESTION 1

Fire was standing near a fire with his friends when he noticed the fire becoming hotter against the skin of his legs. To avoid getting burnt by the growing flames, he took a step away from the campfire. The human nervous system has two major divisions. Identify the subdivision of one of these major divisions that activates Fire's responses and outline how the subdivision is involved in Fire's responses. (5 marks)

Source: VCE 2022 Psychology Exam reproduced by permission of VCAA

#### Marking guide

- 1 mark for providing an accurate identification of one division
- 2 marks for correct and coherent outline of the involvement of one of the following in activating the response: the somatic nervous system
- the brain
- the autonomic nervous system

#### Ex the response

Correctly where you did and did not award marks in the above response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

#### Exam tip 2 - Using the command term "justify"

After identifying a correct answer, you may be asked to justify your response. "To justify" means to show adequate grounds or reasons for this conclusion to be reached. Therefore, when asked to justify, it is more important that you provide that reasoning for your answer and do not simply explain the key terms.

#### See it in action

Read the real exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

##### QUESTION 1

b Justify what stage of Selye's General Adaptation Syndrome Rub was in when he started frequently catching colds. Identify your response. (3 marks)

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## Practice SAC 1

### Analysis and evaluation of a psychological case study

Read through the case study and answer the questions.

#### Bella's story

I was born in Tinsford, New South Wales, MY family were Salvation Army and we lived in lots of different places. I was 19 when I found out Dad said, "They're the great, they're crazy. What about the way?" And I said, "Australia isn't gone about the way?" And I said, "Well, I've got a new country!" Any Public Relations Service but it wasn't going to be that.

When I joined the army, I just went to see the Commanding Officer and said, "Boss, can I be the unit photographer?" And he said, "Can you take a photo?" And I said, "Well, I've got a new camera!" Any Public Relations Service but it wasn't going to be that.

East Timor 1999  
When the big conflict occurred in '99 it was mind-boggling. No one was prepared for it. I was so young and inexperienced. I'd never left Australia before. We were parachuted in but we were deployed under war-like circumstances. I was with Australian Platoon. We had loads and loads of rockets and grenades and bullets and our job was to basically keep it safe.

We got into a tent and I said it was hot. We got into a tent and I said it was hot. We got into a tent and I said it was hot. We got into a tent and I said it was hot.

But - and this probably sounds strange - it was kind of boring. It's ordinary and hard as the same time.

But home, you come home and you're trying to keep the experience real but you're also trying to get on with your life. You're trying to get on with your life. You're trying to get on with your life.

But home, you come home and you're trying to keep the experience real but you're also trying to get on with your life. You're trying to get on with your life.

#### Two beers per day, per man

I was a digital artist I joined the army. After the first couple of months in Dili (capital city), you'd get two beers per day, per man, most. So, every day I wasn't a drinker, I'd be drinking. "I can have two beers tonight", it's your friend. And after a while you're not drinking. You're not drinking. You're not drinking.

Change of focus  
I was still very focused on becoming a photographer. I let my mind to that, got my skills up and started writing some articles for the army newspaper. Eventually after some work experience with them, I got a position, got my promotion and then went into the Public Relations Service, which was just photography - it's the best job in the ADP.

Transition  
Back home, my boss knew that my course would be through I still remember with that intensity. I've learnt how to let go and give myself a break and say, "I don't have to be perfect. I don't have to make every decision the right decision. It's my own best."

The session with the psych was a tick and flick questionnaire. Did anything over there disturb you? Yes. Did you feel your life was in danger? Yes. Did you feel your life was in danger? Yes.

Networking challenge  
My partner Kerry and I had only been together for a year and our relationship was pretty good for that. I came back, the depression and the fatigue. I was feeling, sometimes aggressive, withdrawn and with a lack of motivation. A lot of pain. I found it really hard to connect even with the person I loved the most. There were difficulties and despair. Constantly argued, constantly with contempt. I was just going to let it go.

A realisation  
The best bet for me was to do some family counselling. There was no way Kerry could possibly be the support I needed. I've started a photography business and it's going really well. It gets me out of the house and I get to connect with people.

I would give it 4/5 for anything. I'm doing some volunteer work with my counselling, too. I'm trying to change my structure and my self-care.

I've cut my drinking down by half and I'm trying to get motivated about my future and focus. I've learnt how to let go and give myself a break and say, "I don't have to be perfect. I don't have to make every decision the right decision. It's my own best."

## Practice assessments

Four practice assessments to familiarise students with the internal assessments.

## 384 Practice exam

This practice exam is designed to help you review your understanding of all key concepts of the content covered in Units 3 & 4 and practise your skills on a range of exam-style questions. A printable version of this practice exam is available in your glossary.

#### Practice examination

Part	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	9	9	40
Total	49	49	120

#### Part A - Multiple choice

Use the following information to answer questions 1 to 6. Researchers investigated the effectiveness of systematic desensitisation on the severity of phobic symptoms. Thirty-one participants who had been diagnosed with a specific phobia of insects within the last 12 months were randomly selected to take part in the study. Participants were randomly allocated to one of two groups. Group 1 attended eight sessions with a psychologist who applied the techniques of systematic desensitisation in relation to their specific phobia of insects. Group 2 were not exposed to any systematic desensitisation sessions. Prior to the study commencing, participants' baseline heart rate and respiratory rates were measured when presented with a real-life insect. Their heart rate and respiratory rate were again recorded in the presence of a real-life insect at the end of the fourth week of the study and at the end of the eighth week of the study. The results of the study for heart rate are presented in Table 1.

TABLE 1: Heart rate when presented with a real-life insect	Mean baseline heart rate (BPM)	Mean heart rate end of Week 4 (BPM)	Mean heart rate end of Week 8 (BPM)
No use of systematic desensitisation	125	125	125
Use of systematic desensitisation	148	154	110

- Question 1  
An appropriate hypothesis for this study is:  
A individuals who participate in systematic desensitisation will show a reduction in the severity of phobic symptoms compared to those who do not participate in systematic desensitisation sessions.  
B individuals who participate in systematic desensitisation sessions will show an increase in the severity of phobic symptoms compared to those who do not participate in systematic desensitisation sessions.  
C the use of systematic desensitisation will have an impact on the severity of phobic symptoms.  
D the use of systematic desensitisation will have no impact on the severity of phobic symptoms.

#### Question 2

- The type of data collected by this study is:  
A primary, quantitative.  
B primary, qualitative.  
C secondary, quantitative.  
D secondary, qualitative.

#### Question 3

- If the data in the table was to be presented in graphical form, which of the following would be most appropriate?  
A A line graph would be used, with mean heart rate plotted on the y-axis.  
B A line graph would be used, with mean heart rate plotted on the x-axis.  
C A bar chart would be used with mean heart rate plotted on the y-axis.  
D A bar chart would be used with mean heart rate plotted on the x-axis.

#### Question 4

- Which of the following statements accurately explains the results obtained in the study?  
A In the presence of a real-life insect, the parasympathetic nervous system remained dominant for the group who did not use systematic desensitisation, whereas the sympathetic nervous system remained dominant for the group who did use systematic desensitisation.  
B A surge of adrenaline was experienced by the participants at the end of Week 8 in the systematic desensitisation group compared to the group who did not use systematic desensitisation.  
C In the presence of a real-life insect, the sympathetic nervous system remained dominant for the group who did not use systematic desensitisation, whereas the parasympathetic nervous system response became less dominant for the group who did use systematic desensitisation.  
D The use of systematic desensitisation is useful in the short term but not in the long term.

#### Question 5

- A potential extraneous variable in the study is:  
A the small sample size.  
B the uneven number of participants in both groups.  
C only individuals with an insect-based phobia were included in the study.  
D whether any of the participants were taking medication for a pre-existing heart issue.

#### Question 6

The participants potentially experienced psychological harm when faced with their phobic stimulus. Prior to commencing the study, the researchers submitted detailed plans of their research proposal to the human research ethics committee. They provided evidence that any benefits of their research would outweigh any resulting harm.

The ethical concept which the researchers adhered to was:  
A justice.  
B beneficence.  
C non-maleficence.  
D integrity.

#### Question 7

Ken started learning kickboxing at the age of five. By age six, Ken could perform basic kicking techniques. By age eight, Ken could display more advanced kicking patterns and successfully compete against older students. Ken attributes his success to his parents, trained kickboxers who taught Ken by demonstrating kicking techniques and then verbally praising Ken if he reproduced a similar behaviour. The strategy used by Ken's parents can best be described as:  
A operant conditioning and classical conditioning.  
B operant conditioning only.  
C observational learning and operant conditioning.  
D observational learning and classical conditioning.

#### Question 8

Use the following information to answer questions 8 to 10. Trish works as a receptionist for a small business. Her job requires her to answer phone calls and perform computer work, which requires her to sit in front of a screen for extended periods. Recently, Trish has been complaining of eye strain due to staring at the screen for too long. She visited an optometrist who recommended that when Trish is at work, she should set an alarm on her phone to sound every twenty minutes. When the alarm sounds, Trish should go for a walk and avoid looking at screens to minimise eye strain.

#### Question 9

- Trish should go for a walk and avoid looking at screens to minimise eye strain.

## Practice exam questions

Exam-style questions for students to practise writing responses; includes question sets for Unit 3, Unit 4 and combined Units 3 & 4.



**Student investigation chapters**  
Guidance for Unit 4  
AOS 3 Student-designed investigation.

**CHAPTER 11**

## Student-designed investigation

This chapter will guide you through your student-designed or adapted investigation. Each topic will focus on the concepts of investigation design. From planning and conducting to communicating your results. To do this as part of your investigation are also included to help you. Before you get started, make sure you have the details of this assessment task from your teacher. You should always check what the assessment criteria will be, as well as any other tips your teacher might provide to help you succeed.

**KEY KNOWLEDGE**

**Investigation design**

- psychological concepts specific to the selected scientific investigation and their significance, including the definition of key terms
- characteristics of the selected scientific methodology and method, and appropriateness of the use of independent, dependent and controlled variables in the selected scientific investigation

**GROUNDWORK**

This chapter will build on concepts you may have come across in Chapter 1. Before starting the chapter, check how well you know the basics by completing the groundwork quiz.

**UNIT 4 AREA OF STUDY 3**

## Sample poster

**Does a diet rich in fermented foods influence perceived stress levels among adolescents?**

**Introduction**

Emerging research suggests the gut-brain axis, the bidirectional communication network between the gut microbiome and the brain, plays a pivotal role in mental health and stress. Due to the personal impact of diet, particularly consumption of fermented foods, on mental wellbeing is a growing area of interest in stress research. Some strains of bacteria, including *Lactobacillus* and *Bifidobacterium* species, which are often found in fermented foods, have been shown to have positive effects on sustaining a healthy gut, subsequently leading to improved levels of stress. The aim of this study was to investigate if a diet rich in fermented foods could influence perceived stress levels in adolescents. Based on previous research that supports the influence of gut health on stress, it was hypothesised that adolescents who consumed a diet high in fermented foods would report lower levels of perceived stress and show signs of improved mental health.

**Methods**

**Participants**  
The sample consisted of 10 Year 11 VCE students, evenly split between genders and with no reported gastrointestinal or mental health disorders. Participants were randomly assigned to the control (n = 5) or experimental group (n = 5).

**Materials**

- Pen
- Logbook to record results
- Perceived gut health questionnaires
- Food diary sheets

**Procedure**  
For two weeks, the experimental group was instructed to consume a diet rich in fermented foods (e.g. yoghurt, sauerkraut, kefir, kimchi), while the control group maintained their regular diet. To ensure adherence to the diet, participants kept food diaries and took part in weekly follow-up interviews.

Perceived stress levels were measured pre- and post-intervention of the experimental treatment, using the Perceived Stress Scale (PSS), a widely used psychological instrument for measuring the perception of stress. One health was indirectly measured both pre- and post-intervention through participants' self-reported gastrointestinal comfort and regularity. Participants used their gut health as a 4-item scale from 1 to 4, where 1 indicates poor gut health and 4 indicates optimal gut health.

**Results**  
The pre-intervention PSS score for the control group was 26.4, the PSS score increased slightly to 27.4 post-intervention. Average gut health scores of the control group also remained relatively stable, decreasing from 3 (pre-intervention) to 2.4 (post-intervention). Conversely, the experimental group's average PSS score decreased from 28.8 to 24.8, and their average gut health score increased from 2.8 to 3.2.

**Conclusion**  
This study provided evidence to suggest that a diet rich in fermented foods can influence perceived stress levels in adolescents.

**CHAPTER 11 STUDENT-DESIGNED INVESTIGATION 415**

**Figure 1.1** Change in PSS scores in experimental and control groups. Change in perceived gut health in experimental and control groups.

**Figure 1.1a: Change in PSS scores**

Group	Pre-intervention	Post-intervention
Control	26.4	27.4
Experimental	28.8	24.8

**Figure 1.1b: Change in perceived gut health scores**

Group	Pre-intervention	Post-intervention
Control	3.0	2.4
Experimental	2.8	3.2

**Sample investigations**  
Annotated example of Unit 4  
AOS 3 investigation to help  
students create high quality  
assessments.

**UNIT 4 Review**

This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 4, learn some expert tips for answering exams questions, and practice your skills on a range of example questions.

**Part A – Revisit and revise**

Part A of the unit review will help you revisit and revise all the key concepts from Unit 4 and test your understanding to identify strengths and weaknesses in your knowledge so you can better inform your revision.

**Unit 4 Overview**

The chart below shows all the areas of study in Unit 4 and the relevant chapters in your student book. Go to the pages shown to review the key concepts for each chapter.

Area of Study 1	Area of Study 2
Chapter 6 The demand for sleep (page 265)	Chapter 8 Defining mental wellbeing (page 328)
Chapter 7 The importance of sleep for mental wellbeing (page 282)	Chapter 9 Specific phobias (page 352)
	Chapter 10 Maintenance of mental wellbeing (page 362)

**Test your understanding**

Use the following table to guide your revision:

Step 1 – Read the key knowledge for this unit.

Step 2 – Test your understanding of the key knowledge by answering the question(s).

Step 3 – Rate your understanding of each key knowledge from low to high.

Step 4 – Use the topic and page numbers to revise the concepts for which you've identified you need practice.

Key knowledge	Test yourself	Rate yourself	Target your revision
• sleep as a psychological construct is best conceptualised as a naturally occurring altered state of consciousness and is further categorised into REM and NREM sleep	Explain how an EEG machine can recognise when someone is in REM and NREM sleep.	<input type="checkbox"/> High - I've got this bit more practice. <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do!	Topic 6.2 Pages 262–268
• regulation of sleep-wake patterns by internal biological mechanisms, with reference to circadian rhythms, ultradian rhythms of REM and NREM Stages 1–3, the suprachiasmatic nucleus and melatonin	Describe two psychological changes between altered states of consciousness and normal waking consciousness.	<input type="checkbox"/> High - I've got this bit more practice. <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do!	Topic 6.1 Pages 292–300
• differences in, and explanations for, the demands for sleep across the life span, with reference to total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM)	Outline an example of a naturally occurring and an induced altered state of consciousness.	<input type="checkbox"/> High - I've got this bit more practice. <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do!	Topic 6.3 Pages 269–274
• differences in, and explanations for, the sleeping patterns of an adult and a newborn child	Discuss which structures in the brain regulate our circadian rhythm.	<input type="checkbox"/> High - I've got this bit more practice. <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do!	Topic 6.4 Pages 275–279
• identify the total sleep time for newborns, children, teenagers, adults and elderly people.	Distinguish between the sleeping patterns of an adult and a newborn child.	<input type="checkbox"/> High - I've got this bit more practice. <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do!	Topic 6.4 Pages 275–279

**Unit reviews**  
At the end of each unit, students can:

- revisit and revise the content with questions mapped to each key knowledge dot point
- gain tips to succeed in exams and apply their skills in a Think like an examiner activity
- answer practice exam questions.

**Digital hotspots**

Digital icons or hotspots found throughout the student book link to digital resources accessible via the obook pro.

- Video – Watch a video to support understanding of key concepts.
- Assessment – Access a digital quiz for the topic or chapter
- Resource – Access a worksheet or additional resource.

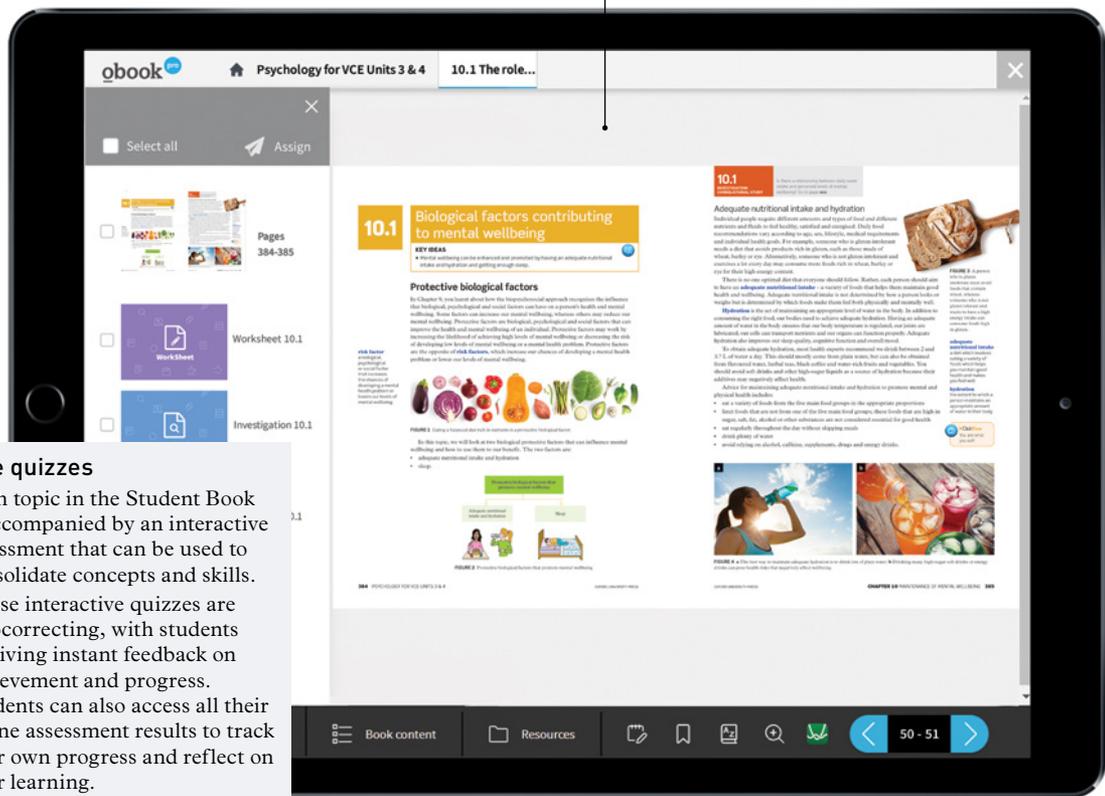
## Key features of Student obook pro

- > Student obook pro is a completely digital product delivered via Oxford's online learning platform, **Oxford Digital**.
- > It offers a complete digital version of the Student Book with interactive note-taking, highlighting and bookmarking functionality, allowing students to revisit points of learning.
- > A complete ePDF of the Student Book is also available for download for offline use and read-aloud functionality.

## Focus on eLearning

### Complete digital version of the Student Book

- This digital version of the Student Book is true to the print version, making it easy to navigate and transition between print and digital.



### Interactive quizzes

- Each topic in the Student Book is accompanied by an interactive assessment that can be used to consolidate concepts and skills.
- These interactive quizzes are autocorrecting, with students receiving instant feedback on achievement and progress. Students can also access all their online assessment results to track their own progress and reflect on their learning.
- Each chapter is supported by a multiple choice quiz to give students further practice with exam-style questions.

- > integrated Australian Concise Oxford Dictionary look up feature
- > videos to engage and strengthen understanding
- > interactive assessments to consolidate understanding
- > integrated Quizlet sets, including real-time online quizzes with live leaderboards
- > access to their online assessment results to track their own progress.

**Benefits for students**

## Key features of Teacher obook pro

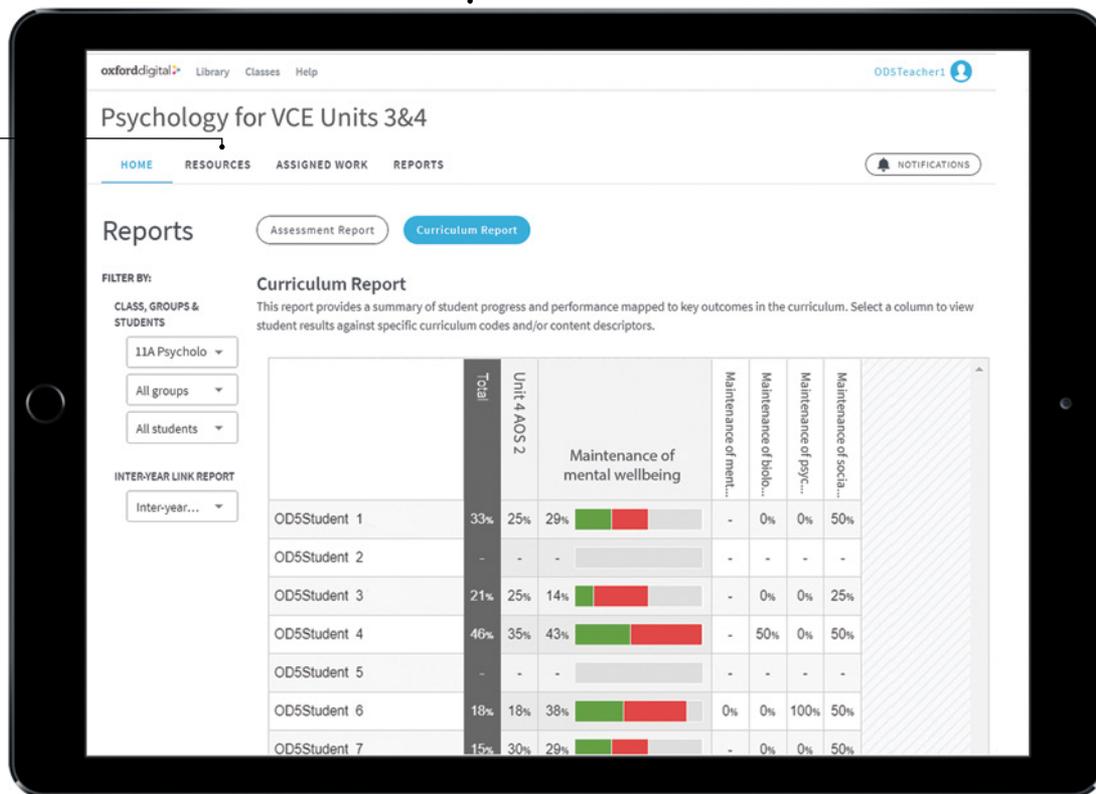
- > Teacher obook pro is a completely digital product delivered via **Oxford Digital**.
- > Each chapter and topic of the Student Book is accompanied by full teaching support. Lesson plans are provided that clearly direct learning pathways throughout each chapter, including ideas for differentiation and practical activities.
- > Teachers can use their Teacher obook pro to share notes and easily assign resources or assessments to students, including due dates and email notifications.

obook <sup>pro</sup>

## Focus on assessment and reporting

### Complete teaching support

- Teaching support includes full lesson and assessment planning, ensuring there is more time to focus on students.



### Additional resources

- Each chapter of the Student Book is accompanied by additional teaching and learning resources to help students progress.

- > In addition to online assessment, teachers have access to an editable practice exam that is provided at the end of Unit 4. This exam is formatted like the VCAA Psychology exam.
- > Teachers are provided with practice exams and guidance for internal assessments, detailed planning resources and reporting functionality that tracks student progress and success against assessments or key knowledge in the Study Design

Benefits for teachers

# MEET THE AUTHORS & REVIEWERS



**Author: Leo Hong**

Leo Hong is an experienced Psychology and Legal Studies teacher at Trinity Grammar School, Kew. Having taught in a range of schools over the past 16 years, Leo has a depth of knowledge and pedagogical experience through his involvement

and implementation of problem-based learning programs and ICT training programs for teachers. He currently holds a Bachelor of Arts/Music, with a major in Psychology and Honours in Criminology, is an assessment writer for other private educational resource companies and VCAA assessor.



**Author: Matthew Rock**

Matthew Rock started his career as a chemist working in energy production and pharmaceuticals whilst finishing studying at Monash University with a double degree in Bachelor of Science/Bachelor of Secondary Education. His passion in science led to a first teaching job at Trinity

Grammar School for five years teaching VCE Chemistry and Psychology gaining skills as a subject coordinator, writer, assessor, and examiner. Matthew's current school, Camberwell Girls Grammar School, allows him to continue his passions in engaging with science, developing student wellbeing projects.



**Author: Jodie Allen**

Jodie Allen has been teaching VCE Psychology since 2001 and has been a VCAA exam assessor for more than 13 years. She has a Bachelor of Arts and Postgraduate Primary and Secondary Teaching degree and is currently teaching at Wellington Secondary College. Over her career

she has held leading teacher and learning specialist roles in areas such as the senior school and student voice & agency. Jodie has worked for OUP in the past writing eBook resources. In her spare time, she likes to spend time with her family, which includes her husband and three daughters and she enjoys playing basketball.



**Author: Elizabeth Blaher-Lucas**

Elizabeth Blaher-Lucas is a passionate and experienced VCE Psychology teacher, VCE psychology assessor, and examination panel member. In addition to having worked in both government and independent school environments for the past 20 years, Elizabeth has also

co-taught 3rd and 4th year preservice psychology teachers at Monash University since 2018.



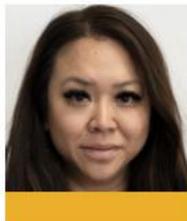
**Author: Paige Jessulat**

Paige Jessulat has taught VCE Psychology and VCE Legal Studies at Frankston High School since 2017. She is passionate about the field of Psychology and has a special interest in the mental health of adolescents which has underpinned her roles

as Year Level Coordinator and Mental Health Week Coordinator. Paige has also been a VCAA Assessor for the Psychology exam since 2020.

**Author: Roger Edwards**

Roger has been involved with the VCE Psychology course since its inception back in 1991. He taught VCE psychology for fifteen years and is currently the Supervising Psychologist at Monash University's Krongold Clinic – a university-based clinic that provides affordable psychological and counselling services.



**Reviewer: Elise Truong**

Elise Truong has taught in the education system since 2009. She worked as an integration aid for four years prior to becoming a teacher in 2013. Elise has taught across the public and private sectors of education including within an alternative setting

for disengaged youth. She holds a Bachelor of Psychology (Interpersonal and Organisational), a Graduate Diploma of Education (Secondary) with a major in English and Psychology and a Masters in Instructional Leadership. Elise has taught in the areas of English, Psychology and is a trained and practising IB Psychology (HL) teacher. Elise has taken up various roles in the educational setting including being a year 11 and 12 coordinator, and a lead teacher.



**Reviewer: Michelle Maxwell**

Michelle Maxwell is a proud Aboriginal woman who brings a self-determined Aboriginal voice and lens to her work, passion and drive for change, focusing on better outcomes for our Aboriginal communities. Michelle currently works as a therapist for Violet Dreaming.

She was formerly the Manager of the Aboriginal Social and Emotional Wellbeing team at the Mental Health Reform Victoria, responsible for implementing the Aboriginal Social and Emotional Wellbeing recommendations from the Royal Commission into Victoria's mental health system. Michelle has years of experience working in and alongside Aboriginal Community Controlled organisations developing the delivery of therapeutic services.



**Reviewer: Sayeeda Bawa-Savant**

Sayeeda Bawa-Savant is a professionally registered career practitioner and certified life coach with degrees and postgraduate studies in psychology, education, educational psychology, Neuro-Linguistic Programming (NLP), and

economics. She began her teaching journey almost two decades ago, in South Africa, with her commitment to her students promoting her to Head of Department roles and Head of a Science Saturday School Program. Sayeeda and her family moved to Australia, where her experience was swiftly recognised by educational institutions. She has held leading teacher roles in psychology and careers coaching, taught business studies, is an exam assessor, and is also a writer of psychology resources. Presently, she teaches in the areas of psychology, business studies, and humanities, while continuing to provide consultancy services in writing, and career and life coaching.

CHAPTER

1

# Psychology toolkit

## KEY SCIENCE SKILLS

- develop aims and questions, formulate hypotheses and make predictions
- plan and conduct investigations
- comply with safety and ethical guidelines
- generate, collate and record data
- analyse and evaluate data and investigation methods
- construct evidence-based arguments and draw conclusions
- analyse, evaluate and communicate scientific ideas.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

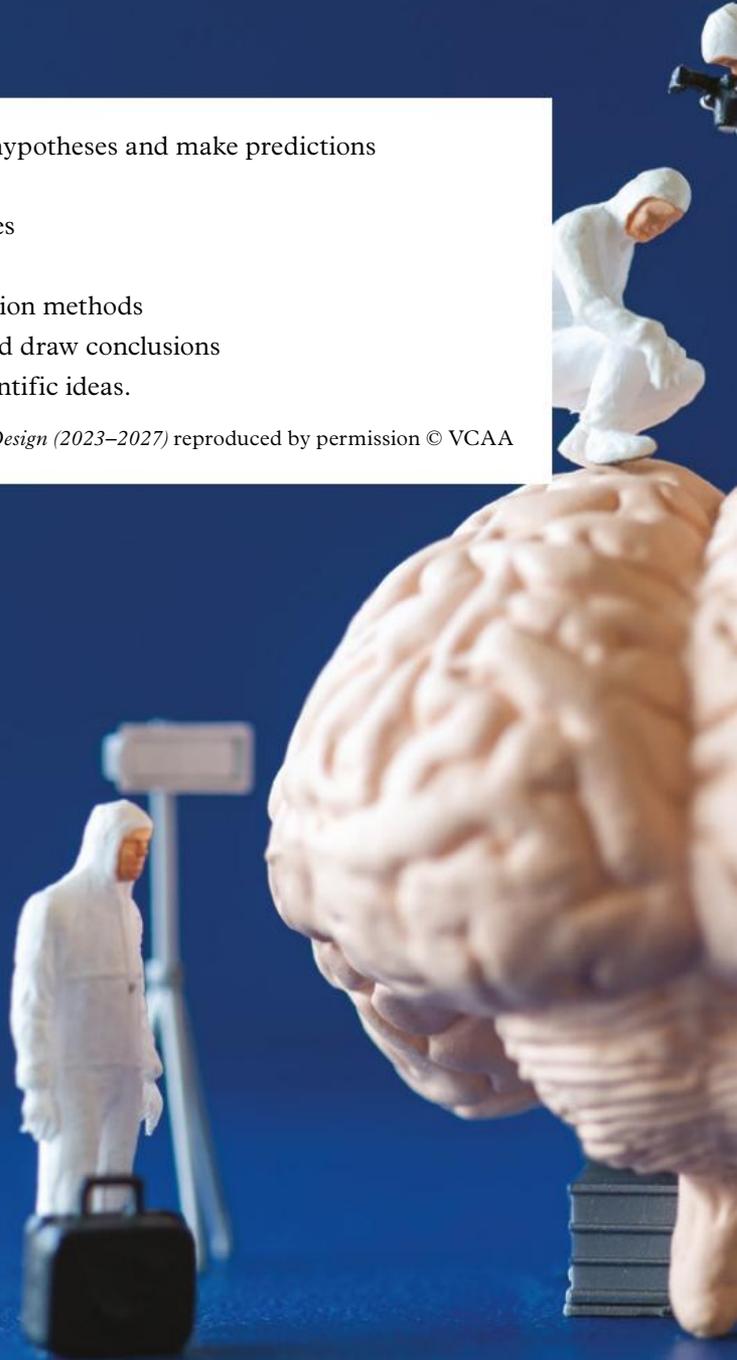


FIGURE 1 Psychology is the scientific study of the human brain and behaviour.

## GROUNDWORK

This topic will build on concepts you may have come across in Units 1 and 2 Psychology junior science. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



Groundwork quiz  
Chapter 1

\* **CONTENT WARNING:** Aboriginal and Torres Strait Islander peoples are advised that this topic may include images of people now deceased.



# 1.1

## Overview of VCE Psychology

### KEY IDEAS

- ✦ Studying psychology can lead to a diverse range of career pathways.
- ✦ VCE Psychology is divided into units and areas of study.
- ✦ The key science skills and their application are important for success in VCE Psychology.



### psychology

the systematic study of the mind (mental processes) and behaviour

**Psychology** is the scientific study of the human brain and its functions and of behaviour. Psychologists use the scientific method to investigate relationships that exist between our brain and nervous system and to investigate and explore the experience of behaviours, thoughts and emotions.

Studying psychology can lead to many different career paths, and it provides a valuable understanding of what influences the way we think, feel and act. This understanding can be used to improve our learning, mindset, relationships and overall quality of life.



**FIGURE 1** Psychology is the scientific study of the human brain, its functions and behaviour.

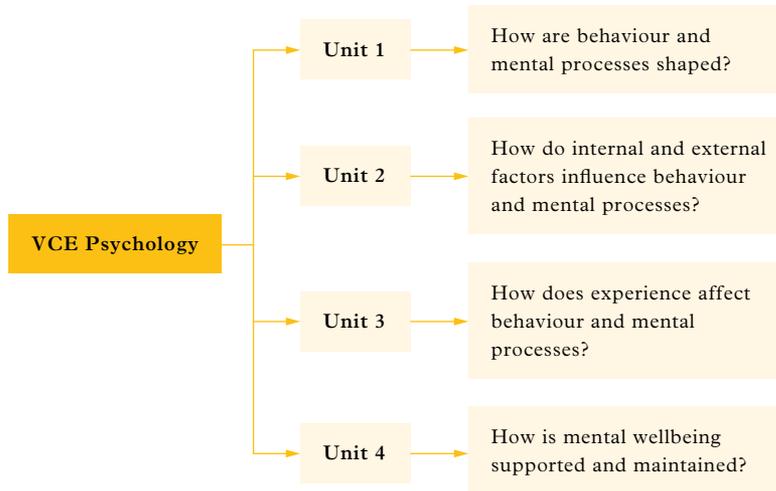
## Structure of the VCE Psychology course

Studying VCE Psychology provides you with the opportunity to engage in a range of inquiry tasks and develop key science skills. You will develop an understanding of how the mind works and what influences behaviour, and will be able to make links between theory, knowledge and practice.

The structure of the VCE Psychology course is laid out in the VCE Psychology Study Design. The course consists of four units. Units 1 and 2 are designed to be the first year of the VCE Psychology course as they form a strong foundation of psychological concepts for Units 3 and 4. However, Units 1 and 2 are not prerequisites for studying Units 3 and 4. An overview of the VCE Psychology units is shown in Figure 2, and Units 3 and 4 are summarised in Table 1.



Resource  
VCE Psychology  
Study Design



**FIGURE 2** The structure of the VCE Psychology course

**TABLE 1** Areas of Study in Units 3 and 4 Psychology

Unit 3 How does experience affect behaviour and mental processes?	
Area of Study	Description
1 How does the nervous system enable psychological functioning?	In this area of study, you will learn about: <ul style="list-style-type: none"> <li>• the roles of different subdivisions of the central and peripheral nervous systems</li> <li>• the role of neurotransmitters in the transmission of neural information</li> <li>• synaptic plasticity</li> <li>• the psychobiological process of stress</li> <li>• the interaction of gut microbiota with stress and the nervous system.</li> </ul>
2 How do people learn and remember?	In this area of study, you will learn about: <ul style="list-style-type: none"> <li>• models to explain learning</li> <li>• memory as the process by which knowledge is encoded, stored and later retrieved</li> <li>• the interconnectedness of brain regions in storing explicit and implicit memories and the role of semantic and episodic memory in cognition</li> <li>• the use of mnemonics to increase the encoding, storage and retrieval of information</li> <li>• the contribution of Aboriginal and Torres Strait Islander knowledges and perspectives in understanding memory and learning.</li> </ul>
Unit 4 How is mental wellbeing supported and maintained?	
Area of Study	Description
1 How does sleep affect mental processes and behaviour?	In this area of study, you will learn about: <ul style="list-style-type: none"> <li>• sleep as an example of an altered state of consciousness</li> <li>• the effects of sleep deprivation on psychological functioning</li> <li>• the sleep–wake cycle and circadian rhythm disorders</li> <li>• how zeitgebers and sleep hygiene can be used to improve the sleep–wake cycle.</li> </ul>
2 What influences mental wellbeing?	In this area of study, you will learn about: <ul style="list-style-type: none"> <li>• the concept of mental wellbeing as a continuum</li> <li>• the influence of internal and external factors on mental wellbeing</li> <li>• Aboriginal and Torres Strait Islander peoples’ multidimensional and holistic views of wellbeing.</li> </ul>
3 How is scientific inquiry used to investigate mental processes and psychological functioning?	In this area of study, you will conduct an investigation that you have designed or adapted yourself. The investigation will relate to concepts you have learnt about in Unit 3 or Unit 4.

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**school-assessed coursework (SAC)**

an internal assessment that contributes to a subject's study score

**study score**

a rank of how a student performed in a subject relative to all other students enrolled in that subject

## School-assessed coursework in VCE Psychology

In Units 3 and 4, you will be assessed on five areas of study, two in Unit 3 and three in Unit 4. Each assessment or “**school-assessed coursework (SAC)**” will run mostly during class time and is designed to test you against an area of study outcome. The outcome outlines what you should be able to do by the end of the area of study if you have understood and applied your knowledge successfully. The SAC for Unit 3 contributes 20 per cent to your **study score**, and the SAC for Unit 4 contributes 30 per cent to your study score. Unit 4 contributes more to your study score because it also includes a research investigation for Area of Study 3, which is structured slightly differently from the other SAC types (Tables 2 and 3). You can use Chapter 11 Student-designed investigation to guide you through Unit 4 Area of Study 3.

**TABLE 2** Areas of Study 1 and 2 outcomes and assessment tasks

Area of Study	Outcome	Assessment
Unit 3 Area of Study 1: How does the nervous system enable psychological functioning?	Students should be able to analyse how the functioning of the human nervous system enables a person to interact with the external world, and evaluate the different ways in which stress can affect psychobiological functioning.	For each outcome in Areas of Study 1 and 2, you will be asked to complete one of the following SAC types: <ul style="list-style-type: none"> <li>analysis and evaluation of at least one psychological case study, experiment, model or simulation</li> <li>analysis and evaluation of generated primary and/or collated secondary data</li> <li>comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities</li> <li>analysis and comparison of two or more contemporary media texts.</li> </ul> Each task type can be selected only once across Units 3 and 4. Your teacher will decide on which task type is used for each area of study.
Unit 3 Area of Study 2: How do people learn and remember?	Students should be able to apply different approaches to explain learning to familiar and novel contexts and discuss memory as a psychobiological process.	
Unit 4 Area of Study 1: How does sleep affect mental processes and behaviour?	Students should be able to analyse the demand for sleep and evaluate the effects of sleep disruption on a person's psychological functioning.	
Unit 4 Area of Study 2: What influences mental wellbeing?	Students should be able to discuss the concept of mental wellbeing, apply a biopsychosocial approach to explain the development and management of specific phobia, and discuss protective factors that contribute to the maintenance of mental wellbeing.	

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**TABLE 3** Area of Study 3 outcomes and assessment tasks

Area of Study	Outcome	Assessment
Unit 4 Area of Study 3: How is scientific inquiry used to investigate mental processes and psychological functioning?	Students should be able to design and conduct a scientific investigation related to mental processes and psychological functioning, and present an aim, methodology and method, results, discussion and conclusion in a scientific poster.	A scientific poster that does not exceed 600 words and adheres to the structure outlined on pages 15 and 16 of the VCAA Psychology Study Design

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## External assessment in VCE Psychology

After you have finished learning all the key knowledge and have completed all your SACs, you will be assessed at the end of the VCE Psychology course by an external exam. Unlike your SACs, the external exam is not written or marked by your teachers but is created and marked by VCAA. It will test you on the key knowledge from Units 3 and 4 as well as your application of the key science skills. Your performance on the VCE Psychology exam contributes 50 per cent to your final study score.

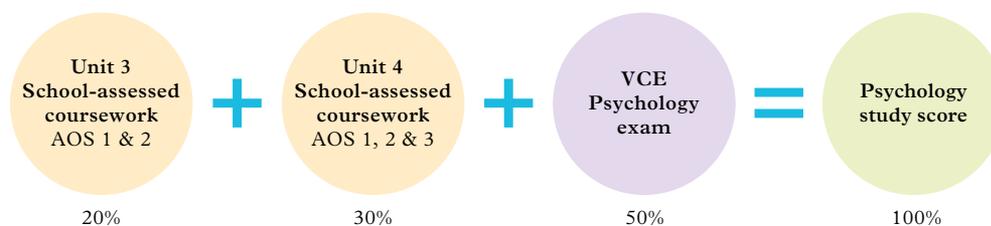


FIGURE 3 Summary of assessment in VCE Psychology

## Key science skills

In addition to key knowledge (which we will cover in Chapters 2 to 10), VCE Psychology also requires you to develop and apply a range of key science skills. These skills are specified in the VCE Psychology Study Design and are listed in Table 4. Chapters 1, 6 and 11 will help you develop each of these skills.

The key science skills are applicable to all areas of study in Units 1 to 4 of the VCE Psychology course. They are especially important for planning and conducting investigations for your assessment tasks.

TABLE 4 Key science skills

Key science skill	VCE Psychology Units 1 to 4
Develop aims and questions, formulate hypotheses and make predictions	<ul style="list-style-type: none"> <li>identify, research and construct aims and questions for investigation</li> <li>identify independent, dependent and controlled variables in controlled experiments</li> <li>formulate hypotheses to focus investigations</li> <li>predict possible outcomes of investigations</li> </ul>
Plan and conduct investigations	<ul style="list-style-type: none"> <li>determine appropriate investigation methodology: case study; classification and identification; controlled experiment (within subjects, between subjects, mixed design); correlational study; fieldwork; literature review; modelling; product, process or system development; simulation</li> <li>design and conduct investigations; select and use methods appropriate to the investigation, including consideration of sampling technique (random and stratified) and size to achieve representativeness, and consideration of equipment and procedures, taking into account potential sources of error and uncertainty; determine the type and amount of qualitative and/or quantitative data to be generated or collated</li> <li>work independently and collaboratively as appropriate and within identified research constraints, adapting or extending processes as required and recording such modifications</li> </ul>
Comply with safety and ethical guidelines	<ul style="list-style-type: none"> <li>demonstrate ethical conduct and apply ethical guidelines when undertaking and reporting investigations</li> <li>demonstrate safe laboratory practices when planning and conducting investigations by using risk assessments that are informed by safety data sheets (SDS), and accounting for risks</li> <li>apply relevant occupational health and safety guidelines while undertaking practical investigations</li> </ul>
Generate, collate and record data	<ul style="list-style-type: none"> <li>systematically generate and record primary data, and collate secondary data, appropriate to the investigation</li> <li>record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data</li> <li>organise and present data in useful and meaningful ways, including tables, bar charts and line graphs</li> </ul>
Analyse and evaluate data and investigation methods	<ul style="list-style-type: none"> <li>process quantitative data using appropriate mathematical relationships and units, including calculations of percentages, percentage change and measures of central tendencies (mean, median, mode), and demonstrate an understanding of standard deviation as a measure of variability</li> <li>identify and analyse experimental data qualitatively, applying where appropriate concepts of: accuracy, precision, repeatability, reproducibility and validity; errors; and certainty in data, including effects of sample size on the quality of data obtained</li> <li>identify outliers and contradictory or incomplete data</li> <li>repeat experiments to ensure findings are robust</li> <li>evaluate investigation methods and possible sources of error or uncertainty, and suggest improvements to increase validity and to reduce uncertainty</li> </ul>

(continued)

TABLE 4 continued

Key science skill	VCE Psychology Units 1 to 4
Construct evidence-based arguments and draw conclusions	<ul style="list-style-type: none"> <li>distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas</li> <li>evaluate data to determine the degree to which the evidence supports the aim of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation</li> <li>evaluate data to determine the degree to which the evidence supports or refutes the initial prediction or hypothesis</li> <li>use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with evidence base and relevant to the question under investigation</li> <li>identify, describe and explain the limitations of conclusions, including identification of further evidence required</li> <li>discuss the implications of research findings and proposals, including appropriateness and application of data to different cultural groups and cultural biases in data and conclusions</li> </ul>
Analyse, evaluate and communicate scientific ideas	<ul style="list-style-type: none"> <li>use appropriate psychological terminology, representations and conventions, including standard abbreviations, graphing conventions and units of measurement</li> <li>discuss relevant psychological information, ideas, concepts, theories and models and the connections between them</li> <li>analyse and explain how models and theories are used to organise and understand observed phenomena and concepts related to psychology, identifying limitations of selected models/theories</li> <li>critically evaluate and interpret a range of scientific and media texts (including journal articles, mass media communications, opinions, policy documents and reports in the public domain), processes, claims and conclusions related to psychology by considering the quality of available evidence</li> <li>analyse and evaluate psychological issues using relevant ethical concepts and guidelines, including the influence of social, economic, legal and political factors relevant to the selected issue</li> <li>use clear, coherent and concise expression to communicate to specific audiences and for specific purposes in appropriate scientific genres, including scientific reports and posters</li> <li>acknowledge sources of information and assistance, and use standard scientific referencing conventions</li> </ul>

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## 1.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “psychology”.
- 2 Identify the format that must be used to present the Unit 4 Area of Study 3 student-designed investigation.
- 3 Reflect on the key science skills listed in Table 4 and identify three to five skills you need to practise most.

### Apply, analyse and compare

- 4 Summarise how your knowledge and skills will be assessed for Outcomes 1 and 2 in VCE Psychology Units 3 and 4.

- 5 Summarise how your knowledge and skills will be assessed for Outcome 3 in VCE Psychology Unit 4.

### Design and discuss

- 6 Research a field of psychology that interests you and create an infographic that includes:
  - a description of what the field focuses on
  - the different career opportunities related to that field of study
  - a summary of the qualifications needed to work in the career opportunities identified above
  - a summary of how your chosen field of psychology has a positive impact on the world.

# 1.2

## Developing aims, questions and hypotheses

### KEY IDEAS

- ✦ A research question states the specific problem or issue on which your investigation will be based.
- ✦ An aim is a statement of what is to be investigated.
- ✦ A hypothesis is a testable statement that should include a prediction about the outcome of an investigation, based on scientific reasoning.



#### research question

a clear, focused and concise query that guides an investigation and forms the foundation of a research study

#### aim

the primary focus of the research that states the purpose of the research

#### scientific method

a standardised way of making observations, gathering data, testing hypotheses and interpreting results to establish theories to describe and measure behaviour

## The scientific method

Psychology is a science that uses research methods and experimental evidence to test theories and understand human nature. Psychologists use a variety of research methods to help answer **research questions** – these are the specific inquiries that researchers want to find more information about through investigations. The research **aim** is the overall purpose of conducting a specific research investigation.

To investigate research questions, psychologists use the **scientific method**, a process of problem-solving that is applied in all sciences. There are eight main stages of the scientific method, as shown in Figure 1. You will notice that Figure 1 shows the scientific method as a cyclical process. This is because if the findings lead to more questions about a particular area, it may trigger the process again and a new investigation will begin.

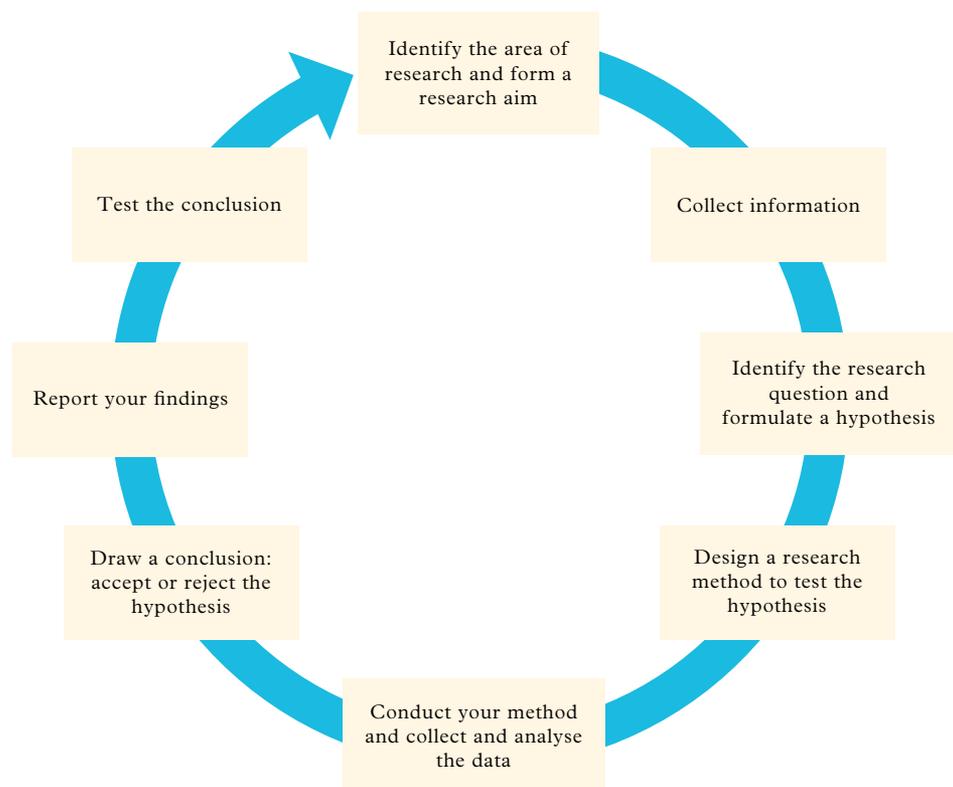


FIGURE 1 Steps in the scientific method

To see exactly how the scientific method works, consider the example of some interesting research by Thai et al. (2023).

- 1 Identify the area of research and form a research aim.** Thai and colleagues wished to investigate whether a reduction in social media usage could result in improved appearance and weight esteem in young people with emotional distress.
- 2 Collect information.** From previous research, it appeared that heavy or frequent users of social media tended to have more body issue concerns. Studies also suggested that distressed youth appear to be more susceptible to the negative effects of social media use.
- 3 Identify the research question and formulate a hypothesis.** Thai and colleagues asked the question: “Can social media use reduction lead to improvements of weight and body esteem in youth who experience emotional distress?” They formed the hypothesis that participants who limited their social media usage (SMU) would exhibit greater improvement in both appearance and weight esteem after four weeks, compared to the control group, who did not limit their SMU.
- 4 Design a research method to test the hypothesis.** Participants consisted of Canadian undergraduate psychology students aged between 17 and 25 who used social media at least two hours per day and displayed symptoms of depression and anxiety. A pre-test was conducted to assess each participant’s baseline appearance and weight esteem. Participants were randomly assigned to one of two groups: the control or intervention group. Participants in the intervention group were instructed to restrict their SMU to a maximum of one hour per day for four weeks; participants in the control group were given no restrictions on SMU. After four weeks a post-test was conducted to assess each participant’s baseline appearance and weight esteem.
- 5 Collect and analyse the data.** It was found that compared to the control group, the intervention group had significant increases in appearance and weight esteem.
- 6 Draw a conclusion – support or refute the hypothesis.** Based on results, the research hypothesis was supported.
- 7 Report findings.** This study was published in a journal called *Psychology of Popular Media*.
- 8 Test the conclusion.** Findings of the study can now be tested by other researchers or continue to be explored by Thai and colleagues.

### Study tip

Research questions can evolve from a psychology topic or phenomenon of your interest and can be based on your observations, experiences, thoughts or reading.



**FIGURE 2** Thai et al. (2023) wanted to investigate whether reducing social media usage could result in improved appearance and weight esteem in young people with emotional distress.

# Variables

A **variable** is a quantity or quality that can change at different times or in different places. In psychology, we are mainly interested in properties that vary from person to person or within the same person at different times. These include:

- age
- race
- gender
- level of education
- aggression
- position in family
- income
- eye colour
- quality of life
- feelings of wellbeing.

In psychology and other sciences, we often look to find and assess the relationships between variables. To do this, scientists perform investigations that manipulate, measure and control variables to examine what sort of relationships exist between them.

## Independent and dependent variables

An **independent variable (IV)** is a variable that is deliberately manipulated or altered in some way by the experimenter. This is planned before the experiment begins. Simple experiments use one independent variable with two values (e.g. male/female or yes/no). In Thai et al.'s research, it was social media usage (restricted or unrestricted). In a more complex experiment, the IV could be continuous – that is, it could have a range of values on a scale; for example, age, body mass or levels of optimism.

The **dependent variable (DV)** is the property that is measured in the research. Its value depends on the IV and that is why it is called “dependent”. The DV is therefore the property that the researcher believes will change as result of changes to the value of the IV. The DV is usually continuous (it has any value within a certain range) and should be stated through how it is measured (e.g. in litres, seconds or bpm).

## Extraneous and confounding variables

An **extraneous variable** is any variable other than (“extra to”) the IV that may cause a change in the value of the DV. For example, when investigating how blood alcohol concentration (IV) affects driving performance (DV), the type of car being driven, traffic conditions and weather are all examples of extraneous variables that may affect driving performance. To ensure that any change in the DV is due to the IV, extraneous variables need to be removed or manipulated to be kept constant. For the example above, this would include making sure all driving performance tests use the same model car and occur under the same traffic and weather conditions. An extraneous variable that has been removed or manipulated so that it no longer influences the DV is called a **controlled variable**.

### **variable**

a factor, trait or condition that can exist in differing amounts or types

### **independent variable (IV)**

the variable that is changed or manipulated during an investigation

### **dependent variable (DV)**

the variable that is observed or measured when the independent variable is changed during an investigation

### **extraneous variable**

a variable other than the independent variable that may cause changes in the value of the dependent variable

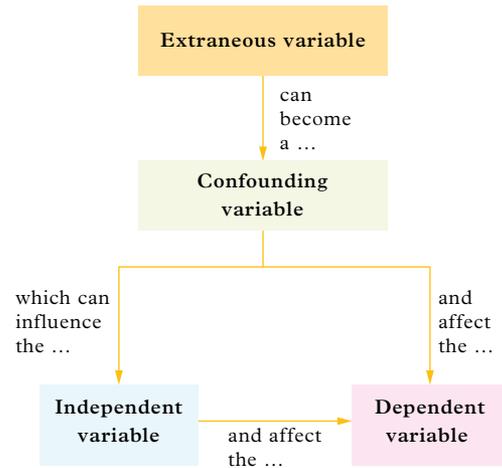
### **controlled variable**

a variable that a researcher keeps constant (controls) in an investigation

**confounding variable**

an unwanted variable that has a systematic effect on the value of the dependent variable. If a confounding variable exists, no valid conclusions about the research can be drawn

A **confounding variable** is a variable (other than the IV) that has directly or systematically affected the DV. A confounding variable could be an uncontrolled for extraneous variable, or a type of variable that cannot be controlled for. For example, if you were investigating how blood alcohol concentration (BAC) affects driving performance, a confounding variable could be the dehydration of all the participants. Dehydration can increase a person’s BAC (alters the IV) and can also cause loss of concentration (which can affect the DV). Therefore, if participants were dehydrated, the researcher would not be able to attribute any changes in driving performance to BAC levels. If a confounding variable exists, results are not internally valid because the DV cannot be attributed to the IV and the experiment has not accurately tested what it set out to test. Confounding variables are only able to be identified after an experiment is completed and after results have been analysed.



**FIGURE 3** A summary of how extraneous and confounding variables can affect the results (dependent variable). Remember that if a confounding variable occurs, it is impossible to determine whether the change in DV is due to the IV or a confound.

**Hypothesis**

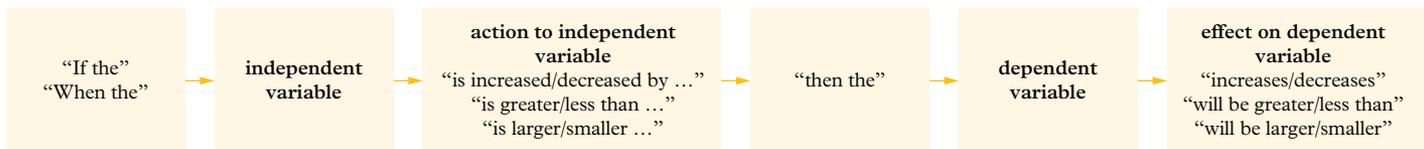
**hypothesis**

a testable statement that includes a prediction about the outcome of an investigation based on scientific reasoning

A **hypothesis** in psychological research is a clear statement predicting how changes in the independent variable(s) will affect the value of the dependent variable(s). A hypothesis should also clearly state the population about which the researcher intends to draw conclusions.

The hypothesis does not need to include how variables are measured; however, this information should be clearly stated in the introductory part of the research report. One method to make sure you include everything in your hypothesis is to use a structure such as “If ... then” or “When ... the ... then ...”. Suggested phrases for formulating a hypothesis using this approach are listed in Figure 4.

An example hypothesis might be: “**If** the blood alcohol concentration in drivers is greater than 0.05 **then** reaction speed will decrease.” Remember that different hypothesis writing styles can be equally effective. This hypothesis could also be written as: “It was hypothesised that drivers with a blood alcohol concentration greater than 0.05 would experience a decline in reaction speed.”



**FIGURE 4** Constructing a hypothesis using suggested phrases

## 1.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify the steps of the scientific method.
- 2 Define:
  - a independent variable
  - b dependent variable.
- 3 Explain why the scientific method is a cyclical process.

### Apply, analyse and compare

- 4 In each situation below, determine what the independent and dependent variables are.
  - a Primary school children who watch violent cartoons on television have more nightmares than those who watch funny cartoons.
  - b By the age of six, children who were in daycare before the age of six months are socially better adjusted than those who stayed with a sole caregiver.
  - c Children who sleep more than nine hours each night have better concentration in school than those who sleep less than nine hours.
- 5 Distinguish between a research aim and research question.
- 6 Compare extraneous variables and confounding variables.

### Design and discuss

- 7 A researcher theorises that students who eat cereal in the morning will have lowered exam performance. Propose a research question and hypothesis for this theory.
- 8 A researcher had a theory that an increased intake of sugar improves people's problem-solving ability. They define increased sugar intake as a 10 per cent increase in sugar intake per day. The researcher also needs to decide how they could measure "problem-solving ability". Discuss one way the researcher could measure "problem-solving ability".



**FIGURE 5** What sort of hypothesis could be written for an investigation that explores if students who eat cereal in the morning perform worse on exams?

# 1.3

## Planning and conducting investigations

### KEY IDEAS

- ✦ Different scientific methodologies can be used to conduct investigations.
- ✦ Participants in a psychological investigation can be selected through random or stratified sampling techniques.
- ✦ Within-subjects, between-subjects and mixed designs have specific advantages and disadvantages for different types of controlled experiments.



In VCE Psychology Unit 3, you will complete at least 10 hours of practical work and in Unit 4, you will complete at least 20 hours of practical work. Scientific investigations are important to the VCE Psychology course and can be used to collect data. You can complete an investigation individually, in a small group or with the whole class; however, all the work required for assessment purposes must be your own work.

### Scientific investigation methodologies

#### methodology

the approach used to plan and conduct a scientific investigation

A variety of **methodologies** can be used when planning and conducting scientific investigations. A methodology refers to the approach you take to answer your scientific question. There are many ways to investigate your research question and collect data. The different methodologies that you will encounter in VCE Psychology are outlined in Table 1. You can also find examples of each of these in Chapter 12 Investigations.



**FIGURE 1** Modelling can help us to investigate scientific concepts and phenomena; it is especially useful if we are unable to observe the real thing in the lab.



**FIGURE 2** Fieldwork allows us to investigate phenomena that occur at a specific location. For example, studying the behaviour of toddlers at an early learning centre.

**TABLE 1** Key scientific investigation methodologies in VCE Sciences

Investigation method	Investigation outline	Example	Strengths and weaknesses
<b>Case study</b>	A case study involves the investigation of a specific event, an activity or a problem that contains a real or hypothetical situation.	Read about people's different experiences of synaesthesia and use those experiences to answer questions.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>provides in-depth qualitative data about events or experiences</li> <li>allows the researcher to study experiences that may be unethical or impossible to replicate</li> <li>can lead to new research</li> <li>useful when participant selection is limited.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>often focuses on one person or a small group of participants so results may not be representative of a population or may be externally invalid.</li> </ul>
<b>Classification and identification</b>	Classification refers to the arrangement of phenomena, objects or events into smaller, more manageable groups. Identification is a process of recognising things as belonging to particular sets or belonging to new sets.	Classify thoughts, feelings and behaviours as adaptive or maladaptive.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>classification can be used to narrow down groups</li> <li>classification or identification of a disorder can help people access better treatment for conditions</li> <li>classification or identification of a disorder can be used to make predictions.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>grouping people using classification or identification may lead to labelling and subsequently stereotyping, prejudice, discrimination and stigma</li> <li>a lot of information is required to create classification and identification categories</li> <li>classification or identification groups may not be entirely representative, particularly when dealing with subjective or nuanced phenomena.</li> </ul>
<b>Controlled experiment</b>	A controlled experiment investigates the relationship between an independent variable and a dependent variable. All other variables are controlled so they do not affect the outcome of the investigation.	Test whether the presence of music affects memory recall.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can identify cause/effect relationships between variables</li> <li>internally and externally valid results can be generalised to the population.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>controlled conditions may be difficult to maintain and subject to extraneous and confounding variables</li> <li>artificial or lab settings may influence behaviour of participants</li> <li>if settings are too artificial they may render results externally invalid.</li> </ul>

*(continued)*

TABLE 1 continued

Investigation method	Investigation outline	Example	Strengths and weaknesses
<b>Correlational study</b>	Planned observation and recording of events and behaviours that have not been manipulated or controlled to understand the relationships/associations that exist between variables, to identify which factors may be of greater importance and to make predictions.	Conduct a survey to determine if social media usage decreases with age.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can help determine how strong or weak the relationship between two variables is</li> <li>observation of behaviours is more natural since variables have not been manipulated</li> <li>established correlated relationships can be used to make predictions about variables.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>does not confirm if one variable causes a change in the other</li> <li>a large amount of data is needed</li> <li>since variables are unmanipulated, an extraneous variable could influence results, therefore causing low internal validity.</li> </ul>
<b>Fieldwork</b>	Fieldwork involves going to a specific location to investigate a phenomenon or problem that is unique to that site. When completing fieldwork, you should record site-specific data in your logbook, such as observations and data collected about the conditions of the environment.	Visit a primary school to observe different cognitive stages of development.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>able to provide site- or environment-specific data.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>can be expensive to run and conduct</li> <li>can be time-consuming to organise the logistics of fieldwork (such as travel, site permissions)</li> <li>limited control over extraneous variables</li> <li>if observing masses of people in public settings, there may be ethical concerns with lack of informed consent.</li> </ul>
<b>Literature review</b>	A literature review involves researching, gathering and interpreting secondary sources (also called “literature” by academics) to answer a research question. This may be used to answer questions that have already been asked by other scientists, or to develop a background understanding before you start your own investigation.	Gather secondary data on the gut microbiome to assess whether probiotics are worth adding to a balanced diet.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can shed light on how much knowledge has been established about a particular subject</li> <li>can help identify gaps in knowledge about a particular subject and inform direction of future research</li> <li>uses secondary data so can be more time- and cost-effective than conducting primary research.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>can be vulnerable to selection bias</li> <li>there may not be enough existing research to adequately respond to the research question.</li> </ul>
<b>Modelling</b>	A physical, conceptual or mathematical model simulates a concept or system to assist understanding.	Use modelling clay to build a brain.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can help consolidate complex ideas or subjects through more straightforward representations</li> <li>can allow unobservable events to be visualised.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>some psychological theories may be difficult to represent through modelling.</li> </ul>

(continued)



FIGURE 3 You may use plasticine to model structures in psychology.

TABLE 1 continued

Investigation method	Investigation outline	Example	Strengths and weaknesses
<b>Product, process or system development</b>	Product, process or system development involves designing a thing, process or system to meet a need. This should link scientific knowledge to technological developments.	Design a piece of sporting equipment to prevent concussion and traumatic brain injury.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can help create new solutions to existing issues or problems</li> <li>can shed light on the strengths and weaknesses of existing products, processes and systems.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>can be time- and labour-intensive.</li> </ul>
<b>Simulation</b>	Simulations involve using an existing model to investigate a scientific phenomenon by manipulating variables in the simulation. Simulations are useful when variables cannot be manipulated in real life.	Use an application to simulate the experience of colour vision deficiency and how this condition affects perception.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>allows for manipulation of variables that would otherwise be difficult to manipulate in real life</li> <li>can be a cost-effective alternative to conducting physical research</li> <li>can be used to make predictions.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>complex simulation software may be expensive to purchase</li> <li>simulations are artificial and might not be able to be generalised to the broader population.</li> </ul>

Source: Adapted from *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## Participant selection

In research, we are always interested in drawing conclusions that are valid for a particular group of people. The group about which we wish to draw conclusions is referred to as the **population**.

It is rarely possible to perform an experiment on every member of a population. As a result of this, psychologists select a smaller number of individuals from the population to be participants in their research and to represent the population. This group is referred to as the **sample** and the selection of participants for research is called “sampling”. Sampling procedures must ensure that the sample is representative of the population from which it is drawn. This means that personal characteristics of the sample should be distributed in the same proportions as in the population. Two procedures used to make sure that the sample is representative are random sampling and stratified sampling (or stratified random sampling).

### Random sampling

**Random sampling** is a sampling procedure in which every member of the population has an equal chance of being selected – just as lottery numbers do in each draw.

Imagine that we wish to draw conclusions about all 18,000 Psychology students in Victoria. The VCAA has allocated a number to each student, so all we need to do is put each number in a barrel, roll the barrel and pull out one number at a time until we have enough for our experiment.

This process would be very time-consuming, so luckily, we can use technology to help. Scientific calculators and computers have the capacity to generate a list of random numbers. If we instruct the computer to give (for example) 180 random numbers between 1 and 18,000, we can then get a list of the population from VCAA and select the students whose numbers appear in those 180 different positions shown in the random number list.

#### population

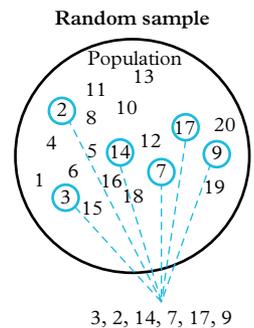
the group of people about whom scientists want to draw conclusions

#### sample

the members of the population who have been chosen to take part in the research

#### random sampling

a sampling procedure in which every member of the population has an equal chance of being selected



**FIGURE 4** Random sampling is a selection process where everyone in the population has an equal chance of being selected for the sample.

## Stratified sampling

### stratified sampling

a sampling process by which the effects of a certain variable can be eliminated as a possible confound in an experiment

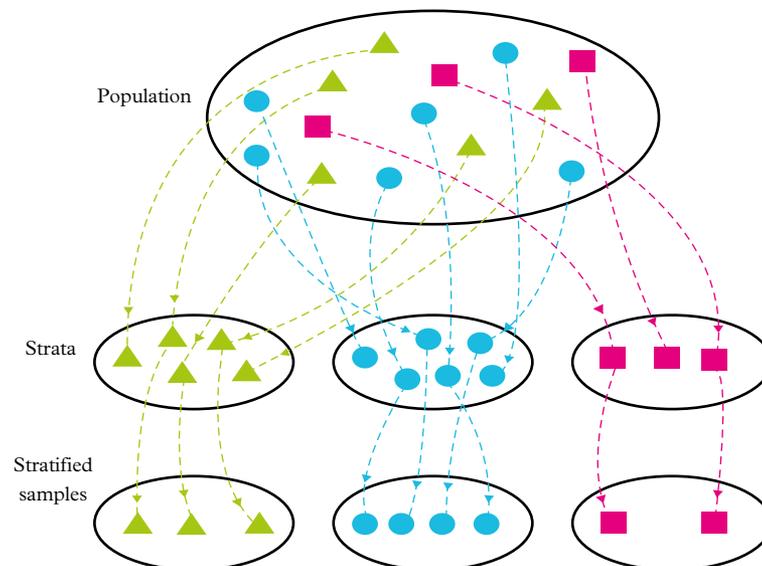
**Stratified sampling** (or stratified random sampling) is a process by which the effects of a certain variable can be removed as a possible confound in an experiment. This is done by ensuring that this variable is distributed within the sample in the same proportions as it is within the population. For example, if we wanted to draw conclusions about VCE Psychology students, we should first note that there might be 18,000 students in total, 13,000 who are female, 5000 who are male. If our sample had an equal number of males and females, the sample would not represent the population and our results could not be generalised to the population. In this case, stratification by sex would mean a sample of 180 students should consist of 130 females and 50 males to eliminate the possible confounding effects of sex.

Stratified sampling involves a number of procedures:

- 1 Identifying a property that may interfere with the effects of the IV on the value of the DV.
- 2 Measuring that property for each member of the population.
- 3 Dividing the population into particular strata (groups) based on the value of that variable.
- 4 Deciding on the number of participants required for the experiment.
- 5 Selecting participants in the same proportions as exist in the population to make up the sample (a stratified sample).
- 6 Selecting a random sample from each stratum, in the same proportions as exist in the population (a stratified random sample).

The stratum could really be any personal variable, such as age, years of completed education, ethnicity, gender or body mass.

Stratified sampling is used in the creation of many high-quality psychological measuring instruments, such as the Wechsler Intelligence Scale. These scales are stratified according to ethnicity, age group and years of completed education.



**FIGURE 5** Stratified sampling involves dividing the population into distinct “subgroups” and then selecting a separate sample from each subgroup in the same proportions as they occur in the population.

## Summary of sampling techniques

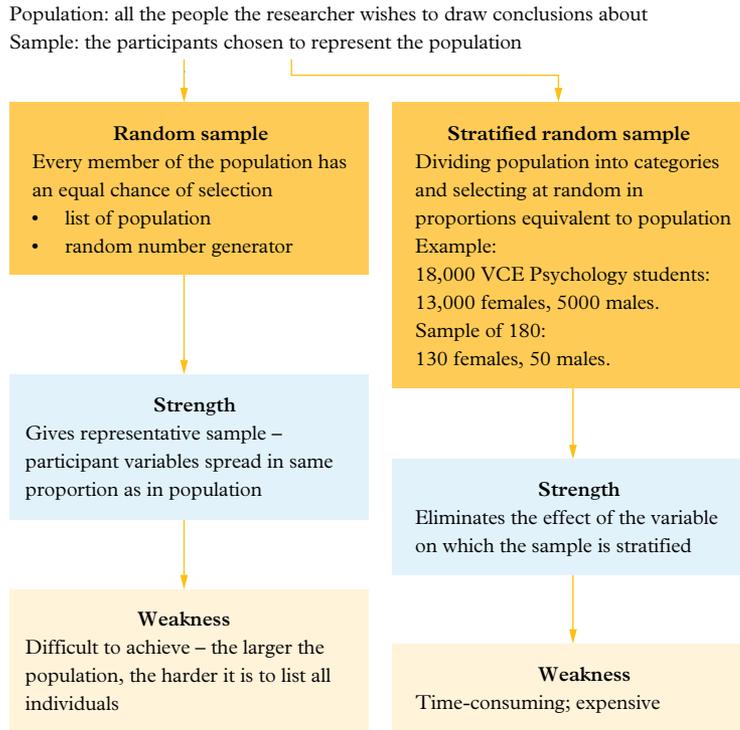


FIGURE 6 Summary of sampling techniques

## Experimental and control groups

In controlled experiments participants may be randomly allocated to different groups. The basic experimental method uses two different groups called the **experimental group (E-group)** and the **control group (C-group)**.

Members of the E-group are exposed to the IV. This is referred to as the condition that receives the treatment. The treatment is the variable that the experimental group participants receive and the members of the control group do not. The purpose of the E-group is to show the effects of the IV on the value of the DV.

The control group consists of the participants who are not exposed to the IV – they do not receive the treatment. The purpose of the C-group is to form a basis for comparison with the E-group.

After the experiment, the average value of the DV for the E-group is compared with the average value of the DV for the C-group. If there is a significant difference, it is concluded that the independent variable (the treatment) has caused this difference.

It is important that the experimental group and the control group are as similar as possible in relevant **participant characteristics**, and that they are treated as similarly as possible throughout the experiment.

**experimental group (E-group)**  
 the group of research participants exposed to the independent variable; the results are compared with the control group so that the effects of the independent variable can be determined

**control group (C-group)**  
 the group of research participants not exposed to variations in the independent variable; the results are compared with the experimental group so that the effects of the independent variable can be determined

**participant characteristic**  
 individual factor such as age, sex, health levels, education and socioeconomic status

## Random allocation

### random allocation

a subject-selection procedure where all participants who have been selected for an experiment have an equal chance of being in either the experimental group or the control group

**Random allocation** is when all participants who have been selected for an experiment have an equal chance of being in the E-group or the C-group.

When the sample is large enough, this means that the E-group and the C-group will be equal on all participant characteristics, and the presence or absence of the IV will be the only difference between them – meaning that it is entirely responsible for any difference in the measured DV.

For example, suppose we performed an experiment to test the theory that “sleep deprivation adversely affects performance on a problem-solving task”, and we allocated all males to the E-group and all females to the C-group. No conclusions could be drawn from this research because the difference in results between the two groups may be due to differences in the sex of the participants, rather than (or as well as) the effects of the sleep deprivation. We would say that these results were confounded by sex.

## Investigation designs

### investigation design

the framework of research methods and techniques used by a researcher to conduct an investigation

Another method of controlling extraneous and confounding variables is through **investigation design**, which is how you allocate participants into groups and set up your experimental conditions in controlled experiments. In VCE Psychology you need to understand three investigation designs: within subjects, between subjects and mixed design. Each design can have advantages and disadvantages depending on the aim of the study. A researcher must be able to choose the design that best suits the population and variables to be investigated.

## Within-subjects design

### within-subjects design

a subject-selection procedure where each participant is part of both the experimental group and the control group

In a **within-subjects design**, each participant in the sample is tested under all conditions of the experiment. For example, in the research previously mentioned that looks at the effects of sleep deprivation on problem-solving ability, all participants would be tested for problem-solving on two occasions. They would be tested once in a normally rested state (the control condition) and once in a sleep-deprived state (the experimental condition). The results from each condition would then be compared.



**FIGURE 7** In a within-subjects design, all participants are tested in each condition of the experiment.

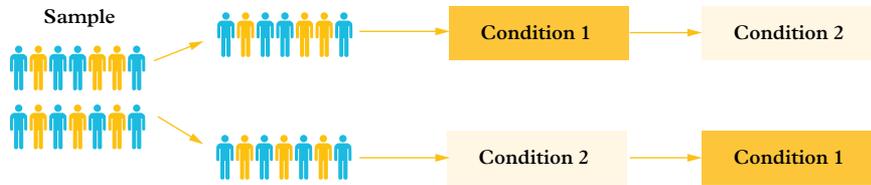
### order effect

an effect on results that is due to the order or sequence in which the treatments in an experiment are given

If participants in this type of design need to perform the same task twice, they would be more likely to perform better the second time due to practice. This is due to the influence of **order effects** – when the order of treatments influences results. One method of overcoming order effects is **counterbalancing**. To counterbalance, half the participants should first perform the experimental condition and then perform the control condition. The other half of the participants should experience the conditions in the reverse order, the control first and the experimental second. Random selection should be used to decide which participants perform the tasks in which order.

### counterbalancing

a method for controlling order effects in a repeated measures design

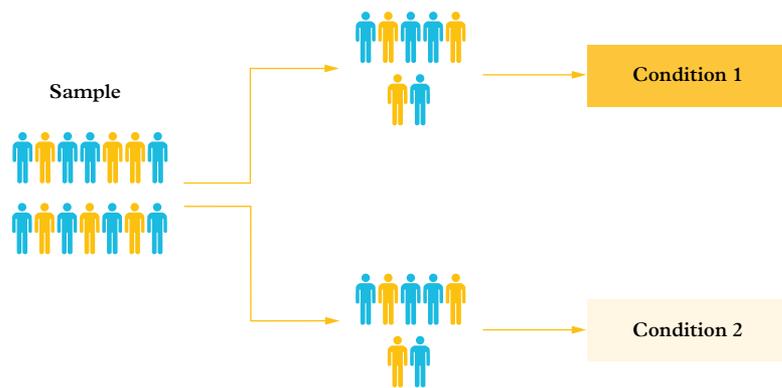


**FIGURE 8** Counterbalancing can be applied to within-subjects designs to overcome potential order effects.

Order effects can also be limited by increasing the time that passes between the two measurements being taken. This lessens the chance of either practice or boredom affecting results. A setback of this strategy is that by increasing the interval between the two events, you also increase the likelihood of participant withdrawal.

## Between-subjects design

In a **between-subjects design** the sample is randomly allocated into groups and each group only experiences one condition of the experiment. The results from each group are then compared. For example, a researcher testing whether a new drug is more effective at treating depression than psychotherapy splits their sample so that half receive the new drug and the other half receive psychotherapy. Results from each condition are then compared.



**FIGURE 9** In between-subjects designs the sample is randomly allocated into groups and each group will experience one condition or treatment of the experiment.

Because different people experience different experimental conditions, subjects in each group might need to be matched based on similar characteristics to eliminate any confounding variables. Once a confounding variable has been identified, participants can be ranked in accordance with their scores on this variable and then allocated into groups. For example, an educational psychologist designed a program that she believed would increase the rate at which Foundation children learnt to read. She decided to test this by giving the E-group of children instructions using her program. The C-group consisted of children taught by traditional methods without her instructions.

She believed that the reading ability of each child could be a confounding variable, so she measured the reading ability of each child through a test. The two children with the highest reading ability scores were randomly allocated so one would join the E-group and one the C-group. The two children with the third and fourth highest scores were also randomly allocated, one to the E-group and one to the C-group. This procedure continued until all the children were allocated and the mean reading ability of the E-group and the C-group was the same.

### Study tip

Order effects and counterbalancing are concepts that won't come up on your end of year exam; however, they are valuable to consider when planning investigations.

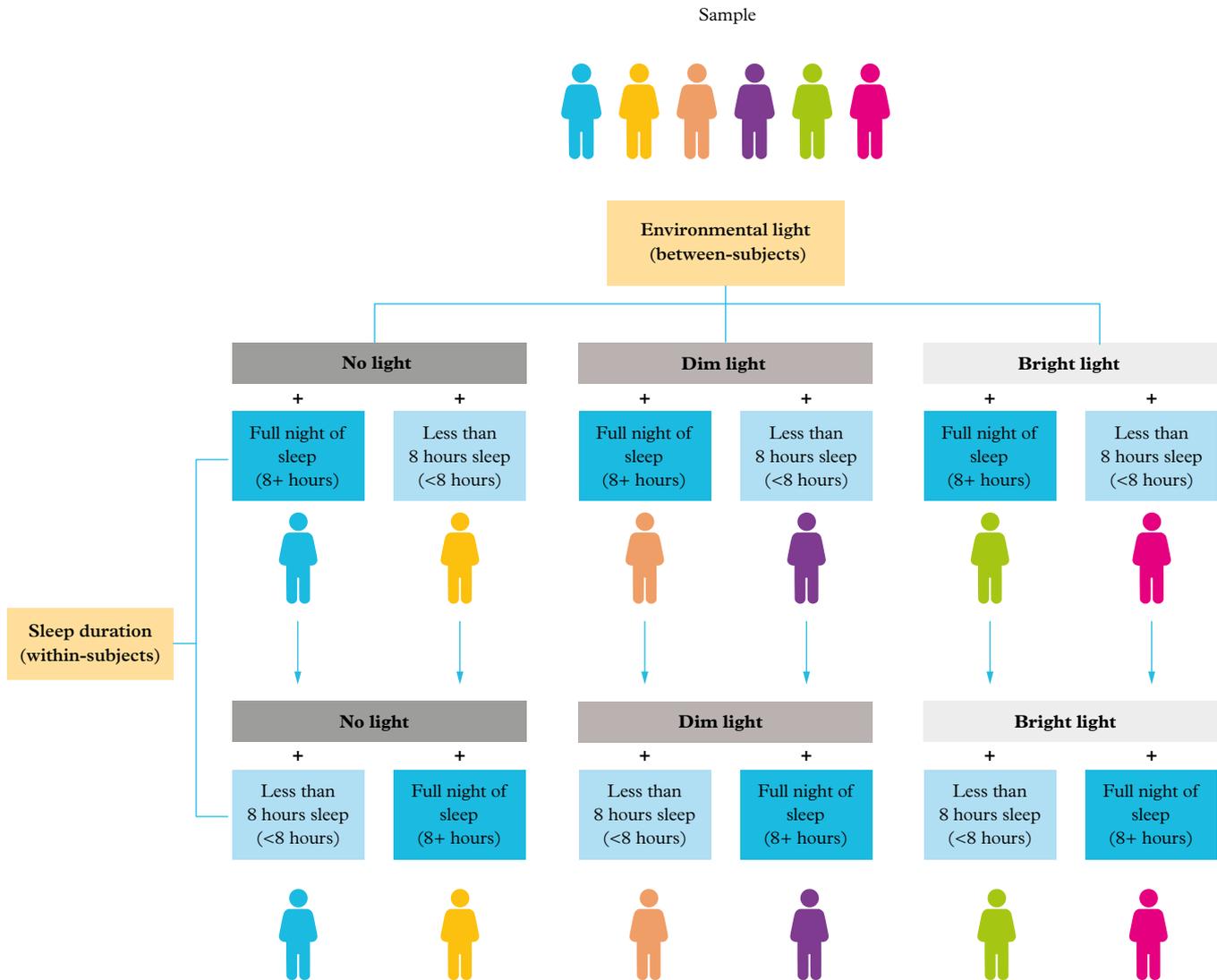
### between-subjects design

a subject-selection procedure where participants are allocated at random to either the experimental group(s) or the control group

## Mixed design

**mixed design**  
a study that combines features of both a between-subjects design and a within-subjects design

A **mixed design** is an experimental design that combines elements of within-subjects and between-subjects designs. This design is often used when there is more than one independent variable that can affect the dependent variable. For example, a researcher wants to investigate how environmental light affects sleep quality. They may have three conditions of environmental light: no light, dim light and bright light. The researcher suspects that sleep duration (the second IV) could also affect sleep quality, so the researcher sets up two conditions for sleep duration: a full night of sleep (8+ hours) and an incomplete night of sleep (<8 hours) (Figure 10).



**FIGURE 10** Mixed designs incorporate elements from both within-subjects and between-subjects designs.

In this case the two independent variables affecting sleep quality are environmental light and sleep duration. Each participant only experiences one condition of environmental light (either no light, dim light or bright light), so in this study, the first IV of environmental light is investigated through a between-subjects design. Since every participant in the sample experiences both sleep duration conditions (<8 hours and 8+ hours), the second IV of sleep time is investigated through a within-subjects design. The combination of both between- and within-subjects investigation elements makes this study an example of a mixed design.

Mixed designs are often used in research when it is not possible or ethical to use a fully between-subjects or fully within-subjects design. They can also reduce error variance (the difference between the observed data and the predicted values of the dependent variable based on the independent variables) and increase efficiency by allowing researchers to test multiple hypotheses with the same set of participants.

## Twin and adoption studies

One way of eliminating interpersonal variables as potential confounds is to use participants who are as similar to each other as possible. The nature-versus-nurture debate is a major theme in psychology. Twin studies – especially with identical twins – and adoption studies provide the strongest evidence for the balance between the contributions of genetics and the environment to personal variables.

## Advantages and disadvantages of design types

Advantages and disadvantages of within-subjects, between-subjects and mixed designs are described in Table 2.

**TABLE 2** Advantages and disadvantages of some experimental designs

Experimental design	Advantages	Disadvantages
Within-subjects	<ul style="list-style-type: none"> <li>Using the same participants in experimental conditions means that confounds caused by “participant variables” will be eliminated.</li> <li>Uses fewer participants than other designs.</li> </ul>	<ul style="list-style-type: none"> <li>Within-subjects designs take a long time to complete.</li> <li>Participants must take part in all conditions, so “drop-outs” are likely.</li> <li>Procedures can suffer from confounding variables known as order effects: participants may perform better on the task when doing it a second time because of the effect of practice, or participants may do worse the second time because of fatigue or boredom.</li> </ul>
Between-subjects	<ul style="list-style-type: none"> <li>The procedure can all be done at once and drop-outs are unlikely, which can therefore make it more time-efficient.</li> </ul>	<ul style="list-style-type: none"> <li>Procedure needs many participants to ensure that the spread of participant variables in the sample will match the spread in the population; this can also lead to less control of participant variables.</li> <li>If matching is required it can be time-consuming (and therefore expensive) to find out the value of variables for each participant.</li> </ul>
Mixed design	<ul style="list-style-type: none"> <li>Can investigate the effects of more than one independent variable on the dependent variable, which can also make the study more time- and cost-effective.</li> </ul>	<ul style="list-style-type: none"> <li>Findings can be difficult to interpret.</li> <li>Research design can be very complex; discrepancies can be unclear and hard to correct.</li> </ul>

### 1.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Explain why extraneous variables need to be controlled and provide an example.
- 2 Identify two differences between a within-subjects and a between-subjects design.
- 3 Describe what a control group is.
- 4 Explain the purpose of an experimental group.
- 5 Define “random allocation”.
- 6 Identify at least one variable on which the sample should be stratified in the following research questions.
  - a Does the Acme Reading Instruction Method increase the rate at which early primary school students learn to read?
  - b Does consumption of one standard alcoholic drink interfere with an adult’s problem-solving ability?
  - c Do teachers who use PowerPoint presentations get better results than those who dictate notes?

#### Apply, analyse and compare

- 7 Consider why random allocation is a necessary part of the experiment process.

- 8 Determine how a psychologist could obtain a random sample for all the adult population of Geelong.

#### Design and discuss

- 9 For each of the scenarios below, evaluate whether a within-subjects design, between-subjects design or mixed design would be most appropriate.
  - a A researcher wants to investigate the impact of sleep on cognitive performance using two conditions (after a full night of sleep and after a night of sleep deprivation).
  - b A researcher wants to study the effectiveness of two different teaching methods (rote learning and hands-on learning) on student performance in a maths class.
  - c A researcher wants to study the effects of a new medical treatment on anxiety levels in two different age groups (young adults and older adults).
- 10 Evaluate the benefits of a twin study against a between-subjects design. Justify why a twin study may yield better results.

FIGURE 11 What are the benefits of twin studies against between-subjects studies?



# 1.4

## Complying with ethics and safety requirements

### KEY IDEAS

- ✦ Ethical understanding should be applied when undertaking research.
- ✦ Ethical concepts guide discussion and decision-making in psychological research.
- ✦ Laboratory safety practices minimise risks and protect investigation participants' safety.



### Ethical understanding

Ethics are moral principles that govern how a person behaves or how an activity is conducted. When undertaking student-designed investigations or evaluating research, you must apply an ethical understanding.

Applying an ethical understanding means applying ethical concepts when collecting and analysing data. Psychological investigations often involve humans as subjects. In such situations, it is important to ensure that ethical concepts are adhered to. You need to consider how the investigation may affect the subject's life. Decisions based on science-related ethical issues take into consideration scientific knowledge, current and future needs, and sociocultural, economic, political and legal factors.



**FIGURE 1** Have you ever decided on something based on your “moral compass”? Ethical concepts help researchers determine what is right and what is wrong.

#### ethical concept

an idea that helps explore ethical conduct in investigations; can be used to decide whether an action or course of action is ethically acceptable

#### integrity

the ethical principle about the commitment to search for knowledge and be honest in the approach

### Ethical concepts

When exploring ethical issues and dilemmas, you need to consider **ethical concepts** to determine the acceptability of research methods and effects of research (Figure 2). There are five ethical concepts.

- **Integrity** is the commitment to searching for knowledge and being honest. When researching, it is important to honestly communicate results and research, whether favourable or unfavourable.

**justice**

the ethical principle of ensuring fair and equal consideration of all factors

**beneficence**

the ethical principle of a commitment to minimising risk and doing good

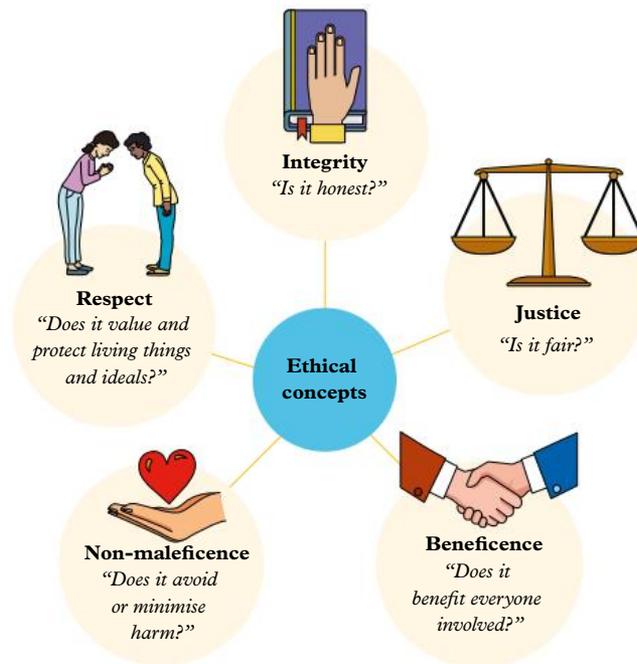
**non-maleficence**

the ethical principle of avoiding harm or decreasing the amount of harm inflicted

**respect**

the ethical principle that considers the value of living things and the ability for living things to make their own decisions where possible

- **Justice** is ensuring fairness in all areas of research: recruitment and selection of participants, treatment of participants, distribution of the benefits of participating in research and access to the benefits of research.
- **Beneficence** is the idea that the purpose of a person’s action should be to do well and minimise the risks of harm while maximising benefits.
- **Non-maleficence** is avoiding the causations of harm. As scientific research can sometimes unavoidably involve harm, any benefits of the course of action must outweigh the resulting harm. If not, the investigation is not worth undertaking.
- **Respect** refers to the intrinsic value of all living things, which considers the religious beliefs, cultural heritage, views and opinions, customs, health and safety of an individual or group. This ethical principle makes sure that living things can make their own decisions and when that capacity is diminished, decisions should be based on empowerment and protection.



**FIGURE 2** A summary of questions you can ask to assess whether ethical concepts apply to research.



**Resource**

Ethical guideline checklist



**Resource**

Informed consent form

## Ethical guidelines

In psychological research, there are ethical considerations involved when working with both animals and humans.

- **Research with animals:** Animals have been used in research for centuries, however research today has stringent guidelines in place to protect them. Animals must be protected, well-cared for and pain must be minimised.
- **Research with humans:** Psychological research most commonly involves human beings as participants. It is vital that the wellbeing of participants is safeguarded. The overriding principle is that there must be no physical or psychological harm to participants.

## The ethics committee

To ensure the wellbeing of participants, before beginning a study researchers must submit detailed plans of their proposal to the human research ethics committee (HREC) of their university or other research institution (such as a hospital or medical research body).

The HREC will study the proposal and indicate any changes that must be made or additional procedures that are required before it will give approval for the study to proceed.

The Australian Psychological Society publishes a “Code of Ethics” for psychologists. This includes a section on the conduct of psychological researchers and draws together regulations and guidelines from bodies such as the National Health and Medical Research Council and guidelines such as the National Privacy Principles.

An HREC will take account of each of the following ethical guidelines before giving approval.

- **The role of the researcher:** The researcher must always act in a professional manner, making sure that the best interests of the participants, and of society in general, are met.
- **Participants’ rights (respect for participants):** Researchers must always maintain respect for the participants. Participants’ rights include those listed below.
  - **Confidentiality** (privacy): Participants must not be identified in any way in terms of test results, their involvement in the study or any other confidential data. Data needs to be stored and disposed of using secure procedures. The means by which confidentiality is to be established and maintained should be described to the participants at the beginning of the study.
  - **Voluntary participation:** Participants have the right to refuse to take part in a study. There must not be any pressure to take part in a study, nor should the participants be tricked into taking part. Participants must also not be disadvantaged if they choose not to participate.
  - **Withdrawal rights:** Participants have the right to leave a study at any stage, regardless of the possible effects on the results. They also have the right to withdraw their results after the study has been completed. This must be explained to the participants before beginning the study.
  - **Informed consent:** Participants must be given information about a study and understand the nature of the study before they agree to take part. For participants who are either too young or too intellectually disabled to give their consent, their guardian must be given the information before giving consent on their behalf.
  - Use of **deception in research:** Deception is the provision of false or incomplete information for the purpose of misleading research participants. This is only permitted if the results would be confounded if the participants had too much information before taking part in the study. The researcher must ensure that participants do not unexpectedly suffer distress as a result of deception; the study must be stopped immediately if this occurs. Participants must be debriefed when the study is complete.
  - **Debriefing:** Debriefing occurs after completion of the study, when participants are told the aim, results and conclusions of the study. Any erroneous beliefs about the study are corrected, especially if there was any deception involved. Participants are informed of the availability of, and how to obtain, counselling if they feel they need it.



**FIGURE 3** Animal ethics help ensure that animals used in research do not suffer through unnecessary pain.

**confidentiality**  
participants must not be identified in any way in terms of test results, their involvement in the study or any other confidential data

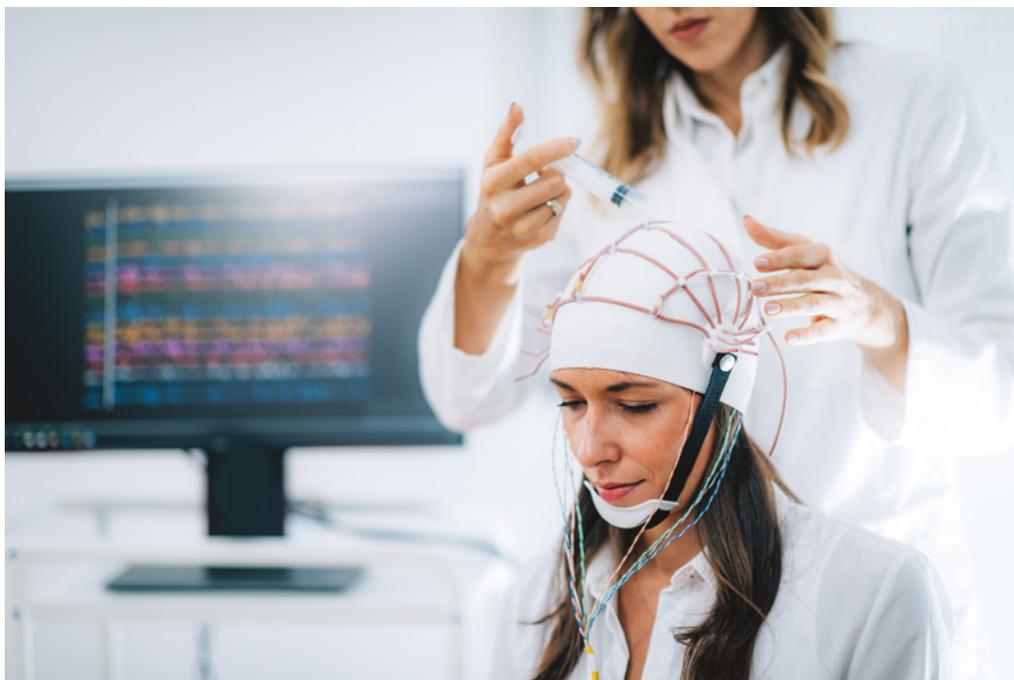
**voluntary participation**  
participants have the right to decline to participate in a study; they must not be pressured to take part in the study and must not be tricked into taking part

**withdrawal right**  
the right of participants to leave a study at any stage, including the right to withdraw their results after the study has been completed, regardless of the possible effects on the results

**informed consent**  
the ethical basis for psychological treatment or experimentation requiring that the subject (or client) is fully aware of all procedures and their likely and possible effects, before they agree to participate

**deception in research**  
the provision of false or incomplete information for the purpose of misleading research participants

**debriefing**  
the experimental process during which, after the experiment, subjects are told of the purpose of the research, and any deception is explained; a vital ethical component of any psychological research

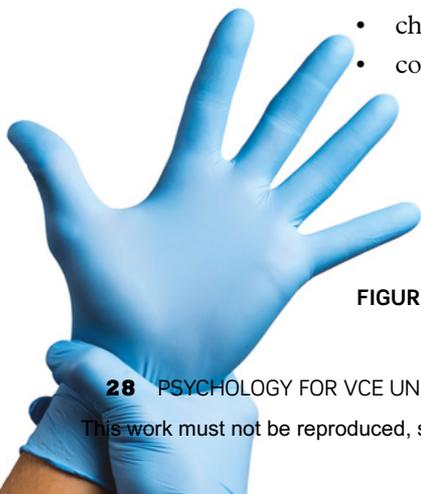


**FIGURE 4** All universities that conduct scientific research have a human rights ethics committee and an animal ethics committee.

## Safe laboratory practices

Psychological investigations can often involve work in the laboratory. Laboratories implement several safe practices to ensure that procedures or investigations conducted in a lab are performed in a way that minimises risks and protects the safety of people in the lab. Common laboratory safety practices include:

- keeping long hair tied back
- listening to instructions from teachers or supervisors
- not eating or drinking in the lab
- being aware of your peers and surroundings
- acting appropriately in a way that does not cause harm
- wearing personal protective equipment (PPE), such as lab coats, safety glasses, gloves and closed-toe shoes when required (Figure 5)
- knowing the safety procedures and locations of eye wash stations, showers, spill kits, first-aid kits and fire alarms
- handling chemicals with care
- keeping flammable materials (such as alcohols or aerosols) away from open flames
- checking equipment for damage before using it
- considering ethical concepts before conducting experiments.



**FIGURE 5** Wearing PPE is an important part of laboratory safety, particularly when working with chemicals.

## Risk assessments

A **risk assessment** is a document that identifies any materials or procedures related to an investigation that may potentially cause risk or harm. Risk assessments are created prior to conducting an investigation so that the researcher is aware of any risks involved before starting. This minimises the chances of risks occurring because the researcher can modify and control the experiment to reduce potential risks. It also ensures that the researcher has time to check whether they have the necessary equipment or resources needed to manage risks if they do occur. You can access an example of a risk assessment and a risk assessment template using the hotspot links.



**risk assessment**  
a system or document that evaluates any potential risks involved with a particular activity, such as performing an experiment



**Resource**  
Risk assessment template

**FIGURE 6** Risk assessments help researchers minimise and prepare for potential risks prior to running investigations (e.g. checking fire extinguishers before working with flammable materials).

## Safety data sheets

A **safety data sheet (SDS)** is a document that provides information on a specific chemical or substance and identifies whether a substance is considered hazardous. SDSs also provide instructions for handling substances safely and instructions on how to respond to any risks (e.g. eye contact, skin contact and ingestion) related to hazardous and non-hazardous substances. SDSs are most often used to inform risk assessments for investigations that use chemicals, but you may need to use them when working with common foods and drinks.

**safety data sheet (SDS)**  
a document that lists information related to hazardous and non-hazardous materials

### 1.4 CHECK YOUR LEARNING



#### Describe and explain

- 1 Define the ethical concept of “respect”.
- 2 Describe how the role of the researcher could influence research.
- 3 Explain the role of an ethics committee.
- 4 Define each of the following terms and provide an example of how each could be applied in a psychological investigation.
  - a Informed consent
  - b Withdrawal rights
  - c Confidentiality

#### Apply, analyse and compare

- 5 Compare the ethical concepts of beneficence and non-maleficence, providing examples of both.
- 6 Infer why a risk assessment should be completed before conducting an investigation rather than after.

#### Design and discuss

- 7 Determine which ethical concepts are being applied to each of the following situations. Justify each of your answers.

- a A researcher conducts a study to determine which classroom strategies improve engagement in schools in the hope of improving outcomes for students and teachers.
- b A researcher finds that results of their latest study contradict the large body of work they have established over the past few years. The researcher still submits the work for publication.
- c A researcher writing a literature review includes papers from a diverse range of published material rather than only including their colleague’s work.
- 8 Researchers want to use a group of 10-year-olds in a study. Consider the ethical implications of using this group and explain how these implications could affect the study.

# 1.5

## Generating, collating and recording data

### KEY IDEAS

- ✦ Data can be classified as either qualitative or quantitative.
- ✦ Observations, interviews and questionnaires can be used in research investigations to collect data.



## Types of data

Our knowledge of psychological concepts and theories has come from the collection, interpretation and analysis of different forms of data. In VCE Psychology you will need to practise generating, collating and recording data. You will work with two types of data:

- **primary data** – data that you have gathered firsthand through your own research, such as responses from a questionnaire you have conducted
- **secondary data** – data that has come from a secondary source, such as data you have found in a scientific journal or database.

Primary and secondary data can be further classified as either qualitative or quantitative.

**Qualitative data** refers to descriptions of the characteristics of what is being studied.

For example, when asking a participant what their favourite food is, the response “apple” is a form of qualitative data. Common sources of qualitative data include:

- open-ended survey responses
- interviews
- focus groups
- observations.

Qualitative data offers in-depth insights useful for exploring context. This type of data can be effective for gathering subjective data (such as feelings or preferences). Analysis of qualitative data involves identifying, examining and interpreting patterns and themes in the data.

### primary data

data collected by the investigator from firsthand sources

### secondary data

data collected by another person, not the investigator, which is relevant to the scientific investigation

### qualitative data

descriptive characteristics of what is being studied



FIGURE 1 Self-report surveys collect qualitative data.

**Quantitative data** refers to measurements or numerical values of the variables being studied. For example, a heart rate of 120 bpm (beats per minute) is an example of quantitative data. Most psychological research aims to gather quantitative data because statistical procedures can be performed on these and, provided the data are accurate and precise, psychologists can determine whether results are significant and hypotheses supported.

**quantitative data** measurements (numerical information) about the variables being studied

## Collecting and recording data

There are many different sources and ways of collecting data. Depending on the sort of data you want to collect, some data collection methods may have benefits over others. Observations, interviews, focus groups and yarning circles are all methods of obtaining data.

### Observations

Psychological research often uses observations to gather data on subjects. **Direct observation** is a type of data collection that involves a researcher simply watching or listening to subjects without asking specific questions or manipulating variables. Direct observation can be used to collect qualitative data (e.g. writing a description of a person’s facial expressions) or quantitative data (e.g. counting the number of times a person claps their hands). **Controlled observations** are when voluntary behaviours are monitored within a structured environment such as a laboratory.

**direct observation** a research method in which the researcher watches and records behaviour as it occurs naturally without intervention or interference

**controlled observation** observation of voluntary behaviours within a structured environment such as a laboratory

**TABLE 1** Comparing direct and controlled observation

Observation type	Strength	Weakness
Direct observation	Highly realistic, especially if the observer is not visible.	There is a lack of ability to control the independent variable.
Controlled observation	Control over the environment enables more accurate observations.	Participant behaviour may be changed by the environment.

**participant observation** a data collection method where the researcher immerses themselves or “participates” in a specific setting or group to make observations of the target of their research

**Participant observation** is a method of data collection where a researcher immerses themselves in a particular social setting or group to observe the behaviours, interactions and practices of subjects. In participant observation, the researcher may disguise themselves or go “undercover” to observe the behaviours or actions of subjects (e.g. they may join an online forum as an anonymous user to observe the responses of others without posting anything). Alternatively, a researcher may choose to share their identity and intentions with the participants in the group they are observing (e.g. a researcher may join a fitness class and inform the class that they will also be observing participant behaviour for research purposes).

**structured interview** a research technique that involves an interviewer asking a participant a set of pre-determined questions

### Interviews

All interviews involve interaction between the researcher and the participant. Interviews can be structured or clinical. In a **structured interview** participants are asked a set of pre-determined questions with a fixed choice of responses such as yes/no, or never/sometimes/often/always. In a **clinical interview** there are guidelines, but the interviewer may choose to add additional or unscripted questions for clarification.

**clinical interview** a qualitative research technique where an interviewer has a dialogue or conversation with the participant that is not structured or contains unstructured questions

The strengths of structured interviews include that they make it easy to compare participants and that they are easy to replicate, but data may be missed because of limited response choices. Strengths of clinical interviews are flexibility, and that they are usually high in validity. However, clinical interviews rely on the objectivity of the interviewer.

**focus group**

a research technique that involves collecting data from a small group of people as they discuss or respond to different ideas or products

A **focus group** is a data collection technique that involves a researcher conducting a group interview with specific groups or subjects (Figure 2). During focus group interviews participants are often given questions or prompts to freely discuss as a group (e.g. a tech start-up company might interview a group of teenagers about the features they find most engaging on social media applications). Focus group interviews can help identify and explore people’s collective opinions and how they might think and behave.



**FIGURE 2** In focus groups, people discuss ideas and the researcher collects the data.

**questionnaire**

a list of questions used for data collection

**survey**

the collection and analysis of the experiences and/or opinions of participants who have been asked questions

**Likert-type scale**

a question that uses a scale for responses, ranging from one extreme to another

**psychological test**

a type of assessment used to evaluate various aspects of emotions, cognitions or behaviours (such as a personality test or an intelligence assessment)

## Questionnaires

A **questionnaire** is a research tool that consists of a series of questions that help collect information from respondents. Questionnaires can take various forms, such as surveys and psychological tests. A **survey** can combine question-and-answer responses and **Likert-type scales** (rating scales). A benefit of using surveys is that they are easy to replicate and to score. Likert-type scales can provide a means of quantifying data (Figure 3). However, surveys may be open to bias if participants are trying to present themselves in a particular way.

I complete my Psychology homework on time.	Never	Sometimes	Often	Always
	1	2	3	4
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**FIGURE 3** A Likert-type scale is a rating scale used to measure behaviours, attitudes or opinions. It can also help turn qualitative data into quantitative data by assigning numerical values to responses.

**Psychological tests** are written, visual or verbal evaluations given to assess the cognitive and emotional functioning of participants. Personality and multiple-choice intelligence tests are examples of psychological tests. The strengths of psychological tests include being standardised, easy to replicate, and easy to score. Weaknesses include that they are difficult to construct and validate.

## Yarning circles

A **yarning circle** is an informal speaking and listening space where members of a group are free to share, discuss, receive and question information openly and without judgment from others. Yarning circles or “yarning” has been practised in Aboriginal and Torres Strait Islander communities for thousands of years and is a tradition with high significance in many Aboriginal and Torres Strait Islander communities. Yarning can help strengthen the bonds between people and allow people to pass on and preserve cultural knowledges, histories and perspectives. Some of the benefits of yarning circles include that they:

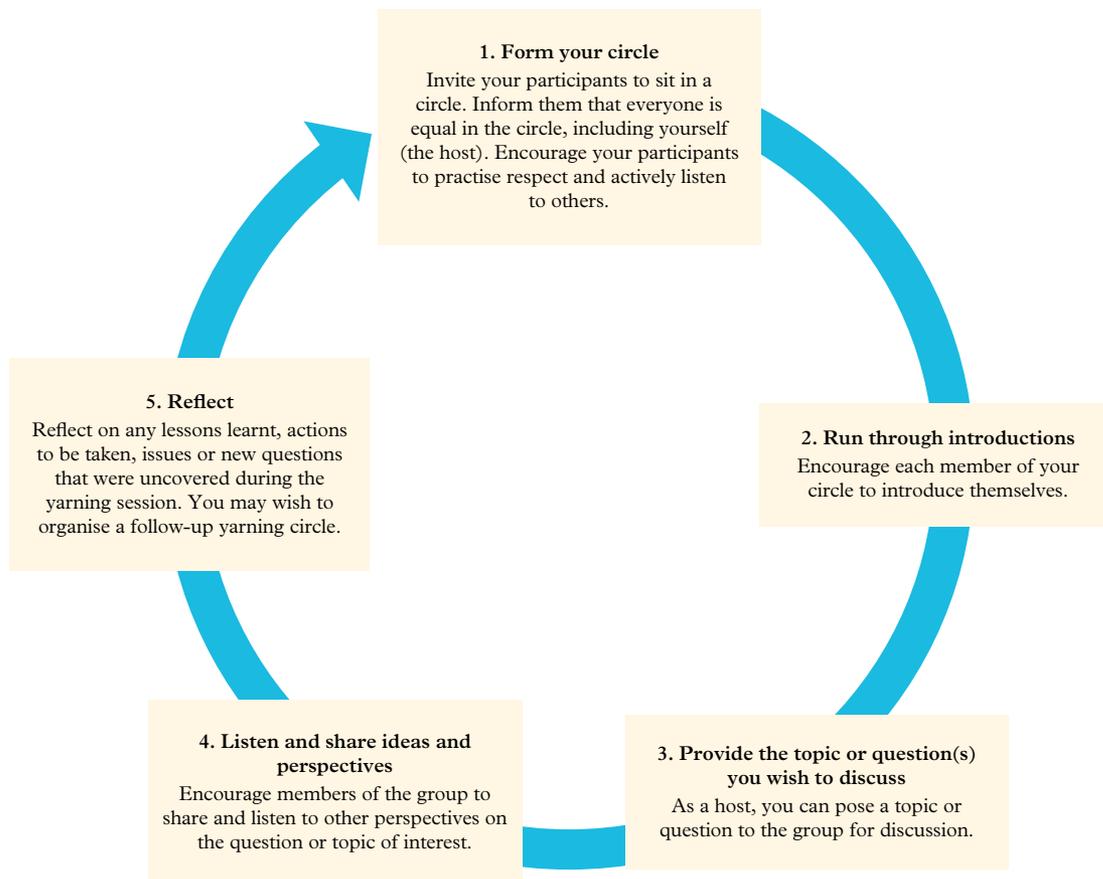
- provide a safe, respectful and trustworthy environment to share experience, perspectives and knowledge
- build relationships between people
- encourage honesty and sharing
- foster a sense of community connection.

In VCE Psychology you may engage with yarning circles to build relationships with your peers, learn new information, or provide a safe space for information sharing. Yarning can also inform psychological research investigations. For example, a student may run a yarning circle to share perspectives on factors that can influence social and emotional wellbeing and then, with the consent of all members involved, use the knowledge they have obtained as inspiration for a research question about factors influencing social and emotional wellbeing. A guideline for running a yarning circle is outlined in Figure 4.

**yarning circle**  
a harmonious, creative and collaborative way of communicating to encourage responsible, respectful and honest interactions

### Study tip

Consulting with Aboriginal and Torres Strait Islander community groups or individuals for guidance on yarning can help you determine the best approach to take.



**FIGURE 4** An outline of how you could run a yarning circle

## Logbook

### logbook

a record of investigation ideas, events, results and interpretations

You will need a **logbook** in hard copy or digital form to record primary and secondary data from all types of scientific investigations undertaken in Units 1 to 4. You will need to submit your logbook to your teacher for some assessment tasks so they can check that the work you have submitted is your own.

Each entry must include:

- the date and entries sequenced in chronological order
- acknowledgment of secondary resources, expert advice and teacher assistance when this information is referred to.

Your logbook could also include the following information as you complete your investigations:

- planning notes for experiments
- a description of the activities you have carried out
- the results or data from guided activities or investigations (including outliers and/or risk identification and management)
- personal reflections made during or at the conclusion of demonstrations, activities or investigations
- any links to spreadsheet calculations or other digital records and presentations you might use
- any notes and electronic (or other) images taken on excursions, or any database extracts
- notes of any additional work completed outside of class time.

A well-organised logbook that contains all of this information will make it much easier to complete your scientific investigation in Unit 4 Area of Study 3.



**FIGURE 5** If your logbook is hard copy, use a bound notebook to make sure you do not lose any pages.

### 1.5 CHECK YOUR LEARNING

#### Describe and explain

- 1 Define “primary data” and “secondary data”.
- 2 Identify three benefits of using yarning circles.
- 3 Summarise the strengths and weaknesses of direct and controlled observations.

#### Apply, analyse and compare

- 4 Explain one method you could use to change qualitative data into quantitative data.
- 5 Compare qualitative and quantitative data.

#### Design and discuss

- 6 Discuss a research scenario where using a structured interview for data collection would be more appropriate than using a clinical interview.
- 7 Marion is conducting a research investigation to observe how often teachers in the staffroom complain about students. Marion is contemplating whether she should observe the teachers by openly revealing her identity and research purpose or whether she should go undercover as a student teacher. Discuss which approach you believe Marion should take. Justify your answer.



# 1.6

## Organising, presenting and processing data

### KEY IDEAS

- ✦ Organising and presenting data in the correct format can help us determine what the data means.
- ✦ Descriptive statistics can be calculated or used to help us process what our data means.



## Organising and presenting data

**raw data**  
unprocessed data

**Raw data** is the unprocessed data collected during an investigation. For example, look at the data below, collected by a student who has rolled a die 80 times and recorded the number shown on each throw:

1, 3, 6, 5, 2, 1, 6, 1, 5, 2, 1, 2, 5, 4, 3, 6, 5, 2, 3, 4, 1, 4, 3, 2, 5, 1, 6, 2, 3, 1, 5, 5, 2, 3, 5, 4, 1, 3, 5, 3, 6, 3, 1, 6, 6, 3, 3, 4, 3, 3, 6, 3, 1, 3, 4, 6, 2, 4, 6, 3, 4, 5, 4, 6, 2, 3, 4, 5, 5, 4, 2, 1, 5, 4, 5, 6, 1, 6, 2, 5.

Looking at raw data like that shown above can be confusing and make it hard to determine what your data means or shows. Luckily, there are many ways we can organise and present data to make it easier to analyse and interpret.

### Tables

**table**  
a format of presenting data using rows (horizontal) and columns (vertical)

Placing the above data into a **table** can make it much easier to perform simple calculations with the data. Compare the data set from rolling a die 80 times above with Table 1. Which would you prefer to work with? Tables can summarise information and be used to present both qualitative and quantitative data. Tables should also include a heading or caption that summarises what the table is showing. The left column of a table generally shows the independent variable and other columns show measurements of the dependent variable. If you are working with numerical data, you should also include the relevant specific measurement units of any variables in the heading cells of the table.



**FIGURE 1** Placing data from rolling a die into a table makes calculations easier.

**TABLE 1** Results recorded from rolling a die 80 times

Number on die face	Number of times rolled
1	12
2	11
3	17
4	12
5	15
6	13

## Graphs

Tables can help to organise data, but they do not always reveal much about what the data means. Presenting data in the right format can help us make sense of the data and identify any patterns or trends that exist within our data. **Graphs** are visual representations that show the relationship between two or more variables measured along a pair of axes. All graphs should include:

- a graph title that succinctly describes what the graph is showing (this statement often includes the independent and dependent variable)
- clearly labelled axes that include units of measurement (the independent variable placed on the horizontal “x” axis; the dependent variable placed on the vertical “y” axis)
- equally spaced units of measurement along the axes (scaling)
- axes that start at zero (when possible)
- data plotted within the confines of each axis
- distinguishing symbols, colours or keys when more than one set of data is plotted on a single graph.

### graph

a pictorial representation that displays values and data in an organised way

### bar chart

a pictorial representation of data where the numeric values of variables are represented by the heights or lengths of bars

### discrete categories

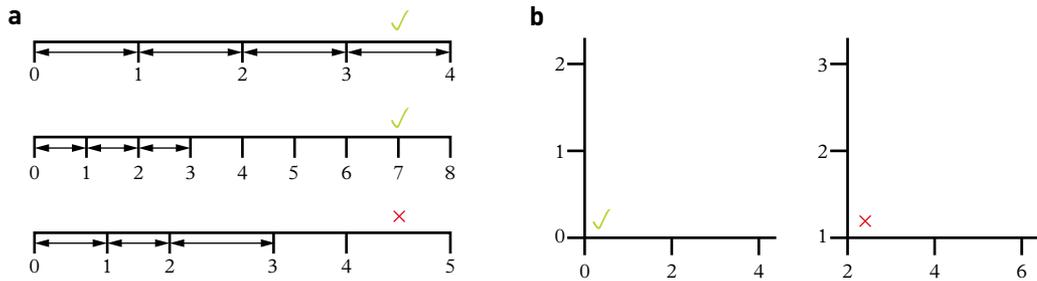
groups of data that have gaps or spaces between values (are not continuous)

### line graph

a pictorial representation of data linking two variables, where one is plotted on the y-axis and the other on the x-axis

### correlation

a statistical measure of the strength and direction of the relationship between two variables; does not show a cause-and-effect relationship, but describes the way in which the variables are different in relation to each other

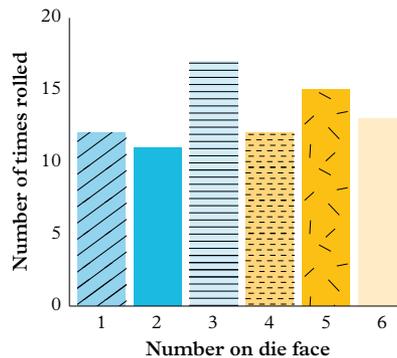


**FIGURE 2** When drawing your graph, remember to **a** scale your axes correctly, and **b** start your axes at zero.

## Bar charts

**Bar charts** are graphical representations of data with **discrete** (countable) **categories**.

The height or length of a rectangle (or bar) is used to show the value of one category of data. We can use bar charts to get a much clearer picture of the numbers rolled on the die. Looking at Figure 3, we can quickly see that a three was rolled most frequently.



**FIGURE 3** This bar chart shows the number of times each number was thrown in 80 rolls of one die.

## Line graphs

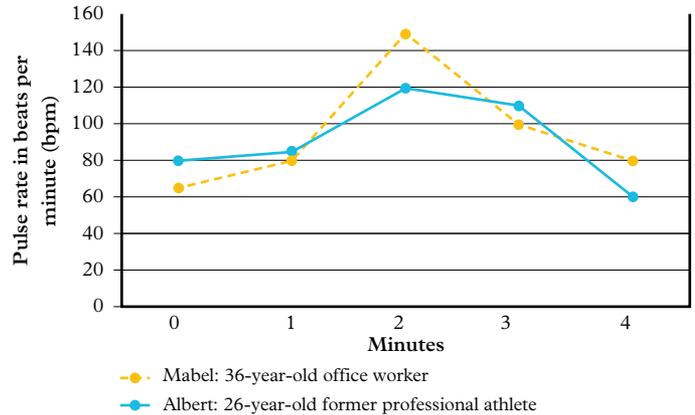
When one variable is continuous (meaning that it can have any value within a certain range) – such as body mass, or age in months – we can showcase it using a **line graph**. Line graphs are graphical representations that can show the relationship between two variables (**correlation**) or show how a variable might change over time. Line graphs can also be used to show more than one data set on the same axis, as long as both data sets have the same defined relationship (Figure 4).

## Scatterplots

A **scatterplot** is a graph of unconnected plotted data points that is used to determine whether a relationship exists between two variables that have no defined relationship (that is, there is no clear or apparent connection between the two variables). For example, imagine you have a data set that includes the number of hours people exercise and the number of pairs of shoes they own. There is no logical or expected relationship between these two variables, so you could say that there is no defined relationship.

Scatterplots are often used to graph data collected in correlational studies as they help to identify and describe the relationship between two variables. After data is plotted onto the scatterplot, a **line of best fit** can be generated to indicate the closeness of two variables. If the trend of the data is linear, then the line of best fit should be drawn as a straight line; if the trend is curved, then the line of best fit should be drawn as a smooth curved line.

Change in pulse rate during exercise



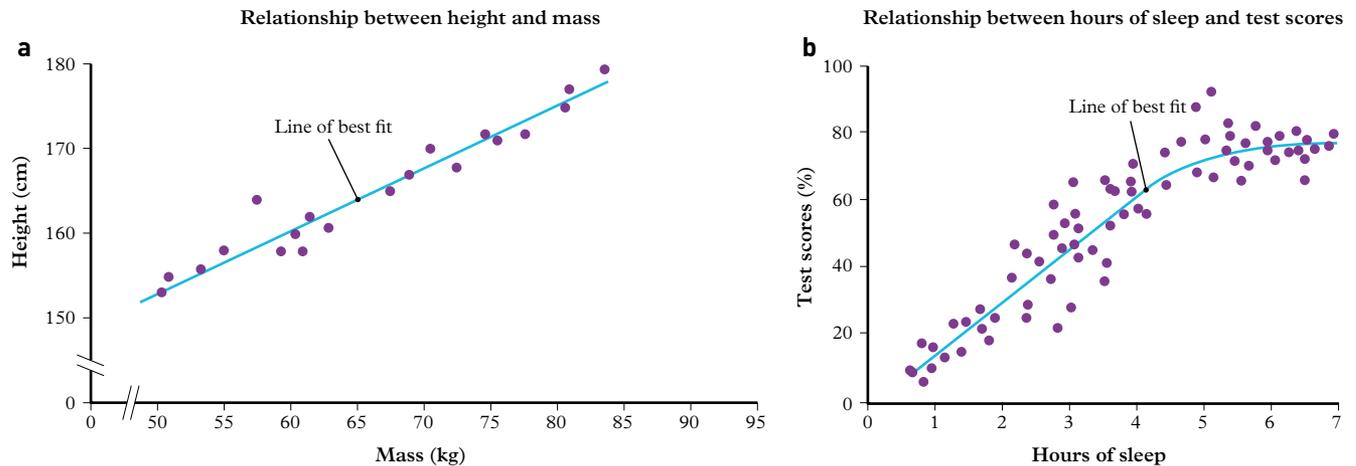
**FIGURE 4** This line graph shows how one variable (pulse rate) changes over time during exercise.

### scatterplot

a diagram showing the values of the two variables for each result in the sample by representing the intersection of those two values with a dot on a graph

### line of best fit

a trendline that gives an approximation of the linear relationship between two variables on a graph



**FIGURE 5** Two scatterplots depicting a line of best fit

If the line of best fit slopes upwards (Figure 5a) it means that the independent variable and dependent variable increase together. This is called a **positive correlation** and describes when two variables change in the same direction – that is, as one increases, so does the other; or alternatively, as one decreases, so does the other.

### positive correlation

a relationship in which the two variables change in the same direction – that is, as one increases (or decreases), so does the other

**negative correlation**

a relationship in which the two variables change in the opposite direction – that is, as one increases, the other decreases

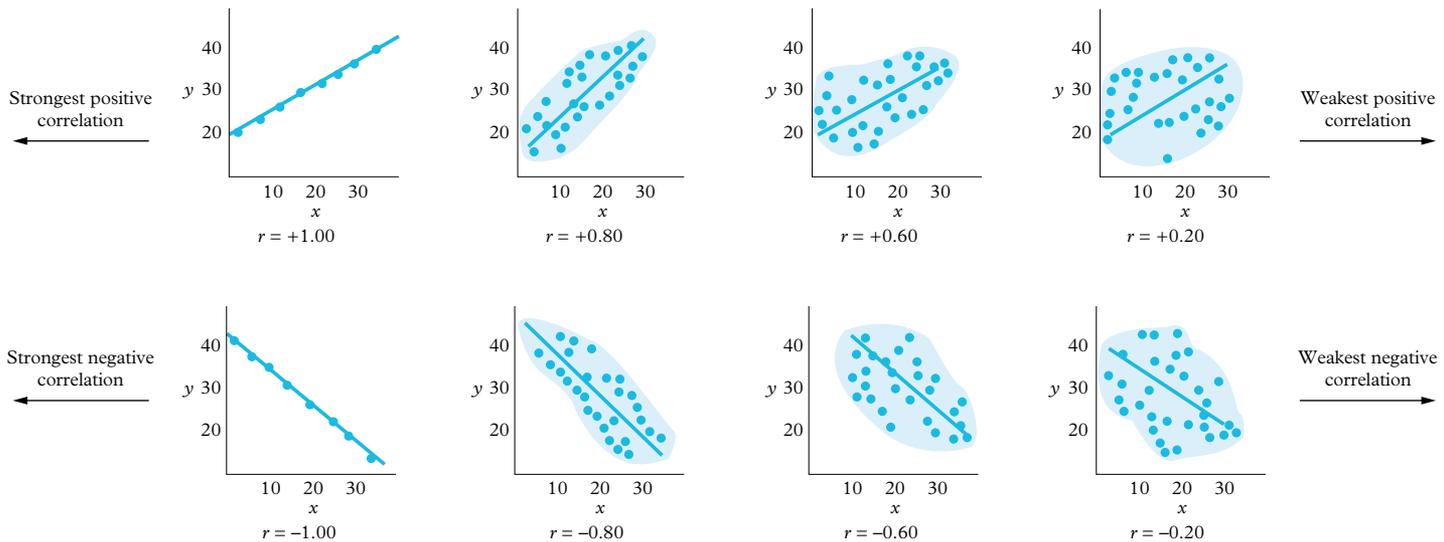
**Pearson correlation coefficient ( $r$ )**

a measure of the strength of the linear relationship between two continuous variables



For example, we might expect to find a positive correlation between hours spent sleeping each night and test results in VCE Psychology – meaning that as the number of hours spent sleeping each night increases, the average results increase. If the line of best fit slopes downwards, it indicates a **negative correlation** – where the two variables change in opposite directions (as one increases, the other decreases). Using our sleep and test results example, a negative correlation would be as the number of hours spent sleeping each night increases, the average test results decrease.

A **Pearson correlation coefficient ( $r$ )** is a measure of the strength of the correlation expressed as a decimal number in the range of  $-1.0 < r < +1.0$ . The (+) or (–) sign in front of the number shows whether it is a positive or negative correlation. The number following the positive or negative sign indicates the strength of the correlation. The higher the number, the stronger the correlation, whether positive or negative. Correlation coefficients of  $+1.0$  or  $-1.0$  show perfect positive or perfect negative correlations respectively. This would mean that as one variable increased by one unit, the other variable would increase by one unit (perfect positive correlation) or decrease by one unit (perfect negative correlation). A correlation coefficient of  $r = 0.00$  indicates that the two variables are not related in any way. A correlation of  $r = +0.80$  indicates that the two variables have a strong, positive correlation, while a correlation of  $r = -0.14$  indicates that the two variables have a weak, negative correlation.



**FIGURE 6** Scatterplots showing direction and strength of correlations

**causation**

a cause-and-effect relationship, where changes in one variable lead directly to changes in another variable

It is important to remember that correlation does not equal **causation**. This means if two variables happen to show a statistical relationship (correlation), it does not confirm that changes in one variable will cause changes in the other variable. To establish if a cause-effect relationship exists between variables, researchers need to conduct controlled experiments or use advanced statistical techniques to rule out alternative explanations. Simply observing a correlation is not enough evidence to conclude that one variable is causing the changes in another.

## Processing data

Presenting or organising raw data in the correct format is only one way to help make sense of it. **Descriptive statistics**, which are statistics that analyse and summarise key features of a data set, can also be calculated or used to help us understand what our data means. In VCE Psychology there are three main descriptive statistics you need to understand:

- percentages
- measures of central tendency
- standard deviation.

### descriptive statistic

a measure or point of information that describe the characteristics of a data set

## Calculating percentages and percentage change

A **percentage** is a number or ratio expressed as a fraction of 100. Percentage is a very useful and commonly used descriptive statistic. Psychologists often need to calculate what percentage of a data set is represented by a certain score. Percentage can be calculated using the following formula:

$$\text{Percentage (\%)} = \frac{\text{value}}{\text{total value}} \times 100$$

For example, consider the data set of the die rolled 80 times from Table 1. To discover what percentage of the data was a six, our “value” would be the number of times the die rolled six (13), and our “total value” would be the total number of times the die was rolled (80). Therefore, our calculation would be:

$$\text{Percentage change (\%)} = \frac{13}{80} \times 100 = 16.25\%$$

**Percentage change** is another useful descriptive statistic that assesses the difference (the increase or decrease) between two percentages. Percentage change can be calculated using the following formula:

$$\text{Percentage change (\%)} = 100 \times \frac{\text{new percentage} - \text{initial percentage}}{\text{initial percentage}}$$

If the number generated from the formula above is positive, it means the percentage has increased; if the number is negative, it means the percentage has decreased. For example, imagine you were conducting a study to determine how effective a revision program was at improving test scores. If a student scored 12 out of 30 on the test before the program and 27 out of 30 after the program, to figure out percentage change you would need to:

- 1 convert both scores to percentages (the initial score is 40% and the post-program score is 90%)
- 2 use the formula to calculate the percentage change ( $100 \times \frac{90 - 40}{40}$ ). Since the percentage change is positive, you could say that the program resulted in a 125% increase in test score.

### percentage

a number or ratio expressed as a fraction of 100

### Study tip

The word percentage comes from the Latin *per centum*, which translates to “by the hundred”.

### percentage change

the factor by which an initial data percentage changes after time or an event

## Measures of central tendency

### measure of central tendency

summary statistic that represents the central point of a data set

### mean

the calculated central number or “average” of a set of numbers

**Measures of central tendency** are descriptive statistics used to describe a whole set of data with a single value that represents the middle or “centre” of the distribution of data. There are three main measures of central tendency: mean, median and mode.

### Mean

The **mean** or “average” is calculated by adding up all the values in a data set and then dividing that figure by the number of values in the data set. For example, consider the data in Table 2. The mean test score for this data set would be calculated as follows:

$$\begin{aligned} \text{Mean} &= \frac{57 + 70 + 81 + 25 + 50 + 92 + 70 + 63}{8} \\ &= 63.5\% \end{aligned}$$

**TABLE 2** Test scores of 8 students in a Grade 6 class

Student	Test score (%)
John	57
Robert	70
Kiet	81
Luke	25
Hanna	50
Jacob	92
Adelina	70
Ahmed	63



The mean is a useful statistic to describe data when most values of the data set fall close to the mean. It is less useful to use when there are extreme or irregular scores that might influence the mean. For example, if the class scores were 6%, 4%, 2%, 7%, 87%, 100%, 97% and 93%, the mean test score for this data set would be 49.5%; however, none of the students in the class got a score close to this mean – they were all either well over or well under it.

### Median

The **median** is the middle number (or the mean of the two middle numbers) of a data set that has been listed in numerical order. For example, consider the data from Table 2. The scores in numerical order would be as follows: 25, 50, 57, **63, 70**, 70, 81, 92.

Because the data set has an even number of scores (eight), there are two middle numbers: 63 and 70. Our median is therefore the mean of these two values:  $\frac{63 + 70}{2}$ .

### Mode

The **mode** is the most commonly occurring score in the data set. Looking at the test score data from Table 2 (25, 50, 57, 63, **70, 70**, 81, 92), the mode would be 70 as it is the only number that occurs more than once. The mode is the least used measure of central tendency; however, it can help researchers find a central point of the data when mean or median are not able to be calculated or are not representative.

## Measures of variability

**Measures of variability** are descriptive statistics that inform us about the spread of scores around a central point in a data set. When used alongside measures of central tendency, they can tell us a great deal about the features of the data set. The closer the scores of a data set are to the mean, the lower the variability of data. The more widely dispersed that scores are from the mean, the higher the variability. There are three measures of variability: range, variance and standard deviation.

### median

the middle number in a set of numbers that are listed in ascending or descending order

### mode

the number that occurs most frequently in a data set

### measure of variability

summary statistic describing how spread out the data is in a data set

**Range** is the simplest measure of variability; it is calculated by subtracting the lowest value in a data set from the highest value in a data set. For example, if the lowest test score in a class is 25 and the highest score is 90, the range of the test scores would be 65 ( $90 - 25 = 65$ ). **Variance** is a measure of how spread out the data is from the mean. You will not be required to calculate variance in VCE Psychology.

One of the most useful measures of variability is **standard deviation**, which is a measure of how far, on average, scores in the data set differ from the mean. The higher the value of the standard deviation, the higher the variability of the data set or the more the data “deviates” from the mean. The lower the value of the standard deviation, the lower the variability of the data set and the less the data “deviates” from the mean.

## Normal distribution

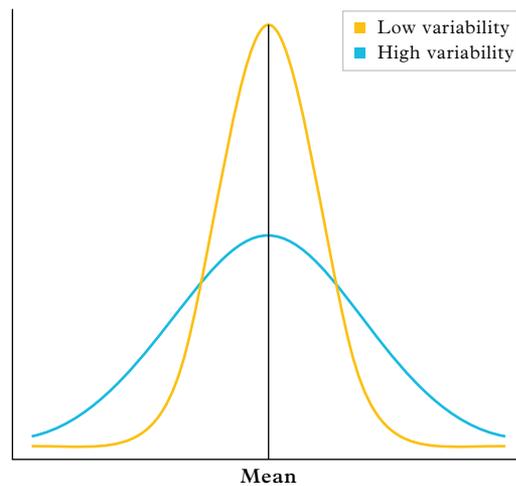
A **normal distribution** is a continuous probability distribution often used to model things that happen in the real world. The distribution of data looks like a bell-shaped curve, where most data falls near the centre and fewer data points are located away from the centre. A normal distribution is described by two parameters: the mean and the standard deviation. The mean represents the centre of the distribution curve and is also the point of highest frequency (the most number of times something occurs). The standard deviation measures the spread of the data around the mean. A normal distribution is a symmetrical shape, which means the frequency of data points to the left of the mean is equal to the frequency of data points to the right of the mean.

One of the most important properties of the normal distribution is that it is characterised by data falling into a consistent pattern. This is known as the 68–95–99.7 rule, which states that:

- approximately 68% of the data falls within one standard deviation of the mean
- approximately 95% of the data falls within two standard deviations of the mean
- approximately 99.7% of the data falls within three standard deviations of the mean.

The normal distribution is important in research because many real-world phenomena can be estimated by a normal distribution. This allows researchers to use models to make predictions and draw conclusions about data that follow this type of distribution.

High variability vs low variability



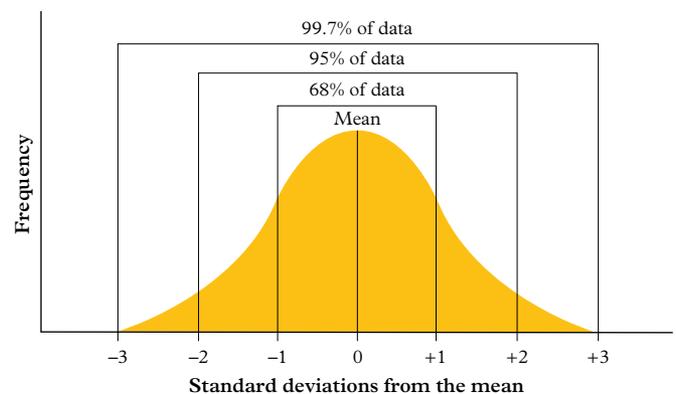
**FIGURE 7** A high-variability distribution versus a low-variability distribution

**range**  
the difference between the lowest and highest value in a data set

**variance**  
a measure of how spread out data is from the mean

**standard deviation**  
a measure that tells us how far, on average, scores are different from the mean

**normal distribution**  
a statistical distribution where data is symmetrically distributed around the mean



**FIGURE 8** A normal distribution curve



## 1.6 CHECK YOUR LEARNING

### Describe and explain

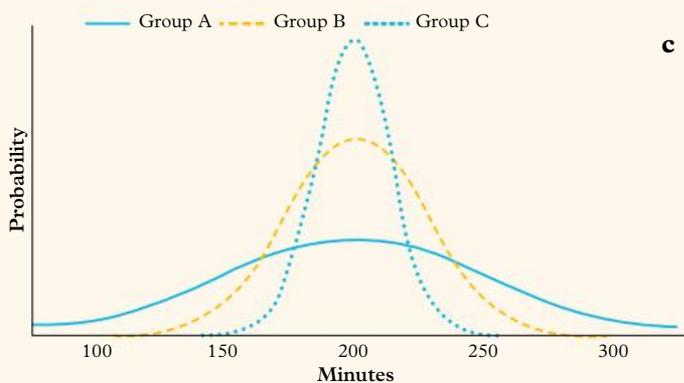
- Identify on which axis of a graph you would place the:
  - independent variable
  - dependent variable.
- Define “range”.

### Apply, analyse and compare

- Consider the following data set, which includes the ages of people who go to a small rock-climbing gym: 20, 23, 23, 25, 25, 26, 29, 33, 35, 31, 29, 22, 27, 28
  - Identify the median and mode from the data.
  - Calculate the mean.
  - Calculate the percentage of gym members older than 30.
- Lossalia completes an online topic quiz just after learning about the brain in Psychology. She scores 8/10 on the quiz. Four weeks later when revising, she completes the same quiz and scores 3/10. Calculate the percentage change in Lossalia’s score.
- Compare positive correlation and negative correlation.

### Design and discuss

- Consider the graph in Figure 9, which shows the distribution of data related to the average number of minutes spent on social media for three groups.



**FIGURE 9** The distribution of data related to the average number of minutes spent on social media for three groups

- Identify which group has the highest standard deviation and justify your answer.
  - Identify which group has the lowest standard deviation and justify your answer.
- A researcher is investigating whether a relationship exists between meditation and stress levels. They conduct a pre-test survey on seven participants that asks participants to rate their general stress levels from 1 to 5 (where 1 = not stressed at all and 5 = extremely stressed). Following the meditation session, the researcher conducts a post-test survey. The results are shown in Table 3.

**TABLE 3** Pre-meditation and post-meditation stress levels

Participant	Pre-test stress level	Post-test stress level
A	5	2
B	4	2
C	4	3
D	3	2
E	5	2
F	3	1
G	2	1

- Calculate the mean pre-test and post-test stress level of participants.
- Graph the data from the investigation in a format of your choosing. Justify your selection of graph format.
- Describe what your graph suggests about the relationship between meditation and stress levels.

# 1.7

## Analysing and evaluating data and investigation methods

### KEY IDEAS

- ✦ Investigations that generate raw data must be valid, repeatable and reproducible.
- ✦ Errors and outliers must be included and accounted for in data evaluations.



## Analysing and evaluating data and measurements

Once data has been generated and processed, scientists must analyse and evaluate its quality and the investigation methods that were used to obtain it. This helps to ensure that any results or findings from the investigation can effectively address the research question. This topic will explain some of the key concepts that you should apply when analysing and evaluating data and investigation methods in VCE Psychology.

### True value

**true value**  
the value that accurately represents the measurement if the experiment ran perfectly

**True value** is the value or range of values you would expect to find if a quantity was measured perfectly without error. A true value cannot always be determined because the nature of some measurements and quantities can be hard to define or quantify. However, scientists can take steps to minimise the level of uncertainty around a value.

Imagine a researcher who is interested in measuring the reaction time of participants in response to a stimulus. The true value of reaction time would be the time it takes for a participant to react to the stimulus, measured perfectly without any error. However, due to various factors, such as measurement error, individual differences and extraneous variables, the researcher cannot obtain a true value with certainty. Instead, the researcher can obtain an estimate of the true value by using reliable and valid measurement tools, controlling for extraneous variables, and collecting data from a large and diverse sample. These actions make it more likely that the obtained value reflects the true value as closely as possible.

### Accuracy and precision

**accuracy**  
how close experimental data is to the true value



**precision**  
how close a set of data values are to each other



**Accuracy** describes how close a measurement is to its true value. Measurements can be described as “more accurate” or “less accurate” when compared to their true or expected value. Alternatively, **precision** is a measure of how close the values in a data set are to each other. If the values in a data set are all close (or the same), they can be described as precise. Precision does not indicate how close measurements are to the true value and should not be confused with accuracy.



**FIGURE 1** Data that is both accurate and precise falls close together and close to the true value (the target).

Consider the image of the dartboards in Figure 2. If the true value or “target” is the bullseye (centre of the dartboard), then the closer a dart lands to the bullseye, the higher the accuracy. The closer that all darts thrown are to each other, the higher the precision. It is crucial that data is both accurate and precise in scientific research because inaccurate or imprecise data can lead to incorrect conclusions and misleading interpretations. Inaccurate data may introduce bias or systematic errors, while imprecise data may introduce random errors.

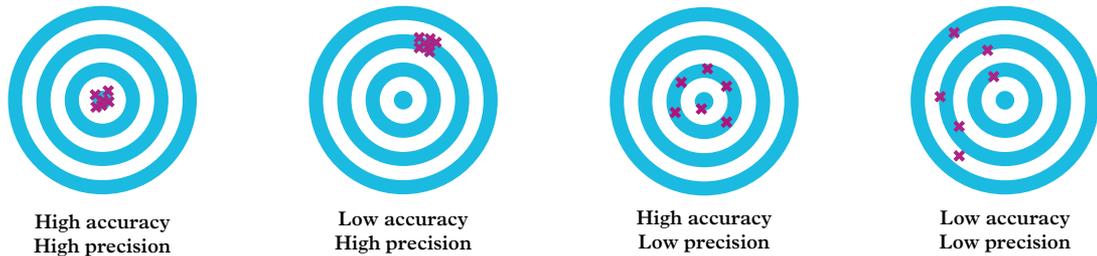


FIGURE 2 Accuracy and precision are different concepts.

**repeatability**

the degree to which an experiment can produce the same results when repeated under the same conditions

**robust**

the degree to which a result is consistent across different studies, methods and/or samples

**reproducibility**

the degree to which results can be independently confirmed by other researchers using different methods, techniques or instruments than the original conditions of the experiment

**validity**

a measure of whether the investigation is sound

**internal validity**

the extent to which the investigation results truly measured what was intended to be measured

**external validity**

the extent to which the investigation results are applicable to other settings outside of the experiment

## Repeatability

**Repeatability** refers to the ability to obtain the same data values again under the same experimental and laboratory conditions by the same observer. To determine repeatability, the same experiment should be conducted at least three times. Repeatability can be used to assess the precision and quality of measurement results and to ensure that findings are **robust**.

## Reproducibility

**Reproducibility** refers to the ability to obtain the same data values again under slightly different experimental conditions, such as with a different measuring instrument, in a different laboratory, or with different experimenters. Reproducibility requires clear experimental methods and well-defined variables. Reproducibility is closely linked to the accuracy of an experiment and can also be used to evaluate the precision and quality of measurement results.

## Validity

The **validity** of a measurement is how well it measures what it sets out to measure. The validity of a psychological investigation refers to how well the results among participants represent true findings among similar individuals outside of a study. To assess the validity of an investigation we usually consider two types of validity: internal and external.

**Internal validity** assesses whether the investigation truly measured what it was designed to measure, accounting for factors such as the appropriateness of the investigation design, the sampling and allocation techniques used, and the potential impact of confounding and extraneous variables. A lack of internal validity suggests that the results may not accurately reflect the truth, and conclusions cannot be drawn from those results.

**External validity** assesses whether the results of the investigation can be applied to similar individuals in a different setting. A lack of external validity suggests that the results may not apply to individuals from a different population than the one studied. External validity can be increased by using broad inclusion criteria and sampling techniques that result in a study population representative of the overall general human population.

# Analysing and evaluating errors, uncertainty and outliers

Although we may aim to produce data that is close to the true value when researching, this is not always possible due to errors and other factors including uncertainty and outliers.

## Errors

An **error** is the difference between the measured value and the true value of what is being measured. Table 1 outlines different kinds of errors that can occur during investigations and affect the integrity of results.

### error

the difference between the measured value and the true value

### random error

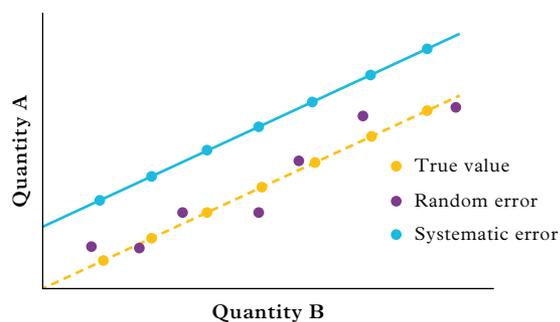
an error that affects the precision of the data set due to an unknown and unpredictable error in the experimental process

**TABLE 1** Types of errors and their possible causes

Type of error	Definition and example	Possible causes	Can be reduced by
<b>Random errors</b>	Unpredictable variations in the measurement process that affect the <b>precision</b> of results. For example, a participant drops their pencil on the ground during a memory test, which distracts them and impacts their recall ability.	<ul style="list-style-type: none"> <li>• Limitations of instruments</li> <li>• Environmental factors</li> <li>• Slight variations in procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting multiple trials</li> <li>• Taking repeated measurements and calculating a new mean</li> <li>• Increasing sample size</li> <li>• Refining measurement method or technique</li> </ul>
<b>Systematic errors</b>	Errors that cause readings of a measurement to differ from the true value by a consistent amount or proportion each time, thus affecting the <b>accuracy</b> of results. For example, if a researcher used a weighing scale that was off calibration by 0.5 grams.	<ul style="list-style-type: none"> <li>• Observation error</li> <li>• Imperfect instrument calibration</li> <li>• Environmental interference</li> </ul>	<ul style="list-style-type: none"> <li>• Becoming familiar with the limitations of instruments and experienced with their correct use</li> </ul>
<b>Personal errors</b>	Mistakes, miscalculations and biases introduced by the observer or researcher. For example, if a student miscalculates the mean.	<ul style="list-style-type: none"> <li>• Confirmation bias</li> <li>• Rushing through experiments</li> <li>• Observer bias</li> <li>• Misconduct</li> <li>• Unstructured investigation designs</li> </ul>	<ul style="list-style-type: none"> <li>• Using rigorous investigation designs</li> <li>• Carefully following instructions</li> <li>• Double checking calculations</li> <li>• Developing standards of conduct</li> <li>• Having peers review work or interpretations</li> </ul>

## Uncertainty

**Uncertainty** occurs when you are unsure of the exact value of the quantity you are measuring. In psychology, many of the variables of interest are psychological constructs, which are abstract concepts that cannot be directly observed or measured (e.g. emotions, attitudes and personality traits). As psychological constructs are inherently subjective and can vary from person to person, there is often a degree of uncertainty surrounding their measurement.



**FIGURE 3** A representation of how random error and systematic error affect results. Random error affects the precision of results and systematic error affects the accuracy of results in a consistent way.

### systematic error

an error that affects the accuracy of the data by causing the reading to differ from the true value

### personal error

a mistake, a miscalculation or an observer error that occurs when conducting research

### uncertainty

the degree to which the result of a measurement does not reflect the exact value of what is being measured

**contradictory data**

incorrect data

**incomplete data**

data that is missing or unfinished in some way due to errors in data collection, processing or limitations in the data itself

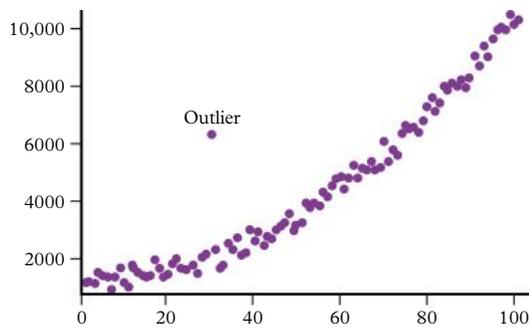
**outlier**

a value that lies outside of the expected data set

In VCE Psychology, uncertainty is treated qualitatively (without calculations). This means that when you are evaluating data to check whether it is uncertain, you should look out for **contradictory data** (incorrect data) or **incomplete data** (missing responses or observations). Qualitative evaluation of uncertainty in research may involve looking at patterns in the data, considering alternative explanations for the results, and considering contextual factors that may influence the interpretation of the data. For example, a study participant's emotional state on the day of testing could be part of a qualitative evaluation of uncertainty.

## Outliers

**Outliers** are data points or observations that lie a long way from, or are significantly different to, other points in the data set. Outliers can occur for many reasons, including measurement errors, data entry errors, a skewed distribution, or data points from a different underlying distribution. A small number of outliers is expected when there is a larger sample. It is important to explain outliers when analysing data in the discussion of a scientific report, because they can have a significant impact on the results and conclusions of a study.



**FIGURE 4** An outlier is a data point or observation that is significantly different to other points in the data set.

Plotting outliers on a graph can be a useful way to visualise their impact on the data and assess their significance. Outliers can also be excluded from the calculation of a line of best fit if they are believed to be non-representative of the underlying data. Repeating measurements is another useful way to examine outliers and assess the reliability and validity of the data. If a measurement is found to be an outlier on multiple occasions, it may be an indication of a genuine phenomenon that requires further investigation. In VCE Psychology you must be able to recognise when outliers are present in visual data and reflect on how an outlier could affect the data.

### 1.7 CHECK YOUR LEARNING



**Describe and explain**

- 1 Which types of errors would affect the accuracy of data collected in a scientific investigation?
- 2 Explain why implementing multiple trials in scientific investigations improves the reliability of data obtained.

**Apply, analyse and compare**

- 3 Compare the following sets of terms:
  - a accuracy and precision

- b repeatability and reproducibility
- c random error and personal error.

**Design and discuss**

- 4 Design a revision summary tool to help you remember how to determine whether an investigation is internally or externally valid. Include steps you can take to improve the external and internal validity of an investigation.

# 1.8

## Constructing evidence-based arguments and conclusions

### KEY IDEAS

- ✦ Analysis of raw data generated in a scientific investigation is important for constructing evidence-based arguments and conclusions.
- ✦ Sentence structure and paragraph structure are important when constructing evidence-based arguments and conclusions.



#### evidence

data, observations or facts obtained from valid research

#### anecdote

a personal account or story that is often used to illustrate a point or make an argument

#### opinion

a personal view or belief about a particular topic or issue

#### scientific idea

an idea or a theory based on empirical evidence that has been rigorously tested through observation or scientific investigation; supported by the scientific method

#### non-scientific idea

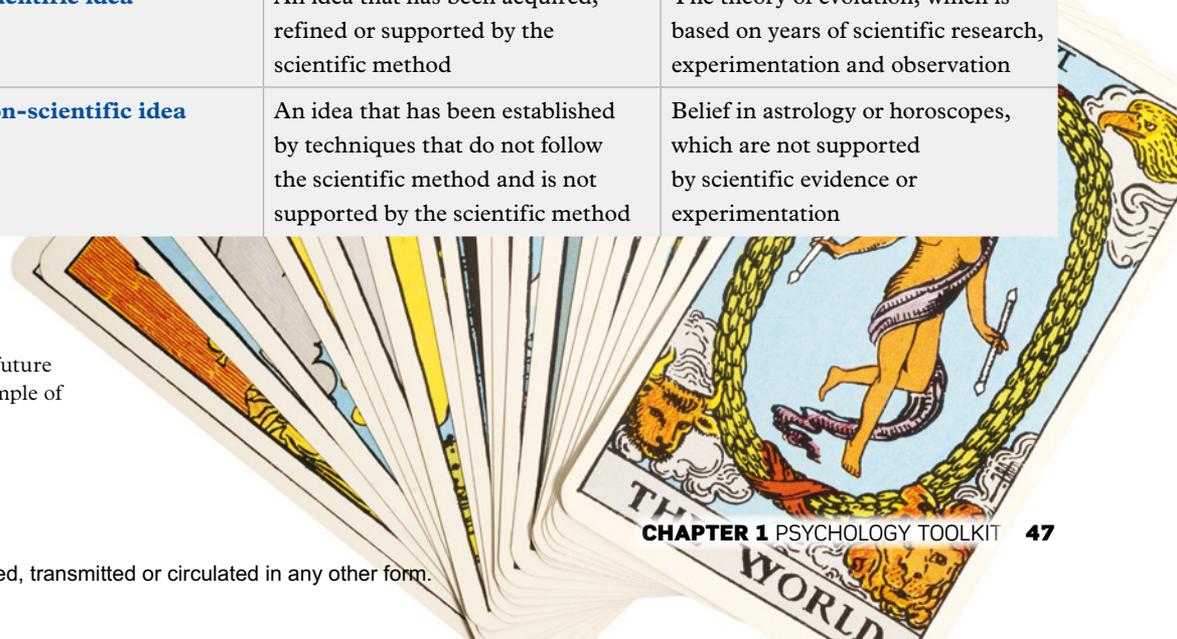
an idea or a theory that is not based on empirical evidence and has not been rigorously tested or supported through observation or scientific investigation; not supported by the scientific method

Constructing evidence-based arguments and conclusions is an important key science skill required for VCE Psychology. It is primarily used in the analysis, discussion and conclusion sections of a scientific investigation report. The type of information and ideas you source and use to help build your arguments and draw conclusions can vary. In VCE Psychology, it is important that you can tell the difference between opinion, anecdote, evidence, scientific and non-scientific ideas. Table 1 summarises different sources of information and idea types with examples.

TABLE 1 Summary of different sources of information and ideas

Term	Definition	Example
<b>Evidence</b>	Information or data on a topic that has been systematically collected; this information can help form conclusions	Data on the effects of exercise on mental health collected from participants using a standardised questionnaire
<b>Anecdote</b>	A personal observation collected in a casual non-systematic manner, used to support a view or judgment; this information is often biased	“My friend tried that diet and it didn’t work for her, so I don’t think it’s worth trying.”
<b>Opinion</b>	A person’s or organisation’s judgments or views about a topic; opinions may not always be based on evidence, experience or fact	“I think that social media is harmful to young people’s mental health.”
<b>Scientific idea</b>	An idea that has been acquired, refined or supported by the scientific method	The theory of evolution, which is based on years of scientific research, experimentation and observation
<b>Non-scientific idea</b>	An idea that has been established by techniques that do not follow the scientific method and is not supported by the scientific method	Belief in astrology or horoscopes, which are not supported by scientific evidence or experimentation

FIGURE 1 Predicting the future using tarot cards is an example of a non-scientific idea.



## How to construct evidence-based arguments and conclusions

Some broad questions that may be answered when constructing evidence-based arguments are:

- What is the origin or who was responsible for the experimental results, findings, evidence or raw data collected?
- Are the experimental results, findings, evidence or raw data accurate, precise, repeatable, reproducible and/or valid?
- What kinds of errors, inconsistencies and outliers may have affected the experimental results, findings, evidence or raw data collected?
- What kinds of background information (such as psychological concepts, scientific understandings or other researched information sources) were used to link or connect the experimental results, findings, evidence or raw data to the investigation question and to the aim?
- What series of steps or procedures could be used to improve the experimental design or methodology for future trials of this scientific investigation?

### Evaluating evidence

Any data or evidence you have produced or sourced to help answer your investigation question needs to be evaluated before you can use it to form an argument. When evaluating data or evidence you should consider whether the evidence supports the aim of the investigation.

Evidence that supports the aim of an investigation is any information, data or observations that help to answer the research question or hypothesis being investigated. This evidence is directly useful to support the goal of the investigation. For example, if the aim was to “investigate the effects of sleep duration on academic performance in high school students”, evidence that supports this aim would be data on academic performance in response to different sleep times or conditions. This could include results from trials, questionnaires or case studies.

If evidence does not support the investigation aim or could be improved, you should offer recommendations or modifications that could improve or extend the investigation.

### Constructing an argument

Argument structure usually follows a pattern, the length of which is determined by the number of arguments addressed. One argument usually corresponds to one paragraph.

#### **Introduction (what is your argument/point of view?):**

- Position statement (what is your hypothesis or summary of the scientific investigation?)
- List the arguments that you will make.

#### **Explain your supporting arguments:**

- Supporting argument 1:
  - Point – identified in topic sentence
  - Explanation – support with evidence, scientific finding, result or data



**FIGURE 2** How would a lack of sleep affect a high school student’s academic performance?

- Supporting argument 2:
  - Point – identified in topic sentence
  - Explanation – support with evidence, scientific finding, result or data
- Supporting argument 3:
  - Point – identified in topic sentence
  - Explanation – support with evidence, scientific finding, result or data

**Reinforce your main point – “To sum up ...”**

## Language features

When writing an argument, use the following language features to enhance your writing:

- connectives to show cause and effect; for example, “As an outcome of ...”, “As a result of ...”, “because ...”, “consequently ...”
- scientific terminology and/or supporting figures
- supporting facts and/or quotes from experts or other researched external sources of information; for example, “A study conducted by XX found that ...”
- making evaluative statements; for example, “The data shows a clear trend ...”, “Evidence contradicts the argument that ...”
- formal language and avoiding personal language (such as I, you, he, she, we, they, me, him, her, us and them); for example, “the hypothesis was supported”, not “I proved my hypothesis”.

## Drawing conclusions

Once you have evaluated your evidence and used this to construct your arguments, you can then start to form an evidence-based conclusion. A **conclusion** is a statement or a few statements that summarise the findings of an investigation in response to the investigation hypothesis. Psychologists never say that a hypothesis has been “proven” or “disproven”. After all, there may be another hypothesis that explains the relationship even more accurately than the one that was tested. Instead, the conclusion assesses whether the findings either **support** or **refute** the hypothesis.

If the results or investigation methods had low validity or did not address the research aim, then you should not draw a conclusion. Most conclusions from an investigation only apply to the population of that specific study. Conclusions can only be drawn for wider populations if the investigation is externally valid.

## Limitations

**Limitations** refer to factors or constraints that can potentially affect the reliability or validity of research. Limitations are generally related to the study design or the external environment in which the study is conducted (e.g. methods used, limited funding, time constraints, sampling constraints or ethical considerations) and are often outside the control of the researcher. Limitations are not the same as extraneous or confounding variables; they may instead result in extraneous or confounding variables existing within a study. For example, in a study examining the relationship between exercise and mood, a limitation could be inability to control for participants’ dietary habits, which could introduce an extraneous variable that affects their mood independently of exercise. If any limitations in the research are identified, then recommendations should be made to negate the limitation in future. This might include suggesting improvements to the method or way the research was conducted or identifying if further research needs to be conducted.

### **conclusion**

a summary of the findings and results obtained from the study or investigation

### **support**

agrees with (in relation to the hypothesis)

### **refute**

contradicts or does not support (in relation to the hypothesis)

### **limitation**

a factor or condition that may affect the accuracy or validity of results

### **Study tip**

Remember, a hypothesis cannot be “proved”; rather, findings are assessed on whether they support (agree with) or refute (do not agree with) the hypothesis.

## Implications

### implication

a potential consequence or effect of scientific results or conclusions

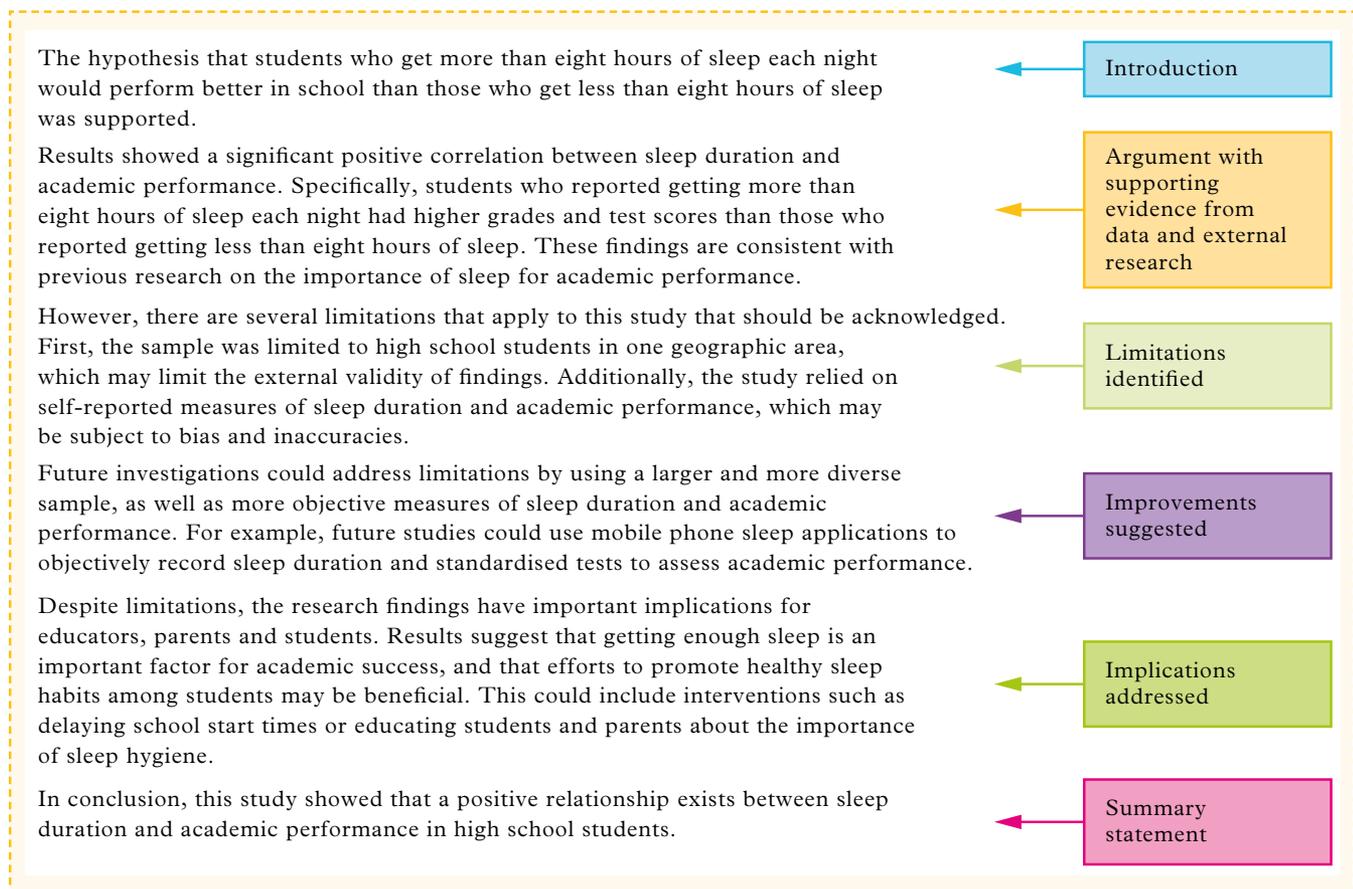
**Implications** are the potential impacts that research results may have on a population, field of study, related fields or on society. For example, if results showed that students who reported getting more than eight hours of sleep each night had higher grades and test scores than those who reported getting less than eight hours of sleep, then implications of this research may include:

- the need for schools to promote healthy sleep habits among students
- government interventions (e.g. delaying school start times, including sleep education as part of health curriculums)
- the need for more research to determine the cognitive impacts sleep deprivation may have on adolescents.

When discussing the implications of an investigation, it is important to consider how appropriate and applicable findings are to different cultural groups and to assess whether any cultural bias might exist within the research. For example, the implications of research conducted on Australian students might differ for Finnish or Japanese student populations due to cultural differences and norms. **Generalisability** is the degree to which findings of research can be applied to other situations. In VCE Psychology you should consider generalisability where evaluating the appropriateness and application of data to different cultural groups and when reviewing the external validity of research.

### generalisability

the extent to which findings of research can be applied to other situations or populations



**FIGURE 3** Example of using evidence to structure arguments and form a conclusion

## 1.8 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain why it is important to construct and understand evidence-based arguments and conclusions in science.
- 2 Identify three things you should (or should not) do when writing an evidence-based argument.

### Apply, analyse and compare

- 3 Distinguish between a limitation and an implication.
- 4 Classify the following examples as one of evidence, anecdote, opinion, scientific idea or non-scientific idea.
  - a Results of a study that used a large sample of participants and systematic data collection that show how smoking increases the risk of lung cancer
  - b A person's belief that vaccinations are harmful and should not be given to children
  - c The belief that certain gemstones have healing powers
  - d Charles Darwin's theory of evolution

- e A story shared by a friend about how their aunt who only ate junk food lived until 95 years old without any health problems.

### Design and discuss

- 5 A study was conducted to investigate the relationship between caffeine consumption and anxiety levels. Researchers recruited 200 participants and asked them to report their average daily caffeine intake and anxiety levels over the past week. Results found a significant positive correlation between caffeine consumption and anxiety levels.
  - a If the original hypothesis was that “the greater the amount of caffeine consumed, the higher the level of anxiety experienced”, do results support or refute the hypothesis? Justify your response.
  - b Discuss two potential limitations of this study and provide recommendations to improve the study in future based on the limitations you have discussed.
  - c Identify two potential implications of the study.

# 1.9

## Analysing and evaluating scientific ideas

### KEY IDEAS



- ✦ Ideas, concepts, models and theories are different forms of scientific information.
- ✦ Sources of scientific information such as journal articles, mass media communications, opinions, policy documents and reports in the public domain have strengths and limitations and can vary in levels of credibility.
- ✦ Psychological issues can be influenced by social, economic, political and legal factors.

## Types and sources of scientific information

Scientific information is not only found in your science subjects at school. It is found across everyday life in journalism, advertising, government policy and online (such as on websites, blogs, videos and social media). In VCE Psychology, you must be able to analyse and evaluate scientific information. To do this, you need to be familiar with different types and sources of information about psychology.

### Types of scientific information

In VCE Psychology, you will need to be able to discuss different types of scientific information and draw links between many ideas. Table 1 outlines the differences between ideas, concepts, models and theories.

**TABLE 1** Summary of different types of scientific information

Type of information	Definition	Example
<b>Idea</b>	A mental representation of a thought or concept, often without a specific structure or framework. An idea is typically an initial thought that has yet to be fully formed or developed.	A psychologist may have an idea that a certain type of therapy may be effective for treating depression.
<b>Concept</b>	A mental construct that organises linked ideas and observations into a clear framework. It is a more structured way of thinking about a particular subject or phenomenon. Concepts can be used to define, categorise and explain various aspects of the world around us.	The concept of self-esteem refers to a person's overall evaluation of themselves and their worthiness as an individual.
<b>Model</b>	A simplified representation or summary of a complex system or phenomenon that is used to help explain or predict behaviour.	The Information Processing Model is a cognitive model used to describe how people perceive, process and store information.
<b>Theory</b>	A well-substantiated explanation of a phenomenon that has been developed through scientific observation, experimentation and reasoning. It is typically supported by a large body of evidence and can be used to make predictions about future observations or experiments.	The theory of social learning, as developed by Albert Bandura, provides a well-substantiated explanation for how individuals learn new behaviours through observation and imitation of others. It has been extensively studied and supported by empirical (experimental) evidence.

#### idea

a mental construct representing a vague thought or notion that lacks a specific structure or framework

#### concept

a mental representation that organises ideas and observations into a clear structure or framework

#### model

a simplified representation of a complex system or phenomenon used to improve understanding of a complex construct or make predictions; the person who is demonstrating a behaviour being watched by the learner

#### theory

a well-supported reason or descriptive account of a phenomenon that has been established through rigorous scientific investigation

## Sources of scientific information

Scientific information can come from many different sources. Understanding the strengths and weaknesses of different sources of scientific information can help you evaluate the credibility of scientific information, assess claims, make informed decisions and communicate effectively. Table 2 outlines common sources of scientific information and their strengths and weaknesses.



**FIGURE 1** Mass media communications can reach a large audience.

**TABLE 2** A summary of different sources of scientific information

Source of information	Description	Example	Strengths	Weaknesses
Journal articles	Scholarly papers published in academic journals that present original research findings, theories or reviews	A paper published in the journal <i>Psychiatry Research</i> that provides an overview of the mental health of Australians during the COVID-19 pandemic	<ul style="list-style-type: none"> <li>Provides detailed information about research methods, results and conclusions.</li> <li>Undergoes peer review by experts in the field.</li> </ul>	<ul style="list-style-type: none"> <li>Can be highly technical and difficult for non-experts to understand.</li> <li>Can take a long time to publish.</li> <li>May not be accessible to the public.</li> </ul>
Mass media communications	News articles or broadcasts that present information to a wide audience	A news segment on the ABC about a study on the impact of bushfires on the mental health of Australians	<ul style="list-style-type: none"> <li>Reaches a large audience.</li> <li>Can raise awareness about scientific issues.</li> </ul>	<ul style="list-style-type: none"> <li>May oversimplify complex scientific concepts or exaggerate findings for dramatic effect.</li> <li>May not provide sufficient context or detail.</li> </ul>
Opinions	Personal views or beliefs on topics	A blog post by a mental health advocate discussing the importance of early intervention for children with anxiety	<ul style="list-style-type: none"> <li>Can provide different perspectives on scientific issues.</li> <li>Can be accessible to the public.</li> </ul>	<ul style="list-style-type: none"> <li>May not be based on evidence or scientific consensus.</li> <li>Can be biased or influenced by personal beliefs or interests.</li> </ul>
Policy documents	Documents created by governments or organisations that outline plans or guidelines related to an issue	The Australian Psychological Society's Code of Ethics	<ul style="list-style-type: none"> <li>Can influence public policy and decision-making.</li> <li>Can provide a framework for addressing scientific issues.</li> </ul>	<ul style="list-style-type: none"> <li>May not be based on the most up-to-date scientific research.</li> <li>Can be influenced by political or economic interests.</li> </ul>
Reports in the public domain	Documents created by researchers or organisations that are publicly available and provide information about issues	Suicide Prevention Australia's annual report	<ul style="list-style-type: none"> <li>Can provide accessible information about scientific issues to the public.</li> <li>Can highlight areas for further research or action.</li> </ul>	<ul style="list-style-type: none"> <li>May not undergo the same level of scrutiny as peer-reviewed journal articles.</li> <li>May be biased or influenced by the interests of the organisation that produced them.</li> </ul>

## Factors influencing psychological issues

In addition to the ethical concepts and guidelines outlined in Topic 1.4, there are several additional factors that may influence information on psychology, including social, economic, legal and political factors. Understanding how these factors influence psychological research and issues is important for developing effective research strategies and interventions. Table 3 summarises how social, economic, legal and political factors can influence psychological research or issues.

**TABLE 3** Summary of factors that can influence psychological issues and research

Factor	Description	Example
Social	Refers to the ways in which society and culture shape psychological research and issues.	A study on the impact of social media use on mental health may be influenced by differences in social norms around technology use, as well as cultural values regarding privacy and self-disclosure.
Economic	Refers to the financial resources available for psychological research and issues, as well as the economic factors that influence them.	Access to medication may be influenced by its cost.
Legal	Refers to the laws and regulations that impact psychological research and issues, including ethical guidelines and regulations regarding data collection and privacy.	Researchers conducting a study on sensitive psychological topics, such as trauma or addiction, are subject to data and privacy laws.
Political	Refers to the influence of politics and government on psychological research and issues, including policies related to mental health care and funding for research.	Mental health policies and the allocation of funding for research may be influenced by political factors, such as the priorities of the current government or the influence of interest groups.



**FIGURE 2** The financial resources available for psychological research and issues are economic factors.

## 1.9 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify two benefits of being able to understand the strengths and weaknesses of different sources of psychological information.
- 2 Explain one strength and one weakness for each of the following sources of information:
  - a journal articles
  - b policy documents
  - c mass media communications.

### Apply, analyse and compare

- 3 Distinguish between a model and a theory.

### Design and discuss

- 4 Pierre is conducting a study on how the media's coverage of bushfires affects the mental health of Australians. Discuss how two factors (social, economic, legal or political) could affect his research.
- 5 Tory is the host of a popular podcast that discusses pop culture and daily life.

In one episode, Tory shares her experience of being diagnosed with attention deficit hyperactivity disorder as an adult and how symptoms have presented in her life. Following the episode, many listeners wrote in to say the episode was eye-opening and helped them recognise symptoms in themselves.

- a Identify the type of information Tory is providing. Justify your answer.
- b Identify what source of information Tory's podcast is. Justify your answer.
- c Discuss the positive and negative impacts that this information could have on listeners.
- d The money from her podcast has allowed Tory to access and pay for top-quality psychologists and expensive medications. Explain how economic factors could influence some of Tory's lower-socioeconomic listeners' access to psychological assessment and costly medications.

# 1.10

## Communicating scientific ideas

### KEY IDEAS

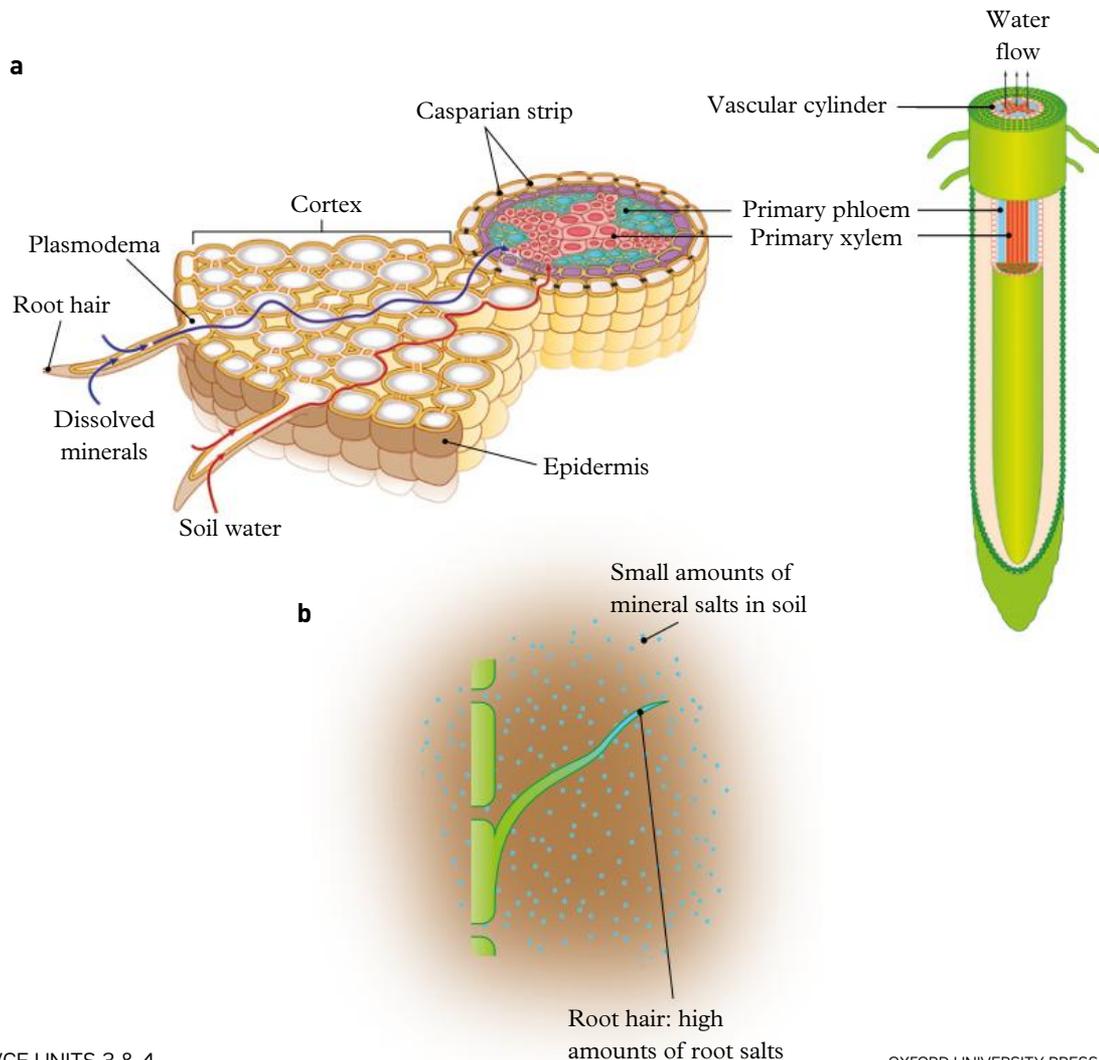
- Effective science communication depends on knowing your audience and prioritising important information.



### Communicating scientifically

Science can often be difficult to understand, especially for those outside the scientific community. Effective science communication can help bridge this gap by translating scientific findings and concepts into language that a variety of audiences can understand. Actions you can take to improve the effectiveness of your scientific communication include the following.

- Identifying and understanding your target audience.** Presenting work for teachers or external examiners will be different from presenting to your peers. You want to ensure the language and methods you use to communicate ideas are appropriate for your audience and encourage them to engage. Consider the two diagrams in Figure 1. They are focused on the same concept, but the style, details and labels included are specific to two different audiences.



**FIGURE 1** Both these diagrams show how plant root hairs take in water. Diagram **a** is appropriate for a VCE Biology class, whereas diagram **b** is appropriate for a Year 8 science class.

- **Using language that is appropriate for your target audience.** If you are speaking to the public, then limit the use of **jargon** wherever possible. If you need to incorporate acronyms, make sure in your visual presentation that the full words are written in brackets next to the abbreviation on one occasion.
- **Being concise and only including essential content.** Your communication should contain essential facts that enhance your target audience’s understanding of the science involved.
- **Using appropriate stylistic elements relevant to your target audience.** This might include (but is not limited to) the use of a specific presentation format (poster, report, infographic or digital media platform), diagrams, photographs, graphs, tables or other text elements (such as similes, metaphors or analogies). They should convey clear content and messages, appeal to your audience and enhance the information so that the science is simple, easily understood and relatable without too much information or confusion.
- **Using appropriate psychological terminology and conventions.** This might include (but is not limited to) the use of coherent, concise, objective and formal use of scientific language; the consistent use of tense and/or active or passive voice; definition of key psychological terms and accurate scientific representations (such as diagrams, flowcharts or graphs) and a bibliography or reference list for citation of text and/or diagrams that are not of your own creation. You can learn more about referencing correctly in Chapter 11, Topic 11.3.

**jargon**

specific terminology or language relevant to a field of study that might be difficult for others to understand

**Study tip**

Spell check on your digital device is not always 100 per cent reliable. Read, re-read or ask another person to review your work before final submission(s) to confirm that there are no spelling or grammatical errors and that methods of effective scientific communication have been used.

## Formats for communication

Science is not all about practical reports. There are many ways to communicate scientific concepts that you might like to try in VCE Psychology. For example, you could present information as:

- an oral presentation
- a report
- an infographic
- a video or animation
- a multimodal presentation
- a scientific poster.

### Scientific poster

In VCE Psychology, you will produce a scientific poster as part of a major piece of assessment in Units 3 and 4.

The poster may be produced electronically or in hard copy and should not exceed 600 words, to meet criteria of conciseness, clarity and legibility. Note that tables, graphs and references and/or acknowledgments are not included in the word count.

Table 1 shows the required scientific poster format as specified by the VCE Psychology Study Design. The centre of the poster should take up 20–25 per cent of the poster space and contain a one-sentence summary of the major finding or outcome of the investigation that answers the investigation question.

**TABLE 1** The format for the scientific poster

Title Student name		
Introduction	Communication statement reporting the key finding of the investigation as a one-sentence summary	Discussion
Methodology and methods		Conclusion
Results		
References and acknowledgments		

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## 1.10 CHECK YOUR LEARNING



### Describe and explain

- 1 Define the term “jargon” and explain why it is important to minimise the use of jargon when presenting ideas to the public.
- 2 Rewrite each of the following statements to express the same idea to an audience of eight-year-old children.
  - a “It is important to include all sources of information used in a reference list at the end of an assessment to ensure you are correctly acknowledging the work of others.”
  - b “When communicating scientific concepts, it is better to be concise than to include irrelevant or unnecessary information.”

### Apply, analyse and compare

- 3 Compare the elements of science communication used in a TikTok video against a media article of your choice. In what ways are they similar and different?

### Design and discuss

- 4 Ezra is writing a report that examines the effects of sleep deprivation on academic performance at school.

Ezra wants to include the following features and points in their report:

- an explanation of sleep deprivation and the effects of sleep deprivation
  - an explanation of how academic results are collated in VCE
  - summarised findings of published studies that have examined or tested how sleep deprivation impacts performance on cognitive and academic tasks
  - a graph based on the results of a study that shows a correlation between lack of sleep and poor academic performance
  - the average VCE study scores in their school
  - a conclusion that summarises what Ezra has learnt about the effects of sleep deprivation on academic performance.
- a Discuss which of the listed features Ezra should focus on, and which features they should not include within their report. Justify your reasoning.
  - b Suggest any features, points or advice Ezra could use or include in their report to enhance how well it is communicated.



**FIGURE 2** When creating a scientific poster, remember to use colour to engage your audience!

# 1.11

## Aboriginal and Torres Strait Islander knowledges, cultures and histories

### KEY IDEAS



- ✦ Aboriginal and Torres Strait Islander peoples – the traditional owners of Australia – hold Indigenous knowledges developed by their ancestors and passed down through generations. These knowledges are broad in subject matter and have facilitated the continuing survival of Aboriginal and Torres Strait Islander cultures to make them the oldest living cultures in the world.
- ✦ Correctly acknowledging cultural and/or language groups, rejecting deficit discourse, avoiding Eurocentrism and critically evaluating sources of information can help you to respectfully engage with Aboriginal and Torres Strait Islander knowledges, cultures and histories in VCE Psychology.

### Aboriginal and Torres Strait Islander peoples

past and current descendants of the original inhabitants and custodians of the land we know today as Australia

### Indigenous knowledge systems

Aboriginal and Torres Strait Islander traditional systems of knowledge, that include understandings, practices, skills, spirituality and innovations

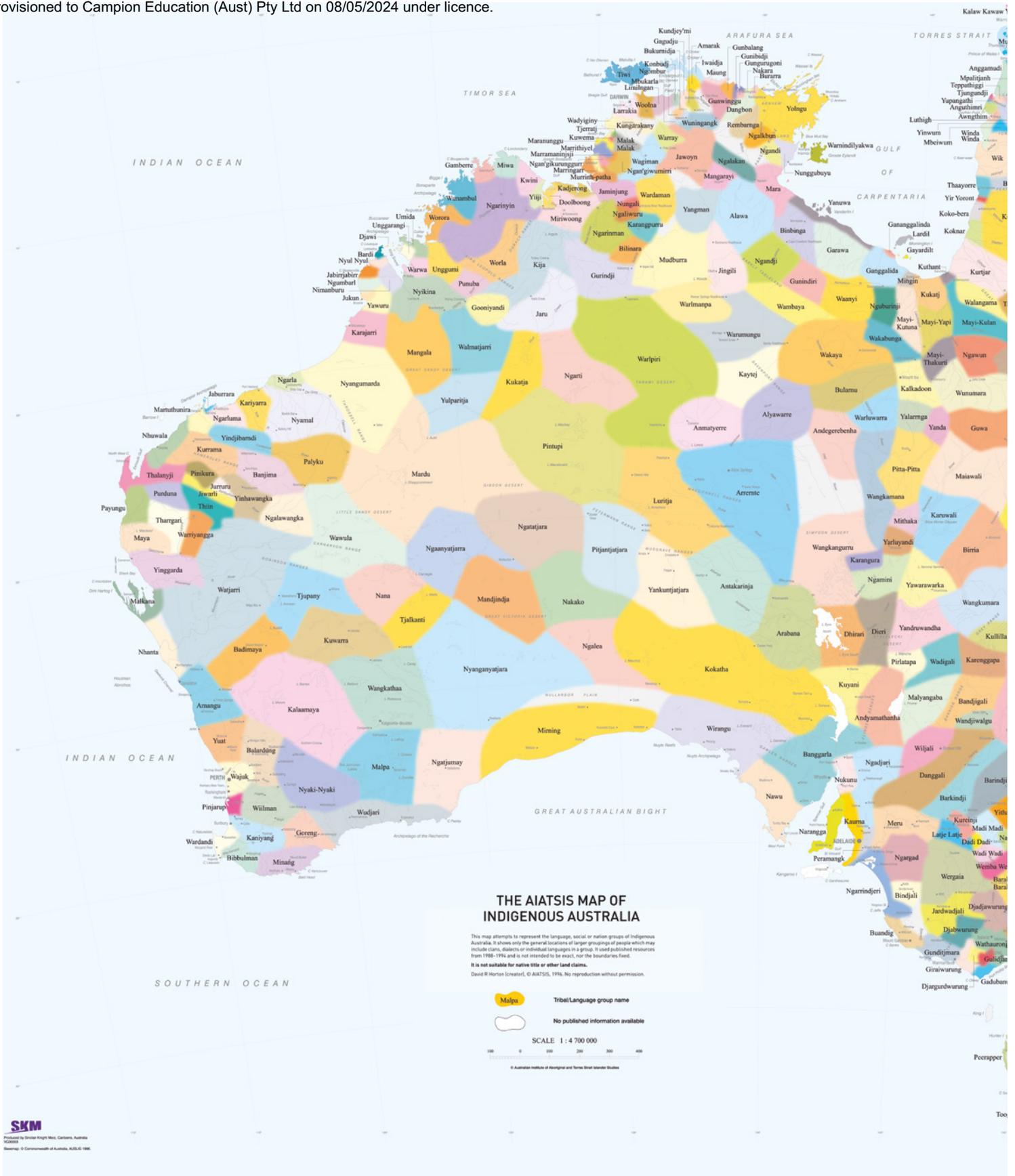
**Aboriginal and Torres Strait Islander peoples** are the first peoples and traditional owners of Australia. For more than 65,000 years, Aboriginal and Torres Strait Islander peoples have developed, and continue to refine, understandings of the world through a variety of different practices. Aboriginal and Torres Strait Islander ways of knowing, being and doing are complex and promote sustainable lifestyles that foster peaceful relationships between cultural groups, kinship, land, waterways, skies, plants, animals and ancestry. These **Indigenous knowledge systems** allow Aboriginal and Torres Strait Islander peoples to thrive.

Aboriginal and Torres Strait Islander peoples are not a homogeneous group; there are approximately 250 different language groups within Australia including 800 dialects (Figure 1). Throughout VCE Psychology, you will have the opportunity to learn about some Aboriginal and Torres Strait Islander knowledges, cultures, histories and experiences.

In Unit 3 Area of Study 2, you will learn about the contribution of Aboriginal and Torres Strait Islander knowledges and perspectives in understanding memory and learning. In Unit 4 Area of Study 2, you will consider Aboriginal and Torres Strait Islander peoples' multidimensional and holistic views of wellbeing. As you learn about Aboriginal and Torres Strait Islander knowledges, cultures and histories it is important that you:

- recognise the significance of how Aboriginal and Torres Strait Islander knowledges, cultures and histories, along with Indigenous psychology, have contributed to the overall field of psychology
- consider and understand the unique history and cultural diversity of Aboriginal and Torres Strait Islander peoples and diverse ways of being, knowing, thinking and doing
- recognise that what is experienced, observed or felt by one Nation, Mob or individual can differ greatly to what is experienced, observed or felt by another.

In this topic we will explore some practices and considerations you can apply to help you best engage with Aboriginal and Torres Strait Islander knowledges, cultures and histories in VCE Psychology. Please note that the content in this topic has been written by a non-Indigenous individual in consultation with First Nations peoples from the Australian Psychology community and may not represent the views and perspectives of all Aboriginal and Torres Strait Islander peoples.



**FIGURE 1** The Australian Institute of Aboriginal and Torres Strait Islander Studies map of Indigenous Australia

This map attempts to represent the language, social or nation groups of Aboriginal Australia. It shows only the general locations of larger groupings of people which may include clans, dialects or individual languages in a group. It used published resources from the eighteenth century-1994 and is not intended to be exact, nor the boundaries fixed. It is not suitable for native title or other land claims. David R Horton (creator), © AIATSI, 1996. No reproduction without permission. To purchase a print version visit: <https://shop.aiatsis.gov.au/>



## Engaging with Aboriginal and Torres Strait Islander knowledges

Engagement with Aboriginal and Torres Strait Islander knowledges can enrich your understanding of and interaction with the world. However, there are certain protocols that must be applied to ensure that the sharing and acquisition of such knowledges is done respectfully, acknowledging Aboriginal and Torres Strait Islander peoples. The 8 Ways of Learning is a framework that was designed to help teachers incorporate Aboriginal perspectives in classrooms by using Aboriginal learning techniques. The framework, which describes eight Aboriginal learning practices (that you will learn about in Unit 4) was developed by James Cook University's School of Indigenous Studies and the Western New South Wales Regional Aboriginal Education Team. The 8 Ways framework also outlines ten cultural interface protocols to apply when engaging with Aboriginal knowledge:

- 1 Use Aboriginal processes to engage with Aboriginal knowledge.
- 2 Approach Aboriginal knowledge in gradual stages, not all at once.
- 3 Be grounded in your own cultural identity (not “colour”) with integrity.
- 4 Bring your highest self to the knowledge and settle your fears and issues.
- 5 Share your own stories of relatedness and deepest knowledge.
- 6 See the shape of the knowledge and express it with images and objects.
- 7 Build your knowledge around real relationships with Aboriginal people.
- 8 Use this knowledge for the benefit of the Aboriginal community.
- 9 Bring your familiar understandings but be willing to grow beyond these.
- 10 Respect the aspects of spirit and place that the knowledge is grounded in.



**FIGURE 2** Seeing the shape of knowledge and expressing it with images and objects is one cultural interface protocol to apply when engaging with Aboriginal knowledges.

In addition to these protocols, there are other actions you can take throughout your learning journey to best engage with both Aboriginal peoples' and Torres Strait Islander peoples' knowledges, cultures and histories. These include:

- knowing and correctly acknowledging cultural or language groups of the land you are a visitor on
- rejecting deficit discourse in preference to a strengths-based approach
- avoiding Eurocentrism
- critically evaluating sources of information through a cultural lens.

## Correctly acknowledging culture

Whenever writing or referring to Aboriginal or Torres Strait Islander peoples, it is important to use correct and respectful language. Using “Aboriginal and Torres Strait Islander peoples” is generally seen as best practice as it encompasses all diverse Aboriginal and Torres Strait Islander cultures. The words “peoples”, “First Nations” and “First Peoples” can also be used to respectfully refer to all diverse Aboriginal and Torres Strait Islander cultures. You should avoid abbreviating “Aboriginal and Torres Strait Islander” as this can be seen as lacking respect for different identities. Including capitalisation is a sign of respect and should be used for the following terms:

- **A**boriginal and **T**orres **S**trait **I**slander peoples
- **F**irst **N**ations/**F**irst **P**eoples/**F**irst **A**ustralians
- **I**ndigenous (if used)
- **E**lders
- **T**raditional **O**wners/**C**ustodians
- **C**ountry.

## Country, Nation and Mob

When referring to specific cultures or language groups it is important to understand the difference between **Country**, **Nation** and **Mob**. Having this understanding will help you to correctly acknowledge the sources of knowledges and more specifically understand who and where histories and cultures apply to or originate from.

**TABLE 1** Summary of the terms Country, Nation and Mob

Term	Description
Country	The traditional lands connected to a particular language or cultural group. “Country” is a term often used by Aboriginal peoples to describe the lands, waterways and seas to which they are connected. This also includes complex ideas about lore, place, custom, language, spiritual belief, cultural practice, material sustenance, family and identity. For example, Wurundjeri Country is connected to the Wurundjeri people.
Nation	A larger grouping or federation of language groups that may be linked geographically, socially, politically and/or linguistically. For example, the Kulin Nation (Figure 3) is an alliance of five Aboriginal nations in south-central Victoria (Boonwurrung, Dja Dja Wurrung, Taungurung, Wathaurong and Woiwurrung).
Mob	May refer to an ethno-linguistic group or be used to refer to one’s family or community; for example, “My Mob are the Taungurung from my dad’s side and Yuin from my mum’s side.” Use of the term “Mob” can be debated among Aboriginal and Torres Strait Islander communities and individuals. Some communities and individuals prefer to use the term, others may prefer to use alternative terms, and some others may find the term offensive.

### Country

an area (not just geographically) that is traditionally owned and looked after by an Aboriginal language group(s) or community; a place of spiritual meaning with deep feelings of spiritual, cultural and emotional connection and attachment, including all living beings, plants and natural elements within it

### Nation

a collective of language groups linked through geographic, social, political and/or linguistic ties

### Mob

a family unit, language group, Nation or wider community group that a First Nations person identifies with



FIGURE 3 The Kulin Nation is a federation that consists of five language groups.

## Rejecting deficit discourse

The European colonisation of Australia has had a lasting impact on Aboriginal and Torres Strait Islander peoples, communities, identities and cultures. Colonisation displaced many First Peoples from their Country and/or Place, families and ways of life. Post-colonisation governing bodies continually failed to acknowledge the rights and cultures of Aboriginal and Torres Strait Islander peoples. This suppression and denial of Aboriginal and Torres Strait Islander cultures has contributed to an increased prevalence of **intergenerational trauma** and decreased health outcomes in Aboriginal and Torres Strait Islander communities. Despite the long-lasting impacts of colonisation, the **resilience** and strength of Aboriginal and Torres Strait Islander peoples have allowed Aboriginal and Torres Strait Islander systems, customs and understandings to continue to thrive.

### intergenerational trauma

trauma that is passed down from those who have directly experienced an incident to their future generations

### resilience

the ability to mentally cope with or adapt to uncertainty, challenges and adversity



FIGURE 4 Torres Strait Islander dancers performing at the Cairns Indigenous Art Fair in 2016

**social and emotional wellbeing**

a holistic understanding of wellness for Aboriginal and Torres Strait Islander peoples that includes intrinsic connections between the relational-self, mind-emotions, body, Country, community, culture, kinship and ancestry

**deficit discourse**

a mode of thinking that frames and represents people through a negative or lacking perspective

**strengths-based approach**

a mode of thinking that frames and represents people through their resilience and strengths

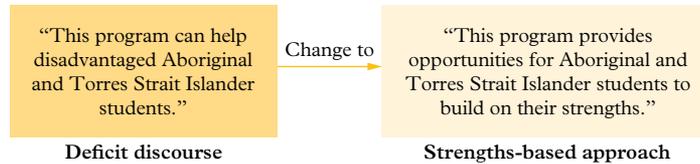
**self-determination**

the right for people to determine their own political status and to direct their own economic, social and cultural development, without outside intervention

**Eurocentrism**

a worldview that focuses on or favours Western or European histories and thinking

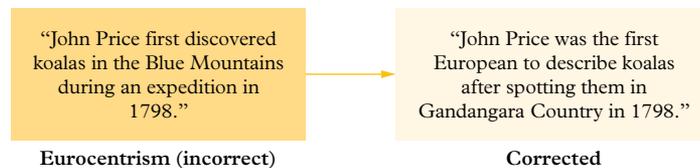
It is important to acknowledge how colonisation has impacted and continues to affect the **social and emotional wellbeing** of many Aboriginal and Torres Strait Islander peoples. However, Aboriginal and Torres Strait Islander peoples should not be viewed solely through the lens of the struggles or challenges faced. Doing so can result in **deficit discourse**, which characterises people or groups in terms of deficiency, absence, lack or failure and reinforces negative stereotypes. Deficit discourse can be countered by taking a **strengths-based approach**, a perspective that focuses attention on the **self-determination**, resilience and strengths of a person or group rather than the adversity faced by that person or group (Figure 5).



**FIGURE 5** Example of changing deficit discourse to a strengths-based approach

**Avoiding Eurocentrism**

**Eurocentrism** is the tendency to view things from a European or Western perspective while denying the perspectives and experiences of non-European cultures. Eurocentrism should be avoided as it can disregard important First Peoples understandings that have existed for thousands of years prior to European settlement in Australia. For example, many scientific discoveries of animals, plants and locations have been credited to Europeans, despite the same animals, plants and locations having been discovered and characterised by First Peoples well before European settlement. The way that you present or describe information when researching can help dismantle Eurocentric statements and beliefs (Figure 6).



**FIGURE 6** Example of correcting a Eurocentric statement

**Evaluating sources of information**

Not all sources of information are equal. In fact, some sources of information that appear to be educational or helpful can contain language or elements that may misrepresent other cultures and perspectives. Much of the information accessed when researching can come from Western perspectives and may contain Eurocentric or incorrect interpretations or a deficit discourse narrative, and may lack First Peoples voices or consultation. Therefore, when researching Aboriginal and Torres Strait Islander knowledges, cultures and histories it is important to evaluate the credibility of sources. Madsen, Perkins and Shay (2021) created the YARNS (Year, Author, Representations, Nouns, Sensitivity) tool to help evaluate resources containing information related to Aboriginal and Torres Strait Islander peoples. The YARNS tool poses a range of questions that can be asked to help assess whether a resource is fit for use (Table 2).



**FIGURE 7** The discovery and characterisation of many native Australian animals, plants and locations are often falsely credited to European colonisers.

**TABLE 2** The YARNS tool to evaluate resources

Aspect of YARNS	Questions to ask about the resource
Year	<ul style="list-style-type: none"> <li>• When was the resource made?</li> <li>• Is it up to date?</li> <li>• Does the year reflect contemporary (modern) Indigenous Australia?</li> <li>• Is additional context needed to understand the resource?</li> </ul>
Author	<ul style="list-style-type: none"> <li>• Does the author identify themselves as Aboriginal and/or Torres Strait Islander?</li> <li>• Were Aboriginal and/or Torres Strait Islander peoples consulted in the creation of the resource and were they recognised for their contribution?</li> <li>• Does the author identify the Traditional Owners of the Country on which the resource was produced?</li> <li>• Does the author (if non-Indigenous) clearly name the cultural standpoint and position they are writing from?</li> </ul>
Representations	<ul style="list-style-type: none"> <li>• Are Aboriginal and/or Torres Strait Islander peoples presented in a balanced way showing both historical and contemporary cultural practices?</li> <li>• Does the resource use racist terms (e.g. “primitive” or “uncivilised”) for Aboriginal and Torres Strait Islander peoples?</li> <li>• Are there diverse representations of Aboriginal and/or Torres Strait Islander peoples through images?</li> </ul>
Nouns	<ul style="list-style-type: none"> <li>• Are accepted descriptions or names for Aboriginal and Torres Strait Islander peoples used in the resource?</li> <li>• Are capitals used correctly in the resource?</li> <li>• Is the language contemporary and does it reflect contemporary guidelines?</li> </ul>
Sensitivity	<ul style="list-style-type: none"> <li>• Does the source name all Aboriginal and/or Torres Strait Islander peoples pictured or group them into one homogeneous group?</li> <li>• Is there cultural information that may not be appropriate to represent?</li> <li>• Does the resource have images of Aboriginal and/or Torres Strait Islander peoples who have died and is there a warning about this?</li> </ul>

Source: Adapted from Madsen, Perkins and Shay (2021)

## 1.11 CHECK YOUR LEARNING



### Describe and explain

- 1 Define:
  - a Country
  - b Mob
  - c Nation.
- 2 Describe what Eurocentrism is and explain why it is important to avoid writing Eurocentric statements or relying on information that is written in a Eurocentric way.
- 3 Identify three questions you could ask to evaluate whether a resource is worth using based on its representations of Aboriginal and Torres Strait Islander peoples.
- 4 Explain why shortening Aboriginal and Torres Strait Islander peoples to an acronym is disrespectful.

### Apply, analyse and compare

- 5 Distinguish between deficit discourse and a strengths-based approach.
- 6 Rewrite the following Eurocentric statements so that they are corrected.
  - a Sydney Parkinson was the first person to draw the kangaroo.
  - b The first major use for eucalyptus leaves was discovered by Baron Ferdinand von Mueller, who suggested eucalyptus oil could be used as an antiseptic.

### Design and discuss

- 7 Research and discuss one example of Aboriginal and/or Torres Strait Islander peoples' knowledge that has made a significant contribution to the world of psychology.

# 1.12

## Preparing for assessment

### KEY IDEAS

- ✦ Organisational skills are important for revision.
- ✦ Understanding the meaning of command terms (such as describe, discuss or identify) will help you to answer questions well in assessments.



Preparing for any assessment in VCE Psychology requires organisational skills that can be practised throughout the year. Throughout Units 3 and 4 it is a good idea to practise and build your revision skills, as such skills become increasingly important in Units 3 and 4.

### Organisational skills

Organisational skills that are useful for VCE studies include:

- creating a timetable for your studies, homework and other commitments
- setting SMART goals
- incorporating reflection or evaluation of strategies for continuous improvement.

### Creating a timetable

It is important to maintain a balance between all your activities and commitments when you are in VCE. You need to make sure you have time to study, continue your extracurricular activities (such as hobbies or a part-time job) and have time to rest properly.

A template that you could use to create a study timetable can be found in your [obook pro](#). You can also use different resources on your phone or computer to create your own version. Make sure that you block out the time spent at school (including travel), playing sport, family commitments, having meals or snacks and at part-time work. Be realistic – look at the amount of time you have left available; you may have to make some sacrifices to succeed in your VCE studies without sacrificing your mental health.

For the remaining time, allocate homework and/or study time for each subject, making sure that you are actively applying the skills learnt in class rather than only trying to remember the content.

### Setting SMART goals

Setting and achieving goals in VCE studies improves your motivation to succeed. Goals are most effective when they are SMART:

- **s**pecific – clear and explicit
- **m**easurable – can be measured or is a measure of success
- **a**ttainable – can be challenging but within reach
- **r**elevant – are meaningful and worthwhile
- **t**ime-based – are committed to deadlines or set times.

When setting your SMART goals, consider your strengths and weaknesses, as well as your thoughts and feelings about subject(s). An example of a SMART goal could be “By the end of Term 1, I would like to achieve an average of B+ or higher for my SAC tasks in VCE Psychology”, rather than the less specific “I want to improve in Psychology”.

## Reflection

Every few weeks, pause to reflect on your progress and the effectiveness of your organisational approach. Aim for continuous improvement – if something isn't working, then change to a more reliable (and repeatable) strategy. Celebrate small successes and continue to challenge yourself by setting new goals.

The advantages of having good organisational skills include improving your marks in school-assessed coursework and reducing your stress, worry, procrastination and uncertainty levels. It will allow you to work smarter (not harder), avoid last-minute panics and gain a sense of accomplishment in the knowledge that you did your best.

## Exam tips

Before sitting an assessment in Units 3 and 4, there are a few strategies that could help you prepare.

- Start revising early. Cramming is stressful!
- Eat a healthy diet and cut back on processed or junk food and sugar-laden drinks.
- Try to keep the area where you revise or study separate from where you sleep.
- On the day of the assessment, eat breakfast so that you are not distracted by hunger or the noise of your rumbling stomach.
- Take a bottle of water to maintain hydration.
- Allow time for a bathroom visit before sitting the assessment.



**FIGURE 1** A healthy diet can provide you with the energy and nutrients your body needs to perform well on assessment tasks.

## Understanding command terms

### command term

a verb that relates to performing a particular task, set of tasks or mental processes

Assessments often contain **command terms** (instructive words). By understanding what different command terms mean and require, you can provide succinct and appropriate responses. Table 1 lists examples of command terms that are often used in assessment tasks and exams.

**TABLE 1** List of command terms and what they mean

Term	Explanation
account of	Describe a series of events or transactions.
account for	State reasons for; report on.
analyse	Identify components/elements and the significance of the relationship between them; draw out and relate implications; determine logic and reasonableness of information.
apply	Use; employ in a particular situation or context.
assess	Make a judgment about, or measure, determine or estimate, the value, quality, outcomes, results, size, significance, nature or extent of something.
calculate	Determine from given facts, figures or information; obtain a numerical answer showing the relevant stages in the working; determine or find (e.g. a number, answer) by using mathematical processes.
clarify	Make a statement or situation more comprehensible.
compare	Recognise similarities and differences and the significance of these similarities and differences.
construct	Make, build, create or put together by arranging ideas or items (e.g. an argument, artefact or solution); display information in a diagrammatic or logical form.
contrast	Show how things are different or opposite.
deduce	Draw a conclusion from given information, data, a narrative, an argument, an opinion, a design and/or a plan.
define	Give the precise meaning and identify essential qualities of a word, phrase, concept or physical quantity.
demonstrate	Show ideas, how something can be done or that something is true by using examples or practical applications, or by applying algorithms or formulas.
describe	Provide characteristics, features and qualities of a given concept, opinion, situation, event, process, effect, argument, narrative, text, experiment, artwork, performance piece or other artefact in an accurate way.
discuss	Present a clear, considered and balanced argument or prose that identifies issues and shows the strengths and weaknesses of, or points for and against, one or more arguments, concepts, factors, hypotheses, narratives and/or opinions.
distinguish	Make clear the differences between two or more arguments, concepts, opinions, narratives, artefacts, data points, trends and/or items.
evaluate	Ascertain the value or amount of; make a judgment using the information supplied, criteria and/or own knowledge and understanding to consider a logical argument and/or supporting evidence for and against different points, arguments, concepts, processes, opinions or other information.
examine	Consider an argument, concept, debate, data point, trend or artefact in a way that identifies assumptions, possibilities and interrelationships.
explain	Give a detailed account of why and/or how with reference to causes, effects, continuity, change, reasons or mechanisms; make the relationships between things evident.
extract	Select relevant and/or appropriate detail from an argument, issue or artefact.
extrapolate	Infer and/or extend information that may not be clearly stated from a narrative, opinion, graph or image by assuming existing trends will continue.
identify	Recognise and name and/or select an event, feature, ingredient, element, speaker and/or part from a list or extended narrative or argument, or within a diagram, structure, artwork or experiment.
infer	Derive conclusions from available information or evidence, or through reasoning, rather than through explicit statements.

(continued)

TABLE 1 continued

Term	Explanation
interpret	Draw meaning from an argument, point of view, description or diagram, text, image or artwork and determine significance within context.
investigate	Observe, study or carry out an examination in order to establish facts and reach new conclusions.
justify	Show, prove or defend, with reasoning and evidence, an argument, decision and/or point of view using given data and/or other information.
list	Provide a series of related words, names, numbers or items that are arranged consecutively.
name	Provide a word or term (something that is known and distinguished from other people or things) used to identify an object, person, thing, place etc.
outline	Provide an overview or the main features of an argument, point of view, text, narrative, diagram or image.
persuade	Induce (someone) to do something through reasoning or argument; convince.
predict	Give an expected result of an upcoming action or event; suggest what may happen based on available information.
propose	Suggest or put forward a point of view, idea, argument, diagram, plan and/or suggestion based on given data or stimulus material for consideration or action.
recall	Present remembered ideas, facts and/or experiences.
recommend	Put forward and/or approve (someone or something) as being suitable for a particular purpose or role.
recount	Retell a series of events or steps in a process, usually in order.
state	Give a specific name or value or other brief answer without explanation or calculation.
suggest	Put forward for consideration a solution, hypothesis, idea or other possible answer.
summarise	Retell concisely the relevant and major details of one or more arguments, text, narratives, methodologies, processes, outcomes and/or sequences of events.
synthesise	Combine various elements to make a whole or an overall point.

Source: *Glossary of command terms* reproduced by permission © VCAA

## 1.12 CHECK YOUR LEARNING

### Describe and explain

- 1 Describe at least two strategies that can be useful as you prepare for assessment tasks.
- 2 Explain why having good organisational skills is important for VCE studies.

### Apply, analyse and compare

- 3 Analyse the revision strategies that you currently use and develop a SMART goal for improvement in this area.
- 4 Compare the following command terms:
  - a list and identify
  - b propose and predict
  - c contrast and compare.

### Design and discuss

- 5 Use ICT resources to create and print a personal study timetable.
- 6 Design a lotus diagram for one of the topics in VCE Psychology that you find challenging and ask a classmate to peer review it for additions and/or improvements. (Use the internet to find out about lotus diagrams if you need to.)



## Study tip

Studying for your VCE exams should begin during the first week of the first topic, as smaller and consistent study sessions create better student outcomes (higher marks) than longer and irregular study sessions.

## Chapter summary

- 1.1 • VCE Psychology is divided into units and areas of study.
- The key science skills and their application are important for success in VCE Psychology.
- 1.2 • A research question states the specific problem or issue on which your investigation will be based.
- An aim is a statement of what is to be investigated.
- A hypothesis is a testable statement that should include a prediction about the outcome of an investigation, based on scientific reasoning.
- 1.3 • Different methodologies can be used to conduct scientific investigations.
- Participants in a psychological investigation can be selected through random or stratified sampling techniques.
- Within-subjects, between-subjects and mixed designs have specific advantages and disadvantages for different controlled experiments.
- 1.4 • Ethical understanding should be applied when undertaking research.
- Ethical concepts guide discussion and decision-making in psychological research.
- Laboratory safety practices minimise risks and protect investigation participants' safety.
- 1.5 • Data can be classified as either qualitative or quantitative.
- Observations, interviews and questionnaires can be used in research investigations to collect data.
- 1.6 • Organising and presenting data in the correct format can help us determine what the data means.
- Descriptive statistics can be calculated or used to help us process what our data means.
- 1.7 • Investigations that generate raw data must be valid, repeatable and reproducible.
- Errors and outliers must be included and accounted for in data evaluations.
- 1.8 • Analysis of raw data generated in a scientific investigation is important for constructing evidence-based arguments and conclusions.
- Sentence structure and paragraph structure are important when constructing evidence-based arguments and conclusions.
- 1.9 • Ideas, concepts, models and theories are different forms of scientific information.
- Sources of scientific information such as journal articles, mass media communications, opinions, policy documents and reports in the public domain have strengths and limitations and can vary in levels of credibility.
- Psychological issues can be influenced by social, economic, political and legal factors.
- 1.10 • Effective science communication depends on knowing your audience and prioritising important information.
- 1.11 • Aboriginal and Torres Strait Islander peoples – the traditional owners of Australia – hold Indigenous knowledges developed by ancestors and passed down through generations.
- Correctly acknowledging cultural and/or language groups, rejecting deficit discourse, avoiding Eurocentrism and critically evaluating sources of information can help you to respectfully engage with Aboriginal and Torres Strait Islander knowledges, cultures and histories in VCE Psychology.
- 1.12 • Organisational skills are important for assessment preparation.
- Understanding command terms can help you to answer questions properly on assessment tasks.

## Revision questions

### Multiple choice

Use the following information to answer questions 1 and 2.

A researcher has been investigating whether excessive time (more than five hours per week) spent playing online games causes a reduction in academic success at school. He compares the memory skills of students who spend more than five hours per week playing games with the memory skills of students who spend less than five hours per week playing games when both groups learnt a list of 40 botanical names of plants.

- 1 In this research, what is the independent variable?
  - A Whether participants spent more or less than five hours per week playing online games
  - B Students who played online games or students who did not play online games
  - C Academic success or academic failure
  - D Academic success; hours students spent playing online games
- 2 In this research the dependent variable is \_\_\_\_\_ measured as \_\_\_\_\_.
  - A excessive time spent playing online games; number of hours per week spent playing online games
  - B students who play online games; more than five hours per week spent playing online games
  - C academic success; average percentage score in school examinations
  - D academic success; score on test of memory of 40 botanical names of plants
- 3 A student completes a maths test and scores 34 out of 40. What was the student's score as a percentage?
  - A 85%
  - B 34%
  - C 90%
  - D 40%
- 4 Research is the process by which psychologists and other scientists collect and analyse data. They can then make informed statements about properties of the population. In this sense, what does the word population refer to?
  - A All the people who live in a certain area
  - B All the people of a certain age
  - C All the people about whom the researcher wishes to draw conclusions
  - D All the people who took part in the experiment or research
- 5 The purpose of using different experimental designs is to try to reduce the influence of confounding variables, but each design may have its own problems. The problem of the sample becoming biased because of a change in the characteristics of the sample during the research is greatest in which design?
  - A Within-subjects
  - B Between-subjects
  - C Mixed design
  - D Twin studies
- 6 Which option is the best definition of a random sample?
  - A A group of participants selected from the population by picking names at random from the electoral roll
  - B A group of participants selected from the population by putting all the names in a hat and drawing them out at random
  - C A group of participants selected from the population in such a way that each member of the population has an equal chance of selection
  - D A group of participants selected from the population by means of a random number generator on a computer
- 7 A researcher wishes to use deception in an experiment, where participants would believe that they were taking part in research that investigated their ability to solve puzzles on a computer, but in reality the computer would
 

“crash” near the end of the test and their emotional response would be measured.

This research:

- A** would be ethical if no psychological or physical harm was caused to the subjects in the long term and debriefing procedures were carried out.
- B** would be ethical if the research aim was considered sufficiently important and the ethics committee of the researcher’s university had approved it as long as debriefing procedures were carried out.
- C** would be ethical if the subjects gave informed consent about the deceit and debriefing procedures were carried out.
- D** would be unethical since deceit in research can never be ethical and is not permitted even if debriefing procedures are carried out.

*Use the following information to answer questions 8 and 9.*

Professor Dembele is conducting some research to investigate how the human brain changes its responses when a person has been without sleep for 14 hours, compared with its responses one hour after waking from a full night’s sleep. She gives each of her first-year university Psychology students a card and instructs them to attend the experimental session and submit the card. She tells her students that if they do not do this, they will lose 5 per cent of their semester mark.

- 8 Which ethical guideline is Professor Dembele violating for the rights of participants in research?
- A** Voluntary participation in research
  - B** Informed consent from participants
  - C** Confidentiality of participant information
  - D** No physiological or psychological harm to participants
- 9 Another researcher wishes to do further research and thinks that Professor Dembele’s data will be useful. The professor gives her a list of the student names and data collected.
- Which ethical guideline has this action breached?

- A** Voluntary participation in research
- B** Informed consent from participants
- C** Confidentiality of participant information
- D** Both informed consent and confidentiality of participant information

- 10 Professor Chen is researching the effects of increased vitamin A intake on the rod function in the eye. He gives his experimental group 125 mL of carrot juice each day and gives the control group water.

What is the purpose of the control group in this experiment?

- A** To show the effects of the IV
- B** To control or eliminate the effects of participant variables
- C** To form a basis for comparison with the experimental group
- D** To show the effects of the DV

### **Short answer**

#### **Describe and explain**

- 11 Explain why valid research is important.
- 12 Describe the importance of debriefing.
- 13 Define:
- a** independent variable
  - b** dependent variable
  - c** confounding variable
  - d** extraneous variable.

#### **Apply, analyse and compare**

- 14 Identify the independent variable and population in the following hypotheses.
- a** Primary school students will find it easier to learn two languages when they have a bilingual parent.
  - b** Football players are more likely to score goals when they train.
  - c** Teenagers are more likely to adopt a stereotype if their in-group also adopts this stereotype.
- 15 Distinguish between informed consent and the right to withdraw.
- 16 Provide an example of research that applies the ethical concept of beneficence.
- 17 Compare variance and standard deviation.

- 18 Analyse why it is important to gain parental or guardian consent when a participant is underage.
- 19 Determine the mean, median and mode of the following data set:  
8, 9, 10, 16, 17, 19, 19, 20
- 20 It is thought that adolescents will sleep for longer periods after they have spent the day studying or engaged in intense physical activity compared to a normal day's activity. A researcher wished to study this.
- Explain why a between-subjects design would be less appropriate than a within-subjects design.
  - Outline two extraneous variables that may affect the research.
  - Suggest how the variables identified in part b could be controlled.
- 21 Compare the use of journal articles versus mass media communication as a source of scientific information.
- 22 Distinguish between the ethical concepts of respect and integrity.

*Use the following information to answer questions 23 to 28.*

Richard wished to compare the mood of Year 6 children after they had role-played being a victim of bullying (Condition 1) with their mood after they had role-played helping an injured person (Condition 2). He decided to measure mood on a scale of 1 to 10, with 1 being "depressed" and 10 being "elated".

He took his measurements with the first 30 children on the school's alphabetical roll. The role-plays took place on Monday afternoons, one week apart.

He made sure that half the children role-played Condition 1 the first week and Condition 2 the second, with the other half role-playing the conditions in the opposite sequence.

Richard's results showed that the mean mood score for Condition 1 was 3.4 and the mean mood score for Condition 2 was 7.2.

- 23 Identify the population in this research.
- 24 Was Richard's sampling procedure appropriate? Explain your answer.
- 25 Identify the IV in this research.
- 26 Identify the DV in this research.
- 27 Describe how the DV was measured.
- 28 a Create an appropriate experimental hypothesis for this research.
- b Identify the experimental design used in this research. Justify your answer.
- c Discuss why Richard made sure that half the children role-played Condition 1 the first week and Condition 2 the second, with the other half role-playing the conditions in the opposite sequence.

### Design and discuss

- 29 A researcher wants to investigate the effects of a new anti-anxiety medication on anxiety levels in participants with generalised anxiety disorder. They recruit 40 participants and randomly assign them to two groups: a treatment group that receives the new medication, and a control group that receives a placebo (sugar pill). The anxiety levels of each participant are measured at four different time points: before the treatment (baseline), immediately after the treatment, one week after the treatment, and four weeks after the treatment. Discuss the type of investigation design the researcher has used and suggest the benefits of using this design type over others.

You can find the following resources for this section in your **obook pro**:

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of Key Science Skills.



#### Chapter checklist

Rate your understanding of Key Science Skills.

UNIT

# 3

## How does experience affect behaviour and mental processes?

**FIGURE 1** Have you ever wondered how climbers know exactly where to place their hands for grip? Or how they can hang on if they lose their footing? In Unit 3, you will explore how our brain and body enable us to learn in response to experience and survive in response to stress.

## Unit 3 Overview

In Unit 3 of VCE Psychology, you will investigate the contribution that classical and contemporary research has made to the understanding of the functioning of the nervous system and to the understanding of biological, psychological and social factors that influence learning and memory. You will investigate how the human nervous system enables a person to interact with the world around them and explore how stress may affect a person's psychological functioning. You will consider models to explain learning and memory and the interconnectedness of brain regions involved in memory. You will also learn how mnemonics can be used to improve memory, including Aboriginal and Torres Strait Islander peoples' use of place as a repository of memory.

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## Unit 3 Areas of Study

The learning for this unit has been divided into two areas of study. The following table shows how each area of study aligns with the chapters in this book and lists the page numbers for each chapter.

Area of Study	Chapter	Pages
<b>Area of Study 1</b> How does the nervous system enable psychological functioning?	<b>Chapter 2</b> Nervous system functioning	76–105
	<b>Chapter 3</b> Stress as a psychobiological process	106–141
	<b>Unit 3 Area of Study 1</b> Checkpoint	142–151
<b>Area of Study 2</b> How do people learn and remember?	<b>Chapter 4</b> Approaches to understand learning	152–183
	<b>Chapter 5</b> The psychobiological process of memory	184–225
	<b>Unit 3 Area of Study 2</b> Checkpoint	226–233

## Unit 3 Outcomes

In this unit, you will:

- analyse how the functioning of the human nervous system enables a person to interact with the external world, and evaluate the different ways in which stress can affect psychobiological functioning
- apply different approaches to explain learning to familiar and novel contexts and discuss memory as a psychobiological process.

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CHAPTER

2

# Nervous system functioning

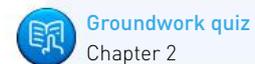
## KEY KNOWLEDGE

- the roles of different subdivisions of the central and peripheral nervous systems in responding to, and processing and coordinating with, sensory stimuli received by the body to enable conscious and unconscious responses, including spinal reflexes
- the role of neurotransmitters in the transmission of neural information across a neural synapse to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma-aminobutyric acid [GABA]) as compared to neuromodulators (such as dopamine and serotonin) that have a range of effects on brain activity
- synaptic plasticity – resulting from long-term potentiation and long-term depression, which together act to modify connections between neurons (sprouting, rerouting and pruning) – as the fundamental mechanism of memory formation that leads to learning.

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## GROUNDWORK

This topic will build on concepts you will have come across in Units 1 and 2 Psychology and junior science. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.

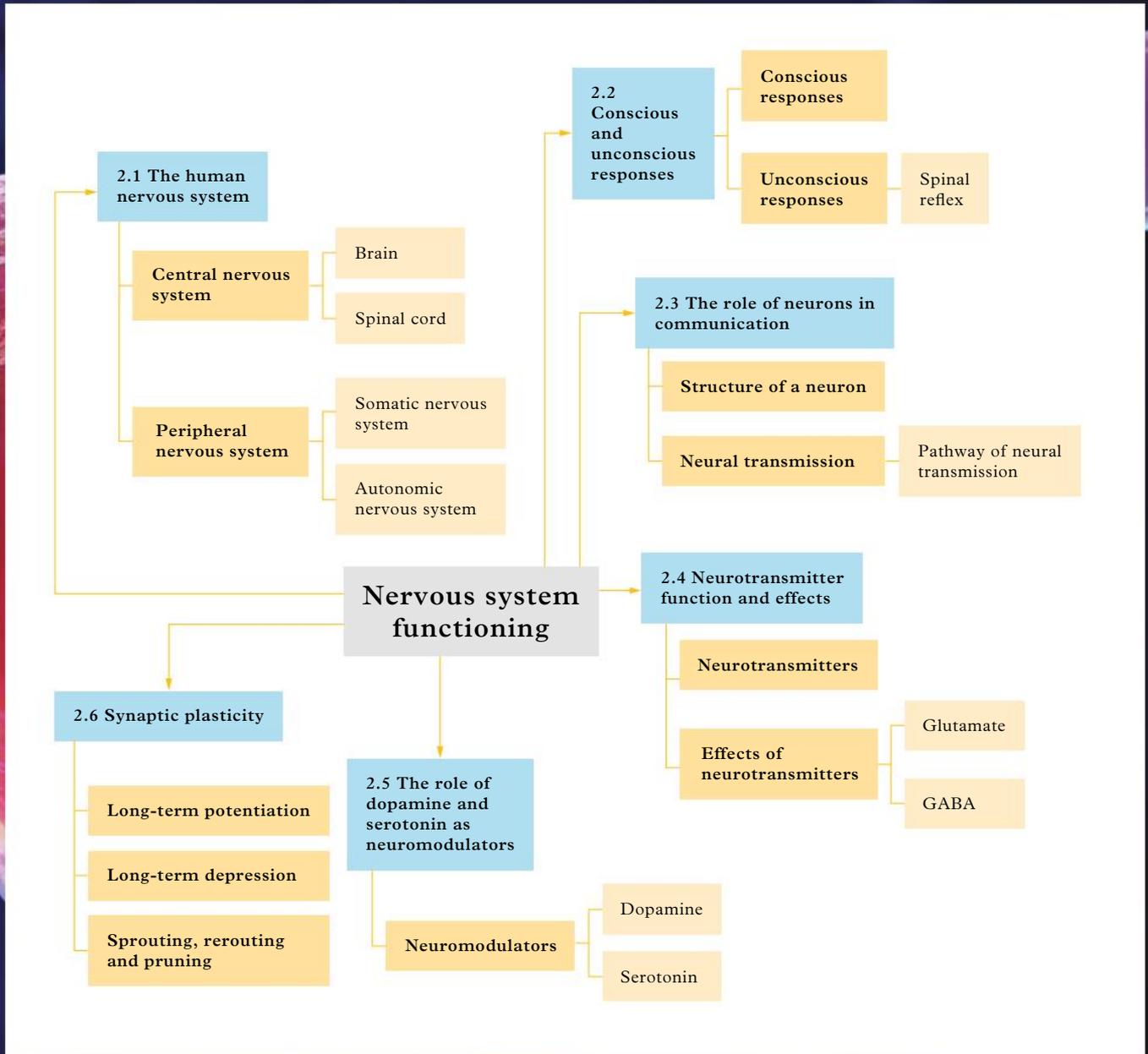


## INVESTIGATIONS

2.1	INVESTIGATION: SIMULATION	Does activation of the sympathetic and parasympathetic nervous systems lead to a change in heart rate?	Page 468
2.3	INVESTIGATION: MODELLING	How can neural transmission across a synapse be modelled?	Page 470

FIGURE 1 Neurotransmitters are chemical messengers that travel across a synapse to enable neural communication.

## CONCEPT MAP



# 2.1

## The human nervous system



### KEY IDEAS

- ✦ The nervous system is divided into the central nervous system (CNS) and the peripheral nervous system (PNS).
- ✦ The CNS, which consists of the brain and spinal cord, processes information and coordinates responses.
- ✦ The PNS, which consists of all nerves outside of the CNS, connects the CNS to the rest of the body.
- ✦ The PNS is further divided into the somatic nervous system, which controls voluntary actions, and the autonomic nervous system, which controls involuntary functions through the sympathetic and parasympathetic branches.

### nervous system

the body's entire network of specialised cells called neurons that transmit signals between different parts of the body

### neuron

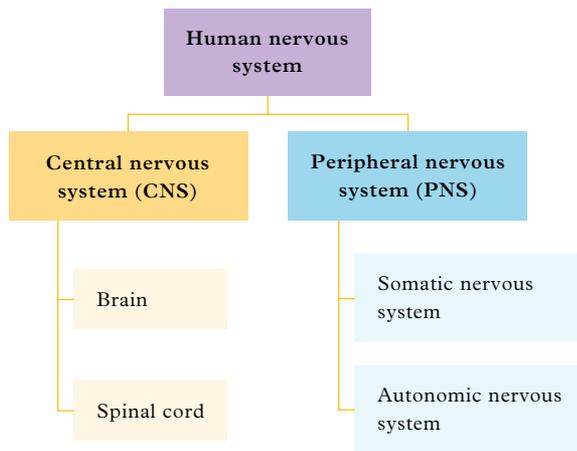
a nerve cell; responsible for transmitting neural information

### stimulus

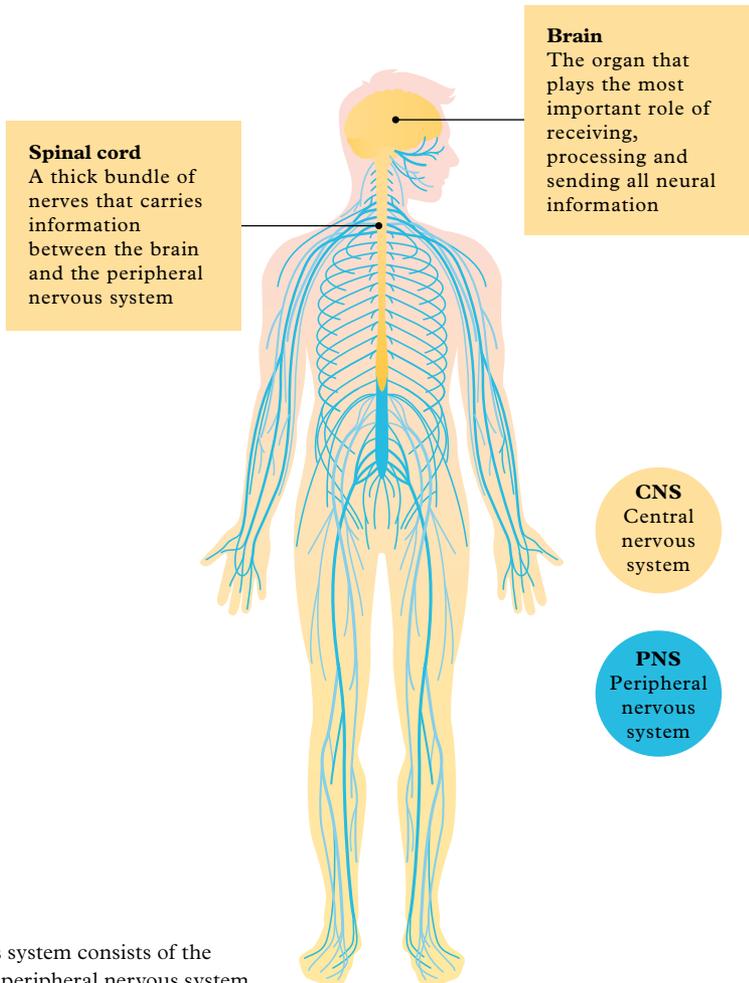
a thing or an event that triggers a response/behaviour by evoking a specific functional reaction in an organ or tissue

The **nervous system** is a network of nerve cells called **neurons** that allow our body to receive and respond to all internal and external **stimuli**. This is achieved by transmitting signals between the brain and the body. The main functions of the nervous system are to receive, process and coordinate responses to information. In this topic, we will examine the two main divisions of the nervous system, which are the:

- central nervous system
- peripheral nervous system.



**FIGURE 1** The divisions of the human nervous system



**FIGURE 2** The human nervous system consists of the central nervous system and the peripheral nervous system.

## Central nervous system

The **central nervous system (CNS)** is a major division of the nervous system that consists of the brain and spinal cord. The main function of the CNS is to process information and coordinate responses. This is achieved by receiving messages from and transmitting messages to the peripheral nervous system. For example, if our peripheral nervous system detects information (e.g. warmth from the Sun), then this information will be sent to the CNS where it can be processed. Our CNS then coordinates a response (e.g. move to a shady area) and transmits this information back to the peripheral nervous system so that the response can be performed. The CNS relies on the interaction between our brain and spinal cord (Figure 2).

### central nervous system (CNS)

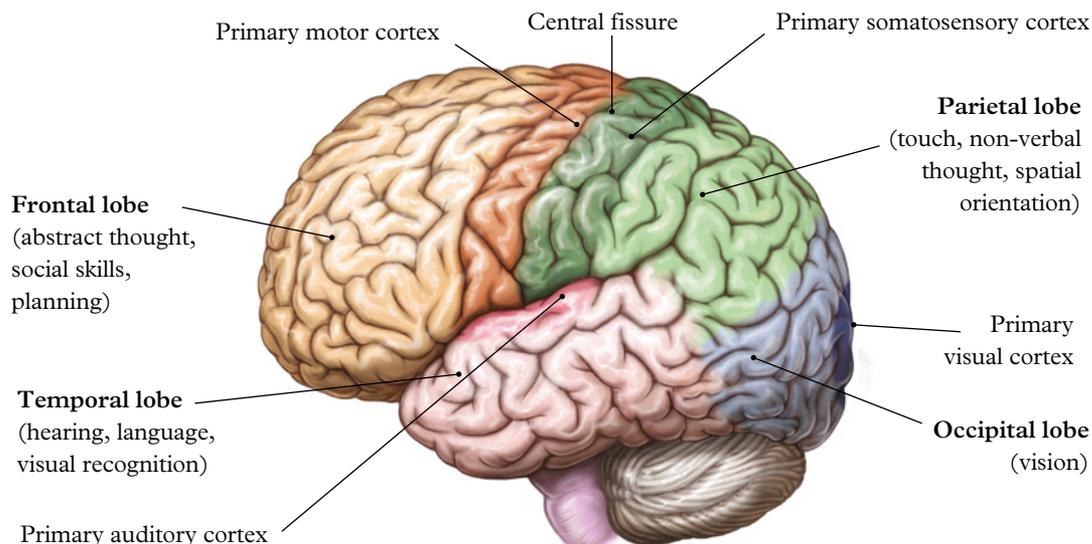
a major division of the human nervous system, consisting of the brain and spinal cord

## Brain

The **brain** is the organ responsible for controlling our thoughts, emotions and memories (Figure 3). It is the control centre for all our voluntary actions and many involuntary actions. Along with the spinal cord, the brain allows messages to be received from, processed and sent to the peripheral nervous system.

### brain

the organ responsible for controlling our thoughts, emotions and memories



**FIGURE 3** The human brain

## Spinal cord

The **spinal cord** is a bundle of nerve fibres (neurons) that run from the base of the brain down the spine (Figure 4). The function of the spinal cord is to connect the brain to the rest of our body. It acts as a pathway for neural information to travel between the brain and the peripheral nervous system. Specifically, it carries motor (movement) information towards the peripheral nervous system and sensory information from the peripheral nervous system towards the brain for processing.



### spinal cord

a bundle of nerve fibres (neurons) that run down the spine beginning at the base of the brain

**FIGURE 4** The spinal cord runs from the base of the brain down the spine.

# Peripheral nervous system

## peripheral nervous system (PNS)

a major division of the human nervous system, consisting of the somatic nervous system and autonomic nervous system

## somatic nervous system

the subdivision of the peripheral nervous system responsible for voluntary movements associated with skeletal muscles

## skeletal muscle

a muscle connected to bone that coordinates movements

## sensory neuron

a specialised nerve cell that transmits sensory information from sensory receptors to the central nervous system; also known as afferent neuron



## Study tip

You can use the **SAME** acronym to help remember these neurons:

**S**ensory = **A**fferent  
**M**otor = **E**fferent

## motor neuron

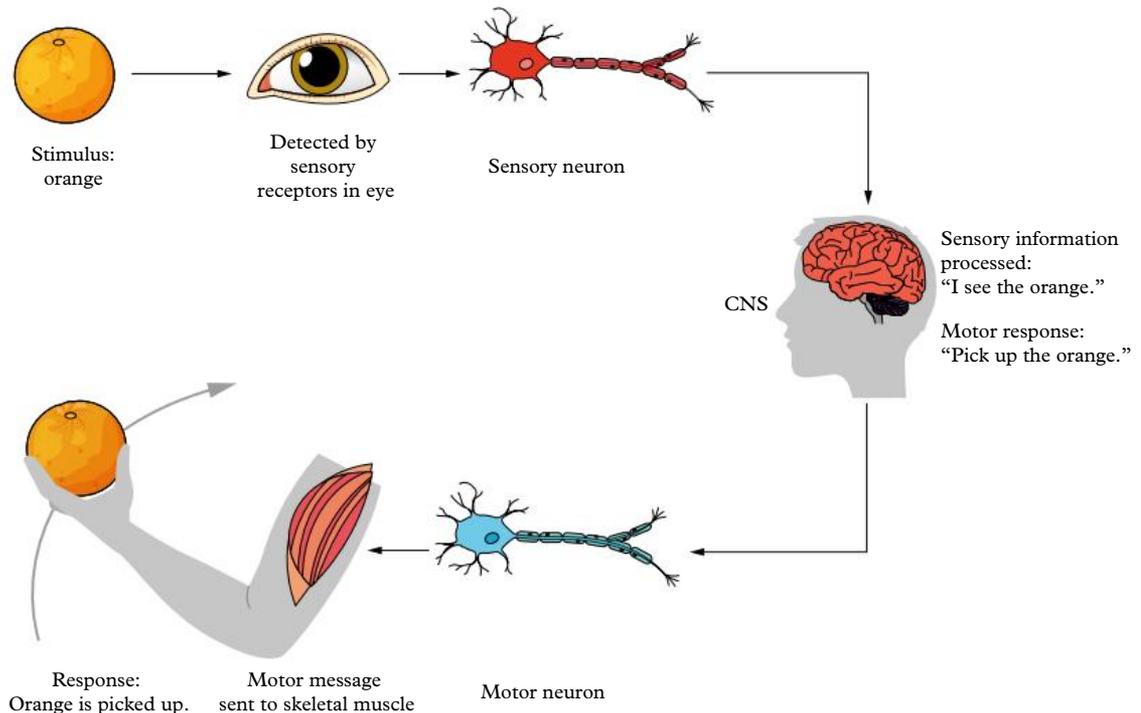
a specialised nerve cell that transmits signals from the central nervous system to muscles and glands; also known as efferent neuron

The **peripheral nervous system (PNS)** is the second division of the human nervous system and consists of all nerves outside of the CNS. The PNS is responsible for connecting the CNS to the rest of our body. There are two subdivisions of the PNS: the somatic nervous system and the autonomic nervous system.

## Somatic nervous system

The **somatic nervous system** is the branch of the PNS that carries sensory information from the body's sensory receptors to the CNS and transmits motor information from the CNS to **skeletal muscles** (muscles that coordinate movement). Sensory information, such as taste, touch, sight, sound and smell, is detected by specialised sensory receptors throughout the body. These receptors convert the sensory stimuli into electrical signals, which are then transmitted through "afferent" or **sensory neurons**. Sensory neurons carry information from sensory receptors to the CNS, specifically to the brain and spinal cord (Figure 5).

In the CNS, sensory information is processed and interpreted, so that an appropriate response can be coordinated. For example, if you touch a sticky surface, sensory receptors in your skin detect the texture of the substance and send neural signals through the sensory neurons to the CNS. In the brain, the information is processed, and a response is coordinated, leading to the motor instructions being sent.

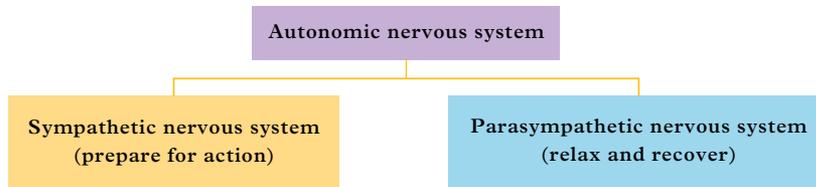


**FIGURE 5** The somatic nervous system detects sensory information from the external environment and transmits this information to the CNS, which then coordinates a motor response.

Motor (movement) information, in the form of motor instructions, is carried by "efferent" or **motor neurons** from the CNS to the skeletal muscles. Motor neurons transmit signals that control muscle contraction and movement. When motor instructions reach the skeletal muscles, they trigger a response, allowing you to move and perform a desired action.

## Autonomic nervous system

The **autonomic nervous system** is the branch of the PNS that controls involuntary responses such as heart rate, breathing, digestion and glandular activity. The main role of the autonomic nervous system is to communicate information between the CNS and non-skeletal **visceral muscles**. Visceral muscles are smooth muscles in the body's organs. The autonomic nervous system regulates the functioning of visceral muscles, organs and glands without our conscious awareness or mental effort. The autonomic nervous system is further divided into two branches: the sympathetic nervous system and parasympathetic nervous system (Figure 6).



**FIGURE 6** The two branches of the autonomic nervous system

### Sympathetic nervous system

The **sympathetic nervous system** is the branch of the autonomic nervous system that activates during times of stress, excitement, physical exertion or when under threat. It prepares the body for action by increasing heart rate, dilating airways, constricting blood vessels, and releasing stress hormones such as adrenaline. Responses triggered by the sympathetic nervous system are shown in Figure 7. The sympathetic nervous system also plays a role in activating the **flight-or-fight-or-freeze response**, which is an unconscious response to perceived threats. It prepares the body to flee from a threat, fight it off, or freeze in place to avoid detection. You will learn more about the flight-or-fight-or-freeze response in Chapter 3.

### Parasympathetic nervous system

The **parasympathetic nervous system** is the branch of the autonomic nervous system that promotes relaxation, rest and restoration of the body's functions. The parasympathetic system works to maintain **homeostasis**, which is the balance and optimal functioning of the body's internal processes. It slows down heart rate, promotes digestion, conserves energy and facilitates bodily functions during rest and inactivity. It also restores the body to a calm state decreasing arousal after a threat has passed. Responses triggered by the parasympathetic nervous system are shown in Figure 7.

The interaction between the sympathetic and parasympathetic systems allows our body to adapt to different situations and maintain a balanced state of functioning. These two systems often work in opposition to each other, with the sympathetic system preparing the body for action, and the parasympathetic system promoting relaxation and restoration.

**autonomic nervous system**  
the subdivision of the peripheral nervous system responsible for controlling involuntary responses

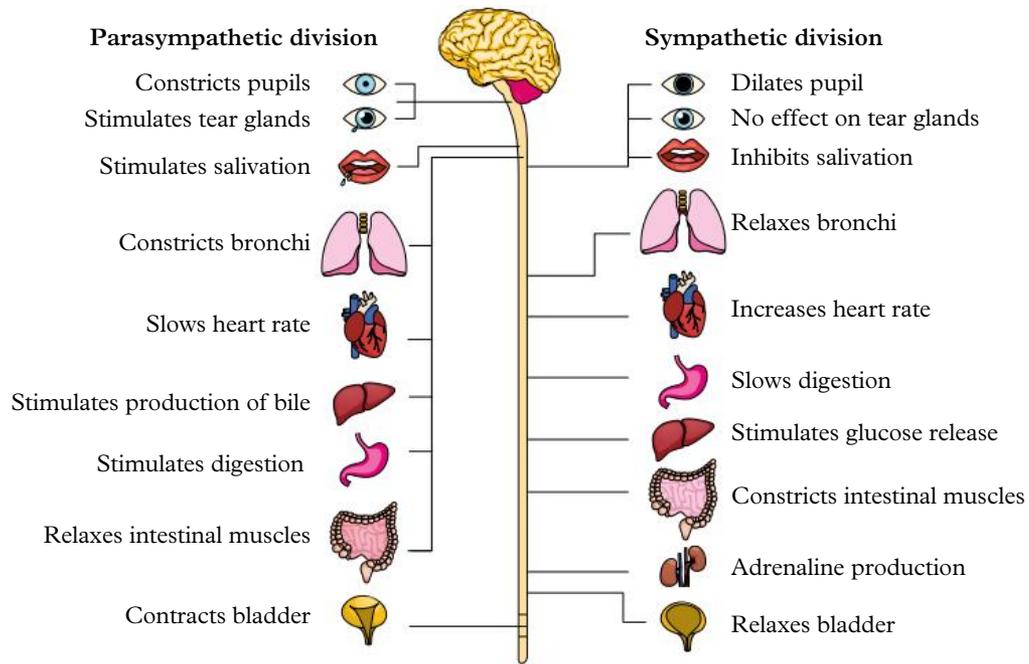
**visceral muscle**  
a smooth muscle controlled by the autonomic nervous system that is found in the walls of organs and structures, including the digestive tract, blood vessels and respiratory airways

**sympathetic nervous system**  
a branch of the autonomic nervous system that activates the flight-or-fight-or-freeze response – the body's rapid involuntary response to stress

**flight-or-fight-or-freeze response**  
the body's automatic physiological response to a stressor or threat, which results in a person escaping the stressor (flight), confronting the stressor (fight) or becoming immobile (freeze); also known as the stress response

**parasympathetic nervous system**  
a branch of the autonomic nervous system responsible for maintaining homeostasis and day-to-day functioning

**homeostasis**  
the body's ability to maintain a stable internal environment in response to external changes



**FIGURE 7** Sympathetic and parasympathetic responses of the autonomic nervous system

## 2.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify the two main divisions of the nervous system and the function of each.
- 2 Identify the two components that make up the CNS and describe the function of each.
- 3 Describe the relationship between the CNS and the PNS.

### Apply, analyse and compare

- 4 Compare sensory neurons and motor neurons.
- 5 Compare the role of the somatic nervous system and the autonomic nervous system, using an example.

- 6 Outline how the CNS and the PNS communicate to process and coordinate motor responses.

### Design and discuss

- 7 Draw a labelled diagram of the nervous system showing the CNS and the PNS.
- 8 With reference to the somatic nervous system and the autonomic nervous system, discuss the role of sensory and motor neurons when patting a cat.
- 9 Discuss the role of each subdivision of the autonomic nervous system with reference to an example from your own life.

# 2.2

## Conscious and unconscious responses

### KEY IDEAS

- ✦ A conscious response is a voluntary response controlled by the somatic nervous system.
- ✦ An unconscious response is automatic, involuntary and controlled by the autonomic nervous system.
- ✦ A spinal reflex is an unlearnt and unconscious response that occurs to aid our survival. It is controlled by the autonomic nervous system.



#### conscious response

a voluntary response controlled by the somatic nervous system that is performed with conscious awareness

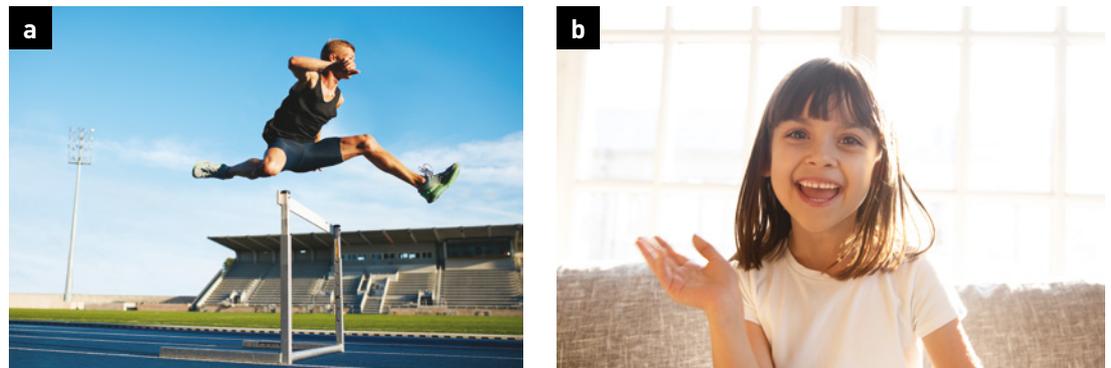
#### unconscious response

an involuntary response controlled by the autonomic nervous system that is performed without conscious awareness

When we interact with the world around us, sensory stimuli from our external and internal environment are detected by specialised receptors. This information is then processed by the brain, which coordinates a response. These responses may be performed either with or without awareness. Responses that are performed voluntarily, with awareness, are called **conscious responses**. Responses that are performed involuntarily, without awareness, are called **unconscious responses**.

### Conscious responses

Conscious responses are performed voluntarily and with awareness. These responses are controlled by the somatic nervous system, specifically through the activation of skeletal muscles. Conscious responses involve deliberate and conscious decision-making by the brain. For example, the actions of waving your hand, walking, jumping, or stamping your feet are consciously initiated and performed with intentional control and awareness.



**FIGURE 1** Actions such as **a** jumping over a hurdle and **b** waving goodbye are conscious responses.

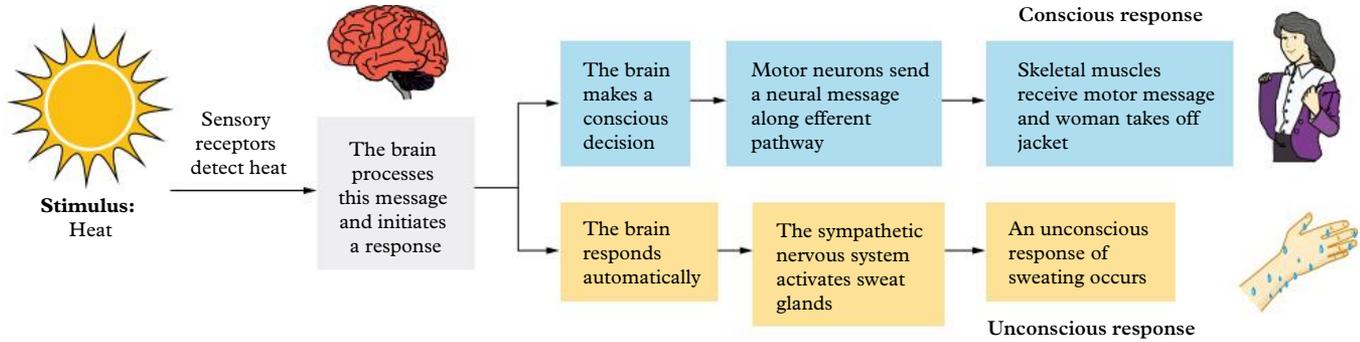


**FIGURE 2** Your pupils dilating or constricting in response to the amount of light in a room is an example of an unconscious response.

### Unconscious responses

Unconscious responses are involuntary and occur without our conscious control or awareness. Many of these responses are regulated by the autonomic nervous system, which is responsible for controlling and coordinating various involuntary processes in the body, such as heart rate, digestion and glandular activity. Other unconscious responses, such as the spinal reflex, are produced by the CNS. Typically, unconscious responses are not under our voluntary control, because they are automatic and occur without conscious effort.

Examples of unconscious responses include when your pupils constrict in response to bright light (Figure 2) or when your heart rate increases during exercise. Both responses happen automatically without you consciously deciding to make them occur. Even though these responses are not consciously controlled, the brain still plays a role in regulating them and receiving feedback about their occurrence.



**FIGURE 3** An example of a conscious response and an unconscious response to the same stimulus of heat

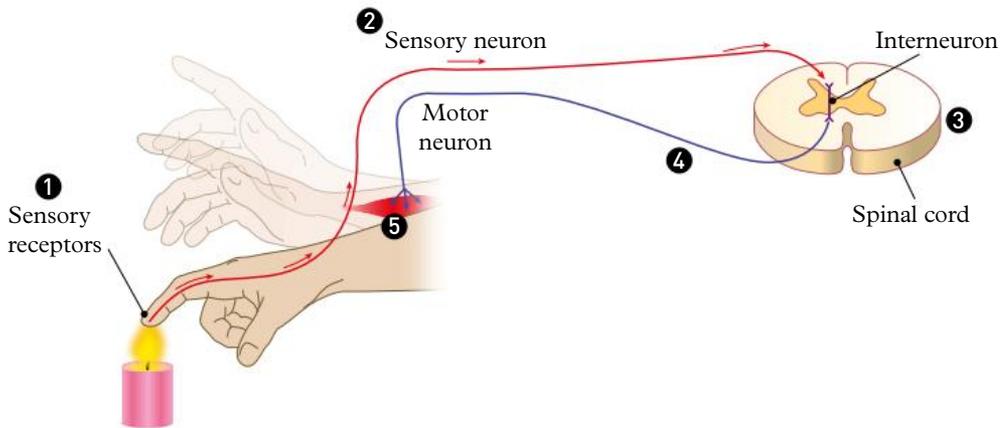


## Spinal reflex

The **spinal reflex** is an unconscious and automatic response to a stimulus – it occurs rapidly. It is a protective mechanism that helps to prevent harm or minimise damage to the body. The spinal reflex pathway involves the coordination of sensory neurons, motor neurons and **interneurons** (neurons that transfer information between sensory and motor neurons) located in the spinal cord. The interactions between these neurons bypass the involvement of the brain, reducing the time needed to coordinate a response.

**spinal reflex**  
an involuntary response that is initiated in the spinal cord with no involvement of the brain

**interneuron**  
a neuron in the CNS that transfers information between sensory and motor neurons



**FIGURE 4** Steps involved in the spinal reflex

The process of the spinal reflex is shown in Figure 4 and can be summarised as follows:

- 1 A sensory stimulus, such as the heat from a candle, is detected by sensory receptors on the body, such as on the skin or muscles.
- 2 Sensory neurons transmit the information about the stimulus from the sensory receptors to the spinal cord. These neurons carry the sensory signals as electrical impulses.

### Study tip

When you are discussing conscious and unconscious responses, make sure you explain each step of the biological process and that you identify which division of the nervous system is responsible for initiating the response.

- 3 Interneurons in the spinal cord relay the information from sensory neurons to motor neurons.
- 4 Motor neurons transmit a signal from the spinal cord to relevant muscles or glands, causing them to respond.
- 5 The reflex response, such as quickly removing the hand from the heat source, occurs before information about the stimulus reaches the brain and is consciously perceived.

## 2.2 WORKED EXAMPLE

### Identifying the steps in the spinal reflex

Maurice is walking barefoot on grass when he feels a stab of pain from stepping on a piece of sharp glass. Before he can even think about it, Maurice has moved his foot away from the glass.

With reference to Maurice's response to the glass, outline the steps involved in the spinal reflex. (5 marks)

#### Solution

Think	Do
Step 1: Identify any command terms in the question and determine what they require.	The command term "outline" is used. This means the response should provide an overview of the main features of an argument, point of view, text, narrative, diagram or image.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	There are 5 marks assigned to this question so five steps (five pieces of information) need to be outlined.
Step 3: Recall the steps involved in the spinal reflex.	<ol style="list-style-type: none"> <li>1 A sensory stimulus is detected by sensory receptors located on the body, such as on the skin or muscles.</li> <li>2 Sensory neurons transmit information about the stimulus from the sensory receptors to the spinal cord. These neurons carry sensory signals as electrical impulses.</li> <li>3 Interneurons in the spinal cord relay the information from sensory neurons to motor neurons.</li> <li>4 Motor neurons transmit a signal from the spinal cord to relevant muscles or glands, causing them to respond.</li> <li>5 The reflex response occurs before information about the stimulus reaches the brain and is consciously perceived.</li> </ol>
Step 4: Apply information about Maurice's scenario to each of the steps.	<ol style="list-style-type: none"> <li>1 A sensory stimulus, the sharp glass, is detected by sensory receptors on Maurice's foot. (1 mark)</li> <li>2 Sensory neurons transmit information about the stimulus from the sensory receptors to the spinal cord. These neurons carry sensory signals as electrical impulses. (1 mark)</li> <li>3 Interneurons in the spinal cord relay the information from sensory neurons to motor neurons. (1 mark)</li> <li>4 Motor neurons transmit a signal from the spinal cord back to the foot so it can respond. (1 mark)</li> <li>5 The reflex response, moving the foot away, occurs before information about the stimulus reaches the brain and is consciously perceived. (1 mark)</li> </ol>

## 2.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify the part of the CNS that has the most significant role in the spinal reflex.
- 2 Explain the role of the somatic nervous system in conscious responses.
- 3 Explain the role of the autonomic nervous system in unconscious responses.

### Apply, analyse and compare

- 4 Compare conscious and unconscious responses.
- 5 Thao picks up their hot coffee. They decide that it is too hot, so they put in more milk to cool it down. Apply your understanding of the steps involved in conscious responses to explain Thao's response.



- 6 With reference to conscious and unconscious responses, demonstrate why a spinal reflex aids in survival.

### Design and discuss

- 7 While walking on the beach, Anton stepped on a sharp shell. He quickly lifted his foot and then felt the pain from where the shell scratched his foot. Determine whether Anton experienced a spinal reflex. Justify your response.
- 8 Design a diagram like Figure 3 using your own examples to differentiate between conscious and unconscious responses.



# 2.3

## The role of neurons in communication

### KEY IDEAS

- ✦ A neuron is a nerve cell that enables nervous system communication.
- ✦ Neural transmission is the process by which information is transmitted within the nervous system through the exchange of electrical and chemical signals between neurons.
- ✦ A presynaptic neuron sends/transmits the neural message, whereas a postsynaptic neuron receives the neural message.



ClickView  
The neuron

#### soma

the cell body and largest part of a neuron

#### dendrite

a branch coming off the cell body of a neuron

#### axon

a nerve fibre that extends from the cell body of a neuron

#### myelin

a fatty substance covering the axons of most neurons

#### axon terminal

the end of an axon branch of a neuron

### Structure of a neuron

Neurons are nerve cells that enable all communication in the nervous system. Although neurons can have specialised shapes, sizes and roles, they have many common structural features. These structures, which include **soma**, **dendrites**, **axon**, **myelin** and **axon terminals**, are shown in Figure 1 and summarised in Table 1. Understanding the structure of a neuron will help you understand how neurons communicate with each other.

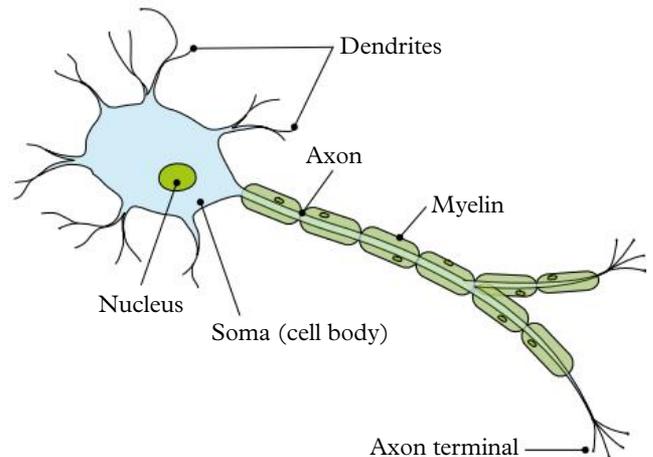


FIGURE 1 The structure of a neuron

TABLE 1 Key structures of a neuron

Structure	Description	Function
Soma	<ul style="list-style-type: none"> <li>The cell body and the largest part of the neuron</li> </ul>	<ul style="list-style-type: none"> <li>Controls the metabolism and maintenance of the neuron</li> <li>In most neurons, the soma receives messages from other neurons.</li> </ul>
Dendrites	<ul style="list-style-type: none"> <li>Look like branches coming off the soma (<i>dendron</i> means “tree” in Greek)</li> <li>A neuron can have thousands of dendrites.</li> </ul>	<ul style="list-style-type: none"> <li>Receives information from other neurons and carries it to the soma</li> </ul>
Axon	<ul style="list-style-type: none"> <li>A nerve fibre that extends from the soma</li> <li>Some axons have two or more offshoots, and some can be up to a metre long.</li> </ul>	<ul style="list-style-type: none"> <li>Electrical information travels down the axon so it can be communicated to other neurons.</li> </ul>
Myelin	<ul style="list-style-type: none"> <li>A fatty substance covering the axons of most neurons</li> <li>Axons with myelin are white rather than grey.</li> <li>The coating of myelin around an axon is often referred to as a myelin sheath.</li> </ul>	<ul style="list-style-type: none"> <li>Protects the axon from potential chemical and physical interference, protecting the electrical impulses that travel along it. Insulation provided by the myelin sheath also allows electrical messages to travel faster – up to 400 km/h.</li> <li>The myelin sheath facilitates the transmission of information to other neurons.</li> </ul>
Axon terminals	<ul style="list-style-type: none"> <li>Located at the end of the axon branch</li> <li>Although they never actually touch, the axon terminals of one neuron link with the dendrites of the next neuron.</li> </ul>	<ul style="list-style-type: none"> <li>Transmit messages to the next neuron</li> <li>Have terminal buttons, which contain sacs that secrete chemical messengers (neurotransmitters) whenever electrical impulses are sent down the axon.</li> </ul>

# Neural transmission

**neural transmission**

the process where information is sent from one neuron to another

**action potential**

a neural message in the form of an electrical impulse that travels down the axon in response to signalling from another neuron

**synapse**

the junction between two neurons where neural communication takes place

**synaptic cleft**

a small gap between the presynaptic and postsynaptic neurons

**presynaptic neuron**

a neuron that is responsible for sending a neural message

**postsynaptic neuron**

a neuron that is responsible for receiving a neural message

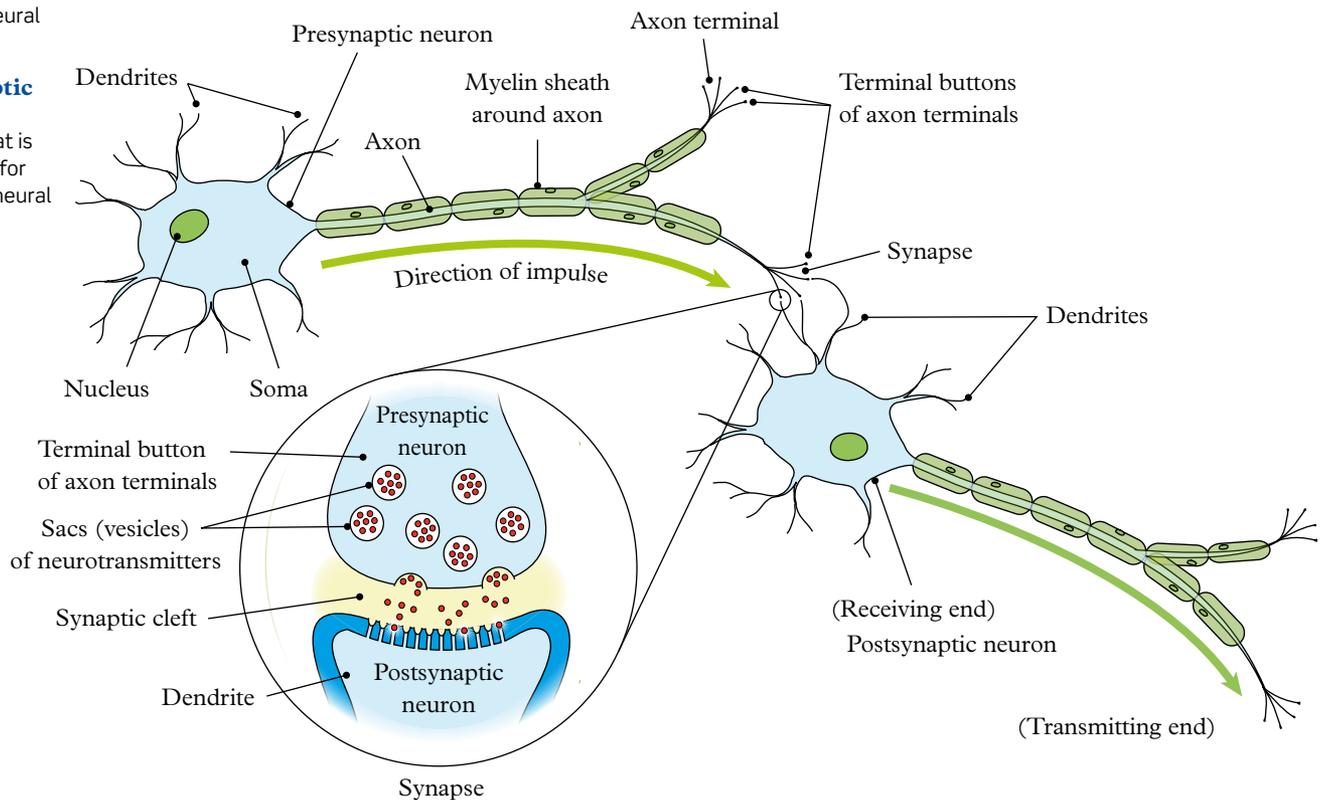
**Neural transmission** is the process by which information is transmitted within the nervous system when electrical and chemical signals are passed between neurons. It is the fundamental mechanism by which neurons communicate with each other to transmit and process information. Neural transmission involves the transmission of electrical signals, known as **action potentials**, along the length of a neuron.

Neurons lie close together but do not physically touch. So for a message to continue, communication needs to take place between two neurons. This communication occurs at the **synapse**, the junction between two neurons. The synapse includes the axon terminal of the neuron sending a message, the small gap between two neurons (**synaptic cleft**) and the dendrite of the neuron receiving the message. Neural transmission across a synapse involves several different structures performing different functions (Figure 2).

## Pathway of neural transmission

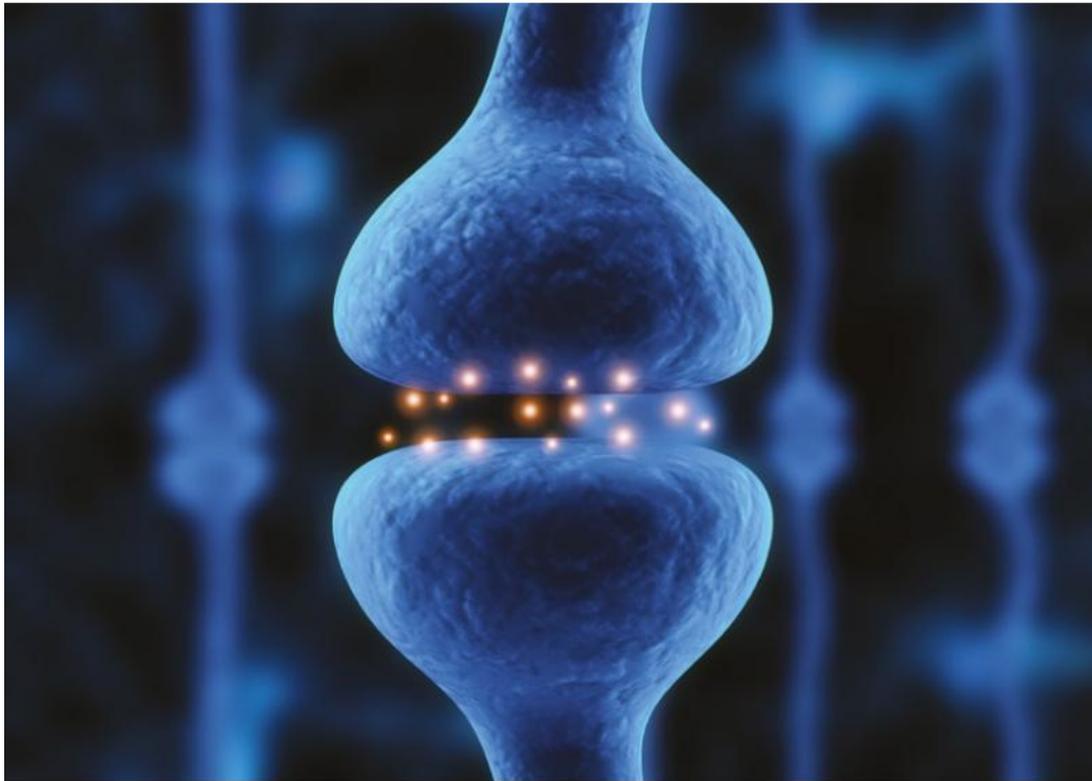
In the pathway of neural transmission, information is passed on from one neuron to another, creating a chain of communication. Each neuron acts as a **presynaptic neuron** when it sends a message and a **postsynaptic neuron** when it receives a message.

Neural transmission begins with the presynaptic neuron, which receives input from other neurons or sensory receptors and processes information. When the presynaptic neuron becomes active, it generates an action potential (an electrical impulse). The impulse travels down the neuron's axon towards its axon terminals at the end of the presynaptic neuron's axon.



**FIGURE 2** The pathway of neural transmission

The axon terminals are specialised structures involved in transmitting the message. When the action potential reaches the axon terminals, the presynaptic neuron releases chemical messengers (called **neurotransmitters**) into the synaptic cleft.



**FIGURE 3** A visual representation of neurotransmitters being released into the synaptic cleft

Neurotransmitters bind to specific receptors on the dendrites of the postsynaptic neuron, also known as the receiving neuron. After the neurotransmitter binds to the postsynaptic neuron the message is received and processed by the postsynaptic neuron. Once the postsynaptic neuron has received the message, it continues the transmission of information by generating its own action potential. This electrical impulse travels along the neuron's axon, allowing the message to be passed on to the next neuron in the chain. This process repeats as the message is transmitted through a sequence of neurons, forming a chain of communication.

**neurotransmitter**  
a chemical that carries neural messages across the nervous system



### Study tip

Remember that neurons themselves do not move. It is the message that is sent from one neuron to the next neuron that moves.

## 2.3 CHECK YOUR LEARNING

### Describe and explain

- Describe the function of the following neuron components:
  - dendrites
  - axon terminals
  - myelin.
- Outline the pathway of neural transmission.
- Define “synapse”.

### Apply, analyse and compare

- Contrast the roles of the presynaptic and postsynaptic neurons.

### Design and discuss

- Draw an annotated diagram showing the pathway of neural transmission.



# 2.4

## Neurotransmitter function and effects

### KEY IDEAS

- ✦ Neurotransmitters are chemicals that carry neural messages and facilitate communication between neurons by crossing the synapse and binding to receptor sites on the postsynaptic neuron.
- ✦ The effects of neurotransmitters can be either excitatory or inhibitory, depending on whether they increase or decrease the likelihood of a postsynaptic neuron firing an action potential.
- ✦ Glutamate is the main excitatory neurotransmitter in the CNS. It helps promote neural transmission and plays a critical role in cognitive processes such as learning and memory.
- ✦ GABA is the main inhibitory neurotransmitter in the CNS. It helps regulate neuronal excitability, promotes relaxation, and plays a role in anxiety, stress, and sleep-wake cycles.



## Neurotransmitters

Neurotransmitters are chemicals that carry neural messages across the nervous system. They are released from the presynaptic neuron and cross the synapse to either excite or inhibit the postsynaptic neuron from firing. The role of a neurotransmitter is to carry messages between neurons by travelling across the neural synapse.

Neurotransmitters are stored in sacs called synaptic vesicles at the end of axon terminals. When an electrical signal reaches the end of a presynaptic neuron, the sacs are triggered to release neurotransmitters into the synapse. After crossing the synapse, neurotransmitters bind to receptor sites on the dendrites of the postsynaptic neuron to enable neural transmission.

### excitatory effect

an effect that increases the likelihood of a neuron firing an action potential

### inhibitory effect

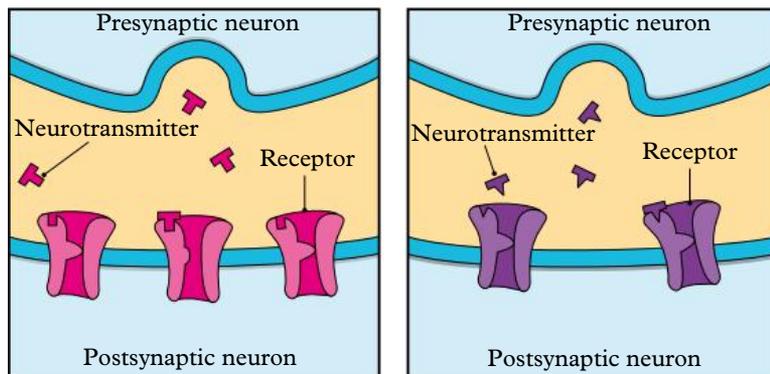
an effect that decreases the likelihood of a neuron firing an action potential

## Effects of neurotransmitters

Neurotransmitters that successfully bind to receptor sites have either an excitatory effect or an inhibitory effect on the postsynaptic neuron. Neurotransmitters that increase the likelihood

of a postsynaptic neuron firing an action potential are said to have an **excitatory effect**. Neurotransmitters that decrease the likelihood of a postsynaptic neuron firing an action potential are said to have an **inhibitory effect**.

The interplay between inhibitory neurotransmitters and excitatory neurotransmitters is crucial for maintaining the overall excitability and stability of neural circuits. The balance between neuron inhibition and excitation helps fine-tune neural responses and maintain optimal brain function.



**FIGURE 1** Neural transmission is often referred to as a lock and key system, where the neurotransmitter is the “key” and the receptor is the “lock”. Each neurotransmitter (key) only binds with a complementary receptor site (lock). When the neurotransmitter successfully binds to the receptor site, it causes an inhibitory or excitatory effect in the postsynaptic neuron.

## Glutamate

**Glutamate** is the main excitatory neurotransmitter in the CNS. It plays a critical role in neural communication and information processing. When released by presynaptic neurons, glutamate binds to receptors on postsynaptic neurons and results in depolarisation (the change to a more positive charge), increasing the likelihood of an action potential being fired. This promotes neural transmission and delivers an excitatory effect.

Glutamate is also involved in various cognitive processes. It is essential for thinking, perception, and higher-order functions such as learning and memory. Glutamate helps form and strengthen synaptic connections, a process known as synaptic plasticity, which is essential for learning and memory.

High levels and low levels of glutamate can both have significant effects on the nervous system and overall brain function. Excess glutamate can lead to excitotoxicity, a process where the overactivation of glutamate receptors results in cell damage or death. This may contribute to the development of neurodegenerative disorders such as stroke. Excess glutamate may also lead to an overstimulation of neurons and hyperexcitability in the nervous system. This can cause seizures, epileptic episodes and other abnormal neuronal activity. Low levels of glutamate may disrupt normal synaptic transmission, leading to impaired communication between neurons. Glutamate deficiency has also been linked to several neurological conditions.

## GABA

**Gamma-aminobutyric acid (GABA)** is the main inhibitory neurotransmitter in the CNS (Figure 3). Like glutamate, GABA plays a crucial role in neural communication and information processing. When released by presynaptic neurons, GABA binds to receptors on postsynaptic neurons, leading to hyperpolarisation (the change to a more negative charge) and a decreased likelihood of an action potential firing (which slows down neural activity). This results in an inhibitory effect.

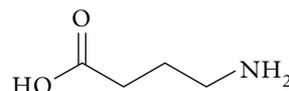
GABA is also involved in several cognitive processes. It helps regulate neuronal excitability and promotes a state of calmness and relaxation. GABA also helps control anxiety, stress and the sleep–wake cycle and plays an important role in maintaining the overall balance and stability of neural circuits.

High levels and low levels of GABA can both have significant effects on the nervous system and overall brain function. Excess GABA can induce sedation and cause a general calming effect on the nervous system. Too much of this effect can result in drowsiness, decreased alertness, and reduced cognitive function. Insufficient GABA can disrupt sleep patterns and contribute to insomnia and other sleep disorders and neurological disorders (you will learn more about GABA and anxiety in Topic 9.1).



**FIGURE 2** Glutamate plays a significant role in learning and memory.

**glutamate**  
an excitatory neurotransmitter involved in learning



**FIGURE 3** The chemical structure of GABA (gamma-aminobutyric acid)

**gamma-aminobutyric acid (GABA)**  
an inhibitory neurotransmitter involved in reducing symptoms of anxiety

### Study tip

You can remember the neural effect of glutamate by underlining its last letter, “e”, which matches up with its excitatory effect.

**TABLE 1** A summary of the roles of glutamate and GABA

**Study tip**

The role of GABA in anxiety is explored further in Unit 4. People who have low levels of GABA (GABA dysfunction) experience a greater risk of developing anxiety.

Glutamate	GABA
<ul style="list-style-type: none"> <li>Increases neural transmission and increases the likelihood of the postsynaptic neuron firing</li> </ul>	<ul style="list-style-type: none"> <li>Decreases the likelihood of the postsynaptic neuron firing</li> </ul>
<ul style="list-style-type: none"> <li>Involved in thinking, perception, and the processes of learning and memory</li> </ul>	<ul style="list-style-type: none"> <li>Involved in calming the nervous system and helping it to maintain optimal levels of functioning</li> <li>Plays a role in reducing anxiety and promoting relaxation</li> </ul>
<ul style="list-style-type: none"> <li>Counterbalances the effect of excitatory neurotransmitters such as GABA</li> </ul>	<ul style="list-style-type: none"> <li>Counterbalances the effect of excitatory neurotransmitters such as glutamate</li> </ul>

**2.4 CHECK YOUR LEARNING**



**Describe and explain**

- 1 Explain the role of neurotransmitters in neuron communication.
- 2 Identify the effect of the neurotransmitter glutamate.
- 3 Identify the effect of the neurotransmitter GABA.

**Apply, analyse and compare**

- 4 Compare the neurotransmitters glutamate and GABA.

**Design and discuss**

- 5 Create a visual diagram to contrast the different effects of the neurotransmitters GABA and glutamate.
- 6 Discuss how excess levels of both GABA and glutamate can have negative impacts on functioning.



**FIGURE 4** GABA plays a role in promoting relaxation.

# 2.5

## The role of dopamine and serotonin as neuromodulators

### KEY IDEAS

- Neurotransmitters act on individual neurons to directly transmit signals, whereas neuromodulators affect broader regions of the brain, modulating the overall activity of neuronal networks.
- Dopamine is a neuromodulator that helps to fine-tune signal strength across a network of neurons and affects learning and memory processes.
- Serotonin is a neuromodulator that significantly influences the regulation of mood, sleep, appetite, and pain perception.



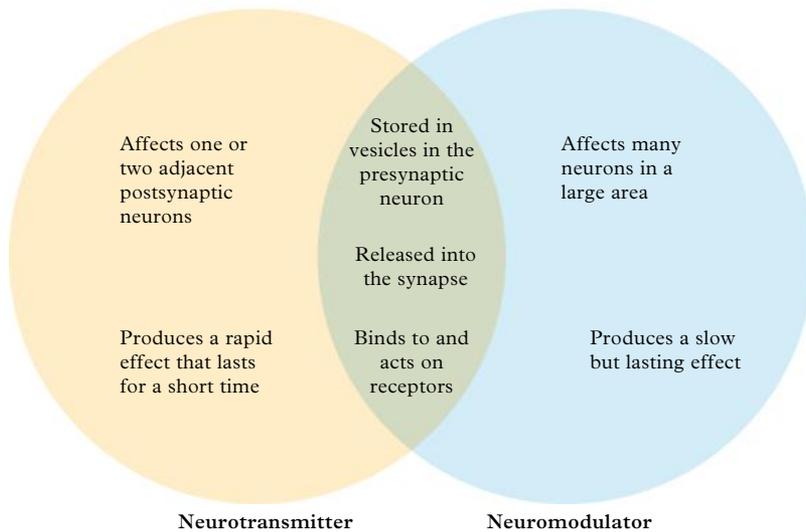
### neuromodulator

a type of neurotransmitter that can modulate or modify the activity of neural circuits by influencing the release, reuptake or sensitivity of other neurotransmitters

## Neuromodulators

In Topic 2.4, you learnt that neurotransmitters are chemical messengers that transmit signals between different neurons in the nervous system. When an electrical signal travels along a neuron, it causes neurotransmitters to be released into the synapse. Neurotransmitters then bind to specific receptors on the following neuron, causing the neuron to fire off its own electrical signal. This is like sending an invitation (the neurotransmitter) by post to your friend's house (the receptor); it will result in your friend making the specific action of either attending or not attending your event (the neuron firing or not firing).

**Neuromodulators** are also chemical messengers that transmit signals between neurons. However, unlike neurotransmitters, which send a single message to a specific neuron, neuromodulators are secreted in bulk and dispersed across a larger area. This means they influence the behaviour of several neurons at one time rather than just one or two. Neuromodulators can change the overall level of activity in a part of the brain by making neurons in that area more or less likely to fire. This is like making an announcement over a loudspeaker – it may influence many people (neurons) at once, but it doesn't tell any one person specifically what to do. Two neuromodulators we will explore in this topic are dopamine and serotonin.



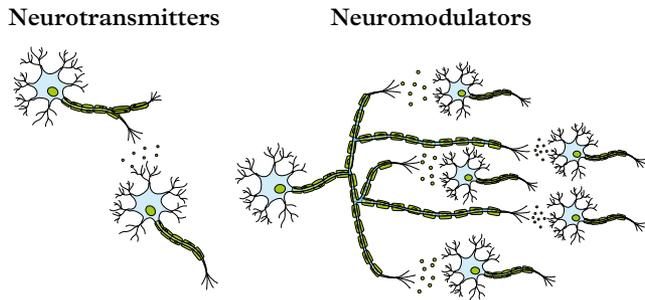
**FIGURE 1** Similarities and differences between neurotransmitters and neuromodulators

### dopamine

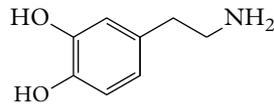
a neuromodulator involved in coordinating smooth muscle control, motivation and the reward and pleasure centres in the brain

## Dopamine

**Dopamine** is a chemical messenger that is released in the brain and has several significant roles in our body. Dopamine has strong roles in coordinating smooth muscle control, in motivation and in the reward and pleasure centre in our brain. It is unique because it can act both as a neurotransmitter and a neuromodulator. In VCE Psychology, you are only expected to know about the role of dopamine as a neuromodulator; however, understanding



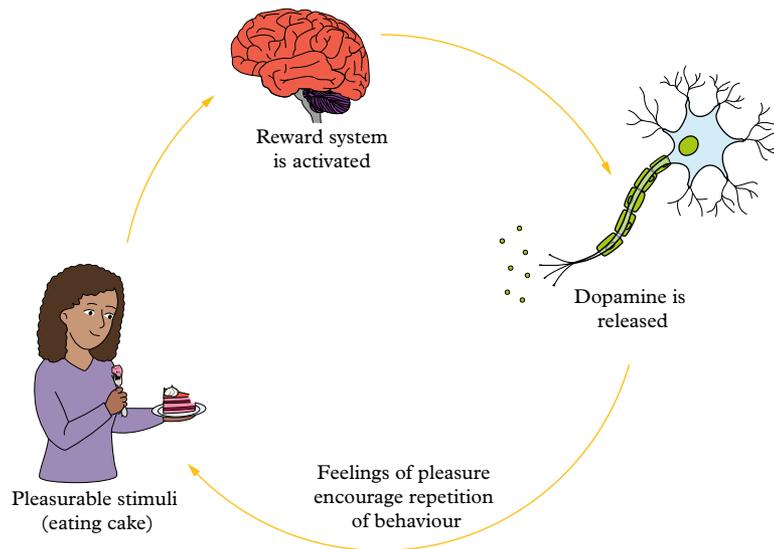
**FIGURE 2** Neurotransmitters can communicate a signal to one or two nearby neurons, whereas neuromodulators are secreted in higher concentrations and communicate a signal to many different neurons in one area.



**FIGURE 3** The chemical structure of dopamine

for survival, such as eating and exercising. When we engage in these behaviours, our brain releases dopamine, which gives us a sense of pleasure and reward, making us want to repeat the behaviour in the future.

In other parts of the brain, such as the prefrontal cortex, dopamine plays a role in cognitive functions like attention and decision-making. This is one reason why dopamine is often associated with motivation and goal-directed behaviour. In essence, dopamine helps us focus on and pursue actions that will lead to rewards, while also helping us derive pleasure from those rewards. That's why it's often called the "reward" neurotransmitter.



**FIGURE 4** Dopamine plays a role in the brain's reward system, making us more likely to repeat behaviours regarded as pleasurable.

how it also acts as a neurotransmitter may make the distinction between neurotransmission and neuromodulation clearer.

### Function as a neurotransmitter

As a neurotransmitter, dopamine can be either excitatory or inhibitory depending on the type of receptor it binds to. Dopamine receptors are spread across different parts of the brain and each plays a unique role in how dopamine functions. When dopamine binds to D1-type receptors, it usually has an excitatory effect and encourages neurons to fire off a signal. In contrast, when dopamine binds to D2-type receptors, it usually has an inhibitory effect and makes neurons less likely to fire.

Since D1-type and D2-type receptors are spread across many regions of the brain, dopamine can influence a variety of behaviours and functions. For example, dopamine's role in the brain's reward system helps reinforce behaviours that are essential

## Function as a neuromodulator

When acting as a neuromodulator, dopamine does not target just single neurons. Instead, it is secreted in bulk across a large area to influence many neurons simultaneously. As a neuromodulator, dopamine fine-tunes the effectiveness of signal transmission at the synaptic level, affecting the activity of a network of neurons.

Dopamine may have an overall excitatory or inhibitory effect depending on the receptors it binds to. For example, if the brain needs to increase or decrease the activity of a group of neurons in a specific area, dopamine can be released in this region to modulate the overall signal strength. It can then make adjustments to specific receptors on the receiving postsynaptic neurons to render them more responsive to incoming signals.

This ability to adjust synaptic signal strength has a direct impact on learning and memory processes. For example, dopamine can promote the strengthening of synaptic connections between neurons (long-term potentiation) if it acts on receptors to make them more responsive to receiving signals. Alternatively, dopamine may weaken synaptic connections between neurons (long-term depression) if it acts on receptors to make them less responsive to receiving signals. In both instances, dopamine's modulating effects on the signals between neurons directly influence our ability to form and recall memories.

## Serotonin

**Serotonin** is a chemical messenger that plays a number of roles in the brain. In particular, it plays a large role in regulating processes relating to mood and behaviour. Imbalances in serotonin levels or receptor function can lead to mood disorders such as depression and anxiety. Like dopamine, serotonin can act as both a neurotransmitter and a neuromodulator. In VCE Psychology, you are only expected to know about serotonin's role as a neuromodulator; however, understanding how it also acts as a neurotransmitter may improve your understanding of its actions as a neuromodulator.

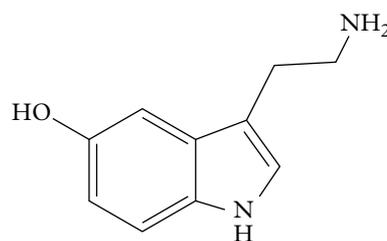


FIGURE 5 The chemical structure of serotonin

### serotonin

a neuromodulator involved in regulating processes relating to mood and behaviour

## Function as a neurotransmitter

As a neurotransmitter, serotonin primarily transmits signals between individual neurons in a localised manner within the synapse. Serotonin is released from presynaptic neurons into the synapse and binds to specific receptors on the postsynaptic neuron, directly influencing the excitability and transmission of signals. Serotonin is typically a fast-acting neurotransmitter and has a relatively immediate impact on the postsynaptic neuron. Serotonin acts on specific synapses and targets postsynaptic neurons specifically, enabling precise control over the signalling between individual neurons.

## Function as a neuromodulator

As a neuromodulator, serotonin diffuses more widely throughout the brain, affecting multiple neurons and brain regions beyond the immediate synapse. Serotonin modulates the activity and function of neural circuits rather than directly transmitting signals between individual neurons.



**FIGURE 6** When acting as a neuromodulator, serotonin can modulate **a** pain perception and **b** sleep-related processes.

The effects of serotonin as a neuromodulator are generally slower and more prolonged than its effects as a neurotransmitter. It can bring about long-lasting changes in neuronal excitability and synaptic plasticity. As a neuromodulator, serotonin can have broad-ranging effects on multiple brain regions and systems simultaneously, allowing for the coordination of complex processes and behaviours.

Serotonin plays a broader role in mood regulation by modulating the activity and functioning of multiple brain regions and circuits involved in emotional regulation. Its wide influence allows it to coordinate the overall balance of mood-related processes.

Serotonin also influences the overall regulation of sleep by modulating the activity of brain regions and circuits involved in sleep–wake regulation. Its wide range of effects contribute to the coordination of sleep-related processes, including the timing and duration of sleep stages.

As a neuromodulator, serotonin also exerts broader control over appetite and digestion by modulating the activity of brain circuits involved in appetite regulation, including the hypothalamus. Its influence helps regulate gastrointestinal movement and secretion, contributing to digestion.

Finally, serotonin modulates pain perception more broadly by influencing the activity of multiple brain regions involved in pain processing. Its effects contribute to the regulation of pain transmission and the overall experience of pain.

## 2.5 CHECK YOUR LEARNING

### Describe and explain

- 1 Define “neuromodulator”.
- 2 Describe the main roles of serotonin in the body.
- 3 Describe the main roles of dopamine in the body.

### Apply, analyse and compare

- 4 Compare neurotransmitters with neuromodulators.
- 5 Distinguish between dopamine and serotonin in terms of the type of effect they have on neurons.

### Design and discuss

- 6 Create a labelled diagram to illustrate the neural transmission of dopamine as a neuromodulator.
- 7 Use your understanding of serotonin’s role as a neuromodulator to discuss how serotonin deficiency could affect a person’s regulation of mood, sleep, appetite and digestion, and pain perception.



# 2.6

## Synaptic plasticity

### KEY IDEAS

- ✦ Synaptic plasticity refers to the ability of synapses to change strength and efficacy based on patterns of neural activity.
- ✦ Long-term potentiation (LTP) is an experience-dependent process that strengthens synaptic connections, whereas long-term depression (LTD) weakens synaptic connections.
- ✦ Sprouting, rerouting and pruning are processes that influence synaptic plasticity.



**synaptic plasticity**  
structural changes that occur in the synapses

Throughout our life, we are constantly forming memories and learning from our experiences. When this occurs, our brain undergoes physical changes. **Synaptic plasticity** refers to the ability of synapses, the connections between neurons, to undergo changes in their strength and efficacy based on patterns of neural activity. Synaptic plasticity allows the brain to adapt and modify its neural circuitry in response to experiences, learning and environmental stimuli.



**FIGURE 1** Each time we learn a new skill, such as how to play a musical instrument, we form and send neural signals in our brain. The more we practise the skill, the more we use those signalling pathways and the stronger they can become.

When we learn or form memories, specific patterns of neural activity are established in our brain. These patterns of activity can lead to synaptic changes that strengthen or weaken the connections between neurons involved in the learning process. Synaptic plasticity describes the cellular mechanisms that allow these changes to occur. In this topic, we will examine two processes that facilitate synaptic plasticity: long-term potentiation and long-term depression. We will also look at how other neural processes such as sprouting, rerouting and pruning influence synaptic plasticity.

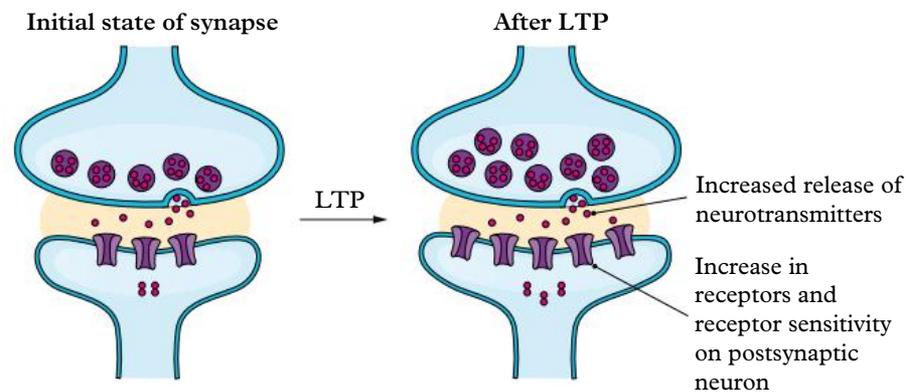
## Long-term potentiation

### long-term potentiation (LTP)

the long-lasting strengthening of neural connections

**Long-term potentiation (LTP)** is an experience-dependent process that leads to the long-lasting strengthening of synaptic connections between neurons. It typically occurs when a synapse is repeatedly stimulated or experiences strong stimulation during neural communication. Repeated or intense stimulation triggers specific molecular signalling pathways within the synapse that cause the postsynaptic neuron to become more receptive to signals sent from the presynaptic neuron. This activity strengthens the synaptic connection between the two neurons and results in an increased likelihood of the postsynaptic neuron successfully firing an action potential.

During LTP, structural and functional changes occur at the synapse. The axon terminals of the presynaptic neuron may undergo growth, forming more synaptic contacts with the dendrites of the postsynaptic neuron. This growth increases the surface area available for synaptic transmission. Additionally, the number and sensitivity of neurotransmitter receptors on the postsynaptic neuron may also increase. This change allows for a more substantial response to the neurotransmitters released by the presynaptic neuron. Consequently, when the presynaptic neuron fires and releases neurotransmitters, it is more likely to have a more intense effect on the postsynaptic neuron because there are more receptors that can simultaneously receive the signal (Figure 2).



**FIGURE 2** Long-term potentiation (LTP) results in structural changes at the synapse that can increase the likelihood of an action potential being fired by the postsynaptic neuron and increase the strength of the signal.

The combination of the structural and functional changes that take place during LTP enhance the efficiency of neural transmission and result in a strengthened pathway. LTP also makes it easier to retrieve information associated with that pathway, as the strengthened synapses are more likely to activate the postsynaptic neuron in response to the corresponding neural signals.

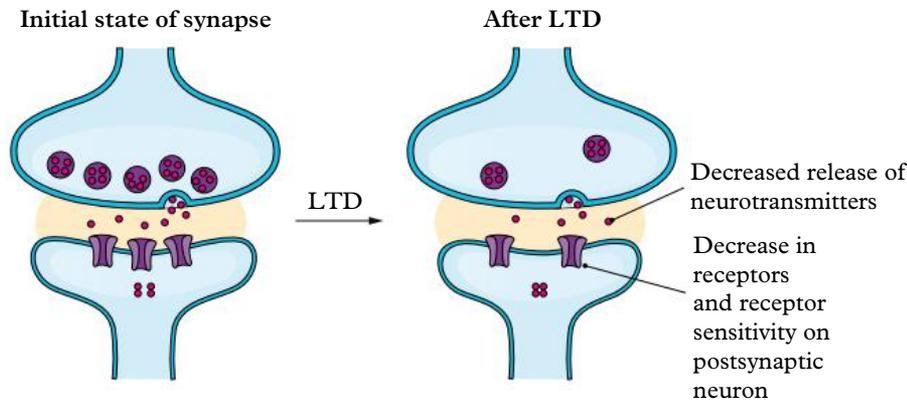
## Long-term depression

### long-term depression (LTD)

the long-lasting weakening of neural connections

**Long-term depression (LTD)** is an experience-dependent process that leads to the long-lasting weakening of synaptic connections between neurons. It typically occurs when synapses experience repeated low-intensity stimulation or no stimulation during neural communication. In this situation, specific molecular signalling pathways within the synapse can be triggered that result in the postsynaptic neuron becoming less receptive to signals from the presynaptic neuron. This activity weakens the synaptic connection between the two neurons and decreases the likelihood of the postsynaptic neuron successfully firing an action potential.

During LTD, both structural and functional changes take place at the synapse. The axon terminals of the presynaptic neuron may shrink or be pruned, reducing the number of synaptic contacts with the dendrites of the postsynaptic neuron. This shrinkage can also contribute to a decrease in the surface area available for synaptic transmission. Additionally, the number and sensitivity of neurotransmitter receptors on the postsynaptic neuron may decrease. This change results in a reduced response to the neurotransmitters released by the presynaptic neuron. Consequently, when the presynaptic neuron fires and releases neurotransmitters, the effect on the postsynaptic neuron is diminished because there are fewer receptors to receive the signal simultaneously.



**FIGURE 3** Long-term depression (LTD) results in structural changes at the synapse that can decrease the likelihood of an action potential being fired by the postsynaptic neuron and reduce the strength of the signal.

The structural and functional changes that take place during LTD weaken or eliminate synaptic connections, making the retrieval of information associated with those connections more challenging. Additionally, LTD may occur to make room for the formation of new connections during learning and memory processes, allowing the brain to adapt and reorganise its neural circuits. It is important to remember that a balance of LTP and LTD is necessary to ensure efficient neural transmission.

## 2.6 CHALLENGE

### Drawing links between neurotransmitters and synaptic plasticity

Glutamate is the main excitatory neurotransmitter in the CNS. It has an excitatory effect, which increases the chances of an action potential being fired from the postsynaptic neuron.

Use your understanding of LTP and LTD to discuss how glutamate may affect both processes.

## Sprouting, rerouting and pruning

Sprouting, rerouting and pruning are processes that can alter synaptic plasticity (including both LTP and LTD) by modifying the connections between neurons in the brain. These processes are part of the brain's structural plasticity, which refers to the ability of the brain to physically reorganise its neural circuits.

### Sprouting

**Sprouting** is the process by which a neuron's axon or dendrites grow to form new connections with other neurons. Sprouting typically occurs in response to damage, disruption or loss of neurons or neuron connections. When such damage occurs, neighbouring neurons may extend their axons or dendrites to establish connections with an affected area (Figure 4). Sprouting helps compensate for lost connections and restores neural communication. Sprouting plays a crucial role in synaptic plasticity and functional recovery after brain injury, as well as during the rewiring processes associated with learning and memory.

### Rerouting

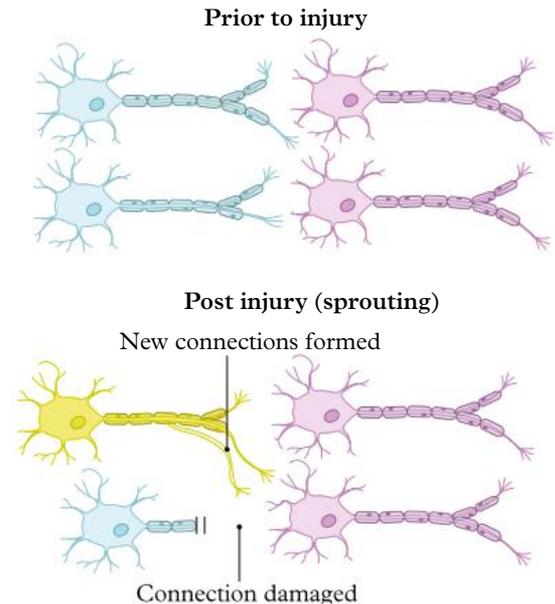
**Rerouting** occurs when a healthy neuron establishes new connections with different neurons from those it originally connected with to create an alternative neural pathway. This process allows neural signals to be redirected and new neural pathways to be formed (Figure 5). Rerouting can be a compensatory mechanism when the original connections are disrupted or lost. The healthy neuron adapts and establishes alternative connections to maintain functional neural communication. Rerouting is particularly relevant when specific brain regions are damaged or dysfunctional.

#### sprouting

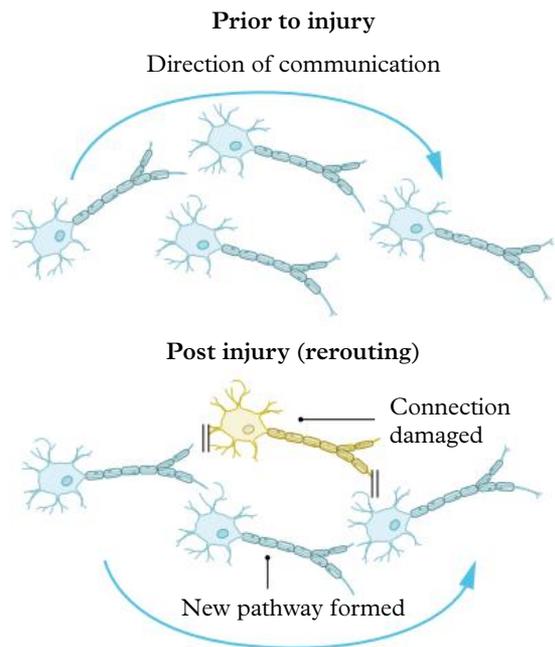
the formation of new connections between neurons

#### rerouting

the formation of an alternative neural pathway by the removal of damaged neurons and the formation of a new pathway between healthy neurons



**FIGURE 4** The process of sprouting involves a neuron's axon or dendrites growing to form new connections with other neurons.



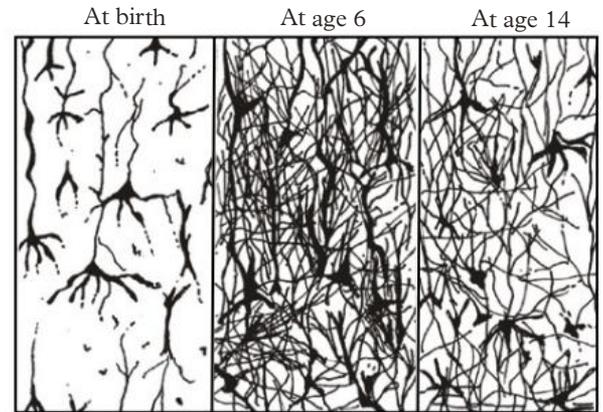
**FIGURE 5** The process of rerouting involves a neuron establishing new connections to alternative healthy neurons to form new neural pathways.

## Pruning

**Pruning** is the brain's process of selectively eliminating or reducing specific neural connections and synapses to refine and optimise the wiring of the brain. It is an ongoing process that begins in childhood and continues into adulthood.

During the early stages of brain development, there is an overproduction of synaptic connections, creating an excess of neural circuits. Pruning allows the brain to selectively eliminate any unnecessary or weak connections to preserve more relevant and efficient connections. This process helps shape neural circuitry and enhances the efficiency of neural communication. It helps refine sensory pathways, fine-tune motor control, and shape cognitive abilities such as language acquisition and memory formation.

Pruning is influenced by various factors, including genetic factors and experience-dependent mechanisms. It is thought to be driven by neural activity and experience – connections that are frequently used or activated are more likely to be preserved, whereas connections that are less active or unused are more likely to be pruned.



**FIGURE 6** From age 6 to 14 years, the brain undergoes pruning to maintain the most essential neural connections.

### **pruning**

the removal of excess neurons and synaptic connections to enable more efficient neural processing

## 2.6 REAL-WORLD PSYCHOLOGY

### Olympian Tess Lloyd

At 16, Olympian Tess Lloyd had a promising sailing career ahead of her. Then in 2012, an accident left her with a severe brain injury. After the accident, she was unable to talk and communicate effectively. She had to relearn the meaning of words and how to speak again. Tess defied the odds and returned to sailing just 10 months after her accident. She said sailing felt natural and wasn't as difficult to pick up as the other processes she had to practise.

### Apply your understanding

- 1 With reference to LTP, discuss why Tess was able to pick up sailing more quickly than other processes.

## 2.6 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “synaptic plasticity”.
- 2 Describe how each of the following processes contributes to synaptic plasticity:
  - a sprouting
  - b rerouting
  - c pruning.
- 3 Explain why the brain needs to prune neural connections as it develops.

### Apply, analyse and compare

- 4 Compare LTP and LTD in terms of structural changes and effects.

### Design and discuss

- 5 Draw a labelled diagram to show how the structure of a neuron changes during LTD.
- 6 Using an example from your own life, discuss how LTP contributes to improved retention of information and how LTD contributes to loss of information.

## Chapter summary

- 2.1** • The nervous system is made up of the central nervous system (CNS) and the peripheral nervous system (PNS).
  - The CNS, which consists of the brain and spinal cord, processes information and coordinates responses.
  - The PNS, which consists of all nerves outside of the CNS, connects the CNS to the rest of the body.
  - The PNS is further divided into the somatic nervous system, which controls voluntary actions, and the autonomic nervous system, which controls involuntary functions through the sympathetic and parasympathetic branches.
- 2.2** • A conscious response is a voluntary response controlled by the somatic nervous system.
  - An unconscious response is automatic, involuntary and controlled by the autonomic nervous system.
  - A spinal reflex is an unlearned and unconscious response that occurs to aid our survival. It is controlled by the autonomic nervous system.
- 2.3** • A neuron is a nerve cell that enables nervous system communication.
  - Neural transmission is the process by which information is transmitted within the nervous system through the exchange of electrical and chemical signals between neurons.
  - A presynaptic neuron sends/transmits the neural message, whereas a postsynaptic neuron receives the neural message.
- 2.4** • Neurotransmitters are chemical messengers that facilitate communication between neurons.
  - The effects of neurotransmitters can be either excitatory or inhibitory, depending on whether they increase or decrease the likelihood of a postsynaptic neuron firing an action potential.
  - Glutamate is the main excitatory neurotransmitter in the CNS. It helps promote neural transmission and plays a critical role in cognitive processes such as learning and memory.
  - GABA is the main inhibitory neurotransmitter in the CNS. It helps regulate neuronal excitability, promotes relaxation, and plays a role in anxiety, stress and sleep–wake cycles.
- 2.5** • Neurotransmitters act on individual neurons to directly transmit signals, whereas neuromodulators affect broader regions of the brain, modulating the overall activity of neuronal networks.
  - Dopamine is a neuromodulator that helps to fine-tune signal strength across a network of neurons and affects learning and memory processes.
  - Serotonin is a neuromodulator that significantly influences the regulation of mood, sleep, appetite and pain perception.
- 2.6** • Synaptic plasticity refers to the ability of synapses to change strength and efficacy based on patterns of neural activity.
  - Long-term potentiation (LTP) is an experience-dependent process that strengthens synaptic connections, whereas long-term depression (LTD) weakens synaptic connections.
  - Sprouting, rerouting and pruning are processes that influence synaptic plasticity.

## Revision questions

### Multiple choice

- 1 Which of the following describes the function of the autonomic nervous system?
  - A To regulate involuntary responses without conscious awareness
  - B To regulate voluntary responses without conscious awareness
  - C To regulate involuntary responses with conscious awareness
  - D To regulate voluntary responses with conscious awareness
  
- 2 Kai is watching a scary movie and becomes so frightened that they feel an acceleration in their heart rate.  
Kai is most likely experiencing:
  - A the involuntary activation of the parasympathetic nervous system in response to dangerous stimuli.
  - B the voluntary activation of the sympathetic nervous system in response to dangerous stimuli.
  - C a rush of hormones that increase the heart rate and that occurs with conscious control.
  - D a rush of blood straight to the heart that Kai consciously controls.
  
- 3 The quick removal of your hand from a hot oven demonstrates:
  - A how the brain processes a spinal reflex.
  - B the role of the spinal cord in initiating a deliberate movement.
  - C the neural transmission of motor neurons in the brain and spinal cord.
  - D a reflexive response necessary for survival.
  
- 4 Which statement best explains the transmission of neural information across a neural synapse?
  - A The postsynaptic neuron releases a message from the axon terminals that crosses the synapse and is received by the dendrites of the presynaptic neuron.
  - B The presynaptic neuron releases a message from the axon terminals that crosses the synapse and is received by the dendrites of the postsynaptic neuron.
  - C The presynaptic neuron releases a message from the dendrites that crosses the synapse and is received by the axon terminals of the postsynaptic neuron.
  - D The postsynaptic neuron releases a message from the dendrites that crosses the synapse and is received by the axon terminals of the presynaptic neuron.
  
- 5 In terms of neurotransmitter effects, which of the following best describes the role of glutamate?
  - A Glutamate increases the likelihood that a neuron will fire an action potential.
  - B Glutamate decreases the likelihood that a neuron will fire an action potential.
  - C Glutamate excites the neural synapse of the presynaptic neuron.
  - D Glutamate inhibits the neural synapse of the presynaptic neuron.
  
- 6 When Guaneer finishes his oral presentation, he sighs with relief and begins to feel his breathing rate return to normal. Which of the following accurately describes the biological processes Guaneer is experiencing?
  - A The sympathetic nervous system returns the internal body to normal functioning.
  - B The parasympathetic nervous system returns the internal body to normal functioning.
  - C Glutamate activates the postsynaptic neuron, calming the body.
  - D Glutamate activates the presynaptic neuron, calming the body.



- 7 Tegan regularly practises the basketball technique of dribbling to decrease the likelihood of her forgetting the skill.

With reference to synaptic plasticity, Tegan is demonstrating:

- A long-term potentiation to increase the responsiveness of the presynaptic neuron.
  - B long-term potentiation to decrease the responsiveness of the postsynaptic neuron.
  - C persistent weakening of synapses, which leads to a long-lasting increase in the strength and efficiency of signal transmission.
  - D persistent strengthening of synapses, which leads to a long-lasting increase in the strength and efficiency of signal transmission.
- 8 Long-term depression is:
- A the long-lasting weakening of synaptic connections.
  - B the long-lasting strengthening of synaptic connections.
  - C a neuron's ability to form connections with another neuron.
  - D the brain's ability to prune synaptic connections.
- 9 Dopamine is a:
- A neuromodulator that inhibits sleep.
  - B neuromodulator that turns sad and hurtful experiences into pleasurable ones.
  - C neurotransmitter that facilitates sprouting and rerouting.
  - D neuromodulator that is involved in the modulation of neurotransmitters such as GABA and glutamate.
- 10 What is the primary role of serotonin as a neuromodulator in the nervous system?
- A Serotonin acts as an inhibitory neurotransmitter that reduces neural activity.
  - B Serotonin enhances the feeling of pain in the CNS.

C Serotonin modulates mood and emotions and regulates sleep–wake cycles.

D Serotonin is involved in the regulation of motor functions and movement control.

### **Short answer**

#### **Describe and explain**

- 11 Identify the subdivision of the PNS that is involved in conscious responses and outline how it enables motor movement.
- 12 Explain why a spinal reflex enhances survival.
- 13 In terms of nervous system functioning, explain why an increase in heart rate indicates the activation of the sympathetic nervous system.
- 14 Describe the role of the neurons in neural transmission.
- 15 Explain how long-term potentiation is involved when revising for a test.
- 16 “Glutamate produces an excitatory effect.” Describe what is meant by this statement.
- 17 Explain “synaptic plasticity”.
- 18 Describe the role of the postsynaptic neuron in the neural transmission of dopamine.
- 19 Use relevant examples to describe the different roles of the subdivisions of the PNS.

#### **Apply, analyse and compare**

- 20 Compare the role of the PNS in conscious and unconscious responses.
- 21 While gardening, Kylie accidentally touches a sharp thorn on a rose bush. She quickly removes her hand. Outline the role of the spinal cord in Kylie's quick response.
- 22 Differentiate between LTP and LTD as a fundamental mechanism of memory formation.
- 23 Analyse the role of the neural synapse in neural transmission.
- 24 What is the main difference between a neurotransmitter and a neuromodulator?

- 25 With reference to dopamine, why might a person continue to engage in harmful behaviours such as drinking or taking illicit substances?
- 26 While watching TV, Peter begins to feel hungry. He opens a block of chocolate and begins to eat one row. Despite becoming full, Peter continues to eat the whole block until he feels sick.
- In terms of nervous system functioning, outline the role of the brain in signalling the feeling of hunger.
  - How might dopamine be involved in Peter's decision to continue eating after feeling full?
  - Is Peter's behaviour of eating chocolate helpful or harmful? Justify your response.



**FIGURE 1** Peter eats a whole block of chocolate until he feels sick.

- 27 Viv hypothesises that a person's pupils will change during sympathetic nervous system activation. What results would Viv expect to see if her hypothesis is supported? Why would this occur?
- 28 Compare the synaptic changes of someone who has learnt a new skill to someone who has forgotten a previously learnt skill.
- 29 Suggest why excess glutamate is linked to excitatory neural conditions such as epilepsy.

### Design and discuss

- 30 Discuss how changes in synaptic plasticity (LTP and LTD) can result in changes to connections between neurons such as rerouting and pruning.
- 31 Create an annotated diagram to show the neural transmission of the following neurotransmitters and neuromodulators.
- GABA
  - Glutamate
  - Dopamine
  - Serotonin
- 32 Discuss how you could use qualitative observations to determine if a person's parasympathetic or sympathetic nervous system was activated during a stressful speech.

You can find the following resources for this section in your obook pro:

pro

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

# 3

# Stress as a psychobiological process

## KEY KNOWLEDGE

- internal and external stressors causing psychological and physiological stress responses, including the flight-or-fight-or-freeze response in acute stress and the role of cortisol in chronic stress
- the gut-brain axis (GBA) as an area of emerging research, with reference to the interaction of gut microbiota with stress and the nervous system in the control of psychological processes and behaviour
- the explanatory power of Hans Selye’s General Adaptation Syndrome as a biological model of stress, including alarm reaction (shock/counter shock), resistance and exhaustion
- the explanatory power of Richard Lazarus and Susan Folkman’s Transactional Model of Stress and Coping to explain stress as a psychological process (primary and secondary appraisal only)
- use of strategies (approach and avoidance) for coping with stress and improving mental wellbeing, including context-specific effectiveness and coping flexibility.

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## GROUNDWORK

This chapter will build on concepts you may have come across in Chapter 2, Units 1 and 2 Psychology and junior science. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



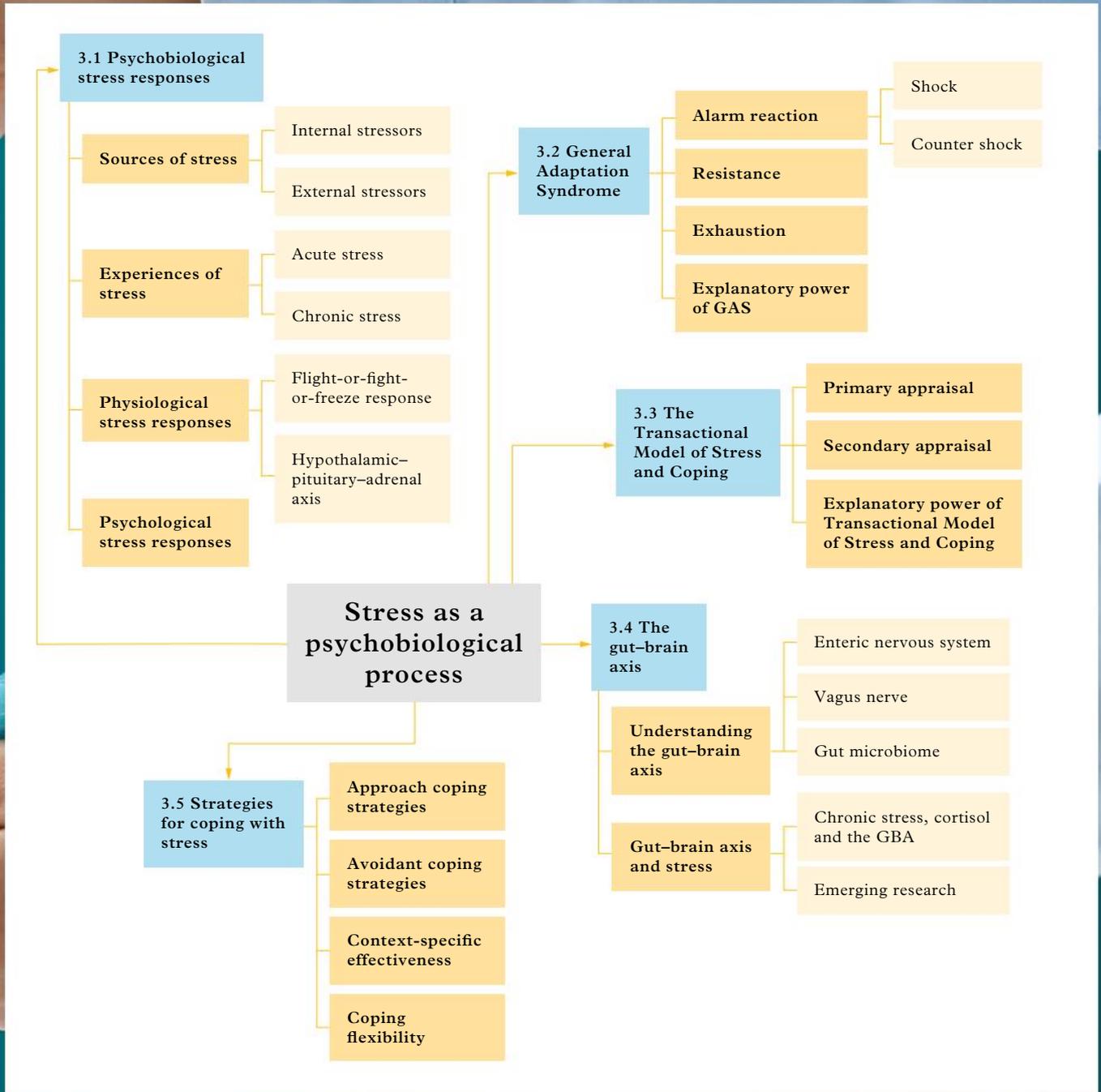
Groundwork quiz  
Chapter 3

## INVESTIGATIONS

3.1	<b>INVESTIGATION: PRODUCT, PROCESS OR SYSTEM DEVELOPMENT</b>	How can we teach primary school students about the flight-or-fight-or-freeze response?	Page 472
3.4	<b>INVESTIGATION: LITERATURE REVIEW</b>	Can diets rich in healthy bacteria and probiotics be used to treat stress-induced gastrointestinal damage?	Page 474

**FIGURE 1** In addition to stress balls, there are many different approaches to manage stress.

## CONCEPT MAP



# 3.1

## Psychobiological stress responses

### KEY IDEAS



- ✦ Stress is a psychobiological response to an internal or external source of tension (stressor).
- ✦ Internal stressors refer to stress that comes from our mind and body. External stressors refer to stress that comes from the environment.
- ✦ Acute stress occurs when a stressor produces a high level of physiological arousal (stress response) for a brief time. Chronic stress occurs when the source of tension is prolonged and perceived as beyond a person's ability to cope with.
- ✦ Two pathways are activated in the flight-or-fight response: the sympathetic adreno-medullary system (SAM) releases adrenaline and noradrenaline, and the hypothalamic-pituitary-adrenal (HPA) axis releases cortisol.
- ✦ Both the sympathetic and parasympathetic nervous systems are involved in the freeze response, but the response is dominated by the parasympathetic nervous system.

### stress

the body's psychological and physiological response to an internal or external source of tension (stressor)

Have you ever felt so nervous about an upcoming exam or event that not only do you feel anxious, but your chest tightens and your heart races? **Stress** is defined as the psychological and biological response to internal and/or external sources of stress that challenge a person's ability to cope. The stress response is psychobiological (psychological and biological) in nature and results in physiological arousal (activates or suppresses bodily functions). Stress affects people across all stages of life, and sources of stress can vary greatly among people; for example, upcoming exams, tension at home, work deadlines, relationship difficulties and physical injuries are all sources of stress.

In this topic, we will look at sources of stress, the difference between acute and chronic stress, and the psychological and physiological elements of the stress response.



**FIGURE 1** Sources of stress can vary greatly from upcoming exams to breaking your arm.

## Sources of stress

### stressor

a source of tension that challenges a person's ability to cope

### cumulative risk

the chance of developing a health problem due to a build-up of risk factors

A source of stress is referred to as a **stressor** – any situation, circumstance or stimulus that impairs a person's ability to cope. Stressors can be positive (e.g. excitement about a new promotion) and negative (e.g. disappointment about losing your job). How we perceive and respond to stressors is a crucial factor in determining our overall level of stress and our ability to manage stress effectively. If stressors are not managed correctly and exceed a person's resources and ability to cope, then they may build up to increase our risk of developing serious physical and mental health problems. This is known as **cumulative risk**. Even small daily hassles such as being late for school, submitting assignments or missing the train can lead to cumulative risk. Being able to identify where sources of stress originate can help us manage stress.

## Internal stressors

**Internal stressors** are sources of stress that come from within us, originating from either our mind or our physical body. Our mind can have a significant role in triggering stress responses. For example, if we have negative self-talk or unrealistic expectations, this may cause us to feel anxious or overwhelmed. Similarly, if we have high expectations for ourselves, such as perfectionism or the need to always be productive, we may experience stress when we don't meet those expectations. Our body can also contribute to internal stressors. Physical factors such as illness, fatigue and chronic pain can affect our mood and overall sense of wellbeing, leading to stress. Other potential internal stressors are our genetic make-up, hormones, physical health, personality and negative thinking patterns. By identifying and addressing internal stressors, we can act to help reduce our overall stress levels and improve our ability to cope with stress.

**internal stressor**  
a source of stress that comes from our mind and body

## External stressors

**External stressors** are sources of stress that stem from our environment. External stressors can be positive or negative, and include a wide range of circumstances such as:

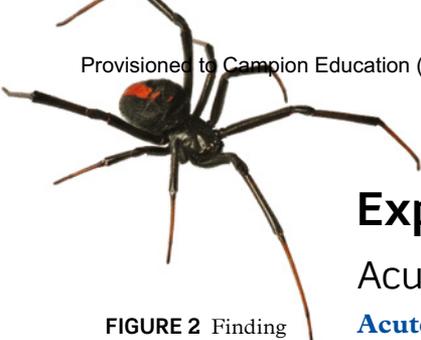
- pressures at home: this can include chores, family conflicts, caregiving responsibilities, or other household stresses
- demands from school and/or work: this can include academic pressure, work deadlines, or difficult relationships with colleagues or supervisors
- major life changes: this can include positive events such as getting married, having a baby or buying a new home, as well as negative events such as the illness or death of a loved one or job loss
- financial problems: money troubles, debt, recession and unemployment can be significant sources of stress
- isolation: lack of social support or feeling disconnected from others can be a major source of stress
- social relationships: difficulties in relationships with friends, family or romantic partners can also contribute to stress levels.

**external stressor**  
a source of stress that comes from the environment

It is important to remember that both internal and external stressors are not always within our control. However, we can learn to manage our responses to stressors through coping strategies and stress management techniques.

**TABLE 1** Examples of internal and external stressors

Internal stressors		External stressors	
<ul style="list-style-type: none"> <li>• Underlying medical conditions</li> <li>• Mental health problems</li> <li>• Physical health</li> <li>• Immune system</li> <li>• Genetics</li> <li>• Thinking patterns</li> <li>• Lack of sleep</li> </ul>	<ul style="list-style-type: none"> <li>• Psychological: rumination, depression, anxiety, catastrophic thinking</li> <li>• Personality traits</li> <li>• Drug-use internal triggers: negative or unwanted emotions, anger, fear, loss, mental or physical illness</li> </ul>	<ul style="list-style-type: none"> <li>• Family problems</li> <li>• Social relationship difficulties</li> <li>• School demands</li> <li>• Work issues</li> <li>• Financial problems</li> <li>• Change stressors: moving house, changing school or job, marriage, divorce</li> </ul>	<ul style="list-style-type: none"> <li>• Pollution, noise, temperature, crowding</li> <li>• Drug-use external triggers: places, people, seeing drug and alcohol consumption in media (e.g. movies, songs, images)</li> </ul>



## Experiences of stress

### Acute stress

**FIGURE 2** Finding a redback spider on your arm might trigger an acute stress response.

#### acute stress

an intense, short-term stress response that is induced shortly after a perceived stressor

#### chronic stress

a prolonged physiological or psychological response induced by a long-term internal or external stressor

#### cortisol

the main stress hormone released by the adrenal glands for a range of vital functions, including increasing blood glucose levels and regulating metabolism and the immune response

#### endocrine system

the network of glands and organs in the body that synthesise hormones and release them into the bloodstream

**Acute stress** is a brief and intense response to a perceived stressor. It typically develops quickly and does not last very long. The stress response to acute stress is high and can include physiological symptoms such as increased heart rate, rapid breathing and a surge of adrenaline. Acute stress is often triggered by a specific event or situation that is perceived as threatening or challenging. Examples of acute stressors are watching a scary film, skydiving, and encountering a dangerous spider (Figure 2).

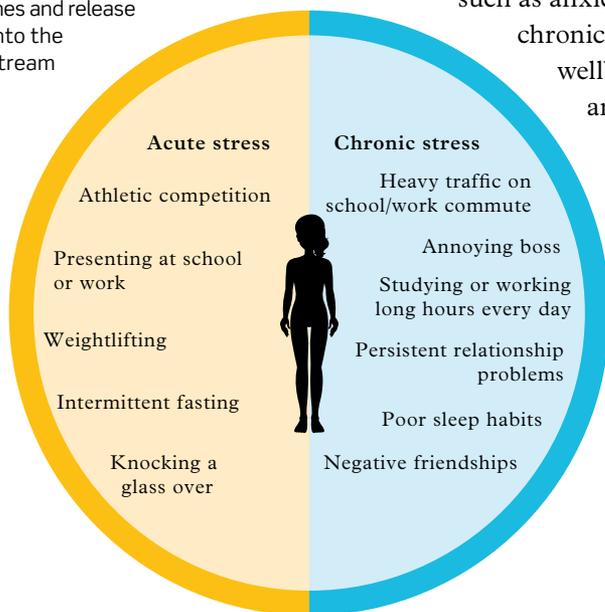
Acute stress is typically short lived, and the source of the stressor is not long lasting. Once the stressor has passed or been removed, the stress response will usually subside quickly. While acute stress can be uncomfortable or unpleasant in the moment, it is generally not harmful in the long term, and may even be beneficial in some situations by helping us to respond quickly and effectively to perceived threats. However, if acute stress persists over time or is not managed effectively, it can increase the risk of developing more serious physical and mental health problems.

### Chronic stress

**Chronic stress** is a type of stress that occurs when a stressor is prolonged or ongoing and is perceived to be beyond a person's ability to cope with. This can include ongoing work pressures, financial difficulties and relationship problems. One of the key features of chronic stress is that it causes an ongoing low-level physiological arousal response through the hypothalamic–pituitary–adrenal (HPA) axis, which you will learn about later in this topic.

In chronic stress, the prolonged nature of the stressor causes the stress hormone **cortisol** to circulate through the bloodstream. Cortisol is released in response to stress and is involved in the body's stress response. Elevated cortisol levels over a prolonged period can suppress the immune system and lead to increased risk of illness and other health problems.

Chronic stress can also have a negative impact on mental health, leading to conditions such as anxiety, depression and burnout. It is important to manage chronic stress effectively to promote overall physical and mental wellbeing. Exercise, relaxation techniques, time management and seeking social support are all strategies that can be applied to help manage chronic stress.



**FIGURE 3** Different sources of acute and chronic stress

## Physiological stress responses

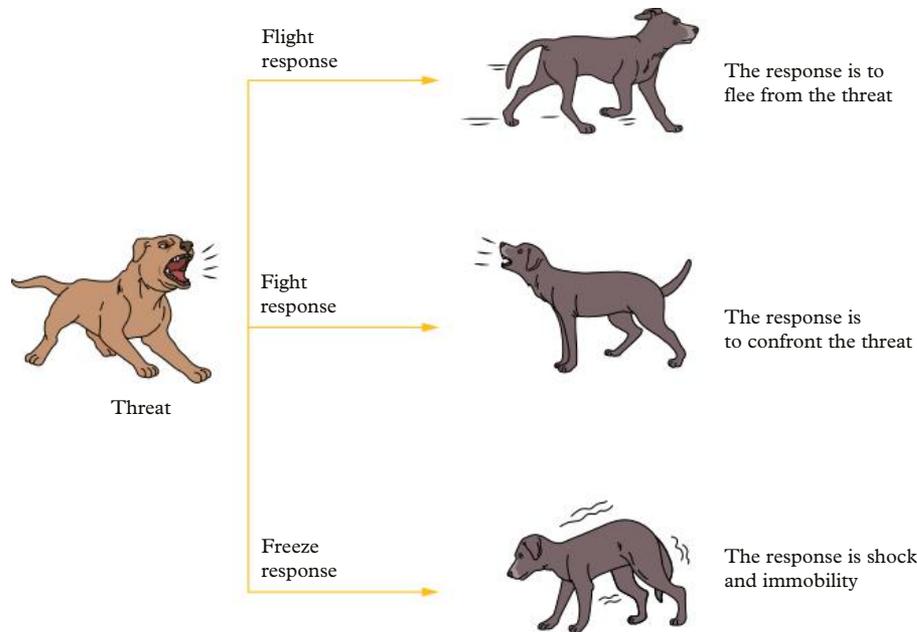
### Flight-or-fight-or-freeze response

The biological aspect of the stress response involves activating the autonomic nervous system and the **endocrine system**. The autonomic nervous system regulates involuntary bodily functions such as heart rate, blood pressure and breathing, whereas the endocrine system releases hormones that help to regulate bodily functions. When we perceive a threat or a stressful situation, the biological stress response is triggered,

which can activate the **flight-or-fight-or-freeze response**. This is an unconscious, automatic response that prepares the body to flee from the threat, fight it or freeze and assess the situation.

In the early stages of human and animal evolution, the flight-or-fight-or-freeze response was essential for survival and was considered to be an **adaptive response**. However, today, there are many reasons why we experience the flight-or-fight-or-freeze response that are not necessarily due to imminent danger. For example, public speaking, taking an exam, or encountering a social situation that we perceive as threatening can also trigger the stress response. Although the flight-or-fight-or-freeze response can be helpful in some situations, it can also have negative consequences if it is activated too often or for prolonged periods of time.

The sympathetic nervous system is generally responsible for activating the flight-or-fight response, which can include increased heart rate, blood pressure and respiration. The freeze response is typically associated with the parasympathetic nervous system and involves a decrease in activity and a decrease in physiological arousal. This can involve slowing of the heart rate and breathing, and a decrease in muscle tension. Figure 7 in Topic 2.1 shows a summary of physiological responses controlled by the parasympathetic and sympathetic nervous systems.



**FIGURE 4** The flight-or-fight-or-freeze response had an evolutionary purpose to increase an animal’s chances of survival.

### Flight-or-fight responses

To assist our bodies in fighting or running away from a perceived threat, our body may release the stress hormones **adrenaline** and **noradrenaline** (also known as epinephrine and norepinephrine). Adrenaline is a hormone that can provide a quick surge of energy; it is often referred to as the “flight-or-fight” hormone. Adrenaline can dilate our air passages to increase oxygen supply to the muscles we use to fight or run away from a threat. It can also trigger blood vessels to contract and redirect blood to important muscle groups such as the heart and lungs. Adrenaline can also heighten awareness and increase a person’s strength. Noradrenaline is a hormone that increases our arousal. During stress, it enables greater focus and levels of awareness, which can improve our responsiveness to the stressor. Noradrenaline also increases blood pressure and assists redirection of blood flow from areas of less importance such as skin and digestion to more crucial areas such as skeletal muscles for a quick escape.

### flight-or-fight-or-freeze response

the body’s automatic physiological response to a stressor or threat, which results in a person escaping the stressor (flight), confronting the stressor (fight) or becoming immobile (freeze); also known as the stress response

### adaptive response

an action that is considered to be appropriate or effective against the environmental stimulus



### adrenaline

a hormone that is released from the adrenal glands during the stress response to increase energy; also known as epinephrine

### noradrenaline

a hormone that is released from the adrenal glands during the stress response to increase arousal; also known as norepinephrine

**sympathetic adreno-medullary system (SAM)**

the pathway used by the brain to activate the sympathetic branch of the autonomic nervous system and initiate a flight-or-fight-or-freeze response to acute stress

**amygdala**

an almond-shaped structure located in the medial temporal lobe of the brain that is central to emotion, aggression and implicit learning

**adrenal medulla**

the inner part of the adrenal gland that can synthesise adrenaline and noradrenaline

**tonic immobility**

a state of temporary paralysis and muscle rigidity in response to the perception of a threat or danger

**hypothalamic-pituitary-adrenal (HPA) axis**

the interaction between the hypothalamus, the pituitary gland and the adrenal glands to produce cortisol in response to a perceived stressor

**hypothalamus**

a region of the brain that has a vital role in coordinating many bodily functions, including hormone secretion from the pituitary gland

**corticotropin-releasing hormone (CRH)**

a hormone released by the hypothalamus that triggers the release of adrenocorticotropin to activate the adrenal cortex

The secretion of adrenaline and noradrenaline in response to stress occurs through the **sympathetic adreno-medullary system (SAM)**. This proceeds as follows.

- 1 A potential threat is detected by the **amygdala**, which triggers the hypothalamus.
- 2 The hypothalamus activates the sympathetic nervous system.
- 3 The sympathetic nervous system signals the adrenal glands to secrete the stress hormones adrenaline and noradrenaline from the **adrenal medulla**.

Adrenaline and noradrenaline enter the bloodstream to energise various organs and systems in the body, including the heart, lungs and muscles, preparing the body for a flight-or-fight response to the threat.

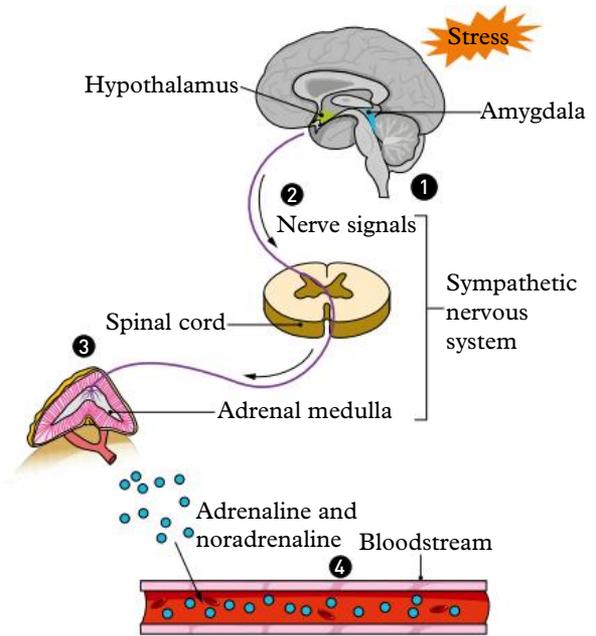


FIGURE 5 The sympathetic adreno-medullary system (SAM)

**Freeze response**

The freeze response occurs when a person or an animal assesses the stressor and remains very still to avoid injury, further injury or attack. An example of this is **tonic immobility**, where an animal pretends to be dead so that the predator will leave it alone. In the freeze response, the sympathetic and parasympathetic nervous systems are both involved, but the response is mostly dominated by the parasympathetic nervous system. When the parasympathetic nervous system is dominant, heart rate, respiration rate and overall physiological arousal decrease – this assists the animal to conserve energy and “freeze”.



FIGURE 6 A mouse freezing in response to the stress of being attacked by a predator

**Hypothalamic-pituitary-adrenal axis**

Adrenaline and noradrenaline are not the only hormones released in the stress response. Cortisol is a stress hormone that helps the body maintain a heightened state of arousal. Cortisol has several effects: it increases blood sugar levels, energises the body, improves metabolism and reduces inflammation. Cortisol is released into the blood shortly after adrenaline and noradrenaline are released from the SAM pathway. This is because the effects of cortisol last longer and help the body to cope with prolonged stress. Unlike adrenaline and noradrenaline, which are released via SAM, cortisol is released into the bloodstream via a pathway called the **hypothalamic-pituitary-adrenal (HPA) axis**. The HPA axis involves the following steps.

- 1 The amygdala in the brain perceives a threat and sends a message to the **hypothalamus**.
- 2 The hypothalamus releases **corticotropin-releasing hormone (CRH)**.
- 3 CRH activates the **pituitary gland** to release **adrenocorticotropin (ACTH)**.

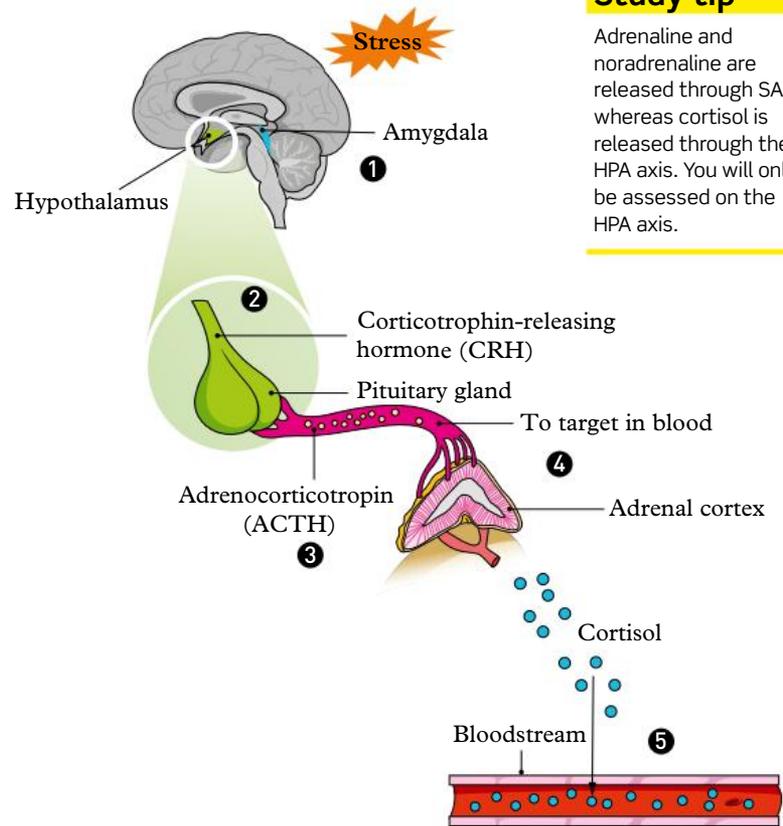
- 4 ACTH passes through the bloodstream to eventually stimulate the adrenal glands; the adrenal glands trigger the adrenal cortex to secrete cortisol.
- 5 Cortisol enters the bloodstream to aid the stress response.

### Cortisol and chronic stress

Chronic low-level stress can keep the HPA axis activated, resulting in the continual release of cortisol into the bloodstream. When cortisol is present in the bloodstream for long periods, it can suppress the immune system, leaving the body vulnerable to physical and psychological illnesses.

Once the source of stress is removed, the body can start to return to normal.

**Acetylcholine** is released, which helps to lower the levels of stress hormones such as cortisol, adrenaline and noradrenaline. However, it can take some time for the effects of these hormones to dissipate completely, and the immune system may take some time to recover from the suppressive effects of cortisol.



### Study tip

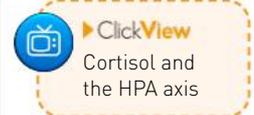
Adrenaline and noradrenaline are released through SAM, whereas cortisol is released through the HPA axis. You will only be assessed on the HPA axis.

FIGURE 7 The hypothalamic–pituitary–adrenal axis

### 3.1 CHALLENGE

Research has suggested that there are individual differences in people’s physiological responses to a chronic stressor. For example, one researcher found that different people produce different levels of stress hormones when exposed to the same stressor. These findings show that not everyone responds in the same way to the same stressor.

Based on your understanding of stress, explain why people may respond differently to the same stressor.



#### pituitary gland

a small gland located at the base of the brain under the hypothalamus that controls several hormone glands in the body

#### adrenocorticotropin (ACTH)

a hormone produced by the pituitary gland that acts on the outer part of the adrenal glands to stimulate cortisol secretion

#### acetylcholine

a neurotransmitter that plays an important role in brain and muscle function

## Psychological stress responses

The psychological aspect of stress involves how a stressor is perceived and how the mind responds. When a stressor is identified as a potential threat, the brain quickly assesses the situation, and the sympathetic and parasympathetic branches of the autonomic nervous system are involved in the stress response. Stress hormones such as adrenaline, noradrenaline and cortisol are released into the bloodstream, leading to significant changes in both the brain and the body.

In terms of cognition, the psychological stress response is characterised by racing thoughts and heightened senses. Racing thoughts can help us quickly assess the situation and determine the appropriate response to the stressor. This can include choosing whether to avoid the stressor (flight), confront it (fight) or remain still (freeze). Heightened senses such as sight, smell and touch can help the brain better process and respond to perceived danger

in the environment. The psychological stress response can also have negative effects, such as impairing cognitive function and decision-making, and contributing to the development of mental health disorders such as anxiety and depression.

The psychological response to stress can also include how we feel in relation to our stressors, which can have negative impacts on our mental health over time. Long-term exposure to stress can lead to a range of negative psychological impacts, including:

- anxiety: feelings of apprehension and worry about something with an uncertain outcome
- nervousness: feelings of apprehension or concern
- sadness: emotional pain linked to loss, grief and disappointment
- anger and irritability: feelings of frustration, hostility and impatience
- depression: persistent feelings of severe sadness and despondency
- rumination: repeatedly thinking about a problem without finding a solution
- catastrophic thinking: tending to dwell on worst-case scenarios
- memory bias: tending to recall negative or frightening aspects of a situation
- memory problems: having difficulty with concentration, memory consolidation and retrieval.

### 3.1 REAL-WORLD PSYCHOLOGY

#### Psychobiological stress responses in an experimental office environment

Kerr et al. (2020) in Switzerland conducted a controlled experiment to simulate social pressure in an office environment. They manipulated the stress experienced by participants and closely monitored their psychobiological stress responses. The simulated office environment elicited both biological and psychological stress responses in participants.

Participants wore heart monitors while sitting at desks with computers. They were asked to behave as though they worked for an insurance company and were to compute sales numbers and book appointments. At specific intervals, participants gave saliva samples and answered psychological questionnaires.

The experiment included three conditions while working on the computer tasks – two experimental conditions and a control. One group of 10 participants underwent a stress test that elicited social pressure: an actor playing a human resources officer informed the participants that they would be interviewed in 20 minutes for a promotion. A second group of 10 underwent this same stress test but also experienced task interruptions in the 20 minutes after being informed (e.g. continual chat messages from their manager). A third control group of 10 did not receive either stressor.

The researchers found that the office-related stress test led to psychological and biological stress responses among participants. The two groups that experienced the stress test demonstrated increased cortisol levels, increased heart rate, and lower heart rate variability compared to the control group. This suggests an activation of the HPA axis and the autonomic nervous system that typically occurs with stress. The stress test groups also demonstrated a psychological stress response, reporting higher perceived stress, worse mood, and stronger declines in calmness compared to the control group.

The task interruptions appeared to aggravate the biological stress response. Subjects who received the stress test and the work interruptions demonstrated increased salivary cortisol compared to the group who received the stress test only, suggesting that getting interrupted while anticipating an anxiety-provoking social interview led to even further activation of the HPA axis.

### Apply your understanding

- 1 Identify the aim of this study.
- 2 Identify the experimental design and suggest one advantage and one limitation of this design.
- 3 Write a research hypothesis for this controlled experiment.
- 4 Identify the independent variable in this experiment.
- 5 Explain why the researchers used the measures outlined in this experiment. Justify your response.
- 6 Analyse the findings of this experiment and discuss the implications of these results on people's stress.

## 3.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “stress”.
- 2 Explain why stress is considered a “psychobiological” process.
- 3 Describe how each of the following aids the stress response.
  - a Adrenaline
  - b Noradrenaline
  - c Cortisol

### Apply, analyse and compare

- 4 Differentiate between internal stressors and external stressors and provide two examples of each.
- 5 Leo has just found out she scored 2 out of 20 on her Psychology test. Terribly upset with her result, Leo experiences a fast heart rate, shaking hands and feels faint. Apply your understanding of the stress response to assess whether Leo is experiencing acute or chronic stress.
- 6 Arabella is a competitive member of a mixed football team. When her team won the final match of the season, Arabella was overjoyed to be presented with the “best and fairest” award

the following day. When accepting her award, her pupils dilated, her heart rate increased, and she felt a surge of energy and excitement to rush to the stage. Apply your understanding of the psychological and biological processes of the stress response and compare Arabella's response to the award with Leo's response in Question 5 to the low test score.

### Design and discuss

- 7 Create a labelled/annotated diagram or flow chart to illustrate the psychological and biological processes involved when a stressor is perceived.
- 8 Discuss the different ways the body can respond in the flight-or-fight-or-freeze response. In your discussion, include appropriate nervous system involvement and biological sequences including brain structures, hormones and associated changes to the body.

# 3.2

## General Adaptation Syndrome



### KEY IDEAS

- ✦ Alarm reaction is the first stage of the General Adaptation Syndrome (GAS) and consists of two phases: shock and counter shock.
- ✦ Resistance is the second stage of GAS and is also known as the adaptive stage. During resistance, the body adjusts to the stressor while stress hormones adrenaline, noradrenaline and cortisol circulate through the bloodstream. During this stage, the presence of cortisol results in the immune system being suppressed.
- ✦ Exhaustion is the third stage of GAS, where the body's resources are depleted, and the person or animal is susceptible to serious illness.

**endocrinologist**  
a medical professional who specialises in treating and diagnosing hormone-related conditions

**General Adaptation Syndrome (GAS)**  
a biological model that describes the physiological changes the body undergoes during stress

**ClickView**  
General Adaptation Syndrome (GAS)

**alarm reaction**  
the first stage of the General Adaptation Syndrome, in which the body responds with shock and then counter shock

**shock**  
the first phase of the alarm reaction, when the body reacts to a stressor as if it is injured, resulting in a decrease in blood pressure and body temperature

As you learnt in Topic 3.1, stress largely impacts on our body's ability to function. Hungarian–Canadian **endocrinologist** Hans Selye contributed to our understanding of how biological processes involved in the stress response could potentially lead to illness and death. He discovered this by chance when he was experimenting with a new sex hormone that was injected into rats. Initially, he thought that the effects he saw were due to the hormone itself. However, he soon realised that the rats all appeared to go through the same physiological processes, regardless of whether he exposed them to low temperatures, surgical injury, excessive exercise or different drugs.

Through his observations, Selye identified a predictable three-stage pattern of physiological responses that he called the **General Adaptation Syndrome (GAS)**. GAS is the body's way of adapting to and dealing with a perceived prolonged stressor or stressors and its three stages include alarm reaction, resistance and exhaustion. Selye also found that not everyone goes through all three stages and that the exhaustion stage is only reached if exposure to the stressor is persistent and not resolved.



**FIGURE 1** Hans Selye is referred to as the “father of stress” because of his research on stress in mice.

### Alarm reaction

**Alarm reaction** is the first stage of GAS; it occurs immediately when a person or animal first encounters or realises that there is a threat or stressor. The alarm reaction consists of two phases: shock and counter shock.

### Shock

**Shock** is the first phase of the alarm reaction. In the shock phase, the body responds as though it is injured. Body temperature and blood pressure momentarily drop as the person or animal becomes aware of the situation and processes it. During shock, the body's ability to manage the stressor is temporarily lowered. After the shock phase, the body rebounds with the countershock phase.

## Counter shock

**Counter shock** is the second phase of the alarm reaction and follows shock. During counter shock, the body increases its resistance to the stressor through the release of stress hormones such as adrenaline, noradrenaline and cortisol into the bloodstream. This effectively increases heart rate and respiration rate and releases more glucose into the bloodstream by diverting it from the gastrointestinal tract to muscles and other body parts in preparation for an emergency response. In other words, the countershock stage is when our flight-or-fight-or-freeze response is activated.

Sometimes a stressor can be dealt with soon after the initial stress encounter. For example, a student might be temporarily shocked and then upset by a test result, but after a few minutes their bodily systems return to normal and they are able to study normally. However, if a stressor is not dealt with immediately, the body will enter the next stage of GAS.

## Resistance

**Resistance** is the second stage of GAS. The resistance stage is an “adaptive” stage where the parasympathetic nervous system acts to reduce heart rate and respiration rate while blood glucose and stress-related hormones such as adrenaline and cortisol continue to circulate through the body. This stage keeps the body prepared for action, and the ability to deal with the stressor rises above normal. If the stressor persists, the person remains in an elevated state of arousal with greater energy resources at their disposal to deal with the situation and physiologically adapt to higher levels of stress.

Because the body has a limited ability to remain physiologically aroused for extended periods of time, adaptation to stressors through continued circulation of stress hormones, particularly cortisol, can depress the immune system. When this occurs, a person becomes more vulnerable to viral or bacterial infections circulating in the environment and may start to show cold or flu symptoms. The resistance stage is also characterised by “energy conservation” as the individual tries to focus on the stressor at hand. For example, a person may decline social invitations or become absent from work or school and may have trouble focusing, remembering and staying awake. They may appear withdrawn because they are conserving energy to deal with their stressor.



**FIGURE 2** Exposure to stress for extended periods of time can depress the immune system and leave us more susceptible to environmental pathogens and viruses.

## Exhaustion

**Exhaustion** is the third stage of GAS and occurs when the body’s ability to meet the demands of a stressor starts to decline. As a person’s biological resources become severely depleted, they become susceptible to more serious illnesses such as stomach ulcers, sleep disorders, fatigue, high blood pressure, heart disease, anxiety and depression. In extreme circumstances, exhaustion can result in death. Organs such as the heart are particularly vulnerable to environmental factors and often show the first signs of serious illness (e.g. heart attack). If a person reaches this stage of GAS, they are often both mentally and physically exhausted and may show signs of burnout.

**counter shock**  
the second phase of the alarm reaction, when the body activates the sympathetic nervous system to produce adrenaline and engage the flight-or-fight-or-freeze response

### Study tip

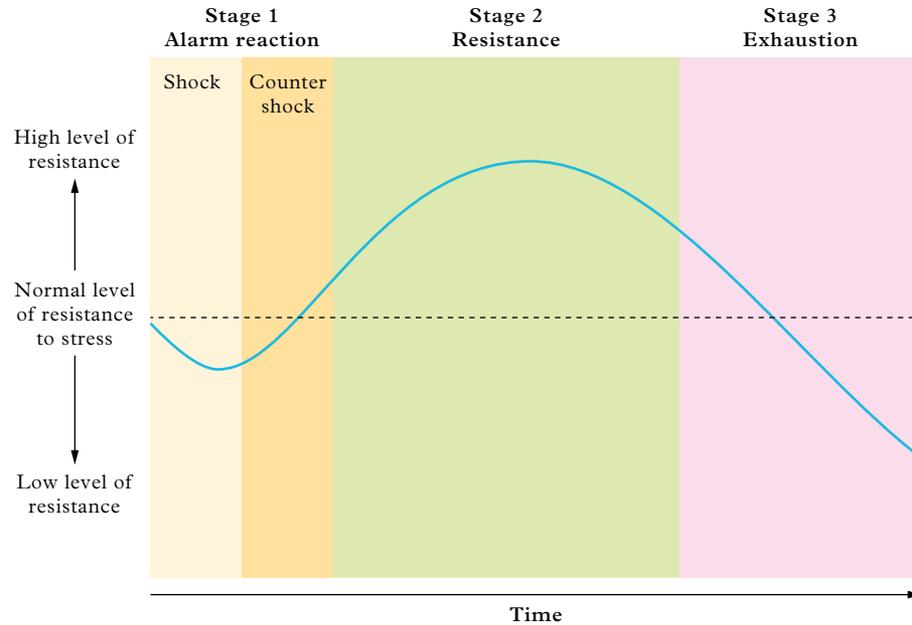
Cortisol is released during alarm reaction – specifically during counter shock.

**resistance**  
the second stage of the General Adaptation Syndrome, in which the body adapts to a stressor and stress hormones continue to circulate to keep resistance levels high, continued cortisol suppresses the immune system and illnesses such as headaches and colds can occur

**exhaustion**  
the third stage of the General Adaptation Syndrome, in which resources are depleted, and serious illness can occur due to long-term suppression of the immune system

### Study tip

You can remember the three main stages of GAS and their order with the acronym **ARE: Alarm reaction, Resistance and Exhaustion.**



**FIGURE 3** The stages of the General Adaptation Syndrome (GAS)

## Explanatory power of GAS

### explanatory power

the degree to which a model or theory can accurately explain the subject matter it relates to

**Explanatory power** is the degree to which a model or theory can accurately explain the subject it relates to. As mentioned earlier in this topic, GAS was first modelled from a laboratory experiment that used non-human subjects. The data obtained from monitoring the physiological responses of rats to artificially constructed stress-inducing situations showed predictable patterns. Unfortunately, many test subjects died during more extreme exposure conditions. This model provided clear and empirical evidence of a causal link between stress and illness. The GAS model went on to further show that prolonged exposure to extreme stress can lead to death.

Due to the purely biological nature of the findings and the use of non-human subjects, it did not provide a full picture. Today we know that when we experience chronic stress, we do not just focus on the physiological aspects; we also consider psychological factors (how a stressor is perceived and the mental state of the person) and social factors (family support, employment status or financial situation), which interact and play equally important roles. Consequently, the explanatory power of GAS is small. A summary of the strengths and limitations of the GAS model is given in Table 1.

**TABLE 1** A summary of the strengths and limitations of the General Adaptation Syndrome model

Strengths	Limitations
<ul style="list-style-type: none"> <li>The model provides an explanation for the physiological processes involved during stress.</li> <li>The model reveals a causal link between stress and illness.</li> <li>The model shows a predictable sequence of stages with a detailed explanation of each stage.</li> <li>Findings are based on sound empirical evidence obtained through controlled experiments.</li> </ul>	<ul style="list-style-type: none"> <li>The model assumes everyone has the same biological response to a stressor.</li> <li>The model attempts to generalise results from non-human subjects to humans.</li> <li>The model fails to address how psychological and social factors affect the stress response.</li> </ul>

### 3.2 WORKED EXAMPLE

#### Recognising stages of GAS

Ghani has two weeks to prepare for three Year 12 exams. He works part time and lives in a single-parent home where he is often left to care for his four younger siblings. Although Ghani is used to juggling responsibilities and does so successfully, he often feels tired after studying, working and caring for his siblings. The extra effort of preparing for examinations has added to Ghani’s workload and led to him feeling incredibly stressed. The day before the first exam, Ghani wakes up with a temperature and sore throat. While Ghani’s body provided the necessary physical resources to deal with the challenges of study, family and work, it has left him vulnerable to infection.

Use information from the scenario to discuss why Ghani is experiencing the resistance stage of GAS.

(4 marks)

#### Solution

Think	Do
Step 1: Identify the command terms in the question and determine what they require.	This question uses the command term “discuss”, which means the response should present a clear, considered and balanced argument that identifies issues and presents the strengths and weaknesses of one or more arguments, ideas or opinions.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	There are 4 marks allocated to this question, so four key pieces of information will need to form the response.
Step 3: Recall the distinguishing features of the resistance phase of GAS.	Resistance is the second stage of GAS and is also known as the adaptive stage as the body adjusts to the stressor while stress hormones adrenaline, noradrenaline and cortisol circulate through the bloodstream. During this stage, the immune system is suppressed due to the presence of cortisol, and a person is vulnerable to mild illnesses.
Step 4: Identify key information from the scenario that relates to the resistance stage of GAS.	<ul style="list-style-type: none"> <li>Ghani’s stressors, including work, caring for younger siblings, and study, have not reduced or been resolved.</li> <li>Ghani feels more tired and mentally stressed due to stressors.</li> <li>Ghani falls physically ill due to an infection the day before his first exam.</li> </ul>
Step 5: Apply your understanding of GAS to explain how key information from step 4 models the resistance stage.	<p>Ghani’s stressors, including work, caring for younger siblings and study, have not reduced or been resolved and cause him to enter the second stage of GAS – resistance. This is shown through the additional effort needed to study for exams beginning to affect Ghani’s health. (1 mark)</p> <p>The stress hormone cortisol, which is released during counter shock (second stage of alarm reaction) has continued to circulate in Ghani’s bloodstream. (1 mark)</p> <p>In the second GAS stage of resistance, the long-term presence of cortisol and other stress hormones eventually suppresses the immune system. (1 mark)</p> <p>This has left Ghani more susceptible to infection, which has resulted in him having a temperature and sore throat on the day before his first exam. (1 mark)</p>

## 3.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify three stress hormones that are released during alarm reaction.
- 2 Explain why the General Adaptation Syndrome is considered to be a biological model.
- 3 Outline the three stages of the General Adaptation Syndrome.

### Apply, analyse and compare

- 4 Contrast two key features of shock and counter shock.
- 5 Analyse the role of the hormone cortisol in the stress response and compare how it affects a person's body before and after prolonged stress.

### Design and discuss

- 6 Hetty has worked in the same job for 20 years. Recently, her company was purchased by new owners who have decided to increase demands on all staff. Hetty now works more than 50 hours

a week and finds it difficult to juggle work, family and caring for her elderly parents.

After four weeks, Hetty begins to experience severe headaches and fatigue and easily catches colds. After one year of trying to meet the demands of the new owners, Hetty collapses at work and is taken to hospital with a suspected heart attack. With reference to the scenario, apply your knowledge of General Adaptation Syndrome to discuss the biological processes that Hetty experienced during the resistance and exhaustion stages of General Adaptation Syndrome.

- 7 Draw the graph for the General Adaptation Syndrome and annotate what occurs during these stages: alarm reaction (including shock and counter shock), resistance and exhaustion.
- 8 Evaluate the explanatory power of the General Adaptation Syndrome by discussing its strengths and limitations.

# 3.3

## The Transactional Model of Stress and Coping

### KEY IDEAS



- ✦ The Transactional Model of Stress and Coping focuses on how a person perceives a stressor (psychological) and views this as a transaction between the individual and their environment.
- ✦ There are two stages of the Transactional Model of Stress and Coping: primary appraisal and secondary appraisal.
- ✦ Primary appraisal is the first stage of the Transactional Model of Stress and Coping, in which the individual evaluates the significance of a stressor. Possible appraisals are harm/loss, threat, challenge and neutral/irrelevant/benign.
- ✦ Secondary appraisal is the second stage of the Transactional Model of Stress and Coping, in which the individual evaluates whether they have the resources to cope with the stressor. Coping strategies are employed at this point.

### Transactional Model of Stress and Coping

a psychological model of stress that proposes a person's ability to cope with stress is influenced by how they assess the stressor

### appraisal

a subjective assessment of a stimulus or an environment made by an individual



ClickView

The Transactional Model of Stress and Coping

### primary appraisal

the initial stage of evaluating a stressor, during which an individual assesses whether the stressor is significant

### secondary appraisal

the second stage of evaluating a stressor, during which an individual assesses whether they have the resources and capacity to cope with the stressor

In Topic 3.2, you learnt about how Selye's GAS provided an empirically tested biological explanation of physiological processes involved in an animal's stress response. A limitation of the GAS model is that it does not consider the psychological or the social aspects of stress. In this topic, we will examine Lazarus and Folkman's **Transactional Model of Stress and Coping**, which focuses on psychological processes, the individual nature of how stressors are perceived and coping strategies. We will also explore the explanatory power of this model, including its strengths and limitations.

US psychologists Richard Lazarus and Susan Folkman's (1984) research deviated from the traditional biological model of stress by directing attention to the important psychological and cognitive processes involved during stress. Their research triggered a shift from using non-human subjects to study stress to studying human subjects. In Lazarus and Folkman's model of stress, stress is seen as a "transaction" between the person and their environment, where the person's individual interpretation or **appraisal** of the stressor assesses how great a threat the stressor is and whether the person has the support or resources to cope with it.

Our initial appraisal of a potential stressor may occur consciously or unconsciously, and our appraisals will vary depending on factors such as personal beliefs, values, goals, circumstances, life experiences and personality. For example, consider an individual who has a family that relies on them, a mortgage and a job where their major skill set is now being automated by artificial intelligence (AI). This person might instantly and unconsciously appraise being made redundant (the stressor) as an extreme threat because redundancy would make their life particularly difficult. However, a person who is single and living at home with their parents might appraise the same stressor as a minor annoyance or even as a positive opportunity to find a more interesting job.

Lazarus and Folkman's model outlines two main stages of appraisal: **primary appraisal** and **secondary appraisal**. The two stages may occur separately or simultaneously.

## Study tip

In primary appraisal, a challenge is always perceived as positive and energising; for example, being chosen as the lead in the school play or gaining entry into a desired course.

### irrelevant

an appraisal in which an individual perceives a stressor to not present any issues

### benign/positive

an appraisal in which an individual perceives a stressor to not have any negative effects or to benefit the individual

### stressful

an appraisal where the individual perceives a stressor to be a source of worry or emotional sensitivity

### harm/loss

an appraisal that some type of damage or loss has occurred

### threat

an appraisal that there may be harm or loss in the future

### challenge

an appraisal that there is opportunity for personal growth, or something might have a positive outcome

## Primary appraisal

Primary appraisal is the initial stage of evaluating the stressor, during which the individual assesses the significance of the stressor. Primary appraisal involves little reflection as people can interpret situations efficiently using their past experiences. During this stage, the stressor is first appraised as either:

- **irrelevant** – the stressor is perceived as not presenting any significant issues to the individual and is therefore assessed as non-stressful
- **benign/positive** – the stressor is perceived as either not harmful (benign) or directly improving outcomes for an individual, so is seen as positive and is therefore assessed as non-stressful
- **stressful** – the stressor is perceived as having an impact on an individual that causes them to worry or respond.

Events that are irrelevant or benign/positive do not cause stress. The Transactional Model of Stress and Coping only continues for events that are appraised as stressful. If an event, such as being made redundant, is appraised as stressful, it can be further categorised as a:

- **harm/loss** – the event is evaluated to have caused some type of damage or loss. For example, the person being made redundant might think “I have lost my source of income”
- **threat** – the event is evaluated to potentially cause harm or loss in the future. For example, the person being made redundant might think “I might not be able to afford to go on holiday next year”
- **challenge** – the stressor is evaluated as an opportunity for personal growth or improvement. For example, the person being made redundant might think “I can try to look for a new role that offers more money and flexible hours”. A stressor that is perceived as a challenge is always considered to be positive. However, a challenge does not guarantee a positive outcome – this is the difference between a challenge and benign/positive stressor.

### 3.3 SKILL DRILL

#### Planning and conducting stress investigations

##### Key science skill: Plan and conduct investigations

A researcher wants to investigate how a stressful event (climate change) is primarily appraised by members of different political parties (e.g. Greens, Labor, Liberal).

- 1 Outline an experimental design the researcher could use to conduct this investigation.
- 2 Explain why collection of qualitative data would be useful in this investigation.

- 3 Write a suitable hypothesis for the investigation.

Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.



**FIGURE 1** How might different political party members appraise climate change?

## Secondary appraisal

Secondary appraisal is where an individual evaluates whether they have the resources and capacity to **cope** with the stressor. This is a more conscious cognitive process during which coping options and strategies are evaluated. These options can be internal (determination and positive mindset) or external (financial and emotional support from family and friends). For example, a person who has been made redundant might apply for another position and ask a family member to help them practise their interview skills. Lazarus and Folkman outlined two different types of **coping strategies**:

- **emotion-focused coping** – applying coping strategies that target the emotional aspects of a stressor to indirectly deal with the stressor
- **problem-focused coping** – applying coping strategies that directly target the stressor, aiming to reduce it in a practical way.

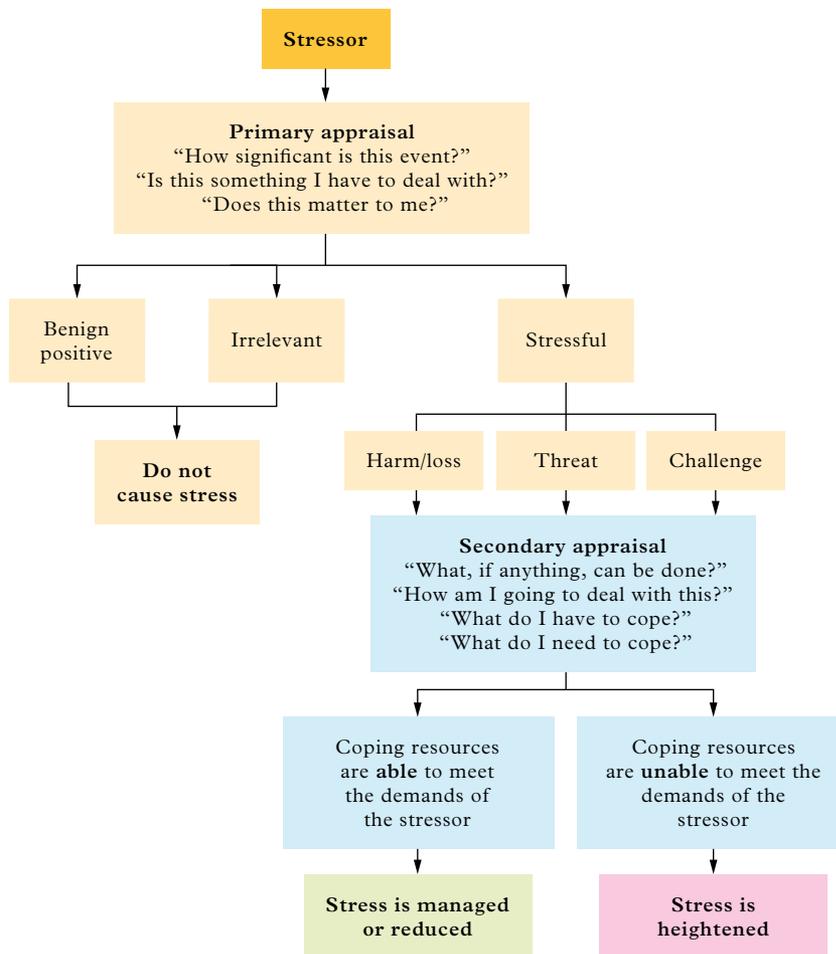
The more the demands of the stressor exceed the support available from coping strategies and resources available, the greater the stress experienced by an individual, which often leads to a greater stress response. During secondary appraisal, it is also possible for the individual, after considering their coping options, to re-evaluate or reappraise whether they have the resources to cope. During the reappraisal process, the stressor can be viewed as more severe or more manageable than originally thought.

**cope**  
exhibit thoughts and behaviours that help manage stress

**coping strategy**  
action or thought process used to help manage or eliminate stressors

**emotion-focused coping**  
coping strategies that focus on regulating emotions and feelings about a stressor rather than addressing the stressor directly

**problem-focused coping**  
coping strategies that focus on taking actions to address a stressor directly



**FIGURE 2** The Transactional Model of Stress and Coping: during secondary appraisal, there can be a reappraisal of the stressor so that it may be considered less or more stressful than originally thought.

## Explanatory power of the Transactional Model of Stress and Coping

Lazarus and Folkman’s Transactional Model of Stress and Coping moved away from focusing on the biological processes of the stress response to focus on the conscious and psychological aspects of how we perceive and react to stressors. Lazarus and Folkman developed a framework that highlighted how an individual interprets and interacts with a given stressor or situation. It factors in a person’s unique cognitive evaluation of the situation and the consequent coping strategies employed that reflect the transactional nature of this model.

Unlike the biological model (GAS), each person is viewed to have an active rather than a passive role in the appraisal of the situation. The dynamic and individual nature of how the stressor is viewed also provides some explanation as to why there is variability in both the assessment of a stressor and the stress response.

The Transactional Model of Stress and Coping provides a compelling case for the individual and psychological nature of how a stressor is appraised and consequently coped with. However, this model makes it difficult to validate the findings through experimental/controlled research. The major strength of the model – an individual’s distinctive evaluation of a stressor – becomes a “double-edged sword” because of the enormous variability in a person’s appraisal and consequent response. A summary of the strengths and limitations of the model is given in Table 1.

**TABLE 1** A summary of the strengths and limitations of the Transactional Model of Stress and Coping

Strengths	Limitations
<ul style="list-style-type: none"> <li>• The model highlights the conscious, active and psychological characteristics of appraisal of a stressor.</li> <li>• Appraisal is personal and likened to a transaction between the individual and their environment.</li> <li>• The model reflects the individual’s ability to assess and control their response to a stressor.</li> <li>• The model shifts from a biological explanation of a stressor to a psychological appraisal.</li> <li>• The model allows for change in the appraisal and use of coping strategies over time.</li> <li>• The model suggests different coping strategies that can be used to manage psychological responses to stressful events.</li> </ul>	<ul style="list-style-type: none"> <li>• The subjective nature of appraisal makes it difficult to test through experimental research.</li> <li>• Primary and secondary appraisals sometimes occur at the same time and may be difficult to separate in experimental conditions.</li> <li>• The stress response can be initiated before a person has had the opportunity to evaluate the situation.</li> <li>• The model does not address the biological processes and/or stress response.</li> </ul>

Consequently, the explanatory power of the Transactional Model of Stress and Coping is somewhat greater than that of Selye’s GAS, although it remains limited due to the dynamic nature of the individual’s interpretation and response to any given situation/stressor – making it more difficult to measure experimentally.

### 3.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Describe Lazarus and Folkman's Transactional Model of Stress and Coping.
- 2 Describe the role of primary appraisal in the Transactional Model of Stress and Coping.

#### Apply, analyse and compare

- 3 Differentiate between a threat and a challenge. Provide an example of each to illustrate your understanding.
- 4 Contrast the Transactional Model of Stress and Coping with Selye's General Adaptation Syndrome.
- 5 Von and Dink are both about to sit a driving test. Von is upset to discover that his instructor's car was involved in a small accident and is not available for the driving test. He has been told that he will need to supply his own car, which means driving his brother's car that he has not driven before. Dink's driving instructor has

organised for Dink to sit the test in the car he is most familiar driving and Dink is excited to take the test in two days time.

- a Using the Transactional Model of Stress and Coping, analyse the scenario. Identify the primary appraisal for Von and Dink and compare how and why they differ.
  - b Using the scenario, apply your knowledge of the model to suggest a coping strategy Von could use in secondary appraisal.
- 6 Analyse the explanatory power of the Transactional Model of Stress and Coping and compare this model with General Adaptation Syndrome.

#### Design and discuss

- 7 With reference to the scenario in question 5, design and annotate your own flow chart to illustrate primary and secondary appraisal processes for both Von and Dink.

FIGURE 3 How might Von and Dink's primary appraisal of their driving tests differ?



# 3.4

## The gut-brain axis

### KEY IDEAS

- ✦ The gut-brain axis (GBA) is a complex bidirectional communication system between the central and enteric nervous systems via the vagus nerve.
- ✦ The enteric nervous system controls the digestive tract, which includes the mouth, pharynx, oesophagus, stomach, small intestine, large intestine and anus.
- ✦ The gut microbiome is a community of more than 100 trillion microorganisms that consist of bacteria, fungi, helminth parasites, protozoa and viruses, which outnumber human cells in the gut.



**gut microbiome**  
the entire community of microorganisms in the intestinal tract

**gut-brain axis (GBA)**

a complex bidirectional communication system between the brain and enteric nervous system that occurs through the vagus nerve

**enteric nervous system**

a division of the autonomic nervous system consisting of neurons that control the gastrointestinal tract

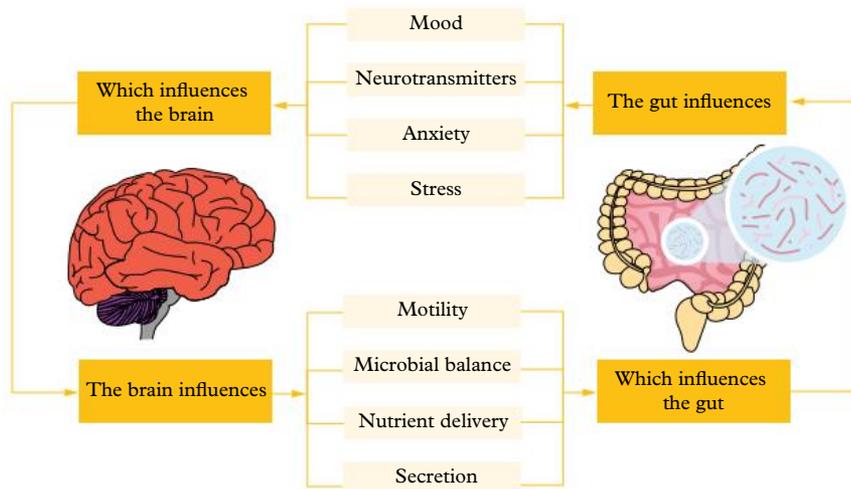
Have you ever felt as though you have “butterflies” in your stomach when stressed or had a “gut feeling” about a certain situation or decision? The gut is frequently referred to as our “second brain” because it is the only organ in the body that has its own nervous system that allows it to function independently from the brain. Incredibly, the gut is not just made up of specialised gut cells – there is an entire “superorganism” made up of trillions of microorganisms living in the gut, known as our **gut microbiome**. In this topic, we will explore what emerging research has uncovered about the connections between the gut and gut microbiota to stress and psychological processes and behaviour.

### Understanding the gut-brain axis

In Topic 3.1 you learnt that during stress, body functions such as digestion and peristalsis (food moving through the intestine) can be inhibited. When this happens, we might feel nervous, experience a dry mouth or loss of appetite. These physical symptoms occur automatically due to a communication pathway between the central nervous system (CNS) and the gut. This pathway is known as the **gut-brain axis (GBA)**, a bidirectional (two-way) communication system between the CNS and the **enteric nervous system**. The main roles of the GBA are to monitor and integrate gut functions, and link emotional and cognitive centres of the brain with the gut. It is also involved in immune system activation during stress. The GBA interacts with the:

- CNS (brain and spinal cord)
- autonomic nervous system (sympathetic and parasympathetic)
- enteric nervous system (digestive system)
- hypothalamic–pituitary–adrenal (HPA) axis
- endocrine system (such as pituitary gland and adrenal glands).

To better understand the GBA, you need to understand some of its key components, including the enteric nervous system, the vagus nerve and the gut microbiome.



**FIGURE 1** The gut and brain communicate via the gut-brain axis and can heavily influence each other.

## Enteric nervous system

The enteric nervous system is a branch of the autonomic nervous system, which sometimes operates independently from the sympathetic and parasympathetic nervous systems. The enteric nervous system controls the **gastrointestinal tract**: the pathway in humans and animals in which food enters through the mouth, is digested to absorb nutrients and then waste is removed as faeces. The gastrointestinal tract includes the mouth, pharynx, oesophagus, stomach, small intestine, large intestine and anus. It is also involved in the regulation of gut hormones and immune activation.

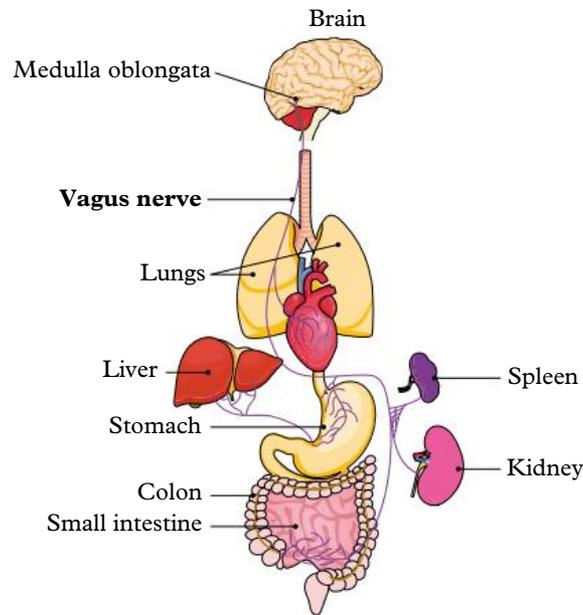
## Vagus nerve

The **vagus nerve** is a large nerve consisting of both afferent (sensory) and efferent (motor) fibres that run from the base of the brain to the small intestine (Figure 2). Because the vagus nerve is made up of both efferent and afferent fibres, it provides a pathway for bidirectional communication between the enteric nervous system and the brain. For example, simply thinking about a tasty meal you know you're going to eat soon can increase the amount of gastric acid secreted in your stomach. This occurs because the information from your brain is relayed down to your digestive tract via the vagus nerve.

The vagus nerve can also direct information from the gut to the brain. For example, **enteroendocrine cells** in the small intestine can sense and react to nutrients and bacteria that have been detected in the gut environment. They can also communicate information about the gut by secreting hormones and neurotransmitters. Signals from within the enteroendocrine cells are transformed into electrochemical/neural impulses. These neural signals from the small intestine are sent via the vagus nerve along sensory pathways to the brain and link information between the two areas within seconds. Consequently, the nutrients and bacteria in our gut can influence our brain function.

## Gut microbiome

A **microbiome** is a community of microorganisms that live in a specific habitat or area. Our gut microbiome consists of about 100 trillion microorganisms, including bacteria, fungi, helminth parasites, protozoa and viruses. Combined, the gut microbiome has 150 times more genes than the entire **human genome**. Humans have a mutually beneficial relationship with the gut microbiome. While microorganisms rely on us as a host for survival, we rely on their actions in the gut for other survival functions.



**FIGURE 2** The vagus nerve consists of neurons that run from the base of the brain to the small intestine. It has connections to many areas of the body.

**gastrointestinal tract**  
the digestive passage between the mouth and the anus

**vagus nerve**  
a neural pathway consisting of afferent and efferent fibres that connect the brain to the enteric nervous system and other body regions



**enteroendocrine cell**  
a specialised cell in the gastrointestinal tract that produces and releases hormones in response to stimuli

**microbiome**  
a community of microorganisms that can usually be found in a given habitat

**human genome**  
the complete set of human genes and their nucleotide sequences

**gut microbiota**

the different microorganisms that make up the gut microbiome

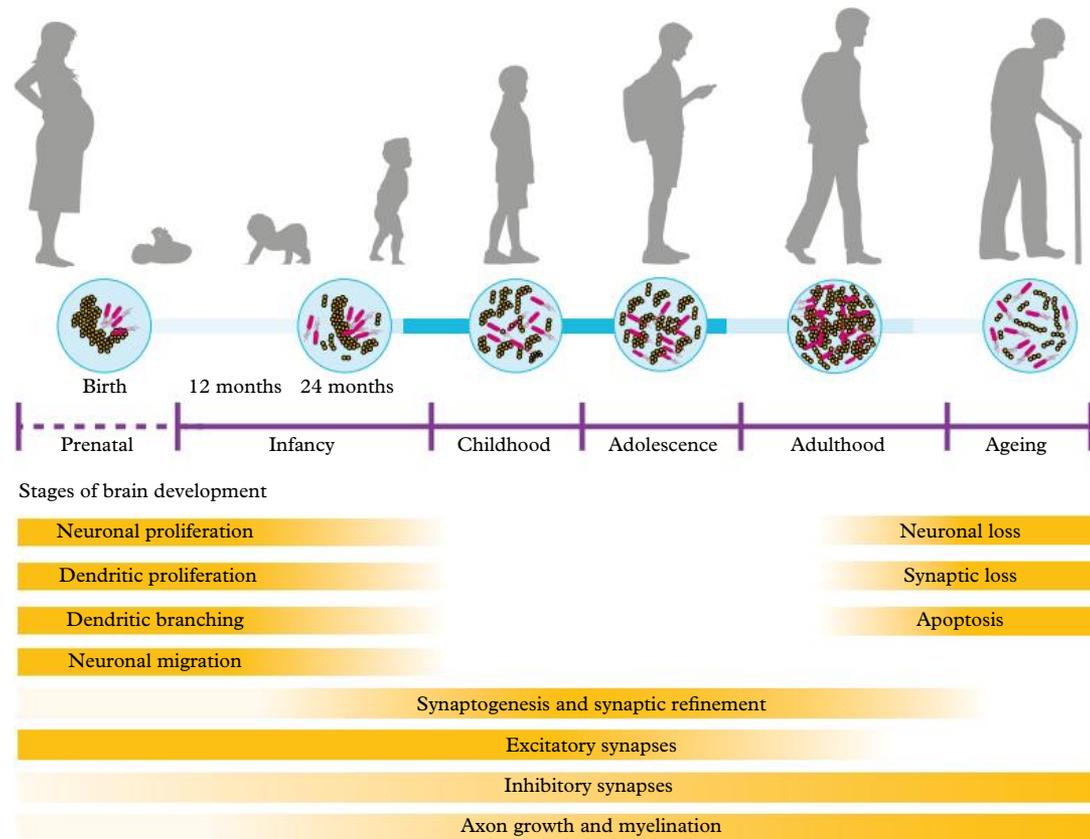
**pathogen**

a bacterium, virus or other microorganism that can cause disease

**Gut microbiota** are the different species of microorganisms that exist within our gut. Gut microbiota living in the gastrointestinal tract provide many important health benefits. They:

- assist with digestion
- help extract nutrients from ingested food
- produce approximately 90 per cent of the body’s serotonin
- act as a first line of defence in response to external **pathogens** and toxins
- break down and eliminate toxins that enter the gastrointestinal tract
- protect against pathogens
- regulate the immune system
- play a crucial role in brain development from birth (e.g. prefrontal cortex, hippocampus and amygdala).

The microbiome begins to form during birth when a baby passes along the mother’s birth canal (vagina) and is exposed to her microbiota. This exposure influences a baby’s microbiome and is important for the healthy development of the brain and immune system. The microbiome in the gut of a newborn begins to colonise and increases with age (Figure 3). Babies born by caesarean section do not immediately benefit from exposure to their mother’s microbes; however, their microbiome continues to colonise and grows normally with age and exposure to microbes.

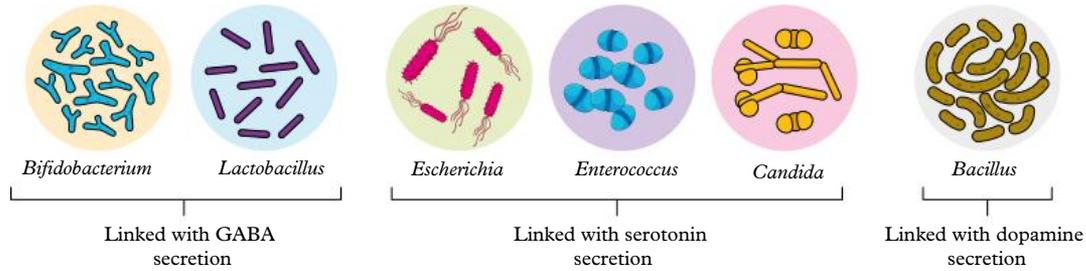


**FIGURE 3** The concentration of gut bacteria during different stages of life. The number of microbes in the gut gradually increases, the greatest concentration occurring during adulthood. The decline during ageing accompanies a decline in neural function.

## Gut microbiota

Certain species in the gut microbiome assist with the release of different neurotransmitters and perform different functions. Interestingly, approximately 90% of the gut microbiome belongs to two major bacterial types: Firmicutes and Bacteroidetes. Both bacterial types are extremely sensitive to environmental change. Therefore, disruption to your intestinal tract can lead to a decrease in certain gut flora and an imbalance of microbiota. This is referred to as **dysbiosis**, a disruption to the microbiome that results in an imbalance in microbiota.

**dysbiosis**  
disrupted and reduced microbiome diversity in the intestinal tract

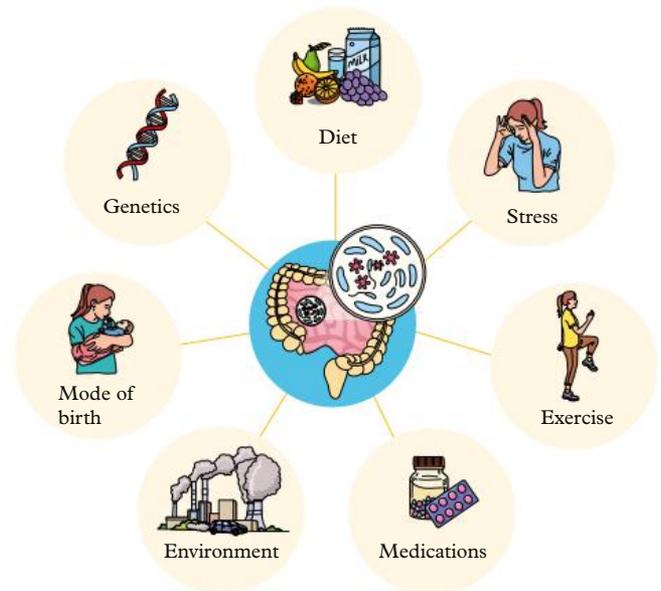


**FIGURE 4** Different genera of bacteria and fungi and their associations with neurotransmitters

*Lactobacillus* and *Bifidobacterium* are bacteria that are thought to regulate the main inhibitory neurotransmitter in the brain, gamma-aminobutyric acid (GABA). Varieties of *Escherichia* and *Enterococcus* bacteria and *Candida* fungi are linked to secretion of the neurotransmitter serotonin, which is particularly important for mood, memory and learning. Other *Bacillus* bacteria species are linked to the secretion of dopamine.

If bacteria that promote the release of serotonin are low or absent due to dysbiosis, the lack or decline of serotonin, which is involved in mood regulation, memory and learning, may lead to depressive symptoms and memory problems. Alternatively, low numbers of gut bacteria involved in the production of the inhibitory neurotransmitter GABA may result in higher levels of anxiety. Thus, healthy diversity and balance in gut flora is important for our brain development and physiological and mental health. Factors that can affect the gut biome include:

- lifestyle choices and diet
- chronic stress and the long-term presence of cortisol
- emotional and psychological factors.



**FIGURE 5** Common factors that affect our gut microbiome and subsequently the gut–brain axis

## Gut-brain axis and stress

The immune system is critical for keeping our body healthy. It is believed that 70 per cent of the body’s immune system is in lymphoid tissue located in the gut and so the gut can be viewed as the largest immune structure in the human body. New research has revealed the importance of the gut microbiome working with intestinal cells to assist with a range of critical functions, including those related to our stress response. Research has also shown the importance of gut microbiota in protecting against and eliminating invading pathogens that

may cause diseases. The gut microbiome in the GBA also regulates important physiological processes such as neural transmission, neurogenesis, neuroinflammation (swelling in neural tissue) and hormone signalling. Our GBA relays information that has significant effects on mood, motivation and higher cognitive functions.

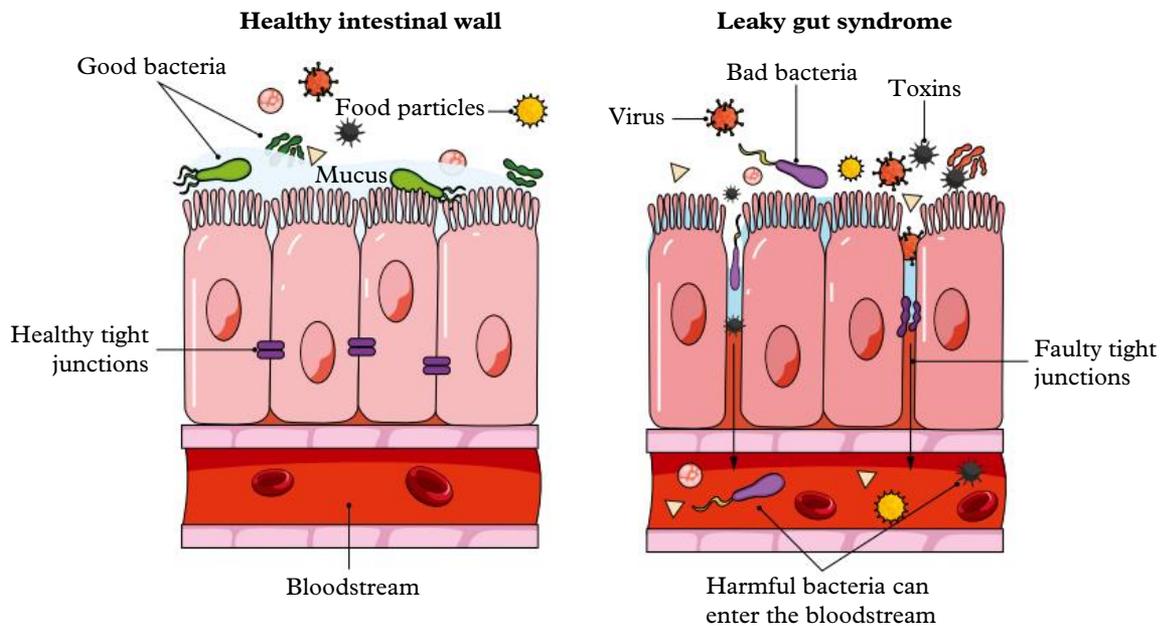
## Chronic stress, cortisol and the GBA

Chronic stress can significantly affect the gut microbiome. Earlier in the chapter, you learnt that the prolonged presence of cortisol in the bloodstream can suppress the immune system. This has a direct effect on the gut biome by leaving us more vulnerable to contracting illnesses. The immune system plays a key role in our gut. In some ways, it acts as a gatekeeper so that we can tolerate specific foods and microbe species and fight off others. A weakened immune system due to chronic stress can change our gut microbiota and lead to dysbiosis.

Chronic stress has also been shown to change our intestinal permeability and lead to **leaky gut syndrome**, a condition where the intestinal barrier is impaired and pathogens and toxins can enter the bloodstream. These pathogens can affect not only our digestive tract but also our brain due to the GBA. Research on stress in relation to the gut–brain axis has found leaky gut syndrome to be linked with low-level inflammation and the development of mental health disorders such as depression.

### leaky gut syndrome

a condition in which the intestinal permeability of the gut is disrupted and pathogens and toxins readily enter the bloodstream

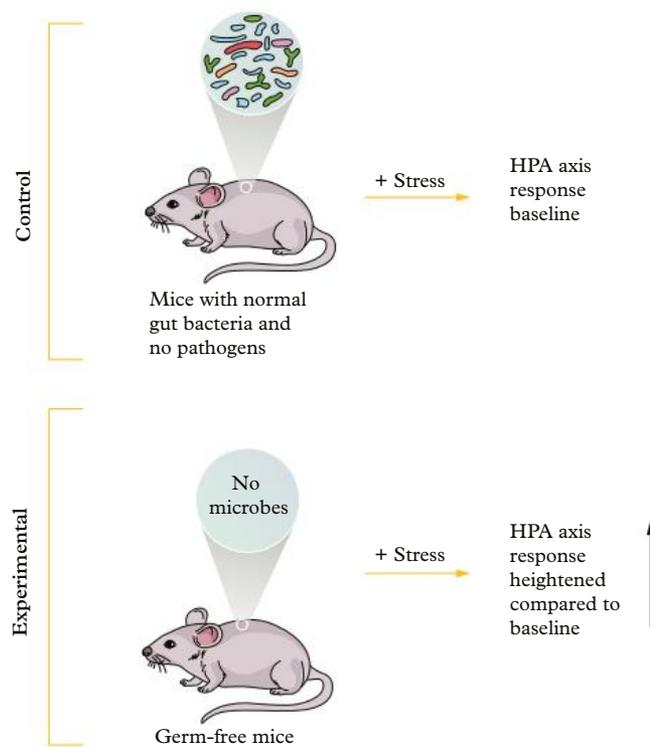


**FIGURE 6** A healthy intestinal wall and an intestinal wall in leaky gut syndrome

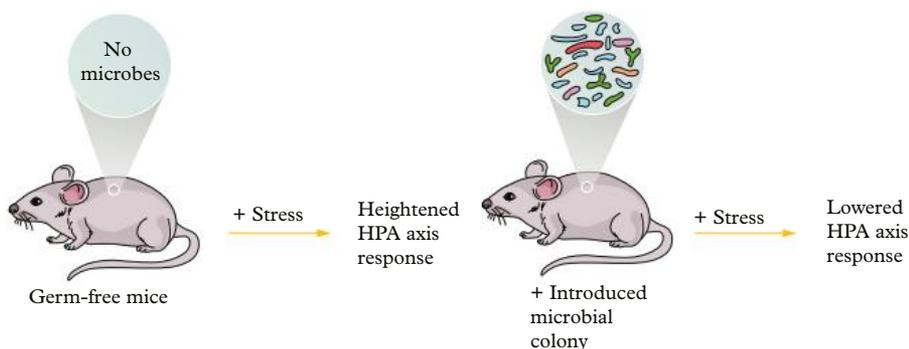
The GBA is also important for maintaining psychological and physical wellbeing. Imbalanced gut microbiomes and some changes to microbiota have been linked to health problems such as allergies, autoimmune diseases, metabolic disorders and mental illnesses such as anxiety disorders and depression. Such conditions may induce stress or influence a person’s perception of stressors. Therefore, promoting a balanced microbiome is important for our management of stress and the stress response.

## Emerging research

Much of the evidence we have to date on the relationship between stress and the GBA has come from animal studies. Germ-free mice are mice that are bred without any exposure to microbes, and are particularly useful for investigating relationships between microbiota, the stress response and behaviours. Sudo et al. (2004) found that germ-free mice had an exaggerated HPA axis response to stress compared to normal mice. In other words, the germ-free mice were more susceptible to becoming stressed, and activation of their HPA axis stress response was faster (Figure 7). This same study found that a heightened HPA axis response could be lowered by introducing certain microbial colonies into the gut of germ-free mice (Figure 8).

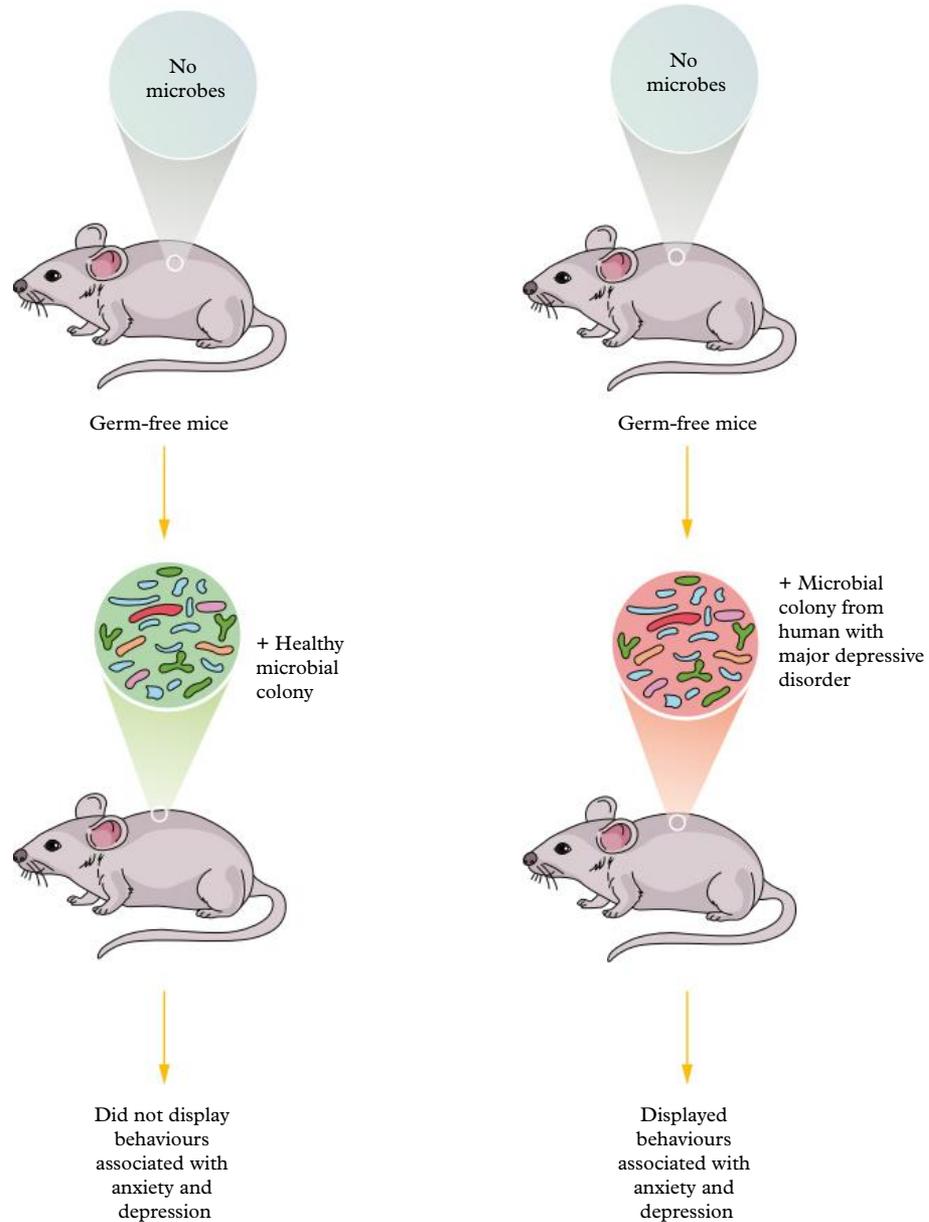


**FIGURE 7** Germ-free mice were found to have an exaggerated HPA axis response to stress compared to mice with a healthy gut microbiome.



**FIGURE 8** After being introduced to a pathogen-free microbial colony, the germ-free mice had a lowered HPA axis response when exposed to stress.

Zheng et al. (2016) found that introducing specific microbiota to germ-free mice could increase the likelihood of them displaying behaviours associated with anxiety and depression. The germ-free mice showed no behaviours associated with anxiety and depression when exposed to healthy microbial communities. However, after being exposed to a microbial colony taken from a person with major depressive disorder, the germ-free mice displayed behaviours associated with anxiety and depression (Figure 9). This suggests a potential link between specific microbiota and mood disorders.



**FIGURE 9** After germ-free mice were exposed to a microbial colony sourced from a human with major depressive disorder, the mice displayed behaviours associated with anxiety and depression.

## 3.4 REAL-WORLD PSYCHOLOGY

### “That gut feeling”

Gut bacteria produce hundreds of neurochemicals that the brain uses to regulate basic physiological processes as well as mental processes such as learning, memory and mood. Recent studies indicate that the gut microbiome’s importance goes beyond physical health: it is also a key player in the gut–brain connection.

In one study, researchers gave BALB/c mice, a strain of mice that are typically timid and shy, a cocktail of antibiotics. They found that the composition of the mice’s gut bacteria and behaviour changed dramatically. The mice went from being timid and shy to bold and adventurous.

The antibiotic treatment also boosted levels of brain-derived neurotrophic factor in the hippocampus. This neurochemical promotes neural connections and is an important factor in memory and mood. When the antibiotic treatment was stopped, the mice soon reverted to their usual, cautious selves, and their brain biochemistry also returned to normal (Carpenter, 2012).

### Apply your understanding

- 1 Write a research hypothesis for this study.
- 2 Identify the experimental design and outline one advantage and one limitation.
- 3 What implications can be drawn from this study?
- 4 How does this study contribute to our understanding of the role of the gut microbiome?

### Study tip

The gut is known as our second brain and there is a bidirectional link between our brain and the enteric nervous system.

## 3.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the gut–brain axis.
- 2 Explain the role of the vagus nerve in the gut–brain axis.
- 3 Describe the role of the enteric nervous system.
- 4 Explain why the gut–brain axis is important for physical and mental health.
- 5 Explain how stress can affect the gut–brain axis.

### Apply, analyse and compare

- 6 Sally is a nurse who is required to work 12-hour shifts 6 days a week. Due to the demands of her work, she sometimes skips meals or feels too stressed to eat. After several months of this schedule, Sally becomes so unwell she goes to see her doctor. She tells her doctor that she is experiencing stomach pains and frequent headaches, and feels exhausted all the time.

Her doctor advises that her symptoms are stress related and that she needs to take time off work to recuperate.

- a Analyse this scenario and use your understanding of the gut–brain axis to explain why Sally became so ill.
- b Suggest and outline one strategy Sally could use to improve her physical and mental health.

### Design and discuss

- 7 Design a pamphlet, brochure or presentation to illustrate how chronic stress affects the gut–brain axis in terms of our biological and psychological health.
- 8 Stress, diet and other environmental toxins can affect our physical and mental health. Discuss this statement in terms of the gut–brain axis.

# 3.5

## Strategies for coping with stress

### KEY IDEAS



- ✦ Coping strategies are cognitive behavioural tactics for reducing psychological and emotional discomfort.
- ✦ Approach (adaptive) strategies are used when a person tries to deal directly with a stressor and exerts effort in finding a solution and reducing their psychological and emotional distress.
- ✦ Avoidant (maladaptive and adaptive) strategies refer to cognitive and behavioural methods that a person uses to distract or delay from dealing with or adjusting to the emotional distress/stress of a situation.
- ✦ Context-specific effectiveness refers to the effective use of previously successful coping strategies to a new/comparable situation.
- ✦ Coping flexibility refers to an individual's ability to adapt effectively to a range of stressful situations.

Facing a stressful situation can often lead to emotional distress. Luckily, we can help manage stress by using coping strategies – cognitive and behavioural tactics for reducing psychological and/or emotional discomfort. In this topic, we will look at approach and avoidant coping strategies and examine the roles of context-specific effectiveness and coping flexibility in managing stress.

### Approach coping strategies

#### approach coping strategy

a cognitive and behavioural method for directly dealing with a stressor to reduce psychological/emotional distress

#### protective factor

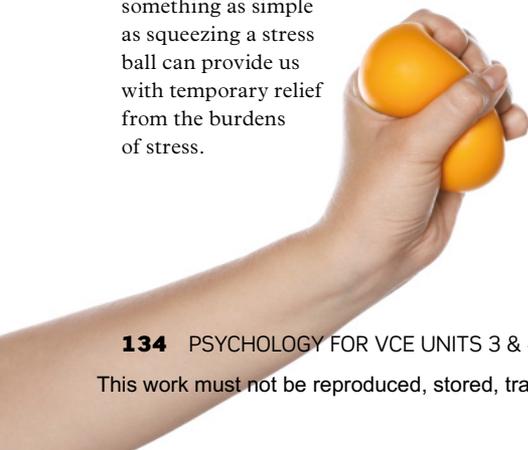
condition that promotes the health and wellbeing of an individual

**Approach coping strategies** refer to efforts a person makes to directly deal with a stressor and find a solution to reduce their psychological/emotional distress. This style of coping can often be more stressful to deal with because the person is required to tackle the stressor head on. However, this style of coping is much more beneficial in the long term because the stressor is managed more effectively through the use of practical methods. Approach coping strategies are viewed as 'adaptive' because the cognitive and behavioural efforts made are considered **protective factors** that decrease the negative effects of stressors on mental and physical health. Research has shown that people who use approach coping strategies such as information seeking and problem-solving are more likely to effectively adapt to life stressors and experience better psychological and physical health.

Approach coping strategies include:

- cognitive and emotional recognition of the situation
- confronting the stressor in a realistic and practical manner
- active problem-solving and asking for support
- attempting to take control of the situation
  - seeking additional information
  - taking responsibility for the situation
  - considering different options for dealing with the stressor
  - viewing the stressor in a more positive manner
  - seeking professional advice
  - taking a step back for greater objectivity of the stressor
  - using previous experience to inform future coping options.

**FIGURE 1** Many strategies exist to help us deal with and manage stress. Even something as simple as squeezing a stress ball can provide us with temporary relief from the burdens of stress.



To better understand approach coping strategies, consider the following example. James, his wife and two children wish to visit their family in Vietnam. James' work requires him to work over the holidays, which has disappointed both his immediate family and his relatives in Vietnam. James evaluates the situation and realises that he does not need to physically see clients – he has a laptop and international roaming on his mobile to keep him connected to work and he has a colleague who is available during that time to take on his in-office duties. James speaks to his colleague to ensure that they are available and happy to assist. He then writes down his proposal to work remotely in Vietnam before presenting it to his employer. James' employer accepts his proposal and agrees he can work remotely while visiting his family in Vietnam. This scenario demonstrates the use of approach strategies. James was distressed at the possibility of not being able to visit his family and resolved the potentially upsetting situation by taking a practical problem-solving approach that would suit his work and his family.



**FIGURE 2** By writing up a proposal and presenting it to his employer, James was able to resolve the stress of not going on holiday with his family.

## Avoidant coping strategies

**Avoidant coping strategies** refer to cognitive and behavioural methods that are used to avoid stressors or delay a person from dealing with or adjusting to the stress of a situation. Avoidant strategies tend to inhibit the development of more effective methods of dealing with a stressor in the long term.

Avoidant coping strategies include:

- avoiding anxiety-producing circumstances
- not taking responsibility for the situation
- procrastinating to delay dealing with the stressor
- denying that the stressor exists
- using distraction through video games and gambling
- consuming/using alcohol and drugs to numb emotional distress
- avoiding friends, family or situations similar to the stressful one
- using aggression or arguments to deflect from the stressful situation
- excessive sleeping
- excessive eating.

The use of avoidant coping strategies often begins in childhood when dealing with emotional discomfort and stress. For example, Emily is four years old and loves chocolate cake. During a 40th birthday party, Emily decides to try the birthday cake. She scoops up some cake with her hands and eats a couple of handfuls. When this is reported to her parents, they ask her if she knows anything about the missing section of the cake. She responds with “No. I didn’t do it”, despite her dress and face being covered with cake.

**Denial**, refusing to admit the truth, is an avoidant coping strategy and is perfectly normal for a child Emily's age to use. However, if Emily continues to use denial in adulthood, this could be viewed as an avoidant coping pattern because she has not developed more effective coping strategies to decrease her emotional distress. Although avoiding a stressor may provide temporary relief, over time the presence of cortisol with a prolonged stress response can suppress the immune system and lead to serious physical and mental illnesses.

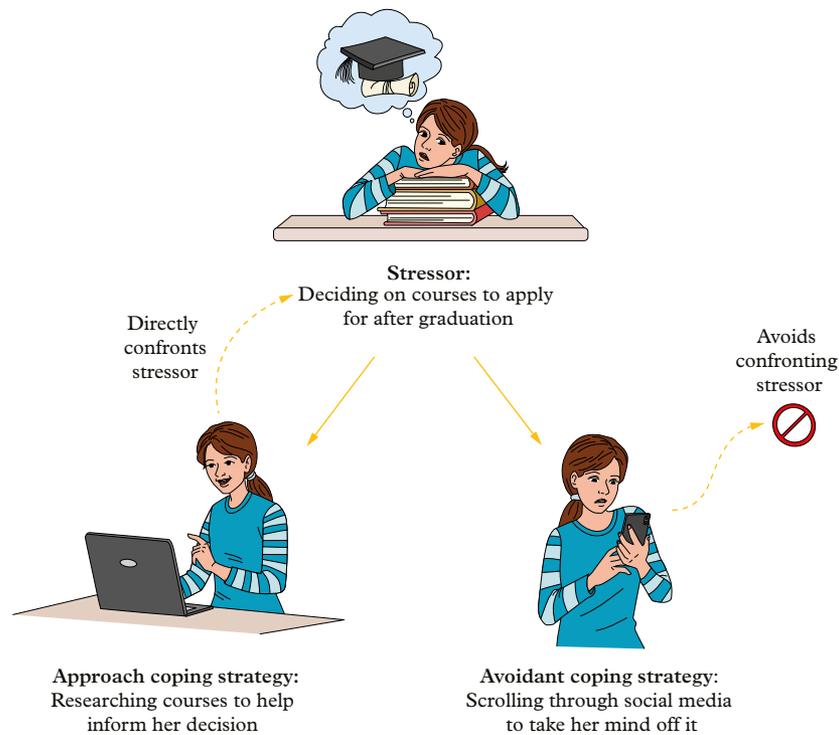
**avoidant coping strategy**  
a cognitive and behavioural method for distracting or delaying dealing with a stressor



**FIGURE 3** A child refusing to admit they have eaten chocolate cake when they clearly have is an example of denial, an avoidant coping strategy.

**denial**  
ignoring the reality of a situation to avoid stress

Approach and avoidant coping strategies reflect different methods of dealing with a stressful situation. On the surface, approach strategies that deal with the stressor directly may appear the best option. However, there are circumstances where the use of avoidant coping strategies can be useful – particularly if a person has limited control over a particular stressor or situation. For example, Robuha is a refugee who has lived in Australia for ten years. He receives a call from a family member in South Africa to say that his only remaining sibling has suddenly died. Robuha is devastated because he is unable to take responsibility for the funeral arrangements, which is his family’s custom. In this situation, avoidant strategies such as distracting himself from thinking about the funeral arrangements and reflecting on his loss by himself could be considered adaptive because he is able to conserve his energy and clear his thoughts to deal with the stress of the situation.



**FIGURE 4** Consider the two coping strategies that could be used to respond to the stress of deciding on a course to apply for. Would the approach or avoidant strategy be more effective at managing stress?

**context-specific effectiveness**

effective use of previously successful coping strategies in a new and comparable situation



**FIGURE 5** Georgia reflecting on strategies that effectively helped her manage redundancy in the past and applying these same strategies to a similar situation is an example of context-specific effectiveness.

## Context-specific effectiveness

**Context-specific effectiveness** refers to when a coping strategy is appropriate for dealing with a stressor. Context-specific effectiveness recognises that the best coping strategy for dealing with a stressor is not only determined by the stressor. The best coping strategy also depends on the unique characteristics of the person and the situation (the context). People often reflect on past experiences to help determine whether previous strategies will be effective in managing similar situations. When similar stressors occur over time, a person can develop a toolkit of effective coping strategies for that type of stressor. This might include approach or avoidant strategies or a combination. In a way, context-specific effectiveness is a matter of “best fit”, the strategy or combination of strategies that best apply to a given situation.

For example, Georgia, the mother of a young family, has just experienced a significant life event – redundancy. Georgia has been in this position before, and used a combination of coping strategies that allowed her to find alternative employment – reducing her financial

and emotional stress at the time. The first time she was made redundant, Georgia, being a proactive person, used approach coping strategies to deal with the stressor. She rewrote her résumé and uploaded it directly to a range of employment agencies and recruiters, which secured her next role. Georgia reflecting on her previous experiences and applying effective strategies such as proactively looking for work to deal with being made redundant is an example of context-specific effectiveness.

## Coping flexibility

**Coping flexibility** refers to an individual's ability to modify their coping strategies to meet the demands of different stressors. As we know, a person will experience a range of stressors throughout their lifetime: from slightly inconvenient (e.g. running late to school), to more demanding (e.g. dealing with a break-up). People with high coping flexibility are better at quickly and effectively modifying the approach and avoidant coping strategies they are familiar with to match other stressful events. People with low coping flexibility tend to rely on applying the same approach and avoidant coping strategies they are familiar with across different situations even if they are ineffective. Coping flexibility is an adaptive personality quality that allows a person to make the necessary adjustments to different stress-inducing situations. Our ability to cope is the product of our coping flexibility and context-specific effectiveness.

Consider Meiko, a Japanese student who has recently moved to a Victorian school to complete her education. Because of her mother's employment, Meiko has attended four schools in four different countries since the age of five. She is a keen learner and wishes to study engineering after she completes VCE. Meiko has achieved excellent marks at every school she has attended. Having a friendly and outgoing personality, she has also made and maintained several good friendships. Meiko's ability to adapt to different schools in different countries provides an example of a person who shows strong coping flexibility.

### **coping flexibility**

a person's ability to adapt effectively to a range of stressful situations

### 3.5 CHECK YOUR LEARNING



#### **Describe and explain**

- 1 Explain why coping strategies are used.
- 2 Explain why approach strategies have more long-term benefits than avoidance strategies.
- 3 Describe a scenario that illustrates context-specific effectiveness.

#### **Apply, analyse and compare**

- 4 Propose why a person with greater coping flexibility might be better equipped for a high-stress job such as that of a paramedic or police officer.
- 5 Vito was very upset when his car was damaged by a hailstorm because he did not have car insurance. Suggest one approach and one avoidance strategy Vito might use in this situation.

- 6 Chanda expected to travel to Sydney for a family reunion that was scheduled for a Friday night. Unfortunately, her flight was cancelled because of mechanical issues and the rest of the flights for that day were booked.

Although Chanda knew she would miss the actual reunion, she decided to drive to Sydney.

Analyse this scenario and identify an approach strategy, context-specific effectiveness and coping flexibility.

- 7 Outline one key difference between context-specific effectiveness and coping flexibility.

#### **Design and discuss**

- 8 Design an annotated diagram or directional flow chart to illustrate the connection between context-specific effectiveness and coping flexibility.
- 9 Discuss why avoidant coping strategies are not always a negative way of dealing with a stressor.

## Chapter summary

- 3.1** • Stress is a psychobiological response to an internal or external source of tension (stressor).
- An internal stressor is a source of tension that comes from our mind and body, whereas an external stressor is a source of tension that originates in our environment.
- Acute stress is experienced when the source of tension, whether real or imagined, produces an elevated level of physiological arousal/stress response for a brief time; for example, a fight with a friend or a minor car accident.
- Chronic stress is experienced when the source of tension is prolonged or ongoing and is perceived to be beyond the person's ability to cope. The prolonged presence of cortisol in the bloodstream can cause psychological and physical illness due to the suppression of the immune system.
- 3.2** • Hans Selye developed a biological model of stress while experimenting on non-human subjects. This is known as General Adaptation Syndrome (GAS) and identifies three main stages: alarm reaction, resistance and exhaustion.
- Alarm reaction is the first stage of GAS and has two phases: shock and counter shock.
- Resistance is the second stage of GAS. It is also known as the 'adaptive stage' because the continued release of stress hormones allows the person to have the resources to deal with the stressor.
- Exhaustion is the third stage of GAS, during which resistance to the stressor reduces to below normal levels.
- 3.3** • Lazarus and Folkman's Transactional Model of Stress and Coping focused on a person's unique perception of a stressor (psychological), which was referred to as a transaction between the individual and their environment, and the use of coping strategies.
- 3.4** • The gut-brain axis (GBA) is a complex bidirectional communication system between the central and enteric nervous systems via the vagus nerve.
- Seventy per cent of our immune system is in our gastrointestinal tract. Chronic stress and the prolonged presence of cortisol can allow bad bacteria and viruses to cross the blood-brain barrier and cause serious illness.
- An imbalance of microbiota in the gut can lead to biological and psychological problems such as depression, anxiety and physical illnesses.
- 3.5** • Coping strategies are cognitive behavioural tactics that are used to reduce psychological and emotional discomfort.
- Approach strategies are considered to be adaptive because a person attempts to deal with the stressor directly and exerts effort in finding a solution to reduce their psychological and emotional distress.
- Avoidant strategies are considered to be maladaptive and refer to cognitive and behavioural methods that distract or delay a person from dealing with or adjusting to the emotional distress/stress of the situation.
- Context-specific effectiveness refers to the effective use of previously successful coping strategies in a new/comparable situation.
- Coping flexibility refers to an individual's ability to adapt effectively to a range of stressful situations.

## Revision questions

### Multiple choice

- 1 Stress is best described as:
  - A an uncomfortable internal experience.
  - B an overwhelming feeling of hopelessness.
  - C a physical and mental reaction to a situation.
  - D a purely physiological response to external problems.
- 2 Jude was concerned about failing the end of year examination. This pressure was affecting his ability to study effectively. For Jude, this is an:
  - A internal source of tension generated by his expectations.
  - B external stressor due to parental pressure.
  - C internal and external reaction due to the demands of school.
  - D internal stimulus because he knew he would fail.
- 3 Which of the following is an example of an internal stressor?
  - A Missing the bus
  - B Issues at school
  - C Problems sleeping
  - D Living in a polluted area
- 4 Which of the following is a key difference between acute and chronic stress?
  - A Acute stress occurs more quickly, whereas chronic stress is extreme and unexpected.
  - B Acute stress is difficult to deal with, whereas chronic stress can end suddenly.
  - C Acute stress is long term, whereas chronic stress is short term.
  - D Acute stress is intense, whereas chronic stress is prolonged.
- 5 During physiological arousal, two pathways are activated. Which pathway is responsible for the release of cortisol?
  - A The hypothalamic–pituitary–adrenal (HPA) axis
  - B Sympathetic adreno-medullary system (SAM)
  - C Flight-or-fight-or-freeze response
  - D Both the HPA axis and SAM
- 6 The key stress hormone that suppresses the immune system during stress is:
  - A adrenaline.
  - B noradrenaline.
  - C cortisol.
  - D dopamine.
- 7 Bodin works two jobs, studies at university and cares for a sibling with a disability. After enduring these stressful conditions for a year, Bodin has developed a sleep disorder and has started to experience heart pains. With reference to General Adaptation Syndrome, Bodin would most likely be in the stage of:
  - A alarm reaction.
  - B counter shock.
  - C resistance.
  - D exhaustion.
- 8 According to the Transactional Model of Stress and Coping, during:
  - A secondary appraisal, a stressor may be viewed as a threat.
  - B primary appraisal, an evaluation of the situation is determined.
  - C primary appraisal, the person considers their options when faced with a stressor.
  - D secondary appraisal, the options of harm, loss, threat and challenge are considered.
- 9 The gut–brain axis refers to:
  - A communication from the vagus nerve to the brain.
  - B a link between the brain and gut through the hypothalamic–pituitary–adrenal axis.
  - C the connection between the central nervous system and the intestines.
  - D the two-way neural pathway between the brain and gastrointestinal tract.



10 Sasha achieved excellent results in high school because she used a range of study techniques she learnt at a conference. Now that she is at university, she is using similar techniques to study.

This is an example of:

- A coping flexibility.
- B context-specific effectiveness.
- C effective coping flexibility.
- D specific use of techniques.

### **Short answer**

#### **Describe and explain**

- 11 Explain why stress is viewed as involving both internal and external factors.
- 12 List and describe the sequence of biological processes during the stress response.
- 13 Explain why cortisol release is delayed compared to that of adrenaline and noradrenaline.
- 14 Describe the freeze response and how it differs from the flight-or-fight response.
- 15 Describe the roles of the three main stress hormones in the body.
- 16 Explain why chronic stress affects our physical and mental health more than acute stress does.
- 17 Describe the gut–brain axis and its role in physical and mental health.
- 18 Describe the human microbiome and the role it plays in maintaining health.
- 19 Explain the mechanisms/biological processes involved when stress affects the gut microbiome.

#### **Apply, analyse and compare**

- 20 Distinguish between shock and counter shock during the alarm reaction in Selye’s General Adaptation Syndrome.
- 21 Contrast two key differences between General Adaptation Syndrome and the Transactional Model of Stress and Coping.
- 22 Zara receives news that her car has been stolen and severely damaged. Zara is devastated because she needs a car for her

Uber job. After several weeks of speaking to the police and her insurance company, she is still without a car and cannot pay her bills.

- a Use Selye’s General Adaptation Syndrome to outline what occurred biologically at each stage of Zara’s response to the situation.
- b When Zara first discovered that her car had been stolen, explain, with reference to the Transactional Model of Stress and Coping, what occurred during primary appraisal and secondary appraisal.
- c Compare the explanatory power of General Adaptation Syndrome and the Transactional Model of Stress and Coping.

- 23 Chronic stress can have a significant impact on the mind and body. With reference to the gut–brain axis, explain the link between stress and the immune system.
- 24 Where is most serotonin produced? Outline the role of serotonin in the human nervous system.
- 25 Gerard was involved in an accident and sustained significant damage to his spinal cord, which severed his vagus nerve and left him in a coma. Based on your understanding of the gut–brain axis, explain whether Gerard’s heart and digestion would continue to function. Justify your response.
- 26 When a person is faced with a difficult and stressful situation such as the loss of a job, they can use different coping strategies. Outline one approach and one avoidance strategy and explain how each would be useful to the person.
- 27 Nalina developed a habit of lying as a child. For example, she told her family that she was unwell so her brother would have to do her chores while she played video games in her room. Now that Nalina is an adult, she uses the same tactics with her partner and at work.
  - a Analyse whether Nalina is using approach or avoidant strategies and whether these strategies are appropriate in the long term.

- b** Is Nalina demonstrating context-specific effectiveness? Justify your response.

**Design and discuss**

- 28** A psychologist has asked you to design a pamphlet, brochure or presentation to educate people about stress. Create your document or presentation, including definitions of stress and stressor, internal and external sources of stress, biological and psychological processes, potential physical and mental effects of stress and a list of strategies to reduce stress.

- 29** Discuss the importance of stress management for maintaining good physical and mental health.

- 30** Create a flow chart about stress that incorporates:

- the biological processes involved in the flight-or-fight-or-freeze response
- the hypothalamic–pituitary–adrenal axis and sympathetic adreno-medullary system
- stress and the gut–brain axis.

You can find the following resources for this section in your **obook pro**:

pro

**Quizlet**

Compete in teams or against yourself to test your knowledge.



**Chapter quiz**

Test your understanding of key knowledge in this chapter.



**Chapter checklist**

Rate your understanding of key knowledge in this chapter.

# Checkpoint

## Part A – School-assessed Coursework support for Unit 3 Area of Study 1

### Study tip

If you have access to the Psychology for VCE Units 3 & 4 Student Workbook, practise some of the key science skills needed for this SAC by completing the Case Cracker activities before attempting this practice assessment.

In Area of Study 1, you will be required to complete **one** task from the following options:

- analysis and evaluation of at least one psychological case study, experiment, model or simulation
- analysis and evaluation of generated primary and/or collated secondary data
- comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities
- analysis and comparison of two or more contemporary media texts.

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### Important notice to students and teachers

The assessment support provided in this section models one way of approaching the following task for Outcome 1:

- analysis and evaluation of at least one psychological case study, experiment, model or simulation.

Your teacher may select one of the other task options above for you to complete as assessment for this outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample SAC and sample response provided below should be used for example purposes only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

**Unless specifically credited, the VCAA has not written this material and does not endorse the content.**

### Overview of SAC 1 – Analysis and evaluation of a psychological case study

As part of your assessment for Unit 3 Area of Study 1, you will be required to analyse a case study and apply your knowledge to various short-answer questions. This task is designed to assess your understanding of nervous system functioning and stress and will require you to demonstrate your knowledge from Chapters 2 and 3 in response to the case study provided.

## **A step-by-step guide to completing SAC 1**

The information provided in this section is designed to help you prepare and practise for SAC 1. The tips and advice included are broad and have been designed to help you successfully complete the analysis of a case study regardless of the specific requirements of the task your teacher or school has created.

### **Step 1: Carefully read the requirements of the task and understand how you will be assessed.**

The best way to set yourself up for success in SAC 1 is to apply the two models of stress to a scenario. Ensure you can evaluate the strengths and weaknesses of both models.

### **Step 2: Revise neurotransmitter effects.**

Create a table to summarise neurotransmitters involved in communication and the effects that excitatory and inhibitory neurotransmitters have on processes such as long-term potentiation and long-term depression.

### **Step 3: Be prepared to outline the role of dopamine and serotonin as neuromodulators.**

Make sure you can provide examples of how dopamine and serotonin can act as a neuromodulator, what each neuromodulator assists with and how neuromodulation differs from neurotransmission.

### **Step 4: Practise applying the flight-or-fight-or-freeze response to multiple scenarios.**

SACs assessing Unit 3 Area of Study 1 will often require you to recognise which stages and reactions of the flight-or-fight-or-freeze response apply to certain scenarios. Practise your ability to do this by thinking of different stressors that could activate the flight-or-fight-or-freeze response, how you might respond and what physiological responses would occur based on your response.

## **Practice SAC 1 with annotated sample response**

Now that you have learnt about some key steps to help you succeed on SAC 1, we can look at how this theory can be put into action on an example SAC. In this section, we examine:

- a practice SAC
- a high-scoring student response for the SAC (complete with tips and annotations to show you how to maximise your marks)
- the marking criteria for the practice SAC.

# Practice SAC 1

## Analysis and evaluation of a psychological case study

Read through the case study and answer the questions.

### Bell's story

I was born in Tenterfield, New South Wales. My family were Salvation Army and we lived in lots of different places. I was 19 when I joined up. Dad said, "Don't join the army, that's crazy. What about the wars?" And I said, "Australia hasn't gone anywhere since Vietnam, don't worry about it". Six months later I was in East Timor.

When I joined the army, I had no training when I became a photographer. I just went to see the Commanding Officer and said, "Boss, can I be the unit photographer?" And he went, "Can you take a photo?" And I said, "Well, I've got a new camera!" This was a part of my aspirations to get into the Army Public Relations Service but it wasn't going to be easy.



FIGURE 1 Australian Army soldiers

### East Timor 1999

When the big conflict occurred in '99 it was mind-boggling. No one was prepared for it. I was so young and inexperienced. I'd never left Australia before.

We were peacekeepers but we were deployed under war-like circumstances.

I was with Ammunition Platoon. We had boxes and boxes of rockets and grenades and bullets and our job was to basically keep it safe,

catalogue it and send it out. We also took control of all the confiscated weapons. We had shipping containers lined up in our compound just chockers full of militia contraband. Really horrific, brutal homemade weaponry. It was pretty tense.

In Australia, the ammunition magazines are kept in empty spaces and bunkers far away. In Timor, we were inside the same compound as the ammo. We were sleeping on boxes of grenades! You're on alert, the "enemy's" out the gates, but you're sitting in the same spot day after day. And it's so hot there and the ammo shouldn't be exposed to heat like that, so it was very stressful.

But – and this probably sounds strange – it was kind of boring too.

It's ordinary and huge at the same time.

### Bell comes home

Six months later, you come home and you're trying to keep the experience real but you're also trying to merge in again with everybody back home. It's hard. You've been with these poor people in this Third World country who don't have anything, who've lost everything and it makes you appreciate the things you have.

It can be so frustrating at times. You go to the shops and get so annoyed with people dawdling along and carrying on like wombats. Then you have a beer with a mate who was in East Timor with you and you go, "Jeez, I hate going to the shops, I hate the crowds". And they would totally understand; it's been the same for them. And then I'd drink more beer and so it goes.

Everyone just assumes you're okay now you're back. They're like, "Oh, you're home, you're safe and life goes on". Nobody rings you and checks and asks, "Hey, how are you going?" Nobody knows how disconnected you feel. So you have a few drinks and that makes you even harder to talk to and it's always there.

## Two beers per day, per man

I wasn't a drinker until I joined the army. After the first couple of months in Dili [capital city], you'd get two beers per day, per man, mostly.

So, every day I wasn't on duty, I'd be thinking, "I can have two beers tonight". It's your reward, basically. And after a while some of us would be doing anything to turn those two beers into four beers.

I came back to Australia with the idea that drinking was the way to do business and everybody does it, right? It isn't that you're an alcoholic but to not have a couple of beers a day annoys you. At the time I didn't realise I was putting it first above everything else. I see it as more of an addiction now and it has had consequences that I didn't even realise.

## Change of focus

I was still very focused on becoming a photographer. I set my mind to that, got my skills up and started writing some articles for the army newspaper. Eventually after some work experience with them, I got a position, got my promotion and then went into the Public Relations Service, which was just phenomenal – it's the best job in the ADF [Australian Defence Force].

You deploy around the world chasing soldiers, taking photos, telling people what it's really like and all the time you're thinking, "Wow, in 20 years' time, these pictures will be on the wall in the War Memorial and people will be coming in and going, 'Oh, this is what the troopies were like then'...". Pretty cool stuff.

## Transition

Back home, my boss knew that my course would be starting and he said, "You've got your plans to keep going with". He suggested I take my two weeks leave but complete my discharge first, and he suggested "before you go, make sure you see the psych".

The session with the psych was a tick and flick questionnaire.

Did anything over there disturb you? Yes.

Did you feel your life was in danger? Yes.

Is there anything you want to talk about? Yes.

But there was no real talking or debriefing.

## Noticing a change

My partner Kerry and I had only been together for a year and our relationship was pretty sweet for the first year. She noticed the differences in me when I came back: the depression and the edginess. I was jumpy, sometimes aggressive, withdrawn and with a kind of numbness. A lot of numbness. I found it really hard to connect even with the person I loved the most. There were nightmares and dreams. Constantly stressed, constantly wired, constantly depressed. Just always battling with life.

You feel like an idiot that you're not coping. You feel stupid because it's not like you went to war and someone shot at you. I think the hardest thing is mostly linked to feeling so isolated by what you've experienced: isolated from friends, family and the community.

## A realisation

The best bet for me was to get formal counselling. There was no way Kerry could possibly be the support I needed. I've started a photographic business and it's going really well. It gets me out of the house and I get to reconnect with people. I wouldn't give it up for anything.

I'm doing some cognitive thinking work with my counsellor, too. I'm trying to change my structure and my self-talk.

I've cut my drinking down by half and I'm trying to get motivated about nutrition and fitness, though I still struggle with that immensely. I've learnt now to try and give myself a break and say, "I don't have to be perfect. I don't have to make every decision the right decision. I'll do my best, that's all".

Source: Open Arms – Veterans & Families Counselling

**Question 1** (2 marks)

Bell states that during her service she was “on alert” with the “enemy at the gates”. Identify which division of the autonomic nervous system would assist Bell in responding to perceived threats.

Justify your answer.

**Question 2** (4 marks)

Bell describes parts of her service in the army as “tense” and “stressful”.

- a Distinguish between an internal and external stressor. (2 marks)
- b Provide two examples of external stressors Bell was exposed to during her time in East Timor. (2 marks)

**Question 3** (4 marks)

During Bell’s time in East Timor, she needed to learn new skills such as how to keep ammunition safe and how to transport ammunition. Discuss how the pathway of neural transmission and effects of the main excitatory neurotransmitter in the central nervous system promote the learning of new skills.

**Question 4** (6 marks)

Bell’s duties in the Ammunition Platoon included keeping ammunition safe, cataloguing it and sending it out.

- a Identify whether cataloguing (making a list of) ammunition would be considered a conscious or unconscious response. Justify your answer. (2 marks)
- b Outline the steps involved that enabled Bell to coordinate the action of cataloguing ammunition. (4 marks)

**Question 5** (5 marks)

Bell starting drinking after joining the army. When she was not on duty she would “reward” herself with two beers. Bell’s drinking eventuated into an alcohol addiction.

- a Identify the name of the neurotransmitter that plays a role in coordinating motivation and the reward and pleasure centre in the brain. (1 mark)
- b Discuss why the release of this neurotransmitter is likely to have contributed to Bell developing an alcohol addiction. (4 marks)

**Question 6** (6 marks)

When Bell returned home from East Timor, she noticed that she was jumpy, agitated, withdrawn, numb and depressed.

- a Is Bell’s experience of stress acute or chronic? Justify your answer. (2 marks)
- b Identify the name of the stress hormone that would have been circulating in Bell’s bloodstream when she returned from East Timor. (1 mark)
- c Discuss the third stage of Selye’s General Adaptation Syndrome model of stress to explain why after returning home Bell felt withdrawn, numb and depressed. (3 marks)

**Question 7** (4 marks)

Discuss the stages of Lazarus and Folkman’s Transactional Model of Stress and Coping to explain how Bell was feeling during “post army changes”.

**Question 8** (9 marks)

- a Distinguish between approach and avoidant coping strategies and provide an example of each that Bell used to cope with stress. (4 marks)
- b Outline the context-specific effectiveness of a coping strategy selected in part a. (2 marks)
- c Discuss how Bell’s secondary appraisal will have changed during the time of “Noticing a change” and “Change of focus”. (3 marks)

Check your Student **obook pro** for these digital resources and more:

pro



**Annotated response and marking criteria**

Once you’ve completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

#### Question 1

Which of the following best describes a spinal reflex?

- A A conscious response to external stimuli processed by the central nervous system
- B A voluntary response when the body is in danger
- C An automatic response that occurs in the central nervous system
- D A brain's instinctive survival response

#### Question 2

As he walked home from work, James witnessed a fight between two men who were throwing punches. At the time of seeing the fight, James' heart rate increased, but when he got home it had decreased to normal again.

The nervous system responsible for lowering James' heart rate is the:

- A parasympathetic nervous system.
- B autonomic nervous system.
- C somatic nervous system.
- D sympathetic nervous system.

Use the following information to answer questions 3 and 4.

Vanessa has been in a relationship for the past four years. She and her partner recently broke up. Upset from the break-up, Vanessa has been struggling to function over the last few weeks. She refuses to leave her house and often overconsumes alcohol. Vanessa's friend, Albert, is particularly worried about her. Vanessa has confessed to Albert that she is "struggling to get on with things" and that she has "tried so many different ways to get over the relationship but nothing seems to work".

#### Question 3

According to Lazarus and Folkman's Transactional Model of Stress and Coping, which of the following would be identified as the transaction in the scenario?

- A Vanessa's excessive alcohol consumption
- B Vanessa's inability to cope
- C Vanessa's refusal to leave the house
- D Vanessa's exposure to the break-up

#### Question 4

According to a primary appraisal of the Transactional Model of Stress and Coping, which of the following best describes what Vanessa is experiencing?

A	Stress	Harm/loss
B	Eustress	Threat
C	Stress	Distress
D	Stress	Inability to cope

#### Question 5

Nathaniel and Maddox started attending the same primary school. Previously, they had attended kindergarten together. Initially, Maddox displayed symptoms of separation anxiety when dropped off in the morning, including crying and clinging to his mother. His heart rate also increased, and a rash appeared on his arm. However, once his mother had left, he felt more comfortable and settled into the activities in class and began to enjoy primary school. After a few weeks, Maddox no longer cried or clung to his mother when dropped off for school and he settled more quickly.

In contrast, when starting primary school, Nathaniel was very excited. He always had his bag packed ready for school and couldn't wait for school to begin. He eagerly ran out of the car to the front of the school and quickly said goodbye to his mother before starting on the day's activities.

Maddox's appraisal of primary school when he first started and then one month later is most likely:

- A irrelevant, then stressful.
- B benign/positive, then stressful.
- C stressful, then harmful.
- D stressful, then benign/positive.

Use the following information to answer questions 6 to 10.

Professor Leong was interested in the interaction between the gut microbiota and the stress response. She conducted a study to determine whether the short-term use of prebiotics would improve gut health and therefore decrease levels of anxiety in adolescents who had been diagnosed with an anxiety disorder within the last 12 months.

**Question 6**

Identify the independent and dependent variable for this study.

	Independent variable		Dependent variable
	Experimental group	Control group	
<b>A</b>	No prebiotic use	Short-term prebiotic use	Anxiety levels
<b>B</b>	Short-term prebiotic use	No prebiotic use	Anxiety levels
<b>C</b>	No prebiotic use	Short-term prebiotic use	Absence of stress response
<b>D</b>	Short-term prebiotic use	No prebiotic use	Absence of stress response

**Question 7**

An appropriate hypothesis for this study is:

- A** adolescents who use prebiotics in the short term will report decreased levels of anxiety compared to those who do not use prebiotics.
- B** prebiotic use will affect anxiety levels in adolescents.
- C** 12 adolescents who use prebiotics in the short term will report decreased levels of anxiety compared to those who do not use prebiotics.
- D** prebiotic use will have a negative effect on stress levels in adolescents.

**Question 8**

Professor Leong conducted a controlled experiment where each participant in the sample was exposed to all conditions within the experiment.

This type of investigation design is known as a:

- A** between-subjects design.
- B** mixed design.
- C** within-subjects design.
- D** correlational study.

**Question 9**

In this experiment, Professor Leong would need to control for extraneous variables to ensure that:

- A** a valid conclusion can be drawn and any change in the independent variable can be attributed to the dependent variable.
- B** the results obtained can be applied to the wider population.
- C** a valid conclusion can be drawn and any change in the dependent variable can be attributed to the independent variable.
- D** the hypothesis can be supported, and a valid conclusion can be drawn.

**Question 10**

To adhere to the ethical guideline of informed consent, Professor Leong must ensure that:

- A** participants' guardians understand the nature and purpose of the experiment, including potential risks, before providing voluntary written consent.
- B** participants understand the nature and purpose of the experiment, including potential risks, before providing voluntary written consent.
- C** participants and their guardians understand the nature and purpose of the experiment, including potential risks, before providing voluntary verbal consent.
- D** participants and their guardians understand the nature and purpose of the experiment, including potential risks, before providing voluntary written consent.

**Short answer**

**Question 1** (7 marks)

Wanda meets a new colleague, Dembe, and offers to shake her hand as a gesture of friendliness. Wanda's new colleague awkwardly grasps Wanda's hand in return.



**FIGURE 1** A handshake is a gesture of friendliness.

- a** Explain whether Wanda reaching out to shake Dembe's hand is a conscious response or an unconscious response. (2 marks)
- b** Describe the role of each division of the nervous system involved when Wanda shakes her colleague's hand. (2 marks)
- c** After awkwardly responding to Wanda's handshake, Dembe feels nervous and begins to sweat. Explain whether sweating is a conscious response or an unconscious response and determine which divisions of the human nervous system are involved in triggering a sweat response. (3 marks)

**Question 2** (5 marks)

Zara accidentally touches a hot pot that has been on the stove for ten minutes. Her arm immediately retracts from the pot.



**FIGURE 2** An unconscious response allows you to immediately remove your hand from a hot pan.

- a** Identify the name of the unconscious response that allows Zara to immediately remove her hand from the source of heat. (1 mark)
- b** Outline the steps involved for Zara to perform the response. (4 marks)

**Question 3** (15 marks)

A psychologist wanted to investigate what happens to the human brain when a new skill is learnt. They conducted a controlled experiment with 24 participants with no previous juggling ability. Twelve participants were assigned to an experimental group and given a complicated

juggling routine to practise every day for two weeks or until they could complete the routine in under a minute. The other twelve participants were assigned to the control group and instructed to go about their daily lives as usual. Neuroimaging scans from the two groups were then compared.

- a** Describe the role of glutamate in long-term potentiation and how this relates to individuals in the experimental group learning a new skill. (2 marks)
- b** Explain how long-term depression can improve nervous system functioning. (2 marks)
- c** Identify two physiological changes to a neuron that could be used as evidence by the researcher to determine if long-term potentiation has occurred. (2 marks)
- d** Explain how the increased release of dopamine could be linked to those participants who successfully completed the complicated juggling routine. (2 marks)
- e** Identify the independent variable and dependent variable in the experiment. (2 marks)
- f** Identify a potential extraneous variable inherent within the experiment and explain how it could be controlled if the experiment were to be repeated. (2 marks)
- g** Identify the type of controlled experiment employed by the psychologist and explain why the psychologist may have selected this type over another. (3 marks)

**Question 4** (11 marks)

Victor has just started university. A high-performing student, Victor has been studying hard in anticipation for his first mid-year exam in the hopes of achieving a high score. When Victor opens the first page of his exam, he realises that he has been studying the wrong content and that he cannot respond to most questions.

Victor temporarily feels numb and in a state of disbelief that he has let himself down. His disbelief then turns to anger at the situation. To the astonishment of those around him, Victor slams his fists on the table and swears profusely before tipping the desk over and storming out of the exam hall.

- a** In terms of Selye's General Adaptation Syndrome, identify the specific stage during which Victor is likely to experience the effects of adrenaline. (1 mark)
- b** Identify another biological response that could occur when adrenaline is released. (1 mark)
- c** After the exam, Victor is called into the university coordinator's office and is warned that his behaviour in the exam hall was unacceptable. He is also informed by his lecturer that he has scored a 0 for the exam and is likely to fail the subject. The prospect of failing weighs heavily on Victor's mind over the next eight months. Victor struggles but continues to persevere with the subject.
- i** Identify the stage of Selye's General Adaptation Syndrome that Victor was in during this eight-month period and describe the role of cortisol throughout this stage. (3 marks)
- ii** Describe how Victor's gut may be affected by this prolonged experience of stress. (2 marks)
- d** Victor decides to seek guidance from a psychologist on ways to manage his stress. The psychologist suggests Victor engage in mindfulness meditation to reduce his cortisol levels. To ascertain the impact of this practice on Victor's stress levels, the psychologist asks Victor to complete a questionnaire weekly for a period of six weeks.
- i** Outline one benefit and one limitation of using questionnaires. (2 marks)
- ii** With specific reference to the scenario, suggest an alternative to using a questionnaire that could overcome the limitation identified in part **i**. (2 marks)

**Question 5** (7 marks)

Yasith received a significant promotion at work; however, he soon learnt that his new role required him to relocate to an office in a distant suburb, significantly increasing his daily commute. This change meant spending less time with his family, which was very important to him. This caused

Yasith to feel overwhelmed and anxious about the new role, doubting whether the promotion was beneficial and worth accepting. Despite these concerns, he accepted the position. A few weeks into his new role, while Yasith began to find the work itself fulfilling and challenging in a positive way, the extended hours and long commute continued to put strain on his family life. Recognising the importance of family time, Yasith proactively approached his boss to negotiate finishing two hours earlier once a week to ensure he could spend more time with his family.

- a** Outline an external source of stress Yasith is experiencing. (2 marks)
- b** Explain Yasith's primary appraisal when he originally received the promotion. (2 marks)
- c** With reference to coping flexibility and context-specific effectiveness, evaluate Yasith's decision to speak to his boss about being able to finish two hours earlier. (3 marks)

**Question 6** (6 marks)

Radoslav and Ivanka are friends who both study at Swinburne University. Results from their first semester exams are going to be released in two days. Radoslav doesn't care about his results because he has already decided to change universities and recently found out that the change has been approved.

However, Ivanka knows she needs to pass all her subjects to continue into semester 2 of her course. In the lead-up to the release of the results, Ivanka finds herself struggling to sleep and is continuously thinking about the first semester exams. She does not know what she will do if she has not passed.

- a** According to Lazarus and Folkman's Transactional Model of Stress and Coping, state the primary appraisals Ivanka and Radoslav would be feeling in the lead-up to the results being released. (1 mark)
- b** In terms of primary appraisal in Lazarus and Folkman's Transactional Model of Stress and Coping, explain why Radoslav and Ivanka have evaluated their situations differently. (3 marks)

**c** Describe the secondary appraisal for Radoslav if he were to fail one of his exams in this situation. (1 mark)

**d** Outline a secondary appraisal Ivanka would make if she were to fail one of her exams. (1 mark)

**Question 7** (7 marks)

Emilia and Stanislav have been married for two years. In the last two years, they have had frequent heated arguments that result in one of them feeling distressed afterwards, particularly when the argument is unresolved. Emilia often goes for a walk so she can think about how she and Stanislav can resolve their differences before going to bed that evening. Stanislav tends to pour himself a large alcoholic drink to take his mind off the argument and distracts himself by watching television.

**a** Identify and explain the types of coping strategies being used by Emilia and Stanislav. (4 marks)

**b** Assess whether their argument would be considered acute or chronic stress. Justify your response. (3 marks)

**Question 8** (10 marks)

Mark is 37 years old and owns his own plumbing company. After six months of long service leave, Mark has returned to work to find that his employees have been working slowly and there are many unfinished jobs that need to be completed soon. Normally, Mark works eight hours a day.

However, to catch up on the jobs that are not completed, he is finding that he needs to work 10- to 12-hour days. After two weeks, he wakes up one morning feeling quite sick and exhausted. His muscles are aching, and he has a sore throat and a runny nose. Mark re-evaluates his work situation and decides he needs to call in some additional help to reduce his workload. After one week of his new assistant helping, Mark no longer feels tired and notices he is back to normal health.

Explain Mark's re-evaluation and the coping strategy he applied by:

- applying Lazarus and Folkman's Transactional Model of Stress and Coping to this scenario and explaining the possible responses Mark may experience throughout this period of time
- evaluating Lazarus and Folkman's Transactional Model of Stress and Coping as a reliable explanation of stress as a psychological process
- evaluating the explanatory power of Lazarus and Folkman's Transactional Model of Stress and Coping
- discussing the types of coping strategies used by Mark and how effective they are at reducing stress.

CHAPTER

4

# Approaches to understand learning

## KEY KNOWLEDGE

- behaviourist approaches to learning, as illustrated by classical conditioning as a three-phase process (before conditioning, during conditioning and after conditioning) that results in the involuntary association between a neutral stimulus and unconditioned stimulus to produce a conditioned response, and operant conditioning as a three-phase process (antecedent, behaviour and consequence) involving reinforcement (positive and negative) and punishment (positive and negative)
- social-cognitive approaches to learning, as illustrated by observational learning as a process involving attention, retention, reproduction, motivation and reinforcement
- approaches to learning that situate the learner within a system, as illustrated by Aboriginal and Torres Strait Islander ways of knowing where learning is viewed as being embedded in relationships where the learner is part of a multimodal system of knowledge patterned on Country.

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## GROUNDWORK

This topic will build on concepts you will have come across in Units 1 & 2 Psychology. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



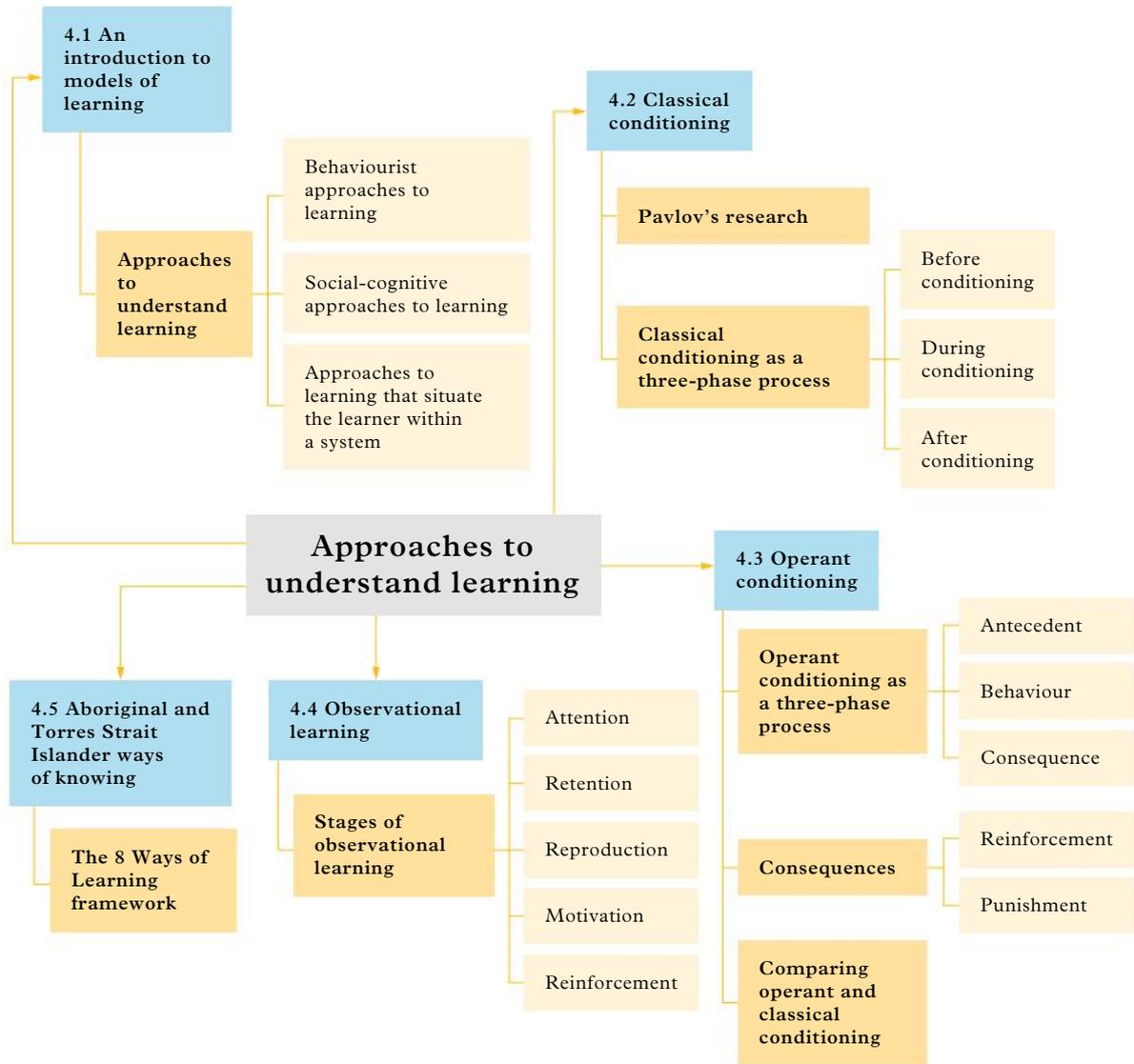
Groundwork quiz  
Chapter 4

## INVESTIGATIONS

4.1	<b>INVESTIGATION: MODELLING</b>	How can we model the process of observational learning in practice?	Page 475
4.2	<b>INVESTIGATION: SIMULATION</b>	How do different circumstances affect the time in which a conditioned response is learnt?	Page 476
4.3	<b>INVESTIGATION: CASE STUDY</b>	Can pigeons learn to operate military weapons?	Page 478

FIGURE 1 Learning occurs throughout life so we may adapt and acquire new skills, like this puppy, who has learnt how to fetch for a treat.

# CONCEPT MAP



**\* CONTENT WARNING:** Aboriginal and Torres Strait Islander people are advised that this chapter may contain images of people who are now deceased.

# 4.1

## An introduction to models of learning

### KEY IDEAS



- ✦ Learning is a relatively permanent change in behaviour or knowledge in response to experience.
- ✦ There are different approaches to learning, including behaviourist approaches, social-cognitive approaches and approaches to learning that view knowledge as one interconnected system that a learner is situated in.

### learning

a relatively permanent change in behaviour or knowledge in response to experience

At one point in your life, you would not have understood what a green traffic light meant or known how to tie your shoelaces. However, at this stage of your life, it is likely that you understand that “green means go” and can tie your shoes without having to think too much. This change in your ability to understand and perform actions is due to learning. **Learning** is a relatively permanent change in behaviour or knowledge in response to experience. The world and the environments we find ourselves in are constantly changing, and learning allows us to adapt and acquire the skills and knowledge needed to keep up with these changes. Hence, psychologists view learning as an adaptive process that allows us to change and grow in response to our experiences. When a person can consistently exhibit a new behaviour or understanding over time, this is taken as evidence that learning has occurred.



**FIGURE 1** Exposing a child to written and verbal language can help the child learn how to read.

The learning process can occur intentionally through **active learning** or unintentionally through **passive learning**. For example, active learning might involve studying for an exam, whereas passive learning might involve picking up the meaning of a foreign word when overhearing another language spoken. Learning a new behaviour or concept can also occur immediately or very quickly (e.g. a person learning a new dance step) or progressively over time (e.g. a child learning to read).

## Approaches to understand learning

Psychologists have characterised different approaches to learning based on how people learn and adapt to their environment. These approaches to learning provide a framework for understanding the different ways that learning can occur and help psychologists identify the factors that contribute to learning. No single approach to learning can fully explain all aspects of human learning and behaviour. Rather, these approaches to learning provide complementary perspectives on the complex process of learning and help psychologists to develop effective interventions and strategies that promote learning and growth. Throughout this chapter, you will look at three approaches to learning:

- behaviourist approaches to learning
- social-cognitive approaches to learning
- approaches to learning that situate the learner within a system.

### Behaviourist approaches to learning

**Behaviourist approaches to learning** centre on the idea that behaviours are learnt by interacting with our environment. These approaches focus on the scientific study of observable behaviours that occur because of external events. There is an emphasis on the connection between a stimulus and a **response**. According to this approach, all behaviours, regardless of how complex they are, can be explained by an association between a stimulus in the environment and a behavioural response. Two examples of behavioural approaches to learning are classical conditioning and operant conditioning. These two approaches to learning are summarised in Table 1 but you will learn about each of them in greater detail in Topics 4.2 and 4.3.

### Social-cognitive approaches to learning

**Social-cognitive approaches to learning** are based on the idea that learning occurs through observing others. These approaches suggest that by watching another's behaviour and the consequences that follow, we are prompted to behave in a similar or different way. This type of learning is often called vicarious learning because it is the act of learning by observing others. One example of a social-cognitive approach to learning is observational learning. Observational learning is summarised in Table 1, but you will learn more about it in Topic 4.4.



**FIGURE 2** A person is said to have “learnt” a song on guitar when they can consistently play the song without making mistakes.

**active learning**  
learning for which the learner is required to do something intentional to engage in their learning

**passive learning**  
learning that involves listening and observing

**behaviourist approach to learning**  
an approach to learning that describes behaviours learnt through interaction with the environment

**response**  
a reaction to something/stimulus

**social-cognitive approach to learning**  
a perspective that stresses the importance of social interactions and cognitive processes in shaping human learning and behaviour

**TABLE 1** A comparison of behaviourist and social-cognitive approaches to learning

Characteristic	Behaviourist approaches		Social-cognitive approaches
	<i>Classical conditioning</i>	<i>Operant conditioning</i>	<i>Observational learning</i>
Learners	Learners are passive as learning occurs unconsciously.	Learners are active and will consciously change their behaviour based on the consequences of that behaviour.	Learners must actively pay attention when observing the responses of others and cognitively process what has been observed.
Responses	Involuntary and automatic	Voluntary	Learnt by watching others (vicariously)
Example	Child learns to involuntarily salivate (response) at the sound of the school lunch bell (stimulus).	Child will learn to say please when asking for food when given praise for the behaviour.	Child will observe how parents use their cutlery to prevent dropping food and will imitate the behaviour.

## Approaches to learning that situate the learner within a system

Western approaches to learning and knowledge often break down big ideas into smaller, simpler constructs. For example, in school you have different subject disciplines such as science, art and maths. Not all approaches to learning break down what we interact with and how we learn into smaller parts and categories. Some approaches to learning view knowledge as one interconnected system that a learner is a part of or “situated in”. These approaches to learning are **holistic**. They view all elements of knowledge as connected to form one whole.

For example, rather than seeing a strong distinction between maths and art, a holistic perspective recognises that both areas are connected and contribute to an overall understanding of the world. Through a holistic perspective, understanding is best achieved by looking at the connections between elements and viewing complex concepts as one whole rather than breaking them down into smaller parts. Aboriginal and Torres Strait Islander peoples’ ways of knowing are holistic. You will learn more about Aboriginal and Torres Strait Islander peoples’ ways of knowing in Topic 4.5.

### holistic

an approach that considers the whole system rather than analysing or focusing on its individual parts in isolation

## 4.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “learning” and provide an example.
- 2 Explain what is meant by the term “conditioning”.

### Apply, analyse and compare

- 3 Compare behaviourist and social-cognitive models of learning.

### Design and discuss

- 4 Discuss how approaches to learning that situate the learner within a system differ from Western models of learning.

## 4.2

## Classical conditioning

## KEY IDEAS

- ✦ Classical conditioning is a behaviourist approach to learning where an individual forms an association between two stimuli to produce a learnt response.
- ✦ Classical conditioning has three phases: before conditioning, during conditioning and after conditioning.
- ✦ The key elements used to describe classical conditioning include neutral stimulus (NS), unconditioned stimulus (UCS), unconditioned response (UCR), conditioned stimulus (CS) and conditioned response (CR).

**classical conditioning**

a behaviourist approach to learning where an individual forms an association between two stimuli to produce a learnt response

**association**

where two or more stimuli are paired together to produce a learnt response

**involuntary response**

a response that occurs automatically and is not under the control of an individual

If you've ever owned a pet dog, you might have noticed that they get incredibly excited and automatically wag their tail fast each time they hear the word "walk". This is because, over time, dogs often learn to associate the word "walk" with the activity of going for a walk, which excites them. In this example, the dog has learnt to associate a word with an activity that triggers an automatic response (tail wagging) due to a type of learning called **classical conditioning**.

Classical conditioning is a behaviourist approach to learning that occurs through the repeated **association** of two or more stimuli. Learning is said to have occurred when an **involuntary response** is produced to a stimulus that previously did not induce that behaviour or thought. Building on the example above, a dog who is excited to go for a walk may begin to show excitement when hearing the word "walk" because they have formed an association between the word "walk" and the activity of going for a walk. Prior to going on regular walks with their owner, the word "walk" would not have triggered the same response from the dog. During classical conditioning, the learner is passive; this is because learning happens unconsciously and begins with a reflex response. After conditioning, the reflexive behaviour occurs in response to the new stimulus.

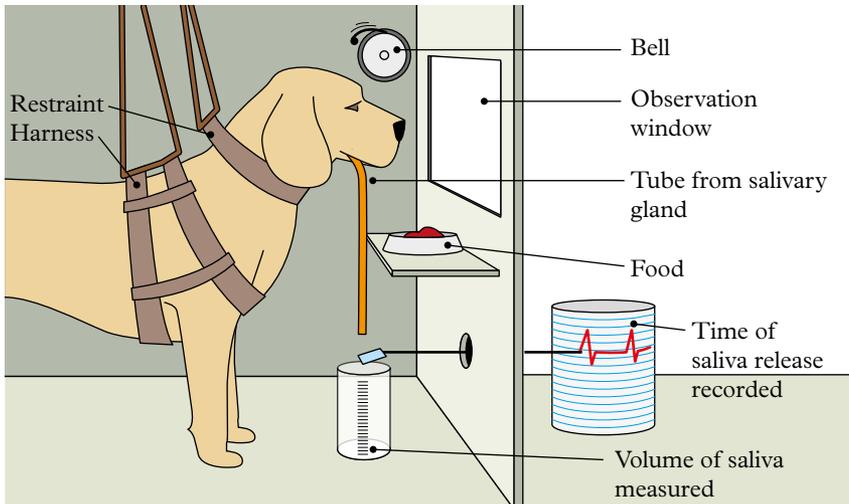


**FIGURE 1** A dog responding to the word "walk" by involuntarily wagging their tail has learnt to associate the word with the prospect of going for a walk.

**Pavlov's research**

Classical conditioning was first described by Russian scientist Ivan Pavlov in the early 20th century. Pavlov accidentally discovered classical conditioning when conducting research on the digestive systems of dogs. He noticed that dogs would begin salivating before they received their food. Pavlov hypothesised that the dogs had formed an association with the sound of the footsteps of the technicians who fed them and the presence of food, and that this association triggered salivation. Pavlov reasoned that:

- initially, the presence of food would trigger the salivation response
- after repeated instances of being fed by laboratory technicians, the dogs would associate the sound of the technicians' footsteps with the presence of food
- eventually, the sound of the technicians' footsteps became so strongly associated with food that the sound on its own (without food) could trigger the salivation response.



**FIGURE 2** Pavlov started experimenting to see if after repeated association with food, different stimuli such as the sound of a bell (set-up shown here) could produce a salivation response in dogs.

Pavlov began experimenting to see if, after repeated association with food, different stimuli such as bells, metronomes and tuning forks could trigger a salivation response in the dogs. Results of his experiments clearly showed that repeated associations of two different stimuli could produce a conditioned response. This response occurs after three phases of conditioning – each of which we will look at in more detail.

## Classical conditioning as a three-phase process

### before conditioning

the first phase of classical conditioning, when the unconditioned stimulus causes an unconditioned involuntary response; the neutral stimulus does not cause any relevant response

### unconditioned stimulus (UCS)

a stimulus that naturally triggers a reflexive behaviour or unconditioned response

### unconditioned response (UCR)

an unlearned reflex behaviour that occurs naturally

### neutral stimulus (NS)

a stimulus that previously did not trigger a relevant response but becomes the conditioned stimulus during classical conditioning

### during conditioning

the second phase of classical conditioning, when the neutral stimulus is paired with the unconditioned stimulus to cause an unconditioned response

Classical conditioning is a process that occurs over three phases:

- before conditioning
- during conditioning
- after conditioning.

### Before conditioning

**Before conditioning** is the first phase of classical conditioning. In this phase, no learning takes place. Rather, during this phase, we can observe how an **unconditioned stimulus (UCS)**, a stimulus that consistently produces a naturally occurring response, can induce an **unconditioned response (UCR)**, an involuntary or automatic response that occurs when an unconditioned stimulus is presented. In Figure 3, we see that food is the UCS and that salivation is the UCR. During this phase we can also observe how a **neutral stimulus (NS)** causes no response when presented. In Figure 3, the sound of a bell is the NS.

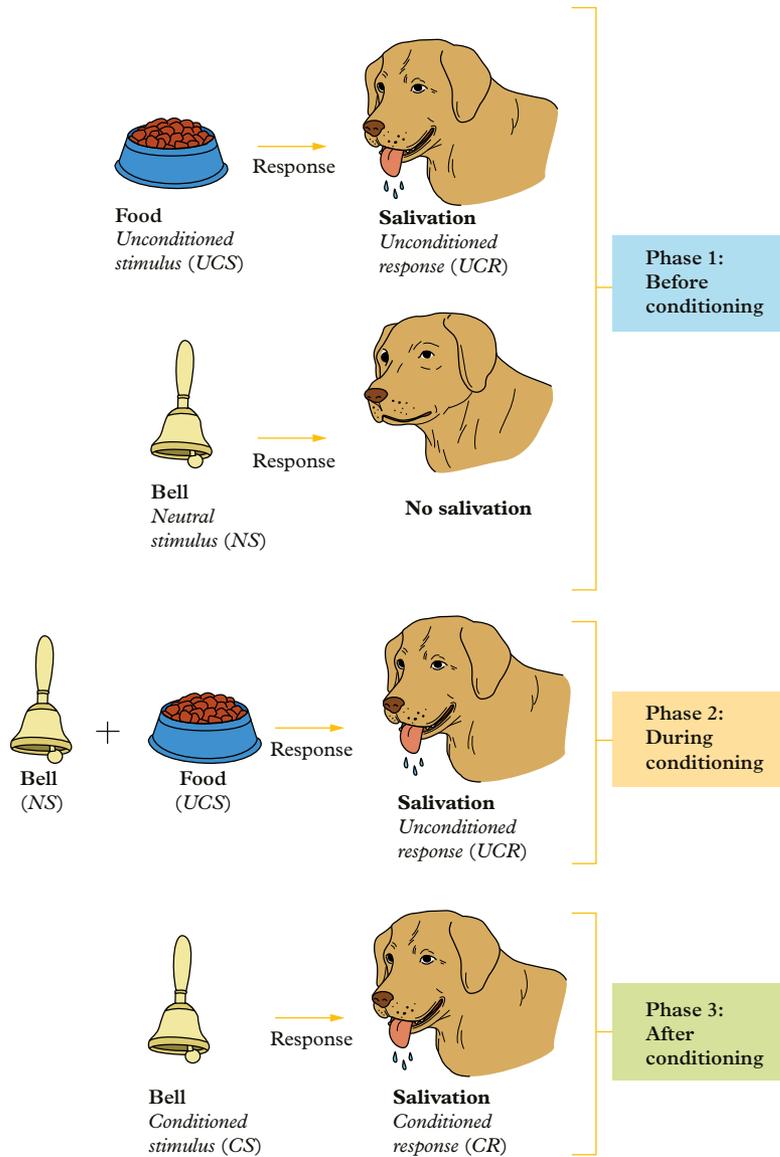
### During conditioning

**During conditioning** is the second phase of classical conditioning. This phase involves the development of an association between the NS and UCS. This association between the NS and UCS is called **acquisition**. For acquisition to occur, the UCS usually needs to be repeatedly presented alongside the NS. For example, in Figure 3 the dog is given food and simultaneously hears a bell; this scenario must be repeated many times for an association to start developing. Because the UCS naturally elicits the UCR, following acquisition the NS will start to induce the same response as the UCS.

### After conditioning

**After conditioning** is the final phase of classical conditioning. In this phase, the NS, on its own, is shown to produce the same response as the UCS. When this occurs, the NS becomes a **conditioned stimulus (CS)**, a previously NS that through repeated association with the UCS now produces a **conditioned response (CR)**. The conditioned response is the learnt automatic response that occurs after repeated association with a previously NS. In Figure 3, the sound of the bell becomes the CS and salivation becomes the CR.

How do different circumstances affect the time in which a conditioned response is learnt? Go to page 476.



**acquisition**  
the initial learning stage, when an individual associates a neutral stimulus or a behaviour with a specific outcome or consequence

**after conditioning**  
the third phase of classical conditioning, when the neutral stimulus has become a conditioned stimulus, causing a conditioned response

**conditioned stimulus (CS)**  
a stimulus that, after conditioning, triggers a conditioned response

**conditioned response (CR)**  
a learnt response that is triggered by the conditioned stimulus

FIGURE 3 Classical conditioning is a three-phase process.

TABLE 1 A summary of the three stages of classical conditioning.

Phase of conditioning	What occurs
Before conditioning	<ul style="list-style-type: none"> <li>An UCS elicits an involuntary response or UCR.</li> <li>No learning takes place.</li> <li>A NS does not produce any relevant response.</li> </ul>
During conditioning	<ul style="list-style-type: none"> <li>The UCS is repeatedly presented with a NS.</li> <li>An association begins to form between the two stimuli (NS + UCS).</li> </ul>
After conditioning	<ul style="list-style-type: none"> <li>The NS has become a CS because it is now so strongly associated with the UCS that it can elicit the same response as the UCR.</li> <li>The response to the CS is now considered to be the CR.</li> </ul>

## 4.2 WORKED EXAMPLE

### Referring to the three-phase model of classical conditioning

Charlotte has always found the smell of tuna repulsive. Each time Charlotte smells canned tuna, it makes her feel nauseous. Charlotte has a new housemate who eats a tuna sandwich on the same blue plate every day. After 3 weeks of living with her new housemate, Charlotte starts to feel nauseous each time she sees the blue plate, even when the plate is clean and has no food on it, when there is no tuna nearby and when her housemate isn't home.

With reference to the three-phase model of classical conditioning, discuss why Charlotte feels nauseous each time she sees the blue plate without the presence of tuna. (8 marks)

### Solution

Think	Do
Step 1: Identify the elements and the conditions of the first phase of classical conditioning (before conditioning).	<p>Before conditioning:</p> <ul style="list-style-type: none"> <li>No learning takes place.</li> <li>An UCS elicits an involuntary response or UCR.</li> <li>A NS does not elicit any relevant response.</li> </ul> <p>In this situation:</p> <ul style="list-style-type: none"> <li>The UCS is the smell of tuna; it elicits an UCR of feeling nauseous. (2 marks)</li> <li>The NS is the blue plate, which does not elicit any relevant response. (1 mark)</li> </ul>
Step 2: Identify the elements and the conditions of the second phase of classical conditioning (during conditioning).	<p>During conditioning:</p> <ul style="list-style-type: none"> <li>The UCS is repeatedly presented with the NS.</li> <li>An association begins to form between the two stimuli (NS + UCS).</li> </ul> <p>In this situation:</p> <ul style="list-style-type: none"> <li>The UCS (tuna smell) is repeatedly presented with the NS (blue plate) because Charlotte's housemate regularly eats tuna sandwiches on the plate. (2 marks)</li> <li>Charlotte begins to associate the blue plate (NS) with the smell of tuna (UCS). (1 mark)</li> </ul>
Step 3: Identify the elements and the conditions of the final phase of classical conditioning (after conditioning).	<p>After conditioning:</p> <ul style="list-style-type: none"> <li>The NS has become a CS because it has become so strongly associated with the UCS that it elicits the same response as the UCR.</li> <li>The response to the CS is now considered to be the CR.</li> </ul> <p>In this situation:</p> <ul style="list-style-type: none"> <li>The blue plate (NS) has become a CS because it is so strongly associated with the smell of tuna (UCS) that it triggers Charlotte to feel nauseous. (1 mark)</li> <li>Charlotte's nauseous response to the blue plate (CS) is the CR. (1 mark)</li> </ul>
Step 4: Put your answer together.	<p>Charlotte has developed a learnt response of feeling nauseous in response to the blue plate because of the three phases of classical conditioning.</p> <p>Before conditioning, the UCS is the smell of tuna; it elicits an UCR of feeling nauseous. The NS is the blue plate, which does not produce any relevant response.</p> <p>During conditioning, the UCS (tuna smell) is repeatedly presented with the NS (blue plate) because Charlotte's housemate regularly eats tuna sandwiches on the plate. Charlotte begins to associate the blue plate (NS) with the smell of tuna (UCS).</p> <p>After conditioning, the blue plate (NS) has become a CS because it is so strongly associated with the smell of tuna (UCS) that it triggers Charlotte to feel nauseous. Charlotte's nauseous response to the blue plate (CS) is the CR.</p>

## 4.2 REAL-WORLD PSYCHOLOGY

### Little Albert

In 1920, US psychologist John B. Watson conducted one of the most infamous cases of psychological research related to classical conditioning. Watson “borrowed” a 9-month-old child known as Little Albert (an alias) from a childcare facility at John Hopkins University. Little Albert’s parents were not aware of the true intentions of the research. Little Albert was selected as the target of the research because he had never been seen to cry at the childcare facility.

Watson placed Little Albert on the floor of his laboratory and allowed him to play with a white rat. Albert showed no fear in response to the rat, or to other animals and objects presented to him, including a rabbit, dog, monkey, cotton wool and human masks. However, Albert did show fear when a steel bar was struck behind his back, making a loud noise.

Two months after his initial observations of Little Albert, Watson began pairing playtime with the rat with the striking of the steel bar. At first Albert did not cry when hearing the striking noise but did jump in fear. After seven pairings of the rat and the striking noise Albert finally cried. Soon afterwards Albert would start to cry when the rat was presented without the striking noise. Little Albert came away from the study psychologically damaged and with a fear of rats and other white fluffy objects.

### Apply your understanding

- 1 Use the three-phase model of classical conditioning to outline how Little Albert became conditioned to fear the white rat.
- 2 Discuss one ethical concept (see Topic 1.4 in your Psychology toolkit) that was breached in Watson’s study on Little Albert. Suggest a modification Watson could have made to his study that would help address this ethical concept.
- 3 Discuss one ethical principle (see Topic 1.4 in your Psychology toolkit) that was breached in Watson’s study on Little Albert. Suggest a modification Watson could have made to his study that would help apply this ethical principle.



**FIGURE 4** Little Albert was conditioned to respond with fear to the presence of a white rat. Albert’s fear extended to other white fluffy objects, including white dogs and rabbits.

**TABLE 2** Key terms in classical conditioning

Key term	Description
Neutral stimulus (NS)	A stimulus that elicits no relevant response (the neutral stimulus becomes the CS after learning has occurred). It is presented in the before conditioning phase to show a baseline.
Unconditioned stimulus (UCS)	A stimulus that will produce a naturally occurring automatic or involuntary response in the before conditioning phase.
Conditioned stimulus (CS)	The stimulus that started as a NS but after conditioning now produces an involuntary response (the stimulus an organism has been taught to respond to). The NS and UCS will be repeatedly linked in the during conditioning phase.
Unconditioned response (UCR)	The naturally occurring automatic response that is elicited only by the UCS before conditioning occurs.
Conditioned response (CR)	Is the same response as the UCR; however, it is elicited by the CS. It is a learnt response and occurs after the NS and UCS have been linked in the during conditioning phase.

**Study tip**

Make sure you always include what a behaviour is in response to. The UCR and CR will be the same behaviour; however, they are in response to different stimuli.

**4.2 CHECK YOUR LEARNING**



**Describe and explain**

- 1 Define “classical conditioning”.
- 2 Briefly describe each of the three phases in classical conditioning.
- 3 Define “acquisition” and identify the phase of classical conditioning it occurs in.

**Apply, analyse and compare**

- 4 Contrast the neutral stimulus and the unconditioned stimulus.
- 5 Using relevant examples, compare an unconditioned stimulus and a conditioned stimulus.
- 6 Ishan’s older sister has started to tell scary stories around the campfire each time the family goes camping. Scary stories give Ishan goosebumps. Now each time Ishan sees a campfire, he gets goosebumps even if nobody is telling a scary story. Apply the three-phase model of classical conditioning to outline why Ishan gets goosebumps around campfires.

**Design and discuss**

- 7 Using the principles of classical conditioning, design an advertising campaign for a new brand of shoes that could encourage people to buy the product.

- 8 Aversion therapy is an application of classical conditioning where a person learns to associate an undesirable behaviour with an undesirable event to reduce the frequency of the undesirable behaviour. For example, to prevent nail biting, people often purchase a fingernail polish flavoured with bitter aloes that have an unpleasant taste. Discuss, with reference to the three-phase model of classical conditioning, how the nail polish could be used to reduce the occurrence of nail biting.



**FIGURE 5** Nail polish products that taste of bitter aloe are worn to deter nail biting through aversion therapy.

# 4.3



**FIGURE 1** Imagine you are an acrobat about to perform a routine in front of a large crowd. How might you feel about performing the same routine again if the crowd cheers loudly after your act compared to if the crowd boos your act?

**operant conditioning**

a behaviourist approach to learning in which an individual learns through associating a behaviour with a consequence

**voluntary behaviour**

a deliberate or chosen response to a stimulus

## Operant conditioning

**KEY IDEAS**

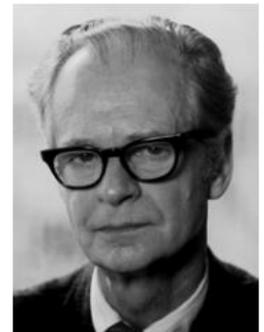
- + Operant conditioning is a behaviourist approach to learning where an individual learns through associating a behaviour with a consequence.
- + Operant conditioning consists of three phases: antecedent, behaviour and consequence.
- + Two types of reinforcements are used to increase the likelihood of a behaviour occurring again: positive reinforcement and negative reinforcement.
- + Two types of punishments are used to decrease the likelihood of a behaviour occurring again: positive punishment and negative punishment.



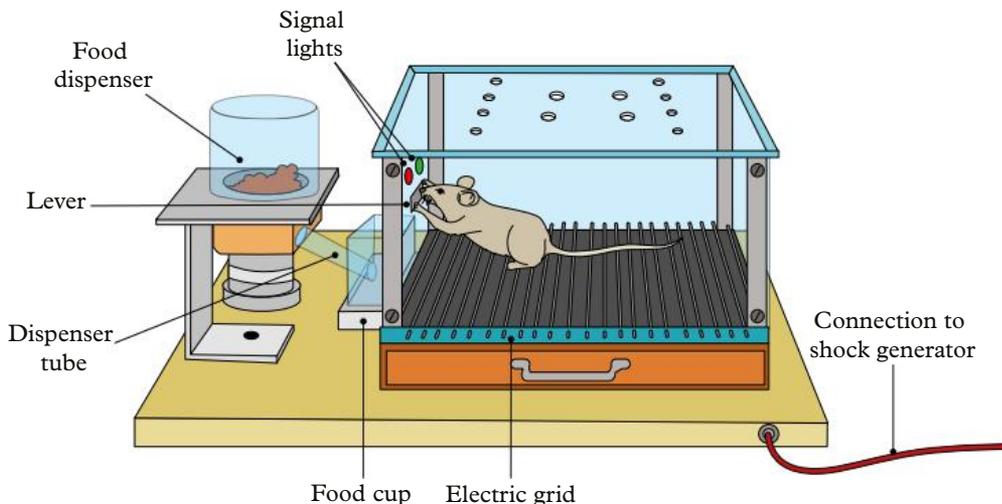
**Operant conditioning** is a type of learning that occurs when we associate a response (behaviour) with a consequence. It is a form of learning where the consequences of a **voluntary behaviour** can increase or decrease the likelihood of that behaviour occurring again. For example, a performer is more likely to perform on stage after they have been applauded and less likely to perform on stage after being booed. During operant conditioning, the learner has an active role in the learning process because they must perform the behaviour to receive the consequence.

Operant conditioning was first described by American psychologist B.F. Skinner in the 1930s. Skinner conducted operant conditioning experiments with rats and pigeons. He placed animals in a “Skinner box”, an enclosed chamber where an animal could manipulate a lever or button to receive a consequence (Figure 3). In one experiment, hungry rats were placed into the Skinner box. The rats learnt that if they pressed a lever, they would be dispensed food. Skinner found that the behaviour of pressing the lever was more likely to be repeated when the rats received the food.

Further trials were conducted in which a red light flashed above the lever to indicate an electric shock was about to be delivered via the floor of the Skinner box. The shock could be removed by pressing the lever. Rats learnt to press the lever when they saw the red light to avoid receiving a shock.



**FIGURE 2** B.F. Skinner was a psychologist who first described operant conditioning.



**FIGURE 3** A rat in a Skinner box

### 4.3 SKILL DRILL

#### Evaluating Skinner's investigation methods

**Key science skill: Analyse and evaluate data and investigation methods**

Skinner only used hungry animals in his experiments.

#### Practise your skills

- 1 Discuss why Skinner had to ensure that only hungry animals were used. How would results have been affected if Skinner had not controlled for hunger?

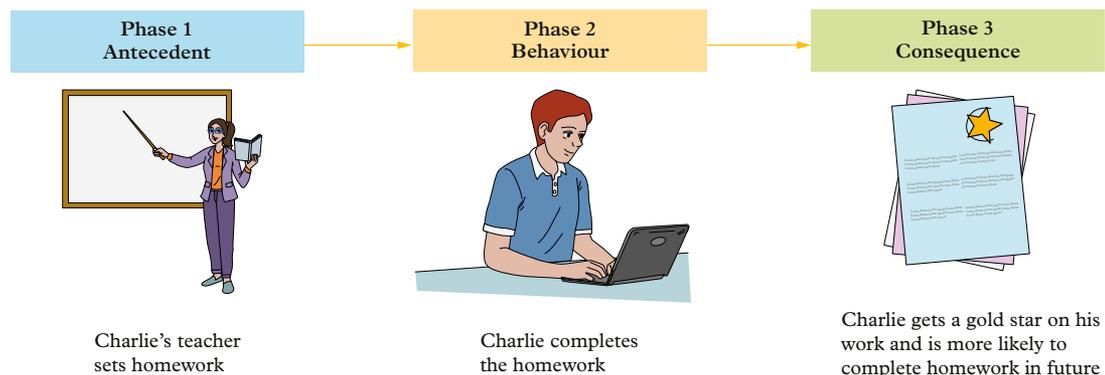
Need help evaluating investigation methods? Go to Topic 1.7 in your Psychology toolkit.

## Operant conditioning as a three-phase process

In operant conditioning, learning occurs through three phases. Each phase describes the relationship between the environment, behaviour and consequence that allows for learning to occur. The three phases of operant conditioning are:

- 1 **antecedent** – the stimulus, event, action or set of circumstances from the environment that triggers a specific voluntary behaviour (e.g. Charlie's teacher setting homework)
- 2 **behaviour** – the specific voluntary response that occurs due to the antecedent (e.g. Charlie completing the homework)
- 3 **consequence** – the outcome of the behaviour that influences the likelihood of the behaviour occurring again (e.g. Charlie getting a gold star for completing his homework and now being more likely to complete homework in future).

This three-phase model of operant conditioning is often referred to as the ABC model of operant conditioning.



**FIGURE 4** The three phases of operant conditioning, also known as the ABC model of operant conditioning: antecedent, behaviour and consequence.

#### antecedent

the first phase of operant conditioning; refers to what is happening before the behaviour occurs

#### behaviour

what the learner does in response to the antecedent; refers to the action

#### consequence

the response that follows the behaviour; refers to the outcome of the behaviour

#### Study tip

The term "operant" means to perform a response that acts on the environment to generate consequences.

# Consequences

Learning in operant conditioning occurs when the learner has developed an association between a behaviour and a consequence. The nature or type of consequence will then influence how likely the behaviour is to occur again. **Reinforcement** is a type of consequence that increases the likelihood of a behaviour occurring again. **Punishment** is a type of consequence that reduces the likelihood of a behaviour occurring again.

## Reinforcement

Reinforcement is any event or object that increases the likelihood of a behaviour occurring again. There are two ways in which reinforcement can increase the chances of a behaviour occurring again (Figure 5).

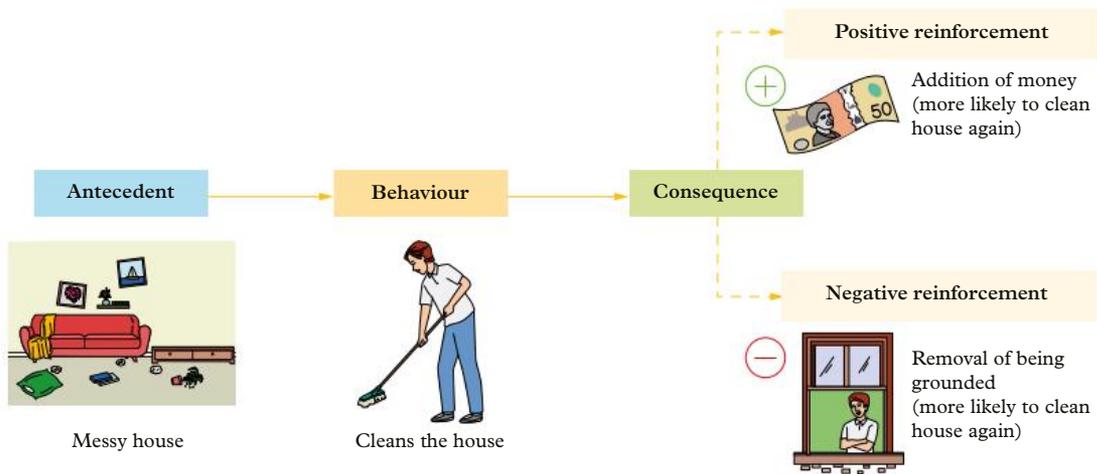
- **Positive reinforcement** is the addition of a desirable stimulus after a behaviour has been demonstrated to increase the chance of that behaviour occurring again; for example, being rewarded with money (an additional desirable stimulus) after cleaning the house (behaviour).
- **Negative reinforcement** is the removal of an undesirable stimulus after a behaviour has been demonstrated to increase the chance of that behaviour occurring again; for example, being ungrounded by your parents (removal of an undesirable stimulus) after cleaning the house (behaviour).

**reinforcement**  
an event or a stimulus that increases the likelihood of a behaviour occurring again

**punishment**  
an event or a stimulus that decreases the likelihood of a behaviour occurring again

**positive reinforcement**  
the addition of a reward or positive stimulus that encourages a behaviour to occur again

**negative reinforcement**  
the removal of an unpleasant stimulus that encourages a behaviour to occur again



**ClickView**  
Comparing classical and operant conditioning

**FIGURE 5** Positive reinforcement involves the addition of a desirable stimulus, whereas negative reinforcement involves the removal of an undesirable stimulus. Both types of reinforcement increase the likelihood of a behaviour occurring again.

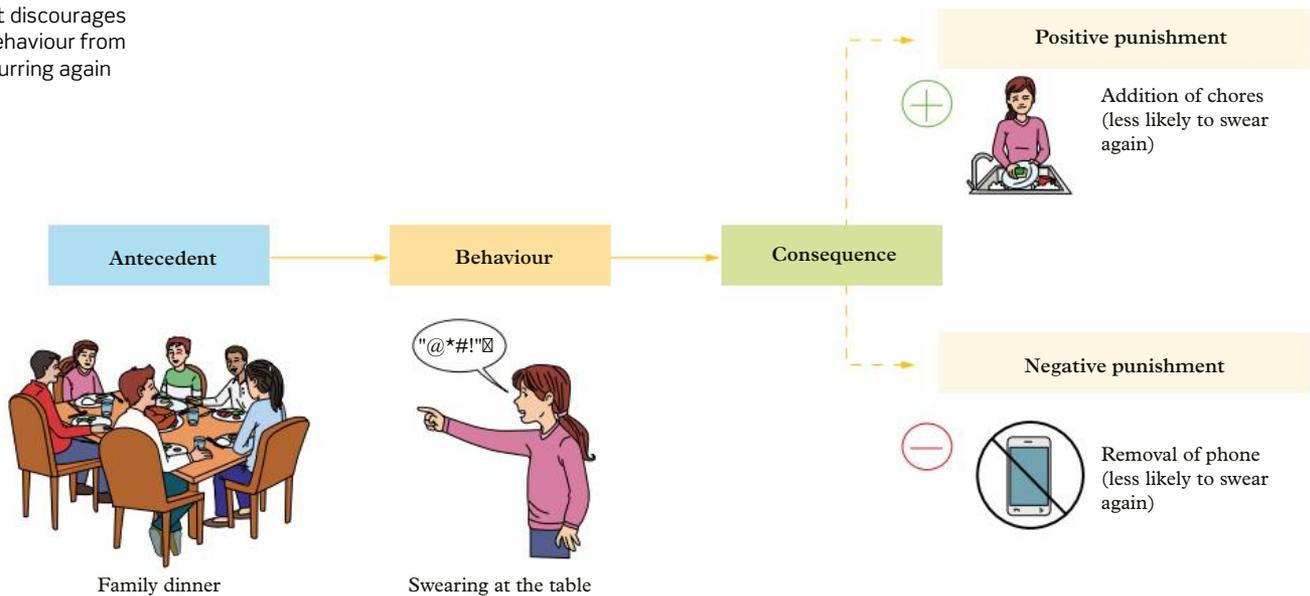
## Punishment

A punishment is any consequence that decreases the likelihood of a behaviour occurring again. There are two ways in which punishment can decrease the chances of a behaviour occurring again (Figure 6).

**positive punishment**  
the addition of an unpleasant stimulus that discourages a behaviour from occurring again

**negative punishment**  
the removal of a pleasant stimulus that discourages a behaviour from occurring again

- **Positive punishment** is the addition of an undesirable stimulus after a behaviour has been demonstrated to decrease the chance of that behaviour occurring again; for example, having to wash the dishes (addition of an undesirable stimulus) after swearing at the dinner table (behaviour).
- **Negative punishment** is the removal of a desirable stimulus after a behaviour has been demonstrated to decrease the chance of that behaviour occurring again; for example, having your phone confiscated (removal of a desirable stimulus) after swearing at the dinner table (behaviour).



**FIGURE 6** Positive punishment involves the addition of an undesirable stimulus, whereas negative punishment involves the removal of a desirable stimulus. Both types of punishment decrease the likelihood of a behaviour occurring again.

**TABLE 1** A comparison of reinforcement and punishment

Type of consequence	Addition of a stimulus (positive)	Removal of a stimulus (negative)	Effect on future behaviour
Reinforcement	Positive reinforcement: the addition of a pleasant stimulus	Negative reinforcement: the removal of an unpleasant stimulus	Strengthens or increases repetition of specific behaviour
Punishment	Positive punishment: the addition of an unpleasant stimulus	Negative punishment: the removal of a pleasant stimulus	Weakens or decreases repetition of specific behaviour

**FIGURE 7** An example of a punishment is being grounded. Would this be a positive or negative punishment?



### 4.3 WORKED EXAMPLE

#### Applying the ABC model of operant conditioning to scenarios

Alexandra has a new puppy who likes to steal her toys. Alexandra was able to stop the puppy from stealing the toys by spraying the puppy with water every time he stole a toy.

Identify the antecedent, behaviour and consequence from this scenario and propose how Alexandra could stop her puppy from stealing toys by using an alternative form of punishment. (4 marks)



#### Solution

Think	Do
Step 1: Identify the command terms used in the question and determine what they require.	The command term “identify” indicates that part of the response will need to recognise and name and/or select an event, feature, ingredient, element, speaker and/or part. The command term “propose” indicates that part of the response will need to suggest or put forward a point of view, idea, argument, diagram, plan and/or suggestion based on given data or stimulus material for consideration or action.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	There are 4 marks allocated to this question so four key pieces of information will need to form the response. In this case, one mark for each identified antecedent, behaviour and consequence (3 marks) and one mark for proposing how Alexandra could stop her puppy from stealing toys using an alternative form of punishment.
Step 3: Identify the antecedent (what happens before), behaviour (what happens) and consequence (what happens after).	Antecedent: Presence of a toy (1 mark) Behaviour: Puppy steals the toy (1 mark) Consequence: Being sprayed with water (a positive punishment that decreases the likelihood of the behaviour occurring again) (1 mark)
Step 4: Consider what you want the outcome of the new consequence to be and how this can be achieved.	Alexandra wants to stop (decrease) her puppy from stealing toys (behaviour). She initially used positive punishment by introducing an undesirable stimulus. The question asks for an alternative form of punishment, so she should use negative punishment instead by removing a positive stimulus.
Step 5: Provide a negative punishment that could decrease the likelihood of the puppy stealing toys.	Alexandra could use negative punishment by ignoring the puppy (the removal of attention) every time he steals a toy to decrease the likelihood of the puppy stealing toys. (1 mark)

## Comparing operant and classical conditioning

Both classical conditioning and operant conditioning are examples of behaviourist approaches to learning. This is because both types of learning involve a person or animal learning by interacting with their environment.

In classical conditioning, learning involves a NS and an UCS being repeatedly paired to form an association, which generates a CR to a CS.

In operant conditioning, learning involves associating a behaviour with a consequence that will either increase or decrease the likelihood of the behaviour occurring again. While many similarities exist between the two types of learning, there are also differences. The similarities and differences between the two types of learning are summarised in Table 2.

**TABLE 2** Similarities and differences between classical conditioning and operant conditioning

Similarities	Differences
<ul style="list-style-type: none"> <li>Both include a three-phase model (ABC in operant conditioning, before, during and after conditioning in classical conditioning).</li> <li>Both types are examples of behaviourist approaches to learning.</li> <li>Both involve the development of an association (NS with UCS in classical conditioning, behaviour and consequence in operant conditioning).</li> </ul>	<ul style="list-style-type: none"> <li>Classical conditioning is a form of passive learning, whereas operant conditioning is a form of active learning.</li> <li>Classical conditioning involves learning an involuntary behaviour, whereas operant conditioning involves learning a voluntary behaviour.</li> <li>There is a consequence in operant conditioning, whereas there is no type of consequence in classical conditioning.</li> </ul>

### 4.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Explain why operant conditioning is considered a behaviourist approach to learning.
- 2 Describe each phase of the three-phase model of operant conditioning.
- 3 Define “reinforcement”.
- 4 Define “punishment”.

#### Apply, analyse and compare

- 5 Using examples, compare positive punishment and negative punishment.
- 6 Using examples, compare positive reinforcement and negative reinforcement.
- 7 Identify the antecedent, behaviour and consequence in each example. Justify each answer.

- a Every time Jonah tells a joke in class, all his friends laugh.
- b Lynna puts her son in time-out every time he misbehaves.
- c Carin has her phone taken away when she does not complete her chores.

#### Design and discuss

- 8 Discuss the similarities and differences between classical and operant conditioning.
- 9 Mariko is trying to encourage her daughter to brush her teeth. Outline how Mariko could achieve this by using the three-phase model of operant conditioning and reinforcement.

# 4.4

## Observational learning

### KEY IDEAS

- Observational learning is a social-cognitive approach to learning in which learning occurs by watching the behaviours of others and the consequences of those behaviours.
- Observational learning occurs over five stages: attention, retention, reproduction, motivation and reinforcement. Each of these stages is important for meaningful learning to occur.



### observational learning

a type of learning that occurs by observing and imitating the behaviours of others



Video  
Observational learning

In behaviourist approaches to learning (e.g. classical conditioning and operant conditioning), learning is said to occur in response to an individual's first-hand experiences with their environment. However, not everything we learn requires us to directly interact with or experience something first hand. **Observational learning** is a type of learning in which behaviours are learnt by watching the actions of someone or something else, known as a model.

Imagine you wanted to give yourself a basic haircut at home. The first thing you might do is watch a tutorial on hair cutting. If the method in the tutorial led to a good haircut, you might replicate the method or parts of it at home. If the method led to a bad haircut, you may choose not to follow that tutorial, watch another tutorial, or avoid cutting your hair altogether. In this example, learning has occurred from:

- observing the model (the person in the tutorial) and their behaviour
- assessing the outcome of the behaviour (whether the haircut looks good or not)
- determining whether it would be beneficial to replicate or avoid the observed behaviour.



**FIGURE 1** Watching a tutorial of a person cutting their hair before you cut your own hair is an example of observational learning.

Observational learning occurs throughout a person's life but is most frequent during childhood. There is a "social" element to observational learning because individuals socially watch and are influenced by the actions of others in their environment. There is also a "cognitive" element to observational learning because individuals must pay attention to behaviours, assess the consequences of the behaviours observed and retain enough information about the behaviour to replicate it themselves. This is why observational learning is considered to be a social-cognitive approach to learning rather than a behaviourist approach to learning.



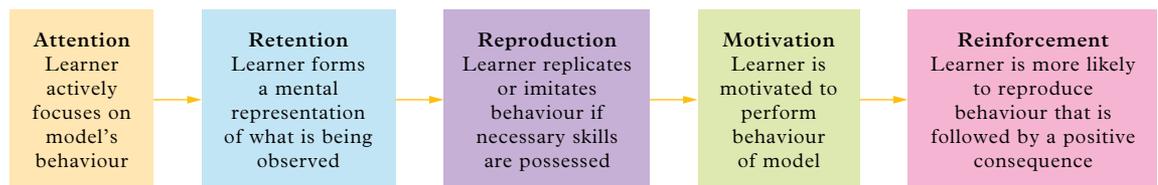
**FIGURE 2** A child trying to copy how their parent dresses after watching them get dressed is an example of observational learning.

### Study tip

The acronym **ARRMR** is a helpful way to recall the five stages of observational learning.

## Stages of observational learning

There are five key stages of observational learning: attention, retention, reproduction, motivation and reinforcement (Figure 3). These stages allow us to understand if an observed behaviour is worth repeating and the factors that may lead to us imitating or reproducing the behaviour.



**FIGURE 3** The five stages of observational learning

### Attention

**attention** the stage of observational learning in which the learner actively watches the behaviour of a model

**Attention** is the first stage of observational learning. In this stage, the learner must closely watch or actively pay attention to the model's behaviours and the consequences. How the learner perceives the model can influence whether they choose to actively focus on the model or not. For example, learners are more likely to focus on models who possess the following characteristics:

- attractiveness
- high status or popularity
- similar attributes to themselves or familiar attributes (e.g. a parent, person of similar age)
- knowledge or expertise in an area.

Sportspeople are often regarded as models to children who aspire to be like their sporting idols.



**FIGURE 4** Sports stars, like Australian Open Champion Ash Barty, are often regarded as models to children and individuals who aspire to be like their sporting idols.

## Retention

**Retention** is the second stage of observational learning. In this stage, the learner stores a mental representation of the observed behaviour. The learner must remember what they have observed and be able to recall it later. The stronger or more meaningful the mental representation, the more likely it is to be reproduced by the learner later.

## Reproduction

**Reproduction** is the third stage of observational learning. In this stage, the learner imitates or replicates the behaviour they have observed from what they have retained in their memory. The behaviour can only be reproduced if the learner has the necessary skills (including both mental and physical capabilities) to do so. For example, it does not matter how much professional tennis a person watches, they will not be able to reproduce the behaviour of serving an ace unless they have a similar skill level.

## Motivation

**Motivation** is the fourth stage of observational learning. In this stage, the learner must be incentivised (motivated) to reproduce a behaviour that has been observed. The learner's cognitive evaluation of the reinforcements or punishments the model receives is a key factor in determining whether they have a desire to reproduce the behaviour. Motivation can be either **intrinsic**, where it stems from a desire within us (e.g. wanting to improve a test result, or better a skill for our own benefit) or **extrinsic**, where it stems from external factors (e.g. wanting to gain praise from your friends or impress your parents).

### **retention**

the stage of observational learning in which the learner forms a mental representation of what is being observed

### **reproduction**

the stage of observational learning in which the learner imitates or replicates the behaviour they have observed from what they have retained in their memory

### **motivation**

the desire of the learner to reproduce the behaviour themselves; it is influenced by the type of consequence the model receives

### **intrinsic**

something that comes from within the individual, driven by internal motivations or interests

### **extrinsic**

something that comes from outside the individual; external factors or rewards that motivate behaviour

## 4.4 CHALLENGE

### Applying observational learning stages to different contexts

Eleni is a big fan of watching Olympic figure skating. She has watched Olympian Alina Zagitova's performance in the 2018 Olympics more than 70 times and can picture the steps of the routine off by heart. Eleni admires figure skaters for their athleticism, creativity and grace, and decides to take up figure skating lessons so that she can build these characteristics in herself. On her first skating lesson, Eleni decides to attempt a highly complex section of Zagitova's routine.

- 1 Identify two aspects of watching an Olympic figure skater that may have influenced Eleni to pay attention to Alina Zagitova and her routine.
- 2 Assess whether you believe Eleni's retention of the model's behaviour is strong. Justify your answer.
- 3 Assess whether you believe Eleni will be successful in her attempt to reproduce the model's behaviour. Justify your answer.
- 4 Is Eleni's motivation behind learning the behaviour intrinsic or extrinsic? Justify your answer.



**FIGURE 5** Champion figure skater Alina Zagitova at the 2018 Winter Olympics

## Reinforcement

Reinforcement is the fifth stage of observational learning. Similar to reinforcement in operant conditioning, in this stage the learnt behaviour is more likely to occur again when it results in a desirable or beneficial outcome. There are three different types of reinforcements that can encourage a behaviour to occur again.

**self-reinforcement**  
reinforcement that occurs from receiving intrinsic rewards following a behaviour

**external reinforcement**  
reinforcement that occurs from receiving rewards or positive consequences from the external environment following a particular behaviour

**vicarious reinforcement**  
reinforcement that occurs from observing another person's behaviour being reinforced

- **Self-reinforcement** occurs when internal factors such as how you feel or perceive yourself reinforce a behaviour. Feeling confident, accomplished, or proud of yourself after a behaviour are examples of self-reinforcement.
- **External reinforcement** occurs when other people or factors outside the individual reinforce a behaviour. Examples of external reinforcement are a parent giving you a gift, your friends complimenting you, getting praise from others, and an employer giving you a bonus.
- **Vicarious reinforcement** occurs when the learner is influenced by seeing someone else be reinforced for a behaviour. For example, if a child sees another child get a lolly for cleaning up after themselves, they may also want to clean up after themselves.

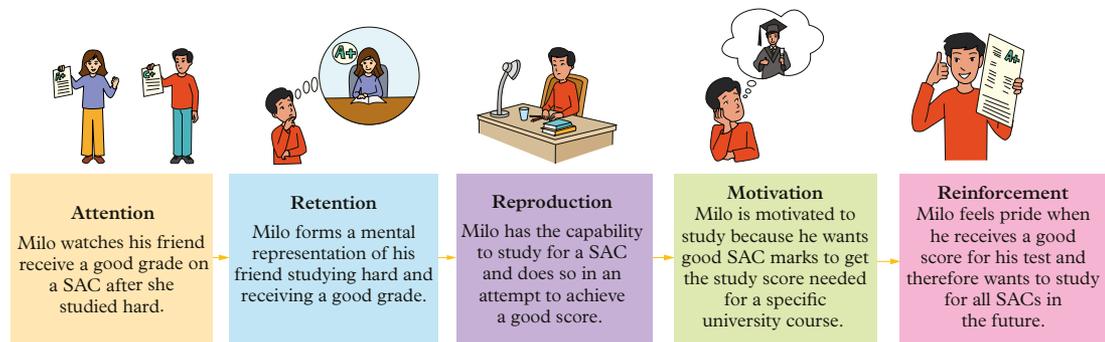


FIGURE 6 Example of observational learning in action

### Study tip

When describing each of the five stages of observational learning, it is important to use words that are not included in the name of the stage. For example, when describing reproduction, you should say that the learner “replicates” or “imitates” the observed behaviour rather than “reproduces” the behaviour.

## 4.4 REAL-WORLD PSYCHOLOGY

### Albert Bandura and social learning theory

In the 1960s, Canadian–American psychologist Albert Bandura and his colleagues conducted a series of observational learning experiments to examine how children learn in response to viewing aggressive and non-aggressive adult behaviour. In these experiments, now known as the “Bobo doll experiments”, 72 children viewed adults interacting differently with an inflatable plastic doll known as a Bobo doll.

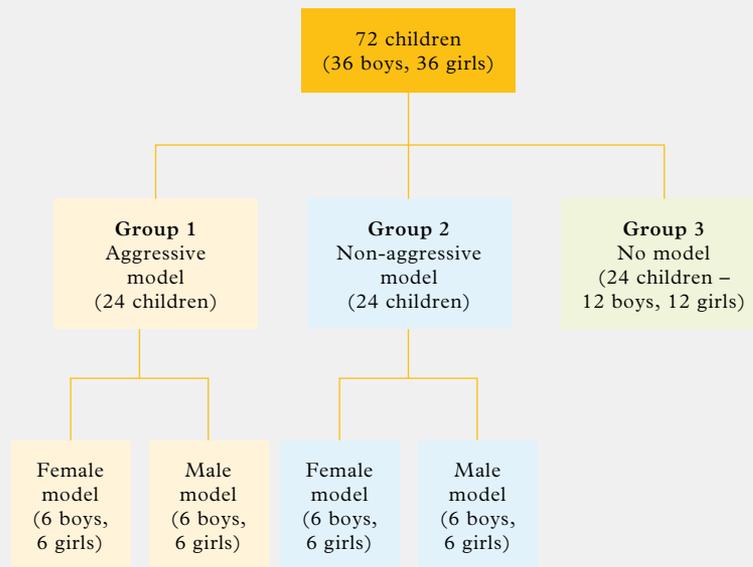
In the first Bobo doll experiment, Bandura investigated whether children would imitate the behaviour they observed in adults.

Children were placed into one of three groups:

- Group 1 – Aggressive model: children observed either a male or a female adult play aggressively with the Bobo doll (hitting the doll, throwing it around).
- Group 2 – Non-aggressive model: children observed either a male or a female adult play non-aggressively with the Bobo doll.
- Group 3 – No model: children observed no one playing or interacting with the Bobo doll (control group).



FIGURE 7 A Bobo doll is a large inflatable toy about 1.5 metres tall that is designed to spring back after being hit.



**FIGURE 8** Experimental conditions and allocation of participants in the original Bobo doll experiment

In the second stage of the experiment, each child was separately taken to a room that contained a variety of toys. The experimenter subjected each child to “mild aggression arousal” by telling them that the toys were reserved for other children. Each child was then left alone in the room and observed for 20 minutes through a one-way mirror. The experimenter recorded each child’s behaviour at five-second intervals.

Results showed that:

- children who observed an adult being aggressive engaged in more aggressive behaviour when they played with the doll themselves
- children who watched the adult being non-aggressive engaged in less aggressive behaviour when playing with the doll themselves
- boys were more likely than girls to copy the behaviour of same-sex models
- boys copied more physically aggressive acts than girls.

Bandura concluded from the results that children can learn aggressive behaviour through watching the behaviour of others.

### Apply your understanding

- 1 What was the purpose of the control group in Bandura’s experiment?
- 2 The experimenter tested and observed the responses of each child separately and away from other children. Explain why this action is important for keeping results valid.
- 3 Discuss the implications of Bandura’s research findings in reference to the context of young children playing violent video games or watching violent movies.
- 4 Bandura conducted the first set of Bobo doll experiments during the late 1960s when traditional gender roles were commonplace (e.g. women often being homemakers with expectations to be “gentle” and “elegant”, men often being breadwinners with expectations to be more “dominant” and “physical”). Discuss whether the era in which the experiment was conducted could have influenced some of the results observed and whether you would expect to see similar or different results today.



## 4.5

# Aboriginal and Torres Strait Islander ways of knowing

## KEY IDEAS



- ✦ Aboriginal and Torres Strait Islander peoples' ways of knowing are often holistic, in which complex concepts are viewed as one whole and best understood through the interconnection of elements rather than the separation of elements.
- ✦ Aboriginal and Torres Strait Islander peoples' systems of knowledge are multimodal. This means a variety of methods can be used to build or connect to knowledge.

## Context behind learning in Australia

Throughout this chapter, you have looked at behaviourist and social-cognitive approaches to understand learning. These approaches to understanding how learning occurs have described mental processes and practices used through a Western knowledge perspective. A Western approach to learning often centralises humans as having greater significance than other creatures or elements and often views knowledge as an object or a tool to be used for our benefit.

Subsequently, through a Western perspective, we might view the process of how a behaviour is learnt and how it affects the individual as the most critical components of learning and knowing. Western knowledge also tends to be **reductive**, which means that complex ideas and constructs are broken down into smaller parts.

It is important to recognise that there is no single way of learning and knowing. Although Western approaches to learning can help you understand how and why you learn things in simple terms, such approaches can also place limits or boundaries on what it means to “know” something. As mentioned in Topic 4.1, there are many other approaches to learning, including holistic approaches that situate the learner within a system of knowledge. In this topic, we will explore **Aboriginal and Torres Strait Islander ways of knowing**. To better understand Aboriginal and Torres Strait Islander ways of knowing, it is important to understand some of the history experienced by Aboriginal and Torres Strait Islander peoples and communities in Australia, and the significance of valuing trust and practising respect and cultural humility when learning from other cultures.

## Valuing trust and practising respect

Throughout history, Western perspectives have failed to respect or acknowledge the complexity of other cultural understandings. For example, from the 1910s to the 1970s, the Australian Government's misbelief that Western knowledge was superior to Aboriginal and Torres Strait Islander knowledges instigated a forceable removal of thousands of Aboriginal and Torres Strait Islander children from their families. We now acknowledge these individuals as the **Stolen Generation**. This violation of human rights drove a rift of mistrust between many Aboriginal and Torres Strait Islander communities and the Australian Government, which, for many, will continue to take time to heal.

Although the racist policy was overturned in the 1970s, its effects still contribute to many of the major inequities experienced by Aboriginal and Torres Strait Islander peoples today. For example, Aboriginal and Torres Strait Islander children are currently 9.7 times more likely than non-Indigenous children to be living away from their families.

### reductive

a process that simplifies concepts, ideas or systems into smaller parts or components

### Aboriginal and Torres Strait Islander ways of knowing

the unique and diverse knowledge systems, beliefs, practices and cultural traditions of Aboriginal and Torres Strait Islander peoples

### Stolen Generation

Aboriginal and Torres Strait Islander people who were forcibly removed from their families and communities by government authorities and placed into institutional care or adopted by non-Indigenous families

Trust is often a central part of knowledge sharing in Aboriginal and Torres Strait Islander cultures and re-establishment of trust between Indigenous and non-Indigenous Australians relies on respect. When learning about Aboriginal and Torres Strait Islander peoples' ways of knowing, it is important that the significance of being entrusted with knowledges from diverse individuals and communities is respected and that knowledge is not **misappropriated**.

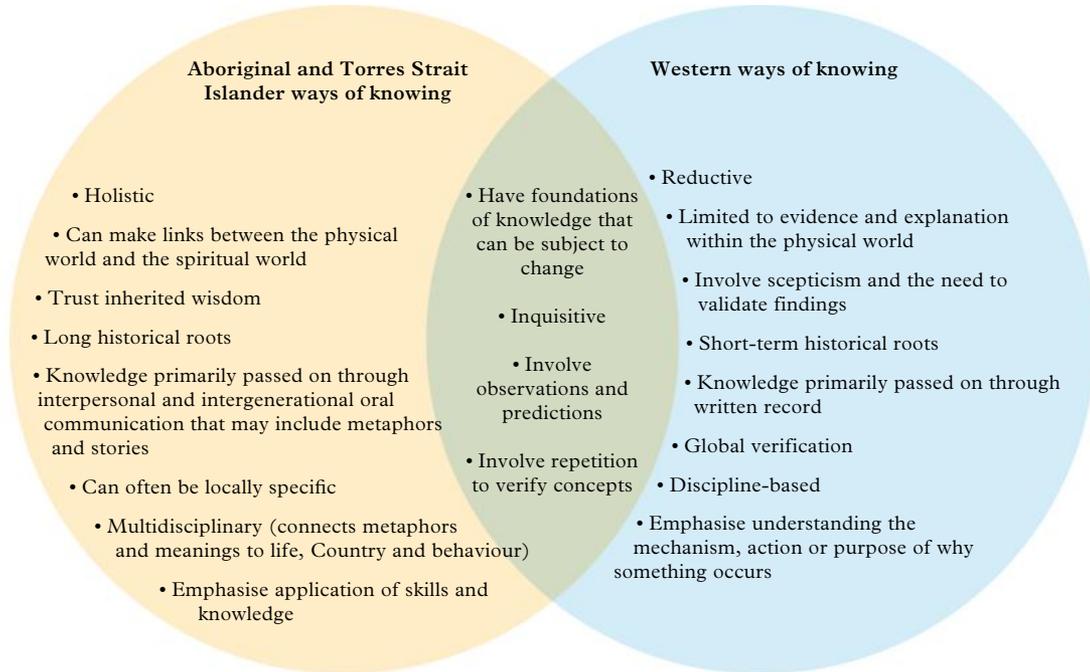
There are both commonalities and differences between Aboriginal and Torres Strait Islander ways of knowing and Western ways of knowing. Respecting, learning from and allowing Aboriginal and Torres Strait Islander ways of knowing to thrive can help contribute to reconciliation.

**misappropriate**

taking something that does not belong to you for personal gain

**Study tip**

"Aboriginal and Torres Strait Islander peoples" is a collective term that includes all communities of Aboriginal and Torres Strait Islander peoples in Australia. What is true for one culture or individual may not reflect another's experience. For more information on cultural awareness in relation to Aboriginal and Torres Strait Islander knowledges, see Topic 1.11 in your Psychology toolkit.



**FIGURE 1** Similarities and differences between Aboriginal and Torres Strait Islander ways of knowing and Western ways of knowing

## Aboriginal and Torres Strait Islander ways of knowing

Aboriginal and Torres Strait Islander communities have passed on and continue to pass on diverse traditions, understandings and knowledges through a variety of practices. Unlike Western ways of knowing, which tend to be reductive, Aboriginal and Torres Strait Islander ways of knowing are often holistic. This is when complex concepts are interpreted as a whole and best understood through the interconnection of elements. For example, to many Aboriginal peoples, Country is not only the physical area of the traditional lands of a cultural or language group but also the spiritual, living, emotional and intellectual connections tied to that land.

Rather than viewing knowledge as the information a learner acquires from their interactions, Aboriginal and Torres Strait Islander ways of knowing tend to view the learner as part of a **system of knowledge**. This means knowledge encompasses interactions, observations, beliefs and understandings that are connected to a culture and that help that culture thrive. The Australian Institute of Aboriginal and Torres Strait Islander Studies has

**system of knowledge**

a structured and interconnected framework for understanding

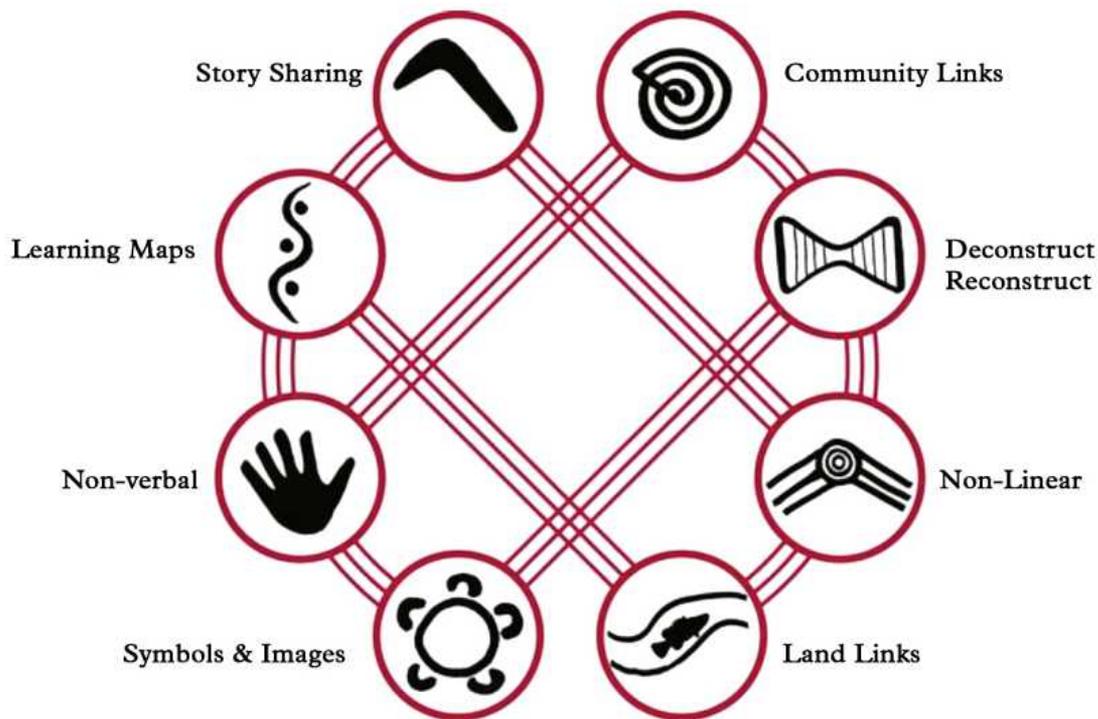
determined that there are approximately 250 different Indigenous language groups and more than 800 different dialects. Each language group’s own connection to Country will give rise to unique systems of knowledge. Therefore, it can be said that systems of knowledge are patterned (created) on Country.

## The 8 Ways of Learning framework

Aboriginal and Torres Strait Islander peoples’ systems of knowledge are **multimodal**. This means a variety of methods can be used to build or connect to knowledge. In 2009, James Cook University’s School of Indigenous Studies, the Western New South Wales Regional Aboriginal Education Team and the New South Wales Department of Education developed a framework for understanding Aboriginal learning processes. Although there are many methods through which learning can take place, this framework, called the **8 Ways of Learning**, describes eight ways through which learning can occur and how each way connects to the others (Figure 3).



**FIGURE 2** The Urban Zendath Kes dance group performing at Yabun Festival



**FIGURE 3** The 8 Ways of Learning framework is a way of understanding Aboriginal knowledge perspectives.

**multimodal**  
using many modes or forms of communication, representation and expression

**8 Ways of Learning**  
a framework to help understand and incorporate Aboriginal knowledge perspectives through Aboriginal learning processes

### Story Sharing

Learning through **Story Sharing** involves approaching learning through narrative. Examples of Story Sharing include distributing information through oral practices such as yarning (see Topic 1.11), conversations and Songlines (see Topic 5.4). Story Sharing helps build connections between people, adds meaning to culture, recognises the significance of a place and helps to consolidate memory and learning and ensures the continuance of culture.

**Story Sharing**  
approaching learning through narrative; one of the eight ways of learning in the 8 Ways of Learning framework



**FIGURE 4** Story Sharing can occur through oral practices such as yarning, conversations and Songlines.

**Learning Maps** approaching learning through explicitly mapping/visualising processes; one of the eight ways of learning in the 8 Ways of Learning framework

**Non-verbal** applying intrapersonal and kinaesthetic skills to thinking and learning; one of the eight ways of learning in the 8 Ways of Learning framework

**Symbols and Images** using images and metaphors to understand concepts and content; one of the eight ways of learning in the 8 Ways of Learning framework

## Learning Maps

Learning through **Learning Maps** involves explicitly mapping and visualising processes and ideas. This type of learning helps individuals plan or organise information by picturing knowledge pathways that can be followed. For example, planning out a run by visualising what you'd like to see on the way and mentally picturing the order in which you'd see landmarks and the turns you'd need to take.

## Non-verbal

Learning through **Non-verbal** actions involves using movement to share, connect to or express knowledge. For example, creating art, dancing and observing nature are all methods in which knowledge can be shared and acquired non-verbally.



**FIGURE 5** Dancers at Sydney's Homeground Festival

## Symbols and Images

Learning through **Symbols and Images** involves using pictures and metaphors to help understand concepts and content. This includes creating meaningful or representative drawings, paintings, icons and metaphorical examples. This type of learning helps inspire creativity, consolidates understanding and establishes deeper meaning through visual and metaphorical representations. For example, Figure 6 shows ancient rock art created by Mowanjum people from the Kimberley region in Western Australia. The central character painted is a Wandjina, a sacred and supreme creator that governs weather and fertility. Wandjinas often have large eyes (like the eye of a storm) and headdresses that indicate different types of storms (Wroth, 2022).



**FIGURE 6** A Wandjina rock art figure in the Kimberley region. Wandjinas are painted by the Ngarinyin, Worrora and Wunumbal peoples.

## Land Links

Learning through **Land Links** involves placed-based learning where ideas and concepts can be linked to an area or Country. This type of learning helps identify, establish, and draw from connections that exist within an area. Land Links are particularly important in Songlines, which you will learn more about in Topic 5.4.

## Non-linear

Learning through **Non-linear** practices involves innovatively understanding ideas by thinking laterally or combining systems. This type of learning helps create new knowledge and combine ideas to form bigger, more encompassing understanding of something.

## Deconstruct/Reconstruct

Learning through **Deconstruct/Reconstruct** involves looking at a concept as whole before breaking it down into parts to study in detail. This type of learning is often referred to as “watch then learn” and encourages learners to first see the entirety of a process or concept so they can then better understand the details of that concept and the purpose each component has in the greater scheme of things.

## Community Links

Learning through **Community Links** involves a learner centring local viewpoints and applying learning to benefit their mob or community. This type of learning allows the learner to connect their community to local knowledge and viewpoints and provides the learner with a sense of purpose.

### Land Links

place-based learning, linking content to local land and place; one of the eight ways of learning in the 8 Ways of Learning framework

### Non-linear

producing innovations and understanding by thinking laterally; one of the eight ways of learning in the 8 Ways of Learning framework

### Deconstruct/Reconstruct

approaching learning through modelling and scaffolding, working from wholes to parts; begin with the whole structure, rather than a series of sequenced steps; one of the eight ways of learning in the 8 Ways of Learning framework

### Community Links

centring local viewpoints, applying learning for community benefit; one of the eight ways of learning in the 8 Ways of Learning framework

## 4.5 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe “reductive” in relation to Western approaches to knowledge.
- 2 “Aboriginal and Torres Strait Islander ways of knowing are often holistic.” Explain what this means.
- 3 Provide an example of how Story Sharing as a method of learning could be used in a classroom setting.

### Apply, analyse and compare

- 4 Analyse how the eight ways of learning in the Aboriginal and Torres Strait Islander framework reflect a holistic view of knowledge and learning.

### Design and discuss

- 5 Discuss why the “Deconstruct/Reconstruct” method of learning might be more effective for understanding complex topics than a purely linear method.
- 6 Design a revision lesson for a topic in this chapter that integrates both Western and Aboriginal and Torres Strait Islander ways of knowing. Discuss which elements you have included and why.

## Chapter summary

- 4.1** • Learning is a relatively permanent change in behaviour or knowledge in response to experience.
- There are different approaches to learning, including behaviourist approaches, social-cognitive approaches and approaches to learning that view knowledge as one interconnected system that a learner is situated in.
- 4.2** • Classical conditioning is an approach to learning where an individual forms an association between two stimuli to produce a learnt response.
- Classical conditioning includes three phases: before conditioning, during conditioning and after conditioning.
- The key elements used to describe classical conditioning include neutral stimulus (NS), unconditioned stimulus (UCS), unconditioned response (UCR), conditioned stimulus (CS) and conditioned response (CR).
- 4.3** • Operant conditioning is a behaviourist approach to learning where an individual learns through associating a behaviour with a consequence.
- Operant conditioning consists of three phases: antecedent, behaviour and consequence.
- Two types of reinforcements are used to increase the likelihood of a behaviour occurring again: positive reinforcement and negative reinforcement.
- Two types of punishments are used to decrease the likelihood of a behaviour occurring again: positive punishment and negative punishment.
- 4.4** • Observational learning is a social-cognitive approach to learning in which learning occurs by watching the behaviours of others and the consequences of those behaviours.
- Observational learning occurs over five stages: attention, retention, reproduction, motivation and reinforcement. Each of these stages is important for meaningful learning to occur.
- 4.5** • Aboriginal and Torres Strait Islander peoples' ways of knowing are often holistic: complex concepts are viewed as one whole and best understood through the interconnection of elements rather than the separation of elements.
- Aboriginal and Torres Strait Islander peoples' systems of knowledge are multimodal. This means a variety of methods can be used to build or connect to knowledge.

## Revision questions

### Multiple choice

- The two types of behaviourist approaches to learning are:
  - classical conditioning and observational learning.
  - operant conditioning and classical conditioning.
  - association and consequences.
  - observational learning and consequences.
- In classical conditioning, acquisition of a learnt response occurs when the:
  - neutral stimulus becomes associated with the unconditioned stimulus to elicit a response.
  - neutral stimulus elicits an unconditioned reflexive response.
  - conditioned response has become the unconditioned response.
  - conditioned response only occurs in response to a conditioned stimulus.
- Sam's teacher gives out lollies at the end of every lesson. Sam and his classmates all salivate when receiving the lolly. Sam now finds himself salivating at the end of every lesson.
 

In terms of classical conditioning, the conditioned stimulus in this scenario is:

  - salivating in response to a lolly.
  - salivating in response to the end of the lesson.
  - the lolly the teacher hands out.
  - the end of a lesson.
- On her way to school, Maddison walks past a dog that barks. The barking causes Maddison to jump and become startled.
 

In terms of the three phases of classical conditioning, Maddison is demonstrating that she is in the third phase when:

  - she jumps and becomes startled when the dog barks.
  - she jumps and becomes startled when walking past the house.
  - the dog barking is associated with the house she walks past.

**D** the dog barking and the house paired together cause her to jump and become startled.

- Which of the following best describes operant conditioning?
  - Learnt behaviour will be repeated after consequences.
  - Learnt behaviour will not be repeated after consequences.
  - Learnt behaviour is less likely to be repeated when a positive consequence is given.
  - Learnt behaviour is more likely to be repeated when a positive consequence is given.
- Phuong has learnt to tidy her room to avoid her mum nagging her to clean it.
 

Which of the following, according to the three-phase model of operant conditioning, would be the antecedent?

  - Cleaning her room
  - Her mum nagging her
  - Her room being messy
  - Receiving pocket money for cleaning her room
- A positive punishment is the:
  - addition of a positive stimulus.
  - addition of a negative stimulus.
  - removal of a positive stimulus.
  - removal of a negative stimulus.
- Which of the following is a difference between classical and operant conditioning?

	Classical conditioning	Operant conditioning
<b>A</b>	Stimulus follows the behaviour.	Stimulus precedes the behaviour.
<b>B</b>	Responses are voluntary.	Responses are involuntary.
<b>C</b>	Association between two stimuli produces the learnt behaviour.	Association between behaviour and consequence produces the learnt behaviour.
<b>D</b>	Behaviourist approach to learning	Extinction sometimes occurs: social-cognitive approach to learning.

- 9 Aben respects the community work his parents do because he sees the positive impact it has on the lives of others. Recently he has been volunteering his time at homeless shelters.

Which of the following identifies the stage of observational learning Aben is in and a reason?

	Stage of observational learning	Reason
A	Reproduction	Aben imitates his parents' behaviour because he admires them.
B	Retention	Aben is able to remember where homeless shelters are and who needs the most help.
C	Motivation	Aben has a desire to perform volunteer work because of the intrinsic reward it provides.
D	Attention	Aben actively watches his parents praise him for his volunteer work.

- 10 Which of the following best describes the primary difference between Western ways of knowing and Aboriginal and Torres Strait Islander ways of knowing?
- A Western ways of knowing prioritise community links, whereas Aboriginal and Torres Strait Islander ways of knowing prioritise individual learning.
- B Western ways of knowing are often reductive, whereas Aboriginal and Torres Strait Islander peoples' ways of knowing are often holistic, viewing the learner as part of a system of knowledge.
- C Aboriginal and Torres Strait Islander ways of knowing are reductive, whereas Western ways of knowing view complex ideas as one whole.
- D Western ways of knowing do not believe in the use of visual aids such as learning maps, whereas Aboriginal and Torres Strait Islander ways of knowing exclusively use visual aids as the primary method of knowledge sharing.

### Short answer

#### Describe and explain

- 11 Explain why classical conditioning and operant conditioning are considered to be behaviourist processes of learning.
- 12 Describe the three-phase process of classical conditioning and how it results in learning.
- 13 Explain the significance of the relationship between behaviours and consequences in operant conditioning.
- 14 In terms of operant conditioning, explain how negative reinforcement leads to a behaviour occurring again.
- 15 Explain the importance of associating two stimuli in classical conditioning.
- 16 Define "acquisition" in classical conditioning and in operant conditioning.
- 17 Name and describe the stage of observational learning that involves the learner actively focusing on a model.
- 18 Using the language of observational learning, outline the importance of memory to whether a behaviour is learnt.
- 19 Identify three ways of knowing that form part of the 8 Ways of Learning framework and explain how each could be used to enhance understanding of a concept from Topic 4.3.

#### Apply, analyse and compare

- 20 Coen has trained his pet bird to fly back into his cage at the sound of a whistle by rewarding his bird with a treat. According to the three-phase model of operant conditioning, how has the bird learnt this behaviour?
- 21 In terms of operant conditioning, compare the effects of reinforcement and punishment on future behaviour.
- 22 Compare the experimental design used in Pavlov's classical conditioning experiment with the experimental design used in Skinner's operant conditioning experiment.
- 23 With reference to the stages of observational learning, explain why children copy the behaviour of their parents.

- 24 Provide two reasons why observational learning and operant conditioning are similar.
- 25 Marli used an electric fence to teach her cows not to push down the fence and escape. Name the antecedent, behaviour and consequence in this scenario.
- 26 Ash has been watching the FIFA Women's World Cup to learn how to play soccer. Despite many attempts, Ash cannot perform a bicycle kick like her idol Sam Kerr. With reference to the stages of observational learning, outline why Ash cannot perform a bicycle kick.
- 27 Compare behaviourist and social-cognitive approaches to learning with approaches to learning that place the learner within a system.
- Design and discuss**
- 28 "Children learning through observing their parents can lead to both positive and negative behaviours in the children." Evaluate this statement.
- 29 "Aboriginal and Torres Strait Islander ways of knowing are reductive." Evaluate this statement.
- 30 Discuss the ethical guidelines that must be followed in experiments that involve children, such as Albert Bandura's Bobo doll experiment.
- 31 Design an experiment that would allow a teacher to use the principles of operant conditioning to improve the attendance rate of her students.
- 32 Discuss the process of learning that led to the following behaviours.
- a Flora wants to watch the same Netflix shows as her sister because she saw how much enjoyment her sister got from them.
  - b Peng has learnt that his mother will say yes to him having a chocolate when she is on the phone and does not want to be disturbed.
  - c Zach does not like maths because his Grade 3 maths teacher used to yell and make him scared.
- 33 Using the three-phase model of classical conditioning, suggest a method to investigate how to stop a child from being frightened when getting a vaccine.
- 34 Discuss a real-world scenario where the Land Links method of learning could be applied. Explain how this method could benefit the learner.

You can find the following resources for this section in your [eBook pro](#):

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

5

# The psychobiological process of memory

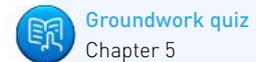
## KEY KNOWLEDGE

- the explanatory power of the Atkinson–Shiffrin multi-store model of memory in the encoding, storage and retrieval of stored information in sensory, short-term and long-term memory stores
- the roles of the hippocampus, amygdala, neocortex, basal ganglia and cerebellum in long-term implicit and explicit memories
- the role of episodic and semantic memory in retrieving autobiographical events and in constructing possible imagined futures, including evidence from brain imaging and post-mortem studies of brain lesions in people with Alzheimer’s disease and aphantasia as an example of individual differences in the experience of mental imagery
- the use of mnemonics (acronyms, acrostics and the method of loci) by written cultures to increase the encoding, storage and retrieval of information as compared with the use of mnemonics such as sung narrative used by oral cultures, including Aboriginal peoples’ use of Songlines.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## GROUNDWORK

This chapter will build on concepts you will have come across in Chapter 3 and Chapter 4. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.

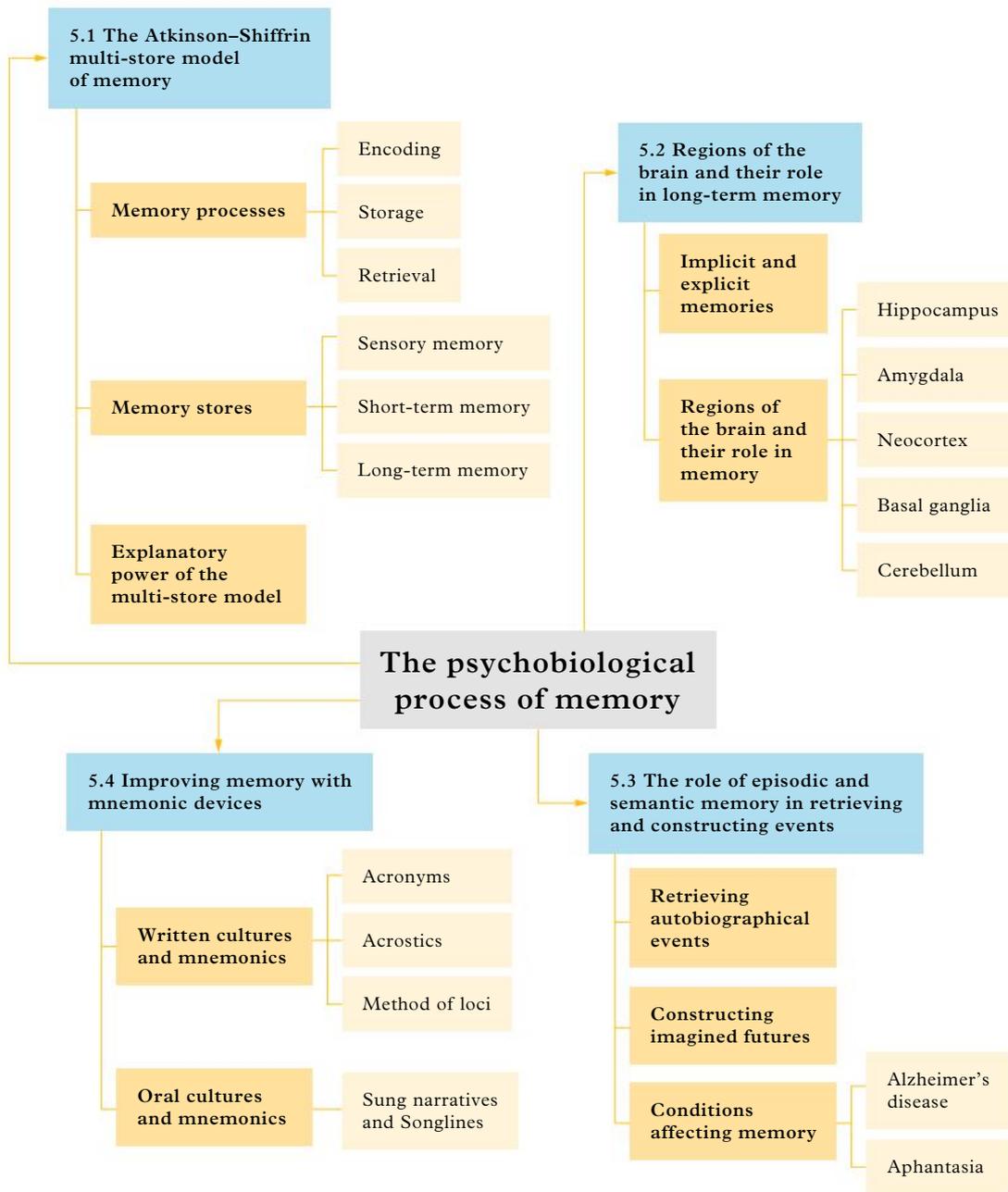


## INVESTIGATIONS

5.4A	INVESTIGATION: CONTROLLED EXPERIMENT	Can the method of loci improve memorisation of visual information?	Page 479
5.4B	INVESTIGATION: CASE STUDY	How does Aboriginal peoples’ use of Songlines improve memory?	Page 481

**FIGURE 1** Unlike photographs that always show the same information, our memory of events may strengthen, weaken, change or even get lost completely over time.

## CONCEPT MAP



\* **CONTENT WARNING:** Aboriginal and Torres Strait Islander people are advised that this chapter contains names and images of people who are now deceased.

# 5.1

## The Atkinson–Shiffrin multi-store model of memory

### KEY IDEAS



- ✦ Atkinson–Shiffrin’s multi-store model of memory consists of unique memory stores that operate together in the processes of encoding, storing and retrieving information.
- ✦ Encoding involves transferring information into a usable form that can be worked with and stored, storage involves the maintenance of information, and retrieval involves accessing and recovering stored information.
- ✦ Sensory memory is a temporary store for raw, sensory information that, if attended to, can be transferred to short-term memory.
- ✦ Short-term memory is a store for information that has been attended to in sensory memory and information that has been retrieved from long-term memory. When information is held in short-term memory, it can be used and manipulated.
- ✦ Long-term memory is a relatively permanent store of information that has been encoded from short-term memory.
- ✦ Despite its explanatory power, the Atkinson–Shiffrin multi-store model of memory is not without limitations. The model has both strengths and weaknesses.

Have you ever forgotten where you put your phone or keys down, but once you thought about it you remembered the exact location? Or wondered why you can sing all the lyrics to your current favourite song but forget the lyrics and song names of music you no longer listen to? **Memory** is the psychobiological process of receiving, encoding, storing and retrieving information. Essentially, memory is how our mind gains, retains and accesses information to help us navigate through the world. Every thought, conversation and conscious action we make would not be possible without memory.

In this topic, we will examine the Atkinson–Shiffrin multi-store model of memory. We will also explore the explanatory power of this model; that is, how effectively the model describes the process of memory.

### memory

the processes of receiving, encoding, storing and retrieving information

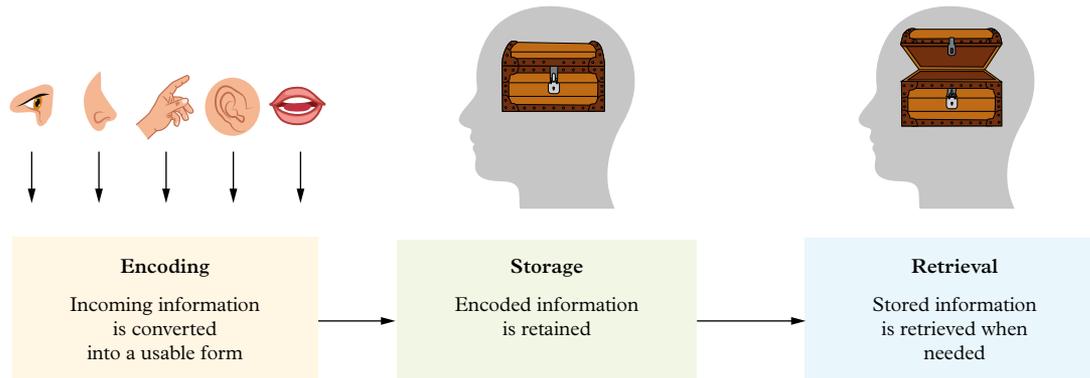
**FIGURE 1** Many people struggle to remember where they put items such as keys, wallets, phones, headphones and sunglasses.



# Memory processes

American psychologists Richard Atkinson and Richard Shiffrin (1968) were two of the first researchers to propose a model of how memory is organised. Their model, known as the **multi-store model of memory**, proposed that human memory consists of different stores of information that work together through the interaction of three key processes, which are: encoding, storage and retrieval.

**multi-store model of memory**  
a model that suggests that memory consists of sensory, short-term and long-term memory, which work together to encode, store and retrieve information



**FIGURE 2** The processes involved in memory

## Encoding

**Encoding** is the first process involved in memory. When sensory information is encoded, it is converted from a source into a usable form that the brain can process and store. After we detect and receive sensory information from the external environment through our senses, the information needs to be changed into electrochemical energy so that the brain can work with, manipulate and give meaning to sensory information. Encoding ensures that incoming sensory information is converted into a usable form. After sensory information is converted into a usable form and given meaning, it can be stored for future use.

**encoding**  
the process of converting raw, sensory information into a form that can be processed by the brain

## Storage

**Storage** is the second process involved in memory. When encoded information is stored, it is retained in a **memory store**. Memory stores organise where specific types of information are held for lengths of time so information can be easily attended to or accessed when required.

**storage**  
the process of maintaining information in a memory store

## Retrieval

**Retrieval** is the final process involved in memory. When stored information is retrieved, it is accessed and recovered from where it was previously stored. The retrieval process allows us to use the information we have stored to complete goal-directed behaviours (e.g. complete a written test, make a cup of coffee, read a map).

**memory store**  
a site where information can be stored temporarily or permanently

**retrieval**  
the process of accessing and diverting information from long-term memory to short-term memory so it can be used and/or manipulated

## 5.1 SKILL DRILL

### Examining the limitations of a memory investigation

#### Key science skill: Develop aims and questions, formulate hypotheses and make predictions

Researchers were interested in investigating the effect of time on memory retrieval. The researchers recruited 100 participants from a local university and randomly allocated the participants into five groups of 20: A, B, C, D and E. All groups were required to watch a screen on which they were shown a sequence of 15 noun–adjective word pairs (e.g. chair–red, fence–loose). Each word pair was individually projected for 3 seconds. Each group of participants was given a different instruction about when they could start writing down as many word pairs as possible after the last noun–adjective pair was shown.

- Group A could write immediately after the presentation ended.

- Group B could write after 20 seconds.
- Group C could write after 40 seconds.
- Group D could write after 60 seconds.
- Group E could write after 80 seconds.

Results between groups were then compared.

#### Practise your skills

- 1 Identify the investigation design used by the researchers and suggest why this design was used instead of others.
- 2 Write a research hypothesis for this investigation.
- 3 Identify one limitation of this investigation design and suggest how the design could be improved to reduce the impact on the investigation.

Need help developing aims and questions and writing hypotheses? Go to Topic 1.2 in your Psychology toolkit.

## Memory stores

As the name implies, the Atkinson–Shiffrin multi-store model of memory suggests that human memory consists of more than one type of memory store. The model proposes that there are three different independent stores:

- sensory memory
- short-term memory
- long-term memory.

Each memory store has a specific function, **capacity** (the amount of information it can hold), and **duration** (the length of time it can hold information). The three memory stores work together to encode, store and retrieve information.

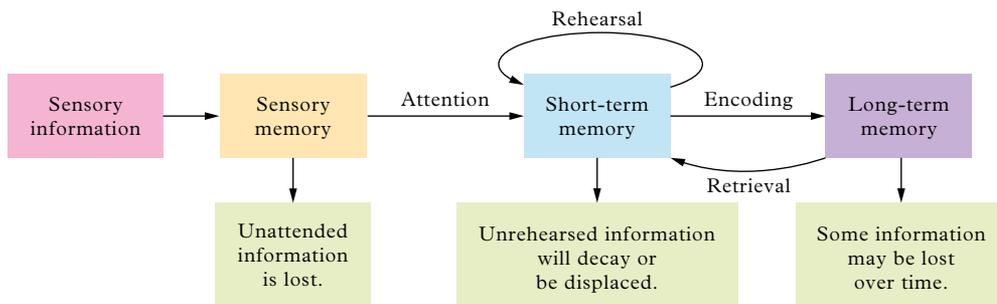


FIGURE 3 The Atkinson–Shiffrin multi-store model of memory

#### capacity

the number of items that a memory store can hold

#### duration

the length of time that items can be held in a memory store



#### Video

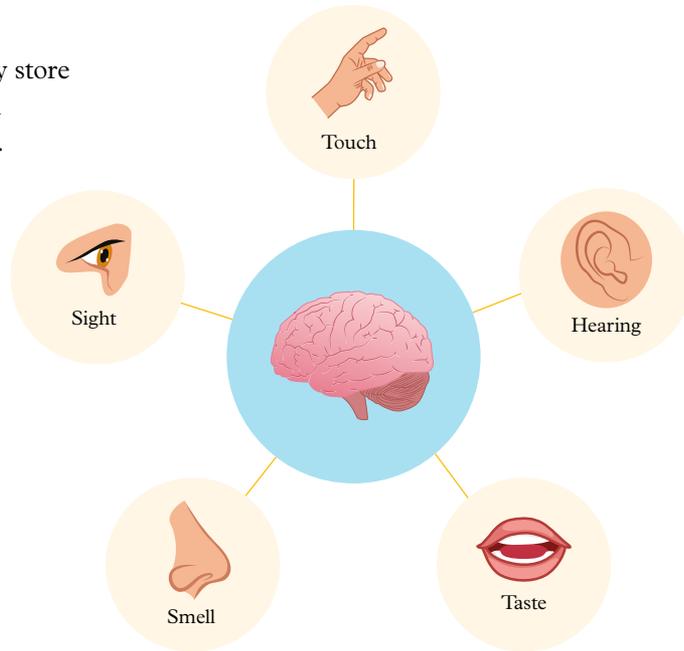
The multi-store model of memory

## Sensory memory

**Sensory memory** is the memory store for incoming sensory information we receive from our environment.

Every day we are exposed to an abundance of sensory information. For example, while swimming at the beach, you encounter all sorts of sensory stimuli, including the:

- vivid brightness of the ocean
- sensation of water on your skin
- distinct smell of the ocean
- taste of salt water
- sound of crashing waves and the calls of shorebirds.



**sensory memory** a memory store for incoming sensory information that is held for a short time (0.2 to 4 seconds)

**FIGURE 4** Sensory information is information from the environment that is detected by and received from our five senses.

At any one time, we can encounter a large amount of sensory input, so our brain uses a filtering process to prevent us from being overwhelmed with excess information. Without this filtering process, even simple tasks would become challenging due to information overload. Imagine trying to enjoy a swim with your friends while simultaneously focusing on the taste of salt water, the texture of a shell you step on, the loud calls of seagulls nearby, and every other sensory detail surrounding you.

By filtering out irrelevant or less important sensory information, our brain allows us to focus on the essential components of our experiences and carry out tasks effectively. Sensory memory acts as a temporary holding place and filter for sensory input, ensuring that only the most relevant and significant information is further processed and stored.

Sensory memory is made up of different memory stores that relate to specific senses (e.g. sight, sound, touch). **Iconic memory** refers to our visual sensory memory and is the part of sensory memory that allows us to process images and sights. Each time we move our eyes, our brain detects a new piece of visual sensory information (e.g. the colour of the ocean) and forms a “snapshot” of this information. These snapshots are sent to the primary visual cortex and held for a brief duration of time.



**FIGURE 5** Having fun at the beach with your friends would be difficult if you could not filter out all the sensory information you receive.

**iconic memory** a part of sensory memory where visual information can be held for 0.2 to 0.5 seconds

**echoic memory**

a part of sensory memory where auditory information can be held for a short time (3 to 4 seconds)

**Echoic memory** refers to our auditory sensory memory and is the part of sensory memory that allows us to process sounds. When our ears detect a piece of acoustic sensory information (e.g. the sound of waves crashing), they send this information to the primary auditory cortex where it is held briefly.

**Capacity and duration**

The amount of information that can be held in sensory memory (capacity) is thought to be unlimited. However, sensory memory can only retain information for a short time. It is considered a temporary store of information because information can only be held for 0.2 to 4 seconds. The duration of sensory memory varies between the different types of sensory memory (Table 1). If a piece of information held in our sensory memory is ignored or we don't pay attention to it, then it will be erased from the memory store. However, if a piece of sensory information is of interest and we focus our attention on it, then this piece of information will transfer into short-term memory.

**TABLE 1** Summary of iconic and echoic memory stores

Type of sensory memory	Properties		Type of information encoded	Forgetting	Example
	Capacity	Duration (s)			
Iconic memory	Unlimited	0.2 to 0.5	Visual	Fades rapidly	Seeing the after-image of a moving lit sparkler
Echoic memory	Unlimited	3 to 4	Auditory	Fades rapidly	Being able to recall the sound of the doorbell tone in your head shortly after you heard it ring

**Short-term memory**

**short-term memory**

a memory store that receives information from long-term and sensory memory stores and has a limited capacity of 5 to 9 items and a limited duration of 18 to 30 seconds

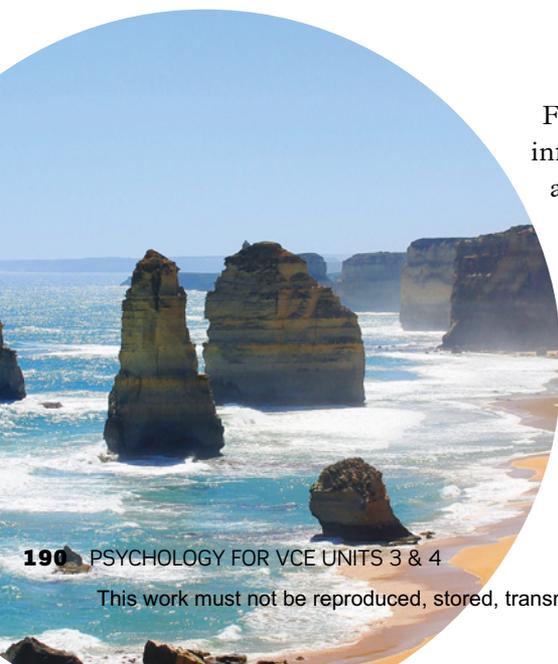
**Short-term memory** is the memory store for information that has been selected and attended to in sensory memory, as well as information that has been retrieved from long-term memory. Short-term memory is sometimes known as “working memory” because it allows us to actively manipulate and work with the information it holds to engage in goal-directed behaviours and responses.



**FIGURE 6** Short-term memory is a temporary store for information that has been attended to in sensory memory or retrieved from long-term memory.

For example, imagine you are walking past a captivating landscape (sensory information). If the view catches your eye and you consciously pay attention to an aspect of it, this information will transfer from your sensory memory to your short-term memory. As a result, you can hold on to and process this visual information for a longer time.

**FIGURE 7** If you were walking past the Twelve Apostles, many pieces of sensory information about the view would be sent to and held in your sensory memory. If you attend to a specific piece of information, such as which apostle is the smallest, then this information will transfer to short-term memory.



Similarly, consider a situation where someone asks you about the address of the first school you attended. In this case, the information about your first school is stored in your long-term memory. Following the question, this information is retrieved from long-term memory and brought to your short-term memory. Once the information is held in short-term memory, you can manipulate or work with it to respond to the person's question. In both instances, short-term memory serves as a temporary store, enabling us to hold and manipulate information from sensory memory and retrieve relevant information from long-term memory for immediate use.

Short-term memory also acts as a bridge for transferring sensory memory into long-term memory. For example, consider the landscape discussed earlier. If you continue to frequently visualise the landscape after it is transferred to your short-term memory, eventually the information will have been attended to so many times that it can be encoded into your long-term memory.

### Capacity and duration

Unlike sensory memory, short-term memory has a limited capacity. Only  $7 \pm 2$  items (5 to 9 items) can be attended to in short-term memory at one time. When short-term memory reaches capacity, it can only focus on a new item after it has pushed away or removed another item. This is called **displacement** – when a new item is added to short-term memory by replacing an older item. Displacement can make it hard for us to complete multiple tasks at once. For example, if you are reading the steps of a recipe and get interrupted by a phone call, you might forget some of the steps you just read because some items have been displaced with new information from your call.

Luckily, there are techniques we can use to maximise the capacity of our short-term memory. **Chunking** involves grouping small items together to form one larger piece of information. For example, when trying to remember the phone number 1-8-0-0-7-2-6-5-0-3, it is much easier to remember the whole phone number by grouping some numbers together and reading it as 1800-726-503. This is because our brain finds it easier to hold on to three large numbers (three items) in short-term memory than ten individual numbers (ten items).

For most people, items are held in short-term memory for 12 to 30 seconds. After this time, if an item has not been worked with or manipulated, it will be erased from the memory store and lost permanently. This process of information fading away is called **decay**. Items in short-term memory can avoid decay if they undergo **rehearsal** – conscious manipulation of an item so that it has an increased chance of being encoded into long-term memory.

Two common types of rehearsal that are used to help retain information in short-term memory and promote the encoding of information into long-term memory are **maintenance rehearsal** and **elaborative rehearsal**. Although you will not be assessed on these types of rehearsal on the exam, you may find them helpful for studying.



**FIGURE 8** Our short-term memory has a limited capacity of 5 to 9 items, which is why many people use shopping lists to remember all the groceries they need.

**displacement**  
when information held in short-term memory is pushed out and replaced by new, incoming information

**chunking**  
grouping or combining small units of information into one bigger piece of information to increase the likelihood of retaining information in short-term memory

**decay**  
the fading and removal of an item from a memory store due to inattention or lack of use

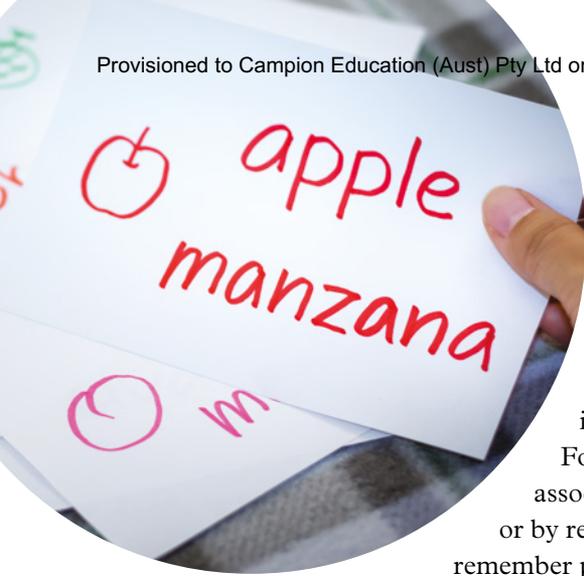
**rehearsal**  
a mental process of repeating and/or manipulating information in short-term memory to enhance the length of time it is held in short-term memory and to increase the likelihood of it being transferred to long-term memory

**maintenance rehearsal**  
repeating information over and over to help retain it in short-term memory and potentially increase the chance of it being encoded into long-term memory

**elaborative rehearsal**  
linking new information to existing information to increase the chance of it being encoded into long-term memory



**FIGURE 9** Credit card numbers are divided into four chunks of four digits because it is much easier to remember four large numbers than 16 individual digits.



**FIGURE 10** Using flash cards to revise involves frequently repeating information and is an example of maintenance rehearsal.

**long-term memory**  
a memory store for information that has been encoded from short-term memory and that has potentially unlimited capacity and duration

Maintenance rehearsal involves repeating information over and over to keep it in your attention. For example, repeating the definition of a word out loud when revising for a SAC. This type of rehearsal can also increase the chance of information being encoded into long-term memory, although it is not always necessary for encoding to occur.

Elaborative rehearsal is when meaning is added to a piece of information to connect it to other ideas or items held in long-term memory. For example, you could remember the definition of the word “chunking” by associating it with a similar term you already understand such as “grouping” or by relating the definition to an example from your own life (e.g. how you remember phone numbers).

## Long-term memory

**Long-term memory** is a relatively permanent memory store for information that has been rehearsed and encoded from short-term memory. Long-term memory acts in a similar way to the hard drive of a computer. It stores, encodes and organises a large amount of information. Like information on a computer, if you know enough about a piece of information (such as the name of a file or document), then you can access it and retrieve it from your long-term memory store and bring it to short-term memory for use. Information in long-term memory may last your lifetime but may also decay if you don’t frequently use that information or if your brain does not consider it necessary to hold on to.



**FIGURE 11** Long-term memory is a relatively permanent store of information. This means you can potentially retain information, such as how to tie your shoelaces or what your 16th birthday party was like, for a lifetime.

The process by which information is stored in long-term memory differs from how information is stored in sensory memory and short-term memory. Unlike sensory memory and short-term memory, long-term memory is a relatively permanent store of information. This means that after information from short-term memory is encoded to long-term memory, the information needs to be stored in a physical location in the brain. At first, this information is encoded and held temporarily in the hippocampus. Later it is distributed across different areas of the neocortex for long-term storage. Stored information can then be accessed when needed or when triggered by a **retrieval cue** – a stimulus that helps retrieve a memory. You will learn more about the regions of the brain and their role in memory in Topic 5.2.

**retrieval cue**  
a prompt or stimulus that improves the ability to recall information from long-term memory

## Capacity and duration

The capacity of long-term memory is believed to be potentially unlimited. However, its exact limits are difficult to determine and measure because it is hard to assess the limits of what someone can store in their brain over long periods of time. It is also difficult to determine whether an item has been forgotten because of capacity limits, forgotten due to irrelevance or if a person just hasn't been exposed to the specific retrieval cues needed to recall a piece of information they have stored.

Information stored in long-term memory is thought to have a relatively permanent duration. This is because after information has been encoded and stored in long-term memory, it has the potential to remain available for recall over extended periods, ranging from years to decades. However, it is important to note that the strength and accessibility of memories can vary, and factors such as physical changes to the brain, retrieval cues, and passing time can affect retrieval.

**TABLE 2** A summary of memory stores and their functions, duration and capacity

Memory store	Function	Capacity	Duration (s)
Sensory memory	Temporary store for incoming sensory information	Potentially unlimited	0.2 to 4
Short-term memory	Store for information that has been selected and attended to in sensory memory and for information that has been retrieved from long-term memory	$7 \pm 2$ items (5 to 9 items)	18 to 30
Long-term memory	Store for information that has been encoded from short-term memory	Potentially unlimited	Relatively permanent

### Study tip

When asked to describe sensory, short-term or long-term memory, make sure you refer to each store's duration and capacity.

## Explanatory power of the multi-store model

In Chapter 3 you learnt that explanatory power is the degree to which a model or theory can accurately explain the subject it relates to. Strengths of the Atkinson–Shiffrin multi-store model of memory include how it provides a clear structure of how information is organised in different memory stores and how it highlights interactions between processes (encoding, storing and retrieving) to store and access information from memory stores. However, the model has some limitations. Some strengths and limitations of the model are summarised in Table 3.

**TABLE 3** The strengths and limitations of the Atkinson–Shiffrin multi-store model of memory

Strengths	Limitations
<ul style="list-style-type: none"> <li>Provides a clear framework for understanding how memory is organised and the processes involved in memory</li> <li>Identifies that there are different stores of memory</li> <li>Explains that memory stores vary in capacity and duration</li> </ul>	<ul style="list-style-type: none"> <li>Is often considered to be an oversimplified model of memory</li> <li>Suggests that short-term memory is a single store, which contradicts other more recent proposals of memory (Baddeley and Hitch, 1974)</li> <li>Does not consider how other factors (e.g. motivation, incentive) can influence the encoding of information from short-term memory to long-term memory</li> <li>Initially suggested that rehearsal was necessary for information to be transferred into long-term memory, which has been refuted by more recent studies</li> <li>Does not account for individual differences in memory processes, storage duration and capacity (e.g. individuals with photographic memories, amnesia)</li> </ul>

## 5.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the function, capacity and duration of the following memory stores.
  - a Sensory memory
  - b Short-term memory
  - c Long-term memory
- 2 Define:
  - a encoding
  - b storage
  - c retrieval.
- 3 Define “decay”. Describe the conditions that result in decay of items held in sensory memory, short-term memory and long-term memory.
- 4 Describe the explanatory power of the Atkinson–Shiffrin multi-store model of memory with references to its strengths and limitations.

### Apply, analyse and compare

- 5 Janelle is visiting Flinders Street Station for the first time. Explain how Janelle’s first view of the station could be encoded into long-term memory. Include the terms sensory memory, short-term memory, long-term memory, encoding, storage and retrieval in your response.



FIGURE 12 Flinders Street Station

- 6 Compare how information is stored in short-term memory and long-term memory.

### Design and discuss

- 7 Discuss why short-term memory can also be considered as “working memory”.
- 8 Ani is reading her Psychology textbook when her mother calls out to her to set the table for dinner. Ani turns her head to respond to her mother and replies that she will set the table in a minute. As Ani returns to look at her textbook, it takes her a moment to remember where she last stopped reading. Using Atkinson–Shiffrin’s multi-store model of memory, discuss why Ani is briefly unable to recall where she stopped reading.



FIGURE 13 It is a common misconception that goldfish have a memory span of 3 seconds. Studies have found that goldfish can memorise pieces of information for months and sometimes years, just like our long-term memory.

## 5.2

# Regions of the brain and their role in long-term memory

## KEY IDEAS

- ✦ The hippocampus is involved in the consolidation and transfer of explicit memories from short-term to long-term memory.
- ✦ The amygdala is involved in the consolidation of emotions linked to explicit memories. It is also involved in the encoding and retrieval of classically conditioned emotional responses.
- ✦ The neocortex is involved in the storage and retrieval of explicit memories, as well as the storage and retrieval of complex, classically conditioned memories.
- ✦ The basal ganglia are involved in the encoding of procedural memory.
- ✦ The cerebellum is involved in the encoding and storage of procedural memory.



## Implicit and explicit memories

In Topic 5.1, you learnt that long-term memory is a relatively permanent and potentially unlimited store of information that has been encoded from short-term memory. Once an item of information has been stored in long-term memory, it can be retrieved and brought to short-term memory for use. The retrieval of an item from long-term memory can occur either unconsciously or consciously depending on the nature of the information stored.

In this topic, we will explore two types of memory: implicit memory (unconscious memory) and explicit memory (conscious memory). We will also look at different regions of the brain and their roles in encoding, storage and retrieval of implicit memory and explicit memory.

### Implicit memory

**implicit memory**  
a memory of a skill, an emotion or a disposition that is unconscious and automatically retrieved

**Implicit memory** refers to the unconscious retrieval of memories, without deliberate or intentional recall. To illustrate this, consider the process of learning how to ride a bike. When you first start learning, you need to consciously and deliberately recall specific information such as where to place your feet, how to steer and the location of the brakes. At first, riding a bike successfully requires concentration and the conscious retrieval of information. However, after sufficient practice, the information about how to ride a bike is stored in your long-term memory. Eventually, you reach a point where you can ride without consciously thinking about the multiple actions you are performing. This is because your memory of how to ride a bike is now implicit. It is retrieved unconsciously from long-term memory when it is required. Two common types of implicit memory are procedural memory and classically conditioned memory.



**FIGURE 1** Riding a bike without conscious thought is an example of implicit memory, specifically procedural memory.

### procedural memory

an aspect of implicit memory that concerns our memory of how to perform particular tasks, skills or actions

### classically conditioned memory

an aspect of implicit memory that concerns our memory of associations between stimuli and responses

### explicit memory

a memory of knowledge, facts and personal experiences that can be retrieved consciously



### semantic memory

an aspect of explicit memory that concerns memory of facts and general knowledge

### episodic memory

an aspect of explicit memory that concerns memory of personal life experiences

## Procedural memory

**Procedural memory** is commonly defined as the memory of “how to” perform a motor skill. It is the memory required to physically carry out a specific action. Initially, learning a motor skill may demand conscious effort and concentration. However, once the information about “how to” perform the skill has been established and stored in long-term memory, the retrieval process typically requires little to no mental effort. Examples of tasks that use procedural memory include handwriting, riding a bike, running and brushing your teeth.

## Classically conditioned memory

**Classically conditioned memory** refers to the memory of a conditioned response to a conditioned stimulus. In Chapter 4, you learnt about classical conditioning, a type of learning where an association is formed between a neutral stimulus and an unconditioned response. Through conditioning, a once-neutral stimulus becomes a conditioned stimulus that elicits a conditioned response. Since our classically conditioned emotional responses occur automatically and without conscious retrieval, they fall into the category of implicit memory.

## Explicit memory

**Explicit memory** refers to memory that is conscious, meaning it is intentionally or deliberately retrieved from long-term memory. For example, if someone asks you about your top three favourite movies, you will consciously and deliberately retrieve information about those movies from your long-term memory to provide a response. Explicit memory is also referred to as “declarative memory” since it consists of information that can be easily shared or “declared” through written or verbal communication. Explicit memory comprises two primary categories of information: semantic memory and episodic memory.

## Semantic memory

**Semantic memory** is memory that relates to general knowledge, facts and understanding about the world. For example, knowing your times tables, how far the Earth is from the Sun, or what ingredients are needed to bake a cheesecake are all examples of semantic memory. You will learn more about semantic memory in Topic 5.3.

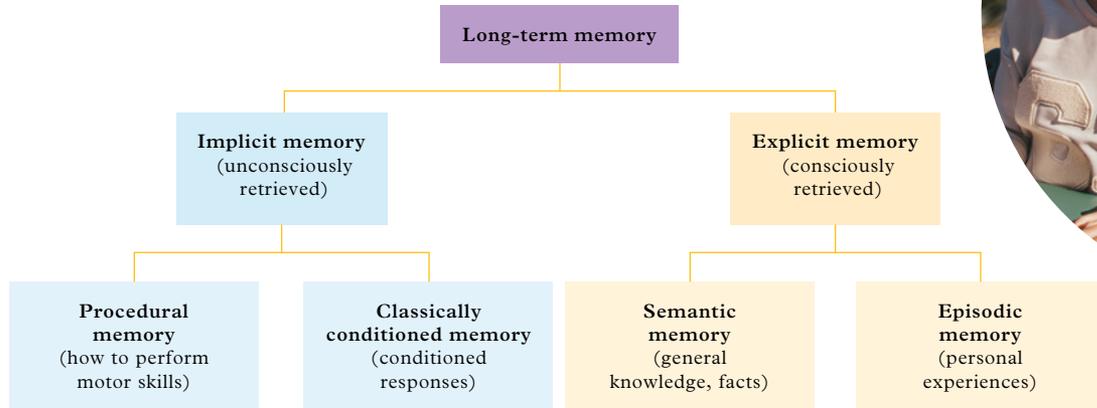
## Episodic memory

**Episodic memory** is memory that relates to the recollection of personal experiences and specific events in your life. It involves remembering specific events and moments from your life. For example, the memory of your first day of school, the intense sensation from the scariest roller-coaster ride you’ve ridden, or the exhilarating moment when you scored a winning goal for your team. These memories are tied to personal contexts and are often accompanied by associated emotions and sensory details. Episodic memories are generally

more prone to being forgotten than semantic memories. This is due to the large volume of information that enters episodic memory, making it challenging to effectively encode and retain every single memory associated with our personal experiences. You will learn more about episodic memory in Topic 5.3.



**FIGURE 2** Knowledge of the ingredients used to bake a cheesecake is an example of semantic memory.



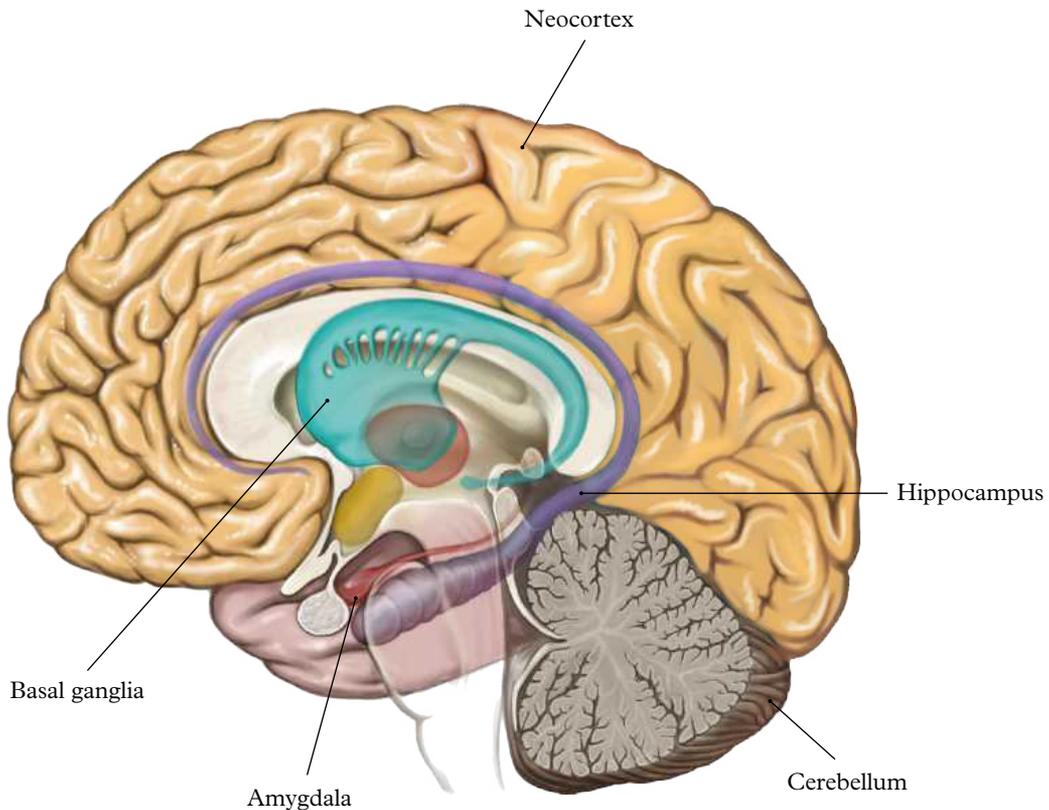
**FIGURE 3** Your memory of the scariest roller-coaster you've ridden is an example of episodic memory.

**FIGURE 4** A summary of the types of long-term memory

## Regions of the brain and their role in memory

Different regions and structures of the brain are associated with performing specific functions related to memory. In this topic, we will look at five specific regions of the brain and the role that each plays in relation to long-term implicit and explicit memory. The five regions of the brain we will cover are the:

- hippocampus
- amygdala
- neocortex
- basal ganglia
- cerebellum.



**FIGURE 5** The different regions of the brain that are involved with long-term memory

**hippocampus**

a curved structure in the brain that is responsible for consolidation of explicit memories and aids in transferring explicit memories to parts of the neocortex for storage

**consolidation**

a series of neurological changes to the brain that results in short-term memory being stored in long-term memory

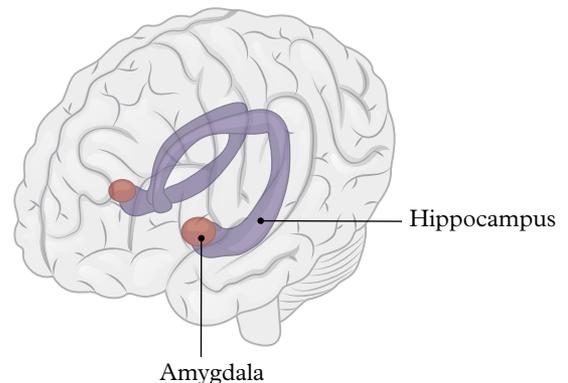
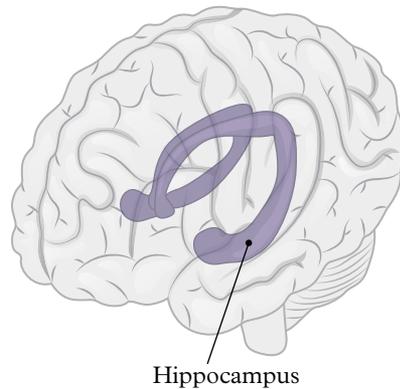
## Hippocampus

The **hippocampus** is a curved, finger-like structure located in the medial temporal lobe (middle of the temporal lobe) of each hemisphere of the brain (Figure 6). It forms direct connections with the frontal lobe, thalamus and amygdala. The hippocampus serves several important functions in long-term memory. It is involved in the encoding, **consolidation** and retrieval of explicit memories.

### Role in explicit memory

To understand the role of the hippocampus in explicit memory, imagine that you are studying for an exam. As you study, the hippocampus plays a crucial role in encoding information from your short-term memory into your long-term memory. The hippocampus transfers newly encoded explicit memory to the relevant parts of the brain for storage. The hippocampus also contributes to the consolidation of this information by organising it and connecting it to other relevant pieces of information stored in your long-term memory. This consolidation process ensures that the information can be easily retrieved later with the aid of retrieval cues.

During the exam, when you encounter a question related to the topic you have studied, the hippocampus will help retrieve the information needed from where it is stored in the neocortex. The hippocampus then directs this information to your short-term memory for immediate use. It is important to note that while the hippocampus aids in the retrieval of explicit memories, it does not serve as the primary storage site for explicit memory. Explicit memories are stored across various regions in the neocortex.



**FIGURE 6** The structure and location of the hippocampus **FIGURE 7** The structure and location of the amygdala

## Amygdala

The amygdala is an almond-shaped structure located in the medial temporal lobe, adjacent to the hippocampus. As with the hippocampus, there is one amygdala in each cerebral hemisphere. The amygdala serves multiple functions that relate to our memory of emotionally arousing events.

### Role in explicit memory

The amygdala is directly involved in regulating our emotional reactions to experiences, especially those that involve fear, anger and pleasure. In Chapter 3, you learnt that during times of stress, the body releases stress hormones as part of the flight-or-fight-or-freeze response to help us respond to stressors. These stress hormones (adrenaline and noradrenaline) stimulate and increase the activity of the amygdala which, as a result, can increase the degree of emotional arousal experienced and heighten our feelings of fear, anger and excitement.

The amygdala works together with the hippocampus to encode and consolidate the emotional component of explicit memories. It adds emotional significance to our memory of experiences, which in turn can make them easier to recall. For example, consider a person who has witnessed a violent crime. At the time of the crime, the amygdala is directly involved in regulating the fear and anger experienced by the witness as they watch the crime occur. The amygdala also recognises that crime is an event that induces fear and anger. As specific details of the event are consolidated in long-term memory by the hippocampus, the amygdala works simultaneously to ensure that the emotional component of the event is attached to this information.



**FIGURE 8** When a person witnesses a violent crime, their amygdala works to encode the emotions felt during the event, such as fear and anger.

The amygdala also plays a crucial role in the retrieval of the emotional content associated with explicit memories. When an explicit memory is retrieved, the hippocampus assists in recalling the factual details or events experienced by the individual, while simultaneously, the amygdala retrieves the emotional component linked to that memory. Expanding on the previous example, when a witness of a crime needs to recall the event during an interview with the police or during court testimony, they not only remember the facts of the event but also the emotions of fear and anger that were experienced. The amygdala allows the individual to remember the emotional reactions that are connected to explicit long-term memory. By working together with the hippocampus, the amygdala ensures that our memories are not only a collection of facts but also encompass associated emotions, providing us with a more comprehensive and vivid picture of our past experiences.

### Role in implicit memory

Classically conditioned responses often have an emotional component to them, such as feelings of fear, avoidance or anxiety. The amygdala, which plays a role in regulating and consolidating emotional reactions, is also involved in the encoding and retrieval of our **classically conditioned emotional responses** in implicit memory.

For example, consider a person whose childhood neighbour's cat consistently hissed at them when they were young, scaring them. The amygdala regulates the fear experienced by attaching it to the person's memory of the cat. As a result, the person develops a conditioned association between seeing a cat and feeling fear. Now, each time the person encounters a cat (the retrieval cue), the memory that associates the neighbour's cat with feeling fear is unconsciously retrieved from long-term memory. This unconscious retrieval of the association and the emotional response causes the person to experience fear each time they see a cat.

In this way, the amygdala contributes to the formation and retrieval of implicit conditioned emotional responses. It helps establish the emotional association between stimuli and emotional reactions, and these associations are automatically and unconsciously retrieved from long-term memory when encountering similar stimuli.

**classically conditioned emotional response**  
an emotional response (e.g. fear, anxiety, excitement) that becomes associated with a neutral stimulus as a result of classical conditioning



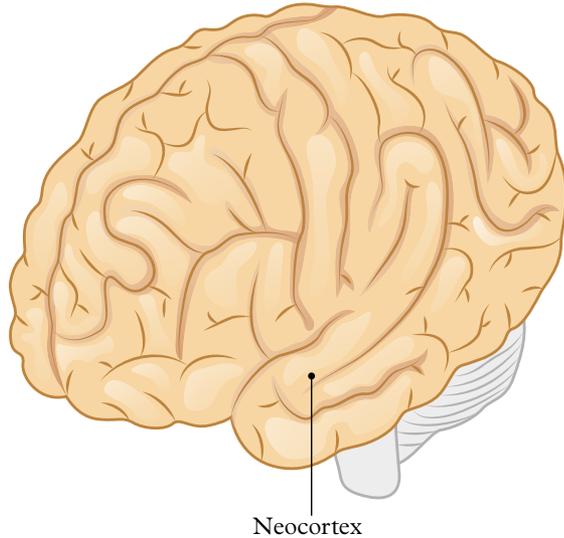
**FIGURE 9** A classically conditioned emotional response of fear in response to seeing a cat is consolidated and retrieved by the amygdala.

### neocortex

the largest section of the cerebral cortex that is responsible for cognitive processes including attention, thought, perception and memory

## Neocortex

The **neocortex**, which is the outer layer of the cerebral cortex covering most of the brain's surface, plays a vital role in various cognitive functions, including memory. Making up approximately 90 per cent of the cerebrum, the neocortex is divided into four cortical lobes. It is responsible for coordinating and executing higher-order functions such as cognition, attention and explicit memory.



**FIGURE 10** The structure and location of the neocortex

### basal ganglia

a group of subcortical nuclei that are responsible for motor control, learning and memory

## Role in explicit memory

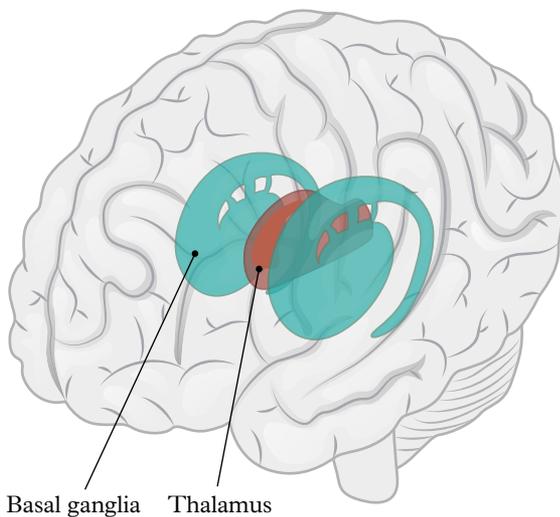
In explicit memory, the neocortex serves as the storage site for information related to our conscious memories. Once explicit memories are encoded by the hippocampus, information is distributed across the neocortex and sent to different regions of the neocortex for storage. These storage sites within the neocortex contain the neural information that forms an explicit memory. When information about an explicit memory needs to be retrieved, information stored at these sites is accessed.

The distribution of information to different locations in the neocortex is influenced by the specialised functions of the four cortical lobes. For example, visual information associated with an explicit memory is more likely to be stored near the primary visual cortex, in the occipital lobe. Similarly, auditory information related to an explicit memory is likely to be stored near the primary auditory cortex in the temporal lobe.

## Basal ganglia

The **basal ganglia** are a group of structures that are located at the base of the forebrain. They include the striatum, globus pallidus, substantia nigra and subthalamic nucleus. The basal ganglia form neural circuits that are crucial for motor control and coordination, as well as other functions such as learning, routine behaviour, emotion and implicit memory. The basal ganglia receive information from the neocortex and the hippocampus and process this information to contribute to motor planning and execution.

In addition to motor functions, the basal ganglia are involved in learning, routine behaviour and emotion. They play a role in the formation and execution of habitual behaviours, as well as the regulation of motivation and reward-based learning. Damage to structures of the basal ganglia can cause movement disorders, including Parkinson's disease and Huntington's disease, which are characterised by impaired motor control.



**FIGURE 11** The structure and location of the basal ganglia

## Role in implicit memory

The basal ganglia play a critical role in implicit memory. As you learnt earlier in the topic, procedural memory involves the acquisition and retention of motor skills and habits that can be reproduced without conscious effort. The basal ganglia, particularly the striatum, play a significant role in the encoding, consolidation and retrieval of procedural memories and classically conditioned responses. The basal ganglia allow us to learn and execute the motor sequences and routines connected to our implicit memories without conscious effort.

## Cerebellum

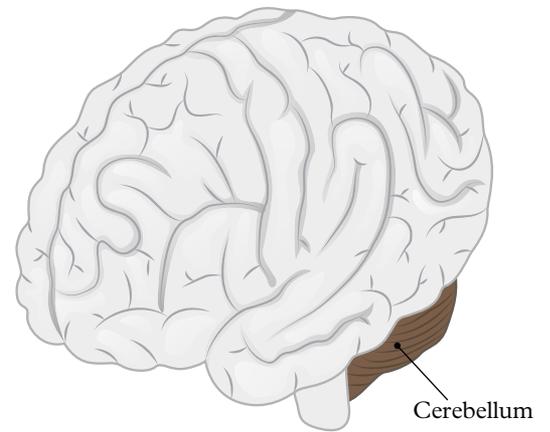
The **cerebellum**, located at the base of the brain, consists of two hemispheres and plays a crucial role in the coordination and control of movement. With its dense concentration of neurons, the cerebellum acts as a “fine-tuning” mechanism for motor movements. It works with the frontal lobe and its specialised cortices so that motor movements can be initiated and executed. The cerebellum helps to refine and adjust these movements, particularly skilled or fine motor movements and postural movements.

One of the important functions of the cerebellum is in the coordination of successive sequences of movements. As we perform complex movements that use many joints and muscles, such as writing with a pen, the cerebellum works to ensure that the timing, tension and release of muscles are appropriately synchronised. Damage to the cerebellum can disrupt the smooth and coordinated execution of these movements. Individuals may struggle to perform a series of movements as a single, integrated process, leading to difficulties in performing motor tasks.

## Role in implicit memory

The cerebellum plays an important role in implicit memory. It is primarily involved in the encoding and temporary storage of implicit procedural memory for motor skills. It is only a temporary store of this information which later gets distributed throughout the neocortex for long-term storage. The cerebellum is more closely associated with the encoding and storage of procedural and classically conditioned memories that involve simple reflexive movement responses, such as blinking or flinching.

**cerebellum**  
a brain structure that is responsible for the encoding and storage of procedural memory and simple classically conditioned memories



**FIGURE 12** The location of the cerebellum

**TABLE 1** A summary of brain regions involved in implicit and explicit memory

Brain structure	Role in implicit memory	Role in explicit memory
Hippocampus	None	Encoding, consolidation and retrieval of explicit memory
Amygdala	Encoding and retrieval of emotions associated with classically conditioned emotional responses	Encoding, consolidation and retrieval of emotions associated with emotionally arousing experiences (episodic memory)
Neocortex	Long-term storage of procedural memory and some classically conditioned memories	Storage of explicit memory
Basal ganglia	Retrieval of procedural memory and some classically conditioned memory	None
Cerebellum	Encoding of procedural memory and some classically conditioned memory. Temporary storage of implicit memory for motor skills created by classical conditioning.	None

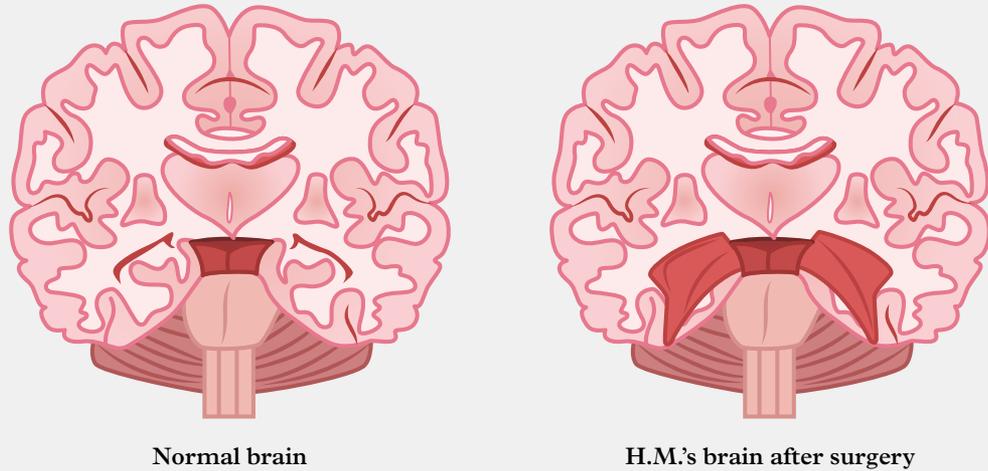
### Study tip

Knowing the roles of the areas of the brain can provide us with an insight into where and how information is encoded, stored and retrieved. You can use this information to predict what could happen to a person's memory if they acquire damage to specific areas of the brain.

## 5.2 REAL-WORLD PSYCHOLOGY

### Henry Molaison

The case study of Henry Molaison presented neuroscientists with a unique opportunity to examine the relationship between regions of the brain and their roles in memory. In 1953, Henry underwent surgery to address the debilitating seizures that were significantly affecting his quality of his life. The surgery involved removing sections of his medial temporal lobe on both hemispheres of his brain.



**FIGURE 13** A comparison of a normal brain with Henry Molaison's brain after surgery

Although the surgery successfully treated the seizures, it left Henry with a memory impairment so that he could no longer remember anything that occurred after the surgery took place. Henry was able to hold conversations with others, watch TV, solve puzzles and talk about his life before the surgery, but he could not remember the names of people he had just met, the content of the conversations he had just held, the TV shows he had just viewed or any new information. Additionally, Henry was able to learn new drawing skills and show improvement in these skills despite having no recollection of practising drawing.

### Apply your understanding

- 1 Based on the information presented above, suggest which part(s) of the medial temporal lobe were removed. Justify your answer.
- 2 Henry was able to improve his ability to draw despite not being able to remember when he practised drawing. Discuss why this was the case.

## 5.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain the role of the neocortex in the storage of explicit long-term memories.
- 2 Outline how emotions are encoded in explicit memory.
- 3 Describe the role of the cerebellum in the encoding and retrieval of implicit memory.

### Apply, analyse and compare

- 4 Ringo's favourite memory is the day he first adopted his best friend, a labrador puppy named Mikey. Explain which region of the brain is responsible for the elements related to this memory below.



**FIGURE 14** A labrador puppy

- a The sense of joy Ringo feels when he remembers the day.
- b Ringo's ability to remember facts about the day, such as what the adoption centre looked like, the time of day he picked up Mikey, how Mikey sat in the front seat of the car on the ride home.
- c The site where the memory is stored.

- 5 Compare the role of the basal ganglia with the role of the amygdala in explicit memory.
- 6 Classify the following as examples of procedural memory, classically conditioned memory, semantic memory or episodic memory. Justify your answers.
  - a A bus driver's memory of how to drive.
  - b A neurologist's memory of the anatomy of the human brain.
  - c A toddler feeling excited each time they hear a car pull into the driveway because they associate the doorbell with their mother coming home from work.
  - d A grandmother's memory of the day her first grandchild was born.

### Design and discuss

- 7 Draw a labelled diagram of the brain showing the locations of the hippocampus, amygdala, neocortex and basal ganglia.
- 8 Evaluate the following statement. "Brain damage to the hippocampus will have a more significant impact on a person's memory than brain damage to the cerebellum."
- 9 Design a flow chart to show how different regions of the brain would work to encode and retrieve an:
  - a implicit memory of yours
  - b explicit memory of yours.

## 5.3

# The role of episodic and semantic memory in retrieving and constructing events

### KEY IDEAS

- ✦ Reconstruction of an autobiographical event involves the conscious retrieval and combination of information from stored semantic and episodic memory.
- ✦ Information from episodic and semantic memory can be creatively combined to construct imagined futures.
- ✦ Alzheimer's disease and aphantasia are both conditions that can alter a person's ability to retrieve autobiographical events and construct possible imagined futures.



**FIGURE 1** Your memory acts somewhat like a mental time machine; it allows you to recall past events and construct imagined futures.

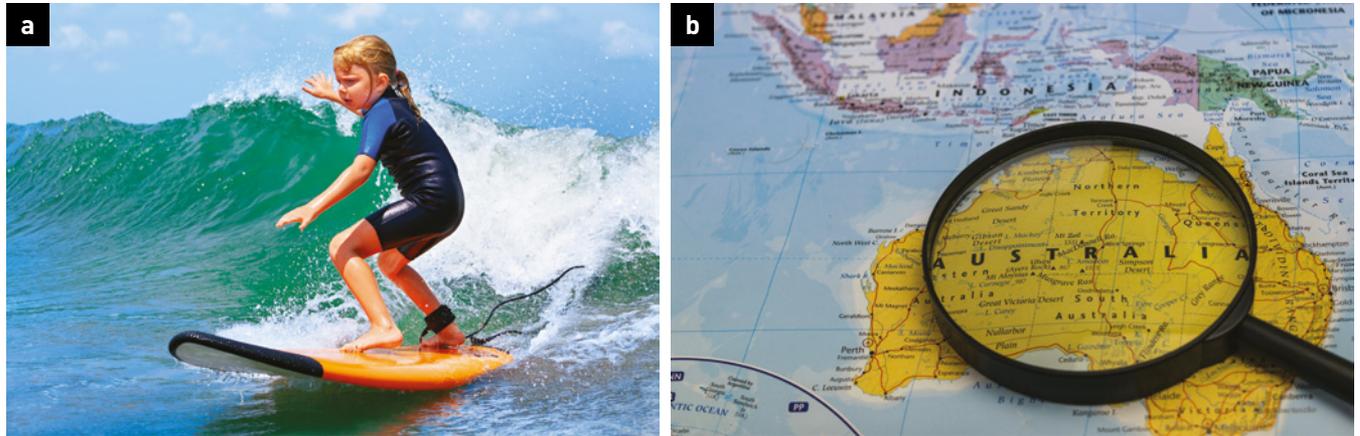
Imagine if you could travel back in time and relive the happiest day of your life. Or jump forward to the future, to the moment when you finish exams and are celebrating with your friends. While you can't physically travel through time, human memory acts somewhat like a mental time machine. It allows us to remember what we once did, thought and felt in past experiences and picture ourselves in future scenarios. To retrieve past experiences and imagine possible futures, our brain weaves together pieces of information that we have stored in our long-term memory, namely information from our semantic and episodic memory.

In this topic, we will look at the role of episodic and semantic memory in retrieving autobiographical events from the past and constructing possible imagined futures. We will also look at how conditions such as Alzheimer's disease and aphantasia can lead to differences in memory and the experience of mental imagery.

In Topic 5.2, you learnt that long-term memory consists of implicit memory (information that is unconsciously retrieved) and explicit memory (information that is consciously retrieved). You also learnt that there are two categories of explicit memory:

- episodic memory; that is, memory of personal experiences (e.g. the first time you went surfing, the embarrassing thing you said at a party or the odd conversation you overheard on the tram)
- semantic memory; that is, memory of general facts and impersonal understandings about the world (e.g. the number of days in a year, the location of Australia on a map, the knowledge that Mt Everest is Earth's tallest mountain).

Episodic and semantic memory may seem distinct enough from each other at first. However, research suggests that semantic and episodic memory are not completely separate. Recent studies have proposed that the two forms of explicit memory work together to retrieve past events and construct imagined futures.



**FIGURE 2** **a** Episodic memory describes memory of personal events such as the first time you went surfing. **b** Semantic memory describes memory of general knowledge and facts like the location of Australia on a world map.

## Retrieving autobiographical events

**Autobiographical events** are past experiences that we have personally lived through. Examples of autobiographical events might be a concert you attended, a holiday you went on, your first date or your first day of school. When we retrieve autobiographical events, our hippocampus activates and retrieves episodic memories associated with that event. For example, when remembering a concert you attended, episodic memories of the event could include the:

- conversations you heard when lining up to get in
- excitement of seeing the artist come out
- happiness you felt when your favourite song was played
- way you and your best friend danced all night.

Retrieval of episodic memory only forms one part of our retrieval of an autobiographical event. Our frontal and temporal lobes are also activated during the retrieval of an autobiographical event to retrieve any associated semantic memories. For example, semantic memories of a music concert could include the:

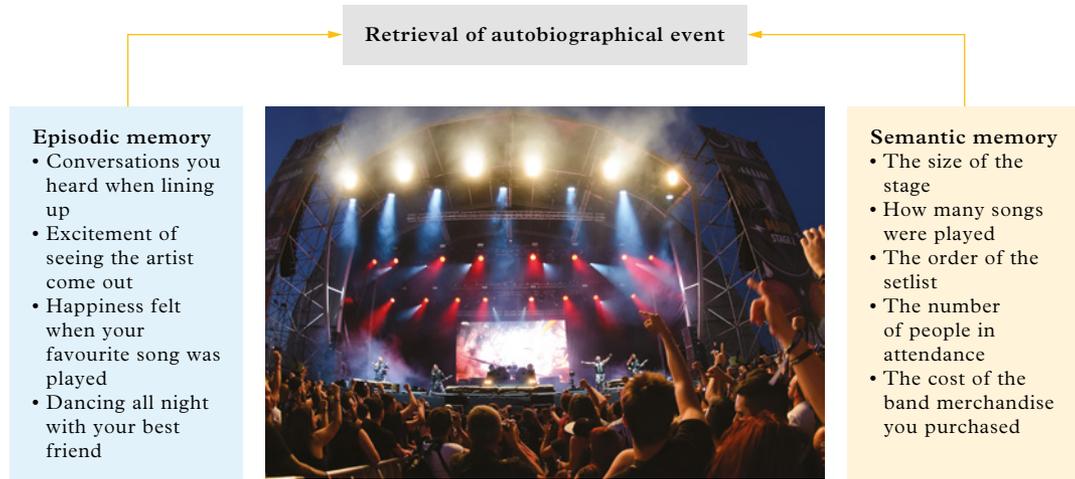
- size of the stage
- number of songs played
- order of the setlist
- number of people in attendance
- cost of the band merchandise you purchased.

**autobiographical event**  
a past event that an individual has experienced



**FIGURE 3** The price of band merchandise you purchased at a concert is an example of semantic memory.

When remembering an autobiographical event, we simultaneously retrieve both episodic and semantic memory. Information from episodic and semantic memory is then pieced together like a jigsaw to construct a richer and more complete memory of the autobiographical event.



**FIGURE 4** To recall an autobiographical event, such as attending a concert, your brain pieces together information from episodic and semantic memory.

It is important to remember that our mental recollection of autobiographical events is not always accurate. It is very common for our brain to fill in unknown or foggy details with other episodic and semantic memories that may seem relevant. For example, if you were trying to remember your first day of high school, you may be able to accurately recall some parts of the day, but other parts, such as the outfit your teacher was wearing or where you sat on the bus to school, may be filled in with other semantic or episodic memories.

## Constructing imagined futures

**possible imagined future**  
a hypothetical scenario that an individual has formed in their mind

**Possible imagined futures** are hypothetical events or situations that have been created in our mind. Some examples of possible imagined futures are:

- imagining yourself working your dream job
- picturing what the party you're going to on the weekend will be like
- imagining how your parents will react when they find out you've broken one of their rules
- imagining yourself on an overseas holiday after school finishes.

We cannot confirm how a future experience might unfold until it happens, so to construct imagined futures, our brain uses information we have stored about our previous experiences and understandings of the world. Much like the way we retrieve and construct autobiographical events, constructing a possible imagined future requires the simultaneous retrieval of information from episodic and semantic memory. These memories are then pieced together to form the imagined situation.

For example, consider a student who is imagining themselves working their dream job as a veterinarian. The episodic memories they retrieve may include the:

- joy they experienced when they successfully nursed an animal back to health
- deep admiration they felt for the veterinarian who saved their own pet's life
- positive conversations they had with veterinarians during careers fairs
- time they spent completing work experience at a veterinary practice.

The semantic memories they retrieve may include:

- understanding that veterinarians provide comprehensive medical care to animals, and complete tasks such as diagnosing illnesses, performing surgeries and administering treatments
- understanding that veterinarians often wear scrubs for sanitary purposes during their work
- recognising that veterinary clinics are equipped with medical instruments, X-ray machines, surgical suites and pharmacy supplies
- knowing that vets often work with pets such as dogs and cats.



**FIGURE 5** To construct an imagined future, such as picturing yourself working as a vet, your brain pieces together information from episodic and semantic memory.

By combining their episodic and semantic memories, the person can construct an imagined future where they envision themselves working as a veterinarian. Their semantic memories help them to visualise themselves in a veterinary clinic, wearing scrubs and using medical equipment and supplies they are familiar with. The episodic memories enable them to appreciate the fulfilment they get from helping animals and imagine how they will interact with both animals and customers.

### 5.3 CHALLENGE

#### Linking the multi-store model of retrieval to retrieving autobiographical events

The Atkinson–Shiffrin multi-store model of memory provides us with a proposed structure to explain how our memories are formed and used over our lifetime. The model discussed in this topic contains different memory stores and types of memory (e.g. procedural, semantic, episodic) that work together to encode, store and retrieve information. With reference to the Atkinson–Shiffrin multi-store model of memory, discuss how memories of your first day of school have been encoded and stored in long-term memory and how you would retrieve this autobiographical event.

## Conditions affecting memory

Episodic and semantic memory are fundamental cognitive processes involved in the retrieval and construction of events. However, individuals can experience variations in these processes, resulting in different ways of encoding, storing and retrieving information. Two conditions that can alter how a person retrieves past events and imagines future events are Alzheimer's disease and aphantasia.

## Alzheimer's disease

### Alzheimer's disease

a progressive neurodegenerative disease that results in cognitive decline and memory loss

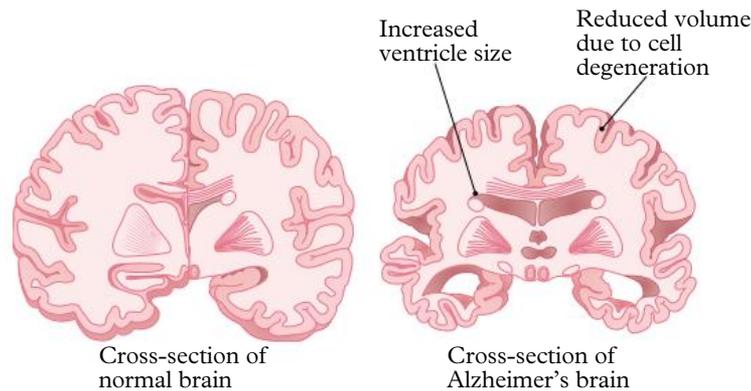
### dementia

a general term that describes diseases that affect memory, cognitive ability and behaviour

### post-mortem examination

a medical assessment of a deceased body to determine cause of death

**Alzheimer's disease** is a neurodegenerative disease characterised by impaired neural communication, cell loss and specific brain lesions. It is classed as a type of **dementia**, a condition that impairs memory, behaviour and function. Despite extensive research, there is currently no known cure or preventative treatment for the disease. Alzheimer's disease primarily affects older people, but can also occur in younger age groups, which account for 5 to 10 per cent of cases. Symptoms of Alzheimer's disease include progressive memory loss, personality changes and behavioural changes that are not characteristic of normal ageing. These symptoms can be used by medical professionals to assign a possible or probable diagnosis of Alzheimer's disease. However, a conclusive diagnosis of Alzheimer's disease can only be made following a **post-mortem examination**, a medical assessment conducted on a deceased person to determine the cause of death.



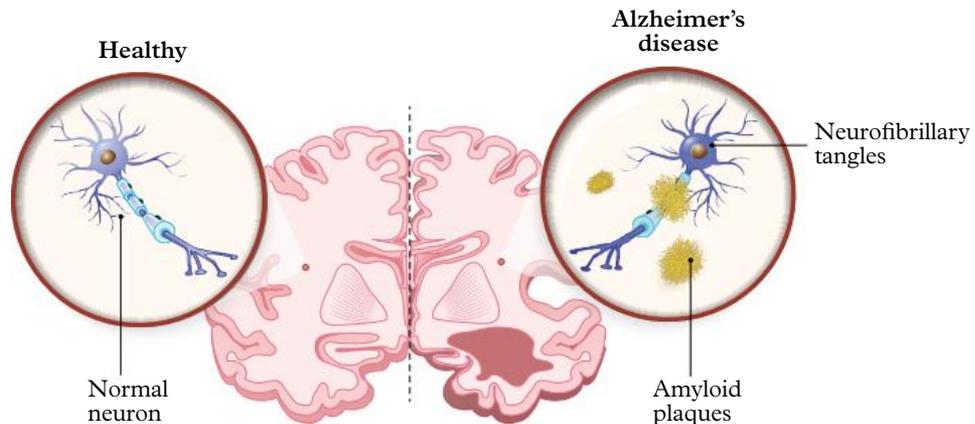
**FIGURE 6** Alzheimer's disease causes neural degeneration, reducing the size of the cerebral cortex.

## Diagnostic markers of Alzheimer's disease

### amyloid plaque

a deposit of the beta-amyloid protein that attaches to axons and axon terminals, disrupting neural communication

In Alzheimer's disease, the beta-amyloid protein accumulates and forms **amyloid plaques** along the axons and axon terminals of neurons. These plaques interfere with the communication between neurons and impair the ability to transmit signals effectively. In healthy brains, the beta-amyloid protein is normally broken down, but in Alzheimer's disease patients, the protein builds up into insoluble plaques resistant to degradation. The accumulation of amyloid plaques typically begins in the hippocampus, affecting the encoding and retrieval of explicit memory. In later stages, the disease progresses to the neocortex, which affects storage and retrieval of memory.

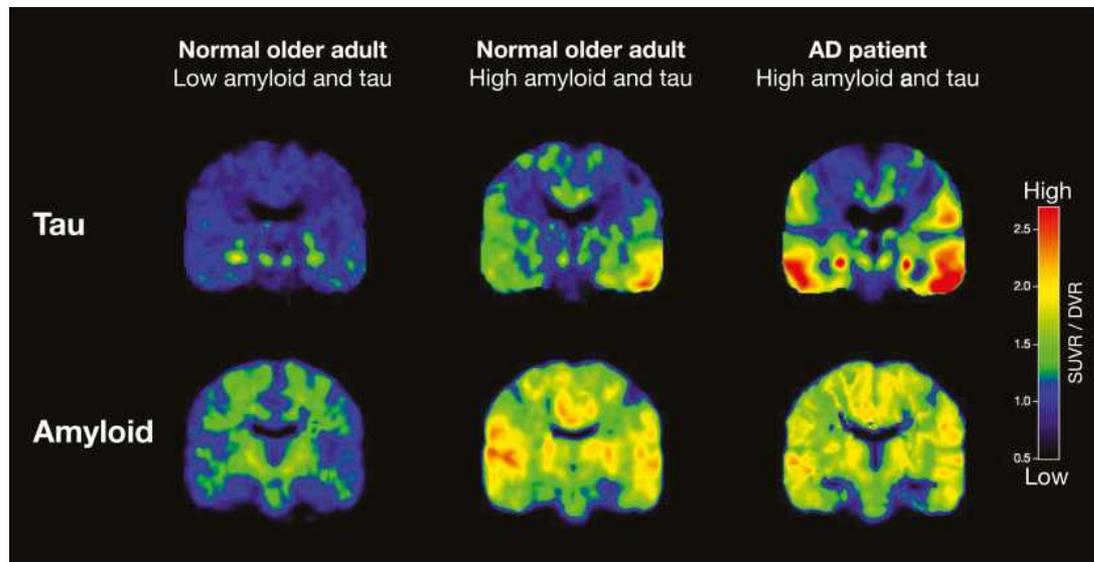


**FIGURE 7** A normal functioning neuron and a neuron with amyloid plaques typically found in Alzheimer's disease patients.

Brain lesions in Alzheimer’s disease can also result from **neurofibrillary tangles**, abnormal clusters of the tau protein that form inside neurons. In healthy brains, the tau protein plays a role in maintaining the structure of neurons and helps facilitate the transport of nutrients in cells. However, in Alzheimer’s disease, tau proteins deform and cause twists and tangles inside the neuron that cannot be broken down. The build-up of these neurofibrillary tangles interferes with the transport of nutrients and other essential molecules to and from neurons, which eventually causes neural degeneration and cell death. Like beta-amyloid plaques, neurofibrillary tangles contribute to cognitive decline and other symptoms associated with Alzheimer’s disease.

**neurofibrillary tangle**  
a twisted segment of the insoluble tau protein that forms within a neuron and disrupts the transport of nutrients into and out of the cell

The presence of beta-amyloid plaques and neurofibrillary tangles are hallmarks of Alzheimer’s disease. Both are used as diagnostic markers for the condition in post-mortem studies. PET (positron electron tomography) scans of Alzheimer’s patients’ brains show a greater concentration of amyloid plaques and tau in the brain, particularly near the hippocampus areas, compared to in normal brains. MRI (magnetic resonance imaging) and CT (computerised tomography) scans of later-stage Alzheimer’s disease show decreased density of the hippocampus and other brain areas due to neurodegeneration. These lesions and reductions in brain mass occur because of cellular death caused by the build-up of amyloid plaques and neurofibrillary tangles (insoluble tau) in the brain. It is worth noting that although beta-amyloid plaques and neurofibrillary tangles are important pathological features of Alzheimer’s disease, the precise mechanisms underlying their formation and their exact roles in the disease progression are still areas of active research.



**FIGURE 8** These PET scans show the concentrations of tau (a substance that forms neurofibrillary tangles) and amyloid plaque in two normal older people and one patient with Alzheimer’s disease.

### Impact on memory

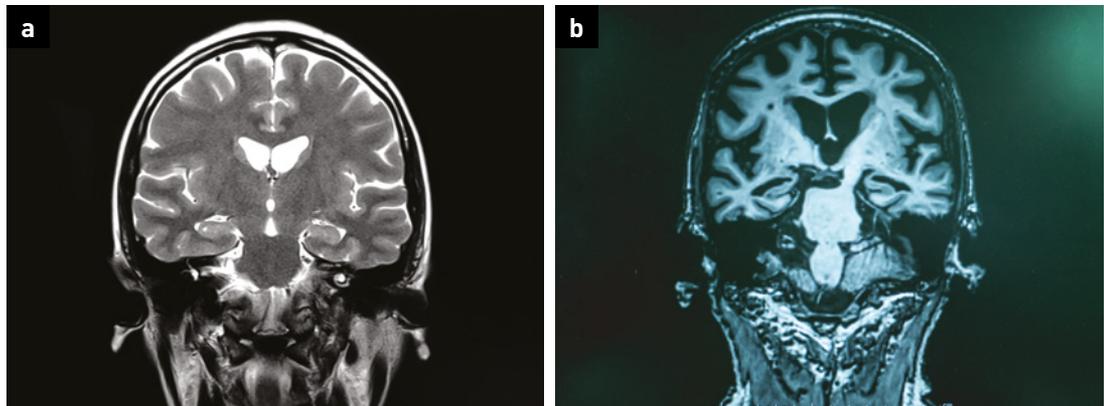
The progression of Alzheimer’s disease can span eight to ten years. As the disease progresses, individuals gradually experience a decline in cognitive abilities and functional independence. Early symptoms often involve memory impairments, particularly in short-term memory and the ability to form new memories (anterograde amnesia). Mood and behavioural changes, irritability, confusion and difficulties with decision-making may also manifest.



**FIGURE 9** Impaired short-term memory is an early symptom of Alzheimer’s disease.

As the disease continues to progress, individuals may struggle to retrieve long-term memories, including recognising loved ones and their own self-identity (retrograde amnesia). They may exhibit personality changes, experience difficulties with language and communication (aphasia), and find it challenging to cope with daily routines. In the later stages of the disease, individuals may require extensive assistance with basic self-care tasks and require full-time care.

In advanced stages of Alzheimer’s disease, individuals experience severely impaired short-term memory as well as severely impaired ability or inability to form and store new explicit long-term memories and imagine future events. This impairment is primarily attributed to the damage that occurs in the hippocampus, due to its role in memory formation and retrieval. It is important to note that the progression and symptoms of Alzheimer’s disease can vary from person to person, and individuals may exhibit different patterns and rates of decline based on a range of individual factors.



**FIGURE 10** MRI scans of a **a** healthy brain and **b** brain of a patient with Alzheimer’s disease

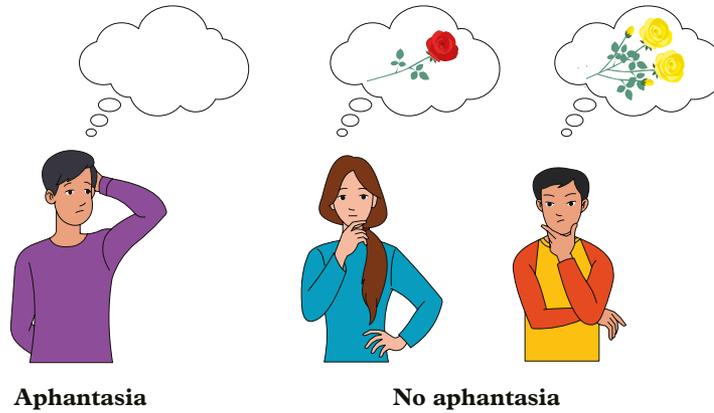
## Aphantasia

Imagine you are in an art class and are asked to draw a rose from memory. Most people would mentally construct some sort of visual image of what a rose looks like before they begin drawing. Some might picture a single red rose, others a yellow rose bush. However, for 2 to 5 per cent of the population, forming visual images in the mind is not possible. These people are affected by a rare condition called **aphantasia**, the inability to form voluntary visual imagery despite having intact semantic memory and visual perception. A person with aphantasia could tell you facts about roses and even give you a general description of what a rose should look like, but they would struggle to visualise the rose, or anything else, in their “mind’s eye”.

### **aphantasia**

a psychological condition characterised by the inability to form voluntary visual imagery despite a person having intact semantic memory and visual perception





**FIGURE 11** When asked to imagine a rose, a person with aphantasia would struggle to form a visual image of the rose in their mind.

The condition was first observed by British psychologist Francis Galton in 1880, when he found that some people were unable to mentally visualise objects. Over a century later, in 2015, the term “aphantasia” was coined by British neurologist Dr Adam Zeman and his colleagues after they conducted research with a small group of participants who were unable to summon mental images voluntarily. This initial study by Zeman identified a link between aphantasia and difficulties with episodic memory. Further research conducted by Bainbridge et al. (2021) assessed participants with and without aphantasia on their ability to draw real-world images from memory through a series of phases. Some phases involved drawing images from memory, other phases allowed drawing from perception (allowing one to look at the image while drawing). Results of the study suggested that:

- people with aphantasia (aphantasics) had impairments in object memory, as they drew fewer objects with less colour
- aphantasics’ ability to position objects accurately in terms of location and size was not affected by their condition
- aphantasics rely more on semantic memory, as their drawings contained more text than those of the control group.

The exact cause of aphantasia has not been determined. One theory suggests that the condition may be linked to lowered activity in regions of the brain that are involved with visual processing. Another theory suggests the condition may be genetic while a third theory suggests the condition may be due to neural variations in the brain. Aphantasia research is a relatively new field and understanding of the condition continues to evolve.

It is currently understood that:

- a person with the condition is unable to voluntarily visualise images or experiences in their mind
- there are varying degrees of aphantasia (some people have a complete inability to visualise mental images; others are only partially affected)
- daily functioning is not typically significantly impaired and aphantasia is not classified as a disability (individuals can still access information and memories through other cognitive processes)
- the condition can be congenital (present at birth) or acquired (developed after an event in life)
- the condition can influence creativity
- retrieval of autobiographical events and creation of possible imagined futures is altered by the condition.



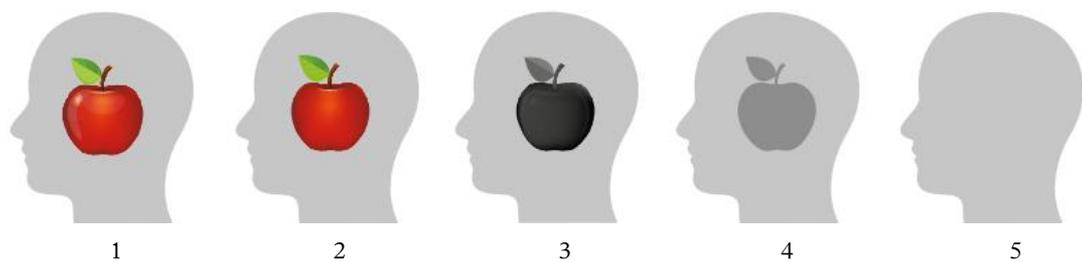
**FIGURE 12** Results from Bainbridge and colleagues' 2021 study on people with and without aphantasia

### Impacts on memory

Recall from earlier in the topic that to retrieve autobiographical events and construct possible futures, most people combine pieces of semantic and episodic information they have stored in long-term memory. Due to their inability or reduced ability to generate mental images, people with aphantasia often rely on other, non-visual, forms of semantic and episodic information stored in memory to compensate for their inability to imagine visual details.

For example, when asked to imagine or draw a rose, a person with aphantasia is more likely to rely on their semantic memory, which holds factual knowledge about roses, such as their colour, whether they have thorns, the number of petals, and their origin from a bud. In some instances, the person may also draw upon episodic memories or personal experiences associated with roses (e.g. memory of their grandfather selling roses at a market). These non-visual details can help guide the person's understanding of what a rose is and inform their drawing, even though they cannot form a mental image of what a rose looks like. The reliance on non-visual information from semantic and sometimes episodic memory is a common way for individuals with aphantasia to compensate for the lack of mental imagery.

It is important to note that the experience of aphantasia can vary among individuals. Aphantasics have varying ability to recall visual imagery. For example, Figure 13 shows different mental images of a red apple. Stages 1 and 2 can easily picture a vivid image of a red apple and are unaffected by aphantasia. Stages 3 to 5, which are affected by aphantasia, vary from a partial to a complete inability to form mental images.



**FIGURE 13** Imagine a red apple in your mind. If your apple resembles 3, 4 or 5, you may be affected by aphantasia.

### 5.3 CHECK YOUR LEARNING



#### Describe and explain

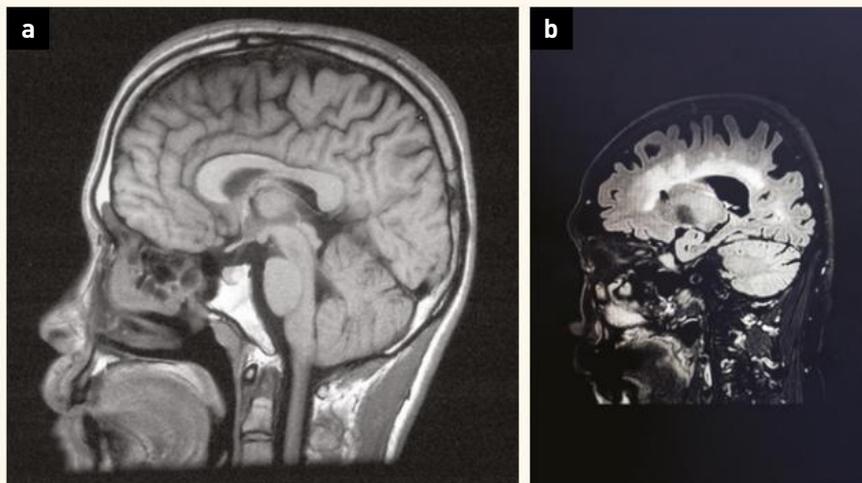
- 1 Using examples from your life, describe the role of episodic and semantic memory in the retrieval of autobiographical events from the past.
- 2 Kofi is reminiscing about his first day of work at McDonald's.
  - a Provide three possible semantic memories Kofi might retrieve to piece together his memory of the day.
  - b Provide three possible episodic memories Kofi may retrieve to piece together his memory of the day.
- 3 Identify two psychological symptoms of Alzheimer's disease.
- 4 Explain how aphantasia affects a person's ability to retrieve autobiographical events and construct imagined futures.
- 5 Describe how the tau protein and beta-amyloid protein behave in patients with Alzheimer's disease and how this contributes to loss of memory and cognitive function.

#### Apply, analyse and compare

- 6 Compare Alzheimer's disease and aphantasia.
- 7 Analyse the two MRI images and determine which scan (a or b) shows the brain of a person with Alzheimer's disease. Justify your answer.

#### Design and discuss

- 8 Shanice and Zoran, who both attended the same kindergarten, are reminiscing about their childhood. Zoran is talking about how he loved playing on the green swing when Shanice argues that the swing was blue. Zoran replies, "How would you know, you rarely ever played on it". They look at an old photo to settle their dispute and find that the swing was green.
  - a Discuss, with reference to the retrieval of autobiographical memories, why Shanice's recollection of the swing was not accurate.
  - b Suggest why Zoran would be more likely than Shanice to accurately envision the swing.
- 9 Alessio wants to investigate whether people with aphantasia can more accurately remember the spatial positioning of a specific item than people without aphantasia.
  - a Suggest which type of investigation methodology Alessio should use to conduct this investigation. Justify your answer.
  - b Write a hypothesis for the investigation.
  - c Design a method Alessio could apply to conduct his investigation.



# 5.4

## Improving memory with mnemonic devices

### KEY IDEAS



- ✦ Mnemonic devices can be used to improve the encoding, storage and retrieval of memory.
- ✦ Some mnemonic devices are the method of loci, acrostics and acronyms.
- ✦ Oral traditions such as Aboriginal peoples' use of sung narratives and Songlines can act as mnemonics to help encode, preserve and retrieve traditional knowledge.

Our long-term memory has the capacity to store remarkably large amounts of information. This is especially evident when we look at individuals who have extraordinary ability to encode, store and retrieve significant amounts of information. For example, Alex Mullins, a former world memory champion, once demonstrated exceptional recall by accurately reciting the order of 28 shuffled decks of cards after studying them for a mere hour. So how do memory champions achieve such remarkable feats of memory? Many of them use memorisation techniques known as **mnemonic devices** to enhance the encoding, storage and retrieval of information.

Mnemonic devices are techniques that improve memory and can be broadly categorised into two types:

- **organisational mnemonics:** memory techniques that provide a structure or framework for arranging information in a way that helps improved memorisation
- **encoding mnemonics:** memory techniques that involve manipulating information in various ways to enhance the storage and retrieval of information.

**mnemonic device**  
a mental technique or strategy for improving the encoding, storage or retrieval of memory

**organisational mnemonic**  
a type of mnemonic device that uses a system to organise information so it can be more easily retrieved

**encoding mnemonic**  
a type of mnemonic device that involves manipulating information into a format that makes for easier storage and retrieval



**FIGURE 1** Alex Mullins, former memory champion, was able to recall the order of 28 shuffled decks of cards after studying them for one hour.

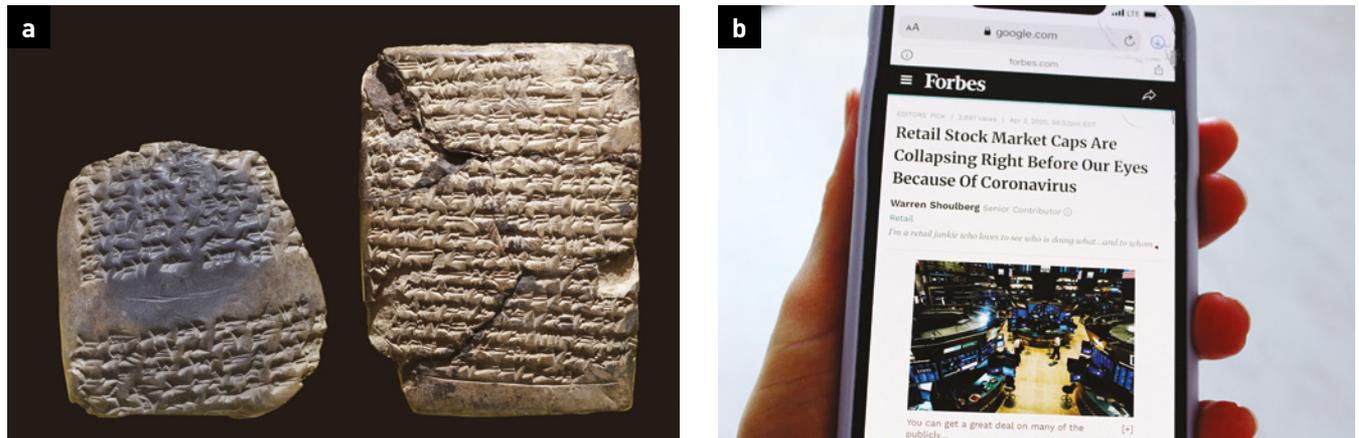
Mnemonic devices allow individuals to elaborate on the information they are learning and encoding. This process of elaboration establishes stronger connections to existing long-term memories and increases the likelihood of successful retrieval of information in the future. With practice, encoding, storing and retrieving information by using mnemonic devices becomes faster and more efficient.

At a neurological level, continued use of mnemonic devices leads to structural changes in the brain. Using mnemonics can increase blood flow in the brain and help form neural connections in the hippocampus and neocortex. These changes highlight the brain's synaptic plasticity – the ability to change its structure and function at a synaptic level in response to experience and learning. Three mnemonic devices we will look at in this topic are the method of loci, acronyms and acrostics. We will also look at how oral traditions such as those used by Aboriginal peoples have acted as mnemonics to encode and preserve knowledge.

## Written cultures and mnemonics

**Written culture** refers to knowledges, stories and traditions that have primarily been passed on through written records of information. Many cultures have strong links to written culture. For example, religious texts such as the Bible, Qur'an, Tanakh and Vedas are used to this day by Christians, Muslims, Jews and Hindus respectively. Written culture also contributes significantly to our present understanding of the world. Much of the information we accept and use today has developed by passing on understandings and teachings through ancient texts, books, journals and modern digital media.

**written culture**  
a culture that primarily uses written words, text and symbols to preserve and transfer information over time



**FIGURE 2** Written culture is any piece of information or tradition that has been passed on through a written language or text. This can vary from **a** the text on ancient cuneiform tablets to **b** the text you see on your mobile devices.

Some mnemonics are particularly effective at improving our memory of information that has a written component (e.g. lists, words and numbers). Three of these mnemonics include:

- acronyms
- acrostics
- the method of loci.

## Acronyms

### acronym

a mnemonic device that uses the first letters of a list of words to create a new word to aid in the encoding, storage and retrieval of information

**R**ed  
**O**range  
**Y**ellow  
**G**reen  
**B**lue  
**I**ndigo  
**V**iolet

**FIGURE 3** An acronym creates a new word or phrase from the first letters of a list of words.

### initialism

a shortened version of a phrase that is constructed from the first letter of each word in the phrase

### acrostic

a mnemonic device that uses the first letters of a list of words to create a sentence or phrase to aid in the encoding, storage and retrieval of information

An **acronym** is a mnemonic device used for encoding, storing and retrieving information. It involves creating a new word or phrase from the first letters of a list of words. Acronyms are particularly useful for remembering and recalling lists of words or items.

For example, the colours of the rainbow are red, orange, yellow, green, blue, indigo and violet. By taking the first letter of each colour, we can create the word “ROYGBIV” (pronounced roy-gee-biv). This acronym serves as a condensed representation of the colours, making it easier to store and retrieve information about them. Instead of remembering all the individual colours separately, you only need to recall the single word “ROYGBIV” to help recall the names of the colours in the rainbow and the order in which they occur. Acronyms make the process of encoding information more efficient, and retrieval simpler. Acronyms provide a compact and memorable way to store and remember lists of words or items.

The word made from an acronym does not need to be a legitimate word, but it does have to be pronounceable. For example, the acronyms ROYGBIV and FOMO (fear of missing out) are pronounced as words, but ABC (Australian Broadcasting Corporation) and FYI (for your information) are not pronounced as words but as letters. These shortened versions of words are known as **initialisms**.

## Acrostics

An **acrostic** is a mnemonic device that uses the first letters of a list of words to create a memorable sentence or phrase. Like acronyms, acrostics provide cues or prompts for memory retrieval.

For example, the planets, in their order from closest to most distant from the Sun (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune), can be encoded as the sentence “My very educated mother just served us noodles”. Each word in the sentence starts with the corresponding letter of the planets, which helps us to retrieve the names and sequence of the planets.

Acrostics, like acronyms, are particularly effective for encoding, storing and retrieving lists of items. They provide a memorable and structured way to link information together. However, for more complex or abstract concepts, the method of loci may be more suitable.



**FIGURE 4** The order of the planets can be remembered by using the acrostic “My very educated mother just served us noodles”.

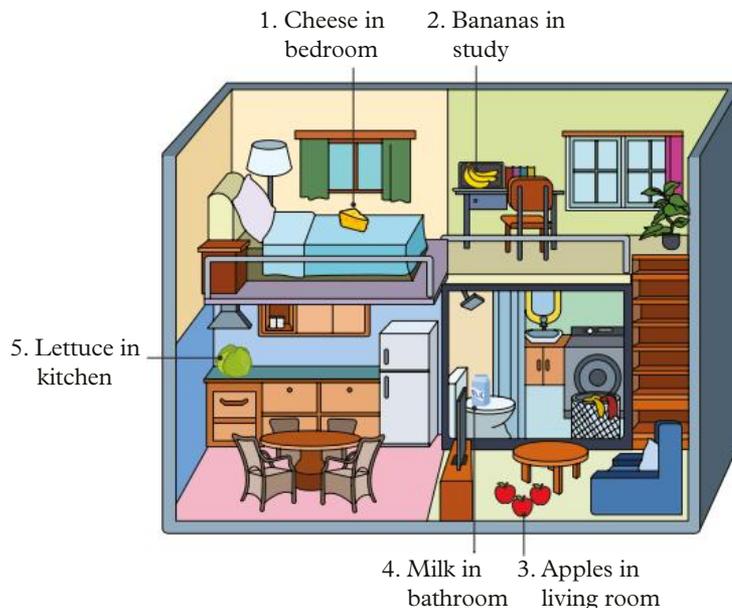
## Method of loci

The **method of loci** is a mnemonic device that aids in memory recall. The technique involves mentally organising information by associating it with the features and spatial layout of a familiar environment that can be navigated through. This environment is known as the **memory palace**. The following steps outline how the method of loci can be applied.

- 1 Create a mental representation of a familiar environment (e.g. a bedroom, house or classroom) that has distinct features or items (e.g. furniture, rooms or landmarks).
- 2 Assign a sequence to the features, allowing you to mentally move from one feature to another.
- 3 Associate a piece of information you want to remember with each feature. Use vivid and memorable imagery.
- 4 Navigate through the features of your mental representation when you want to recall information later.

By applying the method of loci, items of information can be encoded and stored in memory alongside the features of your mental representation. You can retrieve information later by mentally navigating through the environment or representation created and its associated features.

For example, you might have a shopping list that has the following items: cheese, bananas, apples, milk and lettuce. A visual representation can be made by visualising the items on the list in the context of your house (Figure 5). A block of cheese sits on top of your bed, a bunch of bananas on your laptop in the study, apples scattered on the living room carpet, a carton of milk in the bathroom and a head of lettuce on the stove. By mentally navigating through the rooms of the house and recalling these associations, you can recall the items on your shopping list.



**FIGURE 5** Visualising a shopping list by associating each item with a room in a house

The effectiveness of the method of loci as a mnemonic technique depends on how much you practise using your memory palace. The features of the memory palace serve as prompts or cues for memory retrieval. Therefore, the more familiar you become with the features, the more likely they will aid in retrieving the associated memories. Regular practice and repetition in navigating and recalling information within your memory palace enhances the efficiency of this mnemonic device.

**method of loci**  
a mnemonic device that attaches items to be remembered to points of significance in a familiar location; items can then be easily retrieved when navigating mentally through the location

**memory palace**  
the mental representation of a physical location or landmarks that are used as memory cues in the method of loci

### 5.4 WORKED EXAMPLE

#### Applying the method of loci

Andreas wants to apply the method of loci to help him remember the supplies he needs to pick up from the shops before his camping trip. His list of supplies includes a sleeping bag, a camera, a torch, firelighters and a tent.

Outline, in detail, how Andreas could apply the method of loci to remember his camping supplies. (4 marks)

Think	Do
Step 1: Identify the command terms used in the question and determine what they require.	The command term “outline” is used. This means the response will need to provide an overview or the main features of an argument, point of view, text, narrative, diagram or image.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	There are 4 marks allocated to the question, so the response will need to include four key pieces of information about how the method of loci can be applied.
Step 3: Recall that the first step in applying the method of loci is to decide on a memory palace. Select an appropriate memory palace (familiar location with distinct features).	Andreas can first imagine his house, because it is a familiar location that has distinct features (rooms). (1 mark)
Step 4: Recall that the second step in applying the method of loci is to assign a sequence to the distinct features, allowing you to mentally move from one feature to another.	Andreas can then imagine himself walking from his bedroom to his bathroom, then walking down the stairs to the kitchen and finally stepping outside into his backyard. (1 mark)
Step 5: Recall that the third step in applying the method of loci is to associate each item to be remembered with a distinct feature of the memory palace.	Andreas can picture a sleeping bag in his bedroom, a camera on his bathroom sink, a torch sitting on the railing of his staircase, firelighters on his kitchen bench and a tent set up in his backyard. (1 mark)
Step 6: Recall that the final step of the method of loci is to navigate through the sequence of features in the memory palace.	Andreas can picture himself walking through his house from his bedroom to his backyard and mentally picture the items he has assigned to each room to remember his list of supplies. (1 mark)

#### Study tip

You can use the method of loci in your own studies. Create your own mental palace and consistently revise and refine it. When you are ready, begin to associate key terms and definitions with the landmarks and locations of your mental palace and remember to keep practising!

#### oral culture

a culture that primarily uses oral or spoken word to preserve and transfer information over time

#### traditional knowledge

knowledge, understandings and skills that have been developed, maintained and passed on through generations of a culture

## Oral cultures and mnemonics

**Oral cultures** are those that pass on knowledges, stories and traditions primarily through voice, song and sound rather than written word. Many Aboriginal cultures have rich oral traditions that help to establish, preserve and pass on knowledge to future generations. For example, **traditional knowledge** passed on orally by Boonwurrung Elders describes a time when Nairm (Port Phillip Bay) was a land area rather than a port. This traditional knowledge describes the bay area as being abundant with kangaroos and serving as a good hunting ground. Scientific records estimate that 7000 to 10,000 years ago, the surface of Port Phillip Bay was exposed due to low sea levels at the time, which matches up with the knowledge

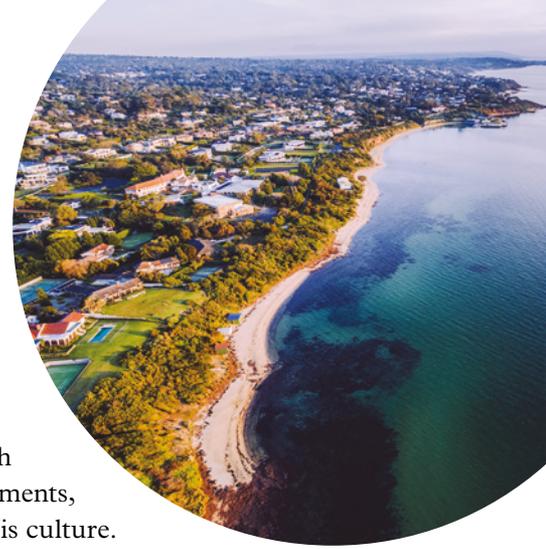
shared by Boonwurrung Elders. This means that the Boonwurrung traditional knowledge describing the area has been successfully passed on orally for at least 7000 to 10,000 years.

Information sharing in oral cultures may use spoken word, song, music, rhythm and dance to communicate, develop or express knowledge. For example, the late Geoffrey Gurrumul Yunupingu, a Gumatj man from Elcho Island in the Northern Territory, gained world recognition for his music that spoke of identity, spirit and connection to Country (Figure 7). His music, which combined elements of traditional song, modern composition and various instruments, created a new way for people to experience and engage with the knowledge of his culture.

Sharing knowledge, making spiritual connections, and drawing people together are just a few of the benefits that oral traditions can bring to a culture or individual. Many oral traditions also work as mnemonics and can improve the encoding, storage and retrieval of information. Examples of oral traditions that also work as mnemonics are the sung narratives and Songlines practised by a variety of Aboriginal cultures.

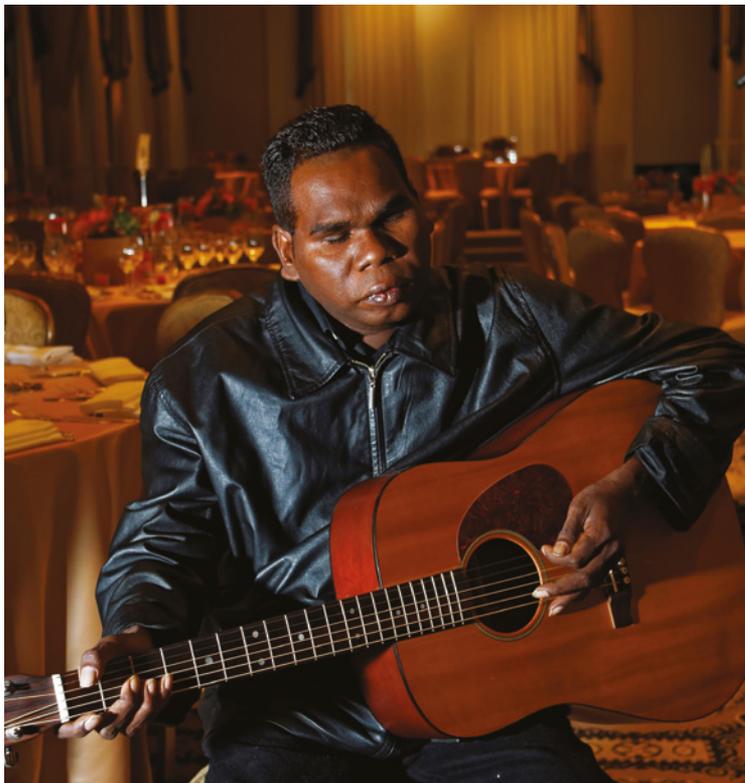
## Sung narratives and Songlines

**Sung narratives** are stories, knowledge or ideas expressed through song, music, sounds and rhythm. The encoding process of a sung narrative involves not only retaining the story or idea being expressed but also the musical, sound and rhythmic components within the narrative. Performing a sung narrative can enhance the encoding and storage of information, because the act of performance is more likely to evoke emotions. The rhythmic, lyrical and musical elements of a sung narrative can also serve as retrieval cues, aiding in the recall of information at a later stage.



**FIGURE 6** Boonwurrung traditional knowledge describes how Port Phillip Bay was once a land area abundant with kangaroos.

**sung narrative** knowledge that is shared through song, music, sound and rhythm



**FIGURE 7** Geoffrey Gurrumul Yunupingu wrote songs that spoke of identity, spirit and connection to Country.



**FIGURE 8** Sung narratives are often accompanied by or expressed through music.

### Songline

in Aboriginal culture, a sung narrative that maps Country and stores complex knowledge systems

### Dreaming

a belief system at the centre of some Aboriginal cultures; it connects all aspects of Aboriginal life, spirituality and law



A **Songline**, also known as a “Dreaming track”, is a sequence of sung narratives linked to specific locations across a landscape. In Aboriginal cultures, Songlines map astronomical features and landscape features from Country that appear in **Dreaming** stories. Songlines often represent a physical or imagined path through Country, with each location holding significance.

Like the method of loci, a Songline can be visualised as a set of locations that an individual can mentally navigate through. However, unlike the method of loci where the primary purpose is to organise and store information at each location, in a Songline, each location is linked to a performance of song and music that embodies traditional knowledge. As individuals become more initiated into their culture, more details and information are encoded about the knowledge associated with each location in the Songline. This ongoing process of encoding strengthens traditional knowledge tied to each location and its significance.

The knowledge that can be encoded from a Songline goes beyond a simple recollection of information. It includes a holistic understanding of the land, its spiritual significance, emotional connection, ties to ancestral beings, the landscape and the culture. This complex intertwining of song, story, location, community, spirit and knowledge in a Songline helps to strengthen an individual’s connection to Country.

### Role of the hippocampus in Songlines

The association between memory and specific locations is a fundamental aspect of Songlines. The brain’s ability to form these associations is facilitated by the hippocampus. The hippocampus plays a crucial role in the consolidation of declarative information from short-term memory to long-term memory. When individuals begin to form spatial associations, the hippocampus encodes new information related to spatial knowledge and its connection to specific locations. Once spatial knowledge is encoded, it is distributed and stored for long-term use in the neocortex. Consequently, whenever a person thinks of a particular location, it triggers the retrieval of associated stories or narratives. Similarly, recalling a story tied to a Songline will trigger the retrieval of memories associated with corresponding locations.

This encoding of spatial information and its integration with traditional knowledge narratives and ideas strengthens the bond between memory, place and story. It allows individuals to mentally navigate through Songlines to access, build on and preserve the knowledge embedded in each location.



**FIGURE 9** The origin of Bung Yarnda (Lake Tyers) in Gippsland, Victoria, is told in a Songline.

## 5.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “mnemonic”.
- 2 Sung narratives and Songlines are often performed. Explain why the performance of a sung narrative or Songline can improve the encoding and retrieval of knowledge compared to simply reading the narrative or Songline.

### Apply, analyse and compare

- 3 Compare acronyms and acrostics and provide an example of each.
- 4 Distinguish between oral cultures and written cultures.
- 5 Compare the method of loci and Songlines as mnemonic devices.

### Design and discuss

- 6 Discuss the role of the hippocampus in encoding and retrieving knowledge related to Songlines.
- 7 Billie is studying to be a chef and will be assessed on her ability to bake a vanilla sponge cake using the following recipe:

- 1 Mix the butter and sugar together until fluffy.
- 2 Mix in each egg one at a time.
- 3 Add vanilla essence and mix.
- 4 Add flour and fold in.
- 5 Add milk to the batter and mix until smooth.
- 6 Divide into tins and bake.

Billie is confident in her ability to bake cakes, especially when she has a recipe on hand.

However, when she doesn't have a recipe, she often struggles to remember ingredients and the order in which they are added.

- a Identify a mnemonic that would help Billie remember the ingredients of the recipe and the order in which they should be added. Justify your selection.
- b Design a mnemonic that would help Billie using the device that you have identified.

## Chapter summary

5.1

- The Atkinson–Shiffrin multi-store model of memory consists of unique memory stores that operate together in the processes of encoding, storing and retrieving memory.
- Encoding involves transferring information into a usable form that can be worked with and stored, storage involves the maintenance of information, and retrieval involves accessing and recovering stored information.
- Sensory memory is a temporary store for raw, sensory information, which, if attended to, can be transferred to short-term memory.
- Short-term memory is a store for information that has been attended to in sensory memory and information that has been retrieved from long-term memory. When information is held in short-term memory, it can be used and manipulated.
- Long-term memory is a relatively permanent store of information that has been encoded from short-term memory.

5.2

- The hippocampus is involved in the consolidation and transfer of explicit memories from short-term to long-term memory.
- The amygdala is involved in the consolidation of emotions linked to explicit memories. It is also involved in the encoding and retrieval of classically conditioned emotional responses.
- The neocortex is involved in the storage and retrieval of explicit memories, as well as the storage and retrieval of complex, classically conditioned memories.
- The basal ganglia are involved in the encoding of procedural memory.
- The cerebellum is involved in the encoding and storage of procedural memory.

5.3

- Reconstruction of an autobiographical event involves the retrieval and combination of information from stored semantic and episodic memory.
- Information from episodic and semantic memory can be creatively combined to construct imagined futures.
- Alzheimer’s disease and aphantasia are both conditions that can alter a person’s ability to retrieve autobiographical events and construct possible imagined futures.

5.4

- Mnemonic devices are methods for improving the encoding, storage and retrieval of memory.
- Some mnemonic devices are the method of loci, acrostics and acronyms.
- Oral traditions such as Aboriginal peoples’ use of sung narratives and Songlines can act as mnemonics to help encode, preserve and retrieve traditional knowledge.

## Revision questions

### Multiple choice

- 1 The information needed to answer the question “How old are you?” will be retrieved from:
  - A semantic memory.
  - B episodic memory.
  - C procedural memory.
  - D iconic memory.
- 2 Which area of the brain is involved in encoding classically conditioned emotional responses?
  - A Amygdala
  - B Cerebrum
  - C Cerebellum
  - D Hippocampus
- 3 Which of the following statements best describes the nature of amyloid plaques?
  - A They increase the efficiency of communication between neurons.
  - B They decrease the efficiency of communication between neurons.
  - C They decrease the quality of nutrient and material transportation to and from the neuron.
  - D They increase the quality of nutrient and material transportation to and from the neuron.
- 4 Phu is in art class where he has to paint a picture of himself driving a sports car. Which of the following statements is false?
  - A Phu’s artistic abilities may be influenced by his cognitive processes.
  - B Phu will combine information stored from his semantic and episodic memory to construct a mental image of him driving the sports car.
  - C Phu will not be able to paint the picture as he does not have any episodic memory of drawing a sports car.
  - D Phu’s ability to pick up and use a paintbrush with ease is an example of procedural memory.
- 5 Hans, 41, recently sustained damage to his hippocampus. Since then, Hans is unlikely to be able to remember:
  - A how to use a spoon and fork.
  - B how to drive a car.
  - C the address of the first house he lived in.
  - D the name of the doctor who treated him after the injury.
- 6 Which of the following is not true of Songlines?
  - A They are often performed.
  - B They can be accompanied or expressed with music, sounds, rhythm and dance.
  - C Their only purpose is to serve as a mnemonic device to help remember information.
  - D They connect various elements, including geographical landmarks, cultural knowledge and spiritual elements to form a holistic understanding of and relationships between people and Country.
- 7 What must occur for information to be transferred from sensory memory to short-term memory?
  - A It must be retrieved.
  - B It must be attended to.
  - C It must be recalled.
  - D It must be factual.
- 8 Which of the following would not be considered an acronym?
  - A NASA (National Aeronautics and Space Administration)
  - B KFC (Kentucky Fried Chicken)
  - C GOAT (greatest of all time)
  - D RAM (random access memory)



- 9 Paola unconsciously shivers in fear each time she sees a mouse. Whenever she is asked why she is afraid of mice, Paola explains in detail that as a child, she stumbled across dead mice under her house multiple times. What type of memory is responsible for Paola's reaction of fear when seeing a mouse?
- A Classically conditioned memory
  - B Semantic memory
  - C Episodic memory
  - D Procedural memory
- 10 Which of the following is not thought to be potentially unlimited or indefinite?
- A The capacity of long-term memory
  - B The duration of long-term memory
  - C The duration of short-term memory
  - D The capacity of sensory memory

### **Short answer**

#### **Describe and explain**

- 11 Using a relevant example from your own life, explain the concepts of encoding, storage and retrieval.
- 12 Referring to the Atkinson–Shiffrin multi-store model of memory, outline how an individual can identify an object on a plate as a piece of toast.
- 13 Identify the capacity and duration of sensory memory.
- 14 Describe short-term memory.
- 15 Explain why classically conditioned memory is not considered a type of explicit memory.
- 16 Explain the role of the hippocampus in the storage of explicit long-term memories.
- 17 Describe how a student could construct a possible imagined future of them working as a teacher.
- 18 Outline how the amygdala may contribute to the consolidation of an inaccurate memory of a traumatic event proposed when someone is questioned in court after witnessing a crime.
- 19 Define “aphantasia”.
- 20 Which parts of the brain are affected in the early stages of Alzheimer's disease and what are the psychological consequences of degeneration of these parts?

#### **Apply, analyse and compare**

- 21 Contrast the functions of the amygdala and the hippocampus in memory.
- 22 Dana has been training in kung fu since he was seven years old. When he first started, Dana used to struggle to coordinate his movements. Over time and with consistent training, Dana's kung fu movements became faster and more efficient. At age 15, Dana entered his first kung fu competition, where he had to demonstrate a series of kung fu moves.
- a Contrast Dana's memory of executing kung fu at seven years old to his memory of kung fu at 15 years old.
  - b Identify the type of long-term memory that Dana's skill of kung fu at 15 demonstrates.
  - c Identify where Dana's memory of “how to” execute kung fu moves would be stored in the brain.
- 23 Kim can remember an event from her childhood where she was playing in the local park and a dog ran up to her and bit her on the leg. The bite caused Kim significant pain and resulted in her going to hospital. Since this event, Kim is apprehensive whenever she goes to a park, and constantly scans for dogs whenever she goes for a walk.
- a Identify which type of memory Kim's recollection of the event is. Justify your response.
  - b Explain why Kim might be better able to recall the event of the dog bite than another visit to the local park she had as a child.
  - c Compare the roles of the hippocampus and the amygdala in encoding Kim's memory of the dog bite.

- 24 Analyse how the method of loci may improve the encoding, storage and retrieval of memory.
- 25 In a recent experiment, two groups of participants were asked to look at a billboard advertisement of a sports car driving through the country. The first group of participants consisted of individuals with aphantasia, whereas the second group of participants had no memory impairments at all. After looking at the advertisement for 1 minute, both groups were tasked to redraw the scene but with them driving the car.

With reference to imagining possible futures, predict how the two groups might imagine the scene of them driving the car differently. Explain your reasoning.

- 26 Ash lost her most recent mixed-martial arts match due to submission. At the time, Ash was strangled around the neck by her opponent to the point where she could not breathe and lost consciousness for a minute.

When she recovered, the medic asked her questions such as “What is your name?”, “Can you tell me where you are right now?” and “What’s the last thing you remember?”. Ash was able to tell the medic who she was but could not explain where she was or how she got there. Ash was in a state of confusion for the next two hours before she finally began to understand where she was and what had happened.

Use evidence from the scenario to deduce which parts of Ash’s brain may have been impaired for the two hours after she regained consciousness.

- 27 Analyse the role of the cerebellum in the encoding and retrieval of procedural memory.

- 28 Distinguish between the processes of retrieval and storage.
- 29 Compare iconic and echoic memory.

### Design and discuss

- 30 “The function of memory is completely dependent on the functionality of short-term memory.” Discuss the extent to which you agree with this statement with reference to the first time you rode a bicycle.
- 31 An experiment was conducted that examined the relationship between neurological brain development and the use of memory mnemonics. In the experiment, the brain density of participants was initially measured through MRI and CT scans. Over four weeks, all participants underwent a daily practice of the method of loci where participants had to visualise the environment of their memory palace, and then apply the method of loci to a randomised list of 50 words. After four weeks, the brain density of participants was measured again through MRI and CT scans. All participants showed a significant increase in brain density in specific parts of their brains.
- Identify the independent and dependent variables of the experiment.
  - Identify which regions of the brain would have displayed increased density and outline the reasons why these areas would have changed over time.
  - Evaluate the investigation methodology and the experimental design that was used in the research.

You can find the following resources for this section in your obook pro:

pro

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

## AREA OF STUDY 2

UNIT

# 3

# Checkpoint

## Part A – School-assessed Coursework support for Unit 3 Area of Study 2

In Unit 3 Area of Study 2, you will be required to complete **one** task from the following options:

- analysis and evaluation of at least one psychological case study, experiment, model or simulation
- analysis and evaluation of generated primary and/or collated secondary data
- comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities
- analysis and comparison of two or more contemporary media texts.

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### Important notice to students and teachers

The assessment support provided in this section models one way of approaching the following task for Outcome 2:

- comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities.

Your teacher may select one of the other task options above for you to complete as an assessment for this outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample SAC, and sample response provided below should be used for example purposes only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

**Unless specifically credited, the VCAA has not written this material and does not endorse the content.**

### Overview of SAC 2 – Comparison and evaluation of psychological concepts, methodologies and methods, and findings from three learning or memory student practical activities

In this practice SAC for Unit 3 Area of Study 2, you will be required to recall key knowledge and complete Investigations 4.1, 4.2 and 5.4A from Chapter 12 Investigations. This task is designed to assess your understanding of learning and memory and will require you to demonstrate your knowledge from Chapters 4 and 5 in response to the investigations completed.

## **A step-by-step guide to completing SAC 2**

The information provided in this section is designed to help you prepare and practise for SAC 2. The tips and advice included are broad and have been designed to help you successfully compare and evaluate psychological concepts, methodologies and methods, and findings from three student practical activities regardless of the specific requirements of the task your teacher or school has created.

### **Step 1: Carefully read the requirements of the task and understand how you will be assessed.**

The best way to set yourself up for success on SAC 2 is to ensure you have researched associated literature or previous experiments associated with Investigations 4.1, 4.2 and 5.4A to be able to provide more in-depth discussion.

### **Step 2: Create a summary table of different learning approaches.**

The next step is to summarise the different approaches to learning. Make sure you understand the role of the learner, active and passive responses, and any consequences or associations connected to the type of learning occurring.

### **Step 3: Understand different mnemonics.**

Next, think about how you have used mnemonics to remember information over time (e.g. acronyms). Ensure you understand the purpose of mnemonics and what sort of information they assist in remembering.

### **Step 4: Language for responses in learning.**

Finally, write down two words that describe a conscious and an unconscious response/behaviour. It is important that you can describe the role of a learner as active or passive, their behaviours as voluntary or involuntary and the learner as aware or unaware of the learning experience.

## **Practice SAC 2 with annotated sample response**

Now that you have learnt about some steps to help you succeed on SAC 2, we can look at how this theory can be put into action on an example SAC. In this section, we examine:

- a practice SAC
- a high-scoring student response for the SAC (complete with tips and annotations to show you how to maximise your marks)
- the marking criteria for the practice SAC.

## Practice SAC 2

### Comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities

Learning is described as a relatively permanent change in behaviour or knowledge in response to experience. This process often occurs through classical conditioning, operant conditioning and observational learning. Once information has been learnt, we sometimes struggle to retrieve it. A way to assist with retrieval is to use mnemonic devices, which are techniques that improve our memory. In this SAC, you will analyse and compare the types of learning and investigation methods used in three investigations:

- 4.1 Modelling: How can we model the process of observational learning in practice?
- 4.3 Case study: Can pigeons learn to operate military weapons?
- 5.4A Controlled experiment: Can the method of loci improve memorisation of visual information?

#### Question 1 (16 marks)

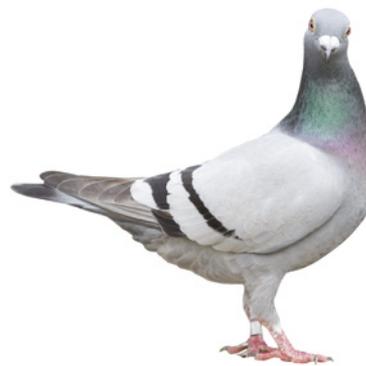
Complete Investigation 4.1 and answer the following questions.

- a Discuss each of the five stages of observational learning in the context of the participant learning how to make a paper origami heart from watching a video clip. (5 marks)
- b Discuss why observational learning is more suitable for learning how to make an origami heart than classical conditioning. Refer to the role of the learner and the type of behaviour in your response. (4 marks)
- c Identify three characteristics that would be important for the model from the video clip to possess to increase attention from the learner to learn to make a paper origami heart. (3 marks)
- d Contrast how case studies, such as the one used in Investigation 4.3, differ from modelling as an investigation methodology. (2 marks)
- e Suggest when a case study would be more useful than modelling for investigating observational learning. (2 marks)

#### Question 2 (17 marks)

Complete Investigation 4.3 and answer the following questions.

- a Identify which type of learning was used in the Skinner experiment. Justify your answer. (2 marks)
- b What was the original intended purpose of the “Pigeon Project”? (1 mark)
- c What learning association was B.F. Skinner trying to form? (1 mark)
- d Use your answer to Question 2a to describe how learning occurred in three phases. (3 marks)
- e At times throughout the experiment, pigeons were provided food when a behaviour was successfully completed and an electrical shock when behaviour was unsuccessfully completed. Discuss what forms of consequences were used by Skinner in this experiment for pigeons. (4 marks)
- f Provide a real-world application for the findings of Skinner’s experiment with conditioning pigeons. (2 marks)
- g Compare the type of learning that occurred to condition the pigeons in the Pigeon Project with the type of learning that occurred in Investigation 4.1 by discussing two similarities and two differences. (4 marks)



**FIGURE 1** B.F. Skinner studied how the process of learning occurs in pigeons.

**Question 3** (22 marks)

We are bombarded with large amounts of information every day. This information includes anything from new people's names, knowledge from school and information from our hobbies and interests or the news. Without even realising, we often find ways to reduce the amount of information we need to remember while still ensuring that the quality of information is maintained. Investigation 5.4A explored how mnemonics can be shown to improve the encoding, storage and retrieval of information from our memory.

- a** Justify why the method of loci is a type of mnemonic device. (2 marks)
- b** According to the Atkinson–Shiffrin multi-store model of memory, how were the three stores of memory involved when participants processed the visual information in Investigation 5.4A? (3 marks)
- c** In Investigation 5.4A, some participants were taught by the experimenter how to apply the method of loci. Discuss which of the two approaches to learning covered in Investigations 4.1 and 4.3 best reflects how individuals learnt to use the method of loci. (5 marks)
- d** Evaluate whether the method of loci used in Investigation 5.4A is an example of an organisational mnemonic or an encoding mnemonic. (2 marks)
- e** Discuss how two participants' use of the method of loci would be affected for this study if one participant had been diagnosed with Alzheimer's disease years ago and the other participant had been diagnosed with aphantasia. (4 marks)
- f** Describe how one participant would be affected in this experiment if they had a damaged cerebellum. (2 marks)
- g** Identify two other mnemonic devices and assess whether they would be as useful for retrieving the visual information in this experiment. (4 marks)

Check your Student [obook pro](#) for these digital resources and more:



**Annotated response and marking criteria**

Once you've completed the practice SAC use this resource to assess your response.

pro

## Part B – Checkpoint questions

### Multiple choice

Use the following information to answer questions 1 and 2.

When Ron goes to the football, he always gets a hotdog. One day, he vomits after having a hotdog at the football and feels ill for the rest of the day. The next weekend, Ron gets another hotdog at the football. Although he does not throw up, he begins to feel very ill after eating the hotdog. Next time he goes to the football, Ron gets a sausage roll instead of a hotdog. Ron hasn't felt ill since he started eating sausage rolls.

#### Question 1

Which of the following is true about Ron's experience of classical conditioning?

- A Ron is an active learner.
- B Ron is conditioned to feel ill whenever he eats a sausage roll.
- C Ron is a passive learner.
- D For conditioning to be successful, Ron must feel ill before eating the hotdog.

#### Question 2

Which of the following best describes the sausage roll in this example?

- A A neutral stimulus
- B A conditioned stimulus
- C A conditioned response
- D An unconditioned response



FIGURE 1 A hot dog

### Question 3

Sofia's younger sister, Isabella, would like to learn how to play the flute. Isabella asks Sofia to teach her. Unfortunately, Isabella's hands are too small to hold the flute properly and she struggles to play notes using the correct technique. However, over time, Sofia comments that Isabella's flute technique is improving every week.

Which key process in observational learning initially prevents Isabella from playing the flute successfully?

- A Retention
- B Attention
- C Motivation
- D Reproduction



FIGURE 2 Sofia's little sister wants to learn how to play the flute.

### Question 4

Rachel is a very experienced doctor. She works in the emergency department of a hospital where patients frequently arrive with injuries, especially to the head. One of her patients had damage to the medial temporal lobe in both hemispheres, including both hippocampi.

Despite the damage, this patient should be able to continue to form new:

- A episodic memories.
- B procedural memories.
- C semantic memories.
- D explicit memories.

**Question 5**

Which of the following changes in the function of memory is characteristic of the later stages of Alzheimer’s disease?

- A** Severe disruption to short-term memory but retention of the ability to consolidate new long-term memories
- B** No disruption to short-term memory but severe disruption in laying down new long-term memories
- C** Difficulty creating new long-term memories but no difficulty accessing old long-term memories
- D** Forgetting how to do everyday things and being unable to form new long-term memories

*Use the following information to answer questions 6 to 10.*

A researcher investigated whether the status of a model would affect how closely Victorian school children would attend to the model’s behaviour. The researcher randomly allocated 22 Victorian school children into two groups. Group A viewed a video of former professional tennis player Ash Barty demonstrating a serving technique. Group B viewed a video of a member of the local tennis club demonstrating the same serving technique. The researcher recorded the mean number of times the school children looked away from the screen during the video. The results are presented in Table 1.

**TABLE 1** The mean number of times school children looked away from the screen

Group	Mean number of times Victorian school children looked away from the screen
<b>A</b>	3
<b>B</b>	7

**Question 6**

According to the information in Table 1, which of the following statements is true?

- A** High status has a negative effect on the attention levels of Victorian school children.
- B** Victorian school children will not be affected by a model who has high status.

- C** Victorian school children are more likely to focus on a model who has high status.
- D** Attention levels of Victorian school children are affected by the length of the video viewed.

**Question 7**

Which of the following represents the sample and population for this study?

- A** The sample is school children, and the population is Victorian school children.
- B** The sample is 22 Victorian school children, and the population is Victorian school children.
- C** The sample is Victorian school children, and the population is 22 Victorian school children.
- D** The sample is 22 Victorian school children, and the population is school children.

**Question 8**

Participants were randomly allocated in this study.

This means that:

- A** all Victorian school children have an equal chance of taking part in the study.
- B** the study possesses internal validity.
- C** the 22 Victorian school children have an equal chance of being placed in either Group A or Group B.
- D** Group A and Group B will contain the same number of individuals.

**Question 9**

The type of data collected in this study is:

- A** primary; qualitative.
- B** primary; quantitative.
- C** secondary; qualitative.
- D** secondary; quantitative.

**Question 10**

At one point during the data collection, the researcher dropped their pencil on the ground. While retrieving it, their ability to determine if one of the school children had looked away from the screen was temporarily affected.

This type of error is known as:

- A** bias.
- B** systematic.
- C** personal.
- D** random.

## Short answer

### Question 1 (6 marks)

Stella is teaching her pet iguana to come to her when she makes a short, high-pitched whistling sound. At first, Stella stands still, holding some kale (the iguana's favourite food) while whistling. Her iguana approaches and chews on the kale. Gradually, the iguana responds faster to Stella's whistling and walks towards her, knowing she has kale.

- Using the language of the appropriate behaviourist approach to learning, explain how the iguana learnt to come to Stella. (4 marks)
- Distinguish between the behaviourist approach to learning and the social-cognitive approach. (2 marks)

### Question 2 (5 marks)

Mario is a university student who is studying to become a teacher, which involves student teacher placements at nearby high schools. On one placement, Mario watches a maths class and observes how the maths teacher explains fractions using slices of cake. Mario notices how well the students understand fractions because of the way the teacher explained the concept. The following week, Mario must teach a different maths class about fractions and is excited about trying out the cake slices strategy.

Outline the five stages of observational learning in relation to Mario.

### Question 3 (11 marks)

Dr Amarco wanted to investigate whether positive punishment or negative punishment was more effective in altering an individual's behaviour in the long term. She advertised for volunteers and recruited 45 university students who classified themselves as a "swearer". The 45 students were randomly allocated to two groups. Participants were seated in separate rooms and shown a horror film. Participants in Group A had their mobile phones confiscated every time they swore during the horror film. Participants in Group B were administered a mild electric shock every time they swore during the horror film.

- Identify the group that experienced negative punishment. Justify your response. (2 marks)
- Explain why a between-subjects design was a better choice than a within-subjects design for this research study. (2 marks)
- Identify a controlled variable within the research study. (1 mark)
- Dr Amarco's study was approved by an ethics committee. Outline the role of an ethics committee and explain how the ethical concept of non-maleficence should be upheld in Dr Amarco's study. (3 marks)
- Evaluate the internal validity of Dr Amarco's research study and determine whether the research study possesses external validity. (3 marks)

### Question 4 (4 marks)

Compare classical conditioning and operant conditioning by outlining two differences and two similarities.

### Question 5 (4 marks)

Tim is learning to tap dance. After learning for one month, he notices that he is learning basic skills taught in his dance classes much faster.

Identify two specific areas of the brain that were involved in improving Tim's ability over time to learn tap dancing quicker. Explain the role of each area.

### Question 6 (6 marks)

Sally has just started working at the Commonwealth Scientific and Industrial Research Organisation. Unfortunately, she occasionally forgets the full title of the company and sometimes the order of the words.

- Outline the capacity and duration of Sally's short-term memory. (2 marks)
- With specific reference to the Atkinson–Shiffrin multi-store model of memory, explain how visual information from Sally's sensory memory is transferred to her short-term memory. (2 marks)
- Describe how Sally could use a mnemonic device to remember the name of her new workplace. (2 marks)

**Question 7** (10 marks)

A new drug is being developed to treat Alzheimer’s disease. The drug, known as Acetine, acts as an acetylcholine neuroagonist, which alleviates the physiological symptoms and thus the psychological symptoms of Alzheimer’s disease.

To assess the effectiveness of the drug, a sample group of 100 patients diagnosed with probable Alzheimer’s disease were selected for testing. All participants underwent a pre-testing phase where they were given a list of twenty three-letter words and were required to memorise them for thirty minutes. All participants then had to recall the words in order.

Half of the participants, Group 1, then started the testing phase, where they were administered a daily dose of Acetine for three weeks. The other participants, Group 2, were given a placebo (a sugar pill with no active ingredient).

At the end of the three weeks, a near-identical memory test was conducted. The results are shown in Table 2.

**TABLE 2** Results of memory tests on Alzheimer’s patients

Time of test	Average score out of 20	
	Group 1	Group 2
Before experiment	6.8	6.9
After three weeks	10.2	6.8

- a** The results from the pre-testing phase can be attributed to the neurological characteristics of Alzheimer’s disease. Outline the two biological changes to the brain that indicate someone suffers from Alzheimer’s disease. (2 marks)
- b** Referring to data, outline whether this drug is reducing the effects of Alzheimer’s disease. (2 marks)
- c** Classify the type of data collected in this study and outline one strength of this data type. (2 marks)

- d** Explain why repeatability is important during the testing of the drug Acetine. (2 marks)
- e** Over time, Alzheimer’s disease will cause specific areas of the brain to degenerate. Identify a specific structure of the brain that could degenerate and explain a related cognitive function that would be impaired due to this degeneration. (2 marks)

**Question 8** (10 marks)

Professor Marco was interested in replicating the Little Albert study (see Real-world psychology 4.2), but with a twist. Professor Marco wanted to investigate whether he could condition a toddler to laugh whenever he saw a white rat. The toddler was 8 months old and was already able to recognise his parents’ faces and smile when he saw them, and had begun showing signs of laughter at funny faces or tickling. The toddler previously had no contact or experience (positive or negative) with white rats.

Professor Marco sought permission from the toddler’s parents to conduct the study and they were present for the week-long duration of the experiment.

With specific reference to the three-phase model of classical conditioning:

- describe the processes Professor Marco would need to use to test whether the conditioning was possible
- explain two ethical concepts Professor Marco would need to consider and outline how they would be adhered to
- identify and describe the roles of two brain structures involved in this learning experience becoming a memory.

UNIT

# 3

# Review

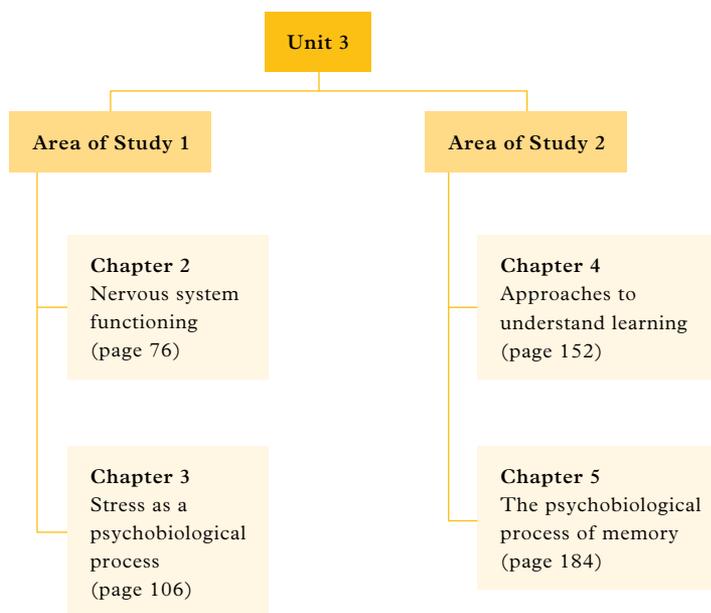
This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 3, learn some expert tips for answering exam questions, and practise your skills on a range of exam-style questions.

## Part A - Revisit and revise

Part A of the unit review will help you revisit and revise all the key concepts covered in Unit 3 and test your understanding to identify strengths and weaknesses in your knowledge so you can better inform your revision.

### Unit 3 Overview

The chart below shows all the areas of study for Unit 3 and the relevant chapters in your Student Book. Go to the pages shown to review the key concepts for each chapter.



## Test your understanding

Use the following table to guide your revision:

Step 1 – Read the key knowledge for this unit.

Step 2 – Test your understanding of the key knowledge by answering the question(s).

Step 3 – Rate your understanding of each key knowledge point from low to high.

Step 4 – Use the topic and page numbers to revise the concepts you’ve identified as needing practice.

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the roles of different subdivisions of the central and peripheral nervous systems in responding to, and processing and coordinating with, sensory stimuli received by the body to enable conscious and unconscious responses, including spinal reflexes</li> </ul>	1 Discuss two different situations where the sympathetic and parasympathetic nervous system are dominant.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.1 Pages 78–82
	2 Describe the process involved for a spinal reflex to occur.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.2 Pages 83–86
<ul style="list-style-type: none"> <li>the role of neurotransmitters in the transmission of neural information across a neural synapse to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma-aminobutyric acid [GABA]) as compared to neuromodulators (such as dopamine and serotonin) that have a range of effects on brain activity</li> </ul>	3 Explain the role of GABA and glutamate in the central nervous system.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.4 Pages 90–92
<ul style="list-style-type: none"> <li>synaptic plasticity – resulting from long-term potentiation and long-term depression, which together act to modify connections between neurons (sprouting, rerouting and pruning) – as the fundamental mechanism of memory formation that leads to learning</li> </ul>	4 Distinguish between long-term potentiation and long-term depression.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.6 Pages 97–101
<ul style="list-style-type: none"> <li>internal and external stressors causing psychological and physiological stress responses, including the flight-or-fight-or-freeze response in acute stress and the role of cortisol in chronic stress</li> </ul>	5 Explain how stress can have psychological and biological effects on the human body.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.1 Pages 108–115
<ul style="list-style-type: none"> <li>the gut–brain axis (GBA) as an area of emerging research, with reference to the interaction of gut microbiota with stress and the nervous system in the control of psychological processes and behaviour</li> </ul>	6 Explain what research suggests is the relationship between the gut and the central nervous system when we are stressed for a long period of time.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.4 Pages 126–133

(continued)

TABLE 1 continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the explanatory power of Hans Selye's General Adaptation Syndrome as a biological model of stress, including alarm reaction (shock/counter shock), resistance and exhaustion</li> </ul>	7 Describe the biological process occurring as someone experiences shock and then counter shock.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.2 Pages 116–120
	8 Discuss two strengths and two limitations of the General Adaptation Syndrome.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.2 Pages 116–120
<ul style="list-style-type: none"> <li>the explanatory power of Richard Lazarus and Susan Folkman's Transactional Model of Stress and Coping to explain stress as a psychological process (primary and secondary appraisal only)</li> </ul>	9 Describe all the components of primary appraisal.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.3 Pages 121–125
<ul style="list-style-type: none"> <li>use of strategies (approach and avoidance) for coping with stress and improving mental wellbeing, including context-specific effectiveness and coping flexibility</li> </ul>	10 Describe examples of an approach and avoidant strategy you use to reduce the stress of studying a Year 12 subject.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.5 Pages 134–137
<ul style="list-style-type: none"> <li>behaviourist approaches to learning, as illustrated by classical conditioning as a three-phase process (before conditioning, during conditioning and after conditioning) that results in the involuntary association between a neutral stimulus and an unconditioned stimulus to produce a conditioned response, and operant conditioning as a three-phase process (antecedent, behaviour and consequence) involving reinforcement (positive and negative) and punishment (positive and negative)</li> </ul>	11 Discuss a unique characteristic for each of the three learning models.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 4.1 Pages 154–156
	12 Explain what the three components of the three-phase model for classical conditioning are.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 4.2 Pages 157–162
	13 Describe the four types of consequences with suitable examples.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 4.3 Pages 163–168
<ul style="list-style-type: none"> <li>social-cognitive approaches to learning, as illustrated by observational learning as a process involving attention, retention, reproduction, motivation and reinforcement</li> </ul>	14 Discuss the five stages of observational learning in response to someone wanting to learn how to sew.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 4.4 Pages 169–174

TABLE 1 continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>approaches to learning that situate the learner within a system, as illustrated by Aboriginal and Torres Strait Islander ways of knowing where learning is viewed as being embedded in relationships where the learner is part of a multimodal system of knowledge patterned on Country</li> </ul>	15 Discuss what it means for a learner to be part of a multimodal system of knowledge patterned on Country and how this compares to other knowledge systems.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 4.5 Pages 175–179
<ul style="list-style-type: none"> <li>the explanatory power of the Atkinson–Shiffrin multi-store model of memory in the encoding, storage and retrieval of stored information in sensory, short-term and long-term memory stores</li> </ul>	16 Identify the capacity and duration of sensory memory, short-term memory and long-term memory.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.1 Pages 186–194
	17 Describe the four types of long-term memories with examples.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.1 Pages 186–194
<ul style="list-style-type: none"> <li>the roles of the hippocampus, amygdala, neocortex, basal ganglia and cerebellum in long-term implicit and explicit memories</li> </ul>	18 Explain which type of long-term memory is associated with the hippocampus, neocortex, basal ganglia, amygdala and cerebellum.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.2 Pages 195–203
<ul style="list-style-type: none"> <li>the role of episodic and semantic memory in retrieving autobiographical events and in constructing possible imagined futures, including evidence from brain imaging and post-mortem studies of brain lesions in people with Alzheimer’s disease and aphantasia as an example of individual differences in the experience of mental imagery</li> </ul>	19 Describe the impact of Alzheimer’s disease on encoding, storage, and retrieval of memory.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.3 Pages 204–213
<ul style="list-style-type: none"> <li>the use of mnemonics (acronyms, acrostics and the method of loci) by written cultures to increase the encoding, storage and retrieval of information as compared with the use of mnemonics such as sung narrative used by oral cultures, including Aboriginal peoples’ use of Songlines</li> </ul>	20 Compare the method of loci and Songlines as mnemonic devices.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.4 Pages 214–221

## Part B – Exam essentials

Now that you have completed your revision for Unit 3, it is time to learn and practise some of the skills you will need to answer exam questions like a pro! To help you, our expert authors have created the following advice and tips to help you maximise your results on the end-of-year examination.

### Exam tip 1 – Referring to conscious and unconscious responses

When answering a question that mentions the nervous system and a specific response, you are expected to identify whether the response is conscious or unconscious. It is also important to justify your classification of the response. To avoid using circular descriptions, you might want to instead use terms such as “automatic” and “involuntary” or “aware” and “voluntary” when describing a response.

### See it in action

Read the real exam question below and see how the tip has made a difference between the high-scoring and low-scoring responses.

#### QUESTION 2

(5 marks)

Matilda takes her new pet dog, Biscuit, for a walk along the same route every day. Children often stop Matilda so that they can pat Biscuit.

- a Identify which subdivision of the peripheral nervous system is responsible for the movement to pat Biscuit and explain the sequence of biological processes that occurs.

Source: *VCE 2021 Psychology Exam* reproduced by permission © VCAA

#### High-scoring response



*The somatic branch is involved. Sensory neurons in the children's eyes would detect seeing the dog and send the information to the brain. The brain would process this information (as a voluntary, conscious response) and send a neural message via motor/efferent neurons to (skeletal) muscles in their hand/arm to pat the dog.*

Linking the term “voluntary” to “conscious response” not only identifies the type of response but also provides your reasoning.

Source: *2021 VCE Psychology External Assessment Report* reproduced by permission © VCAA

#### Low-scoring response

1 mark lost for incorrectly identifying subdivision.



*The peripheral nervous system is responsible for the movement to pat Biscuit. The sensory neurons in the children's eyes detect the dog, and the brain processes this information and sends a message to the muscles in their hand/arm to pat the dog.*

1 mark lost for failing to identify that the response was conscious.

1 mark lost for not elaborating on the specifics of processes (e.g. that the message sent from the brain to the muscle was a motor message).

## Think like an examiner

To maximise your marks on an exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

#### QUESTION 1

(5 marks)

Finn was standing near a campfire with his friends when he noticed the fire becoming hotter against the skin of his legs. To avoid getting burnt by the growing flames, he took a step away from the campfire. The human nervous system has two major divisions. Identify the subdivision of one of these major divisions that activates Finn's responses and outline how the subdivision is involved in Finn's responses.

Source: VCE 2019 Psychology Exam reproduced by permission © VCAA

*The human nervous system has two major divisions. One of these divisions involved in Finn's response is the nervous system that controls the body. It activates Finn's responses by sending signals to his legs to move away from the fire.*

### Marking guide

#### Question 1

- 1 mark for providing an accurate identification of one division
- 4 marks for a correct and coherent outline of the involvement of any one of the following in activating the response:
  - the somatic nervous system
  - the brain
  - the autonomic nervous system

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

### Exam tip 2 - Using the command term "justify"

- After identifying a correct answer, you may be asked to justify your response. "To justify" means to show adequate grounds or reasons for this conclusion to be reached. Therefore, when asked to justify, it is more important that you provide that reasoning for your answer and do not simply explain the key terms.

## See it in action

Read the real exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

#### QUESTION 1

(3 marks)

- b** Identify what stage of Selye's General Adaptation Syndrome Bob was in when he started frequently catching colds. Justify your response.

Source: VCE 2021 Psychology Exam reproduced by permission © VCAA

## High-scoring response

1 mark awarded for correctly identifying the stage of GAS.



Bob is likely in the resistance stage of GAS. The ongoing stress from his work resulted in his body releasing cortisol over a period of time to help overcome the stressor; however, this caused his immune system to be suppressed, making him more vulnerable to catching a cold.

2 marks awarded as justification suggests why Bob is experiencing resistance in the context of the scenario.

## Low-scoring response

1 mark awarded for correctly identifying the stage of GAS.



Bob was in the resistance stage of GAS when he started to catch colds.

Student has lost 2 marks as they did not provide a justification that refers to the ongoing release of cortisol to overcome stress and the suppression of Bob's immune system.

## Think like an examiner

To maximise your marks on an exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

#### QUESTION 4

Advertisers often use learning principles when promoting products. An advertisement for a new soft drink features people having a good time while consuming the product. This is intended to make potential customers experience positive emotions when thinking about the soft drink.

- a What type of conditioning is used to generate positive emotions towards the new soft drink? Give two reasons to justify your response. (3 marks)

Source: VCE 2020 Psychology Exam reproduced by permission © VCAA

*Classical conditioning because if it looks like others are having a good time it reinforces motivation behind the behaviour.*

### Marking guide

#### Question 4a

- 1 mark for correct identification of classical conditioning
- 2 marks for two valid justifications of why the conditioning was classical conditioning.

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

## Part C – Practice makes perfect

Now it is time to put the tips and advice you've learnt into practice while you complete these exam-style questions!

### Multiple choice

#### Question 1

When Shae undertakes a particularly difficult series of steps in her ballet performance, her motor movements are controlled by the:

- A somatic division of the central nervous system.
- B autonomic division of the central nervous system.
- C somatic division of the peripheral nervous system.
- D autonomic division of the peripheral nervous system.

Use the following information to answer questions 2 and 3.

The following table shows physiological responses in two different situations.

Situation	Physiological responses
1 Watching a scary movie	<ul style="list-style-type: none"> <li>• Heart rate increases</li> <li>• Stomach and pancreas activity is reduced</li> </ul>
2 Relaxing while reading a book	<ul style="list-style-type: none"> <li>• Pupils constrict</li> <li>• Breathing rate decreases</li> </ul>

#### Question 2

While watching a scary movie, it is also likely that:

- A pupils are dilated and the bladder relaxes.
- B pupils are constricted and breathing rate increases.
- C perspiration is increased and breathing rate decreases.
- D perspiration is increased and the body reduces the release of glucose.

#### Question 3

When a person is sitting outside an office waiting to have an important job interview, their physiological responses will be similar to those in:

- A situation 1, in which their parasympathetic nervous system is dominant.
- B situation 2, in which their parasympathetic nervous system is dominant.
- C situation 1, in which their sympathetic nervous system is dominant.
- D situation 2, in which their sympathetic nervous system is dominant.

Use the following information to answer questions 4 to 8.

Vincent agreed to take part in a case study investigating the effect of chronic stress on mood. The researcher explained the purpose of the study to Vincent and outlined the risks involved before he agreed to participate. As part of the research, Vincent would be required to have bi-weekly blood tests for a period of three months. In the third week of the study, while having a blood test he became scared and ran out of the room. Vincent did not participate further in the study and the researcher had no further contact with him.

#### Question 4

Identify a strength and weakness of conducting a case study.

	Strength	Weakness
A	Provides in-depth data about events/experiences	Controlled conditions may be difficult to maintain
B	Identifies cause and effect relationships between variables	Results may not be representative of the population
C	Can be useful when participant selection is limited	Results may not be externally valid
D	Can help determine how strong or weak the relationship between two variables is	A large amount of data is required

#### Question 5

The ethical guideline adhered to when the researcher explained the purpose of the study to Vincent and outlined the risks involved was:

- A voluntary participation.
- B confidentiality.
- C withdrawal rights.
- D informed consent.

#### Question 6

Which ethical guideline was potentially violated when the researcher did not contact Vincent after withdrawing from the study?

- A Debriefing
- B Informed consent
- C Confidentiality
- D Voluntary participation

### Question 7

After the incident involving Vincent, the researcher decided to conduct a controlled experiment to investigate the effect of stress on cortisol levels. Rather than measuring cortisol levels by a blood test, a urine sample was taken instead. The researcher employed the use of a mixed design.

A benefit of employing a mixed design is that:

- A** the effects of more than one independent variable on the dependent variable can be investigated.
- B** the same participants can be used in experimental conditions.
- C** fewer participants are used than in other experimental designs.
- D** the procedure can be conducted at once, reducing the incidence of participants dropping out of the study.

### Question 8

The data obtained from the urine sample was:

- A** quantitative and objective.
- B** qualitative and objective.
- C** quantitative and subjective.
- D** qualitative and subjective.

### Question 9

One example of an unconscious response is the patellar reflex, which is when your patellar tendon is tapped with a rubber hammer and your leg involuntarily kicks out.

It is likely that this reflex is coordinated in the:

- A** cerebellum.
- B** amygdala.
- C** spinal cord.
- D** cerebral cortex.

### Question 10

Which statement is most true about synaptic transmission?

- A** The transmission of an impulse occurs only within the central nervous system.
- B** The transmission of an impulse inside a neuron is facilitated by neurotransmitters.
- C** The transmission of an impulse between neurons is facilitated by neurotransmitters.
- D** The transmission between one neuron and another relies on electricity.

Use the following information to answer questions 11 to 14.

A doctor investigated people's responses to stepping on a nail as part of a stress test. The experiment was conducted in two parts. Part A measured how much a participant's heart rate increased on stepping on the nail. In Part B, each participant was asked "How much did that hurt?".

### Question 11

Before Part A, all the participants were shown the nail they would be stepping on in the experiment. One of the participants, Elsa, felt stressed when seeing the nail and she felt her heart rate decrease and the colour drain from her face.

Elsa is probably experiencing:

- A** the alarm reaction stage of the GAS model, in which the body goes into shock characterised by a momentary increase in functioning.
- B** shock, where the body decreases in functioning as coordinated by the parasympathetic nervous system.
- C** the resistance stage of the GAS model, in which the body releases adrenaline into the bloodstream.
- D** counter shock, in which the body decreases in functioning as coordinated by the sympathetic nervous system.

### Question 12

A limitation of the data type collected in Part B is that it is:

- A** often biased.
- B** not detailed enough.
- C** the same for all participants.
- D** measurable.

### Question 13

After taking the heart rate of five participants, the doctor noticed that the heart rate monitor was not calibrated correctly. Consequently, there was a difference between the measured value for heart rate and the true value for heart rate.

This type of error is known as:

- A** random.
- B** systematic.
- C** personal.
- D** bias.

### Question 14

Upon completion of the experiment, the doctor reported that the results were not externally valid.

This means:

- A** the experiment did not measure what it claimed to measure.
- B** no conclusions could be drawn.
- C** the results of the experiment may not apply to individuals who are different from the study population.
- D** the experiment was not repeated multiple times.

*Use the following information to answer questions 15 and 16.*

Maja participated in a television trivia game show about music knowledge and facts. While waiting in the studio for her turn to appear on television, she felt very stressed because she did not think she deserved to be on the show. She felt so anxious that at one point she left the studio where filming was taking place. While outside, Maja studied her notes and quizzed herself to build her confidence, and she eventually returned to the studio for filming.

### Question 15

The coping strategies that Maja used when reviewing her notes before returning to the studio are described as an:

- A** avoidant strategy.
- B** approach strategy.
- C** appropriate strategy.
- D** adaptable strategy.

### Question 16

Maja was stressed because she did not think she deserved to be on the show. The stressor in this incident is:

- A** an external stressor.
- B** an internal stressor.
- C** chronic.
- D** acute.

### Question 17

The gut–brain axis:

- A** explores the interaction between the peripheral nervous system and your gut.
- B** is a response coordinated only through hormones, such as cortisol.
- C** does not interact with the hypothalamic–pituitary–adrenal axis.
- D** describes how the enteric nervous system interacts with the central nervous system via the vagus nerve.

### Question 18

The difference between an extraneous and confounding variable is that an:

- A** extraneous variable may cause a change in the dependent variable, whereas a confounding variable directly impacts the dependent variable.
- B** extraneous variable may cause a change in the independent variable, whereas a confounding variable directly impacts the independent variable.
- C** extraneous variable directly impacts the dependent variable, whereas a confounding variable may cause a change in the dependent variable.
- D** extraneous variable directly impacts the independent variable, whereas a confounding variable may cause a change in the independent variable.

### Question 19

In classical conditioning, the process of associative learning involves the formation of new associations between stimuli.

Classical conditioning is a type of learning in which:

- A** a behaviour is strengthened or weakened by its consequences.
- B** two stimuli are repeatedly paired and form an association.
- C** an organism learns to perform a behaviour to receive a reward.
- D** an organism learns to imitate the behaviour of others through observation.

*Use the following information to answer questions 20 and 21.*

Juan is trying to get an A+ in maths for his end-of-semester exam. His mother has said to him “If you get an A+ in all subjects, I will buy you a new bike”. Juan studies hard and successfully obtains an A+ for his maths exam and begins studying for his English exam because he would like a new bike.

### Question 20

The type of consequence used by Juan’s mother is:

- A** positive reinforcement.
- B** negative reinforcement.
- C** negative punishment.
- D** positive punishment.

### Question 21

Which of the following is true of Juan during this learning process?

- A He is an active learner.
- B His actions are involuntary.
- C He is a passive learner.
- D His actions are learnt by watching the behaviour of others.

Use the following information to answer questions 22 and 23.

Sara lives in Cairo and has just started a job at a factory where she is required to pack boxes with fresh produce. She has worked out a strategy for packing the boxes that she thinks will save her time. When her new boss, Ali, walks past, he notices Sara carrying out her work and offers his own technique for efficiently packing the boxes. Sara realises that Ali's technique is much more effective than her original one. After Sara applies the new effective technique, she is told she can leave work early since she has finished all her work.

### Question 22

What is the relevance of long-term potentiation (LTP) to Sara's situation?

- A Irrelevant. LTP reduces the effectiveness of Sara's newly learnt technique for packing boxes.
- B Irrelevant. Sara had a previous memory store of how to pack boxes, so no synaptic change is required.
- C Relevant. LTP allows for the formation of efficient neural pathways that have stored a mental representation of Ali's effective technique for packing boxes.
- D Relevant. LTP allows the removal of inefficient neural pathways that have stored a mental representation of Sara's original, less-effective technique for packing boxes.

### Question 23

In learning Ali's technique for efficiently packing boxes of fresh produce, it is important that Sara first:

- A forms a mental representation of Ali's technique.
- B is motivated to perform Ali's technique.
- C pays close attention to how Ali packs the boxes efficiently.
- D believes she will receive praise for carrying out Ali's technique.

Use the following information to answer questions 24 to 27.

A researcher investigated whether the use of an acronym would increase the ability of individuals to recall a list of six everyday items. Fifteen participants were randomly allocated into either Group A or Group B. Group A viewed a short educational video outlining what an acronym is and how to create one. They were then presented a list of six everyday items. They were asked to create an acronym based on the items. Group B were presented with the same list as Group A and asked to memorise the list. After an hour, both groups were asked to recall the items on the list.

### Question 24

The dependent variable in this study is:

- A the use of an acronym.
- B recall ability.
- C the use of an educational video.
- D six everyday items.

### Question 25

An appropriate hypothesis for this study is:

- A participants who use an acronym will have worse recall of list items than those who do not use an acronym.
- B the use of an acronym will affect the ability to recall items from a list.
- C participants who use an acronym will have better recall of list items than those who do not use an acronym.
- D the use of an acronym will extend the duration of long-term memory.

### Question 26

One of the participants who took part in the study was an undergraduate Psychology student. At the conclusion of the study, they approached the researcher and told them they thought the study lacked internal validity.

A potential reason for this could be:

- A the characteristics of the participants do not represent the wider population.
- B there was an uneven number of participants in Group A and Group B.
- C as only six items were recalled, the capacity of short-term memory had not been exceeded and therefore it is unclear whether the use of a mnemonic has had a direct effect on recall ability.
- D participants recorded their responses using different coloured pens.

### Question 27

Throughout the study, the researcher upheld the ethical concept of integrity. This means:

- A all participants were treated equally.
- B the risk of harm was minimised.
- C the benefits of the research outweighed any risks.
- D the results of the research were communicated honestly.

Use the following information to answer questions 28 to 30.

Bill is 65 years old and is suffering from the early stages of Alzheimer's disease. He still works as a tutor at a university, but his wife has noticed some signs of his condition.

### Question 28

Which part of the brain does Alzheimer's disease typically start in?

- A Primary motor cortex
- B Corpus callosum
- C Hippocampus
- D Cerebellum

### Question 29

Bill responded to an advertisement asking for volunteers to participate in a study that investigated the effect of early stages of Alzheimer's disease on recall ability. As part of this study, Bill undertook a series of memory tests where the mean number of items correctly recalled was recorded.

The mean is a useful statistic to describe data when:

- A most values of the data are clustered around a central score.
- B outliers are present.
- C data is skewed.
- D there is a limited amount of data.

### Question 30

The researcher of the study assured Bill that he would not be identified by any of the results from the study and that the data would be stored and disposed of using secure procedures.

The ethical guideline that has been adhered to is:

- A informed consent.
- B voluntary participation.
- C confidentiality.
- D withdrawal rights.

### Short answer

#### Question 1 (5 marks)

Anna is a chef in a top Melbourne restaurant and works a dinner shift in the kitchen. The restaurant is very busy, so Anna is frantically completing two or three jobs at once. She accidentally touches the hot handle of a frying pan without using a tea towel to protect her from the heat. Before she registers the pain in her hand, Anna notices that her hand has already moved away from the pan.

- a Assess if Anna's hand moving away from the pan is a conscious or an unconscious response. Justify your answer. (2 marks)
- b By referring to the correct nervous systems, describe how Anna's hand was able to move away and then why she experienced pain. (3 marks)

#### Question 2 (8 marks)

Paul is serving in the final set of the Wimbledon Championships. He has been playing tennis since age four and now, at age 25, is very proud that he has been able to make it to the final match of this well-regarded competition. As the final game begins, Paul is serving.

- a Describe the role of the central nervous system in the integration of information. (2 marks)
- b Explain how Paul's somatic nervous system uses afferent and efferent messages to complete the task of serving. (2 marks)
- c Outline two different physiological changes the sympathetic nervous system would be responsible for managing while Paul plays this game of tennis. Describe the purpose of these specific changes. (4 marks)

#### Question 3 (23 marks)

Astrid is a first-year international university student studying for a Bachelor of Psychology. She is the only student from her high school who enrolled in this university, so she does not know anyone and has yet to make any new friends. Astrid is 17 years old, has yet to obtain her driver's licence and lives an hour away from her university campus. Because of this, she must wake up at 5.30 a.m. and take multiple types of public transport to get to university on time each day. She is finding the travelling exhausting and the workload demanding and unmanageable. Astrid is extremely worried about failing her first year of university.

Over the last couple of days, Astrid has started to feel lethargic and run down, and has missed two of her tutorial classes.

Liam is also a first-year student studying for a Bachelor of Psychology and living on campus, along with his best friend from high school. He is enjoying attending university and participating in the extra-curricular activities on offer. Although his lectures can be challenging, Liam loves them and is finding the new topics he is learning about in his tutorial classes engaging and interesting, despite the amount of homework. He has many friends and has also recently joined a sports club at the university with his roommate.

- a Describe the primary appraisals of Astrid and Liam during their first year at university, by referring to the Lazarus and Folkman Transactional Model of Stress and Coping. (4 marks)
- b Describe Liam’s secondary appraisal with reference to the type of coping strategy he is using. (3 marks)
- c Evaluate the explanatory power of Lazarus and Folkman’s Transactional Model of Stress and Coping to explain Astrid’s experience during her first year of university. (4 marks)
- d While travelling by train to university, Astrid saw an advertisement seeking participants for a study investigating the use of herbal teas to reduce anxiety levels. Astrid decided to partake in the study. Over the course of a three-week period, Astrid and 24 other participants were required to consume three cups of herbal tea a day. At the end of each day, they were required to measure their heart rate using an electronic monitor, which was supplied to each participant. At the end of the three-week period, all participants were asked to consume no herbal tea for another 3 weeks while still measuring their heart rate using an electronic monitor at the end of each day.

The results of the study are presented in Table 1.

**TABLE 1** Mean heart rates with and without herbal tea

	Mean heart rate (beats per minute)
No herbal tea	114
Consumption of herbal tea	89

Identify the investigation design employed during the study and state one advantage of this design type. (2 marks)

- e Classify the type of data collected in this study and outline one strength of this data type. (2 marks)
- f Graph the data in Table 1. (3 marks)
- g During the study, one of the participants reported that the electronic heart rate monitor was faulty. Comment on the accuracy of the data supplied by this participant. (2 marks)
- h Outline a confounding variable inherent within the study and comment on its impact on the internal validity of the study. (3 marks)

**Question 4** (10 marks)

Signe is a doctor in a busy general practice. Signe returned to work after six months of maternity leave to a very busy cold and flu season that required her to work 12-hour days to address the extra patient load. As well as being very busy at work, Signe missed spending time with her baby son. After six weeks of this workload, Signe developed severe tension headaches by the end of almost every working day. Signe’s headaches eventually went away despite her continuing to work long hours in the busy surgery. She then caught a bad cold but continued to work and was able to recover a few days later. However, one morning, Signe was unable to get up to go to work. When she consulted her doctor, she was diagnosed as extremely stressed and physically drained.

- a Identify which stage of Seyle’s General Adaptation Syndrome Signe was in when she contracted the bad cold. Justify your response. (3 marks)
- b Identify the branch of the autonomic nervous system dominant during the stage in part a. (1 mark)
- c Signe’s boss is concerned about her health and suggests she take a week-long beach holiday with her son. By referring to context-specific effectiveness and coping flexibility, comment on the use of this type of coping strategy. (3 marks)
- d While holidaying with her son, Signe decides to seek support from a psychologist as to how to best manage the demands of work and home life. The psychologist recommends Signe participate in a yarning circle. With specific reference to Signe’s situation, outline how participating in a yarning circle could benefit Signe. (3 marks)

**Question 5** (10 marks)

Every year, Atsu receives a flu vaccination. For the past three years, while attending his local medical clinic to get his vaccination, Atsu had a bad response to the injection and vomited shortly afterwards. This year as he approaches the medical clinic to receive his injection, he starts feeling very nauseous and needs to leave quickly because of the nausea. Atsu does not receive the vaccination.

- a Name the behaviourist approach to learning that is discussed in this scenario and outline the three-phase process of conditioning relevant to Atsu's situation. (4 marks)
- b Identify a physiological (biological) process that may occur to a neuron or Atsu's nervous system as he has learnt this new response. (1 mark)
- c Identify and describe the role of a specific neurotransmitter that would assist in consolidating Atsu's learnt response. (2 marks)
- d Provide one difference between a neurotransmitter and a neuromodulator. (1 mark)
- e After a period of five years, Atsu can receive the flu vaccine again. Describe the role of long-term depression in this process. (2 marks)

**Question 6** (9 marks)

Cameron has just begun a new job at a law firm. When he starts one Monday morning, his supervisor takes him around the office and introduces him to the 13 people also working on his floor. Once back at his desk, he decides to write down the names of the new people he just met.

- a With specific reference to the duration and capacity of short-term memory, explain what is likely to happen when Cameron attempts to recall and write down the names he has just learnt. (3 marks)
- b Identify the type of long-term memory associated with forming a memory of names. (1 mark)
- c State why a mnemonic device would be of assistance to Cameron in this situation. (1 mark)
- d Describe two suitable mnemonic devices Cameron could use to remember the 13 new names. (4 marks)

**Question 7** (10 marks)

Michael is at the movies with his friend Stuart, watching the latest Marvel movie. During the movie, Stuart was disturbed by the crying baby a few rows behind them. After the movie, Stuart commented on this, but Michael did not recall the crying baby. They both enjoyed the movie and discussed their favourite scenes in the car trip home. Two weeks later, Michael was telling his co-worker Simon about the movie and his favourite scenes.

- a Apply the Atkinson–Shiffrin multi-store model of memory to explain why Michael can recall his favourite scenes a few weeks later. (5 marks)
- b Describe the role of the amygdala during Michael's experience of watching the Marvel movie. (2 marks)
- c Stuart suffers from aphantasia. Describe a situation where this would affect his ability to recollect the Marvel film as accurately as Michael. (3 marks)

**Question 8** (10 marks)

Diego is 15 years old and has an older brother, Adam, who is 18 years old and in Year 12. In Year 11, Adam did not take his studies seriously and never did his homework. His grades were poor, and his parents started taking away his phone and grounding him on the weekend until his homework was done. His parents were very mindful that they did not want Diego watching Adam and thinking this behaviour was acceptable for VCE.

By the time Diego reached VCE, he knew how his parents would respond if he failed to do his homework. Additionally, Diego's parents said that if he studied hard, he would get a new phone at the end of the year. Because of this, Diego studied hard all year and began enjoying school more, which made it easier to understand and recall the information he was learning.

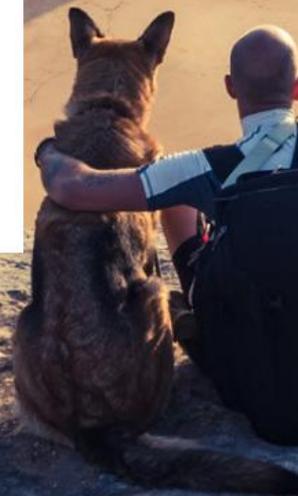
Discuss observational learning with reference to Diego by addressing:

- why Diego's parents were concerned that he would mimic Adam's behaviour
- how the stages of observational learning could be applied to Diego's studying and learning habits in VCE
- how the process of neural plasticity would have made it easier for him to understand and recall information, the more he studied.

UNIT

# 4

## How is mental wellbeing supported and maintained?



**FIGURE 1** In Unit 4, you will look at how mental wellbeing can be defined and supported by protective biopsychosocial factors.

## Unit 4 Overview

In Unit 4 of VCE Psychology, you will explore the demand for sleep and the influences of sleep on mental wellbeing. You will consider the biological mechanisms that regulate sleep and study, and the impact that changes to a person's sleep-wake cycle and sleep hygiene have on a person's psychological functioning. You will consider ways in which mental wellbeing can be defined and conceptualised and explore the concept of mental wellbeing as a continuum. You will also explore how mental wellbeing can be supported by considering the importance of biopsychosocial protective factors and cultural determinants as integral to the wellbeing of Aboriginal and Torres Strait Islander peoples.

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## Unit 4 Areas of Study

The learning for this unit has been divided into three areas of study. The table below shows how each area of study aligns with the chapters in this book and lists the page numbers for each chapter.

Area of Study	Chapter	Pages
<b>Area of Study 1</b> How does sleep affect mental processes and behaviour?	<b>Chapter 6</b> The demand for sleep	250–283
	<b>Chapter 7</b> The importance of sleep for mental wellbeing	284–319
	<b>Unit 4 Area of Study 1 Checkpoint</b>	320–327
<b>Area of Study 2</b> What influences mental wellbeing?	<b>Chapter 8</b> Defining mental wellbeing	328–351
	<b>Chapter 9</b> Specific phobia	352–381
	<b>Chapter 10</b> Maintenance of mental wellbeing	382–407
	<b>Unit 4 Area of Study 2 Checkpoint</b>	408–413
<b>Area of Study 3</b> How is scientific inquiry used to investigate mental processes and psychological functioning?	<b>Chapter 11</b> Student-designed investigation	414–439
	<b>Sample poster</b>	440–441

## Unit 4 Outcomes

In this unit, you will:

- analyse the demand for sleep and evaluate the effects of sleep disruption on a person's psychological functioning
- discuss the concept of mental wellbeing, apply a biopsychosocial approach to explain the development and management of specific phobia, and discuss protective factors that contribute to the maintenance of mental wellbeing
- design and conduct a scientific investigation related to mental processes and psychological functioning, and present an aim, methodology and method, results, discussion and conclusion in a scientific poster.

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CHAPTER

# 6

## The demand for sleep

### KEY KNOWLEDGE

- sleep as a psychological construct that is broadly categorised as a naturally occurring altered state of consciousness and is further categorised into REM and NREM sleep, and the measurement of physiological responses associated with sleep, through electroencephalography (EEG), electromyography (EMG), electro-oculography (EOG), sleep diaries and video monitoring
- regulation of sleep–wake patterns by internal biological mechanisms, with reference to circadian rhythm, ultradian rhythms of REM and NREM Stages 1–3, the suprachiasmatic nucleus and melatonin
- differences in, and explanations for, the demands for sleep across the life span, with reference to total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM).

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### GROUNDWORK

This chapter will build on concepts you may have come across in Units 1 and 2. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



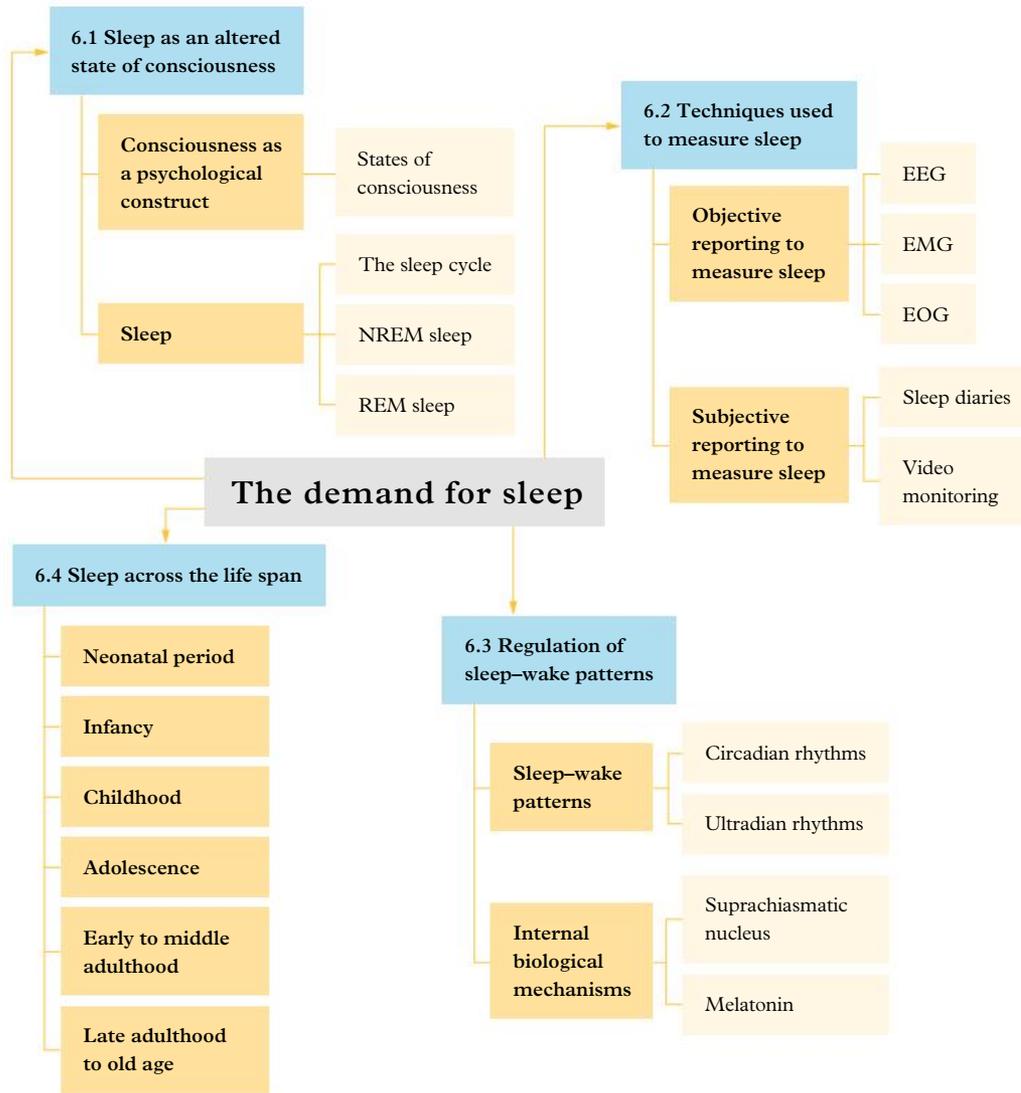
Groundwork quiz  
Chapter 6

### INVESTIGATIONS

6.2A	<b>INVESTIGATION: FIELDWORK</b>	Does the time taken to fall asleep affect the duration of the first sleep cycle?	Page 482
6.2B	<b>INVESTIGATION CORRELATIONAL STUDY</b>	What factors are affecting the sleep of adolescents?	Page 483

**FIGURE 1** During REM sleep, we might experience an altered reality through our dreams, such as going on an adventure with your friends on board giant fishes.

# CONCEPT MAP



# 6.1

## Sleep as an altered state of consciousness

### KEY IDEAS



- ✦ Sleep is an altered state of consciousness.
- ✦ Sleep consists of specific stages, each with unique characteristics that are indicative of sleep as a psychological construct.

What happens when we sleep, how much we should sleep and why we sleep have been the focus of many researchers and psychologists over the years. In this topic, we will explore what sleep is and what occurs in the body when we “catch some z’s”.

Before we learn about sleep, it is important to understand the concept of consciousness.

### Consciousness as a psychological construct

What are the thoughts being formed in your mind as you read this sentence? What were you thinking about before reading the previous sentence? Do you think you are more excited now than you were two sentences ago?

Your ability to answer these questions is evidence of your **consciousness**. This is the knowledge and awareness of our own self-existence, thoughts, perceptions and behaviours at any given moment. It is the content at the front of our mind and can shift at any time.

Consciousness is different from cognitive processes, which include remembering, problem-solving, thinking and other mental processes. Instead, consciousness is the awareness and knowledge that these processes are happening. For example, as you become aware that you are reading this sentence, your consciousness may shift to realising that you are slouching in your chair. Then, to the idea that the authors of this book are probably having a giggle because we were right about your posture. Or you might realise that you feel quite smug because we were wrong.

This experience is unique to ourselves, private and cannot be directly shared with others. Because consciousness is a subjective experience and cannot be seen, touched or traditionally measured, psychologists have come up with a different way to consider the concept – as a **psychological construct**. Psychological constructs are representations of abstract ideas *constructed* to help summarise a group of related phenomena or events that can help describe, understand and predict human behaviour (*psychology*). Other psychological constructs are happiness, self-esteem, intelligence, fear and, one we will explore in this chapter that is closely related to consciousness, sleep.

### States of consciousness

Consciousness is believed to exist on a continuum. Our consciousness shifts into different states along the continuum depending on our brain wave patterns, levels of awareness, perceptual abilities, ability to respond to stimuli, and sense of time (time orientation). The states can be classified into two categories: normal waking consciousness and altered state of consciousness.

#### consciousness

the subjective, private and constantly changing knowledge and awareness of your own self-existence, thoughts, perceptions and behaviours at any given moment

#### Study tip

Don't confuse “consciousness” with “conscience”. Conscience is about your moral principles and belief of what is right and wrong.

#### psychological construct

an abstract psychological concept that summarises a group of related phenomena or events that can describe and be used to predict human behaviour, but cannot be directly observed

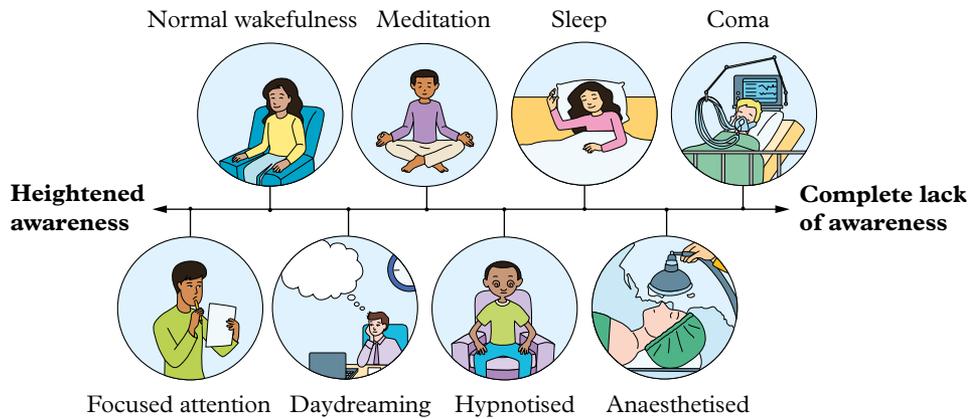


FIGURE 1 States of consciousness

### Normal waking consciousness

**Normal waking consciousness** is a state of consciousness in which you are awake and aware of both your internal state and external stimuli. In normal waking consciousness, you:

- can mainly control the stimuli that you choose to attend to or ignore
- can voluntarily direct your attention and awareness to your thoughts, goal-directed behaviours and perceptions of the external world
- are aware of your existence in time and place
- can manage what information and content enters your consciousness.

However, normal waking consciousness is not a permanent state. Your attention and awareness can shift into a more relaxed, or even heightened, state.

### Altered states of consciousness

Any state of consciousness that deviates from normal waking consciousness is considered an **altered state of consciousness**. In altered states of consciousness, we are less, or potentially even more, aware of our internal states and external stimuli than during normal waking consciousness.

### Study tip

Reviewing your understanding of attention (from Unit 2 Area of Study 2 or Chapter 9 in your *Psychology for VCE Units 1 & 2 Student Book*) can help you better grasp the concept of consciousness.

#### normal waking consciousness

the state of consciousness in which you are awake and aware of your internal and external state

#### altered state of consciousness

any state of consciousness that is a departure from normal waking consciousness in terms of level of awareness and experience

### Study tip

In an altered state of consciousness, your cognitive processes are still happening, but your awareness and experience of them may be different.

## 6.1 SKILL DRILL

### Evaluating the use of reaction time to determine state of consciousness

#### Key science skills: Plan and conduct investigations

In a fictional study, researchers investigated the effect of barbiturates (a class of medicines used to treat conditions such as epilepsy) on reaction time. Participants were selected from a pool of volunteers in response to an advertisement in a local newspaper. All participants were asked to complete a series of tests, and the speed of their responses to light, sound and touch stimuli was measured. After preliminary testing, participants were provided with a moderate dose of barbiturates

and asked to repeat the tests. Results were collated pre- and post-exposure to barbiturates.

#### Practise your skills

- 1 Identify and explain the sampling procedure used in this research.
- 2 Identify and explain the experimental design used in this research.
- 3 With reference to the psychological characteristics of consciousness, explain why a reaction time test could be considered as a valid method of assessing consciousness.

Need help planning and conducting investigations? See Topic 1.3 in your Psychology toolkit.

# Sleep

## sleep

a reversible, naturally occurring altered state of consciousness involving lowered awareness of and responsiveness to the external environment

## rapid eye movement (REM) sleep

a type of sleep that is characterised by rapid eye movement beneath closed eyelids; also called paradoxical sleep

## non-rapid eye movement (NREM) sleep

a type of sleep that consists of three stages; characterised by the slowing of brain activity and absence of rapid eye movement

## sleep episode

one session of sleep; typically lasts 8 hours during the night, and can also occur in shorter lengths (naps)

## sleep cycle

one complete sequence of the different stages of sleep

**Sleep** is a reversible, naturally occurring altered state of consciousness. It is the most commonly occurring altered state. In fact, we spend approximately one-third of our life sleeping.

Sleep is considered to be a psychological construct consisting of a series of similar events that are experienced uniquely by each person, including:

- the shift to and from normal waking to an altered state of consciousness
- events including **rapid eye movement (REM) sleep** and **non-rapid eye movement (NREM) sleep**
- physiological changes (e.g. body temperature, blood pressure, muscle tension)
- psychological activity (e.g. level of awareness, attention, controlled and automatic processes, dreaming).

When we are asleep, our engagement with and responsiveness to our external environment decreases. The level to which this occurs depends on the stage of sleep that we are in.

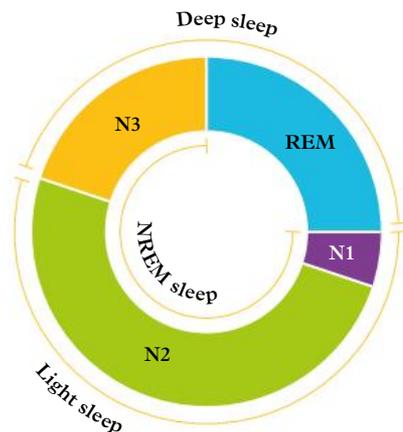


FIGURE 2 The stages of sleep

## The sleep cycle

During each **sleep episode**, we cycle through four different stages (Figure 2). They can be further categorised into two main types:

- REM sleep
- NREM sleep: NREM Stage 1 (N1), NREM Stage 2 (N2), NREM Stage 3 (N3).

When we first fall asleep, we start with N1 sleep. We then progress through the N2 and N3 stages before we experience REM sleep. You will learn more about these stages later, but for now, you only need to know that this makes up one **sleep cycle**. We then move back into N1, and a new cycle begins. On average, we experience four or five sleep cycles each night.

 ClickView  
Why do we sleep?

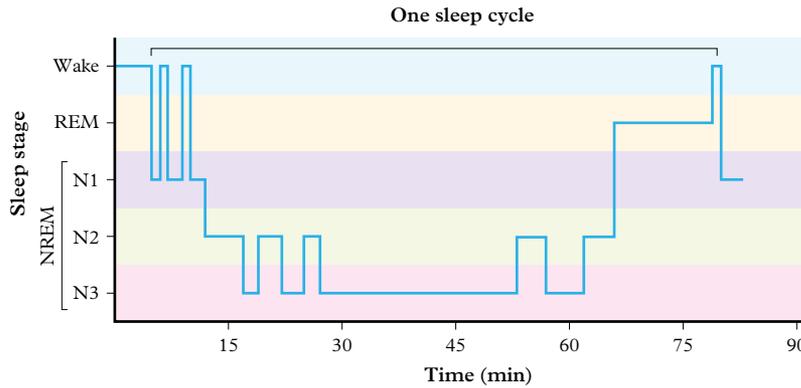
FIGURE 3 Sleep is a naturally occurring altered state of consciousness.



Each sleep cycle differs because of fluctuations in the exact sequence of stages we experience and how long we spend in each stage. For example, the first sleep cycle typically lasts for 70 to 90 minutes, whereas a later sleep cycle can be 120 minutes long.

The transition through sleep cycles is represented by a **hypnogram**, which shows how long a person spends in each stage of sleep. You can see a hypnogram for a typical first cycle of sleep in Figure 4. You will learn more about where the data for these graphs come from in Topic 6.2.

**hypnogram**  
a graphic representation of the transition between stages of sleep over time



**FIGURE 4** A hypnogram of the first cycle of sleep

Each stage has specific physiological and psychological characteristics that define them, including brain activity, eye movement and body movement.

### Brain activity during sleep

Brain activity is described by four types of **brain waves**: beta ( $\beta$ ), alpha ( $\alpha$ ), theta ( $\theta$ ) and delta ( $\delta$ ) waves. They represent different patterns of electrical activity in the neurons of the brain.

**brain waves**  
the electrical impulses produced by neurons in the brain

In each stage of sleep, the frequency of waves (how often they occur) and their amplitude (the height of the wave) differ. These can be measured by a technique called electroencephalography (EEG), which you will learn about in Topic 6.2. The brain waves are summarised in Table 1.

**TABLE 1** Features of the four types of brain waves

Type of wave	Appearance over time	Frequency and amplitude	Meaning
Beta		Highest frequency, lowest amplitude	Normal alertness and consciousness, focus
Alpha		High frequency, low amplitude	Physical and mental relaxation, light meditation, drowsiness
Theta		Low frequency, high amplitude	Deep meditation, dreaming
Delta		Lowest frequency, highest amplitude	Loss of bodily awareness, dreamless

### Study tip

You do not need to use the terms “beta”, “alpha”, “theta” and “delta” to describe brain activity. You just need to describe them in terms of their amplitude and frequency.

## NREM sleep

We spend approximately 80 per cent of our sleeping time in NREM sleep. Remember that this is divided into N1, N2 and N3 stages. Typically, in the first two sleep cycles, all NREM sleep stages are longer than in later sleep cycles.

### N1 sleep

#### N1 sleep

Stage 1 of NREM sleep in which you transition from waking consciousness to sleep; the lightest type of sleep

#### hypnagogia

the state in which you are preparing for deep sleep

#### hypnic jerk

a falling sensation experienced in hypnagogia due to an involuntary muscle spasm

#### non-vivid dream

a sleep hallucination that consists of thoughts and memories; often not very memorable

#### N2 sleep

Stage 2 of NREM sleep, which is considered “true” sleep; light sleep that progressively becomes deeper

#### sleep spindle

a short burst of high-frequency, low-amplitude brain waves; occurs during N2 sleep

#### K-complex

a short burst of low-frequency, high-amplitude brain waves; occurs during N2 sleep

#### N3 sleep

Stage 3 of NREM sleep, which is also considered “slow-wave sleep”; a state of deep sleep

**N1 sleep** is the first stage of NREM sleep.

N1 sleep is considered light sleep. It generally lasts from 5 to 10 minutes per cycle and is considered the transition stage from wakeful alertness (high-frequency, low-amplitude beta brain waves) to drowsiness (lower frequency and higher amplitude alpha brain waves) in preparation for deeper sleep (Figure 5). This stage is also called **hypnagogia** (*hypnos* meaning “sleep”, *agogos* meaning “leading to”). In N1 sleep, higher amplitude (theta) waves start to become prominent.

Our eyes move in a slow, rolling pattern, where the eyelids may slowly open and close from time to time. The body relaxes. A common sensation we can experience here is a **hypnic jerk** or “sleep start”. This is an involuntary muscle spasm that occurs as our muscle tension decreases. It is often described as “falling into a void”. Our heart rate, respiration rate and body temperature also start to decrease.

We become less aware of, but are often still aware and responsive to, external stimuli and start to experience the beginning of **non-vivid dreams** consisting of thoughts and memories. We are most easily roused or woken in N1 sleep. But if we are undisturbed, we will move into N2 sleep.

### N2 sleep

**N2 sleep** is considered “true” sleep and also considered light sleep. It lasts for 10 to 25 minutes per cycle. Theta activity continues in the brain; however, you also experience brief pulses of high-frequency, low-amplitude brain waves called **sleep spindles**. Low-frequency, high-amplitude brain waves called **K-complexes** are also seen. These can occasionally occur during N1 sleep, but when they begin to appear more regularly (about 3 minutes apart), this indicates that we have entered N2 sleep.

In N2 sleep, muscle tension, heart rate, respiration rate and body temperature continue to decrease. The slow, rolling eye movements from N1 sleep decrease and then stop.

As in N1 sleep, we can be woken relatively easily at the beginning of N2 sleep. In fact, both N1 and N2 sleep are considered light sleep. However, as N2 sleep progresses, it is less likely that we will be roused. We continue to experience non-vivid dreams. If undisturbed, we progress into N3 sleep.

### N3 sleep

**N3 sleep** is a state of deep sleep. It typically lasts for 30 to 40 minutes per cycle. It is also considered slow-wave sleep because brain activity shifts towards more low-frequency, high-amplitude (delta) waves (Figure 7).

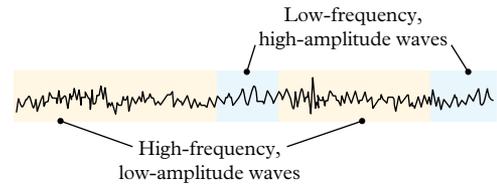


FIGURE 5 Brain activity in N1 sleep

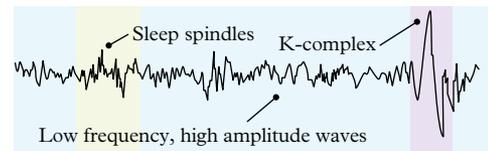


FIGURE 6 Brain activity in N2 sleep

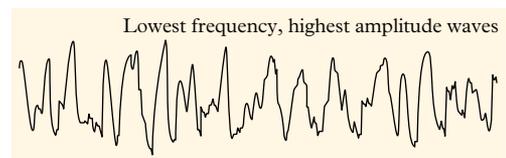


FIGURE 7 Brain activity in N3 sleep

As you would expect, muscle tension, heart rate, respiration rate and body temperature decrease further compared to N2 sleep.

Compared to N1 and N2 sleep, in N3 sleep we are much less responsive to the external environment and more difficult to wake. However, if we are woken successfully, we will experience a period of mental fatigue and grogginess. This is called **sleep inertia**. It is thought that sleep inertia is due to the need to reverse the slower brain activity in N3 sleep back to high-frequency beta waves required for alertness and attention in normal waking consciousness.

After the N3 sleep stage, we often cycle back through N2 and N1 sleep, then into REM sleep.

## REM sleep

We spend approximately 20 per cent of our time sleeping in REM sleep. REM sleep is the stage of sleep primarily characterised by bursts of irregular, rapid eye movement. Despite this, we completely lose muscle tension, aside from occasional twitches. There are irregular changes to our blood pressure, heart rate and respiration rate. We may even experience shallow breathing and sudden gasps.

Our brain displays irregular, high-frequency, low-amplitude (beta-like) brain activity in REM sleep. This is similar to normal waking consciousness. It then makes sense that sleep inertia is less likely to occur. We are also much more easily woken during REM sleep than in N3 sleep and also likely to remember our dreams upon waking from REM sleep.

REM sleep is when we experience **vivid dreams** that contain a narrative or story. They are hallucinations that we have when we are asleep, consisting of images, sounds and/or other sensory characteristics. Often, they are a distorted or illogical sequence of random and unrelated thoughts.

REM sleep generally lasts for 20 to 30 minutes per cycle. At the end of a REM episode, we typically shift back into N2 sleep, which marks the start of the next sleep cycle. In later sleep cycles, the time we spend in REM sleep is longer than in NREM sleep.

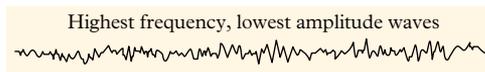


FIGURE 8 Brain activity in REM sleep



FIGURE 9 We might experience a warped perception of our own world during REM sleep.

### Study tip

Inertia is defined as the tendency to do nothing or remain unchanged. Therefore, sleep inertia is the feeling of wanting to stay asleep after you are woken during N3 sleep.

### sleep inertia

the state of mental fatigue experienced immediately after we are woken

### Study tip

If you are using a variety of resources, you may come across NREM Stage 4. For the purposes of the VCE Psychology Study Design, NREM Stage 4 is considered part of NREM Stage 3 (N3).

### vivid dream

sleep hallucination that consists of images, sounds and/or other sensory characteristics that form an, often illogical, narrative; memorable and intense

### Study tip

Due to the high brain activity and body's inactivity, REM sleep is also called "paradoxical sleep". A paradox is when two events that are opposite to (or seem to contradict) each other occur simultaneously.

The stages of sleep are summarised in Table 2.

**TABLE 2** Physiological and psychological characteristics of NREM and REM sleep

Stage of sleep		Brain activity	Body movement	Eye movement	Awareness
NREM	N1	Decrease in wave frequency, increase in wave amplitude; uncommon non-vivid dreams	Hypnic jerk; reduced movement and muscle tension	Slow rolling eye movements	Easily roused and still responsive to external stimuli
	N2	Continued decrease in frequency and increase in amplitude of waves, with regular sleep spindles and K-complexes; uncommon non-vivid dreams	Continued reduction in movement and muscle tension	Slow rolling eye movements gradually decrease	Responsiveness decreases
	N3	Low-frequency, high-amplitude waves; dreamless		Limited eye movement	Least responsive; difficult to wake
REM		Irregular, high-frequency, low-amplitude (beta-like) waves; vivid dreaming	Practically motionless; loss of muscle tension	Rapid eye movements	Easily roused



## 6.1 REAL-WORLD PSYCHOLOGY

### Have you been visited by the night hag?

Have you ever woken up to the feeling of an ominous presence at the foot of your bed? How about the feeling of not being able to move? As though someone is sitting on your chest, making it hard for you to breathe? You might have experienced what people used to think was a visit from a supernatural being called a “night hag”.



**FIGURE 10** A classic depiction of sleep paralysis by Henry Fuseli (*The Nightmare*, 1781)

As described by folklore from all around the world, the night hag has long been thought to be a demon, a shadow or a ghost, or even a dog in Catalonian Spanish culture. However, there is a scientific explanation for the night hag phenomenon: sleep paralysis.

Sleep paralysis can be experienced as you are falling asleep or as you wake up. You are conscious but unable to move, speak or even breathe (paralysis). You may also experience hallucinations. Together, this makes the experience very scary. This is why folklore often describes it as demons or vengeful ghosts. Thankfully, episodes of sleep paralysis tend to last only for a few minutes.

### Apply your understanding

- 1 Evaluate the following claim: “Sleep paralysis occurs during the N3 stage of sleep.”
- 2 Infer the state of consciousness that a person is in during an episode of sleep paralysis. Justify your answer.
- 3 Conduct some research to determine the potential causes of sleep paralysis.

## 6.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “consciousness”.
- 2 Explain why sleep is considered to be a psychological construct.
- 3 Describe the characteristics of REM sleep and explain why it is considered to be “paradoxical sleep”.

### Apply, analyse and compare

- 4 Compare the psychological features of normal waking and altered states of consciousness.
- 5 Contrast the key features of REM and NREM sleep with reference to:
  - a body movement
  - b eye movement
  - c brain activity.

### Design and discuss

- 6 Anissa is reading a post on social media about the “powers of the brain during sleep”. The post claims that the brain operates in a unique manner during sleep. Anissa shows the post to her friend Marcelina, who is a psychology student. Marcelina is sceptical at first, but soon realises that most of the information in the post is correct. Anissa asks Marcelina what the post is all about.

Take the perspective of Marcelina and provide an explanation to Anissa about the information that is in the post. You are encouraged to take a creative approach to present this information; for example, as an infographic, a song or a role play.

- 7 With the use of relevant examples, discuss why consciousness is considered to be subjective, private and constantly changing on a continuum.



# 6.2

## Techniques used to measure sleep

### KEY IDEAS

- ✦ Sleep can be measured by objective reporting, such as using electroencephalographs (EEG), electromyographs (EMG) and electro-oculographs (EOG).
- ✦ Sleep diaries and video monitoring can be used as subjective measures to describe and quantify sleep.



### Study tip

If something is objective, it is based on facts and observations. If something is subjective, it is based on personal feelings and experiences.

### objective reporting

the gathering of data through direct observation or measurement

### electroencephalography (EEG)

a technique in which the electrical activity of the brain is detected, amplified and recorded

### electrode

a material that conducts electricity; typically a metal

Remember from Topic 6.1 that consciousness is a psychological construct; it is a highly personal and private experience that cannot be directly shared with others. It is difficult to measure because we may not even be conscious of any lack of awareness, loss of self-control or cognitive or perceptual distortions that we may be experiencing.

When we are asleep, it becomes even more difficult to measure because we cannot verbally communicate and become unresponsive to external stimuli; for example, a scientist asking you what stage of sleep you are in!

Instead, we have alternative approaches to measure and analyse sleep. This includes a range of objective and subjective reporting tools. They are often used in combination to gain a better understanding of the characteristics and qualities of sleep.

## Objective reporting to measure sleep

**Objective reporting** of sleep uses tools or devices to collect quantitative and qualitative data through direct observation of measurements. The tools are typically used to measure physiological conditions during sleep. The three techniques we will explore are electroencephalography (EEG), electromyography (EMG) and electro-oculography (EOG). Before we continue, think about what each of these might measure.

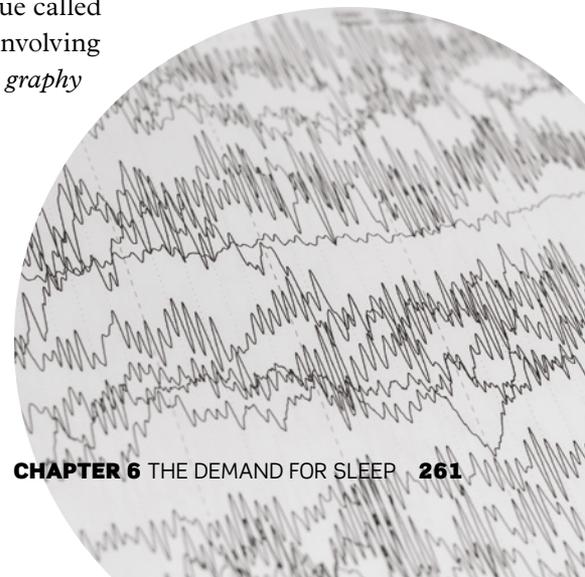
### Electroencephalography (EEG)

In Topic 6.1, you learnt about the types of brain waves and the stages of sleep that they occur in. For example, brain activity in REM sleep resembles the high-frequency, low-amplitude waves observed during normal waking consciousness, whereas low-frequency, high-amplitude waves are predominant in N3 sleep. These electrical impulses occur in neurons of the brain, particularly in the neocortex that lies beneath the skull and cerebrospinal fluid.

The electrical activity can be detected by a technique called **electroencephalography (EEG)** (*electro* meaning “involving electricity”, *encephalo* meaning “relating to the brain”, *graphy* meaning “writing or recording”).

**Electrodes** (materials that conduct electricity) are attached to the scalp via individual patches or a headcap to detect the electrical signals from the brain (Figure 1). They are organised so that data can be collected from individual lobes of the brain.

**FIGURE 1** Data obtained from electroencephalography



### Study tip

To determine the amplitude of a wave, look at its height on the y-axis. For the frequency of a wave, look at its x-axis.

### electroencephalogram

a graph of EEG data, which shows brain activity over time

### amplitude

the height of the peaks and troughs of waves

### frequency

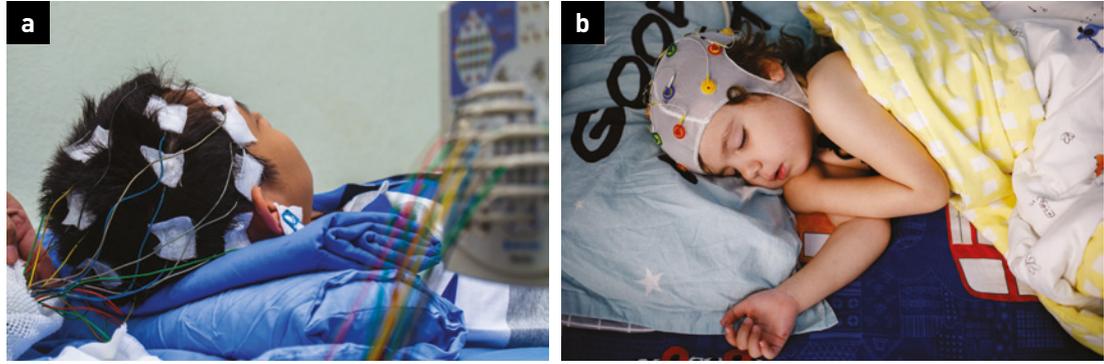
the number of cycles of waves per second

### electromyography (EMG)

a technique in which the electrical activity of the body's muscles is detected, amplified and recorded

### electromyogram

a graph of EMG data, which shows muscle activity over time



**FIGURE 2** Electroencephalography is conducted by using **a** individual electrode patches or **b** a headcap.

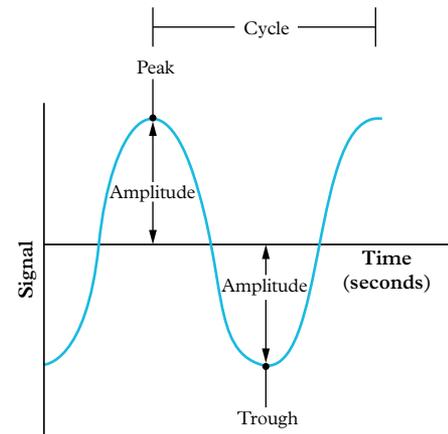
Wires extend from the electrodes to a machine called an electroencephalograph, where the small electrical impulses are amplified. This is connected to a computer that records the signals over time to produce a graph called an **electroencephalogram**.

Remember from Topic 6.1 that the four types of brain waves (beta, alpha, theta and delta) are described by their:

- **amplitude**: the height of the peak or trough
- **frequency**: the number of cycles per second.

Amplitude is measured in microvolts ( $\mu\text{V}$ ) and frequency is measured in hertz (Hz).

By studying the frequency and amplitude of brain waves, we can infer the stage of sleep that an individual is in.



**FIGURE 3** Characteristics of brain waves obtained from electroencephalography

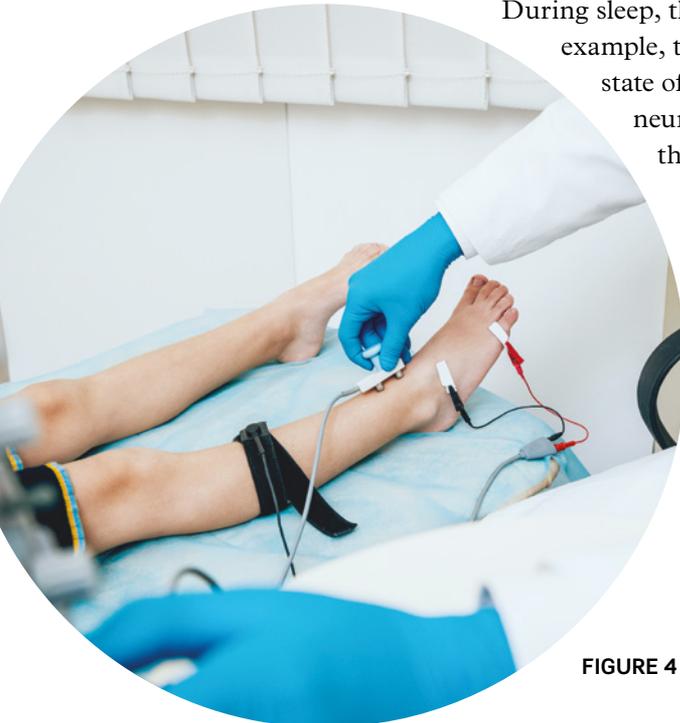
## Electromyography (EMG)

During sleep, there are significant changes to muscle tension and activity. For example, the body relaxes during NREM sleep until we are virtually in a state of paralysis during REM sleep. Electrical signals, like those from neurons in our brain, control our muscles. Therefore, we can measure these signals to infer muscle tension.

Electrical signals from the muscles are measured using a technique called **electromyography (EMG)** (“electromyography” also including the prefix *electro* and suffix *graphy*, *myo* meaning “relating to the muscles”).

Electrodes are attached to certain parts of the body (e.g. torso and legs) and parts of the face (e.g. chin) to detect these electrical signals.

Again, wires connect the electrodes to an electromyograph, which amplifies the signals and sends the information to a computer. This results in an **electromyogram**.



**FIGURE 4** Electromyography probes are attached to different parts of the body.

The level of muscle tension or changes in muscle activity, such as through movement, is used to infer the stage of sleep.

## Electro-oculography (EOG)

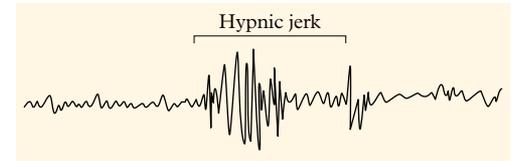
Remember that REM and NREM sleep are differentiated by the presence or absence of rapid eye movements. As with EMG, we can measure the electrical activity of the muscles controlling the eyes. This technique is called **electro-oculography (EOG)** (*oculo* meaning “relating to the eyes”).

Electrodes are attached above, below or next to the eyes to detect eye muscle activity. Wires send the signals to an electro-oculograph, which amplifies the signals and passes them to a computer. The resulting data is an **electro-oculogram**.

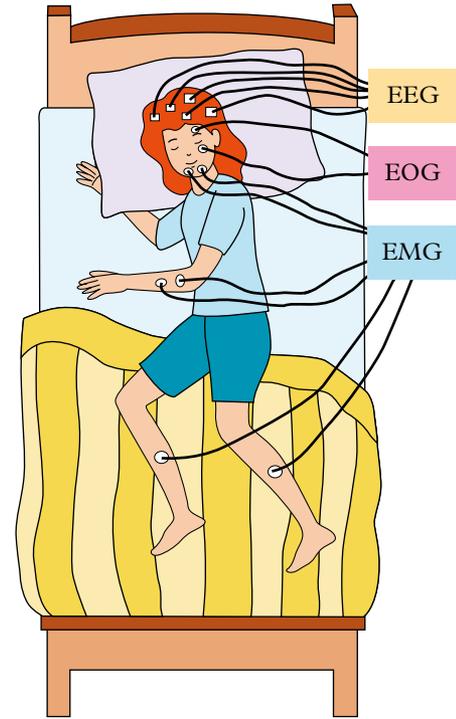
If significant activity around the eyes is recorded, this indicates that the eyes are moving quickly and we can conclude that the individual is in REM sleep. On the other hand, if there are slow rolling eye movements, which eventually become limited to no eye movement, the individual could be in NREM sleep.

Together, EEG, EMG and EOG can provide an accurate depiction of the stages of sleep that an individual is in over a sleep cycle and over their night’s sleep. This data is often combined with measurements of respiration, heart rate and body temperature, altogether called **polysomnography** (*poly* meaning “many”, *somnus* meaning “sleep”, *graphy* meaning “to write or record”). Not only does this help scientists construct an objective picture of sleep, including its quality and characteristics, but it also allows them to pick up any abnormalities that could be used to diagnose sleep disorders.

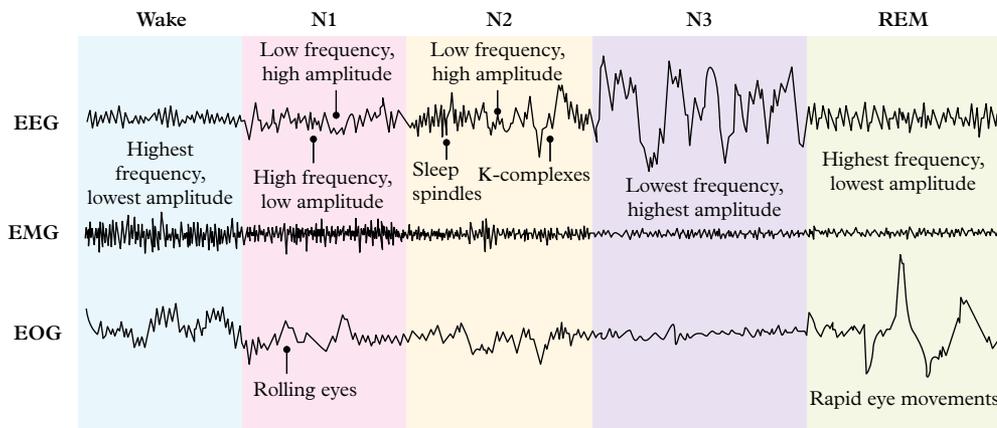
A diagram showing where the electrodes are placed is shown in Figure 6.



**FIGURE 5** A short burst of muscle activity can signify a hypnic jerk, which occurs during N1 sleep.



**FIGURE 6** The placement of electrodes for EEG, EMG and EOG



**FIGURE 7** Typical results from EEG, EMG and EOG during each stage of sleep

### electro-oculography (EOG)

a technique in which the electrical activity of the muscles that control eye movement is detected, amplified and recorded

### electro-oculogram

a graph of EOG data, which shows eye muscle activity over time

### polysomnography

a combination of multiple objective reporting tools (e.g. EEG, EMG, EOG, respiration rate, heart rate, body temperature), which provide an objective picture of sleep

You can also see what the data from EEG, EMG and EOG might look like for each stage of sleep in Figure 8. See how you can apply your knowledge to analyse objective reporting data in Worked example 6.2.

## 6.2 WORKED EXAMPLE

### Determining which stage of sleep an individual is in by objective reporting

Identify which one of the four stages of sleep the individual is in, based on the segment of EEG, EMG and EOG data shown in Figure 8. Justify your response. (5 marks)

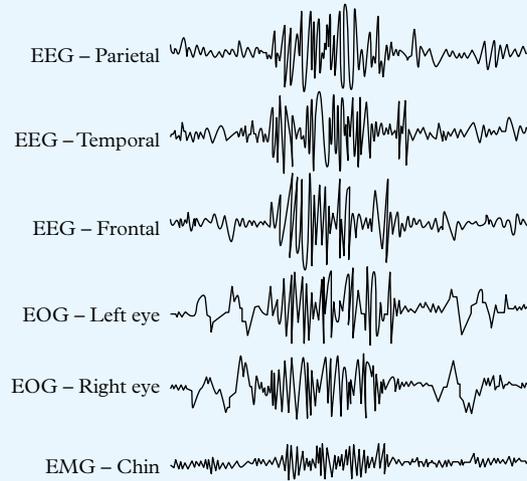
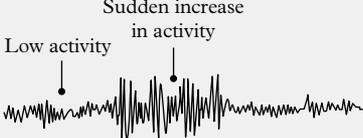


FIGURE 8 A segment of EEG, EMG and EOG data

### Solution

Think	Do
Step 1: Identify the command terms in the question and determine what they require.	The question asks you to “identify” and “justify”. This means you must recognise and name something, then provide reasoning for your decision.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	The question seems to be asking for an analysis of the EEG, EOG and EMG data provided by using your understanding of what these measurements look like in the different sleep stages to determine which sleep stage the data is representing. 1 mark is probably allocated to choosing the correct stage. The remaining 4 marks must be for making four different points to support the selected sleep stage.
Step 3: Look for the key words or information in the question that will help you answer it.	The question asks for “one of the four stages of sleep”. You should recognise that this refers to one of N1, N2, N3 or REM sleep. The question also provides some data. There appear to be three EEG readings from different parts of the brain, two EOG readings from the eyes and one EMG reading from the chin.
Step 4: Analyse the EEG data.	<p>You need to look for the types of brain waves present. All three look quite similar, so annotate the parietal lobe result.</p> <p>Low-frequency, high-amplitude waves are seen in both N1 and N2 sleep. High-frequency waves are also seen, but it is a bit difficult to determine with this section of EEG data alone. There is also something unusual in the sudden burst of brain activity. High-frequency, high-amplitude waves can be seen in N2 sleep, as sleep spindles or K-complexes. The other data may help to determine what this could be.</p>

Think	Do
<p>Step 5: Analyse the EOG data.</p>	<p>The EOG data for both eyes looks similar, so, again, just look at one of them.</p>  <p>There are slow waves of activity present, which supports the idea that it could be N1 or N2 sleep. There is also unusual activity occurring at the same time as in the EEG data.</p>
<p>Step 6: Analyse the EMG data.</p>	 <p>Muscle activity seems to be low, supporting the relaxation of the body during N1 and N2 sleep. However, there is unusual activity here too. In fact, this seems to be synchronised across all of the data. It is probably a hypnic jerk, which occurs during N1 sleep. Therefore, the segment of data must represent N1 sleep.</p>
<p>Step 7: Construct your final answer in a succinct and logical way. Dot points are also acceptable.</p>	<ul style="list-style-type: none"> <li>• In EEG, a mix of low-amplitude, high-frequency and high-amplitude, low-frequency waves are observed. (1 mark)</li> <li>• In EOG, mostly slow rolling eye movements are present. (1 mark)</li> <li>• In EMG, there is low activity overall. (1 mark)</li> <li>• The sudden increase in electrical activity present across all recordings represents the hypnic jerk that occurs during the onset of sleep. (1 mark)</li> <li>• Therefore, this must be N1 sleep. (1 mark)</li> </ul>

## Subjective reporting to measure sleep

**Subjective reporting** of sleep uses techniques that collect quantitative and qualitative data about the personal experience of an individual. It can be biased because it relies on the perspective of the participant or the person observing the participant. Although the data is qualitative, it can be combined with objective reporting tools to better understand the characteristics, stages and quality of sleep. We will explore the use of sleep diaries and video monitoring.

**subjective reporting**  
the gathering of data that relies on an individual's perspective and interpretation of a personal experience

### Sleep diaries

A **sleep diary** is a self-report of the quality and quantity of an individual's sleep over a time. Sleep diaries often consist of open or closed interview questions, statements or entries that the individual must complete at specific times throughout the day, over a few weeks. Individuals usually describe:

**sleep diary**  
a self-report of the quality and quantity of an individual's sleep over time

- when they sleep and wake
- how long they sleep for each night
- the number of times they woke up during the night
- their quality of sleep
- how they feel upon waking
- how often they feel drowsy during the day
- activities they have engaged in before sleep.

Therefore, these records rely on personal and subjective judgments. Combined with objective reporting tools, sleep diaries can provide insight on factors that may affect an individual's sleeping patterns. However, because they depend on individual reporting, they may not accurately reflect reality. For example, there may be some inaccuracies in reporting sleep/wake times, individuals may forget to record data or they may incorrectly judge their quality of sleep. This could lead to inconsistencies between sleep diary reports and data from objective reports.

Sleep Diary		Name: _____						
		Start date: _____						
Day of week:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
	Sun	Mon	Tues	Wed	Thur	Fri	Sat	
What time did you get into bed?	a.m.							
	p.m.							
What time did you try to go to sleep?	a.m.							
	p.m.							
How long did it take you to fall asleep?	hrs							
	mins							
What time did you wake up this morning?	a.m.							
	p.m.							
How many times did you wake up during the night?								
What was the total amount of time you were awake?								
What was the total amount of time you slept?	hrs							
	mins							
How would you rate your sleep quality?								
Very poor	<input type="checkbox"/>							
Poor	<input type="checkbox"/>							
Fair	<input type="checkbox"/>							
Good	<input type="checkbox"/>							
Very good	<input type="checkbox"/>							

FIGURE 9 A section of the sleep diary record from the Sleep Foundation

## Video monitoring

**video monitoring** the video recording and observations of posture changes and physical movements of an individual during sleep

Sleep can also be measured by **video monitoring**. This involves video recording an individual during a sleep study, which can be conducted in a sleep laboratory or at home. The video is then reviewed by researchers, who observe the individual's movement and changes in posture as they sleep. More specifically, researchers can gain data on:

- the number of times an individual shifts body positions while sleeping
- the type of body positioning
- breathing patterns
- physical responses to awakening or dreams
- other sleeping habits or unusual sleeping events (e.g. teeth grinding, sleepwalking).



Researchers then use this information, often in combination with data from polysomnography, to infer which stage of sleep an individual is in.

To reduce the potential for bias in interpretation, sleep movements are rated and described according to standard classification systems. For example, the body positioning can be described as supine (flat on back), prone (flat on stomach), left or right. Advances in technology are leading to the use of fully automated software to analyse and report on sleep movement, further reducing bias and transforming video monitoring into a more objective reporting tool.



**FIGURE 10** Body positioning is just one piece of data obtained from video monitoring.

## 6.2 CHALLENGE

### Correcting mistakes

Evaluate the information in the following paragraph and rewrite it, where appropriate, so that it is correct.

“REM sleep can be measured using a sleep diary, which is a subjective measure of sleep. This information can be combined with objective measures. One example is video monitoring, which detects no movement in the body during REM sleep. These strategies are not useful for measuring NREM sleep. Instead, EOG, EEG and EMG must be used to detect beta-like brain activity and rolling eye movements.”

## 6.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the function of an EEG.
- 2 Explain what frequency and amplitude are in terms of brain waves measured by EEG.
- 3 Explain why video monitoring is considered a method to gather subjective data.

### Apply, analyse and compare

- 4 Describe the EOG, EEG and EMG readings expected during REM sleep.
- 5 Distinguish between brain wave activity during normal waking consciousness and N3 sleep, with reference to amplitude and frequency.
- 6 Explain how a sleep diary can contribute to understanding the sleeping patterns of an individual.
- 7 Imagine you are a laboratory assistant who is monitoring a participant involved in a sleep study. Based only on observing the participant, describe the indicators that would show that the participant is in REM sleep compared to N1 sleep.

### Design and discuss

- 8 Discuss the reliability of using EEG, EMG and EOG to measure states of consciousness.
- 9 Your classmate Chamath suggests that subjective sleep reporting tools are more powerful than objective tools. Evaluate Chamath's suggestion.



**FIGURE 11** What EMG readings would you expect during REM sleep?

## 6.3

# Regulation of sleep–wake patterns

## KEY IDEAS

- ✦ Sleep–wake patterns are described by using circadian and ultradian rhythms.
- ✦ REM and NREM sleep are regulated by internal biological mechanisms such as the suprachiasmatic nucleus, which releases melatonin.



Most of us follow a daily routine. This is largely based on when we wake up and go to sleep, when we get hungry and eat, and when we feel most and least alert and attentive. These patterns are generally consistent and predictable. In this topic, we will explore how the sleep–wake pattern is regulated.

## Sleep–wake patterns

### sleep–wake pattern

an individual's sleeping schedule in which they alternate between hours of sleep and hours of wakefulness

### circadian rhythm

any biological changes or activities that repeat every 24 hours

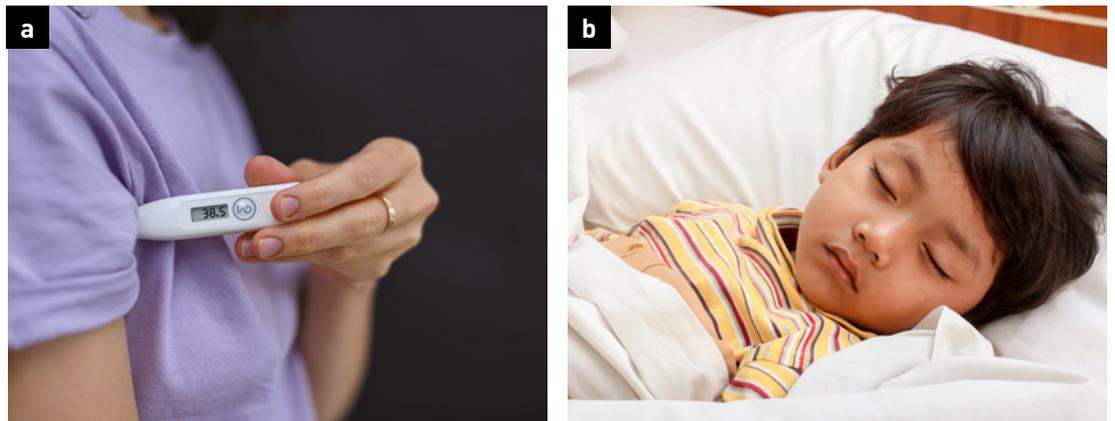
The **sleep–wake pattern** refers to the repeating cycles in which we alternate between sleep and normal waking consciousness. This includes when and for how long we are asleep and awake. Within this, there is the REM/NREM sleep cycle that we learnt about in Topic 6.2. These patterns align to circadian and ultradian rhythms.

## Circadian rhythms

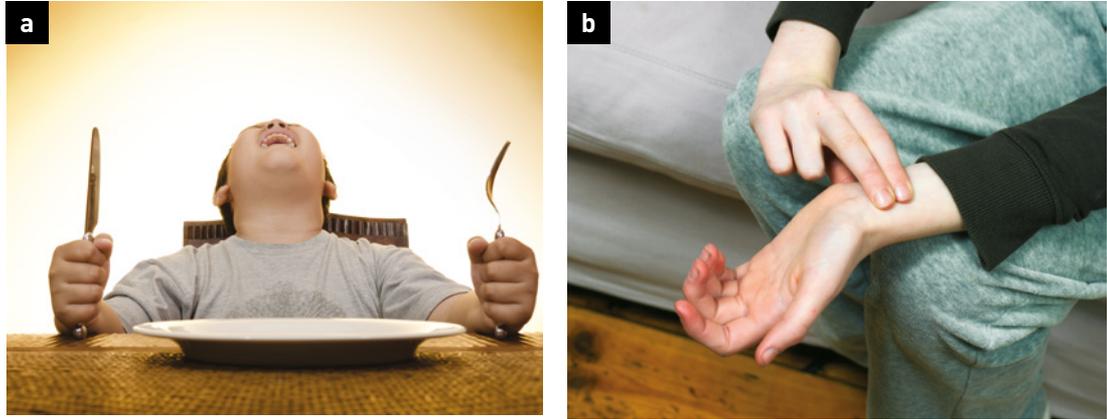
**Circadian rhythms** (*circa* meaning “about/approximately”, *dies* meaning “a day”) refer to any biological changes or activities in which one cycle occurs over 24 hours. The sleep–wake cycle occurs daily; the time that we spend awake combined with the time that we spend asleep adds to approximately 24 hours. Therefore, it is a circadian rhythm.

A typical human sleep–wake cycle consists of 16 hours of normal waking consciousness and 8 hours of sleep. At consistent times of the day, we may experience specific changes to our state of consciousness. For example, every day at around 4 p.m., we may feel a dip in our energy and focus.

Other circadian rhythms include the body temperature cycle and the patterns in which some of the body's hormones are secreted.



**FIGURE 1** **a** Body temperature and **b** secretion of hormones such as cortisol, a stress hormone, are other examples of circadian rhythms.



**FIGURE 2** **a** The average person has three main meals a day and **b** their heart beats about 100,000 times a day. These are ultradian rhythms since one cycle occurs over a period of less than 24 hours.

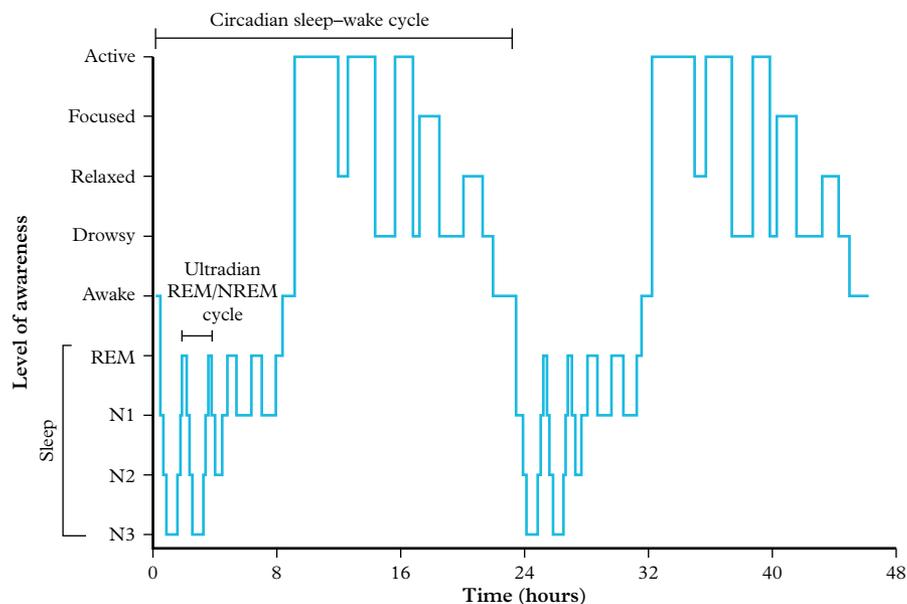
## Ultradian rhythms

**ultradian rhythms**  
any biological changes or activities that repeat more than once every 24 hours

**Ultradian rhythms** (*ultra* meaning “beyond or more frequently”) refer to any biological changes or activities in which the duration of one cycle is less than 24 hours. An example is one sleep cycle consisting of REM and NREM stages 1 to 3. This cycle repeats four to five times over a night of sleep, producing an ultradian rhythm.

Other ultradian rhythms include your appetite or eating behaviours, digestion, blinking and heartbeat.

Hypnograms such as the one in Figure 3 are useful for depicting the circadian and ultradian rhythms of sleep. See how to interpret a hypnogram in Worked example 6.3.



**FIGURE 3** The sleep–wake cycle is a circadian rhythm. The REM/NREM cycle is an ultradian rhythm.

### 6.3 WORKED EXAMPLE

#### Interpreting a hypnogram

Analyse the hypnogram shown in Figure 4.

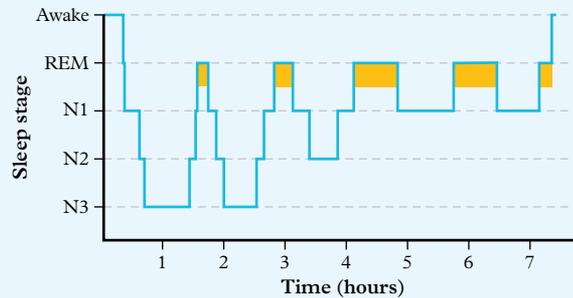


FIGURE 4 A hypnogram

- a** Identify the number of sleep cycles the individual has experienced over seven hours of sleep. (1 mark)
- b** Identify the type of rhythm that is shown (circadian or ultradian). Justify your response. (2 marks)

#### Solution

Think	Do
Step 1: Identify the command terms used in the question and determine what they require.	Part a requires you to “identify”. This requires you to recognise and name something from, in this case, a diagram. Part b requires you to “identify” something and “justify” your response. In addition to recognising and naming something, you are required to provide the reasoning and evidence you have relied on to reach your conclusion.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	Part <b>a</b> is allocated 1 mark, so you should only provide one piece of information: your identification. Part <b>b</b> is allocated 2 marks, so you should provide two pieces of information: your identification and the reason for your identification.
Step 3: Recall what one sleep cycle is.	One sleep cycle consists of a complete sequence of the stages of sleep, i.e. from the N1 stage to N2, N3 and REM, then back to a brief period of awake or back to N1.
Step 4: Count the number of sleep cycles in the hypnogram.	<p><b>a</b> The individual has experienced five sleep cycles over the 7 hours. (1 mark)</p>
Step 5: Recall the difference between circadian and ultradian rhythms.	If a cycle repeats every 24 hours, it is a circadian rhythm. If it repeats more than once every 24 hours, it is an ultradian rhythm.
Step 6: Determine how many times the rhythm repeats.	<b>b</b> This is an ultradian rhythm because each cycle of sleep repeats every one to two hours. (2 marks)

## Internal biological mechanisms

Circadian and ultradian rhythms are managed through a system of endogenous (internal) biological mechanisms. Our body's responses to external and internal stimuli are regulated by the brain.

### Suprachiasmatic nucleus

The specific structure in our brain that is responsible for controlling circadian and ultradian rhythms is the **suprachiasmatic nucleus (SCN)**. It is considered to be the master controller of our body clock. The SCN is a small part of the hypothalamus, just above the optic chiasm where the optic nerves converge (*supra* meaning “above”, *chiasm* referring to the optic chiasm or “crossing”). It is divided into two hemispheres. Each hemisphere consists of approximately 10,000 neurons.

The regulation of our sleep–wake patterns by the SCN relies on the detection of external environmental cues by our sensory organs, particularly the intensity of light picked up by light-sensitive neurons in our eyes. The SCN is conveniently located, allowing it to quickly receive information from the retinas of the eyes.

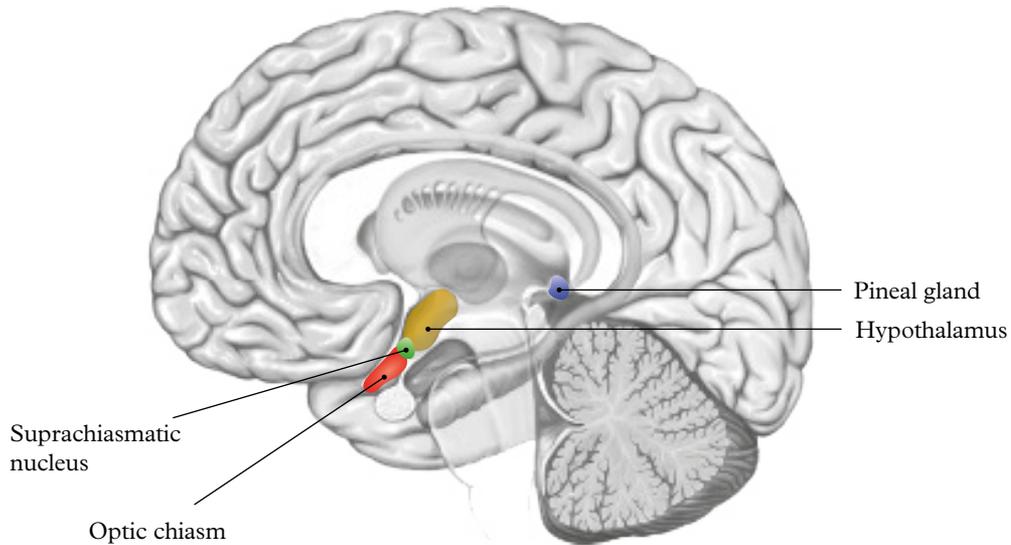
The SCN functions through interactions with other parts of our brain. In the case of our sleep–wake cycle, the SCN communicates with the **pineal gland**, which is located in the midbrain (Figure 5). The pineal gland secretes a hormone called melatonin, which is very important in controlling our sleep–wake cycle.

#### suprachiasmatic nucleus (SCN)

a small structure in the brain that regulates the sleep–wake cycle and other biological rhythms; also known as the “body clock”

#### pineal gland

a gland located in the brain that is responsible for the production and release of melatonin



**FIGURE 5** The SCN, part of the hypothalamus, interacts with the pineal gland to regulate our sleep–wake cycle.

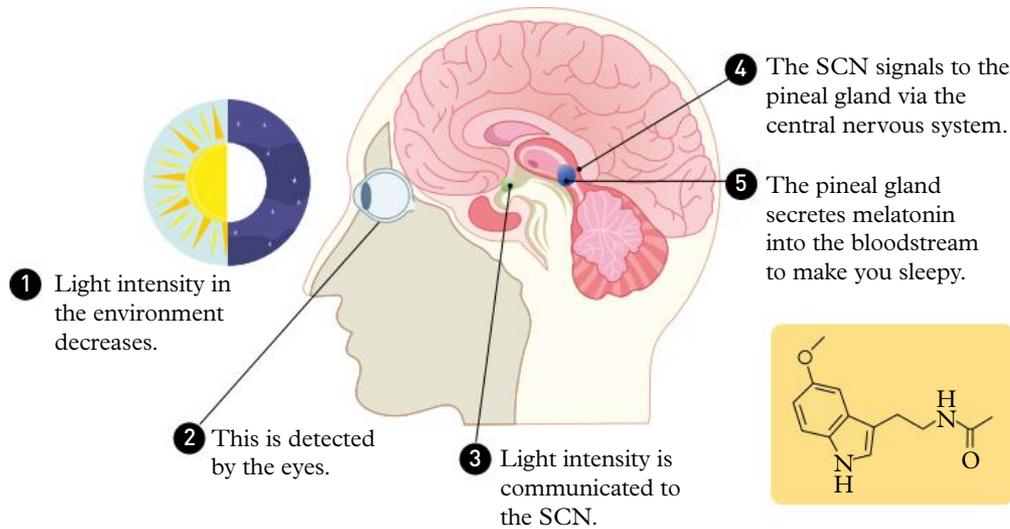
### Melatonin

**Melatonin** is the main hormone involved in regulating the sleep–wake cycle. It acts on parts of the brain to affect the physiological and psychological processes involved in alertness and awareness. Melatonin also decreases cell activity and induces drowsiness.

When low light is detected by the SCN, excitatory neural messages are sent to the pineal gland to release melatonin. This makes you feel drowsy, reduces your awareness and brings about the onset of sleep. During the night, the pineal gland continues to release melatonin to maintain sleep. This is summarised in Figure 6.

#### melatonin

a hormone released from the pineal gland that influences alertness and causes drowsiness to promote the onset and maintenance of sleep



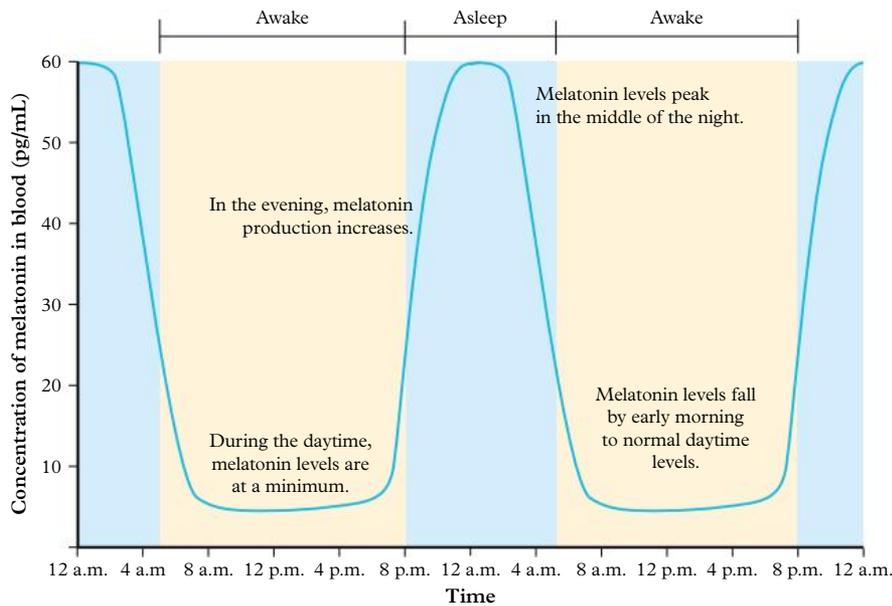
**FIGURE 6** In low light, the SCN and pineal gland work together to secrete more melatonin.

The opposite is also true. When light intensity increases (e.g. in the morning and throughout the day), inhibitory neural messages are sent from the SCN to instruct the pineal gland to reduce the secretion of melatonin. This increases your level of awareness and attention, shifting and maintaining a state of normal waking consciousness.

As well as responding to light levels (an external stimulus), the SCN also monitors and is responsive to levels of melatonin in the blood (an internal stimulus). When melatonin levels in the blood are high, the SCN will signal to the pineal gland to reduce secretion of melatonin. This is a **negative feedback loop**.

Together, light levels and the amount of melatonin in the blood determine whether the SCN will signal to the pineal gland to secrete more or less melatonin. The level of melatonin in your bloodstream varies throughout the day, as shown in Figure 7.

**negative feedback loop**  
a feedback mechanism to stabilise the body's internal environment by opposing and counteracting the effects of external or internal disturbances or stimuli



**FIGURE 7** Melatonin levels (in picograms per millilitre of blood) vary throughout the day.

Understanding how our sleep–wake patterns and other biological rhythms are regulated helps us make informed choices about how to improve our lifestyle and function. You will learn about this in Chapter 7.

### 6.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Define “sleep–wake pattern”.
- 2 Explain why sleep is both an ultradian rhythm and a circadian rhythm.
- 3 Describe the role of melatonin in sleep onset and sleep maintenance.

#### Apply, analyse and compare

- 4 Sinem often complains that she can’t sleep because her housemate always leaves the hall light on, which shines directly into Sinem’s bedroom. With reference to the SCN and melatonin, explain how this would affect Sinem’s ability to go to sleep.
- 5 Describe the sleep-related ultradian rhythms that occur during a nine-hour sleep episode.
- 6 Identify the type of rhythm that your melatonin level follows. Justify your answer.

- 7 Compare the SCN’s response to low levels of light with its response to high levels of melatonin in the blood and explain why they are both considered negative feedback loops.

#### Design and discuss

- 8 In 2014, a 38-year-old woman survived a gunshot wound to her right temple, leaving her with damage to her SCN. Suggest how this injury would affect her circadian sleep–wake pattern.
- 9 Investigate one other circadian rhythm that humans experience. Use the internet to find out how the SCN and glands in the body are involved in the regulation of your selected rhythm. Construct a flow chart to summarise your findings.



# 6.4

## Sleep across the life span

### KEY IDEAS

- ✦ Different age groups experience different sleeping patterns and require different amounts of sleep.
- ✦ The proportion of REM and NREM sleep experienced by humans changes over a normal life span.



### life span

the length of time that an individual is expected to live

Along with the physiological changes we experience as we age, our sleeping patterns also change. This occurs in response to a variety of psychological and social factors. It also helps to support our development. In this topic, you will learn about how sleep patterns change across the **life span**.

### Study tip

These values do not reflect how much sleep is “needed” in each age group but, rather, how sleeping patterns change with age. You will learn that as you age, it becomes harder to have deep and high-quality sleep.

## Patterns of sleep across the life span

In general, the total amount of sleep we experience decreases with age. Neonates (newborns) and infants sleep more than you do, and you sleep more than your teacher does. Not only do the patterns of sleep differ, but also the proportions of REM and NREM sleep, and proportions of N1 to N3 sleep.

Figure 1 summarises this, with the total amount of sleep shown on the y-axis and the life span shown on the x-axis. Each age range is also broken down into the proportions of REM (top section) and NREM (bottom section) sleep. The percentages show the proportion of REM sleep.

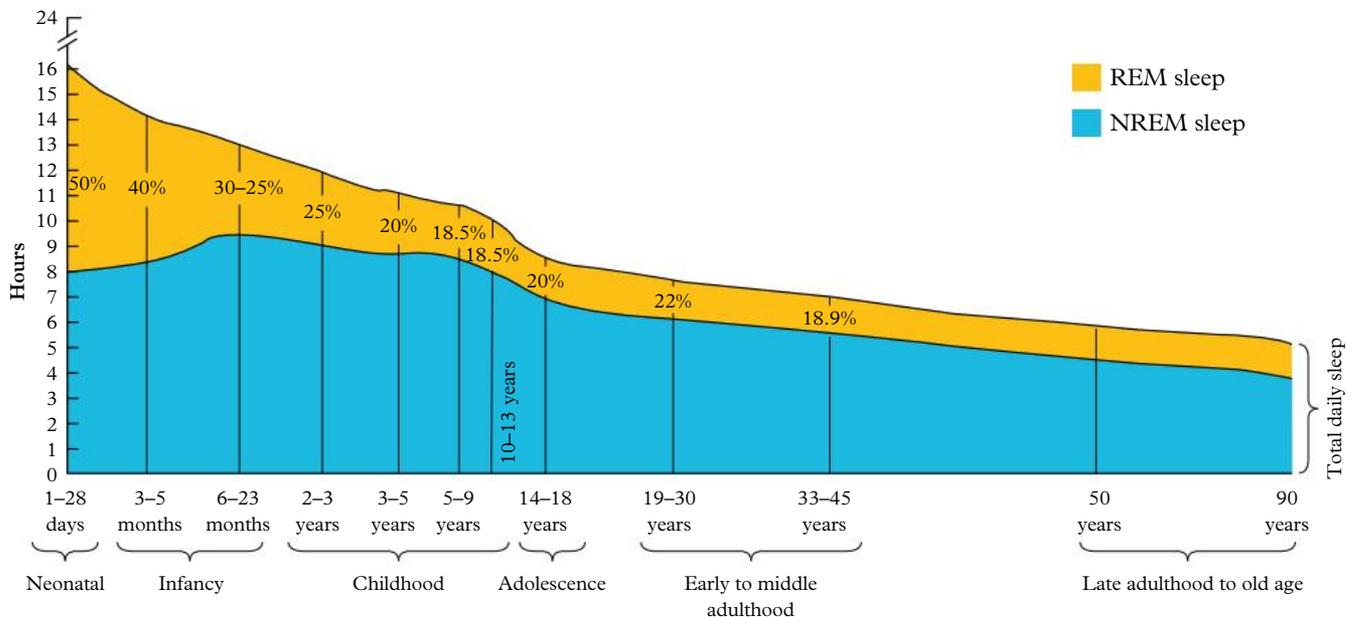


FIGURE 1 Sleep patterns change with age.

## Neonatal period

### neonate

a newborn child up to 28 days old



**FIGURE 2** Sleeping like a baby

The phrase “sleeping like a baby” comes from real observations about the sleeping patterns of **neonates**. Neonates sleep for up to 16 hours each day. Each sleep episode lasts for 2 to 4 hours, with the neonate waking for feeding or other reasons between episodes.

Because they are shorter, these sleep–wake cycles occur more frequently than in older humans and do not align yet with the circadian rhythm. This is thought to be due to ongoing neurological development.

Neonates experience the onset of sleep in a slightly different way than you.

Instead of drifting into N1 sleep, neonates experience REM sleep first. REM sleep accounts for about 50 per cent of the total sleep time. This means that NREM sleep also accounts for 50 per cent of total sleep.

A unique characteristic of neonatal REM sleep is that it may not involve a lack of body movement. In fact, neonates may actively move their limbs and face. The large proportion of REM sleep is thought to support the significant brain and nervous system development that humans undergo at this age.

## Infancy

In infants aged up to one year, the length of each sleep episode increases to five to eight hours during the night. Combined with naps during the daytime, this adds up to 13 to 15 hours of total sleep each day.

There is also a shift towards sleep onset via N1 sleep instead of REM sleep. The proportion of REM sleep decreases to approximately 35 to 40 per cent of total sleep time, with NREM sleep making up the remaining 60 to 65 per cent. Infants start to experience the typical motionless REM sleep. This is thought to be due to maturation of the brain and reduced rates of neurological development.

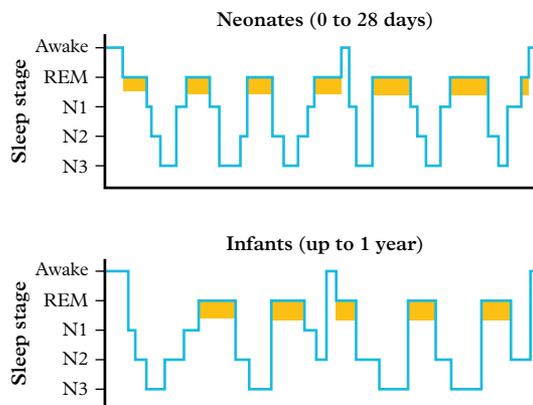
Infants also become more receptive to light, and the interactions between their SCN and melatonin start to synchronise with the 24-hour circadian rhythm. This leads to longer periods of wakefulness during the day and longer sleep episodes during the night.

### Study tip

There is no clear definition for when an individual is a newborn (neonate). Some sources define “neonate” as from birth up to 28 days. Others say from birth to 14 days. Others even use the term for up to one year after birth.

### Study tip

Brain development is not the only function of REM sleep, because fully grown adults and elderly humans still experience it.



**FIGURE 3** The first cycle of sleep experienced by neonates differs from that of infants.

## Childhood

Throughout childhood, the total amount of sleep we get continues to decrease to about twelve hours a day. Most of this occurs during the night. The maturation of our internal biological mechanisms leads to a sleeping pattern that is more aligned to a circadian rhythm.

The proportion of REM sleep further decreases to 20 per cent. NREM sleep increases to 75 per cent. In early childhood (two to five years of age), N3 sleep makes up more than half of our NREM sleep. From five years of age onwards, this decreases. The quality of N3 sleep is also unique to early childhood. Delta waves have a significantly greater amplitude than in other age groups. Young children also often miss REM sleep in their first sleep cycle (Kurth et al., 2010).

For older children (six to ten years of age), the proportion of N1 and N2 sleep increases and N3 sleep decreases. In fact, for the rest of the life span, the proportion of N2 sleep continues to increase.

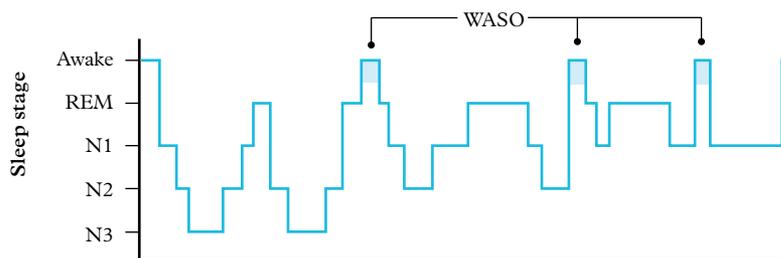
The total daily sleep for older children decreases to about 11 hours. This is suggested to be due to social factors, such as school, where children are required to wake earlier than they would naturally. Social and psychological factors affect total sleep in an even more significant manner in adolescence.

## Adolescence

At the beginning of adolescence (about eleven years of age), individuals typically get about eleven hours of sleep daily. This steadily declines into late adolescence (about 18 years of age) to approximately 8.5 hours.

Consistent with the trends we have already discussed, REM sleep continues to decrease to 20 per cent while NREM sleep increases to 80 per cent. The proportion of N2 sleep increases and N3 sleep decreases.

During early adolescence, you may also begin to experience a greater proportion of time in a state called **wake after sleep onset (WASO)** or interrupted sleep. This is any time spent awake after initially falling asleep. Time in WASO increases as you progress into adulthood. This could be linked to the continuing reduction in N3 sleep, the stage in which we are least likely to be woken, and a corresponding increase in lighter N2 sleep, where we are more prone to being roused.



**FIGURE 5** Adolescents experience less REM sleep and more time in WASO.

In adolescence, you may experience much more irregular patterns of sleep than other age groups. Habits such as staying up or sleeping in very late can affect your sleep–wake cycle, forcing you out of sync with the circadian rhythm. Less overall sleep also means that you may not be able to function at your best. In fact, there are even long-term impacts of insufficient or irregular sleep, which can have negative effects on mental wellbeing. You will explore this in Chapter 7.



**FIGURE 4** Older children require approximately 11 hours of sleep per day.

### Study tip

It is worth remembering the defining characteristics of sleep in each age group. For example, REM sleep is the first stage of sleep after sleep onset in neonates, and young children often skip REM in their first sleep cycle.

**wake after sleep onset (WASO)** the state of wakefulness experienced by an individual after the onset of sleep that can occur periodically throughout an episode of sleep

### Study tip

Both total daily sleep and the proportion of REM sleep decrease with age, but by adulthood, the proportions of REM and NREM sleep remain fairly constant.

## Early to middle adulthood

Up to adolescence, you will have noticed there is a clear trend in total daily sleep and the proportion of REM sleep – they both decrease as we age. However, while the total sleep time continues to decline as we grow older, the proportion of REM and NREM sleep remains consistent throughout adulthood.

Individuals in early to middle adulthood (19 to 50 years of age) sleep approximately 7.5 to 8 hours daily, 20 per cent of this is in REM sleep and 80 per cent in NREM sleep. N3 sleep continues to decrease, and we spend more time in N1 and N2 sleep. In middle adulthood, we experience more frequent WASO. Together with other factors such as work, social pressures, drug and alcohol consumption, more time spent in WASO causes our quality of sleep to decrease.

### 6.4 SKILL DRILL

#### Evaluating potential sources of error in sleep pattern studies

##### Key science skills: Analyse and evaluate data and investigation methods

An experiment was conducted to examine the sleeping patterns of young adults between the ages of 18 and 21. A hundred participants were recruited from local universities and backpacker accommodation hostels, including individuals who had just arrived from overseas and those who were working a range of shifts in hospitality and entertainment venues during the day and night.

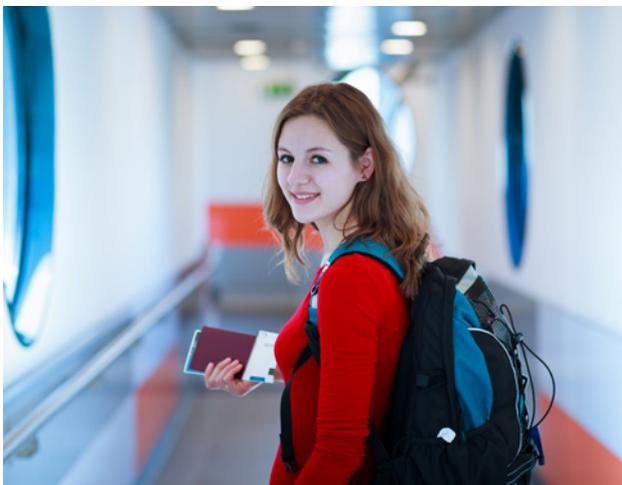
Each participant was asked to complete a daily survey about their sleep–wake times, sleep durations and sleep quality for two weeks. At the end of the two weeks, all of the data was collated.

Following analysis, the researchers found a number of outliers, including participants who slept during the day, had an average of five hours of sleep, or averaged twelve hours of sleep.

##### Practise your skills

- 1 Identify the research design used in this research.
- 2 Outline the extraneous variables that may have affected the results.
- 3 Propose changes to the research design to address and control the extraneous variables you outlined in Question 2.

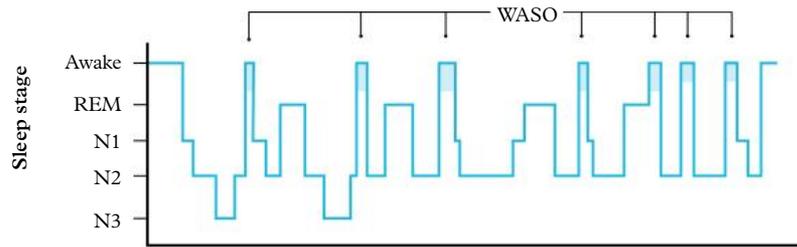
Need help analysing and evaluating investigation methods? See Topic 1.3 in your Psychology toolkit.



**FIGURE 6** The study collected data on the sleep of a range of participants, such as backpackers who had just arrived from overseas and individuals working in hospitality.

## Late adulthood to old age

In late adulthood and old age (50 to 90 years), sleeping patterns differ the most compared to infants. People in this age group typically sleep six to seven hours a day and experience an even more significant decline in N3 sleep. In fact, the older an individual becomes, the more likely it is they will not experience N3 sleep at all. This is associated with much more time spent in WASO (Figure 7).



**FIGURE 7** Older adults experience more frequent episodes of WASO.

The greater disruption of sleep in this age group contributes to reduced quality of sleep. Sleep quality is also affected by other factors such as medical conditions, which may be more prevalent in late adulthood, changing physiology and changes to social and psychological factors. The function of the SCN is also suggested to decrease with age. Together with changes to the production of hormones, including melatonin, this shapes the sleep–wake patterns of older adults.

At this age, we also experience sleep onset earlier in the evening and wake earlier in the morning. This is called advanced sleep phase disorder, which you will learn about in Chapter 7.

### 6.4 CHECK YOUR LEARNING



#### Describe and explain

- 1 Describe the trend in the total hours of sleep experienced across the life span.
- 2 Describe the trend in the proportion of REM and NREM sleep experienced across the life span.
- 3 Define “wake after sleep onset”.

#### Apply, analyse and compare

- 4 As well as the proportion of REM and NREM sleep, there are changes in our experience of the different stages of NREM.
  - a Explain what happens to the proportions of N1, N2 and N3 sleep with age.
  - b Describe the effect of reduced N3 sleep.

- 5 Compare the NREM sleep of adults and children.

#### Design and discuss

- 6 Grandpa Kiran is always complaining about not getting enough sleep. Examine the reasons for Grandpa Kiran’s complaints in relation to his sleep patterns.
- 7 Discuss the sleep patterns of neonates and the reasons for their unique proportion of REM and NREM sleep.
- 8 Discuss the social and psychological factors that affect the sleep patterns of adolescents.

## Chapter summary

- 6.1**
- Sleep is a psychological construct that cannot be directly observed and does not physically exist but is inferred from related phenomena.
  - Sleep is a regular and naturally occurring altered state of consciousness.
  - Cycles of sleep consist of four different stages: rapid eye movement (REM) sleep and three stages of non-rapid eye movement (NREM) sleep.
  - REM sleep is characterised by rapid movement of the eyes, a motionless body and high-frequency, low-amplitude brain activity, similar to brain activity when awake.
  - NREM sleep consists of the N1, N2 and N3 stages of sleep. Each stage has specific psychological and physiological characteristics, such as different levels of brain activity.
- 6.2**
- Sleep can be measured by using objective reporting, which is based on direct observation, and subjective reporting, which is based on personal experience.
  - Objective reporting techniques include electroencephalography (EEG), electromyography (EMG) and electro-oculography (EOG), which measure brain activity, muscle activity and eye muscle activity, respectively.
  - Polysomnography combines EEG, EMG, EOG and other objective measurements to form a better picture of an individual's sleeping patterns.
  - Subjective reporting techniques include sleep diaries and video monitoring.
- 6.3**
- Circadian rhythms occur over a 24-hour period. The sleep–wake cycle is an example of a circadian rhythm, as the time we spend awake combined with the time we spend asleep adds up to 24 hours.
  - Ultradian rhythms occur with a duration of less than 24 hours. The sleep cycle is an example of an ultradian rhythm, as we experience one cycle (N1 through to REM) many times over a 24-hour period.
  - Sleep–wake patterns are aligned to circadian and ultradian rhythms.
  - Circadian and ultradian rhythms are regulated by the suprachiasmatic nucleus (SCN) in response to environmental and internal stimuli.
  - When the eyes detect low levels of light, the SCN sends neural messages to the pineal gland and causes it to release melatonin, a hormone that causes drowsiness and promotes the onset and maintenance of sleep. When higher intensities of light are detected, the SCN signals to the pineal gland to reduce the release of melatonin and promote alertness and attention.
- 6.4**
- Sleep patterns change over a normal life span, including the total sleep time, the proportion of REM and NREM sleep, the proportion of N1 sleep to N3 sleep, and the time of wake after sleep onset (WASO).
  - Neonates experience the highest proportion of REM sleep (50 per cent) and the longest total sleep time (up to 16 hours) compared to any other age group. Both of these decline steadily as we age.
  - Older adults experience the shortest total sleep time (six to seven hours). The proportions of REM and NREM sleep (20 per cent and 80 per cent, respectively) are similar to those of adolescents and are consistent throughout adulthood.
  - WASO is more prevalent in adulthood through to old age. This is associated with a steady increase in N1 and N2 sleep, and a reduction in the proportion of N3 sleep.
  - Social and psychological factors contribute to changing sleep patterns over the life span, especially in adolescence.

## Revision questions

### Multiple choice

- 1 Ahmed is on the train home from work. While gazing out the window, he finds himself drifting off to sleep but tries to stay awake. Suddenly, his leg and arm jolt him awake. Ahmed was most likely experiencing:
  - A N1 sleep.
  - B N2 sleep.
  - C N3 sleep.
  - D N4 sleep.
- 2 A characteristic of sleep as an altered state of consciousness is that it:
  - A is reversible.
  - B is drug induced.
  - C is objective to the individual.
  - D can be replicated.
- 3 Pauline is having a vivid dream of being chased by a herd of angry unicorns. Which of the following is Pauline likely to be displaying?
  - A Her legs would be moving as though she is running away.
  - B Her eyes would be wide open.
  - C Her body would be mostly motionless.
  - D Her breathing would have temporarily ceased.
- 4 If a 17-year-old individual were to be woken from sleep after eight hours, which of the following stages of sleep would they have experienced the most of?
  - A N1 sleep
  - B N3 sleep
  - C REM sleep
  - D N2 sleep
- 5 A characteristic of N2 sleep is:
  - A a greater presence of sleep spindles and K-complexes.
  - B hypnagogia.
  - C the presence of high-amplitude, low-frequency brain waves.
  - D rapid eye movements.
- 6 Which of the following techniques would best measure the number of posture shifts and whole-body movements during sleep?
  - A EMG
  - B EOG
  - C Sleep diary
  - D Video monitoring
- 7 Marianne doesn't sleep as much as she used to when she was a child. She remembers when she was five years old, she would sleep for what felt like a long time, whereas now, she often wakes after seven hours of sleep. Despite this, she often wakes feeling refreshed and alert. Marianne is most likely to be in:
  - A early to middle adulthood.
  - B late adulthood to old age.
  - C late childhood.
  - D adolescence.
- 8 Adults of old age are likely to experience:
  - A reduced REM sleep compared to when they were young adults.
  - B increased N1 and N2 sleep.
  - C decreased N3 sleep.
  - D all of the above.
- 9 REM sleep is characterised by rapid eye movement. This can best be detected using:
  - A EMG.
  - B EEG.
  - C EOG.
  - D ECG.
- 10 Why is the SCN also referred to as the "body clock"?
  - A It helps to keep track of what time of day it is.
  - B It coordinates your body's ultradian and circadian rhythms.
  - C It secretes hormones that control your circadian rhythms.
  - D It uses internal stimuli to regulate your ultradian and circadian rhythms.

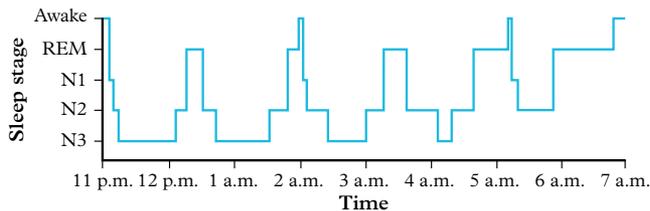
**Short answer**

**Describe and explain**

- 11 Explain why sleep is considered to be a psychological construct.
- 12 Describe the features of beta, alpha, theta and delta brain waves.
- 13 Describe what is meant by slow-wave sleep.
- 14 Explain why REM sleep is sometimes referred to as paradoxical sleep.
- 15 Explain why sleep diaries are used as part of research into sleep and sleep patterns.
- 16 Explain why objective reporting is used to measure sleep.
- 17 Define “circadian cycle”.
- 18 Describe the sleep patterns of adolescents in terms of total hours of sleep, proportions of REM and NREM sleep (including stages N1 to N3), and WASO.
- 19 Describe the first sleep cycle of a neonate.

**Apply, analyse and compare**

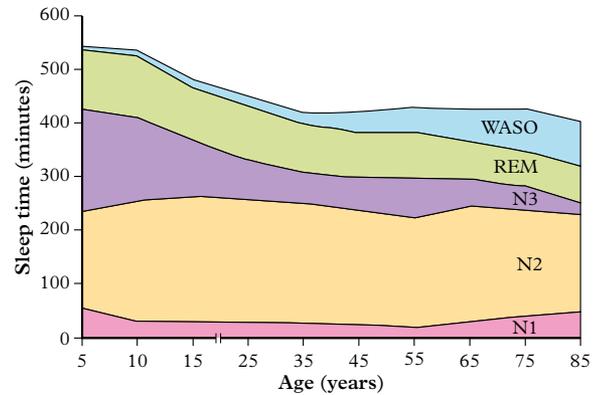
- 20 Fabian is writing an essay in class. He must complete it before the end of the lesson. Outline the characteristics that would indicate he is in a state of normal waking consciousness.
- 21 When working from home, Haruto prefers to work in his home office, which is brightly lit by natural light during the day and LED ceiling lights when the sun goes down. Haruto says that this helps him stay awake for longer so he can complete more work. Explain why Haruto may be right in suggesting that he is able to stay awake for longer while working in his home office.
- 22 The hypnogram in Figure 1 shows one sleep episode experienced by Zoe, who is an adult.



**FIGURE 1** Zoe’s hypnogram

- a Propose the age group that Zoe is likely to be in. Justify your response.
- b Describe the differences between the REM and NREM sleep experienced by Zoe.
- c Compare Zoe’s current sleep patterns to the sleep patterns of when she was an infant.

23 The graph in Figure 2 represents sleep across the life span.



**FIGURE 2** The stages of sleep across the life span

- a Outline two conclusions that can be drawn from the graph.
  - b Explain what WASO is and why it increases in old age.
- 24 Adults generally experience a reduction of melatonin as they age.
- a Outline the biological processes involved in release of melatonin during the early evening and throughout the night.
  - b Analyse the effect of reduced melatonin on adults of older age.
- 25 Hans is in an important staff meeting when he begins to fall asleep. Adam, one of Hans’s work colleagues, notices him dozing off and nudges Hans awake. Adam whispers “Wake up!” to Hans, to which Hans responds “I wasn’t asleep!” At that moment, Hans’ boss, Camilla, asks Hans about his opinion on the topic of discussion.

With reference to the characteristics of altered states of consciousness, propose why it is unlikely that Hans will provide an accurate response to Camilla.

- 26 Ayan claims that her grandmother, who is in a coma, is just asleep. Evaluate her claim.
- 27 Sleeping tablets are hypothesised to increase the duration of total sleep time but reduce the proportion of REM sleep. Propose how objective measurements of sleep can be used to investigate this.

### Design and discuss

- 28 Acetylcholine is a neurotransmitter associated with alertness and increased rates of brain activity. Researchers have found that acetylcholine can be produced by specific neurons located in the pons, a part of the brain located beneath the midbrain. These acetylcholine-producing neurons are activated during normal waking consciousness and alertness, as well as during REM sleep.
- Discuss why the activation of these acetylcholine-producing neurons is an ultradian rhythm rather than a circadian rhythm.
  - Infer how acetylcholine may contribute to the characteristics of REM sleep.
- 29 Jessica, who lives in Sydney, travels to Reykjavik, Iceland, to visit her friend Dora. In Reykjavik, the Sun does not completely set during the summer. This leads to long hours of daylight. In the winter, daylight can decline to 4 hours per day. Discuss how this may affect Jessica's sleep-wake pattern.

- 30 Dr Strawberry is interested in examining the purpose of REM sleep. To do this, they establish a sample size of 10 randomly selected healthy adults. At the start of the experiment, the duration of REM sleep experienced by each participant was measured for three nights, on which the participants went to bed after doing their normal, everyday activities. The following week, Dr Strawberry took all the participants out on a field trip to an art gallery, a restaurant, a shopping centre, and then to an amusement park.

That night, the duration of REM sleep experienced by each participant was measured and compared to the average of the previous week. Dr Strawberry found that both the duration and the proportion of REM sleep was far greater during the night of the field trip than the previous week's average.

- Identify the independent and dependent variables of this investigation.
- Propose a hypothesis for this investigation.
- Explain why a random sample enhances the external validity of the investigation.
- Identify one objective and one subjective measurement technique that Dr Strawberry may have used in their investigation. Justify your response.
- With reference to the results of the research, construct a conclusion about the purpose of REM sleep.

You can find the following resources for this section in your [obook pro](#):

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

7

# The importance of sleep for mental wellbeing

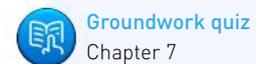
## KEY KNOWLEDGE

- the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person’s affective, behavioural, and cognitive functioning, and the affective and cognitive effects of one night of full sleep deprivation as a comparison to blood alcohol concentration readings of 0.05 and 0.10
- changes to a person’s sleep–wake cycle that cause circadian rhythm sleep disorders (Delayed Sleep Phase Syndrome [DSPS], Advanced Sleep Phase Disorder [ASPD] and shift work) and the treatments of circadian rhythm sleep disorders through bright light therapy
- improving sleep hygiene and adaptation to zeitgebers to improve sleep–wake patterns and mental wellbeing, with reference to daylight and blue light, temperature, and eating and drinking patterns.

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## GROUNDWORK

This chapter will build on concepts you may have come across in Chapter 6. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.

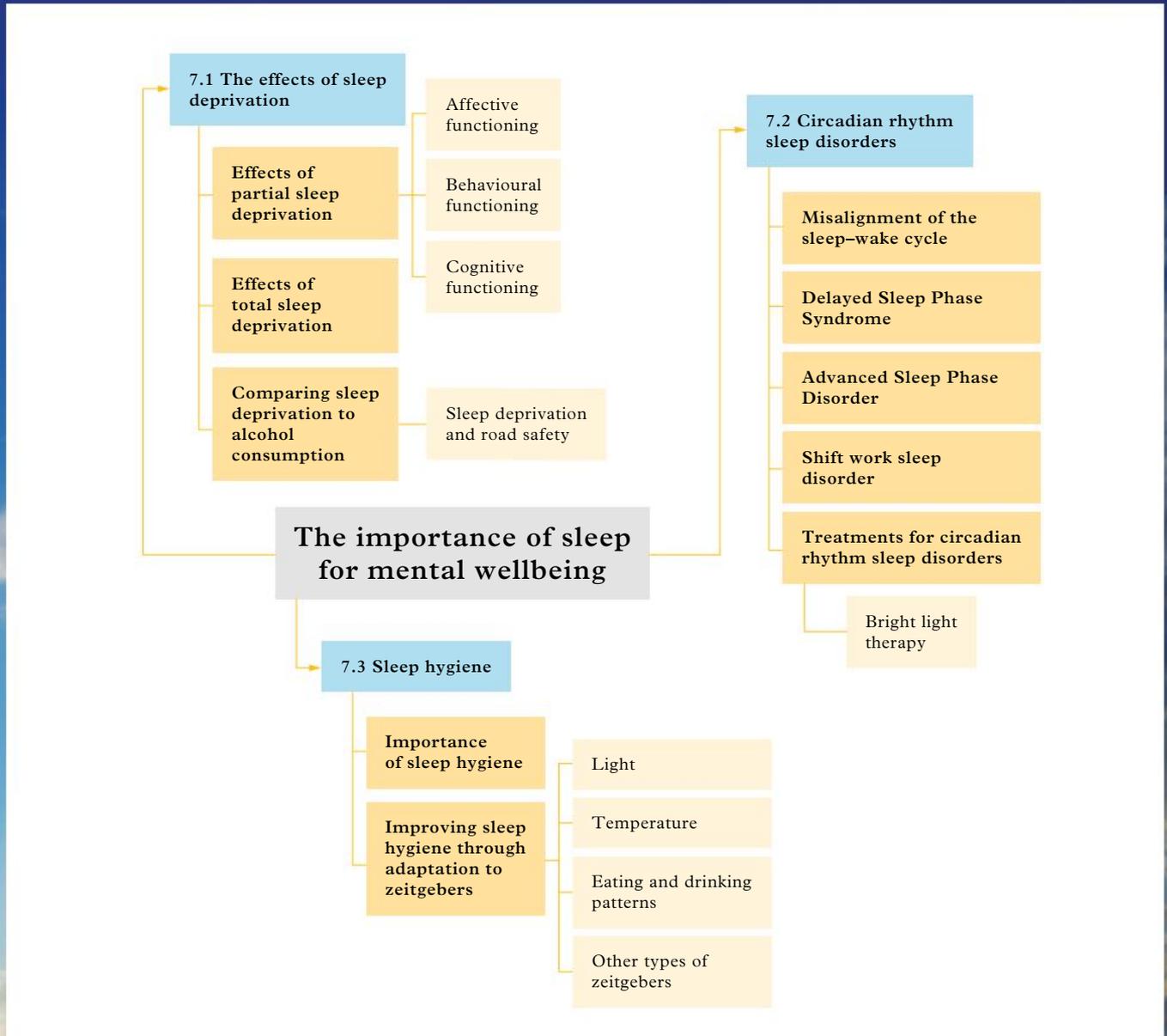


## INVESTIGATIONS

<b>7.3A</b>	<b>INVESTIGATION: CLASSIFICATION AND IDENTIFICATION</b>	How can the sleep of new shift workers be improved?	Page 485
<b>7.3B</b>	<b>INVESTIGATION: PRODUCT, PROCESS OR SYSTEM DEVELOPMENT</b>	How can you improve sleep hygiene by modifying your diet?	Page 487

**FIGURE 1** The Sun is a natural source of blue light that regulates your sleep–wake cycle.

## CONCEPT MAP



# 7.1

## The effects of sleep deprivation

### KEY IDEAS



- ✦ Partial sleep deprivation occurs when a person does not get the amount of sleep and/or the type of sleep they need within a 24-hour period.
- ✦ Total sleep deprivation occurs when a person is deprived of all sleep for at least one 24-hour period.
- ✦ Sleep deprivation has a negative effect on affective, behavioural and cognitive functioning.
- ✦ The affective and cognitive effects of partial and total sleep deprivation are the equivalent of having a blood alcohol content (BAC) of 0.05 and 0.10 respectively.

### physical wellbeing

a general term used to describe a person's ability to complete daily physical activities without undue fatigue, pain or physical stress on the body, in order to maintain a healthy quality of life

### mental wellbeing

a general term used to describe a person's overall mental state in terms of how content they are with themselves and their life, and their ability to realise their potential, cope with the normal stresses of life, work productively and make a contribution to their community, in order to maintain a healthy quality of life

### sleep deprivation

a condition that occurs when a person gets an inadequate quantity and/or quality of sleep

### partial sleep deprivation

a condition that occurs when a person does not get the total amount and/or type of sleep they need within a 24-hour period

### total sleep deprivation

a condition that occurs when a person is completely deprived of sleep for at least one 24-hour period

Sleep is vital for our **physical wellbeing** and **mental wellbeing**. We spend around one third of our lives asleep – so it is as important for our bodies as eating, drinking and breathing – but many of us don't get enough sleep.

In general terms, the state caused by inadequate quantity and/or quality of sleep is known as **sleep deprivation**. There are two main types of sleep deprivation:

- **partial sleep deprivation**: when a person does not get the total amount of sleep (i.e. low **quantity** of sleep) and/or type of sleep (i.e. low **quality** of sleep) they need within a 24-hour period
- **total sleep deprivation**: when a person does not get any sleep for at least one 24-hour period.

Sleep deprivation can be caused by a range of factors, including medical conditions, food consumption, stimulants (e.g. drugs, alcohol), environmental conditions (e.g. noise, light) and social factors (e.g. school or work, stress).

In this topic, we will focus on the effects of partial sleep deprivation.



**FIGURE 1** Sleep deprivation is caused by inadequate quality and/or quantity of sleep.

# Effects of partial sleep deprivation

Partial sleep deprivation can negatively affect our physical and mental wellbeing in many ways. Some common physical effects are increased risk of obesity, heart disease and diabetes. The mental effects can be just as serious.

When psychologists study the effects of partial sleep deprivation on mental wellbeing, they generally group them according to three main types of brain function:

- **affective functioning:** brain functions related to our emotions
- **behavioural functioning:** brain functions related to the way we physically interact with our environment
- **cognitive functioning:** brain functions related to our mental processes.

You will learn more about mental wellbeing in Chapter 8.



**FIGURE 2** Partial sleep deprivation can cause increased irritability, heightened feelings of anger, anxiety or sadness, as well as a lack of motivation.

## Affective functioning

**Affective functioning** includes all brain functions linked to the expression and experience of emotion.

When we are affected by partial sleep deprivation, it is common for us to become irritated, impatient and emotionally triggered by events that wouldn't normally cause an emotional reaction. We can experience **amplified emotional responses**. These emotional reactions are more intense than normal and may be unreasonable in the situation (especially compared with how we would generally react if well rested). For example, we may respond very angrily to a light-hearted joke made by a close friend in conversation.

Partial sleep deprivation is also linked to impaired **emotional awareness**. This is the ability to recognise and make sense of your own emotions and the emotions of those around you. For example, you might make a comment at work that offends a colleague without recognising that you've offended them.

## Behavioural functioning

**Behavioural functioning** includes all brain functions linked to observable actions and the way we act and move our bodies in response to stimuli. It is commonly referred to as **motor skills**.

When we are affected by partial sleep deprivation, the speed and accuracy of our motor skills are reduced. Our balance, coordination and muscle control also decrease, resulting in slower reaction times. Slow reaction times and reduced coordination can have serious effects on our ability to complete everyday tasks such as crossing the road, playing sport or driving.

### **affective functioning**

all brain functions linked to the expression and experience of emotion

### **amplified emotional response**

an emotional reaction to a stimulus, situation or event that is more intense than would typically be considered appropriate

### **emotional awareness**

the ability of a person to recognise and make sense of their own emotions and the emotions of people they interact with

### **behavioural functioning**

all brain functions linked to the way we act and move our bodies in response to stimuli (i.e. motor skills)

### **motor skill**

a specific movement of the body's muscles used to perform everyday tasks such as walking, writing with a pen, and driving a car

**microsleep**

a sudden period of severe drowsiness or sleep lasting from 1 to 15 seconds; episodes of microsleep cannot be controlled and some people may even appear to be awake during them

**cognitive functioning**

all brain functions linked to our mental processes (i.e. thinking, problem-solving, logic and memory)

One of the most serious effects of partial sleep deprivation is **microsleep**. A microsleep is a sudden period of severe drowsiness or sleep lasting anywhere from 1 to 15 seconds. Microsleeps can be extremely dangerous because people can doze off in the middle of a task such as driving or operating heavy machinery without even being aware of it. This can cause serious injury or death.

**Cognitive functioning**

**Cognitive functioning** includes all brain functions linked to our mental processes such as thinking, problem-solving, logic and memory.

When we are affected by partial sleep deprivation, our cognitive abilities become impaired, and we are likely to have difficulty thinking clearly and completing tasks that require problem-solving skills or logic.

Although cognitive functioning will not be completely impaired by partial sleep deprivation, when partially sleep deprived we:

- need more time to complete simple and complex tasks than we normally would
- make more errors completing simple and complex tasks than we normally would.

Our attention span and ability to concentrate are also affected by partial sleep deprivation. This can then affect our ability to form memories because we cannot focus our attention



**FIGURE 3** Partial sleep deprivation can affect our behavioural functioning. This may lead to microsleeps while driving, causing serious injury or death.

on the stimuli for long enough to receive and encode the information. Partial sleep deprivation also impairs our ability to perform cognitive tasks that require retrieval of memory.

The effects of partial sleep deprivation on affective, behavioural and cognitive functioning are summarised in Table 1.



**FIGURE 4** Partial sleep deprivation can affect our cognitive functioning. We will need more time than usual to complete tasks and will make more errors.

**TABLE 1** The effects of partial sleep deprivation on affective, behavioural and cognitive functioning

Affective functioning effects	Behavioural functioning effects	Cognitive functioning effects
<ul style="list-style-type: none"> <li>• Increased irritability</li> <li>• Heightened feelings of sadness and anxiety</li> <li>• Lack of motivation</li> <li>• Increased feelings of sadness and depression</li> <li>• Amplified emotional responses (i.e. a reduced ability to control your emotions in some situations)</li> </ul>	<ul style="list-style-type: none"> <li>• Daytime fatigue and sleepiness</li> <li>• Lack of coordination and muscle control (i.e. motor skills)</li> <li>• Slower reaction times</li> <li>• Microsleeps</li> <li>• An increase in REM sleep</li> <li>• Reduced self-control</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced ability to concentrate</li> <li>• Shorter attention span</li> <li>• Difficulties completing problem-solving and logic tasks</li> <li>• Reduced ability to reason</li> <li>• Impaired memory</li> <li>• Increased difficulty completing both simple and complex cognitive tasks</li> <li>• Impaired judgment</li> <li>• Difficulty problem-solving</li> <li>• Difficulty making decisions</li> </ul>

## Effects of total sleep deprivation

After one 24-hour period of total sleep deprivation, an average person will experience effects on their affective, behavioural and cognitive functioning similar to those associated with partial sleep deprivation. However, longer periods of total sleep deprivation can cause more of these effects and they will become more severe over time.

### 7.1 REAL-WORLD PSYCHOLOGY

#### Randy Gardner's total sleep deprivation experiment

In 1964, a 17-year-old US teenager named Randy Gardner set the Guinness World Record for the longest time a human has gone without sleep. During the experiment, which was part of a high school science project, Randy stayed awake for a total of 11 days and 25 minutes without the use of any stimulants (e.g. coffee, alcohol or drugs).

To help him stay awake during the day, Randy stayed active by completing activities that required physical movement (such as playing basketball). At night, Randy's friends worked in shifts to keep him awake and monitor his progress.

At various points during the 11 days and 25 minutes of total sleep deprivation, Randy experienced:

- visual and auditory hallucinations
- changes in taste and smell (e.g. no longer being able to tolerate smells he would normally like)
- periods of reduced cognitive and sensory abilities (e.g. an inability to concentrate on tasks and remember information and events)
- periods of extreme moodiness and paranoia
- difficulties expressing emotions.

#### Apply your understanding

- 1 Describe some of the effects that you would be likely to experience if you attempted to break Randy's world record. Identify each of these effects as affective, behavioural or cognitive.
- 2 Determine whether you think that Randy would have experienced microsleeps. Justify your response.
- 3 Identify some of the possible risks and ethical considerations associated with studying total sleep deprivation.



**FIGURE 5** Randy Gardner underwent various forms of testing, such as a blindfolded scent test, to assess his functioning during his total sleep deprivation experiment.

### 7.1 CHALLENGE

#### How does sleep deprivation change body and brain function?

Conduct some research on the internet about the biological aspects of sleep. Outline how sleep helps you to function at your best, with reference to the total amount of sleep and proportions of rapid eye movement (REM) and non-rapid eye movement (NREM) sleep. Then describe how inadequate sleep quantity or quality affects the brain and body, drawing connections to affective, behavioural and cognitive functioning.

## Comparing sleep deprivation to alcohol consumption

If you consume alcohol, your affective, behavioural and cognitive functioning are affected in similar ways to if you are sleep deprived. This is because alcohol is a drug that suppresses the activity of the central nervous system (CNS) and reduces brain activity. The most similar effects include:

- reduced concentration and attention span
- slowed reaction time
- lack of coordination and muscle control.

In Victoria, a government organisation called the Transport Accident Commission (TAC) promotes road safety and pays for treatment of people injured in transport accidents.

The TAC estimates that 20 per cent of drivers killed on Victorian roads had a **blood alcohol concentration (BAC)** over the legal limit of 0.05. This is a measure of the amount of alcohol in a person's bloodstream. BAC is generally expressed as a percentage; for example, a BAC of 0.05 per cent indicates that a person has 0.05 grams of alcohol in every 100 millilitres of their blood.

### blood alcohol concentration (BAC)

a measure of how much alcohol is in the bloodstream; expressed as grams of alcohol per 100 millilitres of blood

**FIGURE 6** Australia has strict laws about drinking alcohol and driving. The BAC limit for full licence holders is 0.05. Learners and probationary licence holders must have a BAC of 0.00.



## Sleep deprivation and road safety

In the same way as a high BAC can, sleep deprivation can put you at risk of harm or more serious injury, particularly when you are completing a complex activity such as driving a vehicle.

Changes to your affective functioning due to sleep deprivation can have serious consequences on your ability to drive safely. For example, you may also experience enhanced emotional responses such as becoming very aggressive or angry towards other drivers.

The effect of sleep deprivation on behavioural functioning can also affect your ability to drive. For example, you may be more likely to take risks, such as speeding or changing lanes without indicating, because you have become overly confident or uninhibited.

Your ability to drive can also be compromised by sleep deprivation because of its effects on cognitive functioning. Driving safely requires you to carry out many tasks simultaneously, such as scanning the surroundings, maintaining constant speed when required, anticipating how other drivers may behave, and estimating the distance required to stop safely. All these tasks require the ability to process large amounts of data quickly and engage in complex problem-solving.

## 7.1 SKILL DRILL

### Communicating the effects of total sleep deprivation on safe driving

#### **Key science skill: Analyse, evaluate and communicate scientific ideas**

In 2021, Road Safety Victoria reported that fatigued drivers account for up to 20 per cent of crashes and 11 per cent of fatalities on Victorian roads. Both Road Safety Victoria and the TAC have sought to reduce these figures and raise awareness of the effects of sleep deprivation on driving.



**FIGURE 7** What sort of awareness campaign could be effective at targeting new drivers like learners and p-platers?

### Practise your skills

- 1 Design an awareness campaign or infographic aimed at new drivers (aged between 16 and 21 years). Make sure you use plain language that is suitable for an audience that includes individuals who have little scientific knowledge, and include the affective, behavioural and cognitive effects of total sleep deprivation.
- 2 Swap your work with a partner and evaluate the effectiveness of your partner's campaign. List two strengths and one potential area for improvement.

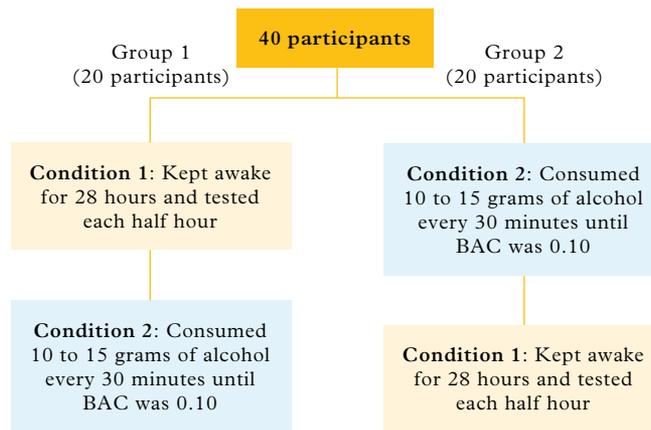
Need help communicating scientific ideas? See Topic 1.10 in your Psychology toolkit.

## Fatigue, alcohol and performance impairment

In 1997, Australian researchers Drew Dawson and Kathryn Reid published a study investigating the impact of sleep deprivation on performance and drew comparisons to different levels of alcohol intoxication. Dawson and Reid conducted a controlled experiment with a within-subjects design. Forty participants were divided into two equal groups and exposed to two different conditions:

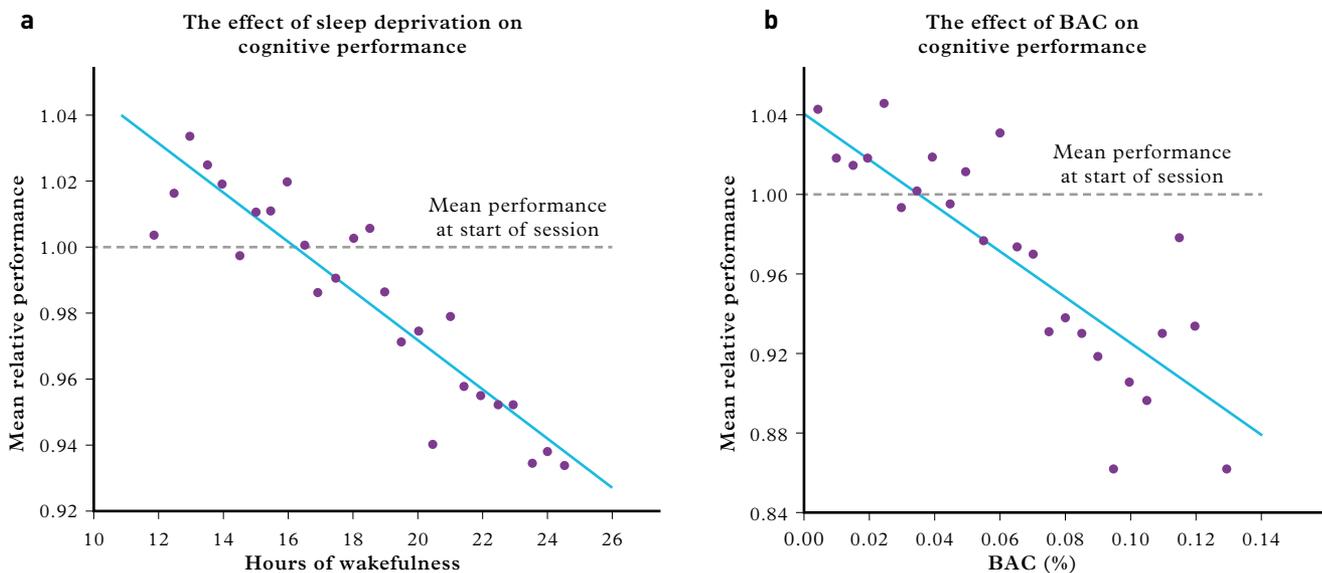
- Condition 1: participants stayed awake for a period of 28 hours
- Condition 2: participants consumed 10 to 15 grams of alcohol every 30 minutes until they achieved a BAC of 0.10.

Group 1 was exposed to condition 1 first. Group 2 was exposed to condition 2 first. Once both groups had completed one condition, they switched and completed the other condition. The study design is shown in Figure 8.



**FIGURE 8** A visual representation of Dawson and Reid’s experiment

During both conditions, participants were required to complete cognitive psychomotor tests every 30 minutes to assess the extent to which their performance was impaired. The results are shown in Figure 9.



Source: Dawson & Reid (1997)

**FIGURE 9** Results of **a** condition 1 and **b** condition 2 in Dawson and Reid’s investigation. The dashed line at Mean relative performance = 1.00 shows the participant’s performance at the start of the session (i.e. at 1 hour of wakefulness and a BAC of 0.00). The data points show the participant’s performance at each time point and BAC.

The results showed that for every 0.01 per cent increase in BAC, performance was impaired by 1.16 per cent. By comparing the performance of participants under both conditions, Dawson and Reid determined that each hour a person stays awake (between 10 and 26 hours) was equivalent to a 0.004 per cent increase in BAC. In other words, the study determined that:

- 17 hours of partial sleep deprivation = BAC of 0.05 (i.e. mild intoxication)
- >24 hours of total sleep deprivation = BAC of 0.10 (i.e. moderate to high intoxication).

The common effects of a BAC of 0.05 and 0.10 are shown in Table 2.

**TABLE 2** The common effects of mild and moderate to high intoxication

Mild intoxication (BAC 0.05)	Moderate to high intoxication (BAC 0.10)
<ul style="list-style-type: none"> <li>• Decreased inhibitions (e.g. more talkative, relaxed and confident)</li> <li>• Slightly reduced reaction time</li> <li>• Slightly reduced cognitive processing speed</li> </ul>	<ul style="list-style-type: none"> <li>• Slurred speech</li> <li>• Reduced cognitive processing speed</li> <li>• Reduced balance and coordination</li> <li>• Impaired decision-making</li> <li>• Reduced attention and concentration</li> <li>• Reduced self-control and emotional awareness</li> <li>• Amplified emotional responses</li> <li>• Increased potential for aggression</li> </ul>

Compare these effects to those of sleep deprivation. You will find that they have similar negative consequences on your ability to drive safely.



**FIGURE 10** Partial and total sleep deprivation can increase your risk of causing a traffic accident.

## 7.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Outline the effects of partial sleep deprivation on cognitive functioning.
- 2 Explain why sleep is important for functioning.
- 3 Explain why the effects of sleep deprivation are often compared to the effects of high blood alcohol concentration.
- 4 Identify the number of hours of sleep deprivation that is the equivalent to BAC 0.10.

### Apply, analyse and compare

- 5 Determine whether you would be able to distinguish whether a person is experiencing partial sleep deprivation or total sleep deprivation. Justify your answer.
- 6 On Friday, Nikita, who is an avid video gamer, plays League of Legends all afternoon and all night, stopping only for a few meals and to go to the bathroom. She only realises it's morning when her alarm goes off at 7 a.m. Nikita starts to panic as she needs to begin her shift as a forklift driver at 8 a.m.

Describe the effects that Nikita may experience at work due to her partial sleep deprivation and categorise these as affective, behavioural and cognitive functions.

### Design and discuss

- 7 Following the 9/11 terrorist attacks in the USA, the US Armed Forces and the Central Intelligence Agency (CIA) established a number of sites around the world where they kept “high-value” prisoners and subjected them to what the CIA called “enhanced interrogation techniques”.

They were authorised to subject prisoners to up to 180 hours of sleep deprivation, to the point of hallucination. However, a 2014 report proved that the CIA had kept some prisoners awake for much longer periods.

They played loud music and white noise, sometimes for 24 hours a day, kept the cells cold, and used a range of other disturbing methods to prevent detainees from falling asleep.

The CIA justified these methods of interrogation by saying “it focuses the detainee’s attention on his current situation rather than ideological goals”.

- a Identify whether a prisoner kept awake for 180 hours would be experiencing partial or total sleep deprivation.
  - b Predict how sleep deprivation may have affected the affective, behavioural and cognitive functioning of the detainees during interrogation.
  - c Evaluate the validity of information and evidence obtained from a prisoner experiencing such severe sleep deprivation.
- 8 The first 3 weeks after giving birth, Marcy finds it difficult to get a full night of uninterrupted sleep because her baby cries every 3 to 4 hours. Marcy’s friend, Oscar, explains to her that driving tired is just as dangerous as driving drunk. Discuss how Marcy’s ability to drive safely may be affected by her sleep deprivation, with reference to Dawson and Reid (1997).



FIGURE 11 New mothers often experience sleep deprivation.

# 7.2

## Circadian rhythm sleep disorders

### KEY IDEAS



- ✦ Circadian rhythm sleep disorders disrupt the regular sleep–wake patterns of humans and can affect mental wellbeing.
- ✦ Delayed Sleep Phase Syndrome (DSPS) is when a person’s sleep is delayed by two or more hours than what is considered a typical bedtime and they wake up later.
- ✦ Advanced Sleep Phase Disorder (ASPD) is when a person’s sleep is two or more hours earlier than what is considered a typical bedtime and they wake up earlier.
- ✦ Shift work sleep disorder (SWSD) affects people who work non-traditional hours (different shifts or overnight) and causes difficulty falling asleep, staying asleep and sleeping when desired.
- ✦ Bright light therapy uses light to treat circadian rhythm sleep disorders in a non-invasive way.

### sleep disorder

a medical condition that involves serious disruptions to the normal sleep–wake cycle and can have negative effects on wellbeing

**Sleep disorders** are medical conditions that involve serious disruptions to the normal sleep–wake cycle. They can have negative effects on physical and mental wellbeing.

The *Diagnostic and Statistical Manual of Mental Disorders* (which is also known as the “DSM-5-TR”) is the standard handbook used by health professionals in Australia to identify mental health conditions. The DSM-5-TR recognises 10 main types or categories of sleep disorders; however, in VCE Psychology, you only need to learn about one of them: circadian rhythm sleep disorders.

## Misalignment of the sleep–wake cycle

In Chapter 6, you learnt that the sleep–wake cycle is a circadian rhythm that repeats approximately every 24 hours. Typically, the human sleep–wake cycle consists of approximately 16 hours of normal waking consciousness and 8 hours of sleep, with a bedtime of 10 to 11 p.m. and a wake-up time of 7 to 8 a.m.

Significant shifts to this schedule result in **circadian rhythm sleep disorders**. This term is used to categorise sleep disorders that involve problems aligning with circadian times. Specifically, they interfere with the natural sleep–wake cycle in humans.

Circadian rhythm sleep disorders can cause:

- general fatigue
- excessive sleepiness
- amplified emotional responses
- impaired cognition and slowed reaction time
- reduced self-control
- reduced emotional awareness.

You may notice that circadian rhythm sleep disorders share many symptoms with sleep deprivation.

## Causes of circadian rhythm sleep disorders

A number of factors can cause or worsen circadian rhythm sleep disorders. They can cause problems getting to sleep and/or staying asleep and, therefore, affect the sleep–wake cycle. These factors include:

- exposure to **light** at irregular or unusual times
- the **colour** of light that a person is exposed to before bedtime, particularly blue and white light

### circadian rhythm sleep disorder

a sleep disorder that involves a misalignment of the sleep–wake cycle to circadian times

- **unhealthy or irregular sleeping habits** such as drinking coffee late at night, napping during the day, staying up late and getting up early, using electronic devices immediately before bed, and having no set bedtime
- **shift work** (working irregular or overnight shifts)
- **travelling**, particularly between time zones, which causes you to stay awake for long periods at unusual times (e.g. jetlag)
- **other underlying health conditions** such as heart problems, stress, depression, obesity, lack of exercise or an unhealthy diet.

Regardless of the factors causing the sleep disorder, people who suffer from them have one or more of the following symptoms:

- difficulty falling asleep
- difficulty staying asleep and often waking up several times during each sleep cycle
- waking up too early and not being able to get back to sleep.



**FIGURE 1** People with a circadian rhythm sleep disorder may find it hard to fall asleep or wake up at a typical time.

In this topic, we will explore the three circadian rhythm sleep disorders:

- Delayed Sleep Phase Syndrome
- Advanced Sleep Phase disorder
- shift work sleep disorder.

### **Delayed Sleep Phase Syndrome (DSPS)**

a circadian rhythm sleep disorder that results in a person sleeping and waking up two or more hours later than would be considered an acceptable or typical sleep-wake cycle

## **Delayed Sleep Phase Syndrome**

If you are affected by **Delayed Sleep Phase Syndrome (DSPS)**, you may go to sleep or wake up two or more hours later than what is typically considered an acceptable or typical sleep-wake cycle.

You may struggle with falling asleep at about 10 to 11 p.m. and instead your bedtime may be between 12 and 1 a.m. or even later. Similarly, you may have trouble waking up at a typical wake-up time (e.g. 7 to 8 a.m.) and instead naturally wake two or more hours after this (e.g. 9 to 11 a.m.).

Although people of all ages can be affected by DSPS, it is most common in teenagers and young adults. When teenagers mature through adolescence into early adulthood, it's common for the suprachiasmatic nucleus (SCN) to delay the release of melatonin each night by around two hours. Similarly, the release of cortisol from the adrenal gland can be delayed each morning by around two hours. Cortisol has the opposite effect of melatonin, helping the body transition from sleep into wakefulness.

This delayed release of melatonin and cortisol can make adolescents more likely to experience delayed sleep onset and waking each day (meaning they fall asleep later and wake up later).

## Effects of DSPS

The main problem for people affected by DSPS is that school and work commitments generally demand that they wake up earlier than they would naturally want to. This reduces the total amount of sleep and results in sleep deprivation.

For example, Olivia is a 17-year-old girl with DSPS. She gets to sleep between 12 and 1 a.m. instead of a typical bedtime of between 10 and 11 p.m. Olivia sleeps until 6.30 to 7 a.m. when her alarm wakes her to get ready for school. As a result, she only gets between 6.5 and 7.5 hours of sleep each night. As the recommended amount of sleep for 17 year olds is 8 to 10 hours per night, Olivia is partially sleep deprived throughout the day, and her affective and cognitive functioning are reduced.



**FIGURE 2** DSPS is most common in teenagers and young adults.



**FIGURE 3** Socialising with friends (either in person or online) can contribute to DSPS, especially if it is happening late at night.

### Advanced Sleep Phase Disorder (ASPD)

a circadian rhythm sleep disorder that results in a person sleeping and waking up two or more hours earlier than would be considered an acceptable or typical sleep–wake cycle

#### Study tip

People affected by DSPS fall asleep late and wake up late. People affected by ASPD fall asleep early and wake up early.

## Advanced Sleep Phase Disorder

If you are affected by **Advanced Sleep Phase Disorder (ASPD)**, you may go to sleep or wake up two or more hours earlier than what is typically considered an acceptable or typical sleep–wake cycle.

You may struggle with staying awake until a typical bedtime (e.g. 10 to 11 p.m.) and instead, fall asleep two or more hours before this (e.g. between 8 and 9 p.m. or even earlier). Similarly, you may have trouble waking up at around 7 or 8 a.m. and instead, wake up two or more hours earlier (e.g. 3 to 4 a.m.).

Although people of all ages can be affected by ASPD, it is most common in middle-aged and older adults. As people age, it is common for the SCN to advance the release of melatonin each night by around two hours. Similarly, the release of cortisol can be advanced each morning by about 2 hours.

This advanced release of melatonin and cortisol can make older adults more likely to experience advanced sleep onset and advanced waking each day (meaning they fall asleep earlier and wake up earlier).



**FIGURE 4** ASPD is most common in middle-aged and older adults.



**FIGURE 5** While most people are asleep in the very early morning, those with ASPD are likely to be awake and alert as early as 3 or 4 a.m.

### Effects of ASPD

Unlike people affected by DSPS, most people with ASPD report that their sleep quality and quantity is not negatively affected. In fact, most people with ASPD report good-quality sleep, and their daytime activities are not affected by ASPD at all.

However, although the average adult may still feel alert in the early evening between 6 and 8 p.m., individuals experiencing ASPD feel sleepy and can struggle to stay awake at this time. Additionally, although most people are asleep in the very early morning, those with ASPD are likely to be awake and alert as early as 3 or 4 a.m.

If a person with ASPD works daytime shifts or socialises during the day, ASPD will have little to no effect on them. However, ASPD can seriously affect a person's ability to participate in evening events. This may affect the quality of their social relationships and opportunities to form social connections. ASPD can also have negative effects if the individual is required to work in the early evening and into the night.

## Shift work sleep disorder

Around the world, many companies operate on 24-hour models that require employees to work on rotating shifts. This is known as **shift work**. As well as helping to meet customer demands and provide essential services (e.g. health care, police and fire services) around the clock, shift work has helped to increase private sector profits dramatically.

However, because shift work interrupts normal sleeping patterns, you may develop **shift work sleep disorder (SWSD)**. If you are affected by SWSD, you may experience difficulty adjusting to the inconsistent sleep–wake cycles that are required of you as your shifts change. This causes ongoing sleep problems such as excessive sleepiness during the night (when night shift workers are awake) and **insomnia** (inability to fall and stay sleep) during the day.

Across Australia today, approximately 16 per cent of all workers (i.e. just over 2 million people) are classified as shift workers. It is estimated that anywhere from 10 to 40 per cent of all shift workers are affected by SWSD.

Research indicates that the people most commonly affected by SWSD regularly work rotating shifts or night shifts. People who work rotating shifts are not able to establish regular patterns of sleep because their work schedules are continually changing.

Those who work night shifts are at risk of SWSD because they need to be awake when they would typically be asleep, and be asleep when they would typically be awake. As a result, they often experience reduced quality and quantity of sleep. While the body clocks of most night shift workers can somewhat adjust to changes in sleep–wake cycles due to work demands, some are unable to adjust to these demands and develop SWSD.

### **shift work**

a business model in which employees work rotating, irregular, overnight, evening, afternoon, morning or split shifts; a work schedule that falls outside of typical business hours

### **shift work sleep disorder (SWSD)**

a circadian rhythm sleep disorder caused by a work schedule that interferes with a person's typical sleep–wake cycle

### **insomnia**

a sleep disorder in which a person has difficulty falling asleep and staying asleep



**FIGURE 6** During the COVID-19 pandemic, healthcare workers across Victoria were required to work long shifts under extremely difficult circumstances. During this time, many healthcare workers reported experiencing the effects of SWSD.

## Effects of SWSD

The prevalence of SWSD can vary across industries, but the symptoms are similar.

They include:

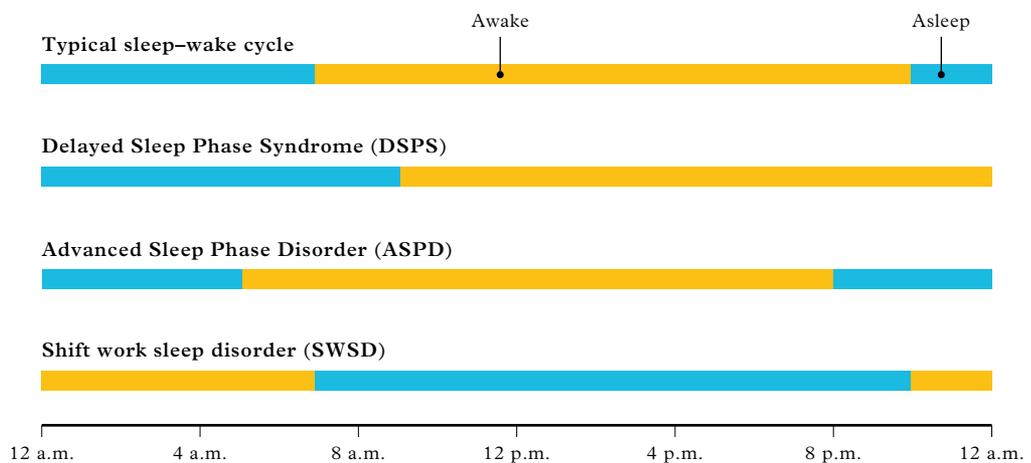
- excessive sleepiness and drowsiness (both on and off the job)
- difficulty concentrating
- lack of energy
- periods of insomnia
- sleep that feels incomplete or not refreshing
- depression or moodiness.

Research conducted in 2016 by Victoria’s health and safety regulator, WorkSafe Victoria, showed that the injury rate for shift workers is significantly higher than for non-shift workers.



**FIGURE 7** The injury rate for shift workers is significantly higher than for non-shift workers.

To reduce the likelihood of SWSD and the risk of workplace injury, WorkSafe Victoria recommends that employers implement rosters with consistent worktimes for a minimum of three weeks at a time. This approach is designed to help shift workers adjust their sleep–wake cycles and reduce the effects of SWSD. Figure 8 shows the typical sleep–wake cycles of individuals with different circadian rhythm sleep disorders.



**FIGURE 8** Examples of a typical sleep–wake cycle and how this changes with DSPS, ASPD and SWSD

## 7.2 REAL-WORLD PSYCHOLOGY

### SWSD in oil rig workers

In 2009, researcher Siri Waage and colleagues in Norway studied SWSD in 103 oil rig workers in the North Sea. The workers completed questionnaires on the first day of a 2-week roster during which they worked 12-hour shifts around the clock. The questionnaires assessed sleep quality and quantity, levels of insomnia, sleepiness, sleep–wake times, coping and subjective health complaints.

The study found that 23.3 per cent of workers had SWSD. These workers experienced poorer quality and quantity of sleep, greater daytime dysfunction, a higher number of health complaints and reduced coping strategies compared to workers not affected by SWSD.

### Apply your understanding

- 1 Identify the type of research methodology that Waage and colleagues used to collect their data.
- 2 Discuss the effects that SWSD may have had on the oil rig workers' affective, behavioural and cognitive functioning, and ability to perform their jobs.



**FIGURE 9** In Waage et al.'s 2009 study, around 23 per cent of oil rig workers were found to suffer from SWSD.

## Treatments for circadian rhythm sleep disorders

There are several possible treatments for circadian rhythm sleep disorders. These vary according to the:

- type of disorder
- severity of the condition
- requirements and personal characteristics of the person affected.

Common treatment options range from simple changes to a person's sleep habits (such as setting regular bedtimes, avoiding naps), to prescribing medications (such as melatonin or caffeine to adjust sleep–wake cycles as required). However, one of the most successful approaches to treat circadian rhythm sleep disorders is bright light therapy.

## Bright light therapy

### bright light therapy

a treatment for circadian rhythm disorders that involves timed exposure to different intensities of light to adjust the sleep–wake cycle

**Bright light therapy** treats circadian rhythm sleep disorders by advancing or delaying the onset of sleep through exposing people to different types and intensities of light for a particular amount of time to reset the sleep–wake cycle. Generally, the goal is to “reset” a person’s body clock to synchronise with the Earth’s cycle of day and night (i.e. light and dark). For night shift workers, bright light therapy helps them cope with the demands of their atypical schedule.

As you learnt in Chapter 6, the suprachiasmatic nucleus (SCN) regulates our sleep–wake cycle by responding to light. Timed exposure to the right type and intensity of light (natural or artificial) can stimulate the SCN to cause release of melatonin by the pineal gland. This allows us to manipulate a person’s circadian rhythm and bring on or delay sleep, as required.

Bright light therapy often involves the use of a portable device called a light box (Figure 10). This can produce artificial light of up to 10,000 lux (a standard unit used to measure light intensity). The user should position the light box at eye level (so the light enters the retinas of the eyes). The duration of treatment can vary depending on the specific disorder, but generally, exposure is 20 to 60 minutes.

Bright light therapy is effective when timed exposure to light occurs over several days. The time when this should occur during the day depends on the circadian rhythm sleep disorder. The timing of this treatment is critical and requires guidance from a sleep specialist. Suggested timings have been defined by Chesson and colleagues (1999) and are outlined in Table 1.



**FIGURE 10** A light box is used to shift a person’s sleep–wake cycle to their desired schedule.

**TABLE 1** Bright light therapy treatments for DSPS, ASPD and SWSD (night shift)

Type of circadian rhythm sleep disorder	Timing of bright light therapy	Intensity of light (lux)	Result
DSPS	Early morning (i.e. 6 to 9 a.m.)	2000 to 2500	<ul style="list-style-type: none"> <li>Causes earlier release of melatonin</li> <li>Shifts the circadian phase forward</li> </ul>
ASPD	Evening (i.e. 8 to 11 p.m.)	2500 to 4000	<ul style="list-style-type: none"> <li>Causes delayed release of melatonin</li> <li>Shifts the circadian phase backwards</li> </ul>
SWSD – for a person working night shifts	<ul style="list-style-type: none"> <li>For at least 3 hours in the evening before commencing night shift</li> <li>Use of light-reducing eyewear after the night shift and avoiding light before major sleep episode during the day</li> </ul>	5000 to 10,000	<ul style="list-style-type: none"> <li>Causes delayed release of melatonin</li> <li>Shifts the circadian phase backwards</li> <li>Reduced light exposure at the end of the night shift supports the natural release of melatonin</li> </ul>

## 7.2 CHECK YOUR LEARNING

### Describe and explain

- 1 Define “circadian rhythm sleep disorder”.
- 2 Explain why DSPS and ASPD are circadian rhythm sleep disorders.
- 3 Describe the characteristics of SWSD.
- 4 Describe the role that a light box plays in bright light therapy when used to treat ASPD.

### Apply, analyse and compare

- 5 Compare the cause and effects of DSPS to the cause and effects of ASPD.
- 6 Quynh is a 17-year-old student who works part-time at a local cinema. She works four nights a week from 7 to 11 p.m., and on Saturday night from 6 p.m. to 12 a.m. During the school week, Quynh often struggles to complete her homework and she finds herself regularly going to bed at 1 a.m. At school, she is often tired because she must leave her home by 7.30 a.m. to get to school on time.

Determine whether Quynh is experiencing DSPS, ASPD or SWSD. Justify your response.

- 7 Compare the approaches to bright light therapy when treating DSPS and ASPD. In your response, include the time of exposure, level of light, and the expected changes to the circadian rhythm with treatment.

### Design and discuss

- 8 Logan is a firefighter in a busy inner-city fire station. Logan’s job requires him to work the following repeating roster:
  - 2 weeks night shift
  - 2 weeks leave
  - 2 weeks day shift
  - 2 weeks leave.

Logan has been experiencing difficulties sleeping, so his station captain suggests that he do some research into the benefits of bright light therapy.



FIGURE 11 Logan is a shift worker.

- a Explain how Logan’s sleeping difficulties may affect his affective, behavioural and cognitive functioning.
  - b Apply your knowledge of bright light therapy to design a bright light therapy treatment plan that could assist Logan with his sleeping difficulties. In your response, include the timings of exposure and intensity of light.
  - c Describe the expected changes to Logan’s affective, behavioural and cognitive functioning after several weeks of bright light therapy.
- 9 Discuss the role of melatonin and cortisol in the sleep–wake cycle and describe how the time of release of these hormones is changed in DSPS and ASPD.

## 7.3

# Sleep hygiene

### KEY IDEAS

- ✦ Sleep hygiene refers to the strategies and routines that enhance the quality and quantity of sleep.
- ✦ Improved quality and quantity of sleep is linked to improved mental wellbeing.
- ✦ Sleep hygiene strategies can involve regulating and adapting to zeitgebers (e.g. light, temperature, eating and drinking patterns).



From a young age, we have been taught to practise some important habits that help us stay healthy and free from disease, such as washing our hands, covering a cough, and showering regularly. These make up our personal hygiene.

In the same way, there are practices and strategies designed to improve our ability to fall asleep and stay asleep throughout the night – **sleep hygiene**.

**sleep hygiene**  
the habits and strategies that can be used to improve the quality and quantity of sleep; good sleep habits



**FIGURE 1** Good sleep hygiene promotes good mental wellbeing.

## Importance of sleep hygiene

As you have learnt in this chapter, sleep is a vital part of maintaining physical and mental wellbeing. Practising good sleep hygiene is a simple and effective way of avoiding some of the negative impacts of sleep deprivation and sleep disorders. Good sleep hygiene:

- involves habits and strategies that are healthy and help to promote our ability to fall asleep, stay asleep and enjoy good-quality sleep
- supports daytime alertness and concentration
- helps to maintain good levels of emotional awareness, positively affecting social interactions and relations
- helps support healthy affective, behavioural and cognitive functioning, leading to positive mental wellbeing.

# Improving sleep hygiene through adaptation to zeitgebers

Table 1 lists a number of simple strategies to improve sleep hygiene. Many of these strategies may seem like common sense, but they are actually based on established scientific research and evidence. Each strategy can be linked to a particular type of environmental cue known as a **zeitgeber** (pronounced *tseit-gayber*).

**TABLE 1** Ways to improve sleep hygiene and their related zeitgebers

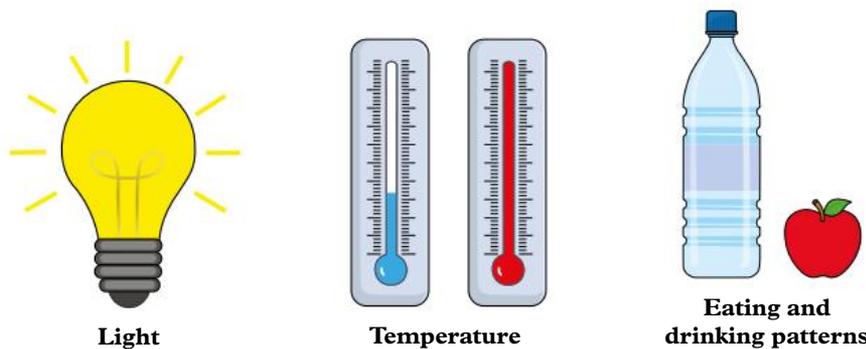
Habits and strategies to improve sleep hygiene	Related environmental cue (zeitgeber)
Create a sleep environment that is as dark as possible (i.e. keep the lights dim before bed; use blackout curtains to block sunlight in the morning).	Light
Avoid using electronic devices (e.g. mobile phones, tablets, TV) at least 60 minutes before bed.	Light
Maintain a sleep environment at a comfortable sleeping temperature (i.e. not too hot or too cold).	Temperature
Avoid eating large meals or meals with high fat or sugar content before bed.	Eating and drinking patterns
Limit caffeine intake for several hours before bedtime (i.e. no coffee, tea, energy drinks or soft drinks such as cola).	Eating and drinking patterns
Go to sleep and wake up at the same time each day.	Other

**zeitgeber**  
an environmental stimulus that helps set or reset the body clock

The word zeitgeber comes from a German word that literally translates as “time-giver” (*zeit* meaning “time”, *geber* meaning “giver”). A better translation is “time-cue” or “time-synchroniser”. Therefore, a zeitgeber is an external cue or stimulus that helps synchronise our body’s processes to a circadian rhythm by causing the suprachiasmatic nucleus (SCN) to reset approximately every 24 hours.

In nature, zeitgebers can include events or recurring patterns in the environment – like the daily cycle of day (light) and night (dark) – that help keep our body’s processes aligned to circadian times. Zeitgebers can also include events or patterns that have become social norms, such as regular mealtimes, work schedules or school timetables.

In this topic, you will learn about three main zeitgebers (Figure 2), including how each of them influences your sleep and how they can be used in good sleep hygiene practices to improve sleep–wake cycles and mental wellbeing.

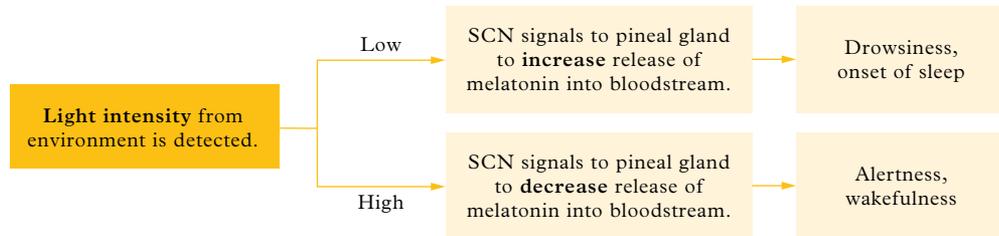


**FIGURE 2** Light, temperature and eating and drinking patterns are powerful zeitgebers.

## Light

Our everyday activities line up with the rising and setting of the Sun. Because of this, it's not surprising that light plays a very important role in our wellbeing. Remember from Chapter 6 that the SCN regulates our sleep–wake cycles by increasing or reducing the release of melatonin in response to light (Figure 3).

Therefore, light is a powerful zeitgeber. The ability of our bodies to adapt to changes in light exposure means that we can use light to manipulate (and improve) our sleep quantity and quality, and mental wellbeing.



**FIGURE 3** The SCN and pineal gland work together in response to light to regulate the sleep–wake cycle.



▶ **ClickView**  
Behind the news – sleep study

### Effect of light on sleep

Earlier, you learnt about how the SCN and melatonin work together to regulate our sleep–wake cycle. Light intensity is detected by our eyes and a signal is sent to our SCN, which then regulates the release of melatonin, the sleep-inducing hormone, from the pineal gland and into the bloodstream.

**Blue light** appears to have the most significant effect on SCN activity. Consistent exposure to blue light before sleep can cause the SCN to adapt accordingly, decreasing the production and release of melatonin from the pineal gland. The detection of blue light also triggers the SCN to release stimulating hormones, such as cortisol, that promote alertness.

#### blue light

light that is emitted naturally from the Sun and artificially from some electronic devices



**FIGURE 4** The Sun is a natural source of blue light that regulates your sleep–wake cycle.

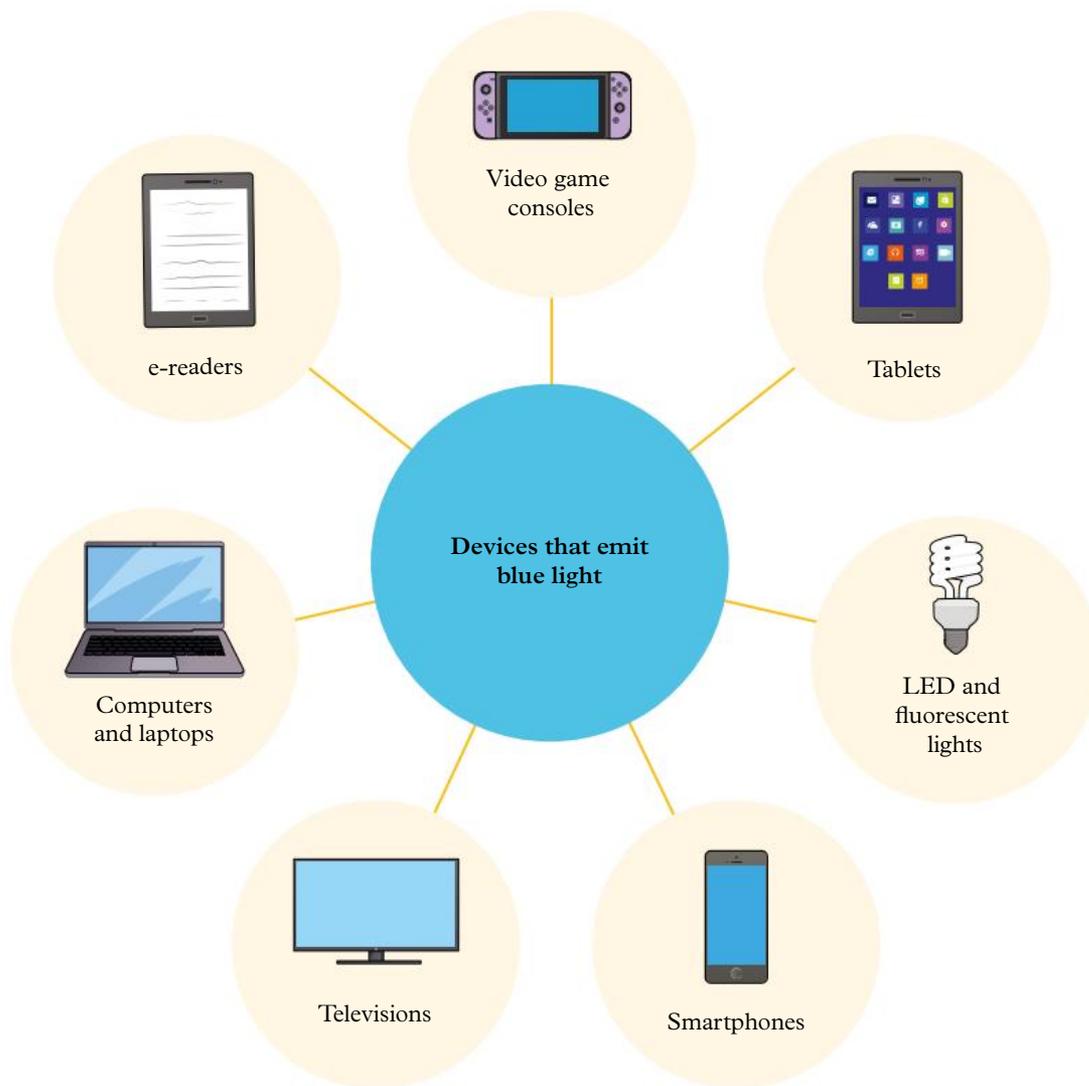


**FIGURE 5** Regular exposure to blue light before sleep can cause our SCN to adapt and delay or reduce the release of melatonin.

Exposing ourselves to blue light in the hours before we go to bed could therefore result in delayed sleep onset and poorer sleep quality. This has similar consequences to partial sleep deprivation, particularly poorer mental wellbeing.

### Modifying light to improve sleep hygiene

A good sleep hygiene practice is to minimise exposure to blue light before bed. What this means is putting away all our blue light-emitting devices at least two hours before bedtime (Figure 6). Making our sleep environment as dark as possible is also helpful. This includes keeping the lights dim before bed and using blackout curtains to block sunlight in the morning. In response to these changes, our body adapts by increasing melatonin production. This encourages better sleep onset and improves mental wellbeing.



**FIGURE 6** Putting away electronic devices that emit blue light before we go to bed is a good sleep hygiene practice.

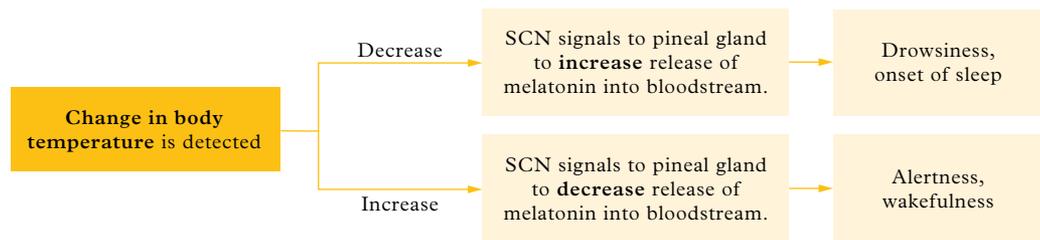
## Temperature

Temperature also influences our sleep–wake cycle. The average human body has a core temperature of 37°C. Core temperatures peak during the day and decline one to two hours before sleep. They can drop by up to 1.5 to 2°C during sleep. Balancing our internal body temperature and the temperature of our sleep environment (our bedroom) is important for getting a good night’s sleep.

### Effect of temperature on sleep

Core body temperature is regulated by the hypothalamus, which detects changes in environmental and skin temperatures. The hypothalamus contains neurons that relay information about the temperature at the skin surface. These can directly initiate NREM sleep. As our body temperature declines, melatonin levels increase. This reduces our alertness and concentration to promote sleep.

The ideal room temperature for sleep is about 18°C. At this environmental temperature, our internal body temperature can drop sufficiently to make us drowsy. Healthy individuals experiencing no sleep disorders or disruptions often fall asleep the moment their body temperature lowers.



**FIGURE 7** The SCN and pineal gland work together in response to change in body temperature to regulate the sleep–wake cycle.

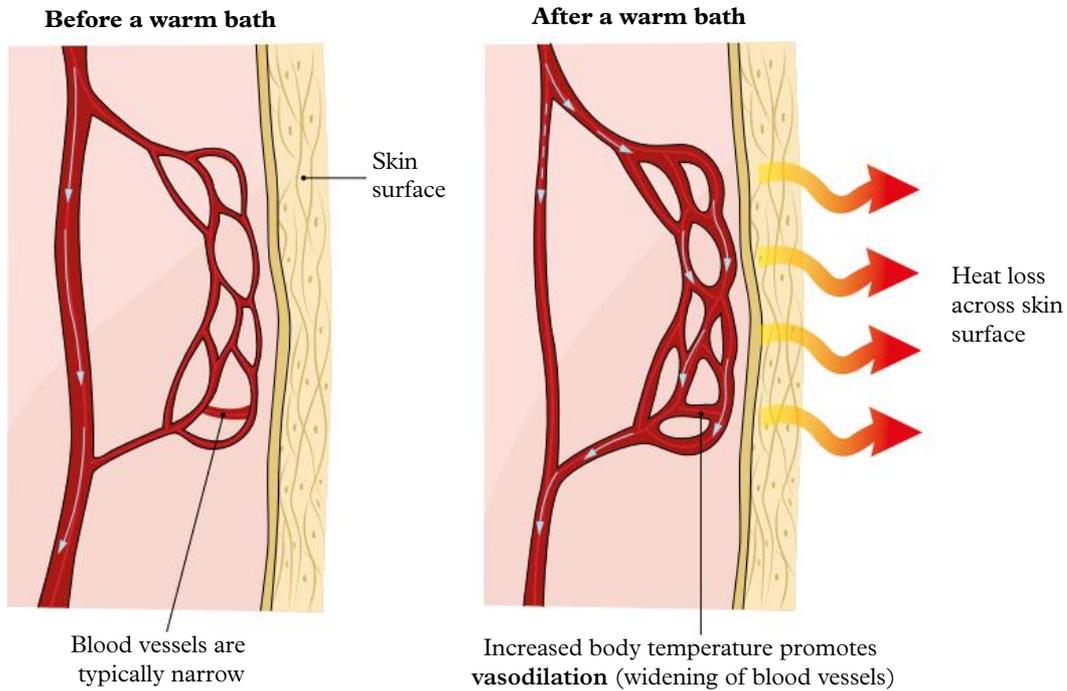
Temperatures too high or too low can interfere with our body’s internal temperature regulation and lead to difficulty sleeping. REM sleep is especially affected by extreme room temperatures. In this stage of sleep, our body’s ability to regulate internal temperature is reduced. We are more likely to awaken during REM sleep if our bedroom is too hot or cold. This leads to disrupted and poorer quality sleep, and poorer mental wellbeing.

### Modifying temperature to improve sleep hygiene

Good sleep hygiene practices promote sleep by supporting ideal internal and environmental temperatures. Making sure our sleep environment isn’t too hot or cold (close to 18°C) is one important practice to promote quality sleep.

Although this may sound counterintuitive, exposing our skin to warmth (e.g. by taking a warm bath or using a blanket) in the hours leading up to sleep is also helpful. Not only does creating a warm environment help us relax, it also causes the blood vessels in our skin to undergo **vasodilation** (widening). We lose heat more easily from dilated blood vessels, so this accelerates the cooling of our body (Figure 8). The neurons that initiate NREM become activated and promote sleep.

**vasodilation**  
the widening (dilation) of blood vessels that enables more blood flow



**FIGURE 8** Increasing our body temperature (e.g. by taking a warm bath) promotes the widening of our blood vessels, which can then lose heat more easily and promote sleep.

Going to sleep the moment we feel tired is also good practice because this is when our core body temperature has lowered and it is easiest to fall asleep.



**FIGURE 9** Good sleep hygiene includes maintaining an appropriate room temperature and going to bed as soon as we feel tired.

## Eating and drinking patterns

Eating and drinking patterns can affect sleep quality and quantity. This includes **what** we consume, **how much** we consume, and the **timing** of when we consume it.

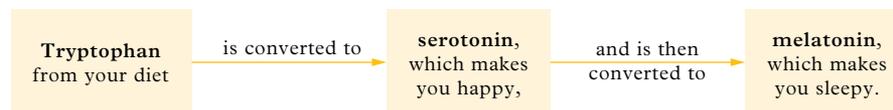
### Effect of eating and drinking patterns on sleep

After we eat, digestion of food triggers our parasympathetic nervous system, also known as the “rest and digest” system. Blood flow increases to our stomach and intestines to break down the food and help absorb its nutrients. While this is happening, the blood flow to the CNS (particularly the brain) decreases, reducing alertness and concentration.

Certain food and drinks can also be a source of melatonin or supply the body with **tryptophan**, an amino acid that is used to produce melatonin. For example, diets high in carbohydrates increase tryptophan, and therefore melatonin, in the brain. This can reduce the time taken to fall asleep and increase time spent in REM sleep. Meanwhile, high-fat diets can decrease the length of major sleep episodes and REM sleep, while increasing the frequency of wake after sleep onset (WASO).

#### tryptophan

an amino acid obtained from the diet that can be converted by the body into serotonin, then melatonin



**FIGURE 10** Tryptophan obtained from your diet is converted to melatonin, which promotes sleep.

In 2014, Japanese researcher Katagiri and colleagues conducted a study on female Japanese workers where participants completed self-report surveys on the types of foods they ate and their sleep quality. A trend was found that linked quality of food to quality of sleep. Those who ate more confectionary and noodles experienced lower quality sleep than those who ate more fish, rice and vegetables.

Alcohol and **stimulants** also influence sleep. The **depressant** effect of alcohol makes it more difficult to enter REM sleep in the first two sleep cycles. Metabolism of alcohol while asleep can also cause a person to wake prematurely. Stimulants such as coffee and nicotine increase the activity of the CNS, making us more alert.

The quantity of food consumed also influences sleep. Workers from Katagiri’s study who skipped breakfast experienced lower sleep quality than those who consumed breakfast. On the other hand, you might be familiar with postprandial sleep (more commonly known as “food coma”) after you have consumed a large meal.

Data from the American Time Use Survey also found that eating or drinking less than an hour before bedtime increases the chance of WASO (Iao et al., 2021). Together, our eating and drinking habits can affect our quality and quantity of sleep.

#### stimulant

a chemical substance that increases the activity of the nervous system; can make you feel more excited, active and alert

#### depressant

a chemical substance that decreases the activity of the nervous system; can make you feel more relaxed and sleepy



**FIGURE 11** A large meal may cause you to enter a “food coma”.

## Modifying eating and drinking patterns to improve sleep hygiene

Good sleep hygiene includes having a balanced diet and consuming an adequate proportion of carbohydrates, fats and protein needed for optimal functioning (Figure 12). Foods that increase melatonin, such as milk, cheese and salmon, may be helpful if you are having a hard time falling asleep. It is also important to avoid caffeinated drinks and stimulants before bedtime. Eating and drinking 4 to 6 hours prior to bedtime is ideal but if you are going to eat before bedtime, choose a snack (not a meal) low in sugar and carbohydrates.

Changes we can make to the light in our environment, our body temperature, and eating and drinking patterns to practise good sleep hygiene are summarised in Table 2. Our body’s ability to adapt to these changes means that we can take control of our sleep and mental wellbeing.

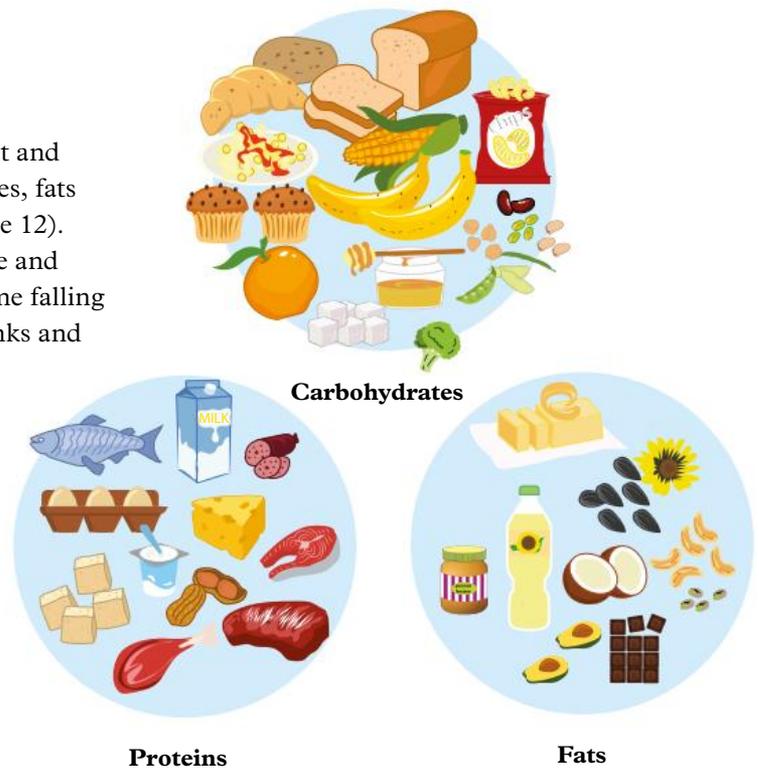


FIGURE 12 Common dietary sources of carbohydrates, proteins and fats

TABLE 2 Good sleep hygiene practices that involve modifying light, temperature and eating and drinking patterns

Light	Temperature	Eating and drinking patterns
<ul style="list-style-type: none"> <li>Avoiding looking at bright screens at least 2 hours before bedtime.</li> <li>Use warmer-coloured artificial lights and LEDs that have reduced blue light emissions.</li> <li>Expose yourself to bright light during the day.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure your bedroom isn’t too hot or cold.</li> <li>Have a warm bath before bedtime.</li> <li>Go to bed when you feel the urge to sleep, as this is when your body temperature is dropping most quickly, which supports sleep onset.</li> </ul>	<ul style="list-style-type: none"> <li>Eat and drink 4 to 6 hours before bedtime.</li> <li>Have a balanced diet and consume adequate proportions of carbohydrates, fats and protein for optimal functioning.</li> <li>Avoid caffeinated drinks and stimulants before bedtime.</li> <li>If you are going to eat before bedtime, choose a snack (not meal) low in sugar and carbohydrates.</li> </ul>

## Other types of zeitgebers

There are many other zeitgebers that can be used to regulate the sleep–wake cycle and positively influence mental wellbeing. Three other practices you can use to improve your sleep are:

- keeping a regular schedule:** irregular sleep schedules make it difficult for your body clock to establish a consistent rhythm of when to release hormones associated with sleep and wakefulness. The SCN works best if there is a regular time for sleep and wakefulness
- keeping your bedroom quiet and relaxing:** an environment that is free from stimuli such as unnecessary noise, bright lights and technology ensures that you aren’t distracted as you enter sleep, and that you aren’t woken unnecessarily
- avoiding stimulating activities an hour before bed:** activities such as exercise, video games, homework or watching movies or shows can heighten your physiological or cognitive state. This makes sleep onset difficult because the body needs time to relax to a point of sleep. Relaxing activities such as reading a book or meditating better prepare the body and mind for the state of sleep.

### Study tip

Adequate quality and quantity of sleep is important for your mental wellbeing but also for your learning. To maximise your memory and cognitive performance, make sure you get the required amount of sleep. Try using the sleep hygiene strategies outlined in this topic.

### 7.3 WORKED EXAMPLE

#### Designing a strategy to improve sleep hygiene

Garima worked as a security guard for a year after finishing her university degree. Initially, Garima thought she could easily do the work because it only involved night patrols and paperwork. However, Garima found working night shifts very difficult and often struggled to stay awake at work. During the day, Garima found it difficult to sleep, because she was constantly interrupted by her phone and friends.

Using your understanding of sleep and sleep hygiene, provide a plan for Garima to address her sleep problems and perform better at work.

- a** Identify the type of sleep problem(s) Garima experiences. Justify your answer. (2 marks)
- b** Suggest sleep hygiene strategies that Garima could implement and explain how they could be used to improve the quality and quantity of her sleep, with reference to the SCN and melatonin. (4 marks)

#### Solution

Think	Do
Step 1: Identify the command terms used in the question and determine what they require.	<p>The question provides two paragraphs of stimulus material to read. There are two questions to answer in relation to this material.</p> <ul style="list-style-type: none"> <li><b>a</b> The question asks you to “identify” and “justify”. This means you must recognise and name the relevant “type of sleep problem(s)”, then provide a reason for your decision.</li> <li><b>b</b> The question asks you to “suggest” and “explain” strategies. This means you must put forward a solution for consideration and then provide some more detail about why/how it works. The question also asks you to refer to the SCN and melatonin.</li> </ul>
Step 2: Look at the mark allocation to determine how many pieces of information are required.	<ul style="list-style-type: none"> <li><b>a</b> This question has a total of 2 marks, so this means that you need two pieces of information (the correct sleep problem/disorder and a justification).</li> <li><b>b</b> This question has a total of 4 marks, so this means that you need four pieces of information (two sleep hygiene strategies and an explanation for each).</li> </ul>
Step 3: To answer part <b>a</b> , carefully read the stimulus material. Recall the types of sleep disorders and select the correct disorder that describes what Garima is experiencing.	<p>The three types of sleep disorders we have explored are DSPS, ASPD and SWSD. Garima is experiencing SWSD. (1 mark)</p> <p>She is a shift worker who is experiencing difficulty sleeping due to the demands of the night shift. (1 mark)</p>
Step 4: To answer part <b>b</b> , recall the zeitgebers that can be modified to improve sleep hygiene. Select two to explain.	<p>Light, temperature and eating and drinking habits are the relevant zeitgebers. Here, we will choose light and temperature, but you can choose any two.</p> <ul style="list-style-type: none"> <li>• Light: Garima could install blackout curtains in her bedroom to simulate a dark, night-time environment. (1 mark) Her eyes will detect the low light intensity, which is communicated to the SCN. Her SCN will then signal to the pineal gland to release melatonin into the bloodstream, which promotes the onset of sleep. (1 mark)</li> <li>• Temperature: Garima could consider taking a warm bath before bedtime. (1 mark) This will increase her body temperature and cause her blood vessels to widen/dilate. As her body cools down to room temperature, the neurons in Garima’s hypothalamus will receive information about the reduction in her body temperature and initiate NREM sleep. (1 mark)</li> </ul>

### 7.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Define “sleep hygiene”.
- 2 Explain what a zeitgeber is.
- 3 Describe the relationship between sleep hygiene and mental wellbeing.
- 4 Outline the effect of blue light on alertness and concentration.

#### Apply, analyse and compare

- 5 Distinguish between good sleep hygiene and poor sleep hygiene using examples.
- 6 Contrast the effects on sleep of a high-carbohydrate diet and a high-fat diet.
- 7 Sandy has turned her heater on and set the temperature to 22°C. Before getting into bed, she forgets to turn it off and tries to go to sleep. Forty minutes later, she is still awake.
  - a Explain why Sandy is having a hard time falling asleep.
  - b Explain why it is important that Sandy remembers to turn off her heater, with reference to the SCN and melatonin.

- 8 Cuong has a regular, nightly routine of watching TV or playing video games after 8 p.m. While he does this, he often eats chips, lollies or ice cream. When Cuong goes to bed at 10 p.m., he often finds it difficult to fall asleep. When he does, he often wakes during the night feeling overheated or covered in sweat.
  - a Analyse Cuong’s sleep hygiene and suggest changes to his nightly routine that will promote sleep onset and maintenance.
  - b Contrast Cuong’s mental wellbeing, including his affective, behavioural and cognitive functioning, before and after he implements the changes you have suggested.

#### Design and discuss

- 9 Design a controlled experiment that uses a between-subjects design to determine which sleep hygiene strategy would best support sleep onset.

**FIGURE 13** Is this an example of a good or poor sleep hygiene practice?



## Chapter summary

- 7.1** • Partial sleep deprivation occurs when an individual has an inadequate quantity or quality of sleep within a 24-hour period. Total sleep deprivation occurs when an individual is deprived of all sleep for at least one 24-hour period.
  - Sleep deprivation has negative effects on:
    - affective functioning (brain functions related to our emotions)
    - behavioural functioning (brain functions related to the way we interact with our environment)
    - cognitive functioning (brain functions related to our mental processes).
  - Partial and total sleep deprivation can have similar effects to alcohol intoxication. Seventeen hours of partial sleep deprivation is the equivalent of BAC 0.05. Twenty-four hours of total sleep deprivation is the equivalent of BAC 0.10.
- 
- 7.2** • Circadian rhythm sleep disorders involve a misalignment of the natural sleep–wake cycle with circadian times.
  - Delayed Sleep Phase Syndrome (DSPS) is when sleep occurs two or more hours later than what is considered a normal bedtime, due to a delayed release of melatonin.
  - Advanced Sleep Phase Disorder (ASPD) is when sleep occurs two or more hours earlier than what is considered a normal bedtime, due to an early release of melatonin.
  - Shift work sleep disorder (SWSD) occurs when work schedules overlap with normal sleeping patterns and can cause ongoing sleep problems.
  - Bright light therapy involves exposure to specific intensities of light at specific times of the day. It is used to treat DSPS, ASPD and SWSD.
- 
- 7.3** • Sleep hygiene refers to a number of healthy habits and strategies designed to improve an individual's ability to fall asleep and stay asleep throughout the night.
  - A zeitgeber is an external cue that can influence our circadian rhythm. Common zeitgebers are light, temperature and eating and drinking patterns. They are important for regulating the sleep–wake cycle.
  - Blue light emitted from electronic devices, such as TVs and tablets, can delay the release of melatonin. Good sleep hygiene involves avoiding blue light at least two hours before bedtime.
  - An environmental temperature of about 18°C will support sleep onset and maintenance, as the body temperature decreases before and during sleep.
  - The types and amounts of foods we consume and the timings of eating and drinking can affect the quality and quantity of sleep. Good sleep hygiene involves eating and drinking four to six hours before bedtime and having a balanced diet consisting of adequate proportions of carbohydrates, fats and protein.

## Revision questions

### Multiple choice

- 1 A common behavioural effect of sleep deprivation is:
  - A amplified emotional responses.
  - B impaired cognitive performance.
  - C reduced levels of restlessness.
  - D microsleeps.
- 2 Which of the following is true?
  - A 17 hours of sleep deprivation is the equivalent to a BAC of 0.05.
  - B 24 hours of sleep deprivation is the equivalent to a BAC of 0.05.
  - C A BAC of 0.05 does not affect performance of simple, monotonous tasks.
  - D Partial sleep deprivation affects behavioural and cognitive functioning more than affective functioning.
- 3 Gonsalvez and colleagues recently conducted research on sleep deprivation. In their study, twenty participants were required to keep a sleep diary for two weeks, monitoring their quality and quantity of sleep. Ten of the participants were adolescents and ten were aged between 25 and 30.

On the final day of the study, all participants were invited to a sleep laboratory where they were required to not sleep at all for 24 hours. After 24 hours, all participants completed a cognitive activity involving memory-based tasks.

It can be hypothesised that the:

- A older group will perform similarly to the adolescents.
  - B adolescents will perform better than the older group.
  - C older group will perform poorly compared to a person with a BAC of 0.05.
  - D older group will perform better than the adolescents.
- 4 Avinder is struggling to complete his Psychology test because he is finding it difficult to concentrate on the information

in the question. He has already read the question three times, but he finds that he has to re-read it again because he has forgotten the information. By the end of the exam, Avinder feels as though he is about to fall asleep.

Which of the following statements best explains Avinder's state during his Psychology test?

- A Avinder's affective functioning has been compromised by sleep deprivation.
  - B The length of the Psychology test added to the effects of Avinder's sleep deprivation.
  - C Avinder is tired because sleep deprivation has affected his behavioural functioning.
  - D Sleep deprivation has resulted in a reduction in Avinder's cognitive functioning.
- 5 The circadian rhythm sleep disorder ASPD is characterised by:
    - A the inability to fall asleep at a desired time.
    - B major sleep episodes that occur earlier than the desired sleep time.
    - C a delay in major sleep episodes.
    - D excessive daytime sleepiness.
  - 6 Gianna has just started a new job at a wholesale market where she is rostered to work night shifts. Her employer has warned her of the impacts that working night shift can have on normal sleep and wake activities, in particular, shift work sleep disorder.
 

This is because:

    - A working night shifts requires workers to catch up on sleep during the day when the zeitgeber of light would normally prevent sleep onset.
    - B night shifts are normally long and can result in increased levels of fatigue and drowsiness.



- C** shift work can result in workers sleeping more than their required amount of sleep during the day.
- D** night shift work causes melatonin to be released in higher concentration during the morning.
- 7 Which of the following is an example of good sleep hygiene?
- A** Going to bed as early as possible
- B** Having a warm bath before bedtime
- C** Consuming alcohol before bedtime to encourage sleep onset
- D** Avoiding exposure to blue light during the daytime
- 8 Which of the following statements about sleep hygiene is true?
- A** Sleep onset is most likely to occur as core body temperature decreases.
- B** Detection of blue light by the eyes will promote melatonin release.
- C** Consumption of foods that are high in carbohydrates prior to sleep will increase N3 sleep and reduce REM sleep.
- D** Eating and drinking less than an hour before bedtime is linked to a decreased duration of WASO.
- 9 Which of the following individuals may be experiencing a circadian rhythm sleep disorder?
- A** Anne-marie gets to bed at 10 p.m. and wakes up at 7 a.m.
- B** Reuben gets to bed at 11 p.m. and wakes frequently during the night.
- C** Li gets to bed at 1 a.m. and wakes up at 5 a.m.
- D** Ashleigh gets to bed at 8 p.m. and wakes up at 5 a.m.
- 10 Ivo suffers from a sleep disorder that can prevent him sleeping for prolonged periods. Recently, this condition has resulted in Ivo not having any sleep for three days.
- Because of this, Ivo's doctor has advised him to:
- A** avoid driving because he is likely to perform the task similarly to an individual with a BAC of 0.10.
- B** expose himself to a light box to increase the release of melatonin.
- C** review his sleep hygiene and ensure that he goes to sleep and wakes at similar times each day.
- D** complete a sleep diary to determine how much REM and NREM sleep he is experiencing.

### Short answer

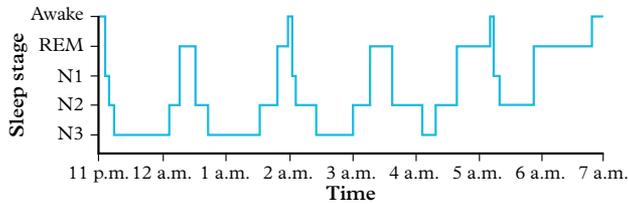
#### **Describe and explain**

- 11 Explain how sleep deprivation affects our daytime activities.
- 12 Describe what is meant by “amplified emotional response”.
- 13 Outline the effects of sleep deprivation on behavioural functioning.
- 14 Explain what a circadian rhythm sleep disorder is and the effect they can have on sleep quality and quantity.
- 15 Explain how bright light therapy can be used to treat DSPS.
- 16 Explain, using an example, how the body's ability to adapt to zeitgebers can be used to improve sleep hygiene.
- 17 Explain why DSPS is more common in adolescents.
- 18 Outline how blue light can affect the SCN and release of melatonin.
- 19 List four strategies that can be used to improve sleep hygiene.

#### **Apply, analyse and compare**

- 20 Esme's teacher has noticed that she has been dozing off in class. He pulls her aside after class to express his concern, but Esme asserts that she was not asleep. Identify the term used to describe the episodes of sleep that Esme is experiencing and explain why she may be so sure that she was not asleep.

- 21** A 43-year-old woman, Natasha, participated in a sleep study where the following hypnogram was obtained.



- a** Determine whether Natasha is experiencing a circadian rhythm sleep disorder. Justify your response.
  - b** Compare Natasha's sleep pattern to an individual who experiences ASPD.
  - c** Explain how Natasha's mental wellbeing may differ from an individual who experiences ASPD.
- 22** Compare a sleep hygiene practice that would adversely (negatively) affect sleep quality to a sleep hygiene practice that would support adequate sleep quality.
- 23** Dr Hill is investigating the effect of eating and sleeping patterns on sleep in adolescents. Specifically, Dr Hill wants to study the effect of eating instant noodles at midnight on sleep-wake cycles and the occurrence of WASO.
- a** Suggest two variables that Dr Hill should control in this study.
  - b** Identify a type of investigation that would be appropriate for this study.
  - c** Predict the result of Dr Hill's experiment.
  - d** Explain your predicted result from part **b**, with reference to the SCN and melatonin.
- 24** Distinguish between the effects of partial sleep deprivation and total sleep deprivation.
- 25** Lainey has been diagnosed with shift work sleep disorder. To address the disorder, Lainey is advised to practise better sleep hygiene, and to use bright light therapy to improve her sleep.
- a** Explain how sleep hygiene could help Lainey achieve better sleep.
  - b** Evaluate the use of bright light therapy to address Lainey's sleep disorder.

**26** Although ASPD is a circadian rhythm sleep disorder, individuals who experience ASPD often indicate that their sleep quality is sufficient for them to complete their daytime activities, such as work. Explain why this is the case.

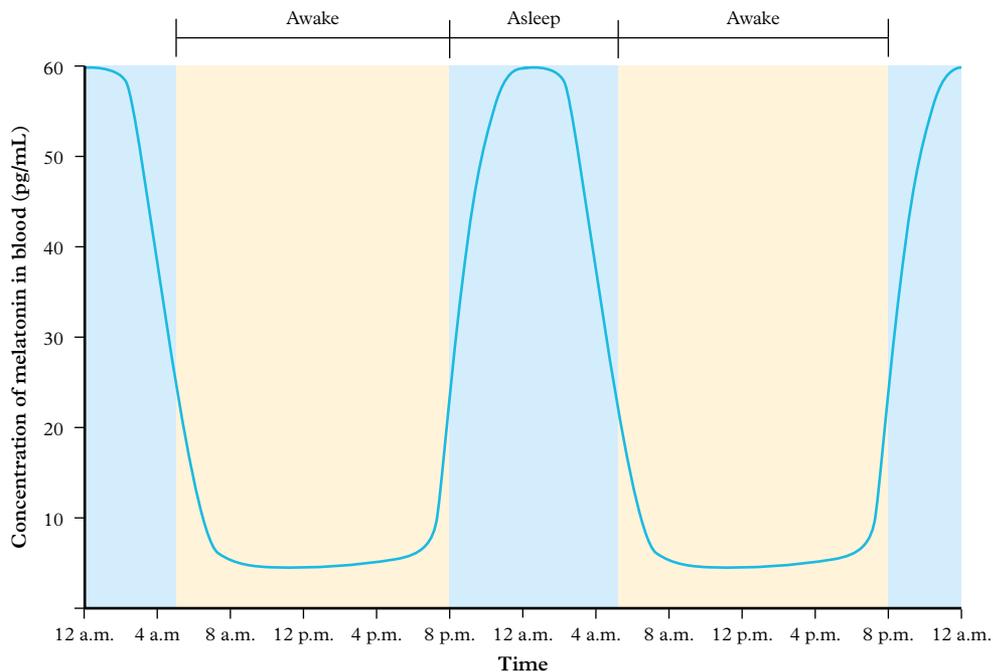
- 27** Valia is currently in Year 12 and studying VCE. She has netball training twice a week after school. On Saturday, she participates in a local netball tournament, with games starting at 8 a.m. This commitment, on top of her homework and studies, often results in Valia sleeping for six to seven hours, on average, every night.

Analyse the factors that contribute to Valia's sleeping patterns and discuss the effects of her sleeping patterns on her functioning.

### Design and discuss

- 28** Teo has been complaining to his friend Takuya about feeling very tired during the day and losing the motivation to complete his assignments. In the next few days, Takuya notices that he needs to repeat Teo's name several times to catch his attention. When Takuya brings this up with Teo, Teo gets very defensive and shouts at Takuya, telling him he doesn't understand.
- a** Analyse Teo's behaviour and suggest how Teo's sleep may be contributing to his affective, behavioural and cognitive functioning.
  - b** To help his friend, Takuya decides to put together a plan that Teo can implement to sleep better. Construct a paragraph of text that outlines the plan in a way that can successfully convince Teo to follow it.
- 29** Discuss the effects of zeitgebers on the circadian rhythm of night shift workers.
- 30** Professor Grant is supervising a PhD student, Lilian. Lilian's first task is to plan an experiment to assess the effects of sleep deprivation on cognitive performance.
- a** Take the role of Lilian and outline an experiment that could be used, based on a between-subjects design.

- b** Swap your work with a peer and take the role of Professor Grant. Evaluate the experimental design. Outline two strengths and suggest one possible improvement.
  - c** Construct a hypothesis for Lilian's experiment.
  - d** Predict the results of Lilian's experiment.
- 31** There is limited research involving healthy humans (with no sleep disorders) being totally sleep deprived for days. Discuss the reasons for this, with reference to relevant ethical considerations and the potential effects on participants.
- 32** Nisha is a police officer working a shift at a booze bus when her team pulls over a driver for random breath testing. The driver's BAC is 0.00, but Nisha notices that the driver is yawning a lot and rubbing their eyes. When Nisha asks them the last time they had a good sleep, the driver reveals that they have been awake for almost thirty hours.
- a** Discuss the similarities between this driver and a driver who is intoxicated.
  - b** Design an information/fact sheet that could be distributed to the public about why driving when sleep deprived can be just as dangerous as drink driving.
- 33** Discuss the effectiveness of good sleep hygiene as a treatment for individuals with DSPS, and comment on whether this should be the only treatment for sleep disorders.
- 34** Construct a Venn diagram that outlines the similarities and differences between ASPD, DSPS and SWSD.
- 35** Figure 1 shows how melatonin levels vary throughout the day.
- a** Copy the graph into your workbook and add another curve to represent the melatonin levels of a person experiencing ASPD.
  - b** Copy the graph into your workbook again and add another curve to represent the melatonin levels of a person experiencing DSPS.
  - c** Copy the graph into your workbook again and add another curve to represent the melatonin levels of a person experiencing SWSD.



**FIGURE 1** A visual representation of the variation of melatonin levels throughout the day

**36** Discuss the importance of consulting a sleep specialist before commencing bright light therapy, with reference to treating ASPD, DSPS and SWSD.

**37** Brian is a nurse whose fortnightly work hours are shown in the table.

During his night shifts, Brian feels extremely tired, yet he struggles to sleep during the days after his night shifts and stay asleep during his days off. During a Week 1 roster, Brian fails to get any sleep after his Thursday shift. He drives to a friend's barbecue on the Friday after more than 24 hours of sleep deprivation.

**a** Identify the type of circadian rhythm sleep disorder Brian is experiencing.

**b** Identify the type of sleep deprivation that Brian is experiencing when driving to his friend's barbecue on the Friday.

**c** Describe the affective and cognitive effects Brian is likely to experience after more than 24 hours of sleep deprivation, the risks these effects have on his driving and the state of his sleep deprivation compared to BAC.

**d** Outline how Brian's circadian rhythm sleep disorder could be treated with bright light therapy and how this treatment would affect his circadian rhythm.

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	12 to 8 a.m.	12 to 8 a.m.		7 a.m. to 3 p.m.		12 to 8 a.m.	
2	2 to 10 a.m.		12 to 8 a.m.	12 to 8 a.m.		10 a.m. to 6 p.m.	6 to 10 a.m.

You can find the following resources for this section in your **obook pro**:

**Quizlet**

Compete in teams or against yourself to test your knowledge.



**Chapter quiz**

Test your understanding of key knowledge in this chapter.



**Chapter checklist**

Rate your understanding of key knowledge in this chapter.

# Checkpoint

## Part A – School-assessed Coursework support for Unit 4 Area of Study 1

In Unit 4 Area of Study 1, you will be required to complete one task from the following options:

- analysis and evaluation of at least one psychological case study, experiment, model or simulation
- analysis and evaluation of generated primary and/or collated secondary data
- comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities
- analysis and comparison of two or more contemporary media texts.

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### Important notice to students and teachers

The assessment support provided in this section models one way of approaching the following task for Outcome 1:

- analysis and evaluation of generated primary and/or collated secondary data.

Your teacher may select one of the other task options above for you to complete as assessment for this outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample SAC, and sample response provided below should be used for example purposes only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

**Unless specifically credited, the VCAA has not written this material and does not endorse the content.**

### Overview of SAC 1 – Analysis and evaluation of generated primary and/or collated secondary data

As part of your assessment for Unit 4 Area of Study 1, you will analyse an experiment conducted on sleep deprivation in teenagers. This task is designed to assess your understanding of consciousness, levels of awareness, sleep deprivation, and other characteristics of sleep. You will be required to use your understanding of key psychological terms and concepts from Unit 4 AOS 1 in response to the experiment provided.

### Study tip

If you have access to the *Psychology for VCE Units 3 & 4 Student Workbook*, practise some of the key science skills needed for this SAC by completing the Data Drill activities before attempting this practice assessment.

## A step-by-step guide to completing SAC 1

The information provided in this section is designed to help you prepare and practise for SAC 1. The tips and advice are broad and should help you successfully complete questions about consciousness and sleep regardless of the specific requirements of the task your teacher or school has created.

### **Step 1: Carefully read the requirements of the task and understand how you will be assessed.**

The best way to set yourself up for success on SAC 1 is to practise using a highlighter or coloured pen when completing questions. Highlight or annotate the question as you read to improve your understanding of the information required, and to develop your skill to be able to critique a question to comprehend the marking scheme. Practise this technique early with other questions and do not wait until the SAC to try this.

### **Step 2: Use summaries to assist in learning key terms.**

A great way to set yourself up for success on SAC 1 is to create cue cards or a summary mind map. For this topic, you are expected to know many key terms (e.g. emotional awareness), so it is important you understand all the terms you can be assessed on in this course. Cue cards are a terrific way to build confidence and focus on specific concepts or key terms that you find difficult. A summary mind map is a great visual display of the course to remind you of how various concepts are linked. This could be for the entire course, psychological changes of consciousness, sleep across the ages, or combinations of content from Unit 4 Area of Study 1.

### **Step 3: Link concepts to real-life experience.**

A way to mentally prepare for SAC 1 is to think about several key terms in real life. We all experience various levels of awareness and sleep; therefore, psychology is just putting “names” to what we experience. For example, when asked about affective, behavioural or cognitive symptoms of sleep deprivation, draw on your own experiences to help form the response. This also includes using common sense; for example, when you think about the advice on sleep hygiene.

### **Step 4: Use of treatments for various sleep disorders.**

When assessing Unit 4 Area of Study 1, sleep disorders are often included. Being able to recognise which sleep disorder is present in a scenario, and then explaining how or when a treatment can be used for the scenario, demonstrates a much deeper understanding than simply stating definitions. Examiners will often link a disorder to a treatment; therefore, an important skill is being able to adapt your understanding of a treatment to fit a specific scenario.

## Practice SAC 1 with annotated sample response

Now that you have learnt some key steps to successfully complete SAC 1, we can look at how to put this theory into action on a practice SAC. In this section, we will examine:

- a practice SAC
- a high-scoring student response for the SAC (complete with tips and annotations to show you how to maximise your marks)
- the marking criteria for the practice SAC.

## Study tip

A hypnogram contains information about duration of sleep or sleep cycles, frequent awakenings, and amount of N3 and REM sleep. Make sure you can interpret hypnograms and identify the age of a person based on their hypnogram.

# Practice SAC 1

## Analysis and evaluation of generated primary and/or collated secondary data



### Article

Teens and sleep: Why you need it and how to get enough

A recent article in the media (“Teens and sleep: Why you need it and how to get enough”) raised concern over the average amount of sleep that teenagers are getting each night. The article discussed how teenagers are affected by emotional changes, demanding social and family lives, sports commitments and studies, and the importance of them receiving the recommended amount of sleep to maintain functioning.

Shortly after the article was published, a research study was undertaken that examined the sleeping patterns of 140 adolescents and how these can affect their levels of concentration when undertaking their final and very stressful year of high school. Each participant was provided with a sleep diary where they recorded their bedtimes, wake times, approximate number of hours asleep and concentration or level of awareness for the day. Participants were required to record this data every day for a whole week. In the morning, after waking and filling in their sleep diaries, participants then completed several cognitive tasks to understand the different levels of functioning in the morning.

In this assessment, you will read through the article (see the hotspot in your eBook pro) and then analyse secondary data collected from the research study to determine the accuracy of the ideas shared in the article.

### Results of the study

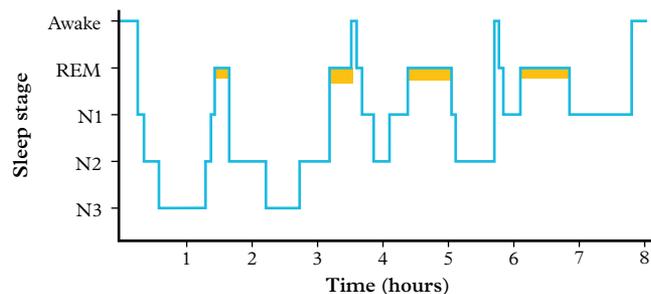
At the end of the first week of the study, participants submitted their data for evaluation. This data is summarised in Tables 1 and 2. During the study, participants’ sleep was recorded across a night using an EEG. A sample of one of the participants’ hypnograms is shown in Figure 1.

**TABLE 1** Mean hours slept and concentration levels of participants in the sleep study

Day	Number of hours slept	Concentration level
Wednesday	7.4	High
Thursday	7.475	High
Friday	7.35	Moderate
Saturday	6.875	Low
Sunday	7.4	High
Monday	6.75	Moderate
Tuesday	7.2	High

**TABLE 2** Median bedtime, mean wake time and mean number of hours slept of participants in sleep study

Median bedtime	12.00 a.m.
Mean wake time	7.30 a.m.
Mean number of hours slept	7.21



**FIGURE 1** A sample hypnogram of a participant

**Question 1** (4 marks)

The article “Teens and sleep” discusses some issues about teenagers (adolescents) not receiving enough sleep. Use the results from the study to assess the accuracy of the article.

**Question 2** (8 marks)

- a** Discuss possible reasons for the study participants’ median bedtime of 12.00 a.m. (4 marks)
- b** Explain sleep deprivation and the various affective, behavioural and social impacts this could be having on teenagers. (4 marks)

**Question 3** (8 marks)

- a** Explain how bright light therapy could be used to help teenagers get to sleep earlier. (3 marks)
- b** Sleep hygiene is another method for improving sleep. Outline four ways teenagers could improve the quality or quantity of their sleep through sleep hygiene. (5 marks)

**Question 4** (7 marks)

- a** Discuss how REM and NREM sleep differ across the duration of sleep, with reference to the hypnogram shown in Figure 1. (4 marks)

- b** Explain three differences between the hypnogram in Figure 1 and the hypnogram expected for an infant. (3 marks)

**Question 5** (13 marks)

After reading the article, a teacher comments that her students become so increasingly sleep deprived towards the end of the week that they appear “drunk”. She says that while her students have not consumed any alcohol, they act as though they have.

- a** Use your understanding of the effects of alcohol on concentration to comment on evidence that suggests BAC and sleep deprivation reduce awareness. (2 marks)
- b** Discuss three psychological changes that could suggest to the teacher that her students are in an altered state of consciousness by the end of the week. (3 marks)
- c** Explain the use of two different measurements of consciousness in this study and classify them as either objective or subjective. (4 marks)
- d** Describe how two other measures of consciousness could be suitably used in this study to gather data on teenagers’ sleep. (4 marks)

Check your Student gbook pro for these digital resources and more:

pro



**Annotated response and marking criteria**

Once you’ve completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

Use the following information to answer questions 1 to 4.

A researcher investigated the effect of turning an electronic device to “night mode” on the quality and quantity of sleep.

Throughout the study, participants wore a Series 9 Apple smart watch provided by the researcher, which can estimate the time of sleep onset and awakenings. Participants were also required to complete a sleep diary, recording sleep duration and how they felt upon waking.

During the first week of the study, participants did not activate night mode on their electronic device before bed. Throughout the second week of the study, participants activated night mode from 8 p.m. until they went to sleep.

#### Question 1

Identify the independent and dependent variables in this study.

	Independent variable		Dependent variable
	Experimental group	Control group	
<b>A</b>	Night mode not activated on electronic device	Night mode activated on electronic device	Quality and quantity of sleep
<b>B</b>	Night mode activated on electronic device	Night mode not activated on electronic device	Quality and quantity of sleep
<b>C</b>	Using an electronic device	Not using an electronic device	Sleep duration
<b>D</b>	Not using an electronic device	Using an electronic device	Sleep duration

#### Question 2

The type of investigation used is:

- A** a controlled experiment using a within-subjects design.
- B** a controlled experiment using a between-subjects design.
- C** a correlational study.
- D** fieldwork.

#### Question 3

The data obtained via the smart watch can be described as:

- A** objective, quantitative.
- B** objective, qualitative.
- C** subjective, quantitative.
- D** subjective, qualitative.

#### Question 4

To test the repeatability of the results, the researcher could conduct the study again using:

- A** the same participants.
- B** a different type of smart watch.
- C** the same methodologies but with different participants.
- D** video monitoring.

#### Question 5

A zeitgeber can be described as:

- A** the body’s biological clock.
- B** the stimulus that induces sleep.
- C** our biological rhythm.
- D** an environmental time cue.

**Question 6**

Which of the following activities would provide a psychologist with unbiased quantitative data about the level of consciousness a person is showing?

- A Ongoing sleep diary
- B Interview of various personal questions
- C A speed typing test
- D Video monitoring of the person across the day

*Use the following information to answer questions 7 to 9.*

Hayden is an 18-year-old high school student who balances his studies with a busy sports schedule that involves rowing and football. He ensures he gets between eight and nine hours of sleep a night so he can complete all his activities at school and sports training. One Saturday night, Hayden attends a friend’s birthday party and only sleeps for four hours.

**Question 7**

Which of the following changes to Hayden’s affective functioning is likely to occur as a result of his partial sleep deprivation?

- A Impaired memory
- B Heightened anxiety
- C Slowed reaction time
- D Fatigue

**Question 8**

Which of the following sleep hygiene strategies would help Hayden fall asleep more easily during the week when he is trying to get to bed on time?

- A Ensure he does not get hungry in the night by eating a heavy meal with coffee before going to bed.
- B Exercise immediately before bedtime so he feels more tired.
- C Keep playing video games until he feels tired and ready for bed.
- D Ensure his bedroom is at an appropriate temperature for sleeping.

**Question 9**

Which of the following statements correctly compares Hayden’s expected sleep cycle to that of a 25-year-old adult?

- A Hayden’s total sleep duration should last for the same time as the adult.
- B Hayden will experience a reduction in the proportion of N3 sleep compared to that of the adult.
- C Hayden is likely to need less sleep than the adult because the quality of REM is much higher.
- D Hayden will experience a reduction in N3 sleep but still have more than the adult.

**Question 10**

Sleep studies often use medical instruments to gather data on the physiological responses of the body. Which of the following parts of the body do electroencephalography (EEG), electromyography (EMG) and electro-oculography (EOG) monitor the electrical activity of?

	EEG	EMG	EOG
A	The muscles that move the eye	The body’s muscles	The brain
B	The brain	The muscles that move the eye	The body’s muscles
C	The body’s muscles	The brain	The muscles that move the eye
D	The brain	The body’s muscles	The muscles that move the eye



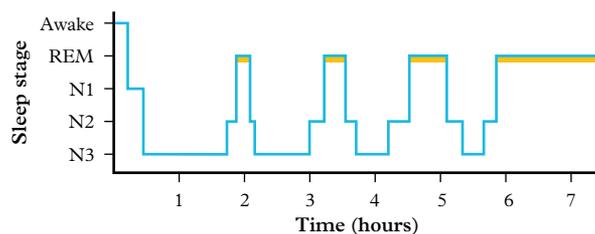
- c Outline three differences between the sleep cycles of infants and those of the age group identified in Figure 1. (3 marks)
- d At times, infants are used in psychological research to advance understanding of sleep rhythms. Outline how the ethical concepts of beneficence and integrity must be applied when working with infants. (4 marks)

**Question 4** (6 marks)

Design a controlled experiment that investigates the effect of caffeine intake on the quality of sleep in adolescents. In your response, include selection and allocation procedures as well as the specific experimental research design. Outline the specific procedures used to collect and then analyse the data.

**Question 5** (9 marks)

Amy, a 45-year-old woman, was concerned about her sleep patterns and visited a sleep psychologist for a check-up. Amy agreed to participate in a sleep research study conducted by the psychologist. The psychologist used electroencephalography (EEG), electromyography (EMG) and electro-oculography (EOG) to record changes in Amy's sleep over the course of one night. From this data, a hypnogram was produced, as shown in Figure 3.



**FIGURE 3** Amy's hypnogram

- a With specific reference to the hypnogram, compare the quantities of non-rapid eye movement (NREM) and rapid eye movement (REM) sleep between Amy and a healthy adult of the same age. (4 marks)

- b Describe how EOG and EMG will indicate that Amy has entered REM sleep. (2 marks)
- c In her check-up with the sleep psychologist, Amy reports that she becomes very tired and regularly falls asleep about 6 p.m. Consistent with this, she falls asleep at 6 p.m. during her visit to the sleep clinic. Identify the name of the circadian rhythm sleep disorder Amy is experiencing and describe two of its common symptoms. (3 marks)

**Question 6** (10 marks)

Joel is a 16-year-old Year 10 student who participates in his school's athlete development program. To fulfil his program obligations, he needs to wake up at 6 a.m. to arrive at school on time for rowing training. However, because he does not feel sleepy until very late, Joel scrolls through TikTok on his phone until 12 a.m. every night. In addition, Joel recently stayed up all night to prepare for a Units 1 and 2 Geography assessment task. Now, he is finding that as the school day progresses, he becomes increasingly tired. This is affecting both his academic and sporting performance.

- a Contrast Joel's sleep-wake cycle with the sleep-wake cycle of a typical 16-year-old, with reference to the relevant internal biological mechanisms. (4 marks)
- b Describe how Joel could improve his sleep hygiene, with specific reference to a zeitgeber. (2 marks)
- c Outline the affective and cognitive effects of one night of full sleep deprivation in comparison to blood alcohol concentration readings of 0.05 and 0.10. (4 marks)

CHAPTER

# 8

# Defining mental wellbeing

## KEY KNOWLEDGE

- ways of considering mental wellbeing, including levels of functioning; resilience, as the ability to cope with and manage change and uncertainty; and social and emotional wellbeing (SEWB), as a multidimensional and holistic framework for wellbeing that encapsulates all elements of being (body, mind and emotions, family and kinship, community, culture, country, spirituality and ancestors) for Aboriginal and Torres Strait Islander peoples
- mental wellbeing as a continuum, with an individual's mental wellbeing influenced by the interaction of internal and external factors and fluctuating over time, as illustrated by variations for individuals experiencing stress, anxiety and phobia.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## GROUNDWORK

This chapter will build on concepts you may have come across in Units 1 and 2. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



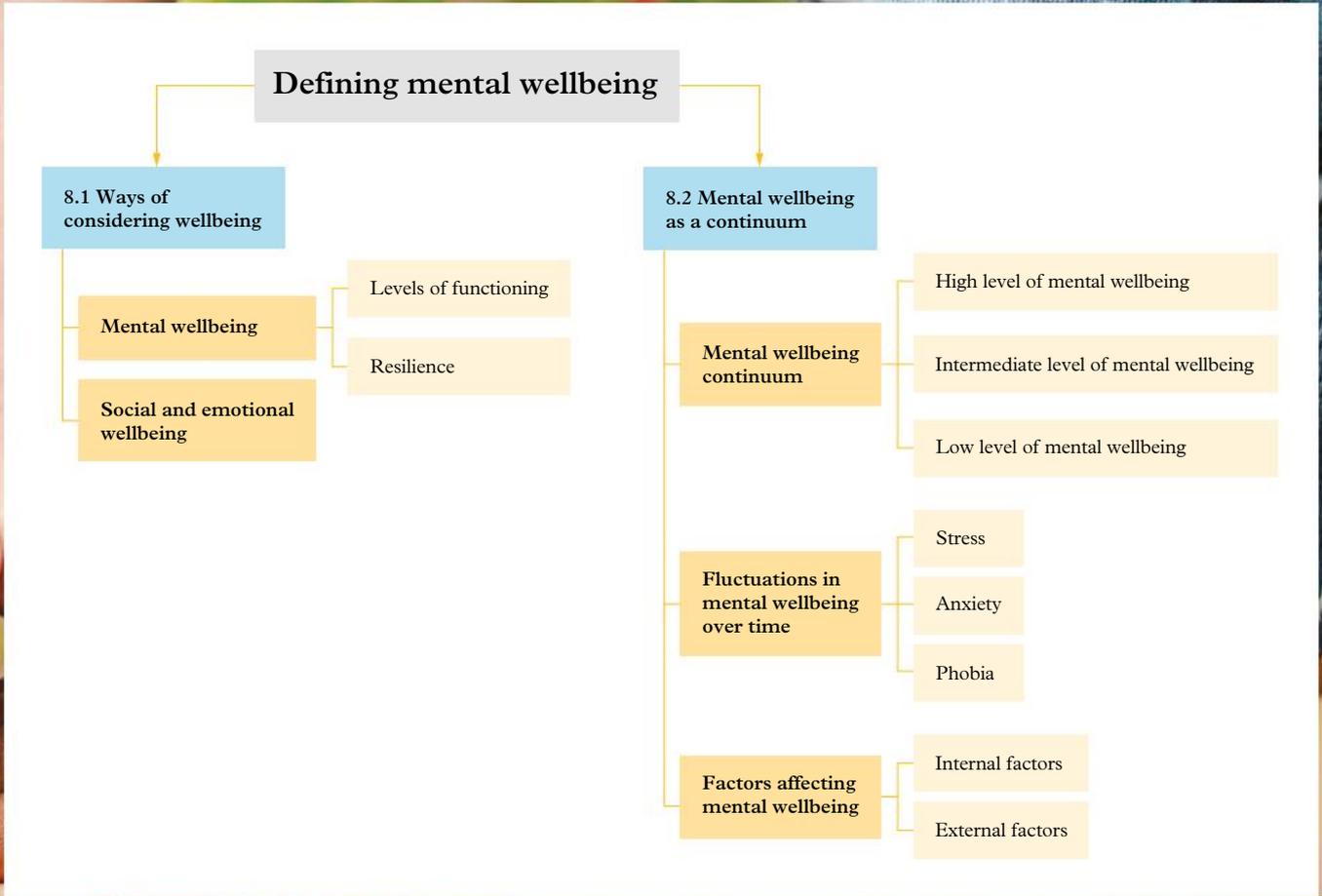
Groundwork quiz  
Chapter 8

## INVESTIGATIONS

8.2A	INVESTIGATION: FIELDWORK	Is there a correlation between stress and perceived mental wellbeing in the workplace?	Page 489
8.2B	INVESTIGATION: LITERATURE REVIEW	How has the COVID-19 pandemic affected the mental wellbeing of students?	Page 491

**FIGURE 1** No two individuals will ever have precisely the same state of wellbeing. Your mental wellbeing is very personal and is influenced by a range of internal and external factors, which fluctuate over time.

## CONCEPT MAP



**\* CONTENT WARNING:** Aboriginal and Torres Strait Islander people are advised that this chapter may contain images of people who are now deceased.

# 8.1

## Study tip

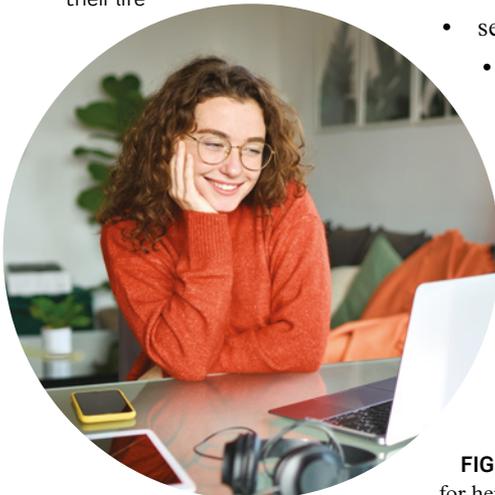
Remember that our state of mental wellbeing is the combined product of our level of functioning and resilience. A person could have a high level of functioning and a low level of resilience, but still have a relatively high level of mental wellbeing.

### mental wellbeing

a general term used to describe a person's overall mental state in terms of how content they are with themselves and their life, and their ability to realise their potential, cope with the normal stresses of life, work productively and make a contribution to their community, in order to maintain a healthy quality of life

### functioning

how effectively a person can operate in their environment and meet the demands of their life



# Ways of considering wellbeing

## KEY IDEAS



- ✦ A person's wellbeing refers to their overall mental state in terms of how content they are with themselves and their life.
- ✦ Wellbeing can be considered in terms of level of functioning and resilience. A person who has a high level of wellbeing would be likely to have a high level of functioning and demonstrate resilience.
- ✦ Social and emotional wellbeing (SEWB) is a framework that explains the impact of factors relevant to wellbeing for Aboriginal and Torres Strait Islander peoples.
- ✦ Good SEWB indicates a high level of wellbeing in Aboriginal and Torres Strait Islander peoples.

You have most likely come across the term “wellbeing” in your studies and outside of school. But what does this mean? In this chapter, we will define and conceptualise mental wellbeing. We also look at social and emotional wellbeing (SEWB) as a framework unique to Aboriginal and Torres Strait Islander peoples.

## Mental wellbeing

**Mental wellbeing** refers to a person's overall mental state, in terms of how content they are with themselves and their life. Our mental wellbeing changes over time and is influenced by numerous factors, which we will explore in the chapter.

We will consider mental wellbeing in relation to:

- level of functioning
- resilience.

## Levels of functioning

One way to consider a person's mental wellbeing is to assess their levels of **functioning**. Functioning refers to how effectively we can operate and meet the demands of our lives. We usually make judgments on functioning based on observable behaviours and traits. This includes:

- cognitive skills: our ability to acquire and use our knowledge, and communicate with others
- self-care: our hygiene, eating and drinking habits
- interpersonal relationships: our interactions and relations with people around us
- life activities: our ability to perform our responsibilities at home, work or school, and our participation in leisure/recreational activities
- community engagement: how we interact with and fit into the broader society.

A high level of functioning enables a person to meet the demands of their day-to-day life effectively and independently, in relation to these behaviours and traits. Examples of traits possessed by a person with a high or low level of functioning are shown in Table 1.

**FIGURE 1** This student considers herself to be highly functional because she has a regular routine for her study and manages this alongside her social and work commitments.

**TABLE 1** Examples of characteristics of individuals with high and low levels of functioning

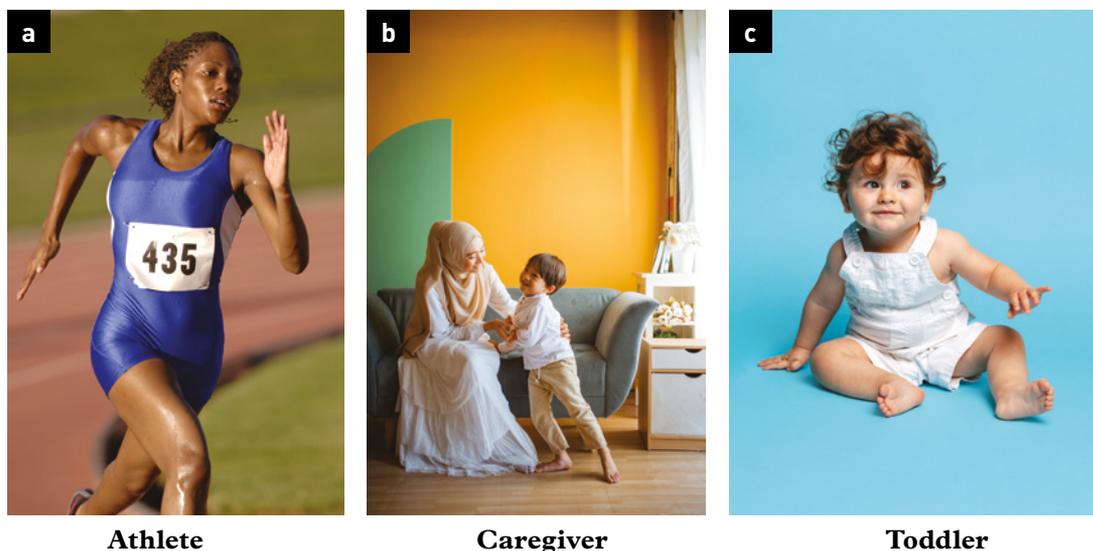
High level of functioning	Low level of functioning
<ul style="list-style-type: none"> <li>• Meets the demands of everyday life independently and safely</li> <li>• Recalls important information as required</li> <li>• Can identify and resolve problems</li> <li>• Maintains good hygiene, eating and drinking habits</li> <li>• Forms and maintains healthy relationships with others</li> <li>• Meets the demands of work or school</li> <li>• Participates in community activities</li> <li>• Has a healthy work–life balance</li> <li>• Realises their aspirations and is working towards their goals</li> </ul>	<ul style="list-style-type: none"> <li>• May have difficulties with concentration and memory</li> <li>• Struggles to complete daily tasks</li> <li>• Struggles to maintain basic hygiene</li> <li>• Often skips meals</li> <li>• Frequently engages in high-risk activities</li> <li>• Has low motivation</li> <li>• Is struggling to meet the standards for performance at work or school; is often late or absent</li> <li>• Has trouble maintaining healthy relationships</li> <li>• Does not feel a sense of belonging</li> </ul>

However, the specific observable traits and behaviours ultimately depend on the individual and their environment. For example, as a student, you might demonstrate a high level of functioning if you can effectively meet the demands of your teenage life. This could include waking up and having breakfast, getting to school on time, completing assigned tasks in class, socialising with your peers, completing homework and maybe working a couple of shifts per week at a part-time job.

However, high functioning for a teacher, a doctor, a stay-at-home caregiver or a newborn baby would look different from how you function as a teenager. This means that how well somebody can function must be considered in terms of their specific environment and take into account factors such as age, gender, profession and culture.



**FIGURE 2** Maintaining good eating and drinking habits is a characteristic indicative of high functioning.

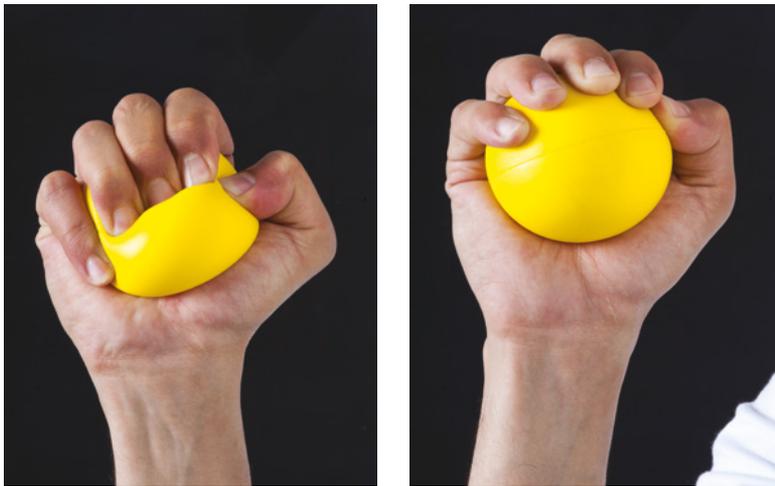


**FIGURE 3** What observable behaviours would demonstrate high levels of functioning for **a** an athlete, **b** a caregiver and **c** a toddler?

Generally, a higher level of functioning represents good wellbeing. Challenges with functioning may indicate that our wellbeing is not at its best. For example, if a conscientious student who normally attends school every day finds themselves unable to get out of bed, this could indicate that they are not functioning at their normal level and thus could be experiencing lowered wellbeing.

## Resilience

Throughout our lives, we will undoubtedly be exposed to things that we find challenging and that we will have to manage or overcome. Our ability to successfully adapt to change and uncertainty is called resilience. Resilience involves overcoming and recovering from adversity and returning to previous normal functioning.



**FIGURE 4** Resilience is like a stress ball that “bounces back” to its original shape as pressure is removed.

When confronted with a change (such as moving house) or uncertainty (such as whether you have made it into your first choice of university course), demonstrating resilience is important to ensure that you can cope with these stressors and continue to function. Resilience is sometimes referred to as the ability to “bounce back” in the face of adversity.

A person who possesses high levels of resilience can cope effectively when confronted with stressors that require them to adapt. Table 2 outlines the general characteristics of a person who has high or low levels of resilience.

**TABLE 2** Examples of characteristics of individuals with high and low levels of resilience

High level of resilience	Low level of resilience
<ul style="list-style-type: none"> <li>• Maintains a positive outlook</li> <li>• Is flexible with their approach to coping with stressors and change</li> <li>• Has problem-solving skills</li> <li>• Has high <b>self-efficacy</b> and high self-esteem</li> </ul>	<ul style="list-style-type: none"> <li>• Struggles to take a positive perspective</li> <li>• Often focuses and dwells on things they cannot change</li> <li>• May have a lack of hope</li> <li>• Is easily overwhelmed by unexpected events or situations</li> </ul>

Your level of resilience is likely to influence your overall wellbeing. A person with high levels of resilience is likely to be able to cope effectively with stressors and challenges when they arise and is less likely to become overwhelmed by them. This is protective against mental health problems. It is important to remember that resilience is not predetermined or fixed – you can learn resilience and work to improve it through practice.

### 8.1 CHALLENGE

#### Varying levels of functioning and resilience

Discuss whether you think a person can have a high level of functioning and a low level of resilience at the same time.



**self-efficacy**  
a person's belief in their abilities to complete specific tasks or achieve specific goals

## Social and emotional wellbeing

The explanations of wellbeing that we have covered so far do not always accurately reflect the mental and physical experiences of all people in the world and the ways they are described. One different and important example is the **social and emotional wellbeing (SEWB) framework**, which is a **multidimensional** and holistic way to consider wellbeing. The SEWB framework is unique to Aboriginal and Torres Strait Islander peoples' understanding and experience of wellbeing. It has nine guiding principles.

- 1 Health as holistic, encompassing mental, physical, cultural and spiritual wellbeing
- 2 The right to **self-determination**
- 3 The need for cultural understanding to shape the assessment, care and management of wellbeing
- 4 The impact of history and disruption of cultural wellbeing on trauma and loss
- 5 Recognition, respect and protection of human rights
- 6 The impact of racism and stigma
- 7 Recognition of the central role of family and kinship
- 8 Recognition of cultural diversity in terms of groupings, languages, kinships, tribes and ways of living
- 9 Recognition of Aboriginal strengths, creativity, endurance and knowledges

Source: Adapted from Australian Institute of Health and Welfare (2023)

These nine principles underpin SEWB, which captures all elements of being – body, mind and emotions, family and kinship, community, culture, Country, spirituality and ancestors. The framework recognises that all these domains overlap and interact with each other to affect and explain wellbeing.

The individual or “self” sits at the centre of the SEWB framework. In the SEWB framework, the self cannot be separated from the domains. The seven domains surrounding the self all interact and influence an individual's overall health and wellbeing, as shown in Figure 5.



Source: Adapted from Gee et al. (2014)

**FIGURE 5** There are seven, interconnected domains of SEWB.

### social and emotional wellbeing (SEWB) framework

a multidimensional and holistic framework that encapsulates all elements of being (body, mind and emotions, family and kinship, community, culture, country, spirituality and ancestors) and explores their interaction to affect and explain wellbeing from Aboriginal and Torres Strait Islander peoples' perspectives

**multidimensional** complex and multifaceted; involves many dimensions

### self-determination

the right for people to determine their own political status and to direct their own economic, social and cultural development, without outside intervention

**Study tip**

You do not need to memorise the nine guiding principles, but they are useful for understanding the SEWB framework.

Table 3 breaks down each domain in the SEWB framework and lists some examples of determinants (factors) that are important to each type of connection. An individual's connection with each domain describes how they experience the domain. The degree to which an individual connects to these domains will influence their overall social and emotional wellbeing. When looking at the SEWB domains, you might note some similarities between "Connection to mind and emotions" and the Western understanding of mental wellbeing. However, it is important to recognise that each domain of the SEWB framework extends beyond conventional Western understandings of mental health and mental wellbeing.

In Topic 1.11, you learnt that there are approximately 250 Aboriginal and Torres Strait Islander language groups, including more than 800 dialects. It is important to recognise that the definitions of SEWB will vary across language groups.

**TABLE 3** Descriptions and determinants of the domains of SEWB

Domain	Description	Determinants
Connection to body	<ul style="list-style-type: none"> <li>Feeling strong and physically healthy; freedom from illness</li> <li>Having the capacity to participate fully in life</li> </ul>	<ul style="list-style-type: none"> <li>Age</li> <li>Weight</li> <li>Nutrition</li> <li>Illness</li> <li>Disability</li> </ul>
Connection to mind and emotions	<ul style="list-style-type: none"> <li>Having the ability to independently manage thoughts and feelings</li> <li>Maintaining cognitive, emotional and psychological wellbeing</li> </ul>	<ul style="list-style-type: none"> <li>An experience of safety and security</li> <li>A sense of belonging</li> <li>Self-esteem</li> <li>Capability and skills</li> <li>Values and motivation</li> </ul>
Connection to family and kinship	<ul style="list-style-type: none"> <li>Feeling connected, secure, stable and loved within family and society</li> <li>Having respect for <b>Elders</b></li> </ul>	<ul style="list-style-type: none"> <li>Relationships of caring, sharing, obligation (where one person has a duty to fulfil a certain role [Berndt and Berndt, 1992]) and reciprocity (where both parties are both benefiting [Milroy, 2008])</li> <li>Gender and age roles</li> </ul>
Connection to community	<ul style="list-style-type: none"> <li>Having the opportunity and ability to support other individuals and families through responsibility and obligation</li> <li>Working together with others cohesively</li> </ul>	<ul style="list-style-type: none"> <li>A sense of identity within a broader space</li> <li>Participation in family and kinship networks</li> <li>Maintenance of personal connections and socio-cultural norms</li> </ul>
Connection to culture	<ul style="list-style-type: none"> <li>Feeling connected with past, present and future</li> <li>Having a strong sense of cultural identity, including cultural expression, activities and knowledges</li> </ul>	<ul style="list-style-type: none"> <li>A sense of cultural identity (e.g. through speaking local languages)</li> <li>An understanding of shared values, rights and responsibilities</li> <li>Participation in cultural practices (e.g. yarning, ceremony, fire, art, dance, song, storytelling)</li> </ul>

(continued)

**Elder**

a respected and trusted leader in a community, who is seen as the holder of particular knowledge, and has the permission and authority to give advice and pass on this knowledge

TABLE 3 continued

Domain	Description	Determinants
Connection to Country	<ul style="list-style-type: none"> <li>Feeling a sense of belonging to land (where one is from and the people one belongs to) (Oxenham et al., 1999)</li> </ul>	<ul style="list-style-type: none"> <li>A sense of identity</li> <li>An experience, belief or feeling of belonging to Country</li> <li>A yearning to heal Country</li> </ul>
Connection to <b>spirituality</b> and <b>ancestors</b>	<ul style="list-style-type: none"> <li>Feeling connected with past, present and future</li> <li>Feeling connected with Country and language, community, and the spiritual dimension</li> <li>Having a sense of purpose and hope</li> <li>Feeling that there is meaning to life</li> </ul>	<ul style="list-style-type: none"> <li>An understanding of traditional systems of knowledge and beliefs (e.g. the Dreaming)</li> <li>A knowledge of stories, rituals, ceremonies and cultural practices that connect person, land and place (Dudgeon, Milroy and Walker, 2014)</li> </ul>

Source: Adapted from Commonwealth of Australia (2017)

In addition to some of the determinants in Table 3, there are social, historical, political and cultural determinants of SEWB. They are important because Aboriginal and Torres Strait Islander peoples experience greater exposure to specific determinants than non-Indigenous Australians. Examples of **social**, **historical** and **political determinants** are shown in Table 4.

**spirituality**

a way of understanding life and connection with others

**ancestor**

(in the context of Aboriginal and Torres Strait Islander people's knowledges, histories and cultures) a spiritual being who guides and protects individuals and communities

**social determinants**

(in relation to SEWB) the conditions in which one is born, grows, lives, works and ages

**historical determinants**

(in relation to SEWB) the influence of colonisation and long-lasting impact of past events

**political determinants**

(in relation to SEWB) the influence of land rights, resource control, cultural security and rights to self-determination and sovereignty (independence)



FIGURE 6 The SEWB framework recognises seven key domains that should be used to define wellbeing: body, mind and emotions, family and kinship, community, culture, Country, and spirituality and ancestors.

**TABLE 4** Example of social, historical and political determinants of SEWB

Determinants	Description	Protective factors	Risk factors
Historical determinants of health	The legacy of colonisation and the disruption to the traditional way of life	<ul style="list-style-type: none"> <li>Aboriginal Rights Movement, National Referendum 1967</li> <li>Land Rights</li> <li>The National Apology</li> </ul>	<ul style="list-style-type: none"> <li>Invasion</li> <li>Frontier wars</li> <li>Massacres</li> <li>Genocide</li> <li>State control and terror (e.g. <i>Aborigines Protection Act 1905</i> that led to the Stolen Generations)</li> </ul>
Political determinants of health	The human rights of all peoples to self-determination, sovereignty and social justice	<ul style="list-style-type: none"> <li>Truth-telling</li> <li>Treaty</li> <li>Land rights</li> <li>Indigenous governance</li> <li>Aboriginal community control</li> <li>Cultural continuity</li> </ul>	<ul style="list-style-type: none"> <li>Oppressive legislation that enables displacement</li> <li>Dispossession of land</li> <li>Forced removal of children and assimilation</li> <li>Suppression of language and culture</li> </ul>
Social determinants of health	Health inequity is a result of social inequity.	<ul style="list-style-type: none"> <li>System level change</li> <li>Access and support for housing, welfare, education and employment</li> <li>Access to community resources and services</li> <li>Supportive family and community</li> </ul>	<ul style="list-style-type: none"> <li>Poverty</li> <li>Insecure or overcrowded housing</li> <li>Limited access to water and food, education, employment, justice system</li> <li>Exposure to violence</li> <li>Stress and trauma</li> </ul>

Source: Adapted from Kimberley Aboriginal Medical Services (2022)

Of the four determinants of health (social, historical, political and cultural), cultural determinants of health have been found to be some of the strongest protective factors for Aboriginal and Torres Strait Islander peoples' SEWB. You will learn about how cultural determinants affect social and emotional wellbeing in detail in Chapter 10.

## 8.1 REAL-WORLD PSYCHOLOGY

### Considering Eddie Betts' story using the SEWB framework

The following extracts are taken from an article published about an episode of *Living Black*, an Indigenous current affairs program broadcast on SBS, 9 August 2022. The episode featured former AFL player Eddie Betts. In this article, Eddie Betts reflects on his experiences with racism.

- Dividing his time between his mother's family in the West and his father's home in South Australia, Betts grew up surrounded by a large extended family, who instilled him with the values of caring and respect.
- Having just turned 18, he was drafted into Carlton Football Club, relocating to Melbourne so he could begin his playing career.
- "It was tough, going through that first year of playing footy. They were writing on the board about structures, about set-ups and all these words and what they mean, and I didn't understand it."
- In his second year at Carlton, he decided the time had come to "nail it down", and he enrolled in literacy and numeracy classes. "I was embarrassed at first, but when I knew some of the other brothers were there, I was like, 'Yeah sweet, we're in this together'."
- Despite being one of the most universally loved and respected players, he has also been subjected to vicious racist attacks, both on and off the field.

- Recently, he visited a local swimming pool with his children, and was told by the lifeguard that they needed to move on.
- “What I want people to realise is, when you speak about racism, and everything that goes on within Australia, this is still happening. Deaths in custody, Black Lives Matter, everything’s happening in our backyard.”
- Pride in his culture and heritage is at the heart of Betts’ legacy and will continue to be so as he moves forward in his role as an educator and a mentor to Indigenous youth.
- With his professional playing career now behind him, he hopes that what he’ll be remembered for most is bringing joy to people’s lives. “If anyone’s watched me play footy,” he said, “I’ve always wanted to make people happy. I just hope that I’ve made people smile.”

### Apply your understanding

- 1 Identify five factors from Eddie’s story and match them to the most relevant domain of the SEWB framework. Suggest whether each factor is likely to have had a positive or negative impact on Eddie’s social and emotional wellbeing.

## 8.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “mental wellbeing”.
- 2 Identify and describe two ways that mental wellbeing can be considered.
- 3 Explain why assessing level of functioning requires consideration of the individual as well as their environment.
- 4 Explain how the phrase “bounce back” relates to resilience.

### Apply, analyse and compare

- 5 Compare two factors that influence the health and wellbeing of Aboriginal and Torres Strait Islander peoples according to the SEWB framework.
- 6 Using an example, analyse the relationship between level of functioning and resilience.

### Design and discuss

- 7 Sylvia is a 27-year-old woman who lives with her husband and two small children. She enjoys

playing with her children at the park and cooking delicious meals for her family. She has many good friends who she meets for exercise and meals out at restaurants. She is currently a little nervous about her youngest child, Leon, beginning school next year as it will be the first time in many years that Sylvia has had the house to herself all day, while the rest of the family are at school or work. Sylvia has started looking for a part-time job to fill her days while the children are at school.

Discuss how Sylvia’s mental wellbeing could be considered with respect to:

- a level of functioning
  - b resilience.
- 8 Design an acrostic poem or acronym to help you remember the seven domains of the SEWB framework. Share these with the class.

**FIGURE 7** Many factors make up your wellbeing, including your interactions with other people.

# 8.2

## Mental wellbeing as a continuum

### KEY IDEAS



- ✦ Mental wellbeing exists as a continuum that recognises that a person's mental state is fluid.
- ✦ Where a person sits on the mental wellbeing continuum is influenced by a range of internal and external factors.
- ✦ People with stress, anxiety and phobia may be at different points along the mental wellbeing continuum at different points in time.

When considering mental health and wellbeing, it is important to remember that wellbeing is not static. It is normal for our mental wellbeing to fluctuate over the course of our lives. This is because there is a range of factors that interact to influence our wellbeing at any given time.

Wellbeing does not mean that a person is always happy, cheerful or content. People who are mentally well will experience negative or unpleasant emotions from time to time – this is a part of the normal fluctuation of wellbeing.

### Mental wellbeing continuum

Fluctuations in wellbeing can be captured on a **mental wellbeing continuum**. This is a tool that can be used to identify and categorise a person's wellbeing at a given point in time.

Over time and with increasing understanding about mental wellbeing, our approaches to describing a person's wellbeing have evolved. For example, the mental wellbeing continuum was previously represented with **mentally healthy** on one end (good mental wellbeing), through to "mental health problem", and then "mental disorder" on the opposite end of the continuum (poor mental wellbeing).

In this version, a **mental health problem** refers to a psychological state that negatively affects the way a person thinks, feels and behaves, but to a lesser extent and for a shorter duration than a mental disorder. A **mental disorder** is a deviation from typical thoughts, feelings and behaviours which are associated with significant distress and cause severe impairment to functioning in everyday life.

Realistically, wellbeing is much more complex. It is not very accurate to place someone along a one-dimensional spectrum based on the presence or absence of mental health problems or disorders. For example, a person who is experiencing a mental health disorder may display a high level of functioning and overall mental wellbeing. In the same way, a person who is not experiencing any mental health problem may display low mental wellbeing.

#### mental wellbeing continuum

a tool used to identify and describe a person's mental wellbeing at any point in time

#### mentally healthy

according to WHO, "a state of wellbeing in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community"

#### mental health problem

a psychological state that negatively affects the way a person thinks, feels and behaves, but to a lesser extent and for a shorter duration than a mental disorder

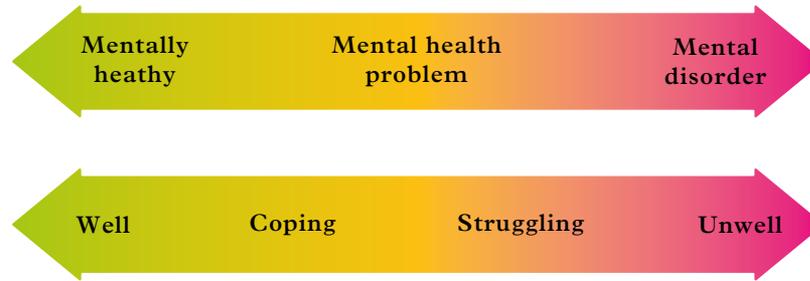
#### mental disorder

a psychological state characterised by atypical thoughts, feelings and behaviours associated with significant distress and which severely impairs functioning in everyday life



**FIGURE 1** Even if you are typically a cheerful person, you may experience negative emotions from time to time.

Another way to visualise the continuum is with “well” on one end, which can progress to “coping”, “struggling” and then “unwell”. Both versions are shown in Figure 2. You may encounter many different versions of this continuum.



**FIGURE 2** Two versions of the mental health continuum

In this topic, we will take a step back and view the continuum in terms of low through to high levels of mental wellbeing (Figure 3).



**FIGURE 3** The mental health continuum, ranging from high to low levels of wellbeing

## High level of mental wellbeing

A high level of mental wellbeing (“mentally healthy” or “well”) is generally depicted on the left-hand side of the mental wellbeing continuum. According to the World Health Organization, being mentally healthy means to be in a “state of wellbeing in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community”.



**FIGURE 4** Mentally healthy students may have positive relationships with their peers and be able to successfully balance their school and extracurricular activities.

An individual placed towards the left-hand side of the continuum:

- is functioning at their best (high level of functioning)
- can cope with challenging experiences and bounce back almost immediately after adversity (high level of resilience).

### Study tip

It doesn’t matter which version of the continuum you use. The important thing is that you recognise that mental wellbeing sits on a continuum, meaning that your mental state may not always fall into a clear-cut category.

## Intermediate level of mental wellbeing

When we deviate from the typical behaviour and functioning in our daily lives, we move towards the right-hand side of the continuum. Depending on the level of distress and dysfunction, the duration of the experience, and how well we can cope, we move further towards the right.

Most of us probably sit somewhere in the middle of the continuum rather than at one of the extreme ends. In other words, we have an intermediate level of mental wellbeing. In this part of the spectrum, there is enormous variability in mental wellbeing. Table 1 shows three individuals who have an intermediate level of mental wellbeing but display very different levels of functioning and resilience.

**TABLE 1** Examples of individuals with intermediate levels of mental wellbeing

Individual 1	Individual 2	Individual 3
<ul style="list-style-type: none"> <li>Does not function at their best but still meets the demands of their daily life (intermediate level of functioning)</li> <li>Experiences high levels of distress and has a hard time recovering from challenging experiences (low level of resilience)</li> </ul>	<ul style="list-style-type: none"> <li>Struggles to meet the everyday demands of life (low level of functioning)</li> <li>Maintains optimism and keeps trying (high level of resilience)</li> </ul>	<ul style="list-style-type: none"> <li>Functions independently in their day-to-day life (high level of functioning)</li> <li>Has good problem-solving skills but struggles with self-esteem (intermediate level of resilience)</li> </ul>

### Study tip

Remember that we can be free from mental health problems and mental disorder but experience a low level of mental wellbeing. Similarly, we can be experiencing a mental disorder and a relatively high level of mental wellbeing at the same time.

### Study tip

To distinguish between a mental health problem and a mental disorder, remember the **four Ds: distress, dysfunction, duration and deviance from typical behaviour**. A mental disorder will have more severe **distress, dysfunction and deviance** and will persist for a longer **duration** than a mental health problem.

## Low level of mental wellbeing

A person sitting on the far right-hand side of the continuum is considered to have a low level of mental wellbeing. They may:

- not be able to function independently in their daily life (low level of functioning)
- struggle to cope with adversity (low level of resilience).

Many individuals who experience a low level of mental wellbeing may also be experiencing (and struggling to cope with) a mental health problem. Mental health problems may not be serious enough to be diagnosed as a disorder, but they are not trivial; they still affect our functioning and cause distress. They tend to be short-term, expected reactions that occur in response to challenging circumstances.

Some examples of mental health problems include the grief associated with a significant personal loss, or the stress experienced by someone going through a challenging transition in their lives. Symptoms of mental health problems tend to clear up with time or once a stressor is no longer present.



**FIGURE 5** Each person at this funeral may experience grief for a different length of time. Some may return to their normal state of functioning quickly. For others, it may take longer. If the symptoms of grief persist, they could progress into a mental disorder.

On the other hand, if a mental health problem persists, it can develop into a mental disorder. Examples include depression, schizophrenia, post-traumatic stress disorder or a specific phobia. The symptoms, nature and course of mental disorders vary from person to person. However, with psychological and/or medical treatment, people experiencing a mental disorder can live fulfilling, successful lives and display a high level of mental wellbeing.

## Fluctuations in mental wellbeing over time

Our mental wellbeing fluctuates over time. Your mental wellbeing last year could be different from your mental wellbeing this year. In fact, your mental wellbeing right now may differ from your mental wellbeing five hours ago. This means that our place on the wellbeing continuum is not fixed and may change. Having mental wellbeing represented along a continuum also reaffirms that a person's mental state does not always necessarily fall into a clear-cut category, but instead falls somewhere on a continuum.

Understanding stress, anxiety and phobia is useful to demonstrate how mental wellbeing can fluctuate along the continuum.

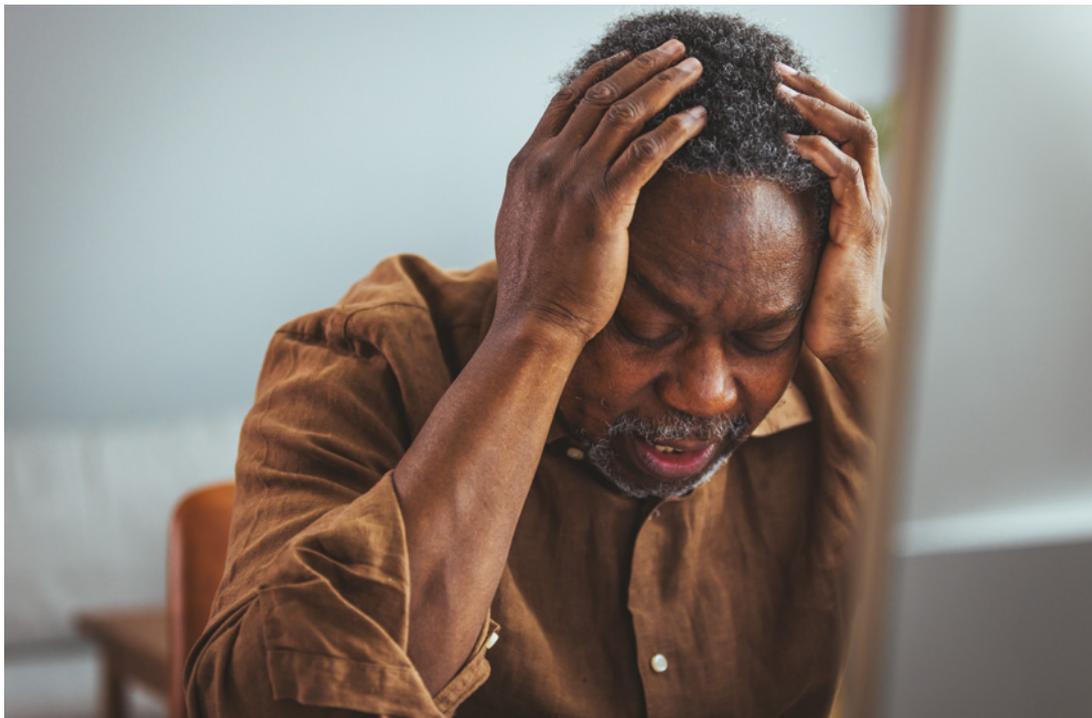
### Stress

As you learnt in Chapter 3, stress is a state of psychological and physiological arousal produced by internal or external stressors, which we perceive as challenging our ability to cope.

Everyone, no matter where they are on the mental wellbeing continuum, experiences stress at some stage. For example, it is normal to be somewhat stressed before an assessment task at school, or before your speech at final assembly. This gives you motivation and energy to prepare – and does not mean you have a low level of mental wellbeing.

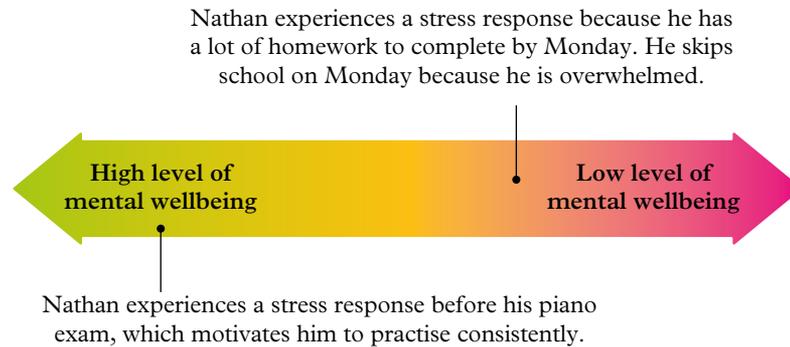
#### Study tip

Just as mental wellbeing fluctuates over time in the Western understanding, SEWB also varies throughout the life span.



**FIGURE 6** The person in this image is stressed. Where might they be on the mental wellbeing continuum? What more information might you need to make your decision?

However, excessive stress can cause such distress that it impairs your functioning. In this case, you might display a low level of mental wellbeing. Figure 7 shows examples of how one individual can display different levels of mental wellbeing in two different states of stress.



**FIGURE 7** An example of Nathan, who is experiencing different stress responses and is at different points on the mental wellbeing continuum at different points in time

## Anxiety

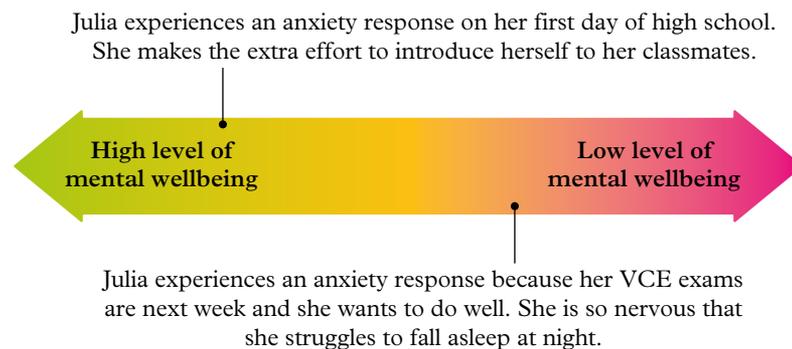
**anxiety**  
a state of arousal characterised by apprehension and worry

**Anxiety** is different from stress. It is a state of arousal characterised by apprehension and worry. The apprehension is not necessarily caused by a particular stressor, but instead can be caused by a belief that something is wrong or something bad is going to happen.

While stress can be perceived as both “good” and “bad”, anxiety is never a pleasant feeling. Anxiety can still be useful, though, because it is adaptive for us to feel apprehensive and be more cautious in some situations. For example, if you are skydiving, a little anxiety about what might happen if you are not sure what to do will ensure that you pay attention to the instructor’s directions and follow them exactly, so that you will be safe.

Like stress, anxiety occurs for all people no matter where they are on the mental wellbeing continuum. If anxiety is brief, useful and disappears when the stressor is removed, a person could still have a high level of mental wellbeing. When anxiety does not subside and persists to the point where our functioning is impaired, our position on the continuum shifts further to the right and can become a disorder.

Figure 8 shows examples of how one individual can display different levels of mental wellbeing in two different states of anxiety.



**FIGURE 8** An example of Julia, who is experiencing different anxiety responses and sits at different points on the mental wellbeing continuum at different points in time

▶ ClickView  
Anxiety

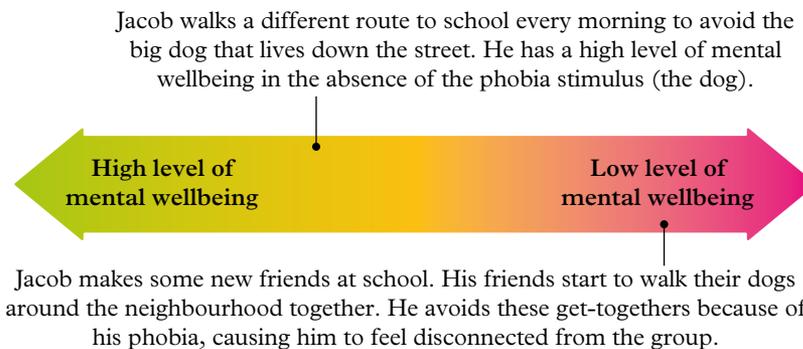
## Phobia

When anxiety becomes a persistent, irrational and excessive fear of a particular object or situation, we develop an anxiety disorder such as a **phobia**.

Phobia is different from fear, which is a rational response that protects us from getting hurt. It is normal for us to experience fear at some stage in our lives, and it can be useful. If you are in the ocean and a shark appears next to you, the sympathetic nervous system response will be activated due to your fear of the shark. This is adaptive as it will provide you with energy to swim away quickly, hopefully! A person could experience this response and still be considered to have a high level of mental wellbeing.

On the other hand, a person with a shark phobia might experience a severe stress and anxiety response when thinking about sharks or hearing the word “shark”. A fear of sharks could even prevent them from going to the beach. This could then be classified as a phobia because the fear experienced is not proportional to the actual threat posed. Phobia can affect your life by stopping you going to perfectly safe places and can lower your level of mental wellbeing.

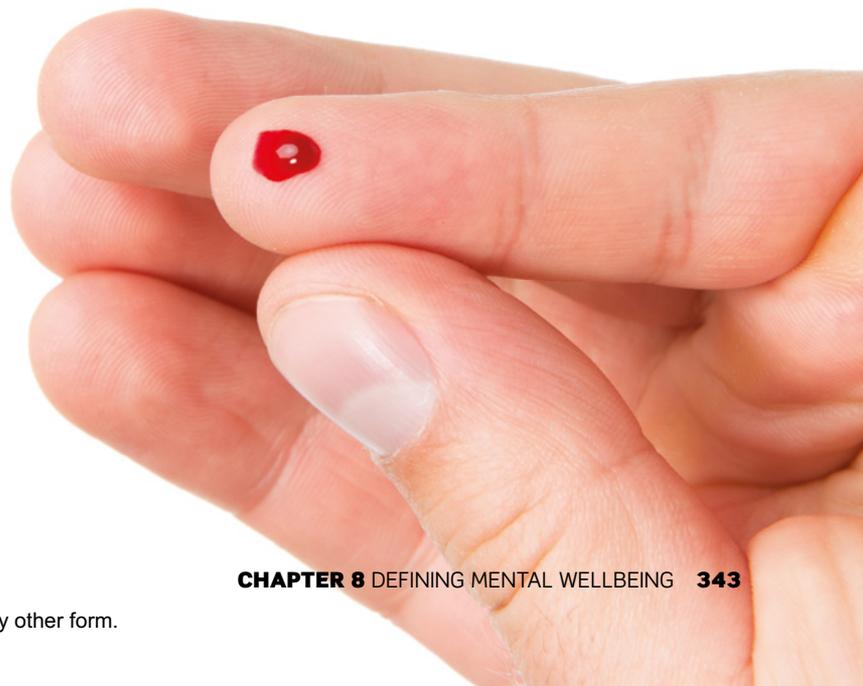
People with phobia do not feel their phobia symptoms constantly. Many only feel their symptoms in the presence of the phobia stimulus. A person with a fear of clowns might have a high level of mental wellbeing most of the time, but a low level of mental wellbeing when in the presence of their phobia stimulus. Another example is shown in Figure 9. You will learn more about phobias in Chapter 9.



**FIGURE 9** An example of Jacob, who has a phobia of dogs and is at different points on the mental wellbeing continuum at different points in time

Each time you experience stress, anxiety or phobia, your position on the mental wellbeing continuum can shift. In some instances, it shifts only slightly. In others, your experience may have significant impacts on your mental wellbeing. This reiterates that mental wellbeing is fluid and sensitive to change.

**FIGURE 10** For people with haemophobia (fear of blood), the sight of blood could instigate an intense fear response and even cause them to faint.



### phobia

a mental disorder characterised by persistent, irrational and excessive fear of a particular object or situation

### Study tip

Figures 7, 8 and 9 present only some examples of where people may be on the mental wellbeing continuum. We cannot make a sound judgment about a person's mental wellbeing based on just their experience of stress, anxiety or phobia. We must consider their level of functioning and resilience as a whole.

# Factors affecting mental wellbeing

The reason mental wellbeing is so dynamic is because it can be affected by a range of internal and external factors.

**internal factor**

an influence on mental wellbeing that originates from within a person's body or mind

**Internal factors** are influences on mental wellbeing that originate from within your mind or body. They are typically biological and psychological factors. Some examples are:

- genetic vulnerability/predisposition
- personality
- biological sex
- memory
- quality of sleep
- hormones
- physical health
- neurotransmitter function
- rumination
- thinking pattern
- emotions
- personality.

For example, if you have a genetic vulnerability to a mental disorder, you are more likely to develop a mental disorder than someone without that same genetic vulnerability. If you get adequate sleep at night, you are less likely to have a low level of mental wellbeing than someone who regularly struggles to get to sleep and feels lethargic during the day.

**external factor**

an influence on mental wellbeing that originates from outside an individual (i.e. the environment)

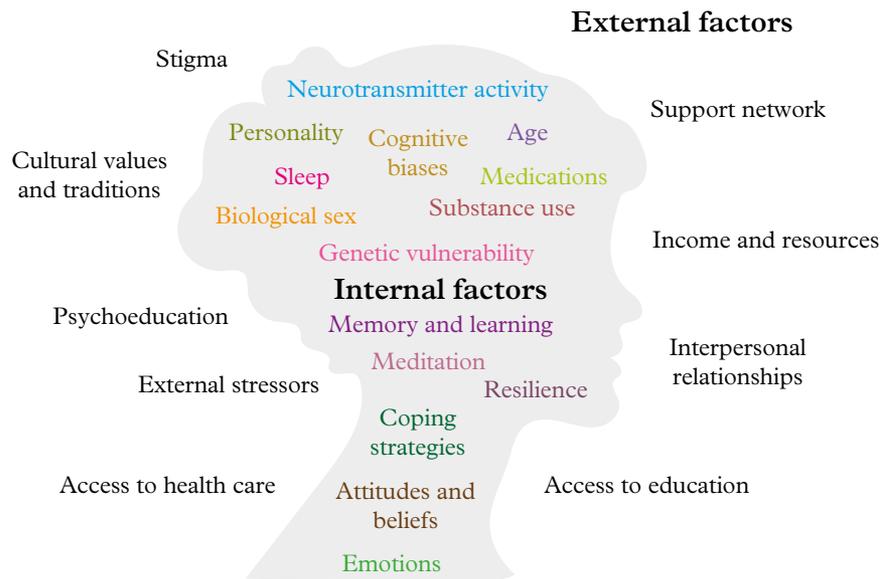
**External factors** are influences on mental wellbeing that originate from outside of an individual. These are factors that come from your external environment and are typically social factors. Some examples are:

- interpersonal relationships
- pressures of work or school
- stigma
- access to health care
- access to education
- cultural or religious values
- income
- access to basic necessities.

**Study tip**

Mental wellbeing is a product of the interaction of both internal and external factors. We do not say that one factor alone "causes" a low level of mental wellbeing.

The effects of internal and external factors on mental wellbeing differ depending on the factor. For example, good social connections and support can boost mental wellbeing, while the presence of negative or toxic relationships in a person's life might promote a low level of mental wellbeing.



**FIGURE 11** Internal factors originate within or relate to the mind and body, while external factors originate from a person's external environment.

Internal and external factors can affect each other and then have a combined impact on mental wellbeing. For example, your peer groups (an external factor) may affect whether you engage in substance use (an internal factor). Your access to health care (an external factor) may influence your income and resources (an external factor) if you are physically unable to work.

## 8.2 WORKED EXAMPLE

### Assessing the factors that influence an individual's mental wellbeing

During his first year of university, Theo has to submit a group assignment for his Cognitive Psychology class. It is worth 30 per cent of his grade. Unfortunately, his group members are very unreliable. Leading up to the due date, one of the students does not contribute to discussion, one submits their portion of the assignment unfinished, and one never shows up to any of their group meetings on Zoom. Theo's levels of stress and frustration gradually increase over the term. On the submission date, he is feeling so overwhelmed that he stays in bed all day watching TV, only getting up twice for snacks, turns his laptop off and does not turn in the group assignment.

Suggest where Theo may sit on the mental wellbeing continuum on the submission date of his group assignment. Justify your response with reference to one internal factor and one external factor that has contributed to Theo's mental wellbeing. (3 marks)

#### Solution

Think	Do
Step 1: Identify the command terms used in the question and determine what they require.	The question asks you to "suggest". So, you need to propose an answer about Theo's position on the mental wellbeing continuum. The question also asks you to "justify". So you need to provide reasoning. The question also asks you to refer to two relevant factors (one internal and one external), so you need to recognise and name them in your reasoning.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	This question has a total of 3 marks, so you need three pieces of information. One mark is allocated to suggesting where Theo sits on the mental wellbeing continuum, 1 mark to linking your response to an internal factor, and 1 mark to linking your response to an external factor.
Step 3: Carefully read the stimulus material. Recall the factors affecting mental wellbeing and select the ones relevant to the scenario.	Examples of internal factors: emotions (Theo is feeling overwhelmed), coping strategies (Theo is coping by removing himself from the situation). Examples of external factors: interpersonal relationships (there is a lack of connection between Theo and his group members), external stressors (the pressure of how much the assignment contributes to his grade).
Step 4: Consider how these factors contribute to Theo's mental wellbeing. It is helpful to assess his level of functioning and resilience to make a judgment. Either describe where he would sit or show this visually.	Level of functioning: low (he is mostly inactive, not eating properly, not completing daily tasks, not submitting his assignment). Resilience: low (in this moment, he is so overwhelmed that he is unable to cope and escapes the situation altogether).
Step 5: Connect your ideas to construct a final response.	Due to the external stressor of academic pressure (external factor) (1 mark) and his coping strategy of isolating himself (internal factor) (1 mark), Theo is likely to have a low level of mental wellbeing, placing him closer to the right-hand side of the continuum. He is displaying low levels of functioning and resilience as shown by staying in bed all day and not communicating with his group members. (1 mark)

## 8.2 SKILL DRILL

### Analysing and evaluating research on the mental wellbeing of graduate students

#### Key science skill: Analyse and evaluate data and investigation methods

A 2018 study published by Evans and colleagues in *Nature Biotechnology* reported on the mental health crisis in postgraduate education. A total of 2279 postgraduate students (from 234 institutions across 26 countries) were surveyed through social media and email. The survey included clinically validated scales for measuring anxiety and depression. The data is shown in Table 2.

**TABLE 2** Results obtained about the incidence of anxiety and depression among postgraduate students

Condition	Number of students
Anxiety	934
Depression	889

Students who identified as either having anxiety or depression were also asked to report on their work–life balance, rating it as either “healthy” or “unhealthy”. The data is shown in Table 3.

**TABLE 3** Results obtained about work–life balance

Condition	Percentage of students who identified as having a healthy work–life balance	Percentage of students who identified as having an unhealthy work–life balance
Anxiety	24	56
Depression	21	55

#### Practise your skills

- Construct two graphs to represent the data. You might like to convert the numerical values in Table 2 into percentages of the total number of students first.
- Discuss two external factors that could be causing the high incidence of anxiety and depression among postgraduate students.
- Discuss the implications of concluding that all postgraduate students are at one position along the mental wellbeing continuum.
- Much research into mental wellbeing relies on self-reported data. Discuss how asking a participant to self-report their position on the mental wellbeing continuum can lead to problems with:
  - objectivity
  - validity.

Need help analysing and evaluating data and investigation methods? See Topic 1.7 in your Psychology toolkit.



## 8.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain why mental wellbeing is represented as a continuum.
- 2 Explain why mental wellbeing fluctuates over the course of a person's life.
- 3 Using examples, explain the difference between internal and external factors that influence mental wellbeing.
- 4 Explain how phobia is different from ordinary fear.

### Apply, analyse and compare

- 5 Identify whether the following factors are internal or external. Then, describe one way that each factor could positively affect mental wellbeing and one way it could negatively affect mental wellbeing. The first one has been done for you as an example.

Factor	Internal or external?	How could this factor have a positive impact on mental wellbeing?	How could this factor have a negative impact on mental wellbeing?
Personality	Internal	If someone has an outgoing personality, this could benefit their mental wellbeing because they have ample opportunity to connect with others and develop close interpersonal relationships which make them feel fulfilled.	If someone has an outgoing personality, they may also be vastly different from their peers, making it challenging for them to connect with others and form close relationships, which could leave them feeling isolated or lonely.
Genetics			
Peer group			
Resilience			
Medication			
Education			

- 6 Reflecting on any personal examples from your own life, compare anxiety and stress.
- 7 Ben, a Year 10 student, is at a busy intersection, waiting to cross the road. Compare how Ben's experience of crossing the road would be different according to whether he is suffering from stress, anxiety or a phobia of cars.
- 8 Choose two internal factors and two external factors that could affect mental wellbeing other than those mentioned in the main text. Analyse how they could interact with each other to influence a person's mental wellbeing.

### Design and discuss

- 9 Create a fictional case study that demonstrates someone progressing along the mental wellbeing continuum, from high to low levels of mental wellbeing.

## Chapter summary

- 8.1**
- Wellbeing refers to a person's overall mental state in terms of how content they are with themselves and their life.
  - A person's level of wellbeing can be considered in terms of their level of functioning and resilience or, in the case of Aboriginal and Torres Strait Islander peoples, social and emotional wellbeing.
  - The social and emotional wellbeing (SEWB) framework is used to describe the impact of factors relevant to the health and wellbeing of Aboriginal and Torres Strait Islander peoples. It consists of the "self" surrounded by seven domains that shape the wellbeing of an individual – body, mind and emotions, family and kinship, community, culture, Country, and spirituality and ancestors.
  - A person who is feeling "mentally well" would be likely to have a high level of functioning and demonstrate resilience.
- 8.2**
- Mental wellbeing exists along a continuum with no clear-cut categories.
  - Our position on the mental wellbeing continuum is not fixed. It can fluctuate at different points of our lives depending on a range of internal and external factors.
  - Our experiences of stress, anxiety and phobia will cause our position on the mental wellbeing continuum to vary.

## Revision questions

### Multiple choice

- Which of the following statements is correct?
  - Mental wellbeing and mental disorder are the same thing.
  - Mental health interferes with a person's thoughts, emotions and functioning.
  - Mental disorders significantly impair day-to-day functioning.
  - Mental health problems are more serious than mental disorders.
- A person who is experiencing a mental disorder:
  - has low levels of functioning and resilience.
  - has a low level of functioning and a high level of resilience.
  - has a high level of functioning and a low level of resilience.
  - does not necessarily have a low level of functioning or resilience.
- The seven domains of the social and emotional wellbeing framework are:
  - Country, spirituality and ancestors, culture, mind and emotions, body, family and kinship, community.
  - spirituality and ancestors, family and kinship, connection, mind and emotions, Country, body, culture.
  - culture, community, family and kinship, mental, physical, spirituality and ancestors, Country.
  - Country, community, culture, social, body, family and kinship, spirituality and ancestors.



- 4 Which of the following statements about the social and emotional wellbeing framework is not true?
- A The SEWB framework places the self at the centre of individual wellbeing.
  - B The SEWB framework is a more appropriate model to explain the health and wellbeing of Aboriginal and Torres Strait Islander peoples than Western models.
  - C The SEWB framework is a holistic approach to mental wellbeing that considers the impact of many factors on wellbeing.
  - D The SEWB framework consists of seven domains that each individually affect a person's wellbeing.
- 5 The mental wellbeing continuum can be used to show:
- A how biological, psychological and social factors interact to influence mental wellbeing.
  - B fluctuations and variability in mental wellbeing.
  - C whether an individual is experiencing a mental health problem or disorder.
  - D the characteristics of a person with low and high levels of mental wellbeing.
- 6 A person who has a high level of mental wellbeing is likely to:
- A usually feel positive emotions and hardly ever feel negative emotions.
  - B express a range of emotions in a manner proportional to the situation at hand.
  - C struggle to understand why other people are feeling a certain way.
  - D rarely feel stressed.

- 7 When comparing stress to anxiety:
- A stress is more likely to be unpleasant than anxiety.
  - B a person experiencing stress will have a higher level of mental wellbeing than a person experiencing anxiety.
  - C stress can only be a negative experience, whereas anxiety can be both a positive and negative experience.
  - D stress can be a positive or negative experience, whereas anxiety can only be a negative experience.
- 8 Which option, A to D, most accurately reflects the correct labels for the following mental wellbeing continuum?



	1	2	3
A	Mentally healthy	Mental health problem	Mental disorder
B	Low level of mental wellbeing	Intermediate level of mental wellbeing	High level of mental wellbeing
C	Well	Coping/struggling	Unwell
D	Happy	Neutral	Unhappy

Use the following information to answer questions 9 and 10.

During fourth period, Vinh is asked to come to the principal's office. He becomes nervous because he thinks he's in trouble. When he enters the principal's office, Vinh is asked to take a seat. His principal tells him that he has some news: Vinh's grandmother has died and his mother is on her way to collect him from school.

- 9 Match the following points in time with where you would expect Vinh's mental wellbeing to sit on the continuum.



	1	2	3
<b>A</b>	During 3rd period	During 4th period	After learning that his grandmother had died
<b>B</b>	During 4th period	After learning that his grandmother had died	During the walk to the principal's office
<b>C</b>	The previous day	During 3rd period	During 4th period
<b>D</b>	During 3rd period	During the walk to the principal's office	After learning that his grandmother had died

- 10 Which of the following best describes Vinh's mental wellbeing once he receives a summons to the principal's office?
- A** Vinh may be experiencing anxiety and a low level of mental wellbeing.
  - B** Vinh may be coping with stress.
  - C** Vinh may be experiencing a temporary mental health problem.
  - D** Vinh may be experiencing a fluctuation in his mental wellbeing.

### Short answer

#### Describe and explain

- 11 Define "wellbeing".
- 12 Describe three ways of considering wellbeing.
- 13 Define "resilience" and explain how it relates to wellbeing.
- 14 Explain why assessing level of functioning to determine wellbeing depends on context.
- 15 Explain the advantages of representing mental wellbeing on a continuum.
- 16 Describe the SEWB framework.
- 17 For each of the seven domains of the SEWB framework, identify a possible factor that would contribute positively to the social and emotional wellbeing of an individual.
- 18 Explain why the SEWB framework is unique to Aboriginal and Torres Strait Islander peoples.

#### Apply, analyse and compare

- 19 Contrast internal factors and external factors that affect mental wellbeing. Give an example of each.
- 20 Explain where a person who is grieving for a relative who has died would be on the mental wellbeing continuum. Justify your response.
- 21 Compare mental health problems and mental disorders.
- 22 Compare stress and anxiety.
- 23 Using examples, analyse the interaction between internal and external influences on mental wellbeing.
- 24 Select two domains of the SEWB framework and for each, identify one way in which a strong connection to the domain would promote a high level of SEWB.
- 25 Determine where a person who is having a phobia reaction to a clown would be on the mental wellbeing continuum. Justify your response.

- 26 Compare the experience of stress for someone who has a high level of mental wellbeing and someone who has a low level of mental wellbeing.
- 27 Explain how a person could progress from a mental health problem to a mental disorder. Use an example to illustrate your response.
- 28 Brent has a job interview tomorrow, which is causing him some stress. He prepares for his interview by laying out his clothes the night before, practising answers to common interview questions and researching the company he is applying to. He does not get much sleep on the night before the job interview and wakes up feeling tired and anxious. However, he drives to his interview and performs as well as possible.

Determine where Brent is on the mental wellbeing continuum leading up to the interview. Justify your response.

- 29 Shehani and Nora were both on the girls' school football team in Year 11. In Year 12, they both try out for the team again, but neither is selected to compete. They are both disappointed about this. However, while Shehani decides to try out for a different sports team instead, Nora quits sport altogether and even throws out her exercise gear in frustration.

Analyse the likely impact of resilience on both Shehani and Nora's mental wellbeing in this scenario.

- 30 Apply your understanding of stress to the mental wellbeing continuum by explaining how someone experiencing stress could be placed at multiple points along the continuum across time.

### Design and discuss

- 31 Discuss whether experiencing negative emotions indicates where a person is on the mental wellbeing continuum.
- 32 Suggest reasons for why experiencing stressors and challenges could be good for mental wellbeing.
- 33 Dr Hong is investigating whether a child's level of resilience affects the likelihood of them developing a mental disorder in adulthood. Suggest a possible research hypothesis for Dr Hong's investigation.
- 34 Design an infographic that highlights the interaction between at least three internal and external factors affecting mental wellbeing.

You can find the following resources for this section in your **obook pro**:

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

9

# Specific phobia

## KEY KNOWLEDGE

- the relative influences of factors that contribute to the development of specific phobia, with reference to gamma-aminobutyric acid (GABA) dysfunction and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, and cognitive biases including memory bias and catastrophic thinking (psychological); and specific environmental triggers and stigma around seeking treatment (social)
- evidence-based interventions and their use for specific phobia, with reference to the use of short-acting anti-anxiety benzodiazepine agents (GABA agonists) in the management of phobic anxiety and breathing retraining (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); and psychoeducation for families/supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social).

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## GROUNDWORK

This topic will build on concepts you will have come across in Units 1 and 2 Psychology and Chapters 2 and 8. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.

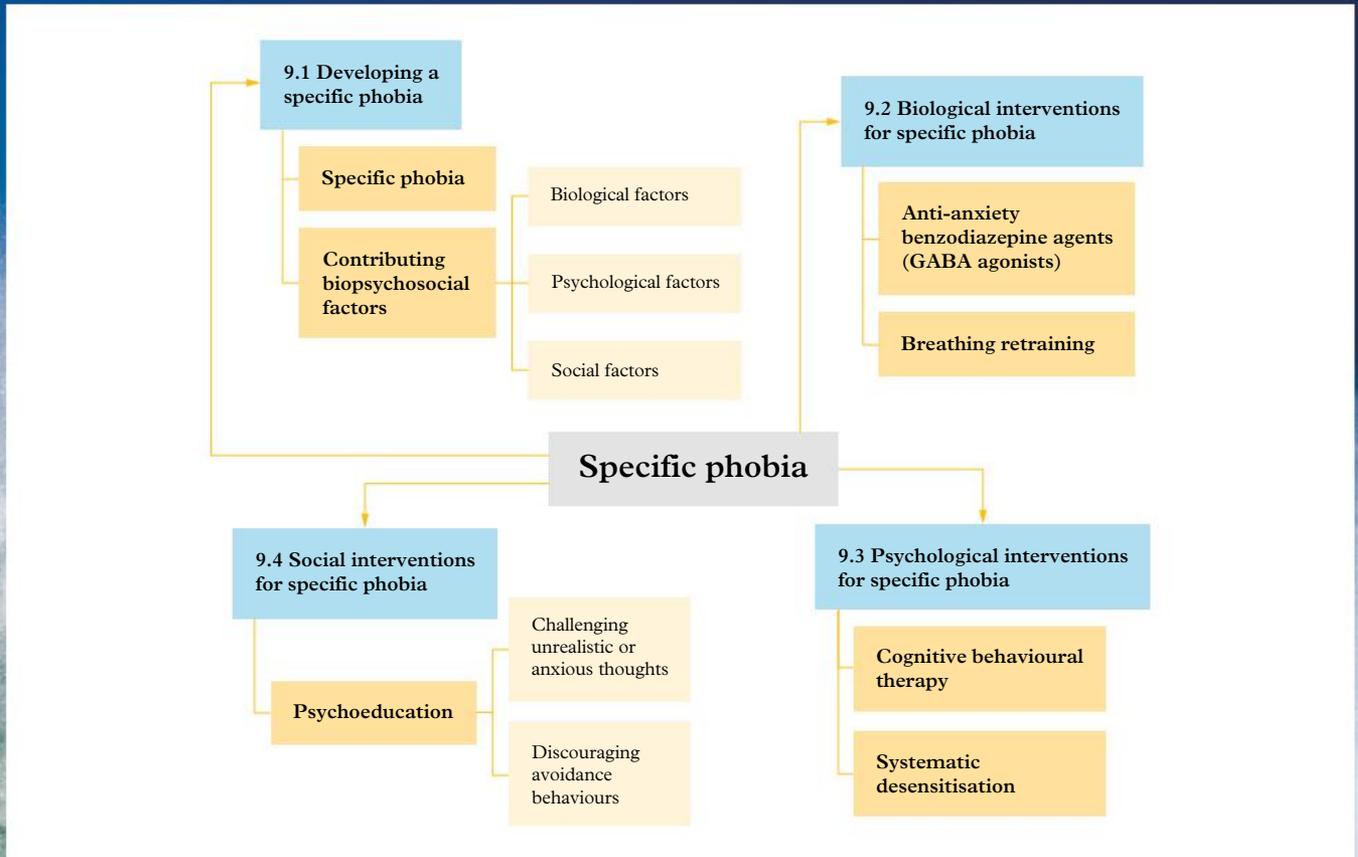


## INVESTIGATIONS

9.4A	<b>INVESTIGATION: CASE STUDY</b>	How does exposure to a phobic stimulus aid in the treatment of specific phobia?	Page 492
9.4B	<b>INVESTIGATION: CLASSIFICATION AND IDENTIFICATION</b>	How can identification of biopsychosocial factors be used to inform the treatment of a specific phobia?	Page 493

**FIGURE 1** Have you ever known someone who was terrified of swimming in the ocean? Thalassophobia is the extreme fear of the ocean.

## CONCEPT MAP



# 9.1

## Developing a specific phobia

### KEY IDEAS

- ✦ Specific phobias are characterised by an excessive and disproportionate fear of a particular stimulus.
- ✦ Biological factors that can contribute to the development and maintenance of specific phobias include GABA dysfunction and long-term potentiation.
- ✦ Psychological factors that play significant roles in developing and maintaining specific phobias include classical conditioning, operant conditioning and cognitive biases such as memory bias and catastrophic thinking.
- ✦ Social factors that can contribute to the development and maintenance of specific phobias include specific environmental triggers and stigma around seeking treatment.



### Specific phobia

Many people instinctively fear creatures such as spiders and snakes and will experience an immediate stress response when confronted by these creatures. From an evolutionary standpoint, this fear is understandable because humans are biologically predisposed to fear things that may potentially threaten our survival (e.g. the venom in spider or snake bites). However, when a fear begins to impede a person's daily life and social functioning, causing them to deliberately avoid objects, situations, or activities that they believe might cause them stress, this fear evolves into a condition known as a **specific phobia**.

A specific phobia is a type of **anxiety disorder** characterised by a persistent, irrational and intense fear of a particular object or event (a **phobic stimulus**). Mental health professionals often use the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5-TR) to guide their diagnosis of a specific phobia. To qualify for a diagnosis, symptoms must have persisted for six months or longer. Specific phobias typically form in childhood and while many eventually fade or are overcome, some people will live with a specific phobia for the rest of their lives. Specific phobias that persist into adulthood are rarely overcome without intervention. Studies have shown that more than 75 per cent of individuals diagnosed with specific phobias experience multiple phobias throughout their lives. Additionally, females are more likely to experience a phobia than males (Figure 1).



ClickView  
Specific phobia  
in children

#### specific phobia

a type of anxiety disorder characterised by an intense and persistent fear that is triggered by facing or anticipating a specific stimulus

#### anxiety disorder

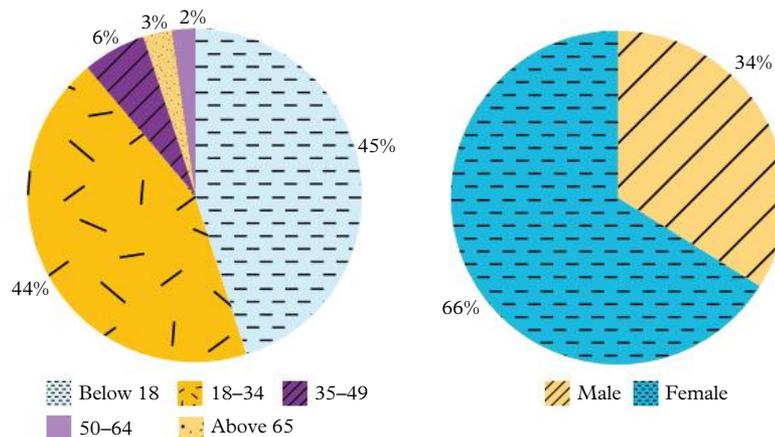
a cluster of mental health conditions characterised by excessive fear or apprehension about a real or perceived threat

#### phobic stimulus

an object, a situation or an event that induces a persistent, irrational fear response

#### Diagnostic and Statistical Manual of Mental Disorders

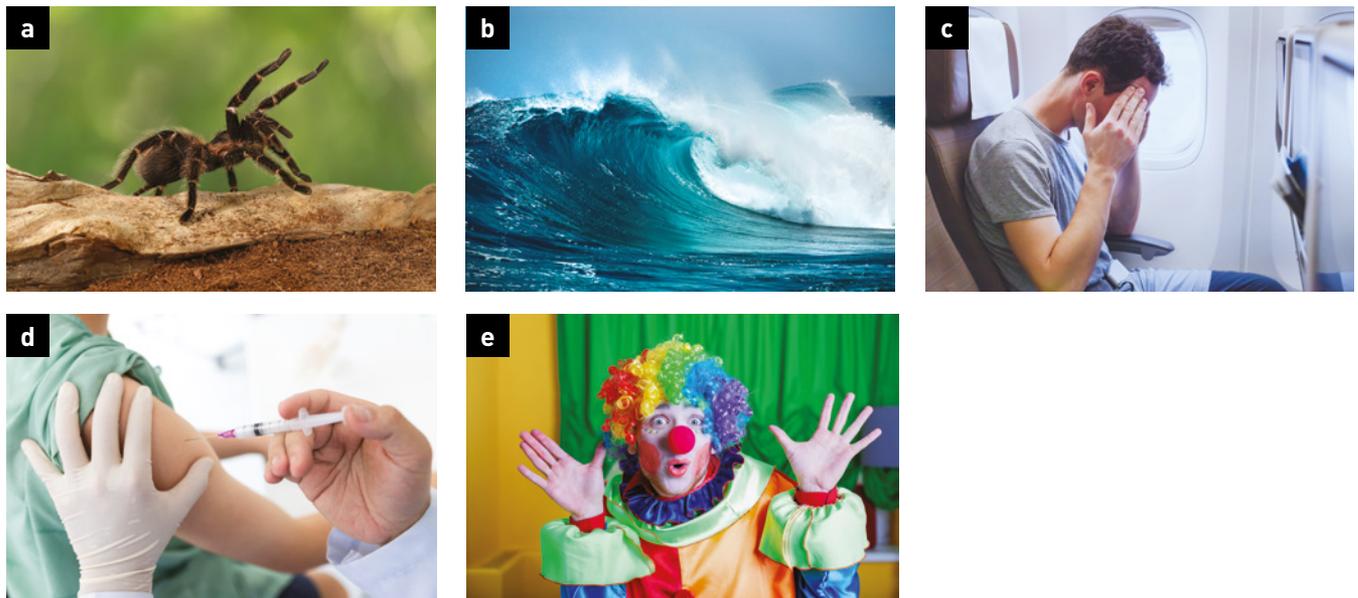
a widely used classification system for psychological and neurodevelopmental disorders published by the American Psychiatric Association



**FIGURE 1** These pie charts show the incidence of phobia by age and gender. Note that people aged under 18 years report the greatest proportion of phobia followed closely by people aged 18 to 34.

Specific phobia can be categorised into five main types:

- animal phobia: phobia associated with specific animals or species, such as snakes, spiders, rats or dogs
- natural/environmental phobia: phobia that relate to certain natural conditions or environments, such as heights, storms, water or darkness
- situational phobia: phobia that involve an intense physical and emotional reaction to certain situations, such as enclosed spaces, flying, driving or dental visits
- blood, injection or injury phobia: phobia that are triggered by the sight of blood, needles, or injuries and medical procedures
- other phobia: phobia that do not fit into the above categories, such as a fear of certain colours (chromophobia) or small objects (microphobia).



**FIGURE 2** There are five broad categories of specific phobia: **a** animal phobia (e.g. arachnophobia), **b** natural/environmental phobia (e.g. thalassophobia), **c** situational phobia (e.g. aerophobia), **d** blood, injection or injury phobia (e.g. trypanophobia) and **e** other phobia (e.g. coulrophobia). Can you guess what each of these phobia relates to?

## Contributing biopsychosocial factors

There is no simple explanation for what causes a person to develop a specific phobia.

Rather, there appear to be several complex factors that contribute to the development of a specific phobia, and that are also relevant to its maintenance and treatment. Because of this, specific phobia are usually examined using the **biopsychosocial approach**. This approach considers how biological factors, psychological factors and social factors can individually and interactively contribute to the development of a specific phobia.

### Biological factors

**Biological factors** include genetic influences, brain chemistry, hormone levels and sex.

Two biological factors that can contribute to the development of a specific phobia are:

- gamma-aminobutyric acid (GABA) dysfunction
- long-term potentiation (LTP).

#### **biopsychosocial approach**

the interaction of biological, psychological and social factors in the diagnosis and treatment of mental health conditions

#### **biological factor**

an internal, physiological factor that can affect a person's health, behaviour and overall wellbeing

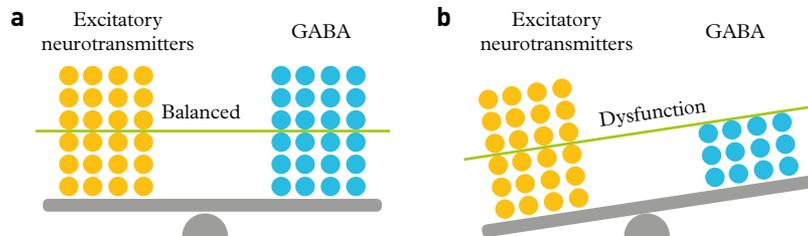
## Gamma-aminobutyric acid dysfunction

In Chapter 2, you learnt that GABA is the primary inhibitory neurotransmitter of the central nervous system (CNS) and that GABA plays a role in anxiety. When GABA binds to a receptor, it has an inhibitory effect, which means that the postsynaptic neuron is less likely to fire, and subsequently reduces the overall excitability of nearby neurons. In contrast, glutamate is the primary excitatory neurotransmitter of the CNS. When glutamate is released from the presynaptic neuron, it binds to receptors on the postsynaptic neuron and increases the likelihood of a neuron firing.

The complementary way that GABA and glutamate work to balance arousal levels can be likened to a set of scales. GABA's inhibitory function balances the excitatory action of glutamate, and vice versa. This balance is essential for regulating arousal levels, which, in turn, helps to manage our anxiety levels. GABA plays a crucial role in calming the CNS as it significantly inhibits the excitatory effect of glutamate, allowing a person to feel more relaxed.



**FIGURE 3** GABA dysfunction can make us hypersensitive to perceived threats.



**FIGURE 4** **a** GABA, the primary inhibitory neurotransmitter in the CNS works with glutamate, the primary excitatory neurotransmitter in the CNS to maintain physiological balance. **b** A person with GABA dysfunction (too little GABA) is more likely to develop a specific phobia.

### GABA dysfunction

lower levels of GABA caused by either insufficient production of GABA or an issue with it binding effectively to the receptor site on the postsynaptic neuron

Research has shown a link between a condition called **GABA dysfunction** and the development of a specific phobia. GABA dysfunction is characterised by insufficient production of GABA and/or problems with GABA binding to receptor sites on the postsynaptic neuron. Low GABA levels caused by dysfunction can disrupt the balance between inhibitory and excitatory regulation in the brain, leading to increased excitatory effects. The amygdala, the part of the brain that responds to perceived threats by initiating the flight-or-fight-or-freeze response, is particularly sensitive to GABA levels. When there is insufficient GABA, the amygdala becomes hypersensitive to potential threats. This triggers a heightened stress response and results in a person feeling more anxious and physiologically aroused. Therefore, GABA dysfunction is linked with the development of specific phobia and other anxiety disorders.

Studies on specific phobia have suggested that individuals with GABA dysfunction (low levels of GABA) are more susceptible to anxiety and other conditions such as depressive disorders, autism and Parkinson's disease. These conditions can predispose individuals to stress and arousal responses, which contribute to feelings of anxiety.

The exact cause of GABA dysfunction is not fully understood. However, several factors have been associated with this condition, including genetics, prolonged or chronic stress, lack of physical activity, and poor nutrition – specifically deficiencies in nutrients that can affect gut health (see Chapter 3). Excessive consumption of caffeine and recreational use of stimulant drugs have also been linked to low GABA levels.

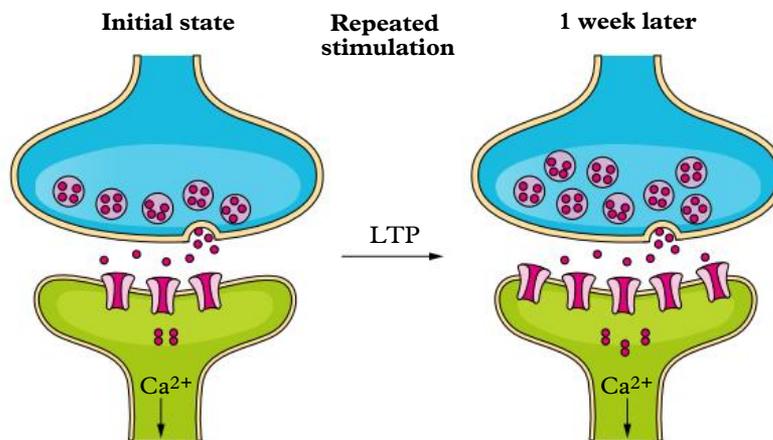


**FIGURE 5** Excessive consumption of caffeine has been linked to GABA dysfunction.

## Long-term potentiation

When an individual encounters a fear-inducing event or stimulus, such as an aggressive dog, this triggers an intricate communication pathway that originates from the senses. This communication is processed by the amygdala, which, in turn, initiates the stress response. This response leads to the release of stress hormones (adrenaline and noradrenaline) into the bloodstream, signalling to the brain that there is a potential threat. The intensity of the fear felt will determine the strength of the stress response. When a strong threat is detected, noradrenaline is released as a neurotransmitter, which activates the amygdala. The amygdala then signals the hippocampus, which encodes a vivid episodic memory about the threat (aggressive dog).

Recall from Chapter 2 that long-term potentiation (LTP) is an experience-dependent mechanism of synaptic plasticity. LTP causes physical changes in synapses due to repeated stimulation of a neural pathway during learning. LTP plays a crucial role in fear conditioning and the formation of fear memories. Fear memories are encoded and retrieved through neural circuits that involve the amygdala and other brain regions, including the hippocampus. LTP in these circuits can reinforce synaptic connections between neurons and contribute to the enduring persistence and retrieval of fear-related information. As a result of LTP, the association between the neural signals involved in perceiving a phobic stimulus and the neural signals involved in activating the fear response strengthens, which more readily triggers the activation of the neural signals responsible for a fear response.



**FIGURE 6** LTP results in structural changes at the synapse that increase the likelihood of an action potential being fired by the postsynaptic neuron and increase the strength of the signal.

For instance, if the neural circuits that are involved in encoding and retrieving memories of a fear-inducing stimulus, such as an aggressive dog, are repeatedly stimulated, the synaptic connections forming these circuits could strengthen. This makes the communication between these circuits more efficient, which allows for quicker retrieval and preservation of fear memories. Consequently, this process can contribute to the formation and persistence of a specific phobia.

## Psychological factors

**Psychological factors** are internal factors that influence our cognition, affect and behaviour. This includes our individual thoughts, beliefs, perceptions, mental abilities, emotions and memories of experiences. Three psychological factors that can contribute to the development of a specific phobia are:

- precipitation by classical conditioning
- perpetuation by operant conditioning
- cognitive biases (such as memory bias and catastrophic thinking).

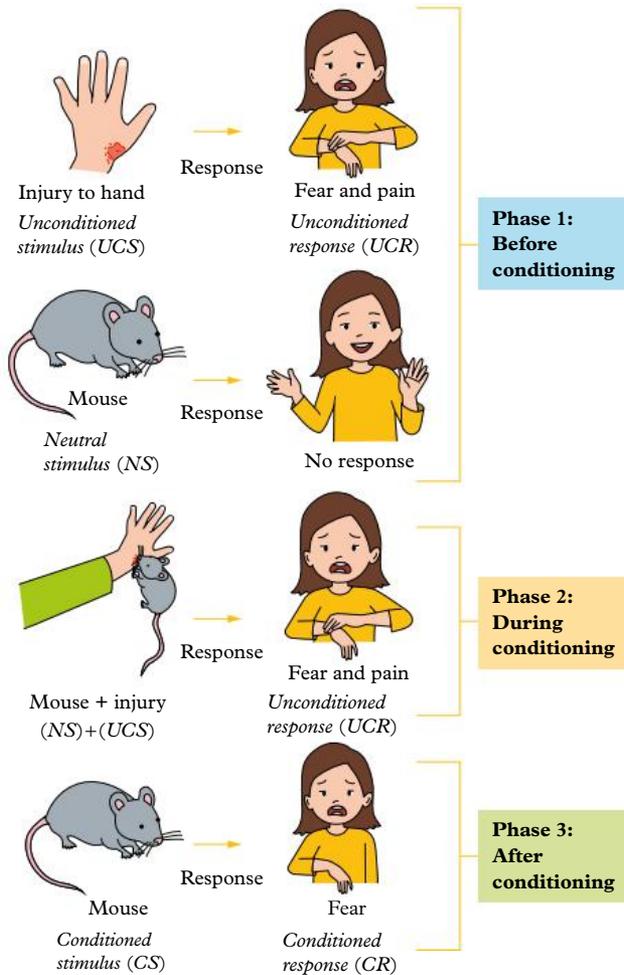
**psychological factor**  
an internal cognitive, emotional or behavioural factor that can affect a person's health, behaviour and overall wellbeing

**precipitating factor**

a factor or an event that triggers the onset of an illness, a disorder or a disease

**Precipitation by classical conditioning**

**Precipitating factors** are events, circumstances or experiences that trigger or worsen a particular condition or symptom. Classical conditioning can serve as a key precipitating factor that contributes to the development of a specific phobia. As you learnt in Chapter 4, in



**FIGURE 7** How the three phases of classical conditioning can contribute to acquiring a specific phobia of mice (musophobia)

**perpetuating factor**

a factor or an event that sustains or prolongs the onset of an illness, a disorder or a disease

classical conditioning, an initially neutral stimulus (NS) is associated with an unconditioned stimulus (UCS) that naturally and automatically triggers a specific unconditioned response (UCR). After repeated pairings of the NS and UCS, the NS becomes a conditioned stimulus (CS) that elicits a conditioned response (CR), mirroring the UCR.

To illustrate this, consider the example of Takila, someone who was left terrified after a mouse in her pantry bit her. In this scenario, the mouse bite serves as the UCS, which automatically triggers a fear and anxiety response – the UCR. Normally, the association between the NS (the mouse) and the UCR would need to be paired several times before conditioning could occur. However, for Takila, repeatedly seeing images of mice in books or on media, or even recurrently thinking about the incident, could be enough to recall feelings of fear and pain (UCR) associated with the initial mouse bite (UCS).

Through repeated pairings of the previous NS (mouse) and the UCS (feelings of fear), the NS turns into a CS. Over time, this CS triggers a CR of fear on its own. Takila has learnt to associate the sight of a mouse with the fear or anxiety of being bitten. This classical conditioning process has precipitated Takila’s specific phobia of mice, also known as musophobia.

**Perpetuation by operant conditioning**

**Perpetuating factors** refer to conditions or elements that maintain or worsen an existing issue or condition.

In the context of specific phobia, operant conditioning plays a significant role in reinforcing and perpetuating phobic behaviour.

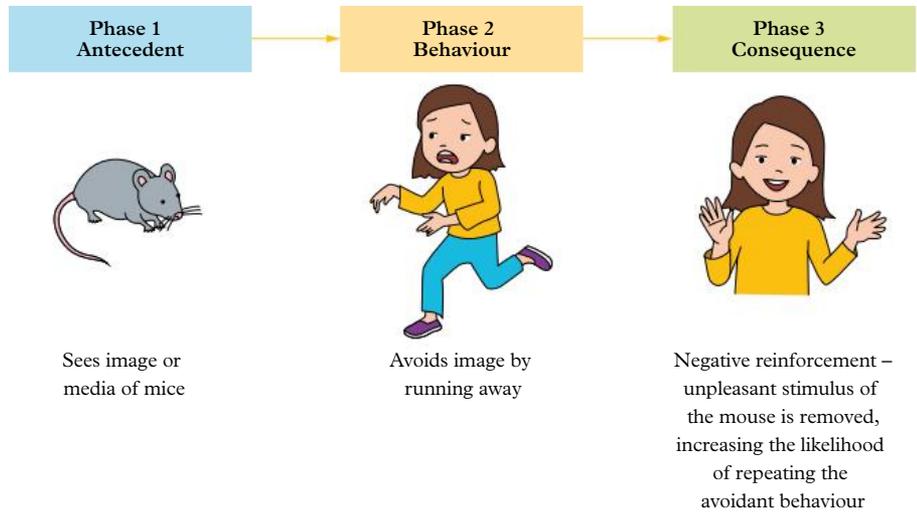
Recall from Chapter 4 that operant conditioning can be examined through the antecedent–behaviour–consequence model. This model also serves as a framework to comprehend how specific phobia can persist and worsen over time.

In this model, the “antecedent” refers to the environmental or situational trigger that precedes a behaviour. In the case of a specific phobia, the antecedent could be the presence or anticipation of the phobic stimulus. For instance, for an individual with musophobia, the sight of a mouse could act as the antecedent, which triggers fear and anxiety.

The “behaviour” refers to the person’s reaction to the antecedent. For those with a specific phobia, this behaviour typically involves actions that help them avoid or escape from the trigger of their phobia. For example, when faced with a mouse, an individual with musophobia might scream, run away, or actively avoid situations where mice are likely to be present.

Finally, the “consequence” is the outcome that follows the behaviour. The consequences either reinforce (encourage) or punish (discourage) the behaviour, affecting the likelihood of its occurrence in the future.

In specific phobia, negative reinforcement frequently occurs, which is when the removal or avoidance of an aversive (unpleasant) stimulus strengthens a behaviour. By avoiding the phobic stimulus, individuals escape or reduce their fear or anxiety, which reinforces the avoidance behaviour and sustains the phobia. This negative reinforcement strengthens the link between avoidance and relief from fear, making behaviours that perpetuate the specific phobia more likely to continue.



**FIGURE 8** The three phases of operant conditioning in the maintenance of a specific phobia of mice



## Cognitive biases

**Cognitive biases** are systematic errors in thinking that can influence the decisions and judgments that people make. Essentially, individuals may construct their own subjective reality based on their perception of the world. Cognitive biases can contribute to the development, maintenance and exacerbation of specific phobia by skewing a person’s recall and perception of the phobic stimulus and ideas or events related to the trigger. This can often cause individuals to remember triggers as more threatening or terrifying than they were. Two specific types of cognitive biases that play particularly strong roles in the development and maintenance of specific phobia are memory bias and catastrophic thinking.

### cognitive bias

a systematic error in thinking that affects a person’s decisions and judgments

## Memory bias

**Memory bias** refers to the tendency to selectively encode and recall certain experiences over others, typically skewed towards memories that validate our existing beliefs, fears and emotions. This type of cognitive bias can often lead to distorted memory recall, resulting in an exaggerated or diminished interpretation of an occurrence.

### memory bias

a tendency to selectively and inaccurately encode a memory that has been influenced by distorted thinking

For example, consider a person with a specific phobia of mice, caused by a past negative experience of being bitten by a mouse. This person may demonstrate a memory bias by remembering the event as being more terrifying and dangerous than it really was. The result is that they form an exaggerated recollection of the fear experienced and the threat level of the mouse. This exaggerated perception may contribute to developing a specific phobia, intensify or prolong an existing phobia, and contribute to justifying avoidant behaviours.

### **catastrophic thinking**

a tendency to ruminate obsessively and overestimate a perceived threat with irrational thoughts of worst-case scenarios



**FIGURE 9** Catastrophic thinking occurs when people jump to the worst possible conclusion or scenario.

## Catastrophic thinking

**Catastrophic thinking** is a cognitive bias that prompts people to jump to the worst possible conclusion, usually inflating the perceived threat of an event. In the context of specific phobia, this can lead to an increase in anxiety and fear. For example, an individual with a fear of mice might irrationally believe that every mouse, irrespective of whether it was bred for research or someone's pet, is plagued with deadly diseases. The mere thought of encountering a mouse and getting bitten may fill them with dread and result in feelings of helplessness, thereby reinforcing their phobia.

## Social factors

### **social factor**

an element of a person's environment that can influence their behaviour, attitudes, health and interactions with others

**Social factors** refer to the external influences and conditions that shape an individual's thoughts, behaviours and wellbeing. In the context of specific phobia, environmental triggers and stigma around treatment are two social factors that can contribute to the development and maintenance of a specific phobia.

## Specific environmental triggers

Specific phobia can often be traced back to specific **environmental triggers**. These triggers typically stem from three sources:

- direct exposure to a distressing or traumatic event (e.g. being attacked by a dog)
- observing others experiencing a traumatic event (e.g. witnessing another person being attacked by a dog)
- learning or indirectly receiving information about threats or traumatic events (e.g. hearing a story about a dog attack on the radio).

If someone is directly exposed to an attacking dog, the dog (phobic stimulus) becomes an environmental trigger that, due to the distressing experience, prompts a fear response.

The severity of the traumatic event could directly affect the likelihood of developing a phobia. Alternatively, if someone observes another person being attacked by a dog and witnesses that person experience pain and fear, they may learn from this incident to also fear dogs. Finally, if someone directly or indirectly gains information about a threat, they could develop a phobia. The source of the information could be the media, the internet, peers or school.

For example, a person hearing about a vicious dog attack on the radio could develop a fear of dogs just from listening to information about a potential threat.



**FIGURE 10** Specific environmental triggers may occur from direct interaction with a phobic stimulus (e.g. being attacked by a dog) or indirect interaction (e.g. watching someone else be attacked or hearing about an attack on the radio).

## Stigma around seeking treatment

**Stigma** refers to the prejudiced attitudes and discriminating behaviour directed towards individuals with specific conditions due to stereotypes that are associated with their condition. Stigma associated with mental health conditions, including specific phobia, often results in individuals feeling marked or labelled as “different”. This can lead to a sense of disgrace or separation from others. Stigma can bring about feelings of embarrassment, shame, distress, helplessness, sadness and heightened anxiety in people suffering from specific phobia. As a result, such individuals may be hesitant to seek help from mental health professionals due to fear of judgment or misunderstanding. This reluctance often results in delayed treatment, with some people going untreated for many years or not at all.

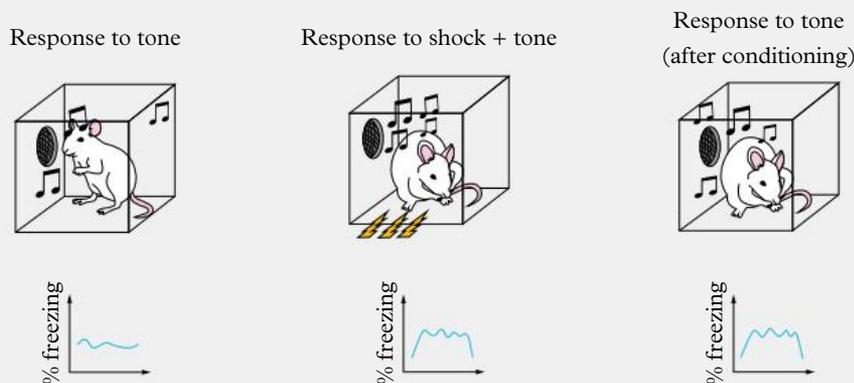
**stigma**  
negative attitudes, beliefs and stereotypes associated with certain individuals, conditions or groups that often lead to discrimination and social exclusion

## 9.1 REAL-WORLD PSYCHOLOGY

### Classical conditioning and LTP

Rogan et al. (1997) explored the relationship between LTP and the role of the amygdala in memory and fear conditioning in rats. They used classical conditioning techniques where a tone was relayed directly into the brain of a rat via an electrode. The rats were then placed into a chamber that could deliver an electric shock under their feet. The tone was activated immediately before the shock was applied. The rats were classically conditioned to fear the sound of the tone as they had associated it with the electric shock. The rats would then “freeze” in fear when the tone was sounded, even when the shock was not applied.

After several trials, the rats demonstrated behaviours and physiological responses consistent with a phobia.



**FIGURE 11** The set-up and freezing results from the conditioning experiment on rats

### Apply your understanding

- 1 Outline the three stages of classical conditioning (before, during and after) in the experiment and identify the NS, UCS, UCR, CS and CR.
- 2 Suggest what evidence the researchers would need to determine that LTP had occurred in the rats. Justify your response.

## 9.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define “specific phobia”.
- 2 Describe the five types of specific phobia.
- 3 Explain why psychologists use the biopsychosocial approach to understand specific phobia.
- 4 Explain how GABA dysfunction can contribute to the development of a specific phobia.

### Apply, analyse and compare

- 5 When Gianni was a small child, he was frightened by a clown at a birthday party. Throughout his childhood, Gianni would repeatedly think about the clown’s face and the fear he experienced on that day. Despite never encountering another real-life clown after the incident, Gianni still feels intense fear when seeing clowns in pictures or movies.  
Explain, with reference to long-term potentiation, how Gianni’s frequent thoughts of the incident could contribute to his specific phobia of clowns.
- 6 Contrast memory bias and catastrophic thinking by outlining two differences between them.

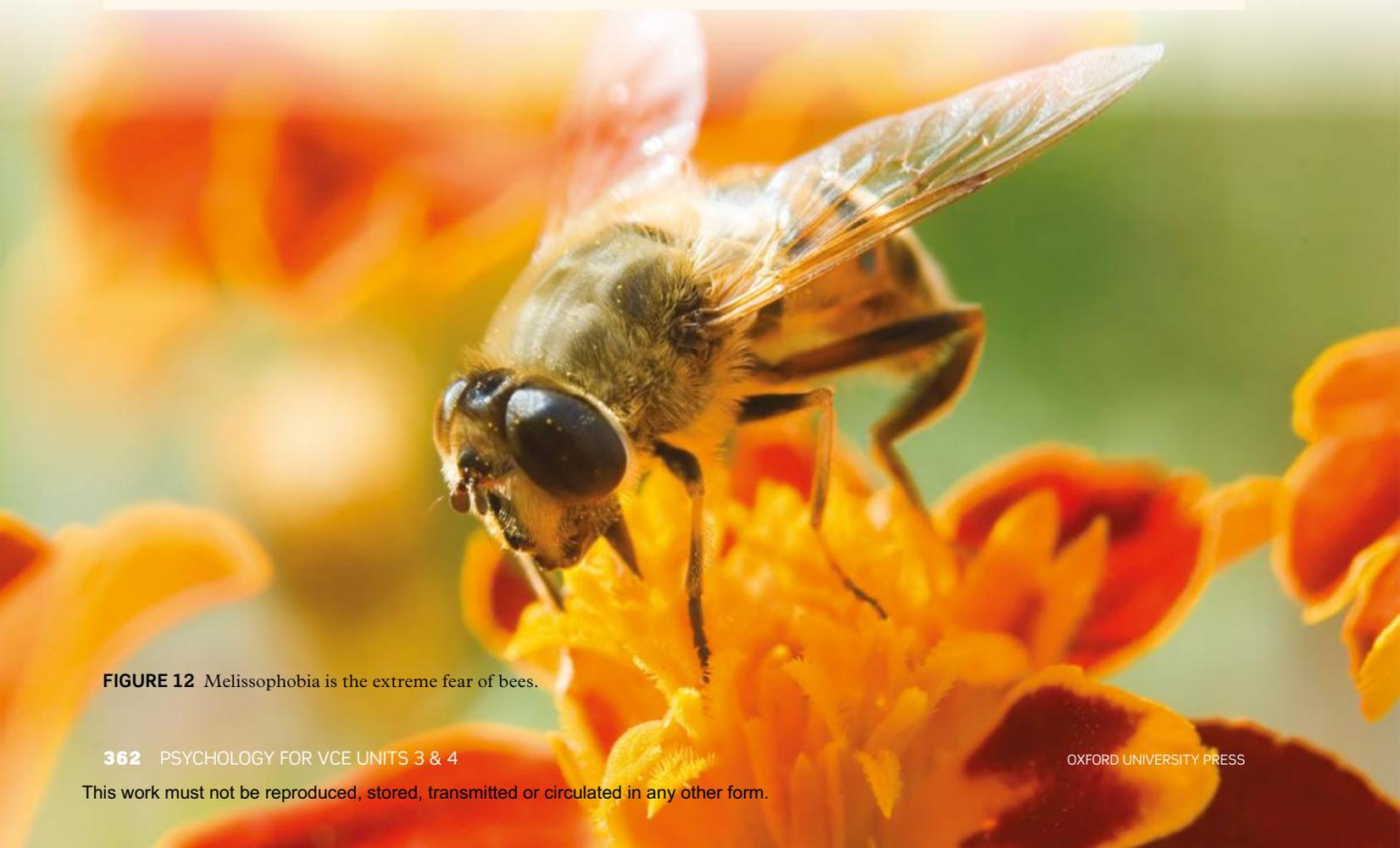
- 7 Compare how the behavioural models of classical conditioning and operant conditioning influence specific phobia.

### Design and discuss

- 8 Figaro is spotlighting at night, looking for owls, when a large moth flies onto his face.

Discuss how memory bias of the event and classical conditioning could contribute to Figaro developing a phobia of moths.

- 9 Marielle has melissophobia, an extreme fear of bees. She receives an invitation to her best friend’s 18th birthday party, which will be held in a garden. Marielle decides to decline the invitation in fear that she will be exposed to bees. Discuss how Marielle’s behaviour demonstrates the perpetuation of a specific phobia by operant conditioning.
- 10 “An individual with a specific phobia of spiders can effectively treat themselves.” Evaluate this statement.
- 11 Design an infographic to summarise how the biopsychosocial model is applied to understand specific phobia.



**FIGURE 12** Melissophobia is the extreme fear of bees.

# 9.2

## Biological interventions for specific phobia

### KEY IDEAS

- ✦ Evidence-based interventions for specific phobia are treatments that have been scientifically tested, peer-reviewed and found to be valid and effective.
- ✦ Biological interventions for specific phobia include anti-anxiety benzodiazepine agents (GABA agonists), which increase the inhibitory effects of GABA on the postsynaptic neuron, and breathing retraining, which corrects incorrect breathing patterns during a phobic response.



#### evidence-based intervention

a treatment to manage health conditions that has been empirically tested and shown to be effective in the scientific literature

#### biological intervention

a treatment targeting the physiological causes or effects of a mental health disorder

**Evidence-based interventions** used to treat specific phobia are treatments that have been scientifically tested many times, peer-reviewed and found to be valid and effective in assisting people with a specific phobia.

**Biological interventions** are one subset of evidence-based interventions that describe any treatment prescribed to relieve or manage the biological causes and symptoms of a mental health condition. In this topic, we will look at two biological interventions used to manage specific phobia:

- anti-anxiety benzodiazepine agents (GABA agonists)
- breathing retraining.



**FIGURE 1** Anti-anxiety benzodiazepine agents (GABA agonists) are a biological treatment that may be prescribed to help individuals manage their specific phobia.

### Anti-anxiety benzodiazepine agents (GABA agonists)

In Topic 9.1, you learnt that GABA dysfunction is a condition characterised by low levels of GABA and is associated with the development of anxiety disorders, including specific phobia. Imbalances between GABA and glutamate levels can lead to heightened anxiety through over-excitation of the CNS. If there is a deficiency of GABA in the amygdala, then our flight-or-fight-or-freeze response is more easily triggered. The result is an overly reactive physiological response to potential threats, including feelings of heightened anxiety.

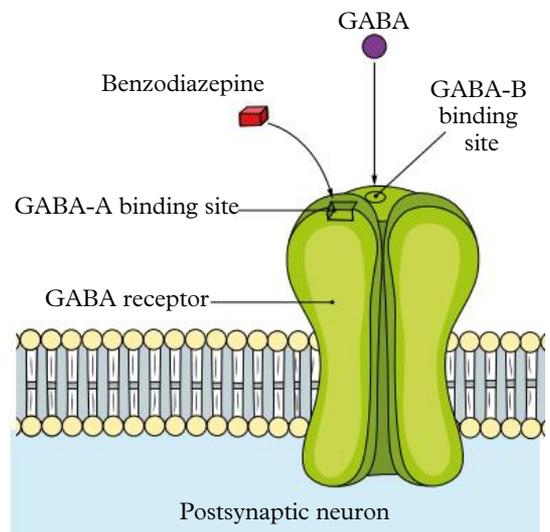
**Benzodiazepines** are a class of anti-anxiety drugs that enhance the inhibitory effects of GABA. Benzodiazepines have proven to be an effective medication for managing a range of anxiety disorders, including specific phobia. Benzodiazepines are GABA **agonists** because they can bind to and alter the activity of the GABA receptor.

#### benzodiazepines

a group of psychoactive drugs that act as depressants on the central nervous system and increase the inhibitory effects of GABA

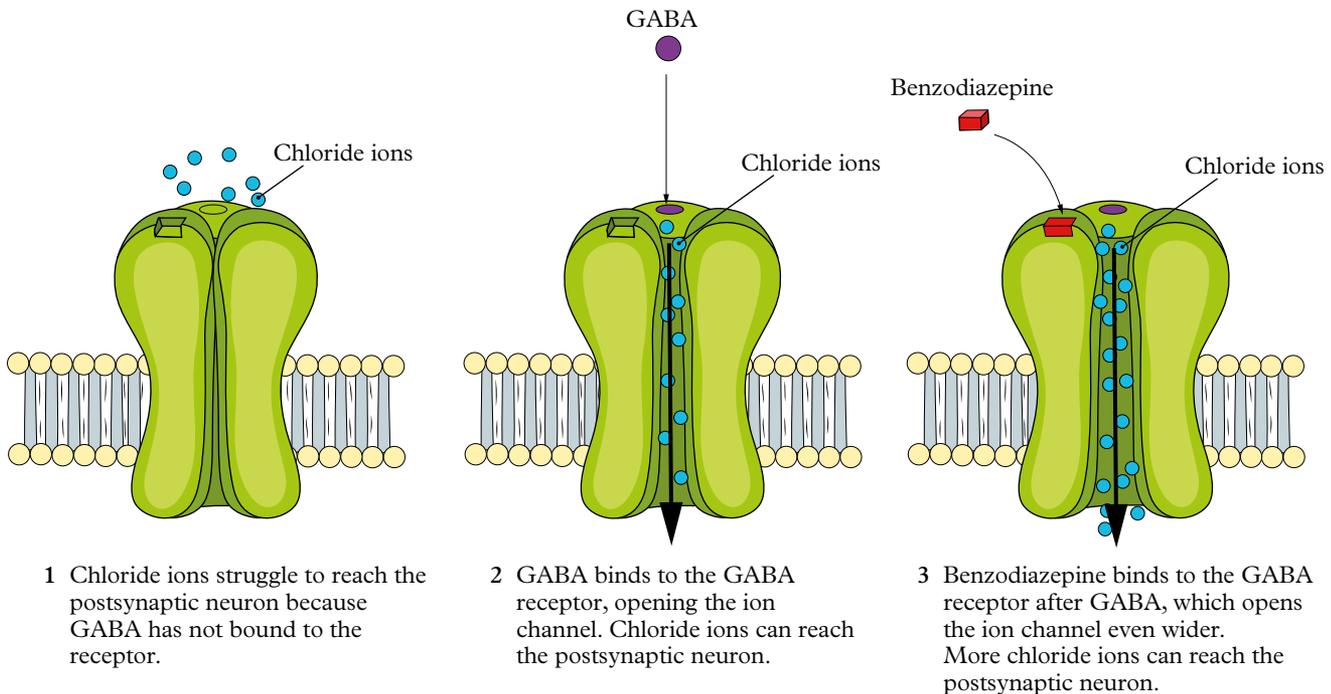
#### agonist

a substance or molecule that binds to receptors and increases the effect of a neurotransmitter



**FIGURE 2** GABA receptors on the postsynaptic neuron have specialised sites for the GABA neurotransmitter and benzodiazepine to bind to.

GABA receptors on the postsynaptic neuron have specialised sites for neurotransmitters and other chemicals to bind to (Figure 2). The GABA neurotransmitter binds to a site on the receptor called GABA-B and opens up a channel through the receptor to transport chloride ions to the postsynaptic neuron. These chloride ions trigger an inhibitory effect on the postsynaptic neuron, reducing the chance of it firing an action potential. Benzodiazepines can bind to a different site on the GABA receptor known as GABA-A. If a benzodiazepine molecule binds to a GABA receptor after a GABA molecule, the receptor will open even more, allowing more ions to travel to the postsynaptic neuron and increasing the GABA's inhibitory effect (Figure 3).



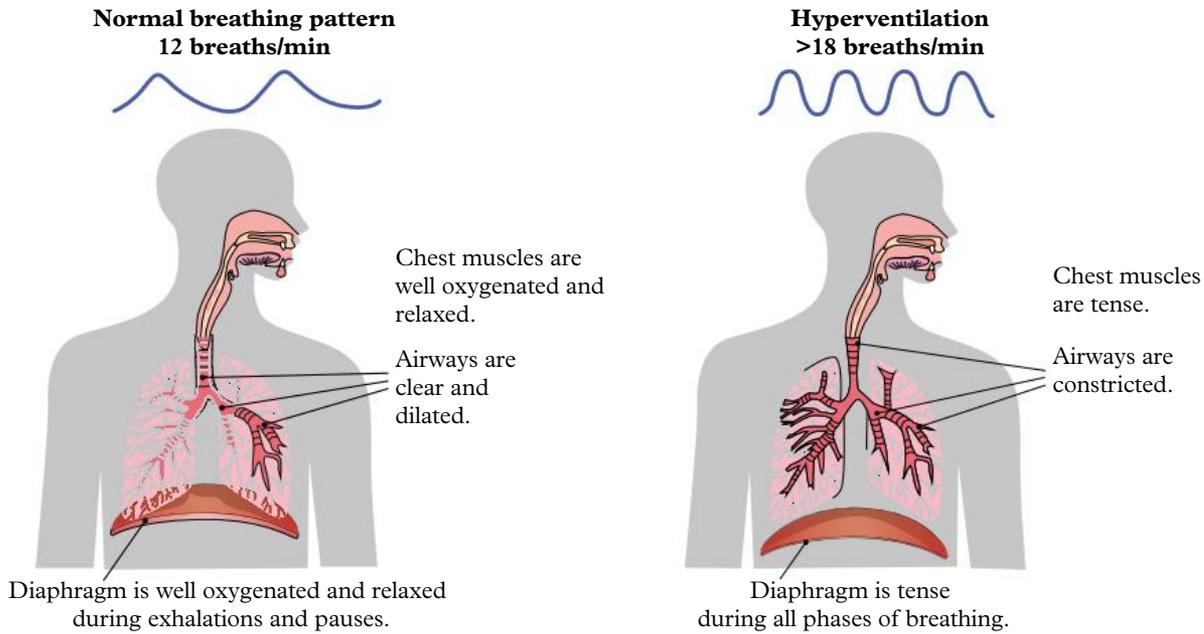
**FIGURE 3** Benzodiazepine increases GABA's inhibitory effect by further opening up the chloride ion channel and allowing more ions to reach the postsynaptic neuron.

It is important to note that benzodiazepines are not a replacement for GABA; rather, when levels of GABA are low, the presence of benzodiazepine can help to intensify GABA's inhibitory effects. Additionally, while benzodiazepines can alleviate anxiety symptoms in the short term, they can be addictive and are only effective while being consumed. Side effects of taking benzodiazepines include drowsiness, decreased alertness, poor concentration, dizziness and poor muscle tone. If not accompanied by other psychological and social interventions, once medication is stopped, anxiety will usually return.

## Breathing retraining

When a person is frightened by a phobic stimulus, they tend to “over-breathe” or breathe faster and more deeply than required. This is referred to as **hyperventilation**. People with specific phobia (and other anxiety disorders) have been found to exhibit abnormal breathing patterns that can alter the balance of oxygen and carbon dioxide in the body. Too much oxygen and too little carbon dioxide can cause dizziness, tingling in the fingers or body and blurred vision. When this is accompanied by heart palpitations, high blood pressure, tightness in the chest and breathlessness, it signals a “panic attack”, which can be very distressing.

**hyperventilation**  
rapid or deep breathing that is usually triggered by anxiety or panic



**FIGURE 4** Hyperventilation can be caused by exposure to a phobic stimulus and can alter normal inhalation and exhalation of oxygen and carbon dioxide.

**Breathing retraining** is a relaxation technique and treatment that is used to help people with specific phobia (and other anxiety disorders) change their incorrect/abnormal breathing pattern (hyperventilating, or over-breathing) to a correct/normal breathing pattern when they are about to face or encounter a phobic stimulus. Individuals are taught a slow-breathing technique to manage the effects of hyperventilation. This normalises the balance of oxygen and carbon dioxide in the body and is recommended to be applied as soon as the person begins to feel anxious.

The steps to practise breathing retraining are as follows.

- 1 Stop what you are doing and sit down or lean against something.
- 2 Hold your breath and count to 10 (do not take a deep breath).
- 3 When you get to the count of 10, breathe out through your nose and say the word “relax” to yourself in a calm, soothing manner.
- 4 Breathe in and out slowly in a 6-second cycle. Breathe in for 3 seconds and out for 3 seconds. This will produce a breathing rate of 10 breaths per minute. Say the word “relax” to yourself every time you breathe out.
- 5 At the end of each minute (after 10 breaths), hold your breath again for 10 seconds and then continue breathing in the 6-second cycle.
- 6 Continue breathing in this way until all symptoms of over-breathing have gone.
- 7 If this is done at the first signs of over-breathing, the symptoms will subside within a minute or two and an anxiety attack will not follow.

Although breathing retraining is a useful technique, it is not a cure for specific phobia. It is often used with other interventions such as cognitive behavioural therapy (CBT) and systematic desensitisation. You will learn about these interventions in Topic 9.3.

**breathing retraining**

a relaxation technique to change an abnormal breathing habit to a normal breathing pattern that balances oxygen and carbon dioxide levels in the body



**FIGURE 5** Breathing retraining can help manage the effects of hyperventilation triggered by a phobic stimulus.

## 9.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain why specific phobias are best treated with evidence-based interventions.
- 2 Describe how anti-anxiety benzodiazepine agents (GABA agonists) work on the central nervous system to alleviate symptoms associated with specific phobia.

### Apply, analyse and compare

- 3 Boschi developed a phobia of water (hydrophobia) after she was thrown into the ocean while on a jet ski. Since then, Boschi has avoided pools, the beach and even baths.
  - a Describe how medication could assist Boschi with her phobia.
  - b How might a psychologist use breathing retraining to assist Boschi with her symptoms? Describe the steps involved.
- 4 Zarina and Hugo both have a phobia of germs (germaphobia). Each has slightly different symptoms. Zarina insists on wearing plastic

gloves and a mask while she is out of her house, whereas Hugo insists on washing his hands with a strong anti-bacterial wash several times a day – even when it is not necessary.

- a Outline two biological treatments that could be used to treat Zarina and Hugo's specific phobia.
- b Consider the benefits and limitations of using anti-anxiety benzodiazepines (GABA agonists) when treating specific phobia.

### Design and discuss

- 5 Design your own graphic organiser to show the biological processes involved in the use of medications such as anti-anxiety benzodiazepines (GABA agonists) and breathing retraining.
- 6 Discuss whether breathing retraining is a more effective treatment of specific phobia than the use of anti-anxiety benzodiazepines (GABA agonists).



FIGURE 6 Germaphobia is the specific phobia of germs and bacteria.

# 9.3

## Psychological interventions for specific phobia

### KEY IDEAS

- Psychological interventions for specific phobia include cognitive behavioural therapy (CBT) and systematic desensitisation.



#### psychological intervention

a treatment that targets the psychological causes or effects of a mental health disorder

**Psychological interventions** are treatments that help to relieve and manage the psychological causes, symptoms and impacts of a mental health condition. Psychological interventions are particularly effective at treating specific phobia because they recognise how specific phobia can uniquely affect an individual's thoughts, feelings and behaviours. We will look at two psychological interventions to treat specific phobia in this topic:

- cognitive behavioural therapy
- systematic desensitisation.



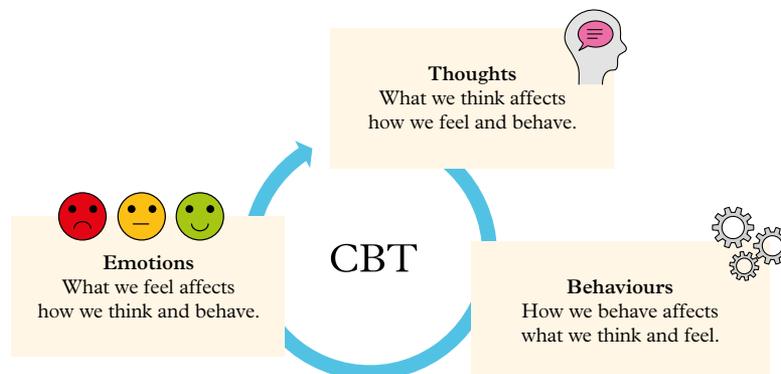
**FIGURE 1** Psychological interventions are treatments that help manage the psychological causes, symptoms and impacts of a mental health condition.

### Cognitive behavioural therapy

#### cognitive behavioural therapy (CBT)

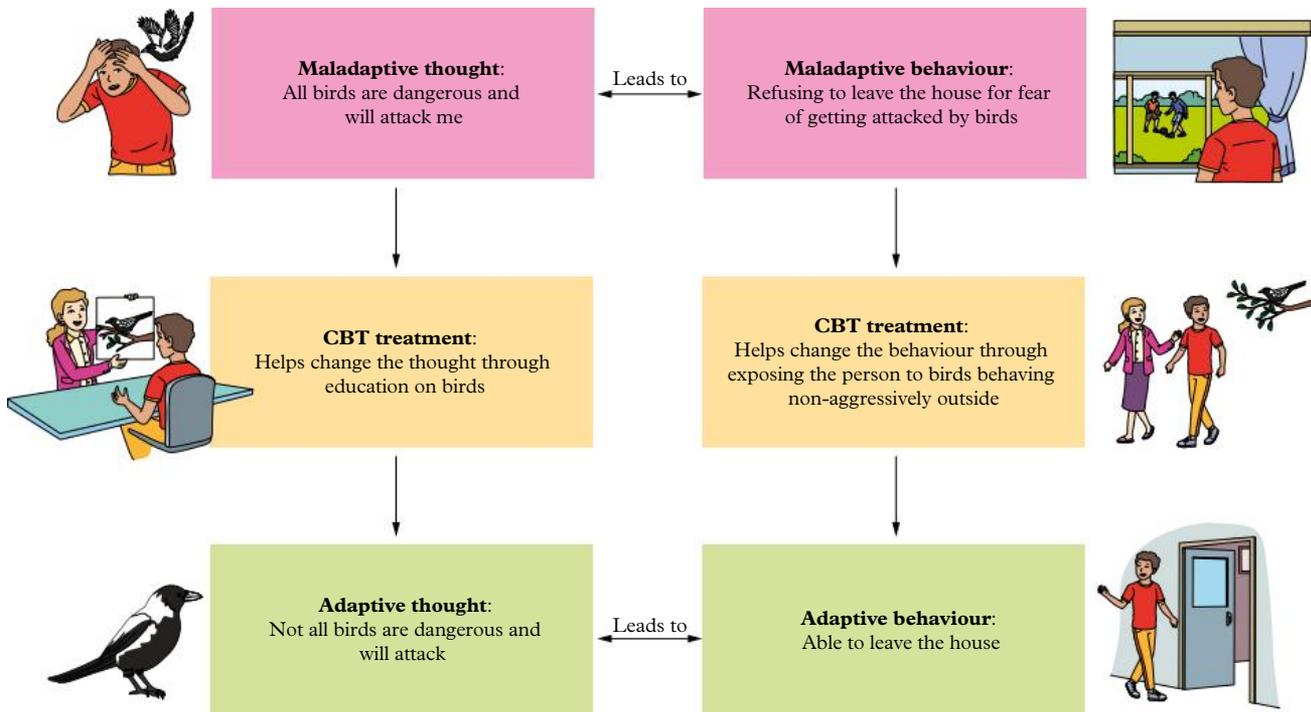
a psychological therapy based on the premise that our thoughts influence how we feel and behave; combines both cognitive and behavioural therapies

**Cognitive behavioural therapy (CBT)** is a type of psychotherapy based on the principle that our thoughts and behaviours have a strong influence on how we feel. CBT is sometimes referred to as “talking therapy” and uses a combination of verbal and behavioural modification techniques to help change automatic, persistent and irrational thoughts and behavioural patterns that maintain or intensify a specific phobia. When a person is exposed to phobic stimulus, negative thoughts can lead to emotional distress and a person will often alter their behaviour to avoid the object or situation. CBT focuses on identifying and replacing negative and dysfunctional thinking and behaviour patterns with more rational and realistic ones. CBT is often combined with other biological interventions (such as breathing retraining) and has been successfully used to treat a wide range of specific phobia.



**FIGURE 2** CBT is based on the principle that our thoughts, behaviours and emotions influence each other.

In CBT, a patient is encouraged to recognise that most of their catastrophic thoughts about a phobic stimulus are not based on reality. Patients undergoing CBT are also taught to monitor and document the occurrence of negative thoughts about a phobic stimulus in an “automatic thought diary”. As a person becomes more aware of their frightening and anxious thoughts and what triggers them, a therapist can then help them to understand which feelings and thoughts are based on incorrect assumptions. Once this understanding has been established, a patient can then learn to change their thoughts to more realistic and positive ones.



**FIGURE 3** CBT works to change the maladaptive thoughts and behaviours that relate to a phobic stimulus; in this case, magpies.

Therapists will often give clients homework to assist them in changing their thoughts and behaviours until, eventually, they can deal with the phobic stimulus without experiencing the phobic response. For example, a person with a phobia of magpies may have negative thoughts such as “all magpies will attack me” or “magpies are ferocious animals”. After monitoring their thoughts and working with a therapist, the person can learn to modify their thoughts to “not all magpies are dangerous and will attack me”.

People with specific phobia also engage in avoidant behaviour, where they actively prevent contact with or exposure to the phobic stimulus. For example, someone with a phobia of magpies may stop going outside to avoid instances where they may encounter magpies. A psychologist will help a client understand which of their avoidant behaviours are maladaptive and help them understand the negative impacts of these behaviours and how they can be changed. The behavioural aspect of CBT may also involve teaching the client relaxation techniques such as breathing retraining, exercises and other activities that can relax the client and help them deal with a phobic stimulus more productively.

## Systematic desensitisation

**Systematic desensitisation** is a behaviour therapy that applies the principles of classical conditioning to treat specific phobia. It assumes that most phobic responses are initially acquired through classical conditioning, so a specific phobia can be eliminated through **counter-conditioning**. Counter-conditioning is when a person is taught a new association that replaces or counters the original learnt association. Systematic desensitisation aims to remove the phobic response and gradually substitute it with a relaxation response.

Like classical conditioning, systematic desensitisation will not usually work after one pairing. Rather, the treatment will need to occur gradually and over several sessions. The number of sessions needed to desensitise or counter-condition the phobic response will depend on the severity of the specific phobia. Generally, most phobia require between four and six sessions to treat. However, phobia that are more resistant can take up to 12 sessions. In each session, the patient will need to confront their phobic stimulus. This can be undertaken in two ways:

- **in vitro**: when the person imagines being exposed to the phobic stimulus
- **in vivo**: when the person is physically exposed to the phobic stimulus.



**FIGURE 4** Systematic desensitisation teaches a person to form new associations that replace their phobic responses.

Research has found that direct exposure to the phobic stimulus tends to be more effective for systematic desensitisation than imagined exposure to the phobic stimulus. To apply systematic desensitisation, a psychologist works through several steps with the patient. These steps are outlined below.

- 1 The psychologist trains the person in relaxation techniques such as breathing retraining and muscle relaxation.
- 2 The psychologist helps the person build an **anxiety/fear hierarchy** to rate their fear from 0 (least) to 100 (most).
- 3 The person makes a list of anxiety-causing stimuli that are linked to their specific phobia, from least anxiety/fear-inducing to most anxiety/fear-inducing.
- 4 The person, with help from the psychologist, works through the hierarchy, learning to remain relaxed while imagining each stimulus on the hierarchy. This is repeated until the person can imagine or be confronted with each triggering situation or object with little or no anxiety/fear.

**systematic desensitisation**  
a behavioural therapy to treat specific phobia; uses the principles of classical conditioning to counter-condition the phobic response

**counter-conditioning**  
when a person is taught a new association that replaces or counters the original learnt association

**anxiety/fear hierarchy**  
where a person makes a list of anxiety-causing stimuli that are linked to their specific phobia, from least to most anxiety/fear-inducing (0-100)

For example, consider a person who has a fear of dogs (cynophobia). To systematically desensitise this person, a therapist will need to expose the person to their phobic stimulus (dogs) and pair this exposure with relaxation techniques at each level. Systematic desensitisation for this person may be applied by a professional using the following steps.

- 1 Teach the person relaxation techniques.
- 2 Develop a hierarchy of fear with the person (Table 1).

**TABLE 1** An example of a fear hierarchy

Fear hierarchy	Fear rating (0 to 100)
Draw a dog on a piece of paper.	5
Read about dogs.	10
Look at photos of dogs.	20
Look at videos of dogs.	30
Look at a real dog through a closed window.	40
Look at a real dog through a partly opened window.	50
Be in the same room as a leashed dog but stand at least 7 m away.	60
Stand at last 3 m away from the dog.	70
Stand next to the dog.	80
Pat the dog's head while it is on a leash.	90
Pat the dog without a leash.	100

- 3 Work through the hierarchy while pairing each exposure with relaxation techniques.
- 4 Eventually, the patient should feel relaxed as they pat the dog on the head.

Although systematic desensitisation has been useful in treating specific phobia, it is not without limitations. For example, systematic desensitisation has been known to be less effective in treating performance fears such as exam anxiety if the person does not study. In this instance, the anxiety is based on a lack of preparation rather than a phobia of exams. Systematic desensitisation may not always be effective in treating specific phobia that have a deep underlying evolutionary survival element, such as a fear of bears, the dark, or other dangerous animals or situations.



**FIGURE 5** A fear of dogs is called cynophobia.

### 9.3 SKILL DRILL

#### Evaluating phobia investigation designs

##### Key science skill: Analyse and evaluate data and investigation methods

In 1963, researchers used systematic desensitisation with a group of 200 college students who were all suffering from a specific phobia of snakes (ophidiophobia). Participants were randomly allocated into two groups: Group 1 was taught breathing retraining and Group 2 was not taught any relaxation techniques. Both groups underwent ten sessions to work through a fear hierarchy. Results showed that after the ten sessions, Group 1 had a significantly lower average fear rating than Group 2. Six months after they finished the sessions, participants were asked again to rate their fear of snakes. Group 1's average fear had decreased further, but Group 2's average reported fear had increased.

Participants of Group 2 were offered psychological sessions with relaxation techniques after the experiment had concluded.

#### Apply your understanding

- 1 Write a research hypothesis for this study.
- 2 Identify independent and dependent variables of the investigation and describe how each was measured.
- 3 Explain what conclusions can be drawn from the results of this investigation.
- 4 Suggest and outline one ethical consideration that the researchers needed to incorporate into this study.
- 5 Suggest a possible confounding variable and how it may have influenced results in this study.

Need help evaluating investigation methods?  
Go to Topic 1.7 in your Psychology toolkit.



FIGURE 6 A fear of snakes is called ophidiophobia.

### 9.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Describe the basis of cognitive behaviour therapy (CBT) and how it is used to treat specific phobia.
- 2 Explain how CBT can be used to treat a person with an insect phobia (entomophobia).
- 3 A psychologist decides to use systematic desensitisation to treat a person with a phobia of cats (gatophobia). Describe the steps they would use to treat this person.

#### Apply, analyse and compare

- 4 Systematic desensitisation is behavioural treatment that uses classical conditioning techniques. Describe this process, using the language of classical conditioning.
- 5 Adolina would like to travel overseas; however, her fear of flying has stopped her from realising this dream. Adolina experiences both physiological and psychological symptoms

whenever she sees an image of an aeroplane or watches a movie with one.

- a Outline two physiological and two psychological symptoms that Adolina might experience.
  - b How could CBT help Adolina overcome her phobia of flying?
- 6 Explain the role of cognitive bias and catastrophic thinking when using CBT to treat specific phobia.

#### Design and discuss

- 7 CBT uses both cognitive and behavioural approaches. Create a graphic organiser/flow chart to show the processes involved when using this intervention to treat a blood-injection specific phobia.
- 8 “CBT and systematic desensitisation are not compatible therapies.” Evaluate this statement.

# 9.4

## Social interventions for specific phobia

### KEY IDEAS



- ✦ Social interventions include psychoeducation to inform the person, their family and their friends about the specific phobia and treatment options.
- ✦ During psychoeducation, family and friends are instructed on strategies to help the person with the phobia, such as challenging unrealistic thoughts and not encouraging avoidance behaviours.

**social intervention**  
a treatment that targets the social causes or effects of a mental health condition

Working through a specific phobia alone can be an isolating experience. Having support from family, friends and other social connections can significantly help a person with a specific phobia achieve the best therapeutic outcomes. **Social interventions** are treatments that help manage and relieve the social causes and impacts of specific phobia. One of the most common forms of social intervention to help manage mental disorders, including specific phobia, is psychoeducation. This is the practice of educating an individual's social support network about their condition to improve outcomes for the individual.



**FIGURE 1** Managing a specific phobia alone can be an isolating experience. Support from family and friends can help a person with a specific phobia achieve successful therapy.

## Psychoeducation

**psychoeducation**  
educating the person affected by a mental disorder and their support group so each person better understands the condition and treatment options

**Psychoeducation** is a form of social intervention that involves a psychologist or mental health professional educating the family, friends or support network of a person affected by a mental health disorder to improve their understanding of the condition and treatment options. Information learnt during psychoeducation helps to dismantle any misconceptions or stigma surrounding a mental disorder. Psychoeducation also helps to empower the affected individual and allow them to develop more adaptive coping strategies for managing their condition. From the family or support network's point of view, psychoeducation provides much-needed support and an opportunity to discover effective ways of helping their relative, friend or colleague.

Psychoeducation programs for specific phobia:

- provide information about how a specific phobia may have formed through the biopsychosocial framework
- provide insight into what it is like to have a specific phobia – especially in identifying the triggers to the phobic stimulus and the biological, psychological and behavioural processes involved
- acknowledge the impact a specific phobia has on family members and friends
- discuss treatment options for managing the specific phobia, their effectiveness and potential cost
- discuss the stigma around having a mental health disorder and the accompanying embarrassment and shame that may discourage the person from seeking and/or persisting with treatment.

As well as these features, psychoeducation can work to inform family and friends of strategies for helping the affected individual challenge unrealistic thoughts related to their specific phobia. Psychoeducation can also inform family and friends of actions or triggers that may inadvertently encourage avoidant behaviours.



**FIGURE 2** Psychoeducation is a form of social intervention that involves educating the family and friends of a person affected by mental health problems to better understand the condition and treatment options available.

## Challenging unrealistic or anxious thoughts

Consider Sarah, who has an extreme fear of spiders (arachnophobia). As discussed in Topic 9.1, people like Sarah with specific phobia are often prone to cognitive bias and catastrophic thinking. This may present as Sarah having thoughts or exhibiting behaviours such as:

- “All spiders are dangerous.”
- “I need to avoid spiders at all costs because if I get bitten, I might die.”
- “If I don’t vacuum each room thoroughly every day, I may miss a dangerous spider.”

These thoughts are exaggerated and overestimate the actual danger posed by most spiders. However, that is not to say that all spiders are harmless. Sarah has established an automatic, negative and irrational pattern of thinking (and behaving) that perpetuates her specific phobia of spiders. Even if Sarah eventually seeks out treatment for her spider phobia, changing her thinking patterns can be quite difficult when she is between therapy sessions. Therefore, it is important to have an informed support network of family and friends who can assist by challenging unrealistic thoughts. If Sarah’s family are informed through psychoeducation about Sarah’s catastrophic thoughts, they can actively challenge or prevent Sarah from thinking this way.

For example, if Sarah tells a family member that “All spiders are dangerous”, then that family member can challenge that thinking by posing alternative questions such as “What evidence do you have that all spiders are dangerous?” and encouraging Sarah to look this up on the internet. This would show Sarah that there are approximately 46,000 known species of spider and only 30 of these species pose a threat to humans. Psychoeducation will provide other useful questions and suggestions on how to tackle and challenge unrealistic thoughts specific to the person’s phobia.



**FIGURE 3** Sarah’s family can help her realise that not all spiders are dangerous.

## Discouraging avoidance behaviours

Typically, people diagnosed with a specific phobia will avoid objects and situations that trigger their fear. Because avoidance behaviours can provide an individual with relief and temporarily lower feelings of anxiety, they are often reinforced through operant conditioning and frequently repeated. Although avoidant behaviours can provide short-term relief, they do not address the phobia itself. As you learnt earlier in the topic, some avoidant behaviours can be reconditioned by systematic desensitisation. However, sometimes family and friends can inadvertently encourage avoidant behaviours or interfere with reconditioning by removing a phobic stimulus because they do not want their family member to feel distressed.

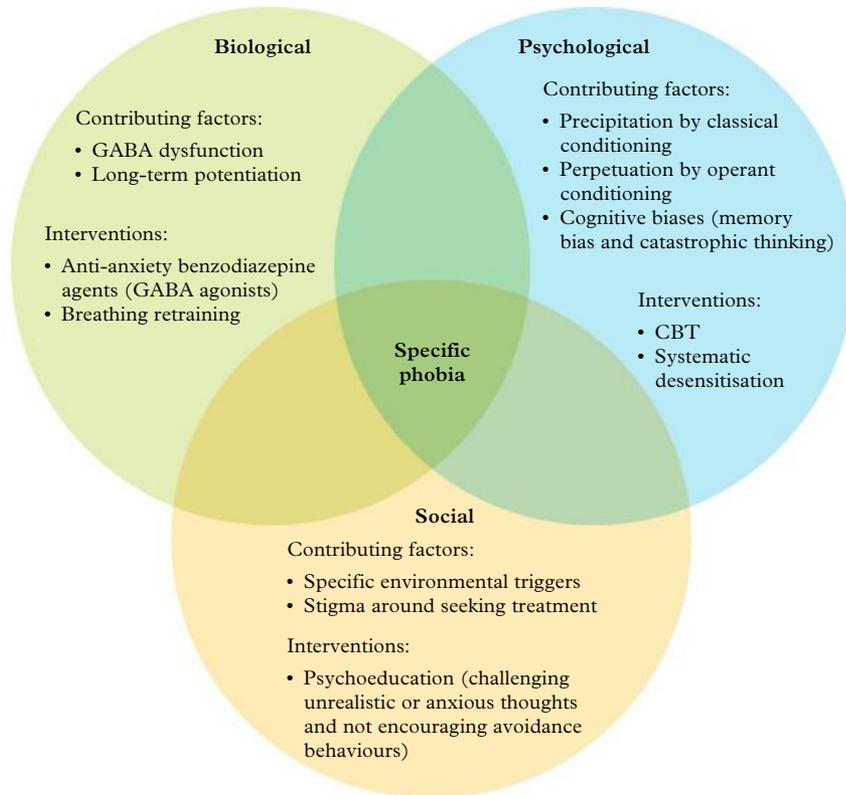
For example, if a person has a phobia of dogs, their family and friends may avoid watching movies with dogs or not show the person a photo of a friend's new puppy for fear of activating the flight-or-fight-or-fear response. Family and friends should not force the person to confront their phobic stimulus; they should use gentle and calm encouragement instead. As with systematic desensitisation, repetition of positive experiences is key to counteracting the fear and anxiety linked to the phobic stimulus. For the dog phobia, once professional treatment has begun, family and friends can reassure the person that dogs are generally not dangerous while walking on lead in the park. Gradually, by gently discouraging avoidance behaviours and challenging unrealistic thinking with facts and information, family and support networks can provide practical and caring support for the person with the specific phobia. This will improve treatment outcomes and increase the person's feelings of acceptance.



**FIGURE 4** Family and friends can often overlook and sometimes encourage avoidance behaviours; psychoeducation can help prevent this from happening.

To help manage a specific phobia, family and friends can also:

- challenge unrealistic or anxious thoughts and help the person replace these with more realistic ones
- encourage positive thinking
- provide evidence to help deter catastrophic thinking
- challenge cognitive and memory bias
- underplay threat information
- participate in stress-relieving activities (e.g. exercising, going for walks)
- help the person with controlled breathing if they experience a panic attack or intense stress response.



**FIGURE 5** This Venn diagram summarises the biopsychosocial factors involved in the development and treatment of specific phobia.

## 9.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe how a psychologist might use psychoeducation for a person with a specific phobia.
- 2 Bobby is embarrassed by her phobia of balloons (globophobia). Her psychologist suggests she participate in a psychoeducation session.  
Explain what psychoeducation is and how the psychologist might use it to assist Bobby with her specific phobia.
- 3 Explain why avoidance behaviours are not a long-term solution for managing a specific phobia.
- 4 If your friend had a specific phobia of flies, describe a social intervention you could use to assist them when you are both at school.

### Apply, analyse and compare

- 5 When Victoria was younger, she was in a boat that capsized, yet her family find it difficult to understand why she is still terrified of boats and

the ocean. Victoria's parents really want to take the family on an ocean cruise and have argued with Victoria, telling her that she is being "silly".

- a Analyse how Victoria's parents' attitudes and behaviours may affect her treatment in dealing with her fear of boats and the ocean.
- b Suggest what information a psychologist could provide to Victoria and her family about her specific phobia to improve outcomes for Victoria.

### Design and discuss

- 6 Design a brochure or presentation about the role of psychoeducation in the management of specific phobia.
- 7 Discuss the role that unrealistic and anxious thoughts and avoidance behaviours have in perpetuating a specific phobia.

## Chapter summary

- 9.1** • A specific phobia is a persistent, irrational and intense fear of a particular object or event.
- Specific phobias are examined by the biopsychosocial approach, which considers the interaction and influence of biological, psychological and social factors.
- Biological factors that may contribute to developing a specific phobia include gamma-aminobutyric acid (GABA) dysfunction and long-term potentiation (LTP).
- Psychological factors that may contribute to developing a specific phobia include the behaviourist models of classical conditioning and operant conditioning as well as cognitive biases (memory bias and catastrophic thinking).
- Social factors that may contribute to developing a specific phobia include environmental triggers and stigma around seeking treatment.
- 9.2** • Evidence-based interventions refer to treatments that have been scientifically tested multiple times (are repeatable), peer reviewed and found to be valid and effective in assisting people with a specific phobia.
- Anti-anxiety benzodiazepines (GABA agonists) are a group of psychoactive drugs that act as depressants on the central nervous system and increase the inhibitory effects of GABA.
- Breathing retraining is a relaxation technique to change an incorrect/abnormal breathing habit (hyperventilation) to a correct/normal breathing pattern to balance oxygen and carbon dioxide levels in the body when faced with a phobic stimulus.
- 9.3** • Cognitive behavioural therapy (CBT) is a psychotherapy based on the premise that our thoughts influence how we feel and behave and combines cognitive and behavioural therapies.
- Systematic desensitisation is a psychotherapy used to treat specific phobia by applying the principles of classical conditioning to counter-condition the phobic response.
- 9.4** • Psychoeducation is a social intervention that involves educating the sufferer of the mental disorder and their family to better understand the condition and treatment options available.
- Psychoeducation works with family and friends to challenge a person's unrealistic thoughts around their phobia and not encourage avoidance behaviours.

## Revision questions

### Multiple choice

- A person may be diagnosed with a specific phobia if:
  - they experience intense temporary fear of an object or stimulus that lasts for three weeks.
  - they feel startled by jump scares in movies.
  - GABA has an inhibitory effect on the neurons in their CNS.
  - their fear prevents them from going to work and catching up with friends.
- Hilton has a specific phobia of injections. When he knows that there will be a vaccination at school, he begins to over-breathe, altering the balance of oxygen and carbon dioxide in his body.

Hilton is experiencing:

  - hyperventilation.
  - GABA dysfunction.
  - classical conditioning.
  - operant conditioning.
- GABA dysfunction is thought to predispose a person to developing a specific phobia.

This is because:

  - there is too little GABA in the axon.
  - the inhibitory effects of glutamate interfere with GABA receptors.
  - insufficient GABA increases the effects of glutamate.
  - there is an absence of GABA in the axon terminals.
- Long-term potentiation is thought to contribute to the development of a specific phobia by:
  - storing threat information in the amygdala.
  - frequently activating the flight-or-fight-or-freeze response.
  - the repeated activation of a fear pathway.
  - pruning unnecessary neural pathways not related to the phobia.
- When Patak was attacked by a dog, his amygdala and hippocampus were both involved in processing this frightening event. The:
  - amygdala processed information about how large and aggressive the dog appeared.
  - hippocampus stored the emotional aspects of the event.
  - amygdala consolidated the fear response associated with the dog.
  - hippocampus triggered the amygdala to recognise the dangerous situation.
- GABA and glutamate play key roles in anxiety disorders such as specific phobia. The role of:
  - GABA is as the primary excitatory hormone in the central nervous system.
  - glutamate is as the main excitatory hormone in the peripheral nervous system.
  - GABA is to counteract glutamate's inhibitory effects on the postsynaptic neuron.
  - GABA is to work with glutamate to balance arousal levels in the body.



7 Classical conditioning:

- A perpetuates a specific phobia by associating the conditioned stimulus and the conditioned response.
- B requires repeated pairing of the unconditioned stimulus and conditioned response.
- C precipitates a specific phobia through the pairing of the neutral stimulus and the unconditioned response.
- D only requires one reinforcement of the unconditioned stimulus to develop a conditioned response.

- 8 Sahara's phobia of lifts began when they went to visit their grandmother in a high-rise apartment. While taking the lift to their apartment, it stopped between floors. It took three hours for Sahara to be rescued. Since then, Sahara is unable to enter a lift and usually takes the stairs.

In terms of operant conditioning, which of the following is correct?

- A The antecedent is the lift breaking down; the consequence is positive reinforcement.
- B The antecedent is Sahara's fear of lifts; the consequence is negative reinforcement.
- C The behaviour is Sahara avoiding lifts; the consequence is negative punishment.
- D The behaviour is Sahara climbing the stairs; the consequence is positive punishment.



FIGURE 1 A high-rise apartment

- 9 When Selene went to school one morning with a friend, she was swooped by a magpie. Since then, Selene refuses to walk to school as she is terrified that she will be swooped again. Selene's recall of the event is quite different from that of her friends. A few weeks later, another friend asks her to describe the event. Selene identifies the bird as a much larger black bird and reports that it screeched loudly and hit her head.

Selene is showing:

- A cognitive distortions and memory bias.
- B memory and cognitive bias.
- C catastrophic thinking and memory reconstruction.
- D memory reconstruction and attentional bias.



FIGURE 2 A magpie

- 10 When a person is diagnosed with a specific phobia, psychoeducation is used to:
- A encourage family and friends to assist the person with a specific phobia.
  - B inform the person, their family and social network about the condition, treatment options and strategies to deal with the phobia.
  - C provide education to the family confidentially so the person with the phobia is not embarrassed.
  - D teach a range of strategies so that the family and friends understand what the person is going through.

### Short answer

#### Describe and explain

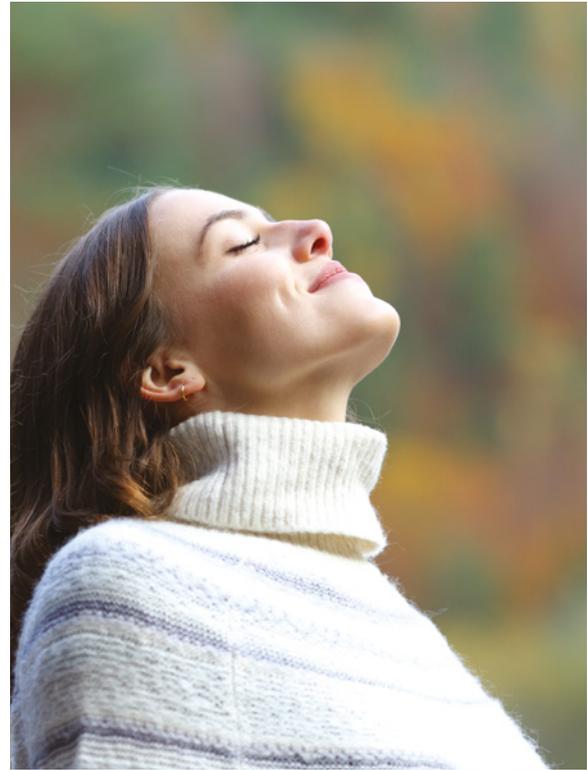
- 11 Describe the biological processes involved in GABA dysfunction.
- 12 Explain the role of the amygdala and hippocampus in specific phobia.
- 13 Describe the role of the stress response and how it is related to specific phobia.
- 14 Explain how long-term potentiation contributes to the development of a specific phobia.
- 15 A person with a dog phobia experiences both physiological and psychological symptoms. Suggest two of each and explain why they occur.



**FIGURE 3** Cynophobia is the fear of dogs.

- 16 The social approach to phobia looks at how environmental triggers contribute to the development of a specific phobia. Describe the different types of environmental triggers and their possible effects.
- 17 Draw up a three-column table and label the columns “Biological interventions”, “Psychological interventions” and “Social interventions”. Under each heading, describe each intervention for specific phobia and summarise how it acts to improve different biopsychosocial contributing factors.
- 18 Explain why taking medication such as an anti-anxiety benzodiazepine agent (GABA agonist) to manage a specific phobia can be helpful in the short term, but not in the long term.

- 19 Explain why breathing retraining is best used with other treatments.



**FIGURE 4** Breathing retraining is often used alongside other treatments.

- 20 Describe the role of systematic desensitisation in CBT.
- 21 Describe why people with specific phobia tend to remember the threatening aspects of a traumatic event and ignore other more positive information.
- 22 Explain why avoidance behaviours are considered maladaptive for people with specific phobia.

#### Apply, analyse and compare

- 23 Researchers wanted to investigate which evidence-based intervention would be most suited to a person with a spider phobia.

They chose to conduct their research using systematic desensitisation and anti-anxiety benzodiazepines (GABA agonists). Compare the two interventions and assess which might be more effective in treating arachnophobia (a fear of spiders).

- 24 Compare the results of imagining a phobic stimulus with direct exposure to a phobic stimulus.
- 25 A researcher wished to explore how CBT can be used to treat people with a specific phobia of dentists. Thirty people volunteered to participate in the study. All participants completed a questionnaire to determine the severity of their phobia. Participants were then matched on their results and randomly allocated to either Group 1 or Group 2. Group 1 was taught relaxation techniques for the behavioural aspect of CBT before commencing treatment. Group 2 was not taught any relaxation techniques.
- Write down the steps that the researcher used when administering CBT for Group 1.
  - Which of the two groups would you expect to report fewer phobic symptoms after the study?
  - In a follow-up to this study, the same researcher recruited a new group of participants with the same phobia. All participants were instructed to attend a dental clinic for six appointments. This time, Group 1 was exposed to CBT, with the relaxation technique taught before commencing CBT, while Group 2 was administered two doses of an anti-anxiety benzodiazepine agent before going to the dentist for the first and second appointments.



FIGURE 5 Dentophobia is the fear of dentists.

- Which of the two groups would you expect to report fewer symptoms after six weeks of treatment? Justify your response.
- Explain why the researcher conducted the study in a dentist's clinic.
- Suggest an alternative evidence-based intervention that the researcher could use in the future.



FIGURE 6 Xanax is a well known benzodiazepine.

- 26 Suggest and outline one biological factor and one psychological factor that can lead to the development of a specific phobia.
- 27 Use a diagram to illustrate how classical conditioning can be used to counter-condition a specific phobia. Make sure that you use the language of classical conditioning (neutral stimulus, unconditioned stimulus, unconditioned response, conditioned stimulus, conditioned response).
- 28 Compare cognitive bias, memory bias and catastrophic thinking.

### Design and discuss

**29** A friend at school suffers from a specific phobia of bees. They are reluctant to seek professional help even though they refuse to go outside during recess and lunchtime and insist on wearing hats and hoodies when travelling to and from school. Consider what information you could share with them to convince them that seeking help from a professional may help them to overcome their phobia. Construct a short script of what you could say based on information covered in this chapter.



**FIGURE 7** Melissophobia is the fear of bees.

- 30** Design a poster to illustrate the biopsychosocial model of how specific phobia are developed and the corresponding treatment options.
- 31** “Psychoeducation is pointless if a person with a specific phobia does not have immediate family.” Evaluate this statement.
- 32** Discuss why it is important to use evidence-based interventions to treat specific phobia.
- 33** You have been asked to create a short video clip to illustrate the use of systematic desensitisation for a person with a phobia of dogs. How would you go about preparing the script, selecting an actor and dog? Create a storyboard to note down each step and scene.

You can find the following resources for this section in your [obook pro](#):

pro

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

# 10

## Maintenance of mental wellbeing

### KEY KNOWLEDGE

- the application of a biopsychosocial approach to maintaining mental wellbeing, with reference to protective factors including adequate nutritional intake and hydration and sleep (biological), cognitive behavioural strategies and mindfulness meditation (psychological) and support from family, friends and community that is authentic and energising (social)
- cultural determinants, including cultural continuity and self-determination, as integral for the maintenance of wellbeing in Aboriginal and Torres Strait Islander peoples.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

### GROUNDWORK

This chapter will build on concepts you will have come across in Chapters 7, 8 and 9 as well as content you may have come across in Units 1 and 2 Psychology. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



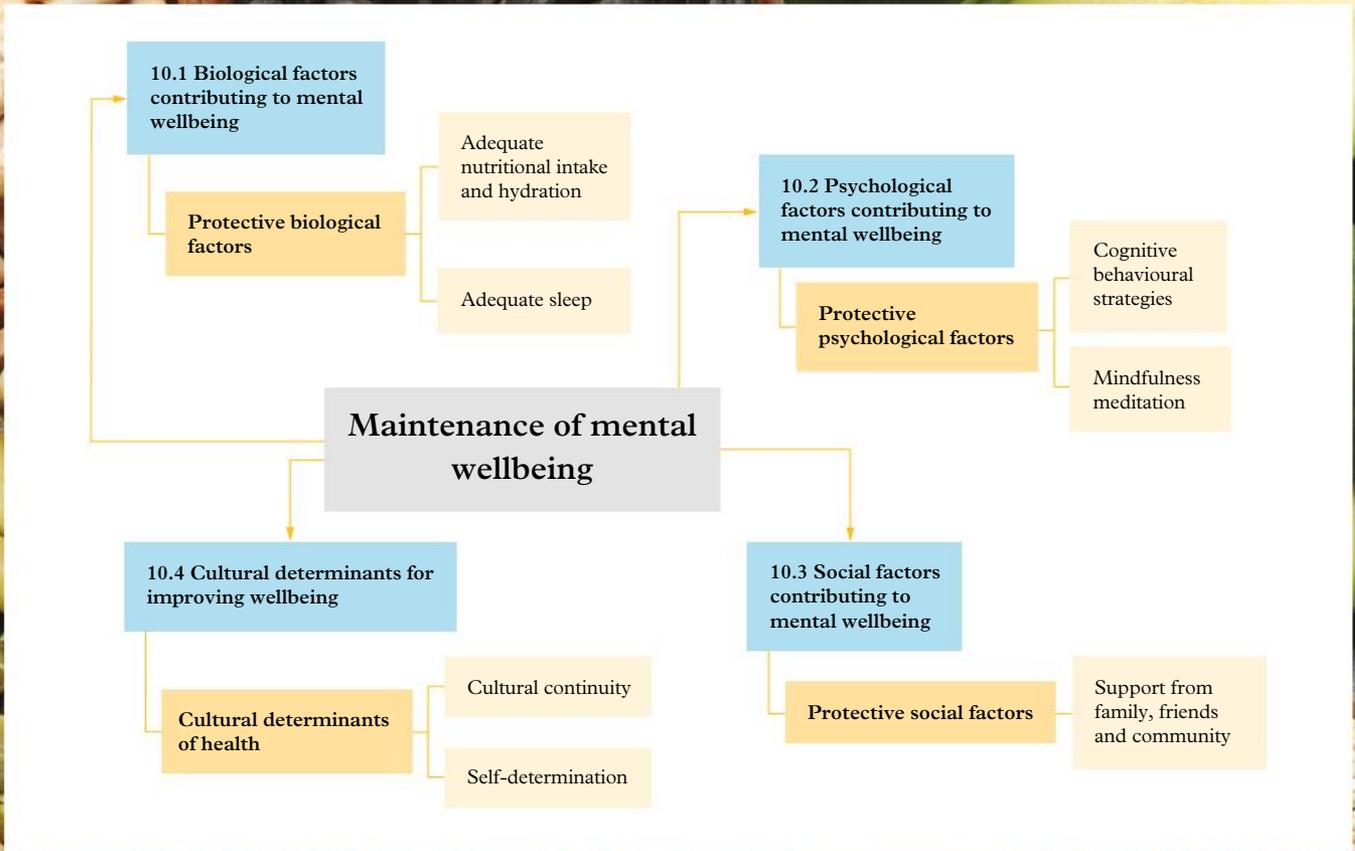
Groundwork quiz  
Chapter 10

### INVESTIGATIONS

10.1	<b>INVESTIGATION: CORRELATIONAL STUDY</b>	Is there a relationship between daily water intake and perceived levels of mental wellbeing?	Page 494
10.2	<b>INVESTIGATION: CONTROLLED EXPERIMENT</b>	Does mindfulness meditation improve relaxation?	Page 495

**FIGURE 1** Do you consume a healthy diet that allows you to obtain the right amount of energy and nutrients? Adequate nutritional intake is an important protective biological factor for maintaining mental wellbeing.

## CONCEPT MAP



\* **CONTENT WARNING:** Aboriginal and Torres Strait Islander people are advised that this chapter may contain images of people who are now deceased.

# 10.1

## Biological factors contributing to mental wellbeing

### KEY IDEAS

- ✦ Mental wellbeing can be enhanced and promoted by having an adequate nutritional intake and hydration and getting enough sleep.



### Protective biological factors

In Chapter 9, you learnt about how the biopsychosocial approach recognises the influence that biological, psychological and social factors can have on a person's health and mental wellbeing. Some factors can increase our mental wellbeing, whereas others may reduce our mental wellbeing. Protective factors are biological, psychological and social factors that can improve the health and mental wellbeing of an individual. Protective factors may work by increasing the likelihood of achieving high levels of mental wellbeing or decreasing the risk of developing low levels of mental wellbeing or a mental health problem. Protective factors are the opposite of **risk factors**, which increase our chances of developing a mental health problem or lower our levels of mental wellbeing.

#### risk factor

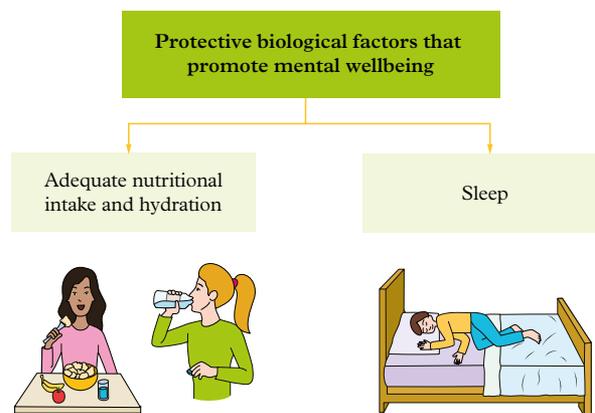
a biological, psychological or social factor that increases the chances of developing a mental health problem or lowers our levels of mental wellbeing



**FIGURE 1** Eating a balanced diet rich in nutrients is a protective biological factor.

In this topic, we will look at two biological protective factors that can influence mental wellbeing and how to use them to our benefit. The two factors are:

- adequate nutritional intake and hydration
- sleep.



**FIGURE 2** Protective biological factors that promote mental wellbeing

## Adequate nutritional intake and hydration

Individual people require different amounts and types of food and different nutrients and fluids to feel healthy, satisfied and energised. Daily food recommendations vary according to age, sex, lifestyle, medical requirements and individual health goals. For example, someone who is gluten intolerant needs a diet that avoids products rich in gluten, such as those made of wheat, barley or rye. Alternatively, someone who is not gluten intolerant and exercises a lot every day may consume more foods rich in wheat, barley or rye for their high energy content.

There is no one optimal diet that everyone should follow. Rather, each person should aim to have an **adequate nutritional intake** – a variety of foods that helps them maintain good health and wellbeing. Adequate nutritional intake is not determined by how a person looks or weighs but is determined by which foods make them feel both physically and mentally well.

**Hydration** is the act of maintaining an appropriate level of water in the body. In addition to consuming the right food, our bodies need to achieve adequate hydration. Having an adequate amount of water in the body ensures that our body temperature is regulated, our joints are lubricated, our cells can transport nutrients and our organs can function properly. Adequate hydration also improves our sleep quality, cognitive function and overall mood.

To obtain adequate hydration, most health experts recommend we drink between 2 and 3.7 L of water a day. This should mostly come from plain water, but can also be obtained from flavoured water, herbal teas, black coffee and water-rich fruits and vegetables. You should avoid soft drinks and other high-sugar liquids as a source of hydration because their additives may negatively affect health.

Advice for maintaining adequate nutritional intake and hydration to promote mental and physical health includes:

- eat a variety of foods from the five main food groups in the appropriate proportions
- limit foods that are not from one of the five main food groups; these foods that are high in sugar, salt, fat, alcohol or other substances are not considered essential for good health
- eat regularly throughout the day without skipping meals
- drink plenty of water
- avoid relying on alcohol, caffeine, supplements, drugs and energy drinks.



**FIGURE 3** A person who is gluten intolerant must avoid foods that contain wheat, whereas someone who is not gluten tolerant and wants to have a high energy intake can consume foods high in gluten.

### adequate nutritional intake

a diet which involves eating a variety of foods which helps you maintain good health and makes you feel well

### hydration

the extent to which a person maintains an appropriate amount of water in their body



ClickView

You are what you eat!



**FIGURE 4** **a** The best way to maintain adequate hydration is to drink lots of plain water. **b** Drinking many high-sugar soft drinks or energy drinks can pose health risks that negatively affect wellbeing.

# Australian Guide to Healthy Eating

Enjoy a wide variety of nutritious foods from these five food groups every day.  
Drink plenty of water.



**FIGURE 5** An adequate diet generally contains appropriate amounts of food from each of the five food groups. It is recommended that we consume only small amounts of foods outside these groups.

## Impact of nutrition and hydration on mental wellbeing

Fuelling our bodies with recommended nutrients and water ensures that we have adequate resources and energy to function physically and mentally. It also reduces the likelihood of us falling sick and suffering physical health problems. This allows us to operate effectively within our environment and ensures that our body and brain have the resources to cope with any challenges we face throughout the day. Adequate nutritional intake is important for good sleep hygiene (Chapter 7) to achieve quality sleep, another protective biological factor that influences mental wellbeing.

## 10.1A SKILL DRILL

### Analysing and evaluating nutrition data

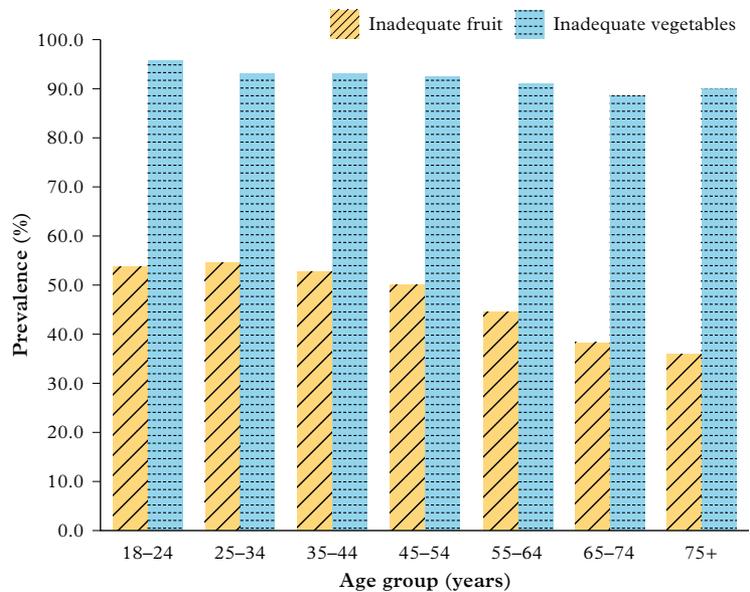
#### Key science skill: Analyse and evaluate data and investigation methods

The Australian Institute of Health and Welfare collected data on whether adults were consuming enough fruit and vegetables. The results of their research are presented in Figure 6.

#### Practise your skills

- 1 Identify whether the data collected to create this graph is quantitative or qualitative. Justify your response.
- 2 Describe one age-related trend visible in this graph.
- 3 Write a possible conclusion that can be drawn from this data, in which you refer to the consumption of fruit and vegetables in adults.

Need help analysing data? Go to Topic 1.7 in your Psychology toolkit.



**FIGURE 6** The prevalence of inadequate fruit and vegetable intake for people aged 18 and over, 2017–2018

## Adequate sleep

As you will recall from Chapter 7, sleep is another factor that can affect our mental wellbeing. Although your sleep quality and quantity can be affected by a range of biological, psychological and social factors, sleep itself is a biological factor that we have some control over. For most people, it is possible to work out how much sleep we require and implement changes so that we regularly get enough sleep to improve wellbeing. When we achieve an adequate amount of sleep, sleep acts as a protective biological factor in relation to mental wellbeing.

**Adequate sleep** generally refers to achieving the correct quality and quantity of sleep required for an individual to feel refreshed. Getting adequate sleep ensures that our body and mind can be restored and replenished from the energy-depleting activities of the day before, providing us with the resources and cognitive ability to do it all again the following day.

Like nutritional intake, the amount of sleep needed per night varies depending on a range of factors including age, health and lifestyle. For optimal physical and mental wellbeing, it is recommended that school-age children sleep about ten hours each night, teenagers sleep about nine hours and adults sleep about eight hours. However, these recommendations are just rough guidelines. Specific sleep requirements vary at an individual level.

**adequate sleep**  
the quality and quantity of sleep that an individual requires to feel refreshed



**FIGURE 7** This person has been sleeping soundly for about eight hours. How many hours of sleep do you average in a night?

## Impact of sleep on mental wellbeing

Inadequate sleep or sleep deprivation can have a negative impact on both physical and mental health, simultaneously affecting our overall wellbeing. Poor sleep is a significant risk factor for mental health disorders. You have probably experienced a time when you have been partially or totally sleep-deprived and noticed a resulting difference in your affect, behaviours and cognitions. Maintaining adequate sleep helps to prevent these negative occurrences and enhances mood, memory, concentration and coordination, leading to an overall more positive and functional state of wellbeing. Information on how to improve your quality and quantity of sleep can be found in Topic 7.3.

### 10.1 WORKED EXAMPLE

#### Identifying biological risk and protective factors

Gigi is a 27-year-old woman who has been staying up very late recently to play a new video game. Gigi's love of the game has caused her to neglect various things in her life. Because Gigi spends seven hours each night after work gaming, she:

- no longer consumes a range of healthy foods and only has meals delivered because she has less time to cook
- no longer makes time to see her friends
- fails to get adequate sleep.

Identify two potential biological risk factors that may be negatively affecting Gigi's mental wellbeing, and propose two lifestyle changes to improve wellbeing through biological protective factors. (4 marks)

#### Solution

Think	Do
Step 1: Identify the command terms used in the question and determine what they require.	The question asks you to "identify" something. This means that you should recognise and name it. The question also asks you to "propose" something. This means that you should suggest or put forward an idea based on the given information.
Step 2: Look at the mark allocation to determine how many pieces of information are required.	The question is worth 4 marks: <ul style="list-style-type: none"> <li>• 2 marks for two correct biological risk factors</li> <li>• 2 marks for two recommendations to improve wellbeing through use of biological protective factors.</li> </ul>
Step 3: Recall that risk factors are those that contribute to lower health or wellbeing and biological factors are those that relate to internal physiological factors. Apply this understanding to the scenario.	One biological risk factor affecting wellbeing is inadequate sleep. (1 mark) A second biological risk factor is poor diet. (1 mark)
Step 4: Recall that protective factors are those that contribute to improved health or wellbeing.	One biological protective factor for getting adequate sleep would be for Gigi to cut down her play time. (1 mark) Another biological protective factor would be to have adequate nutritional intake. Rather than ordering junk food, Gigi could order a range of healthy prepackaged or fresh meals for delivery to ensure she is consuming a range of nutrients. (1 mark)

## 10.1B SKILL DRILL

### Planning and conducting sleep investigations

#### Key science skill: Plan and conduct investigations

Dr Jordan is conducting an experiment to determine whether getting a full night of sleep impacts the wellbeing of Year 12 students.

**a** Write a research hypothesis for this investigation.

- b** Suggest an independent variable and dependent variable for this investigation and describe how each could be either implemented or measured.
- c** Identify three extraneous variables that could affect this investigation. Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.

## Study tip

In addition to supporting mental wellbeing, adequate sleep improves cognitive functions (including learning and memory). Your brain needs time to consolidate information while you sleep. Remember this next time you think about staying up a few more hours for some extra study. This may not be the wisest choice if it leads you to feeling tired and operating less effectively the following day!

## 10.1 CHECK YOUR LEARNING

### Describe and explain

- 1 Explain what it means to have an adequate nutritional intake.
- 2 Explain what it means to get adequate sleep.
- 3 Describe how adequate sleep and adequate nutritional intake can promote mental wellbeing from a biological perspective.
- 4 Identify one similarity between adequate diet and adequate sleep.

### Apply, analyse and compare

- 5 Describe what adequate sleep generally means for you. Compare this to what adequate sleep means for another person you know.
- 6 Consider the kinds of foods you have eaten so far this week. Compare this to what is recommended as part of the Australian Guide to Healthy Eating (Figure 5).

### Design and discuss

- 7 Discuss your own sleep and diet habits. Include one way you think your sleep and nutritional intake are adequate and suggest one way you could improve them.

- 8 Design a controlled experiment to test the effect of junk food on mental wellbeing. In your design, include:
  - a** the independent and dependent variables and how they will be measured and applied
  - b** a research hypothesis
  - c** an explanation of two extraneous variables that could affect investigation results and suggestions for how each variable could be controlled or removed.



# 10.2

## Psychological factors contributing to mental wellbeing

### KEY IDEAS



- ✦ Cognitive behavioural strategies and mindfulness meditation are two psychological protective factors that aim to promote mental wellbeing.
- ✦ Cognitive behavioural strategies are strategies derived from cognitive behavioural therapy that encourage people to identify unhelpful cognitions and behaviours and replace them with more helpful ones.
- ✦ Mindfulness meditation promotes calmness and relaxation by focusing one's attention inward and on present feelings and sensations rather than on stressors.

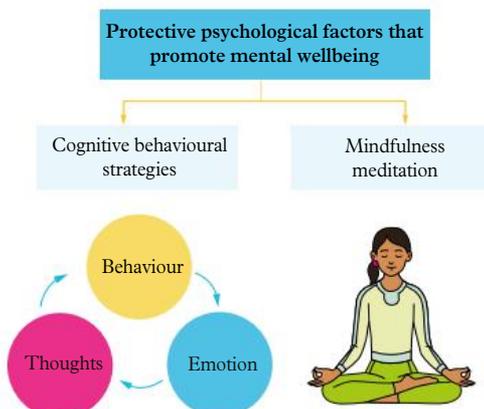
### Protective psychological factors

Psychological factors are factors that influence cognitive, affective and behavioural functioning. These factors originate from within the mind and play a significant role in our overall levels of mental wellbeing. In this chapter, we will explore two psychological protective factors that can be used to promote mental wellbeing and help protect against the occurrence or recurrence of mental health problems. The two factors are:

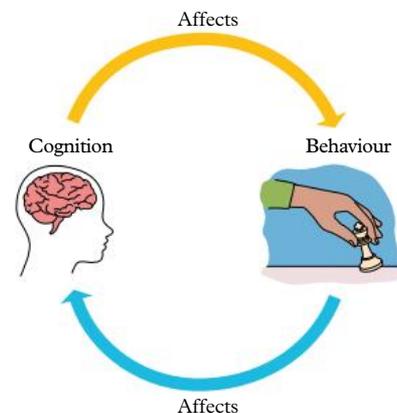
- cognitive behavioural strategies
- mindfulness meditation.

### Cognitive behavioural strategies

In Chapter 9, you learnt that cognitive behavioural therapy (CBT) is a type of psychotherapy based on the idea that how we think and feel affects the way we behave and vice versa. For example, consider the cognitions and behaviours outlined in Figure 3. If you have a test in four weeks, you might think that studying for it is not important, given that the test is weeks away. Because of this, you may choose to spend your evening playing video games instead. However, one week before the test, your thoughts around studying may change. Now you believe that studying for the test is important, so you knuckle down and get to work. In this example, your thoughts and beliefs (about the importance of the test) affected your behaviour (studying for the test).



**FIGURE 1** Protective psychological factors that promote mental wellbeing



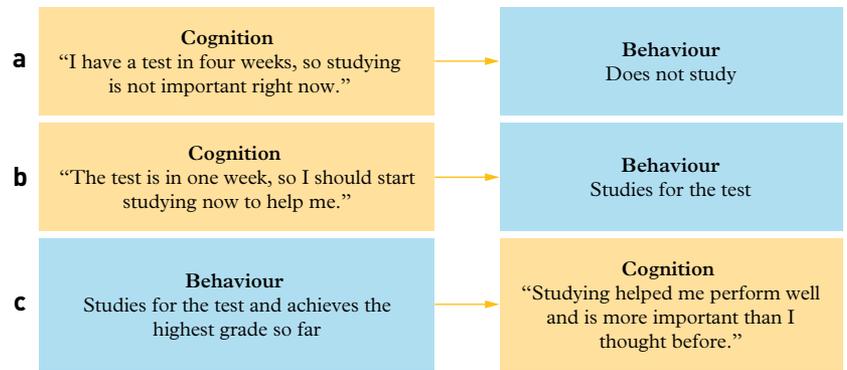
**FIGURE 2** CBT takes advantage of the bidirectional relationship between cognition and behaviour.

Our behaviour can also affect our cognitions. For example, if you studied for the test and it helped you achieve your highest grade, this behaviour could change your perception of how important studying is (the cognition). In each example, cognitions and behaviours have been changed from unhelpful or maladaptive to more useful and adaptive alternatives. Now that we understand the process, we can see how it could be used to promote mental wellbeing.

**Cognitive behavioural strategies**

are strategies derived from CBT that aim to empower individuals to identify unhelpful thoughts and behaviours and replace them with more helpful alternatives. These strategies can often be implemented without the assistance of a psychologist, making cognitive behavioural strategies a valuable protective factor for individuals seeking to restructure their thoughts and behaviours for improved mental wellbeing.

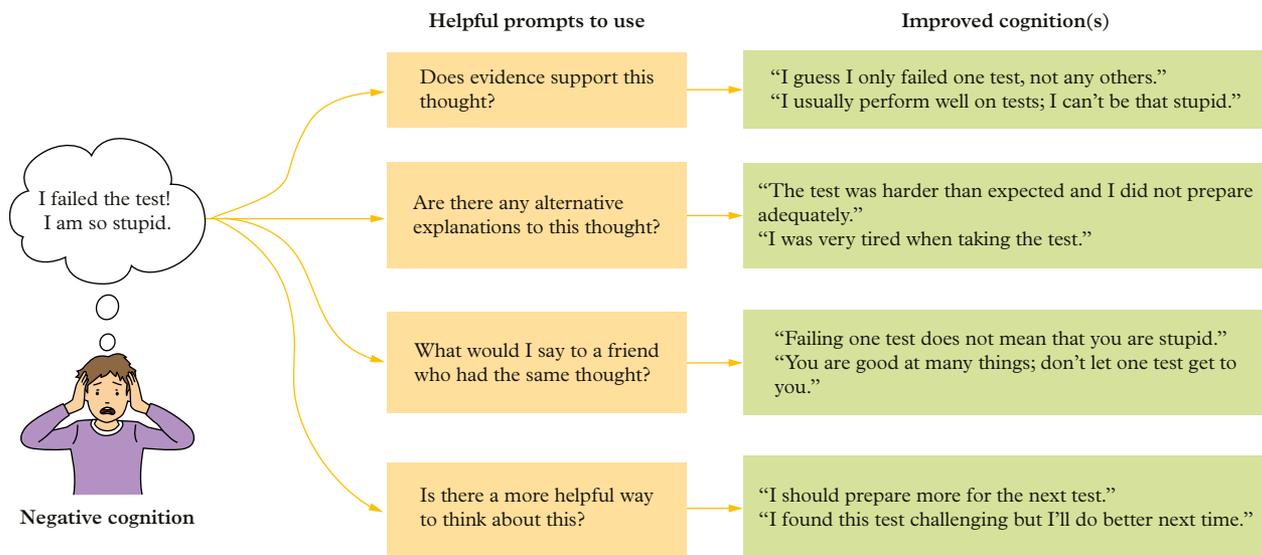
The first stage of applying a cognitive behavioural strategy is identifying any maladaptive cognitions or behaviours. For example, you might notice that your self-talk when you look in the mirror is overly critical, or that your excessive phone use before bed is interfering with your sleep. Once a problematic cognition or behaviour has been recognised, you can actively work on changing or replacing it with a more positive and adaptive alternative. Figure 4 provides a variety of prompts that can assist in challenging and modifying unhelpful cognitions.



**FIGURE 3** a, b How cognitions can affect the behaviours we chose to engage with. c Behaviours can also influence cognitions.

**cognitive behavioural strategy**

a strategy derived from CBT that encourages people to identify unhelpful cognitions and behaviours and replace them with more helpful ones



**FIGURE 4** A variety of prompts that can assist in challenging and modifying unhelpful cognitions

In addition to cognitive modifications, behavioural changes can also be addressed through cognitive behavioural strategies. This might involve practising techniques such as breathing retraining, mindfulness meditation, exercise or any other behaviour that promotes mental or physical wellbeing. By employing cognitive behavioural strategies, individuals can proactively

address negative thought patterns and behaviours, fostering increased mental wellbeing. Through consistent effort and practice, unhelpful thoughts and behaviours can be replaced with more positive and adaptive ones, contributing to enhanced mental health and overall psychological resilience. An example of how changing cognitions and behaviours can promote mental wellbeing is provided in Real-world psychology 10.2.

## 10.2 REAL-WORLD PSYCHOLOGY

### Replacing maladaptive cognitions using cognitive behavioural strategies

Gina is a 35-year-old nurse who has had to quit her job to become a full-time carer for her elderly mother. Caring for her mother has become very demanding and Gina feels guilty if she leaves her mother alone for more than 30 minutes at a time. Because of this, Gina rarely takes time off to relax and unwind. This has led to Gina feeling stressed, isolated and hopeless.

Since Gina believes that taking time for herself is not important in her circumstances, she is unlikely to make time for herself. However, if she can change the way she thinks about this behaviour, she can also change the likelihood of her choosing to engage in it.

If Gina were to use cognitive behavioural strategies to try to improve her wellbeing, a psychologist would instruct Gina to start thinking about her own free time as essential, rather than indulgent. This change in cognition would likely change her behaviour, because by viewing rest and relaxation as important rather than something to be avoided, she is more likely to engage in behaviours that provide her with a break and relaxation, reducing her stress. By changing the behaviour, and getting more time to herself, she is also likely to further modify her cognitions in how much she values her relaxation time because of how much better it makes her feel.

Gina's story demonstrates how replacing maladaptive cognitions with more useful ones is likely to change your behaviour to be more adaptive, too. The same is true of behaviours – changing maladaptive behaviours to more helpful ones is likely to help reframe your thoughts to be more positive and useful. In terms of promoting wellbeing, cognitive behavioural strategies are useful in improving mood, optimism and resilience.

#### Study tip

When responding to exam questions about CBT or related strategies, you need to mention both the cognitive and the behavioural components of the therapy, as well as how they influence each other. This has been made clear by past VCAA exams.

### Apply your understanding

- 1 Identify one unhelpful cognition and one unhelpful behaviour that Gina demonstrated.
- 2 Identify one helpful cognition and one helpful behaviour that Gina could display after implementing cognitive behavioural strategies.
- 3 Using Gina as an example, explain how changing behaviour can lead to changing cognition.
- 4 Using Gina as an example, explain how changing cognition can lead to changing behaviour.

## 10.2 SKILL DRILL

### Planning and conducting mood investigations

#### Key science skill: Plan and conduct investigations

Imagine that you are a researcher testing how effective the implementation of cognitive behavioural strategies has been in improving mood in adolescents.

**a** Identify a possible IV and DV for this investigation.

**b** Design three survey questions that could collect qualitative data for this investigation.

**c** Design three survey questions that could collect quantitative data for this investigation.

Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.

## Mindfulness meditation

When you are feeling sad, stressed or anxious, your mind tends to focus on the past or the future. Many people spend too much time focusing on the past or future and neglect to focus on or experience the present moment. **Rumination** is the act of repeatedly dwelling on negative feelings and cognitions and is common among people with mental health problems such as anxiety and depression. Excessive rumination can perpetuate and intensify low levels of mental wellbeing.

**Mindfulness meditation** is a tool you can use to help anchor your mind to the present moment, and can be particularly helpful when you're feeling distressed, anxious or sad. Often, when our minds are troubled, they are entangled in thoughts of the past or anxieties about the future, causing us to overlook the reality of the present moment.

Mindfulness meditation as a technique encourages reaching a state of tranquillity and relaxation by honing your focus onto the here and now. It consists of two key components: **attention** and **acceptance**.

The attention component requires you to turn your focus inward, noticing internal states and sensations such as thoughts, feelings, physical sensations and the rhythm of your breath. It might seem strange at first, but, with practice, mindfulness becomes more intuitive and accessible.



**FIGURE 5** When practising mindfulness meditation, you should choose a comfortable position either **a** lying down or **b** sitting up. You can practise mindfulness with an aid, such as a guided meditation audio, or independently.



#### ClickView

Does meditation really affect your brain?

#### **rumination**

thinking or focusing repeatedly on negative feelings or thoughts

#### **mindfulness meditation**

a practice designed to induce a state of calmness and relaxation by focusing attention on present feelings and sensations

#### **attention**

a component of mindfulness meditation that involves focusing on inner thoughts and the sensations around us

#### **acceptance**

a component of mindfulness meditation that involves feeling comfort with the thoughts and feelings that come to mind

The acceptance component consists of acknowledging and being at ease with feelings and sensations that come to mind. This helps you to process what you are feeling in a safe space without judgment. You can practise mindfulness independently or with a form of assistance, such as a guided meditation recording. You should choose a position, whether seated or lying down, that allows you to be comfortable yet attentive.

By anchoring your awareness in the present, mindfulness meditation helps divert your mind from ruminating on the past or worrying about the future. This immediate shift can bring about a sense of calm and relaxation. Additionally, it can enhance your mood, sharpen your concentration, and promote focus. This makes mindfulness an ideal “brain break” during periods of work or study. Consistent practice of mindfulness meditation can yield significant long-term benefits. Regular mindfulness exercises have been shown to decrease levels of stress, anxiety and depression while promoting overall mental wellbeing. How about giving it a go? You can try a quick 5–4–3–2–1 activity when you want to feel more connected with the present (Figure 6).

### 5-4-3-2-1 grounding technique



**FIGURE 6** Stop for a moment and take time to identify and acknowledge each of the things you sense.

## 10.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify and describe two psychological protective factors.
- 2 Explain the purpose of cognitive behavioural strategies and how they can improve mental wellbeing.
- 3 Describe the short-term and long-term effects of mindfulness meditation on mental wellbeing.

### Apply, analyse and compare

- 4 Explain why practising the grounding technique identified in Figure 6 would be an example of mindfulness meditation.
- 5 Analyse the bidirectional relationship between cognitions and behaviours. Use an example to illustrate your response.

- 6 In the lead-up to Christmas, Dominic is incredibly stressed. He often finds himself reflecting on how sad his previous Christmas was due to the passing of his father. Dominic also worries about how he is going to pay for his children’s Christmas presents after being made redundant earlier in the year.

Compare how mindfulness meditation and cognitive behavioural strategies could be used to improve Dominic’s mental wellbeing in the lead-up to Christmas.

### Design and discuss

- 7 Identify three unhelpful cognitions or behaviours that you have experienced in the last week. Discuss how you could alter each of these to be more adaptive for your mental wellbeing.

# 10.3

## Social factors contributing to mental wellbeing

### KEY IDEAS

- ✦ Support from family, friends and community can act as a social factor to protect and promote mental wellbeing.
- ✦ Support from family, friends and community should be authentic and energising for it to have positive effects on mental wellbeing.



### Protective social factors

Interacting with others demands both mental and physical effort. Individuals grappling with low levels of mental wellbeing or experiencing mental health challenges may feel that they need to restrict social interactions to preserve energy for coping with their own struggles. This can often isolate struggling people from potential support networks. Research has shown that withdrawing from others can be detrimental to mental wellbeing.

#### social factor

a factor that influences mental health and which originates from or relates to an individual's relationship with their external environment

Protective social factors that promote mental wellbeing

Support from family, friends and community



**FIGURE 1** Protective social factors that promote mental wellbeing

Recall from Chapter 9 that social factors originate from or relate to an individual's relationship with their external environment. **Social factors** include friends, culture, levels of education, community, wealth, family and occupation. Protective social factors are those that work to improve our physical health and/or mental wellbeing. For example, having an understanding group of friends to console you in times of distress is a protective social factor. In this topic, we will examine how support from family, friends and community that is authentic and energising can act as a protective social factor to promote mental wellbeing.



**FIGURE 2** When grappling with low levels of mental wellbeing or with feelings of distress, many people will withdraw from being social.



**FIGURE 3** A supportive family, friends or community can help promote mental wellbeing.

## Support

Have you ever reached out to a friend or family member for consolation when you were upset? If so, it is likely you were seeking their assistance to help reduce or improve your experience of distress. **Support** refers to assistance provided by people to each other and is an example of a social factor that can contribute positively to mental wellbeing. For support to be effective in promoting mental wellbeing, it should be authentic and energising.

### support

the assistance people provide to each other

### authentic support

assistance or care that is genuine and sincere and encourages the sharing of true feelings and thoughts without fear of judgment or rejection

### energising support

assistance or care that helps an individual feel revitalised and enthusiastic or provides them with energy to cope with stressors

### Authentic and energising support

**Authentic support** is assistance or care that is genuine and sincere. Authenticity encourages trust and openness in relationships. If a person feels that the social support they are receiving is authentic, they will be more likely to share their true feelings and thoughts without fear of judgment or rejection. This honesty can lead to better understanding, empathy and, ultimately, more effective support. Authentic relationships can also improve self-esteem and self-worth because they reinforce the idea that an individual is valued and understood for who they truly are.

Social support should also provide a sense of energy or upliftment. As mentioned earlier, during times of distress we often feel as though we do not have enough energy or resources to effectively manage all aspects of our life. **Energising support** is support that helps an individual feel revitalised and enthusiastic or provides them with energy to cope with stressors. This support can be provided through different means such as inspiring conversations, shared positive experiences, taking on extra work or duties to reduce someone else's burden or by simply providing company. These social interactions can help combat feelings of loneliness and isolation, reduce stress, and promote a positive mood.



**FIGURE 4** Energising support helps to uplift an individual.

### Support from family, friends and community

Support can come from various sources, including family, friends and wider communities. By establishing and maintaining positive relationships with others, we gain access to networks of support that often play a crucial role in promoting our mental wellbeing. Support can also manifest in many ways, depending on several variables such as the individual who needs support, their specific situation, and the person or group offering the support. In this topic, we focus on support given from family, friends and community. Some examples of how each of these groups can offer support are provided in Table 1.

**TABLE 1** A few examples of how support may be provided by family, friends and community

Support from family	Support from friends	Support from the community
<ul style="list-style-type: none"> <li>• Providing tangible resources, such as food, clothes, school supplies or money</li> <li>• Encouraging you towards achieving your goals</li> <li>• Demonstrating love and affection</li> <li>• Providing a stable environment for social connection and interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Listening to problems and offering advice</li> <li>• Sharing experiences and adventures</li> <li>• Establishing social connections and interactions, in person, over the phone or online</li> </ul>	<ul style="list-style-type: none"> <li>• Services offering financial, medical or psychological aid to community members</li> <li>• Interest-specific community groups and clubs</li> <li>• Community events such as carnivals, markets and communal work events (e.g. working bees)</li> </ul>



FIGURE 5 Support can come from many different sources, including **a** family, **b** friends and **c** community.

### 10.3 SKILL DRILL

#### Organising data in meaningful ways

##### Key science skill: Generate, collate and record data

One source of social support from the community is accessing services from a mental health professional such as a doctor, counsellor or psychologist.

A study conducted by the Australian Bureau of Statistics showed that 17 per cent of Australian people aged 16 to 85 accessed support from a health professional for their mental health in 2020 to 2021.

#### Practise your skills

- 1 Distinguish between a sample and a population, using this study to illustrate your response.
- 2 Draw a graph that compares the percentage of people who accessed mental health support with those who did not access mental health support. Ensure your graph is labelled.
- 3 Does the graph you drew for Question 2 show descriptive or inferential statistics? Justify your response.  
Need help generating, collating and recording data? Go to Topic 1.5 in your Psychology toolkit.

### Study tip

Be careful not to confuse psychological factors and social factors, because they do overlap and interact. Time spent socialising and connecting with friends is a social factor (external), while the way you feel emotionally and psychologically due to the support those friends provide is a psychological factor (internal). Keep these distinctions clear in your written responses.

### 10.3 CHALLENGE

#### Kindness

Research has shown that engaging in kindness (both to oneself and to others) can improve a person's overall mental wellbeing. One study by Lara Kaffke (2018), examined whether being kind to others is more effective at improving mental wellbeing and positive emotions than being kind to oneself. Results of the study showed that being kind to others was just as effective in improving levels of positive emotions and self-acceptance as being kind to oneself.

- 1 Discuss how being kind can influence the mental wellbeing of both the person being kind and the recipient.
- 2 With reference to biopsychosocial factors, explain why performing acts of kindness to others is likely to promote wellbeing.

## 10.3 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe an example of when you have received social support from:
  - a family
  - b friends
  - c community.
- 2 Explain why support is a social factor rather than a psychological or biological factor.
- 3 Explain why some people choose to avoid socialising with others when they are not feeling mentally well.

### Apply, analyse and compare

- 4 Since the death of his father, Brad has been very depressed. He has struggled to leave the house and has been avoiding his wife, children and colleagues. Brad only leaves the house to go to work and goes straight to bed when he returns home. Brad's wife, Eleanor, feels she has tried everything to help him manage his depression but now when she tries to encourage him each morning, Brad can tell that her heart is not really in it. Brad's colleague Costa has noticed a drop in Brad's productivity and pulls him aside to discuss his concerns. After learning the source of

Brad's mental health struggles, Costa tells Brad about a local grief support group that meets every month which helped Costa when his mother died. After Costa encourages Brad and promises to accompany him to the first meeting, Brad agrees to try the support group.

- a Apply your understanding of different sources of support to Brad's case study by identifying the support given to him from family, friends and the community.
- b Compare the likely impact of the support provided to Brad by both Eleanor and Costa. Justify your response with reference to whether the support was authentic and/or energising.

### Design and discuss

- 5 Discuss why receiving social support from multiple sources is important for maintaining mental wellbeing.
- 6 Compose a fictional dialogue between two people in which one is offering support to the other.

Act this out to your peers. Discuss the source(s) of support mentioned, whether the support was authentic and energising, and the likely impacts on mental wellbeing.



# 10.4

## Cultural determinants for improving wellbeing

### KEY IDEAS

- ✦ Cultural determinants of health include cultural protective factors that individuals, families and communities can draw strength, resilience and empowerment from.
- ✦ Cultural continuity is the practice, preservation and transfer of cultural traditions and knowledge and acts as a protective factor that positively affects social and emotional wellbeing.
- ✦ Self-determination, the right to control one's own development, contributes to empowerment and dignity, and is essential for maintaining social and emotional wellbeing.



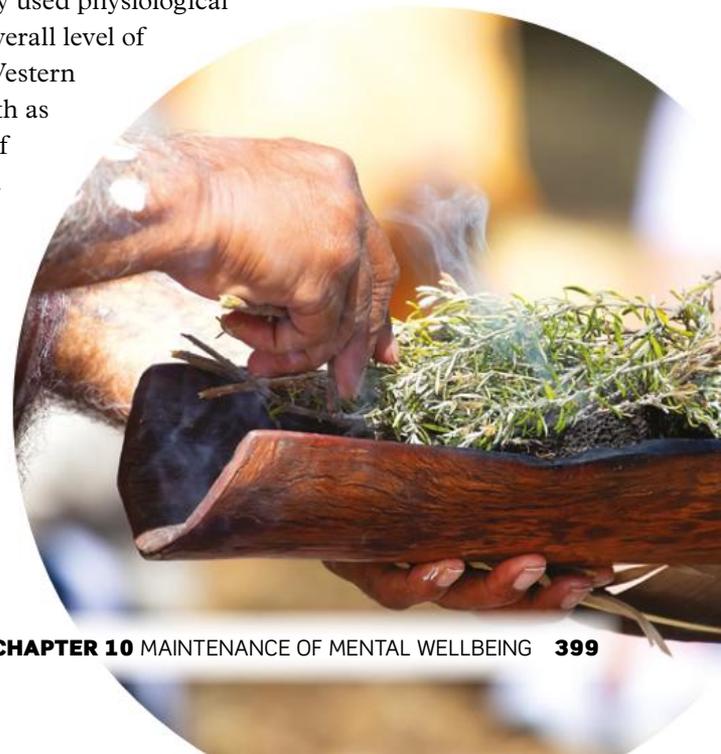
**FIGURE 1** SEWB provides a framework for understanding the overall health, wellness and functioning of a person through Aboriginal and Torres Strait Islander perspectives.

Recall from Chapter 8 that social and emotional wellbeing (SEWB) is a multidimensional and holistic framework of conceptualising wellbeing unique to Aboriginal and Torres Strait Islander peoples. Not only does SEWB consider mental health, it also considers the domains of health and wellbeing such as connection to Country, culture, spirituality, ancestry, family and community. The multiple domains of SEWB provide a framework for understanding the overall health, wellness and functioning of a person through Aboriginal and Torres Strait Islander perspectives. In this topic, we will look at how cultural determinants of SEWB such as cultural continuity and self-determination can form an integral part of maintaining wellbeing in Aboriginal and Torres Strait Islander peoples.

## Cultural determinants of health

Before the introduction of the biopsychosocial model in the late 1970s, Western approaches to understanding health mainly used physiological factors to diagnose and assess a person's overall level of health. Only within the last 50 years has Western medicine shifted towards considering health as holistic and influenced by a combination of biological, psychological and social factors. Comparatively, Aboriginal and Torres Strait Islander peoples' perspectives of health have always been holistic, taking into consideration how body, mind, spirit, community, Country and culture embody a person's social and emotional wellbeing.

**FIGURE 2** Reclamation, revitalisation, preservation and promotion of language and cultural practices is a cultural determinant of health.



**cultural determinants**

cultural factors that influence the health and wellbeing of Aboriginal and Torres Strait Islander peoples

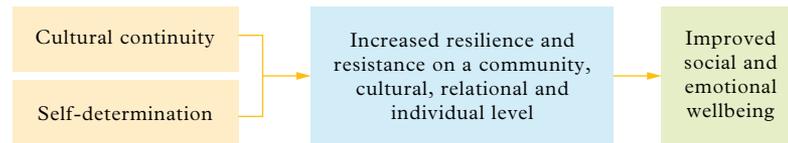
Traditional and holistic approaches to understanding health have always recognised the positive influence that culture can have on a person’s social and emotional wellbeing.

**Cultural determinants** of health are cultural factors that influence the health and wellbeing of Aboriginal and Torres Strait Islander peoples. They include aspects of culture that individuals, families and communities can draw strength, resilience and empowerment from. These determinants can act as protective factors that positively contribute to social and emotional wellbeing. Of the four determinants of health (political, social, historical and cultural), cultural determinants have been found to include some of the strongest protective factors for social and emotional wellbeing.

Cultural determinants include, but are not limited to:

- self-determination
- freedom from discrimination
- individual and collective rights
- freedom from assimilation and destruction of culture
- protection from removal/relocation
- connection to, custodianship and utilisation of Country and traditional lands
- reclamation, revitalisation, preservation and promotion of language and cultural practices
- protection and promotion of Traditional Knowledge and ICIP (Indigenous Cultural and Intellectual Property)
- understanding of lore, law and traditional roles and responsibilities.

In this topic, we will focus on how cultural continuity and self-determination help to maintain and promote wellbeing in Aboriginal and Torres Strait Islander peoples.



**FIGURE 3** Cultural continuity and self-determination are cultural determinants of health that work to promote social and emotional wellbeing.

**Cultural continuity**

Many of the cultural determinants listed above directly reflect an ability to preserve, protect and enrich culture. These determinants are particularly important for Aboriginal and Torres Strait Islander peoples who, in the face of cultural suppression and forced assimilation have been resilient in preserving culture. However, it is not uncommon for Aboriginal and Torres Strait Islander individuals to feel somewhat disconnected from culture due to the long-lasting impacts of colonisation. This cultural disconnect can have a significant negative impact on social and emotional wellbeing.

**Cultural continuity** is the ongoing practice, preservation and transfer of cultural traditions, values and knowledge across generations. Cultural continuity is a protective factor because it has a positive impact on social and emotional wellbeing. By preserving culture, individuals can develop a strong sense of identity, belonging and purpose. In Chapter 5, you learnt that Aboriginal and Torres Strait Islander cultural practices often establish profound connections to land and/or Country, encourage community cooperation and share narratives that hold Traditional Knowledge. Each of these elements also works to provide individuals with psychological, social and emotional support.

**cultural continuity**

the practice, preservation and transfer of cultural traditions and knowledge that act as protective factors for social and emotional wellbeing



**FIGURE 4** Cultural continuity is the ongoing practice, preservation and transfer of culture.

Studies have shown that the revival and reinforcement of Traditional Knowledge and practices can be a protective factor against poor mental health outcomes among Aboriginal and Torres Strait Islander populations. Past interventions, sensitive to Indigenous communities, have also indicated a link between strengthened cultural identity and improved mental health outcomes.

## Self-determination

Self-determination is the right for people to determine their own political status and to direct their own economic, social and cultural development. For Aboriginal and Torres Strait Islander peoples, self-determination is a vital component of social and emotional wellbeing. It allows individuals to exercise autonomy and control over decisions that affect life, community and land. When individuals are given the ability to exercise control and be autonomous in matters that concern them, it can directly contribute to improved empowerment, dignity and self-esteem – all of which help to maintain social and emotional wellbeing. Self-determination includes both having autonomy on a widescale level (e.g. Aboriginal and Torres Strait Islander peoples being involved in creating national curriculums) and having autonomy on an individual level (e.g. a young Yorta Yorta and Dja Dja Wurrung boy wanting to learn more about his community, language and Country).



**FIGURE 5** Self-determination is the right for people to determine their own political status and to direct their own economic, social and cultural development.

A review by VicHealth in 2011 stressed that self-determination is essential for decolonising Australia. This is because self-determination actively allows Aboriginal and Torres Strait Islander peoples to uphold and advance their own cultural, social and economic rights. This sentiment is supported by research conducted by Berry et al. (2010), who argued that addressing issues of powerlessness and lack of control is fundamental to decreasing a preventable burden of disease. For self-determination to be fully actualised, it requires the active involvement of Aboriginal and Torres Strait Islander peoples in every aspect of decision-making. This means that discussions and discourse surrounding self-determination should be led by Aboriginal and Torres Strait Islander peoples.

## 10.4 REAL-WORLD PSYCHOLOGY

### Reclamation of Eastern Maar Traditional Lands

On 28 March 2023, the Eastern Maar people were granted a native title from the Federal Court of Australia. This title recognises that lands spanning from the coastline of the Great Ocean Road up to Ararat belongs to the Eastern Maar people. The native title:

- provides the Eastern Maar people with the rights to access and use the land
- enforces the protection of public land in accordance with Eastern Maar traditional laws and customs
- enforces the right for the Eastern Maar people to be consulted on the use and development of land or its natural resources for the protection and preservation of places and areas with cultural significance.

The area was first taken from the Eastern Maar people in the 1800s during the arrival of European colonisers, whalers and sealers. The Eastern Maar people have been fighting for their ownership of and rights to use the land ever since. Sadly, all the Eastern Maar Elders who originally put forward the claim to the title in 2012 passed away before the decision to grant the title was made. Jamie Lowe, a Gundjitmara Djabwurrung man and the National Native Title Council chief executive, paid his respects to his ancestors who had petitioned the occupation of Eastern Maar Country. In response to the celebration of the native title being granted, Kirrae Whurrong Elder and Eastern Maar member, Aunty Lee-Anne Clarke commented: “I’m in hope that we can take away the sorrow and oppression that we’ve actually felt and replace that with some joy and happiness, with who we are”.

#### Apply your understanding

- 1 Identify which cultural determinants listed earlier in the topic relate to the decision to grant a native title to the Eastern Maar people.
- 2 Discuss how the native title could affect the Eastern Maar people’s ability to engage in cultural continuity.
- 3 Aunty Lee-Anne Clarke stated, “I’m in hope that we can take away the sorrow and oppression that we’ve actually felt and replace that with some joy and happiness, with who we are”. Discuss this statement with reference to the importance of cultural determinants for maintenance of social and emotional wellbeing.



**FIGURE 6** Cape Otway on the Great Ocean Road is now officially recognised as Eastern Maar land.

## 10.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe what cultural determinants of health are.
- 2 Explain why discourse around self-determination as a cultural determinant of health should be led by Aboriginal and Torres Strait Islander peoples.

### Apply, analyse and compare

- 3 Compare cultural continuity and self-determination as protective factors.
- 4 Assess which cultural determinant(s) of health relate to each of the following scenarios. Justify your answers.
  - a A primary school in Swan Hill school implementing Wemba Wemba language classes taught by a Wemba Wemba Aunty
  - b Aboriginal and Torres Strait Islander peoples being able to make political decisions that affect the Community and govern their own communities
  - c Anti-discrimination laws being put in place to enforce respect towards people of all cultures, including Aboriginal and Torres Strait Islander cultures
  - d The right for Aboriginal and Torres Strait Islander peoples to be paid for use of their intellectual property

### Design and discuss

- 5 A Treaty is an official agreement between states, nations or governments. Treaties help to recognise historic injustices and provide an opportunity to recast the relationship between the Indigenous and non-Indigenous people of a country. Unlike New Zealand, Canada, Norway, Sweden, Finland, Japan, Greenland and the United States, Australia has not yet established a formal Treaty with its First Peoples and Traditional Owners. For generations, Aboriginal and Torres Strait Islander communities and leaders have advocated for Treaty to recognise the sovereignty of Aboriginal and Torres Strait Islander peoples and provide Aboriginal and Torres Strait Islander peoples with opportunities for self-governance.

Discuss, with reference to cultural determinants of health, how establishment of Treaty could impact on the social and emotional wellbeing of Aboriginal and Torres Strait Islander peoples across Australia.



## Chapter summary

- 10.1** • Maintaining adequate nutritional intake, hydration and sleep provides the body with the essential resources it needs to function optimally within its environment, enhancing wellbeing.
- 10.2** • Cognitive behavioural strategies empower individuals to identify and replace unhelpful thoughts and behaviours with more helpful alternatives to bolster their mental wellbeing.
  - Mindfulness meditation helps induce calmness and relaxation by focusing attention inward and on the present rather than on external sources of stress.
- 10.3** • Support from family, friends and community can take many different forms, but should be authentic and energising in order to have positive impacts on mental wellbeing.
- 10.4** • Cultural determinants of health include cultural protective factors that individuals, families and communities can draw strength, resilience and empowerment from.
  - Cultural continuity is the practice, preservation and transfer of cultural traditions and knowledge.
  - Self-determination, the right to control one's own development, contributes to empowerment and dignity.

## Revision questions

### Multiple choice

- 1 Which of the following best describes adequate nutritional intake?
  - A A psychological factor that affects mental wellbeing
  - B Consuming a variety of foods that make you feel mentally and physically well
  - C An internal factor because food and drink originate from inside the body
  - D Avoiding foods that are not considered essential for good health at all costs
- 2 Which of the following are two biological factors that promote mental wellbeing?
  - A Adequate sleep and cognitive behavioural strategies
  - B Adequate nutritional intake and adequate sleep
  - C Cognitive behavioural strategies and adequate diet
  - D Mindfulness meditation and social support
- 3 Which of the following is true of mental wellbeing? 
  - A Social support is a protective internal factor and adequate sleep is a protective external factor.
  - B Cognitive behavioural strategies are protective internal factors and social support is a protective external factor.
  - C Adequate nutritional intake is a protective internal factor and social support is a protective internal factor.
  - D Adequate nutritional intake is a protective internal factor and adequate hydration is a protective external factor.
- 4 Which of the following is not a psychological strategy to promote mental wellbeing?
  - A Challenging maladaptive thoughts
  - B Spending more time with your attention focused on the present
  - C Ensuring that you obtain adequate sleep
  - D Taking brain breaks to practise meditation

- 5 Which of the following is necessary for social support to be effective at promoting mental health?
- A It should only come from people we are very close to, such as friends or family.
  - B It should be tangible, such as goods, services or money.
  - C It should be authentic and energising.
  - D It should be intangible, such as verbal praise or advice.
- 6 A psychological benefit of practising mindfulness meditation is that it:
- A provides the body with the resources it needs to function physically.
  - B allows individuals to be mindful of maladaptive thoughts and replace them with more adaptive ones.
  - C allows some mental space from the stressors of the past and future and promotes relaxation.
  - D provides a way for correcting thoughts about the present rather than the past or future.
- 7 Hamish is a Year 12 student studying Psychology. He has been feeling very pessimistic about his education due to receiving a couple of test marks he was unhappy with. Hamish now believes he won't get into the university course he desperately wants to complete and feels guilty for not spending enough time studying each night. After learning about cognitive behavioural strategies from his Psychology teacher, Hamish decides he wants to implement these at home to try and improve his overall outlook on his studies.

Which of the following would be an appropriate behavioural strategy that Hamish could use?

- A Replace negative thoughts about his test results with positive ones.
- B Consider the possible reasons that he scored low on the tests.
- C Allocate more time for study and practise breathing retraining each night.
- D Change his plan for university if he thinks his previous goal was unrealistic.

- 8 Linh has been feeling very stressed about her new job, where the workload has been overwhelming from the first day. She goes home each night feeling as though she has not made a dent in her workload. This affects her ability to get a good sleep because she lies awake for hours thinking about what she needs to do the next day. She then wakes up tired and feels lethargic, though a good healthy breakfast and some exercise with her work friends each morning makes her feel better for a while. She has discussed her feelings with her colleagues, who reassure her that the stress of a new job is normal and she will adapt to it in a few weeks, as they all have in the past.

Which of the following correctly identifies social and biological protective factors that are likely to be working to maintain Linh's mental wellbeing?

	Social	Biological
A	Support from colleagues	Adequate sleep
B	Exercise with colleagues	Adequate sleep
C	Support from colleagues	Adequate hydration
D	Exercise with colleagues	Adequate nutritional intake

- 9 Which of the following is an example of a cultural determinant of health?
- A Adequate sleep
  - B Cognitive behavioural strategies
  - C Freedom from assimilation and destruction of culture
  - D Adequate nutritional intake
- 10 Which of the following determinants of health has been found to include some of the strongest protective factors for social and emotional wellbeing?
- A Social determinants
  - B Political determinants
  - C Cultural determinants
  - D Historical determinants

**Short answer**

**Design and discuss**

11 Copy and complete the following table by identifying the five biopsychosocial protective factors for mental wellbeing.

Biological protective factors	Psychological protective factors	Social protective factors

- 12 Describe the impact of protective factors on mental wellbeing.
- 13 Describe two benefits that adequate sleep can have on mental wellbeing.
- 14 Describe what is meant by “adequate nutritional intake” and explain the benefits that this can have on mental wellbeing.
- 15 Explain the purpose of implementing cognitive behavioural strategies.
- 16 Judith is experiencing some anxiety about sending her twin daughters to school for the first time next year. Describe how mindfulness meditation could help Judith to manage this anxiety in the lead-up to the new school year.
- 17 Explain how social support can act as a protective factor for mental wellbeing.
- 18 Explain why social support should come from energising and authentic sources to be optimally beneficial for mental wellbeing.
- 19 Identify two positive impacts of self-determination.
- 20 Define “cultural continuity”.

**Apply, analyse and compare**

- 21 Distinguish between psychological and social protective factors, using examples to illustrate your response.
- 22 Compare the impact of adequate sleep, adequate hydration and adequate nutritional intake on mental wellbeing.
- 23 Compare the impact of mindfulness meditation and cognitive behavioural strategies on wellbeing in the short term.

- 24 Distinguish between the cognitive and behavioural components of cognitive behavioural strategies that can be used to promote mental wellbeing. Use examples to illustrate your response.
- 25 Amity is completing her final round of placement for her paramedicine degree. She has heard many stories from her friends at university that this was the most stressful time in their lives due to the demands of assignments, placement and their part-time jobs and never feeling as though there was enough time in the day to get everything finished. Amity speaks to her psychologist for advice about how to maintain her mental wellbeing during this period.
  - a Advise Amity about two biological protective factors that could help maintain her mental health during her placement.
  - b The psychologist also suggests that Amity seek as much social support as possible. Suggest an example of support that Amity could obtain from:
    - i family
    - ii friends
    - iii community.
- 26 Choose two protective factors from different sections of the biopsychosocial model and analyse how they could interact to improve mental wellbeing.
- 27 As school captain, Giuseppe is preparing his speech for the final Year 12 Assembly, creating a farewell video for his peers and running an after-school club, while preparing for his end-of-year examinations. He does not believe that he can get it all done in time and this has caused him significant stress. After school one day, he goes home and falls asleep on the couch instead of doing any of his work.
  - a Identify one unhelpful cognition and one unhelpful behaviour that Giuseppe is displaying.
  - b With reference to cognitive behavioural strategies, explain how Giuseppe could modify these unhelpful thoughts and behaviours to improve his wellbeing.

- c Analyse the bidirectional influences between cognitions and behaviours, using Giuseppe's scenario to illustrate your response.
- d Explain how one biological factor in this scenario could be affecting Giuseppe's mental wellbeing in both a positive and negative way.

28 Selma has been feeling stressed recently after realising she has not had enough time to complete all her revision notes for her upcoming exam. She decides to cut her sleep by two hours per night for the next week and use the time to work on her notes instead.

Analyse how Selma's wellbeing is likely to be affected by this decision, with reference to relevant biopsychosocial factors.

- 29 Classify each of the examples below as social, political, historical or cultural determinants of health. Justify your answers.
- a Access to school in remote areas
  - b The right to self-determination
  - c Government policy affecting the lives of Aboriginal and Torres Strait Islander peoples
- 30 Dual naming is when the traditional Aboriginal or Torres Strait Islander name of a geographic location or feature is recognised alongside the English name of that location or site. Killara, a researcher, wants to investigate if dual naming has a positive impact on Aboriginal and Torres Strait Islander peoples' social and emotional wellbeing.
- a Explain why dual naming could contribute positively to social and emotional wellbeing.
  - b Suggest how Killara could collect data for her investigation.

- c Suggest which investigation methodology would be most appropriate for Killara's investigation. Justify your response.

### Design and discuss

- 31 Discuss the importance of a holistic, biopsychosocial approach towards maintaining mental wellbeing.
- 32 Design a one-page pamphlet that outlines the biopsychosocial protective factors for mental wellbeing and how they could be useful for students in Year 12.
- 33 Discuss the likely impact of protective factors in someone who feels mentally well compared to someone with mental health problems.
- 34 Design an experiment that could compare the impacts of both adequate diet and adequate sleep on wellbeing.
- 35 Ella is a proud Boonwurrung Year 12 student and the captain of her high school. Since being elected as captain, Ella has set up an Aboriginal and Torres Strait Islander student committee so that she and her peers can share, connect to and learn from each other's cultures. Every year, Ella's school runs a few activities to celebrate NAIDOC week. Ella makes a recommendation to her school that planning of NAIDOC events should include collaboration with the Aboriginal and Torres Strait Islander student committee. Ella's suggestion is taken on and now she and the Aboriginal and Torres Strait Islander student committee play an active role in planning NAIDOC week events.
- Discuss, with reference to cultural determinants of health, how Ella's actions work to promote social and emotional wellbeing.

You can find the following resources for this section in your [eBook pro](#):

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

## AREA OF STUDY 2

### UNIT

# 4

# Checkpoint

## Part A – School-assessed Coursework support for Unit 4 Area of Study 2

In Unit 4 Area of Study 2, you will be required to complete one task from the following options:

- analysis and evaluation of at least one psychological case study, experiment, model or simulation
- analysis and evaluation of generated primary and/or collated secondary data
- comparison and evaluation of psychological concepts, methodologies and methods, and findings from three student practical activities
- analysis and comparison of two or more contemporary media texts.

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### Important notice to students and teachers

The assessment support provided in this section models one way of approaching the following task for Outcome 2:

- analysis and comparison of two or more contemporary media texts.

Your teacher may select one of the other task options above for you to complete as assessment for this outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample SAC, and sample response provided below should be used for example purposes only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

**Unless specifically credited, the VCAA has not written this material and does not endorse the content.**

### Overview of SAC 2 – Analysis and comparison of two or more contemporary media articles

As part of your assessment for Unit 4 Area of Study 2, you will be required to recall key knowledge for Unit 4 Area of Study 2. This task is designed to assess your understanding of mental wellbeing, specific phobia and maintenance of mental wellbeing in response to two media articles about mental health.

### A step-by-step guide to completing SAC 2

The information provided in this section is designed to help you prepare and practise for SAC 2. The tips and advice included are broad and have been designed to help you succeed in your Area of Study 2 SAC regardless of the specific requirements of the task your teacher or school has created.

### Step 1: Understand the mental health continuum.

Diagnosing mental health can be difficult; therefore, it is important to understand what different levels of mental health can look like in diverse individuals. It is also important to understand how mental health and wellbeing can be perceived through different perspectives.

### Step 2: Differentiate between specific phobia and anxiety.

Prepare a Venn diagram to contrast stress, anxiety and phobia so you feel comfortable comparing them (looking for differences and similarities).

### Step 3: Biopsychosocial model.

Create a mind map of the biopsychosocial model that includes the various external and internal factors that influence mental wellbeing in the categories of biological, psychological and social.

### Step 4: Review Unit 3.

Your understanding of mental health will be reinforced once you understand the physiological terms that were introduced in Unit 3. This includes your understanding of the nervous system, neurotransmitters, the flight-or-fight-or-freeze response and other stress responses. Make sure you organise and review your Unit 3 notes in preparation for completing your Unit 4 Area of Study 2 SAC.

## Practice SAC 2 with annotated sample response

Now that you have learnt about some key steps to successfully complete SAC 2, we can look at how to put this theory into action on a practice SAC. In this section, we will examine:

- a practice SAC
- a high-scoring student response for the SAC (complete with tips and annotations to show you how to maximise your marks)
- the marking criteria for the practice SAC.

## Practice SAC 2

### Analysis and comparison of two or more contemporary media texts



#### Article 1

Breaking down burnout:  
3 warning signs and  
3 coping strategies



#### Article 2

Young people's mental  
health is finally getting  
the attention it needs



#### Article 3

Needle phobia can impede  
jabs – but a hospital service is  
boosting vaccines and injections

Read the three article extracts available in your obook pro and answer the following questions.

#### Question 1 (4 marks)

Article 2 discusses recognising your triggers.

Identify two examples of internal and two examples of external stressors that can negatively impact on our mental wellbeing.

#### Question 2 (14 marks)

Article 1 includes statistics about the growing number of mental health disorders diagnosed in young people.

- a Based on evidence presented in Article 1, is there weight to the claim that the coronavirus pandemic had an impact on young people's mental health? Justify your answer. (2 marks)

- b** Provide two distinctions between a mental health problem and a mental health disorder. (4 marks)
- c** During the coronavirus pandemic, our resilience was challenged. Explain what resilience is and provide one example of a behaviour or trait that would have been considered resilient during the pandemic and one example of a behaviour or trait that would not have promoted resilience during the pandemic. (3 marks)
- d** Many people experienced disconnection or separation from family and friends during the pandemic. Discuss how this disruption to life could impact on cultural determinants of health and the social and emotional wellbeing of Aboriginal and Torres Strait Islander peoples. (5 marks)

**Question 3** (4 marks)

Article 1 mentions that selective serotonin reuptake inhibitors are the most common treatment for anxiety and depression. These drugs bind to receptors on neurons to increase serotonin levels. Anti-anxiety benzodiazepine agents can also be used to help manage anxiety symptoms related to “burnout” as described in Article 2.

Discuss how benzodiazepines affect the postsynaptic neuron and act as a therapy to assist with anxiety, according to the biopsychosocial model.

**Question 4** (6 marks)

Article 2 mentions several strategies that can be applied to help reduce stress.

- a** Identify a biological, psychological and social intervention referred to in Article 2 that could be used to reduce stress and improve our mental wellbeing. (3 marks)

- b** Discuss evidence from Articles 1 and 2 about how stigma should be addressed. (3 marks)

**Question 5** (16 marks)

The coronavirus pandemic resulted in some people developing phobia or having to face their specific phobia such as trypanophobia (fear of needles). As mentioned in Article 3, individuals with trypanophobia were likely to find the vaccination process difficult and make attempts to avoid it, even if they believed the vaccine was necessary.

- a** Distinguish between a specific phobia and stress. (2 marks)
- b** Article 2 discusses seeking professional help. As a psychologist, discuss how you could use systematic desensitisation to treat someone who has a fear of travelling on trains. (4 marks)
- c** Article 2 talks about shifting your focus. Outline two suitable biological interventions for reducing the impact of a phobia like trypanophobia. (2 marks)
- d** Outline how long-term potentiation could perpetuate a phobia like trypanophobia. (4 marks)
- e** Article 1 discusses how, in Iceland, adolescents reported significantly more symptoms of mental ill health during the pandemic. Use your knowledge of social factors that contribute to mental wellbeing and the strategies discussed in Article 2 to make us feel “less alone” to discuss how these social factors may have influenced the decline in the mental health of adolescents in Iceland. (4 marks)

Check your Student gbook pro for these digital resources and more:

pro



**Annotated response and marking criteria**

Once you've completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

#### Question 1

Which of the following statements best describes mental wellbeing?

- A** Mental wellbeing is solely determined by external factors.
- B** Mental wellbeing is a static state that does not fluctuate over time.
- C** Mental wellbeing encompasses all elements of being, including body, mind, emotions and social connections.
- D** Mental wellbeing is the absence of stress, anxiety and phobias.

#### Question 2

According to the concept of social and emotional wellbeing, wellbeing:

- A** is solely dependent on individual factors such as genetics and personality.
- B** is separate from cultural, social and spiritual aspects of life.
- C** includes all dimensions of being, such as family, community, culture, spirituality and ancestors.
- D** only encompasses physical health and fitness.

#### Question 3

Professor Harle conducted a literature review into the effectiveness of breathing retraining in the management of phobic anxiety.

The purpose of a literature review is to:

- A** research and gather primary data on breathing retraining to develop background information before conducting further research into the area.
- B** critique prior research studies that investigated the effectiveness of breathing retraining in the management of phobic anxiety.
- C** repeat prior research studies that investigated the effectiveness of breathing retraining in the management of phobic anxiety.

- D** research and gather secondary data on breathing retraining to develop background information before conducting further research into the area.

#### Question 4

Which of the following are biological factors that can contribute to the development of a specific phobia?

- A** Environmental triggers and genetic predisposition
- B** Gamma-aminobutyric acid (GABA) dysfunction and long-term potentiation
- C** Classical conditioning and stigma around seeking treatment
- D** Operant conditioning and catastrophic thinking

*Use the following information to answer questions 5 to 7.*

Chandra was diagnosed with a specific phobia when he was 19 years old. He has attended regular sessions with his psychiatrist for the past 12 months.

During one of the sessions, the psychiatrist suggested that Chandra participate in a clinical trial examining the effects of a new short-acting benzodiazepine on anxiety levels. Chandra was advised that he would be placed in either the control group or the experimental group.

#### Question 5

The role of the experimental group is to:

- A** show the effects of the new short-acting benzodiazepine on anxiety levels.
- B** form a basis for comparison with the control group.
- C** show the effects of anxiety on benzodiazepine agents.
- D** demonstrate that benzodiazepine agents reduce anxiety levels.

### Question 6

Chandra's parents were concerned when they heard Chandra was participating in the clinical trial. They attended an information session with Chandra and left feeling satisfied that the researcher conducting the study would uphold the ethical concept of non-maleficence.

The term "non-maleficence" means:

- A** the benefits of the research would be maximised.
- B** the research would avoid the causations of harm.
- C** all participants would be treated equally.
- D** the research results would be communicated honestly.

### Question 7

At the conclusion of the clinical trial, the researcher explained that to ensure findings are robust, the same experiment would be repeated.

This demonstrates:

- A** precision.
- B** validity.
- C** reproducibility.
- D** repeatability.

### Question 8

In the context of considering the social and emotional wellbeing of Aboriginal and Torres Strait Islander peoples, cultural determinants are essential because they:

- A** promote assimilation and integration into mainstream society.
- B** neglect the importance of self-determination.
- C** emphasise individualism over community and cultural connections.
- D** contain some of the strongest protective factors that can positively contribute to improved levels of social and emotional wellbeing.

### Question 9

A key difference between stress and anxiety is:

- A** stress involves the activation of the sympathetic nervous system, whereas anxiety involves the activation of the parasympathetic nervous system.

- B** stress is in response to a known stimulus, whereas anxiety is generally in response to an unknown stimulus.
- C** stress is always maladaptive, whereas anxiety can be adaptive.
- D** stress always results in distress, whereas anxiety can be either eustress (positive stress that is beneficial) or distress.

### Question 10

Self-reports are often used to gather data about an individual's level of resilience. A limitation of using a self-report is that the data:

- A** is always qualitative and subjective.
- B** is always quantitative and objective.
- C** can be qualitative and/or quantitative and is subjective.
- D** can be qualitative and/or quantitative and is objective.

### Short answer

#### Question 1 (17 marks)

Jamie is terrified of dogs. Whenever they see a dog, they experience extreme dizziness and nausea. Jamie believes that every dog is dangerous and will attack them. As a child, Jamie witnessed their neighbour being bitten by a dog. Jamie's grandmother has been diagnosed with an anxiety disorder.

- a** Explain a potential biological factor, psychological factor and social factor that may have contributed to the development of Jamie's specific phobia. (6 marks)
- b** Describe how this phobia could affect Jamie's mental wellbeing in the context of levels of functioning, resilience and social and emotional wellbeing. (3 marks)
- c** Describe how cognitive behavioural therapy could be used in treating Jamie's specific phobia. (3 marks)
- d** Initially, Jamie was very reluctant to seek treatment from a mental health professional. Identify the social contributing factor Jamie experiences and describe how it could influence Jamie's mental wellbeing. (2 marks)

- e** Jamie was approached by a researcher who was interested in conducting a study into the relationship between specific phobias and academic achievement. Identify the scientific investigation methodology that would be used by the researcher and outline a strength and limitation of this methodology type. (3 marks)

**Question 2** (11 marks)

Ella, a university student, has been feeling overwhelmed with her course load. Ella approached her Psychology lecturer, who was also a clinical psychologist. They advised Ella that participants were being sought for a study investigating the effects of mindfulness meditation on reported levels of stress. Ella agreed to take part in the study.

The results of the study are presented in Table 1.

**TABLE 1** Effects of mindfulness meditation on reported level of stress

Time spent practising mindfulness meditation per day (h)	Mean reported level of stress (0–10)
>1	7
<1	3

- a** Identify and describe the two key components of mindfulness meditation. (4 marks)
- b** Use graphing conventions to represent the data in Table 1 on an axis. (3 marks)
- c** Propose an appropriate conclusion for the results of the controlled experiment shown your graph. (2 marks)

- d** Outline how the ethical concept of integrity may have been considered during this study. (2 marks)

**Question 3** (8 marks)

Liam, a proud Gunaikurnai man, recently moved away from his community and Country to start a new job. Since his move, he’s been feeling increasingly isolated and stressed.

- a** Discuss the importance of cultural continuity and self-determination for maintaining Liam’s wellbeing in the context of social and emotional wellbeing. (6 marks)
- b** Suggest two potential strategies that Liam could implement to support his wellbeing, considering the factors of cultural continuity and self-determination. (2 marks)

**Question 4** (10 marks)

Tina has recently separated from her partner of 13 years and is a mother of two young children. As a result of her separation, she has picked up extra shifts as a nurse and moved into a rental property with her children. Tina is feeling overwhelmed and is experiencing trouble sleeping. Her youngest child has recently been diagnosed with phobic anxiety.

Consider Tina’s mental wellbeing with specific reference to levels of functioning and resilience. Explain why mental wellbeing is not static and, from a biopsychosocial perspective, propose how Tina could promote her mental wellbeing. Explain how systematic desensitisation could be used to treat her son’s phobic anxiety.

CHAPTER

11

# Student-designed investigation

This chapter will guide you through your student-designed or adapted investigation. Each topic will focus on the essentials of investigation design, from planning and conducting to communicating your results. To-do lists for part of your investigation are also included to help you.

Before you get started, make sure you have the details of this assessment task from your teacher. You should always check what the assessment criteria will be, as well as any other tips your teacher might provide to help you succeed!

## KEY KNOWLEDGE

### Investigation design

- psychological concepts specific to the selected scientific investigation and their significance, including the definition of key terms
- characteristics of the selected scientific methodology and method, and appropriateness of the use of independent, dependent and controlled variables in the selected scientific investigation
- techniques of primary quantitative data generation relevant to the selected scientific investigation
- the accuracy, precision, repeatability, reproducibility and validity of measurements
- the health, safety and ethical guidelines relevant to the selected scientific investigation

### Scientific evidence

- the nature of evidence that supports or refutes a hypothesis, model or theory
- ways of organising, analysing and evaluating generated primary data to identify patterns and relationships, including sources of error and remaining uncertainty
- authentication of generated primary data using a logbook
- assumptions and limitations of investigation methodology and/or data generation and/or analysis methods
- criteria used to evaluate the validity of measurements and psychological research

### Science communication

- conventions of science communication: scientific terminology and representations, symbols, formulas, standard abbreviations and units of measurement
- conventions of scientific poster presentation, including succinct communication of the selected scientific investigation and acknowledgements and references
- the key findings and implications of the selected scientific investigation.

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**FIGURE 1** Unit 4 Area of Study 3 gives you the opportunity to design and conduct your investigation into mental processes and psychological functioning.

## GROUNDWORK

This chapter will build on concepts you may have come across in Chapter 1. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



Groundwork quiz  
Chapter 11



# 11.1

## Investigation design

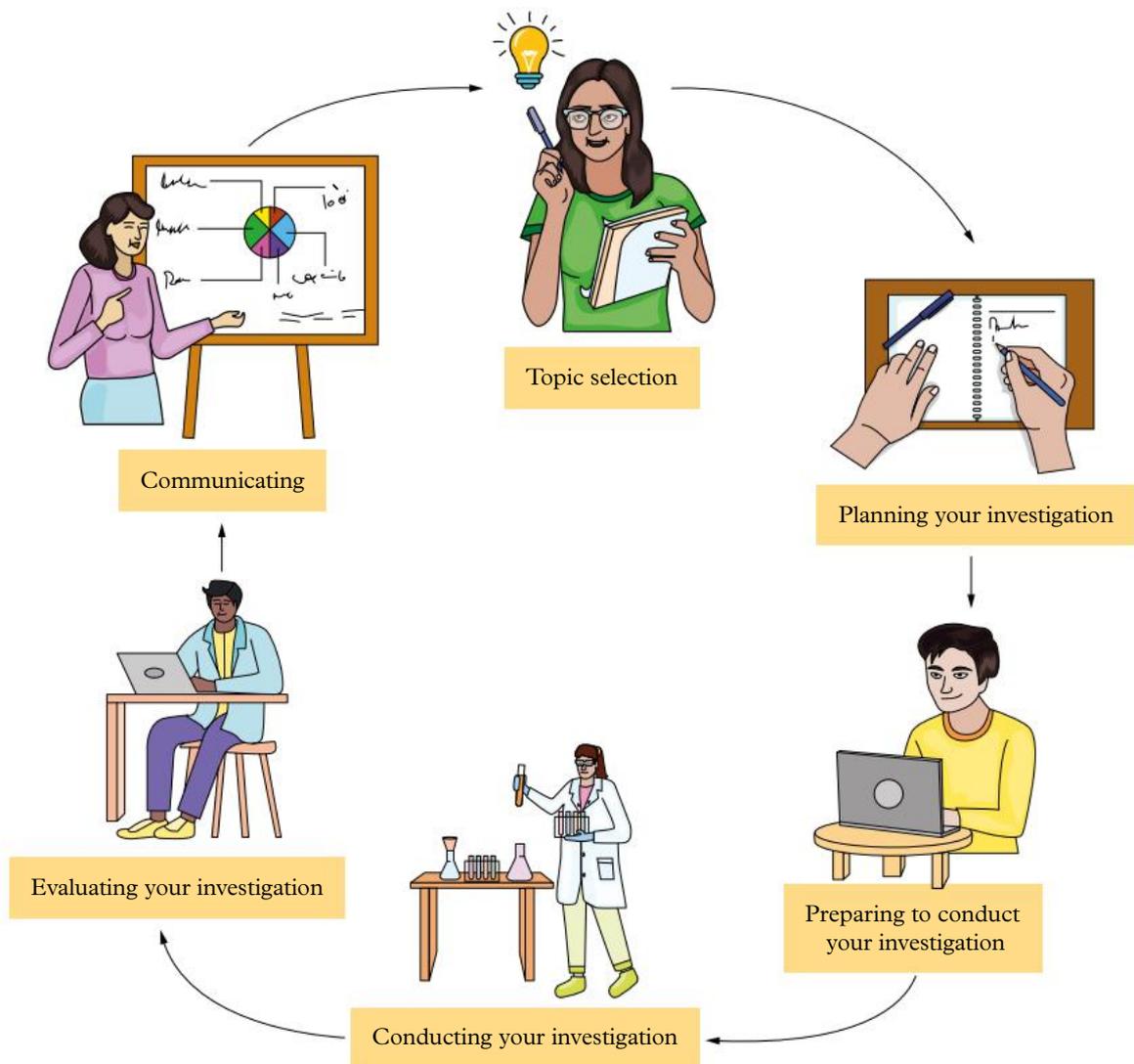


### KEY IDEAS

In this topic, you will:

- + write a scientific question
- + select an experiment to design or adapt
- + conduct research and define key theories
- + understand how to analyse the assessment criteria
- + define your variables
- + write a suitable hypothesis for your experiment
- + construct a methodology for your experiment
- + complete a risk assessment
- + consider the ethics around your experiment.

A scientific investigation is a multistep process. In Figure 1, you can see that the process can cycle, specifically when the final steps of your first investigation prompt a second investigation. Following the scientific process is essential to the success of the investigation.



**FIGURE 1** The scientific investigation process consists of different stages.

This chapter will go through each phase of the process so that you can complete your own scientific investigation for Unit 4 Area of Study 3 “How is scientific inquiry used to investigate mental processes and psychological functioning?”.

## Topic selection

The start of your investigation begins with the topic selection phase. This phase includes:

- deciding on your topic
- deciding whether to design or adapt an experiment
- choosing and writing an investigation question
- conducting research and defining key theories
- analysing the assessment criteria.

Your teacher may have already assigned you a specific topic or set of topics to select from. However, if you are deciding on your own topic, then you must select one related to mental processes and psychological functioning. Although the details of the investigation are presented in Unit 4 Area of Study 3, you could complete the investigation during Unit 3 or 4. This means that your topic might relate to content from just Unit 3, content from just Unit 4 or from both. Revising relevant chapters can help refresh your memory of these topics.

Topic selection can also be inspired by many other areas. Table 1 presents some potential sources for your topic selection and a thinking prompt you can use to help assess your potential interest in a topic.

**TABLE 1** Sources and ideas to help inspire your topic selection

Potential source	Thinking prompt
Direct observation of, and curiosity about, an object, event, phenomenon, practical problem or technological development	Have any science concepts, real-world psychology extracts or scientific articles sparked your interest?
Anomalous or surprising investigation results from analysis of quantitative data	Throughout practicals you have completed, has anything occurred that spiked your interest or intrigued you?
Extension of a previous inquiry	Have any inquiry tasks in practicals led you to ask further questions?
Research involving secondary data	Have you come across something that others have investigated that you might like to expand on or look further into?



Topic selection

**FIGURE 2** The first stage of your scientific investigation is topic selection.

Whatever the inspiration for your topic, you should aim to select a topic that interests you because this will make the process more enjoyable and allow you to engage more. Topic selection can also happen while choosing and writing a question and/or designing or adapting an experiment.

If you are designing your own experiment or reusing/adapting one, make sure to consider:

- whether you can complete the experiment in the time that you have been given
- the equipment you have access to
- whether the experiment allows you to collect primary quantitative data.



**FIGURE 3** Your investigation topic must relate back to concepts covered in Unit 3 and/or Unit 4. This means you can investigate anything from **a** gut health and stress to **b** factors affecting social and emotional wellbeing.

## Choosing and writing a research question

A scientific investigation involves asking or responding to an investigation question and then performing experiments and reporting on your findings. Your investigation and report should always respond to the question that you initially started with.

Once you have a topic or experiment in mind, you should start to consider questions that you have about that topic. You may also choose to start with a general question that you have come across in Unit 3 or 4 and narrow this down into a research question. How you refine your question can vary depending on whether you start with a topic/idea or an experiment in mind.

Research questions often start with a **guiding word** (Table 2). The guiding words lead you to explore one or more **key terms** related to the scientific subject matter. Your question should be specific, clear and complex (i.e. it should not be a yes/no question). You can then break down your research question by asking more specific questions about the key terms it contains. These specific questions may include command terms like those encountered in Topic 1.12 in your Psychology toolkit.

### **guiding word**

a word used to ask a question, such as how, what, when, why, where, who

### **key term**

a word that relates to the key topic you are investigating

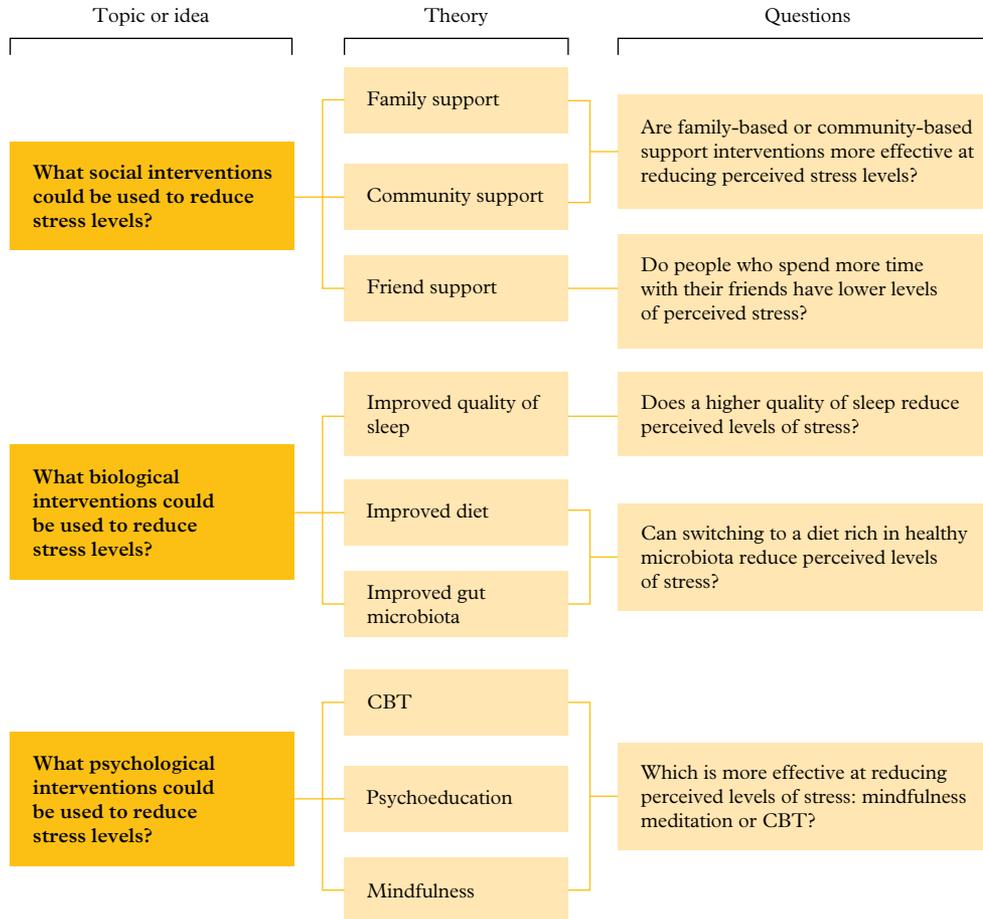
**TABLE 2** Some helpful guiding words and command terms

Guiding words	Command terms
how, what, when, why, where, who	identify, define, explain, describe, summarise, compare, analyse, evaluate, assess, discuss, justify

**Research tip**

Always make sure your research question is written as a question and not as a statement.

Figure 4 shows a process that you could use to help you write a research question, starting with a topic or an idea. This process starts with the topic, considers the theory involved and then structures questions around the relevant theory.



**FIGURE 4** An example of the process involved in developing a research question from a topic or idea

As you first start exploring your topic, you might have to choose from a variety of questions. You may also need to adapt your question so you can perform an investigation related to it, given the available resources and time. Whatever research question you select, it should:

- be clear and focused
- have an appropriate scope (be neither too vague nor too narrow)
- not be too easy/difficult to answer
- be researchable.

**Research tip**

Read your proposed question to a friend or teacher and ask them whether they think it addresses all four of the key criteria for a suitable investigation question.

## Conducting research and defining key theories

Once you have your selected topic and a research question, you should conduct some additional research into the theories surrounding your topic.

Research will help you to:

- understand the key theories or psychological concepts surrounding your topic
- give information to write your introduction
- determine better experiments or methods for conducting your experiment
- write your hypothesis and understand the reasoning behind your prediction
- better understand the data that you might need to collect
- fill any current gaps in your knowledge.

When you access a new piece of information, remember to record the details of it in an organised way in your logbook. You need to use this information in your logbook for authentication purposes. If you have an electronic logbook, you could bookmark all the pages you accessed or use a specific website or program that will record these for you.

You should include:

- a title or description of the source
- the author or the URL
- the date you accessed it.

Collecting this information will help to build your reference list later. It's a lot easier to record this information as you go than to find it again later. As you use different sources to clarify the ideas behind your investigation, make sure to consider the:

- nature of evidence and information
- quality of evidence.

### The nature of evidence and information

With endless information accessible through the internet and other formats, it is important that you can distinguish between opinion, anecdote and evidence and between scientific and non-scientific ideas. Recall from Topic 1.8 in your Psychology toolkit that:

- **evidence** is information or data on a topic that has been systematically collected; this information can help form conclusions
  - **anecdotes** are personal observations collected in a casual non-systematic manner, and used to support a view or judgment – this information is often biased
  - **opinion** is a person's or organisation's judgments or views about a topic, and may not always be based on evidence, experience or fact
  - **scientific ideas** are knowledge that has been acquired and refined by the scientific method
  - **non-scientific ideas** are those that have been established by techniques that do not follow the scientific method.



**FIGURE 5** Do cats or dogs make better companions? Is your answer based on evidence, anecdote or opinion?

You should also make sure that you only refer to credible data and research. One way to evaluate the credibility of a source is to use the CRAAP method.

**Currency:** When was the information published? Is it out of date?

**Relevance:** How does the information fit in with your research question?

**Authority:** Who published or wrote this information? Are they qualified?

**Accuracy:** Is the information or data supported by valid, reproduceable, repeatable and accurate research?

**Purpose:** Why does this information exist? Does the author have any intentions or bias?

If a source does not pass the CRAAP test (e.g. if it is out of date or written by a biased source), do not use it to support your research investigation.

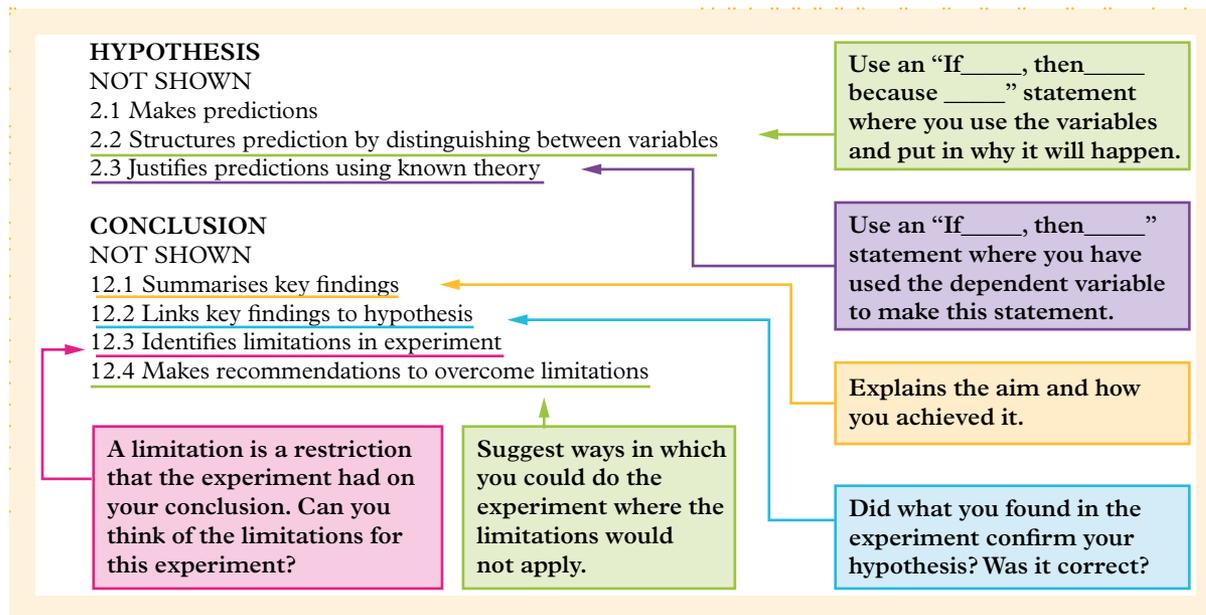
### Quality of evidence

As you review your sources, you should make notes on the quality of your evidence. This includes considering how valid the research is and noting if uncertainty, error or outliers exist within the research. Recall from Topics 1.2 and 1.3 in your Psychology toolkit that research is internally valid if it investigates what it sets out to or claims to investigate.

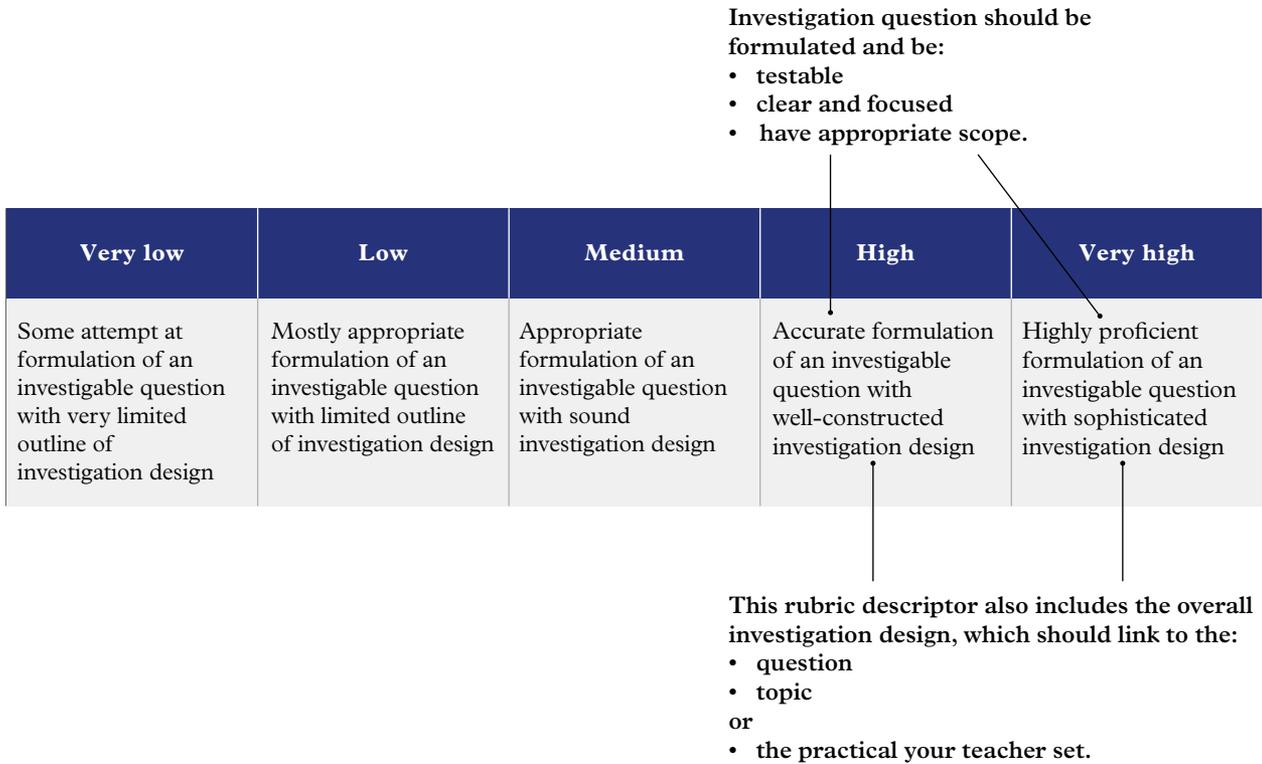
Research is externally valid if the results of the research can be applied to similar individuals in different settings.

### Analysing the assessment criteria

When given your assessment criteria for your Unit 4 Area of Study 3 investigation, you should check to see what is required to achieve the highest marks. You can do this by annotating the rubric or criteria (Figures 6 and 7).

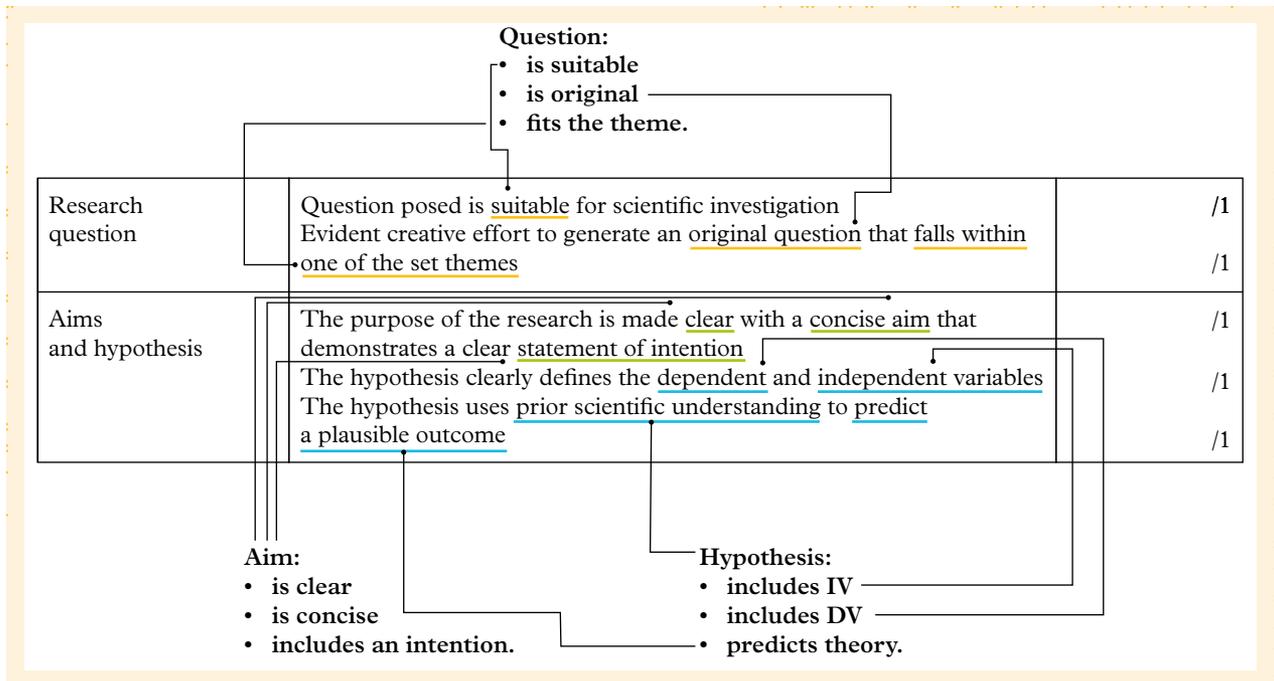


**FIGURE 6** An example of a developmental rubric for a hypothesis and a conclusion and annotations of what to do to get each mark



**FIGURE 7** An example of a performance descriptor rubric for an investigation question and investigation design with annotations of the breakdown of the top marks

You can also annotate your assessment criteria by creating a checklist of what to include (Figure 8).



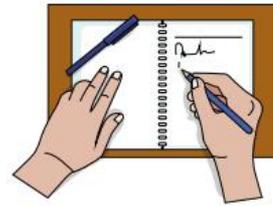
**FIGURE 8** An example of labelling assessment criteria to create a checklist for the investigation

Whatever the assessment criteria you are given, remember to check through it at the start to help you determine what you must do and include. You should also go through the criteria again at the end and double check you have included everything.

## Planning your investigation

After you have selected your topic, the next phase involves planning your scientific investigation. This will include:

- defining the variables
- writing a hypothesis
- designing a method (including participants, materials and procedure).



Planning your investigation

**FIGURE 9** The second stage of your scientific investigation is planning your investigation.

## Defining the variables

Before you can write a hypothesis and method for your investigation, you must first define your variables. If you are conducting a controlled experiment, the three types of variables to consider are:

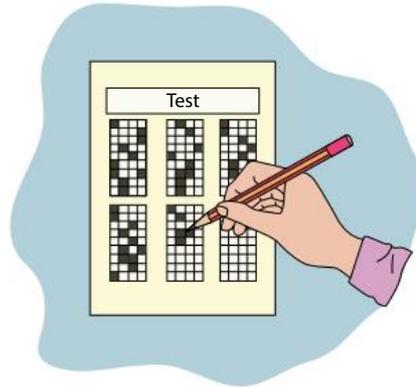
- independent variable (IV): what you change or manipulate
- dependent variable (DV): what you measure
- control variable(s) (CV): what you “control” or keep constant to ensure that any change in the DV is due to the IV and not other factors.

### Research tip

To remember the IV and DV roles and how you would graph them, you can use:  
**DRY** – Dependent (Responding) **y**-axis  
**MIX** – (Manipulated) Independent **x**-axis.



**Independent variable**  
 What you change  
 (e.g. diet consumed)



**Dependent variable**  
 What you measure  
 (e.g. test scores of participants)



**Control variables**  
 What you keep constant (e.g. quiet test environment, participants of similar age and academic ability)

**FIGURE 10** When testing if getting more than 8 hours of sleep affects test scores, the independent variable is sleep, the dependent variable is test score, and control variables could include a quiet testing environment, academic level and age of participants.

## Writing a testable hypothesis

Chapter 1 showed you how to write a hypothesis. Now it's time to put this skill into practice. To write a hypothesis, you might want to use an “If ... then ... because” statement to make sure you cover all the elements you need (Table 3).

**TABLE 3** Summary of how to write a testable hypothesis

If	Then	Because
If the <b>independent variable</b> is [changed]	then the <b>dependent variable</b> will [change]	because of <b>scientific reasoning</b> .
<i>e.g. increased, decreased</i>	<i>e.g. increase/decrease the amount/ rate/height/weight/number</i>	<i>A possible explanation for the relationship between the IV and DV</i>

A useful hypothesis is a testable statement that often includes a prediction. In some instances, a research question may not lend itself to having an accompanying hypothesis. In such cases, students should work directly with their research question. If this applies to your research question, check in with your teacher before moving on, as some criteria might have marks allocated for a testable hypothesis and you may need to change your experiment.

### 11.1 WORKED EXAMPLE

#### Writing a testable hypothesis for a research question

Write a testable hypothesis for the following research question: “Does a diet rich in fermented foods influence perceived stress levels among adolescents?”.

#### Solution

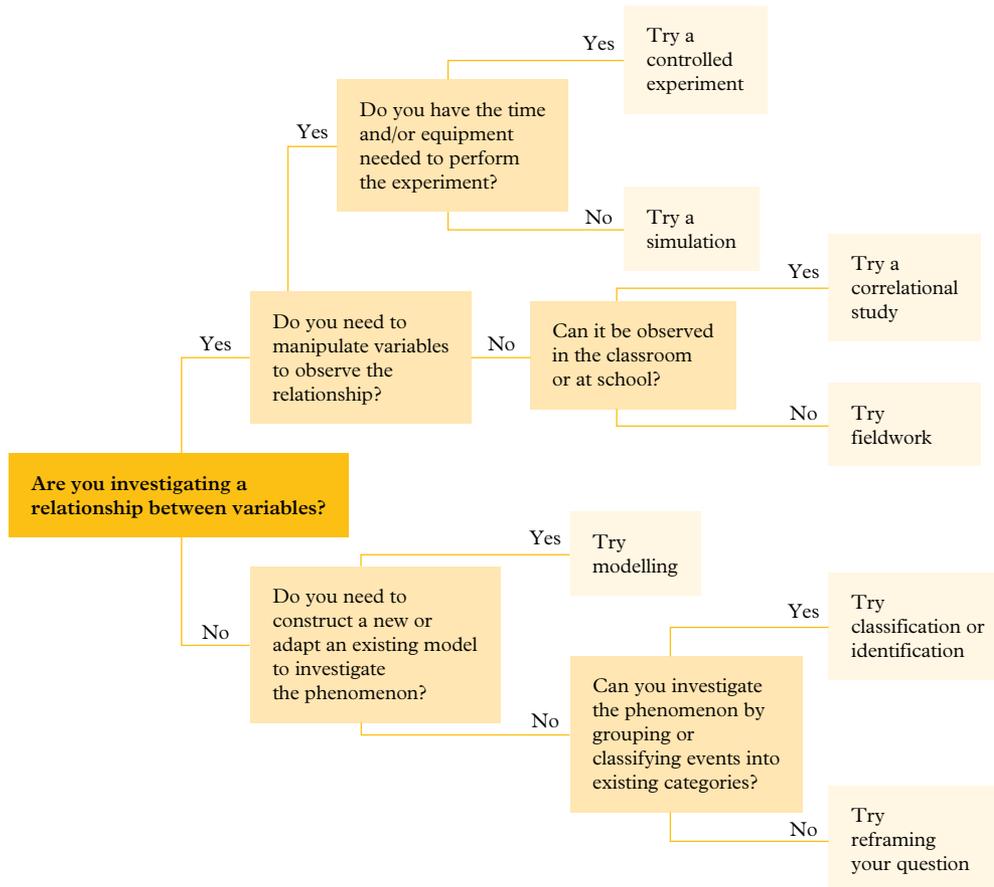
Think	Do
Step 1: Define your variables.	IV: Diet rich in fermented foods DV: perceived stress levels measured by the perceived stress scale CV: Participant age range, health levels, dietary factors, activity levels, gut health
Step 2: Write your hypothesis.	Hypothesis: It is hypothesised that adolescents who consume a diet high in fermented foods will report lower levels of perceived stress because of improved gut microbiota.

## Choosing a methodology

There are several ways to approach your scientific question. How you choose to approach your investigation is called your methodology. Different scientific methodologies are:

- controlled experiment
- fieldwork
- modelling
- simulation
- classification and identification
- correlational study.

Information on each of these methodologies is provided in Topic 1.3 in your Psychology toolkit. The flow chart in Figure 11 can help you to choose the methodology that is best suited for your scientific question.



**FIGURE 11** A flow chart to assist with scientific methodology selection

## Generating primary data

For this investigation, you will need to generate your own primary data. Recall from Topic 1.5 in your Psychology toolkit that there are two types of primary data: qualitative data and quantitative data. However, in your student-designed investigation you will only collect **quantitative data**; that is, numbers or things that are counted or measured and given a numerical value (e.g. scores on a test, the number of times a behaviour occurs). This sort of data can be collected through surveys, scored tests, observations and interviews.

## Writing your method

The method of your investigation is intended to allow other people to understand your methodology and replicate the study. The method is split into three sections:

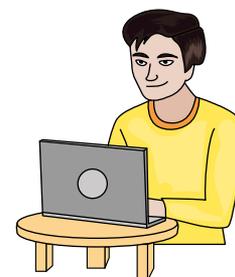
- 1 **participants**: details of any relevant characteristics of the participants in your sample (e.g. age, sex, education level)
- 2 **materials**: a detailed description or list of all equipment and settings needed to conduct your investigation
- 3 **procedure**: a detailed description of the testing procedures, from the selection of participants to how you conducted the study. The descriptions should be specific enough that another researcher could accurately replicate your study.

Key things to remember when writing your method are:

- ensure the steps are in the correct order
- number each of your steps
- ensure your controlled and independent variables are appropriately manipulated (the IV is the thing you change, so that change should be in the method correctly; the CVs are the things you need to control during the experiment; providing detail on this is important for replication)
- include appropriate measurements and concentrations with accurate use of units.

## Preparing to conduct your investigation

In this section, we will look at how you can prepare to conduct your scientific investigation. This process includes conducting a risk assessment and considering the ethics of your investigation.



Preparing to conduct your investigation

### Conducting a risk assessment

When conducting an experiment, there are many health and safety considerations that need to be taken to protect yourself and those around you. Before you conduct an experiment, you must consider any risks involved. Risk assessments help you identify any potential risks associated with your investigation procedure, equipment, and health and safety. These risks could include:

- health and safety risks: anything that could cause physical or psychological harm or injury to participants or the experimenter (e.g. location hazards, equipment, testing set-up, chemicals, stressful activities, physical exhaustion)
- social risks: anything that could affect participants' social relationships (e.g. their friendships, family, work life)
- safeguarding risks: any risks that could result in the abuse or exploitation of young or vulnerable people.

**FIGURE 12** The third stage of your scientific investigation is preparing to conduct your investigation.



**FIGURE 13** If your investigation involves testing physical activity, you will need to consider risks such as potential physical exhaustion of participants.

As part of VCE Psychology, you need to submit risk assessments for any experimental procedures you design yourself. Risk assessments can be written in a variety of formats and some schools may use external programs to generate them. An example risk assessment with annotations is available in your obook pro. A blank risk assessment template is also provided.

## Ethical considerations

For your research investigation, you will need to generate primary data. When writing and planning your investigation, you will need to consider any potential ethical considerations. This includes considering the impact of your research on:

- participants
- the greater community
- living organisms and non-living things.

For example, it is important that participants have their rights explained before starting and that those rights are respected throughout the research period. If you were investigating how a diet rich in fermented foods affects perceived stress levels and a participant wanted to withdraw from the experiment, you the experimenter must not pressure them to stay. If you denied a participant the right to leave or withdraw, it would violate participant rights and not be considered ethical. The details of ethical concepts and considerations you need to account for in your research are described in Topic 1.4 in your Psychology toolkit.

### TO-DO LIST

#### Topic selection

- Write a scientific question that you would like to investigate.
- Make sure your question is posed as a question and not as a statement.
- Select an experiment to adapt or design for your investigation.
- Define the key scientific theories and terms that are relevant to your investigation topic.
- Analyse the criteria you will be marked on for this assessment.

#### Planning your investigation

- Choose a methodology for your investigation and justify why you have chosen this as the best way to answer your scientific question.
- Identify the independent and dependent variables that you will be investigating.
- Identify which variables you will control for your investigation.
- Write a testable hypothesis for your investigation.
- Write a succinct and detailed method for your investigation. (Remember to include enough detail so someone else could conduct your investigation for you – repeatability and reproducibility.)

#### Preparing to conduct your investigation

- Conduct a risk assessment for your investigation.
- Evaluate the ethics of your investigation.

## 11.2

# Scientific evidence

## KEY IDEAS

In this topic, you will:

- + create a data table to collect and record your data
- + be prepared to conduct your experiment
- + display your results
- + evaluate your results
- + identify and discuss any errors
- + write a discussion about your investigation.



In your investigation, you will need to understand how to use scientific evidence to support or assess your findings. This includes being able to produce and collect reliable data when conducting your investigation and evaluating your data as well as data from secondary sources.

## Conducting your investigation

When conducting your investigation, you should remember the following:

- Be safe at all times.
- Consider the safety of those around you.
- Follow your method, or make annotations in your logbook when you change anything.
- Record all results at the time of taking them.
- Record any errors or things that seem out of place.
- Record observations and comparisons between tests.
- Check before disposing of experiment equipment, chemicals and materials.

If you have any questions or concerns, always ask your teacher.



Conducting your investigation

**FIGURE 1** The fourth stage of your scientific investigation is conducting your investigation.

## Recording results, data and observations

Establishing good habits of data recording will help greatly when it comes to writing your discussion and evaluating your errors. Data collection not only includes recording numbers and data; it also includes recording your observations. Figure 2 shows an annotated data table used to record the results of the practical investigation “Does a diet rich in fermented foods influence perceived stress levels among adolescents?”.

There can be a considerable amount of time from when you first conduct the experiment to when you write it up. Good data, results and observation collection will be extremely helpful when you need to write, because it refreshes your memory of the details of the experiment. You should record your results in your logbook because they will need to be verified for authenticity by your teacher.

Each participant is listed in the table according to the group they have been assigned to.

<u>Participants</u>	<u>Group</u>	<u>Pre-intervention PSS* score (out of 56)</u>	<u>Post-intervention PSS* score (out of 56)</u>	<u>Pre-intervention gut health score (out of 5)</u>	<u>Post-intervention gut health score (out of 5)</u>
1	Control	26	27	3	3
2	Control	28	28	3	3
3	Control	25	27	3	2
4	Control	27	28	3	3
5	Control	26	27	3	1
<u>Mean (control group)</u>		26.4	27.4	3	2.4
6	Experimental	28	24	3	4
7	Experimental	25	21	3	4
8	Experimental	27	23	3	5
9	Experimental	26	22	3	5
10	Experimental	28	24	3	4
<u>Mean (experimental group)</u>		26.4	22.8	3	4.4

Headings are labelled with each type of measurement taken. Setting this up in advance is handy, to make sure you have collected all the information you need.

Pre- and post-intervention scores are recorded in the table.

\* Perceived Stress Scale

The average for each different score is calculated for the control and experimental groups, and included in the table.

**FIGURE 2** Annotated and completed table for recording results, data and observations when investigating gut health in adolescents

## Evaluating your investigation

In this stage, you will look at evaluating your scientific investigation. This includes:

- displaying your data
- writing a discussion
  - analysing your results
  - evaluating your errors
  - modifications to the method
- writing a conclusion.



Evaluating your investigation

**FIGURE 3** The fifth stage of your scientific investigation is evaluating your investigation.

### Research tip

When conducting an experiment, scientists constantly take notes and annotate changes made to the method. This ensures the method can be reproduced by others in the future.

## Displaying your data

After conducting your experiment and recording your data and observations, you will need to select the right way to display your data so that others can get a quick snapshot of your results. Your data presentation should also outline any trends that may exist between your variables.

The way in which you choose to display your data is important; some graphs cannot be used for a particular purpose. The flow chart in Figure 4 summarises different methods of displaying data depending on how you wish to use that information. Remember, what you are trying to show the people reading or assessing your poster is the relationship between variables, or the trend or pattern from your results.

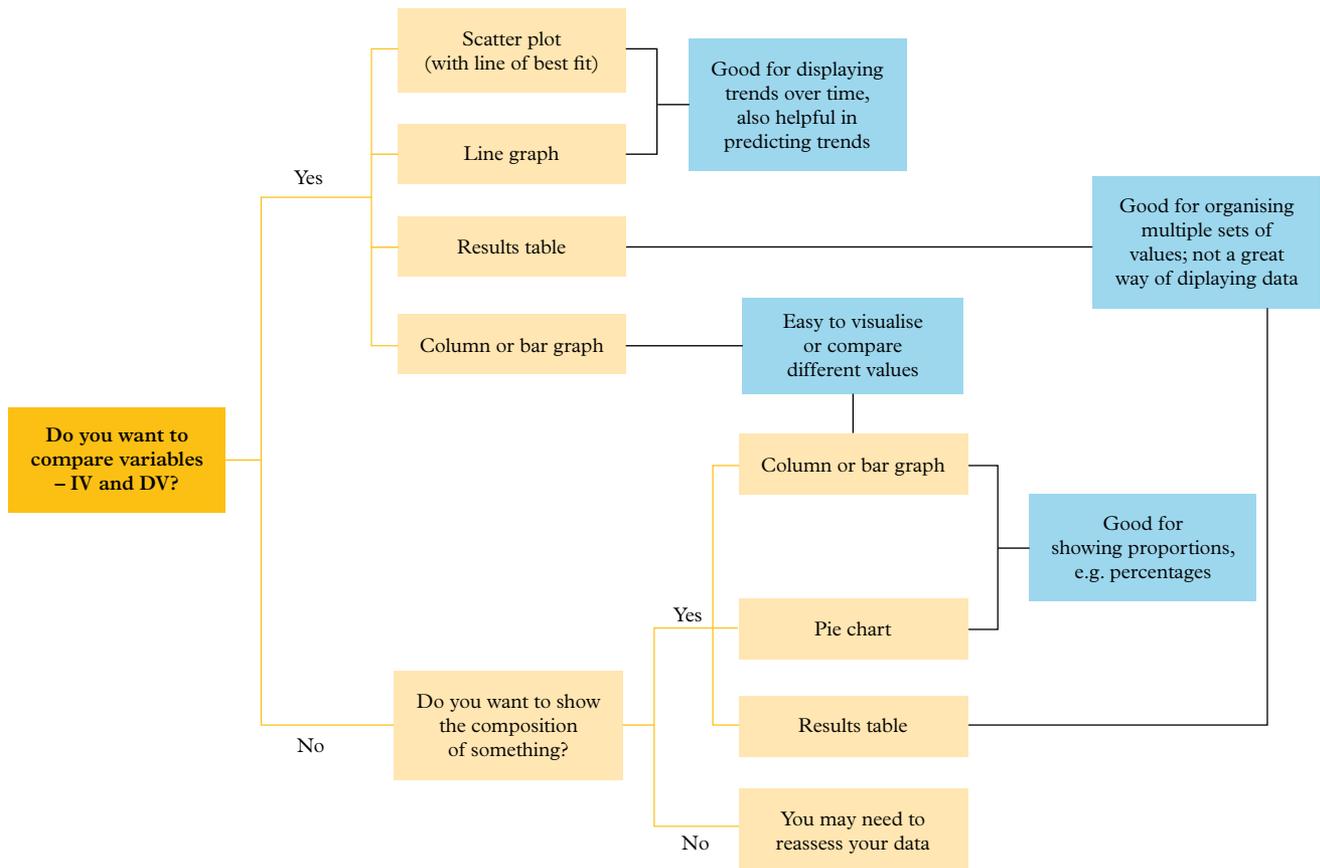


FIGURE 4 A flow chart to assist your decision on how you will display your data

## 11.2 WORKED EXAMPLE

### Displaying data

The data in Table 1 was collected in an investigation exploring the research question: “Does a diet rich in fermented foods influence perceived stress levels among adolescents?”

TABLE 1 Results table from the investigation “Does a diet rich in fermented foods influence perceived stress levels among adolescents?”

Group	Mean pre-intervention PSS score	Mean post-intervention PSS score	Mean pre-intervention perceived level of gut health	Mean post-intervention perceived level of gut health
Control	26.4	27.4	3	2.4
Experimental	26.4	22.8	3	4.4

Select and display the results from the table on the most appropriate graph.

Think	Do
<p>Step 1: Use the data display flow chart (Figure 4) to determine which graph type best suits the data.</p> <p>Step 2: Format data into a column graph, using a program (e.g. Microsoft Excel).</p> <p>Two examples of data from Table 1 that has been graphed are shown.</p>	<p>The results table includes multiple data sets and scores which should be compared. Therefore a bar or column graph should be used.</p> <p>An example of the data from the investigation represented as a bar graph:</p> <p>An example of the data from the investigation represented as a bar graph:</p>

## Writing a discussion

The information you need to provide in your discussion depends on what the assessment criteria for your investigation has said to include. For the most part, it will include:

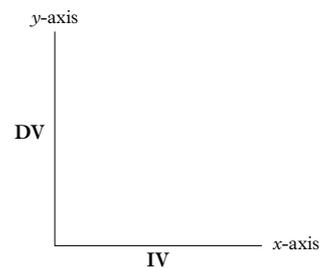
- an analysis of your results
- an evaluation of errors and limitations
- modifications of the method.

## Analysing your results

Once you have displayed your data to show your results and trends, it is time to analyse and evaluate your results. To do this, there are a few questions you need to ask and answer:

- What trend can you see from the data?
- How does the trend relate to the theory?

One approach to addressing these questions is to simply answer them. Another approach if you need more guidance is to use Table 2. Table 2 can help you understand how to unpack each question and format your responses so they can be included in your discussion.



**FIGURE 5** How to graph your IV and DV

### Research tip

Play around with different graph styles if you are having trouble deciding between suitable options. There are graphing programs that will give you lots of different types of graphs, and if in doubt ask someone to tell you what your graph says to them.

### Research tip

If you are drawing graphs that have an x-axis and a y-axis, the IV is on the x-axis and the DV is on the y-axis.

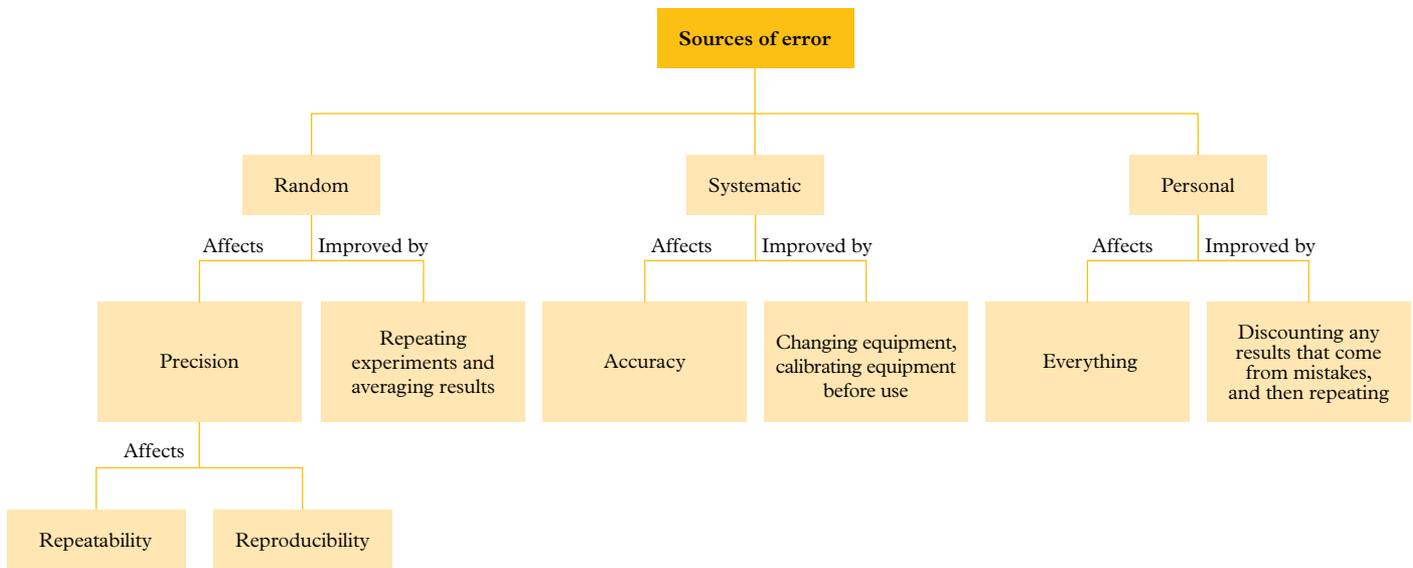
You will need to use research and your understanding to link and support your findings from your experiment. You may use information you have already gathered from the topic selection phase, or conduct more research to inform and support your data and trends. You may also need to gather more information if you find that your data or trend is not supported by the theory, or if your hypothesis is not supported.

**TABLE 2** Analysing results for discussion flow chart

Analyse results		
<b>Step 1:</b> Identify key findings	<b>Observation 1:</b> <b>Result 1:</b>	<b>Observation 2:</b> <b>Result 2:</b>
<b>Step 2:</b> Matches/supports key findings using theory	<b>Theory that explains result 1:</b>	<b>Theory that explains result 2:</b>
<b>Step 3:</b> Uses theory to link/bring together key findings	What does each of the above support in the wider context of the theory? Also identify any outliers and explain why they can be excluded from the analysis.	

### Evaluating errors

Topic 1.7 in your Psychology toolkit explains types of errors, accuracy, precision, reproducibility and repeatability. It is important that you evaluate your errors in your discussion. Figure 6 shows how different errors can affect the results of an investigation.



**FIGURE 6** Errors, their impacts and how they can be improved during an experiment

### Evaluating limitations

In your discussion, you need to consider the limitations in your experiment. Check whether these are assessed in your conclusion or in your discussion. Limitations are things that affect the overall research and conclusion that you are making. For example, if you were conducting a study on the effects of a specific diet and only tested it on individuals from one age group, then you cannot conclude that the same diet will be equally effective for individuals of all age groups. The final step in a conclusion is to propose a way in which you could overcome these limitations (Table 3).

**TABLE 3** Evaluating limitations using the discussion flow chart

Evaluate limitations	
<b>Step 1:</b> Identify the limitation.	<b>Limitation:</b> Small sample size
<b>Step 2:</b> Explain limitation and discuss effects of any errors on quality of experiment/data.	<b>How did it come about/get introduced?</b> Investigation was confined by selecting participants only from the school community. Could not find more than 10 adolescents within the school that had similar stress levels and gut health.
	<b>How did it affect the result?</b> Reduces the power of the study and increases the margin for error. May prevent data from being externally valid.
<b>Step 3:</b> Propose ways to reduce or remove limitations/errors.	<b>How could you prevent this from happening again?</b> Increase the sample size by sourcing participants from the broader community (sporting teams, work, family).

## Modifying the method

Errors or limitations that happened during your investigation can affect the repeatability and reproducibility of your experiment. You need to consider your controlled variables during your experiment and when you are evaluating your errors. Table 4 shows a flow chart that can help you determine modifications you can make to your method.

**TABLE 4** Modifications to method flow chart for discussion

Modifications to method	
<b>Step 1:</b> Propose a modification. (e.g. measure of gut health was self-reported and subject to bias)	<b>What needs to be controlled or modified?</b> Measured level of gut health
	<b>Propose modification/change to a specific step</b> Use more objective means of identifying gut health, e.g. stool sample analysis.
<b>Step 2:</b> Explain how the modification will improve the design. Note: Be specific (e.g. increase/decrease, and the effect on repeatability/reproducibility of the experiment)	<b>How will this make the practical results better?</b> If the level of gut health is more accurately measured, the validity of the measurement increases, which also increases the repeatability of the experiment.
<b>Step 3:</b> Predict the effects of the modification on the quality of the data. (e.g. increased accuracy, with example of how)	<b>What will you get for these “improved” data/results?</b> Increased internal validity because investigation is better at testing what it aims to test

## Writing a conclusion

A conclusion is the end to your poster, a wrap-up of everything you did. You should check the assessment criteria for your investigation to write your conclusion, but they often involve answering the following questions.

- What were your key findings?
- Was your hypothesis supported or refuted?
- To what extent had your analysis answered the research question?

## Addressing your hypothesis

It is important to link all aspects of your poster to the key idea – the question or hypothesis throughout the investigation. In your conclusion, first you should summarise the key findings, and then link them directly to the hypothesis and explain whether they supported your hypothesis or refuted it.

### TO-DO LIST

#### Conducting your investigation

- Set up a logbook so that you can record all results and observations as you conduct the investigation.
- Check in with your teacher to make sure you are ready to begin generating data.

#### Evaluating your investigation

- Find the best way to display your data in order to best represent your results.
- Analyse your results.
  - Identify key findings.
  - Match/support key findings using theory.
  - Link key findings and theory.
- Evaluate your errors.
  - Identify errors.
  - Explain the reason(s) for errors.
  - Discuss the effect of error(s) on quality of data.
  - Propose way(s) to remove or reduce the errors.
- Modifying the method.
  - Propose modifications to the method.
  - Explain how modification(s) will improve experiment.
  - Predict effect of modification(s) on quality of data.
- Identify whether your hypothesis was supported.
- Identify the limitations of your investigation design.
- Propose recommendations to overcome limitations.

## 11.3

# Scientific communication

## KEY IDEAS

In this topic, you will:

- + select a format for your investigation
- + create a reference list and acknowledgments.



## Communicating your findings

This topic will look at the reporting phase of your scientific investigation, which includes:

- communicating your findings
- using scientific terminology
- referencing
- acknowledgments.

### Format of communication

There are many different formats you can use to present your investigation, including:

- an oral presentation
- a video or an animation
- a report
- a multimodal presentation
- an infographic
- a scientific poster.

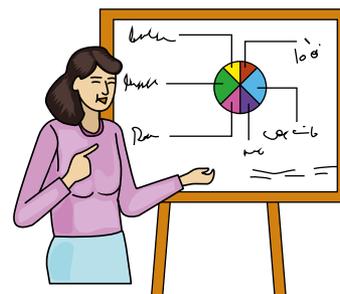
In Unit 4 Area of Study 3, you are only allowed to report your findings as a scientific poster. The poster format outlined in the VCAA study design is shown in Figure 2. This image includes the VCAA's requirements for what should be under each heading. The poster may be produced electronically or in hard-copy format and must not exceed 600 words. The 600-word limit does not include supporting text, such as:

- tables
- graphs
- flow charts
- image captions
- references
- acknowledgements.

You need to summarise everything that you have done throughout your investigation within the 600-word limit. This means it is important to be careful with how many words you designate to each section.

The following tips can help you generate your scientific poster.

- **Choose your content wisely.** Do not include “fluff” and things that do not relate to your question; find one or two key points and stick with those throughout the poster.
- **Do not waste the word count where there are only a small number of marks allocated.** Use the assessment criteria to help with this – if there is only 1 mark for something, do not waste 200 words trying to explain it.
- **Proofread your work.** Edit your poster to make sure that nothing irrelevant is included. After proofreading once, go back and proofread/edit it again. Having a friend proofread it for you is also valuable.
- **Make your poster visually appealing.** Figure 3 shows the dos and don'ts of formatting your poster.



Communicating

**FIGURE 1** The sixth stage of your scientific investigation is communicating your findings.

Title		
Student name		
<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>Brief explanation or reason for undertaking the investigation, including a clear aim, hypothesis and/or prediction and relevant background psychological concepts</li> </ul> <p><b>Methodology and methods</b></p> <ul style="list-style-type: none"> <li>Brief outline of the selected methodology used to address the investigation question</li> <li>Summary of data generation method(s) and data analysis method(s)</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>Presentation of generated data/evidence in appropriate format to illustrate trends, patterns and/or relationships</li> </ul>	<p><b>Communication statement reporting the key finding of the investigation as a one-sentence summary</b></p>	<p><b>Discussion</b></p> <ul style="list-style-type: none"> <li>Interpretation and evaluation of analysed primary data</li> <li>Identification of limitations in data and methods, and suggested improvements</li> <li>Cross-referencing of results to relevant psychological concepts and previous research</li> <li>Linking of results to the investigation question and the aim, to explain whether the investigation data and findings support the hypothesis</li> <li>Implications of the investigation and/or suggestions as to further investigations that may be undertaken</li> </ul> <p><b>Conclusion</b></p> <ul style="list-style-type: none"> <li>Conclusion that provides a response to the investigation question</li> <li>Identification of the extent to which the analysis has answered the investigation question, with no new information being introduced</li> </ul>
<p><b>References and acknowledgments</b></p> <ul style="list-style-type: none"> <li>Referencing and acknowledgment of all quotations and sourced content relevant to the investigation</li> </ul>		

Source: *VCE Psychology Study Design (2023–2027)* reproduced with permission © VCAA

FIGURE 2 The VCAA scientific poster format

DO	DON'T
<ul style="list-style-type: none"> <li>Do use one colour scheme throughout your poster, e.g.</li> </ul> 	<ul style="list-style-type: none"> <li>Don't use more than two font types, because</li> </ul> <p>“MULTIPLE FONTS can <b>make your</b> poster <i>look messy</i>.”</p>
<ul style="list-style-type: none"> <li>Do replace or break up large sections of text with figures, e.g.</li> </ul> 	<ul style="list-style-type: none"> <li>Don't use clashing or garish colours, e.g.</li> </ul> 
<ul style="list-style-type: none"> <li>Do leave some blank space so that your poster is not too text heavy.</li> </ul>	<ul style="list-style-type: none"> <li>Don't use all capital letters, e.g.</li> </ul> <p>“THE HYPOTHESIS WAS REFUTED”</p>

FIGURE 3 A summary of what to do and what not to do to make your poster visually appealing

## The communication statement

The centre of the poster will occupy between 20 and 25 per cent of the poster space and will be a one-sentence summary of the major finding of the investigation that answers the investigation question. When writing your statement, you should:

- keep it succinct, one sentence only
- avoid using large confusing words
- avoid phrasing it as a question
- make sure it relates to the question.

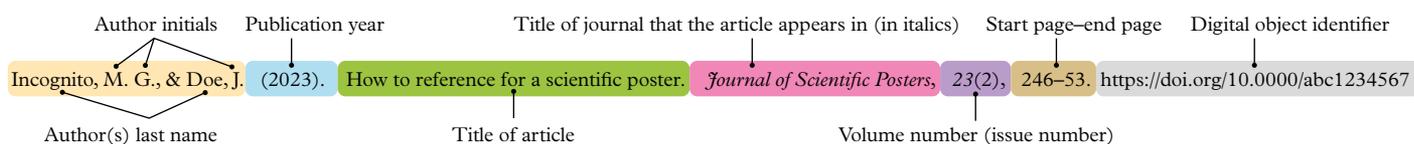
For example, a communication statement based on the sample investigation explored in this topic is: “Diets rich in fermented foods can improve perceived levels of stress”.

## Using scientific terminology

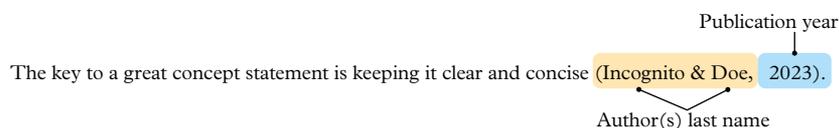
Every scientific discipline uses different terminology and presents ideas in slightly different ways. In Psychology, you need to convey your ideas using the correct scientific terminology and align them with the way psychological ideas are represented. Wherever possible, use correct definitions and terms. Personal language is not used when presenting scientific research. So do not include words such as “I”, “we” or “us”. Aim to write your poster in third-person past tense.

## Referencing

There are many styles of scientific referencing that can be used. Refer to your assessment criteria to see whether a particular type is stated. A common referencing style is APA (American Psychological Association) – see Figures 4 and 5. You need to include your reference list in the bottom section of your poster.



**FIGURE 4** An example of how to include a journal article in your reference list using APA referencing



**FIGURE 5** An example of how to reference a journal article in the body text of your report

## Acknowledgments

The acknowledgments section is where you, the author of the poster, acknowledge and list the people who contributed to or supported your research investigation. People who directly contributed, such as your group members, should appear at the top of the poster as group members and not in the acknowledgments.

People you may wish to acknowledge include:

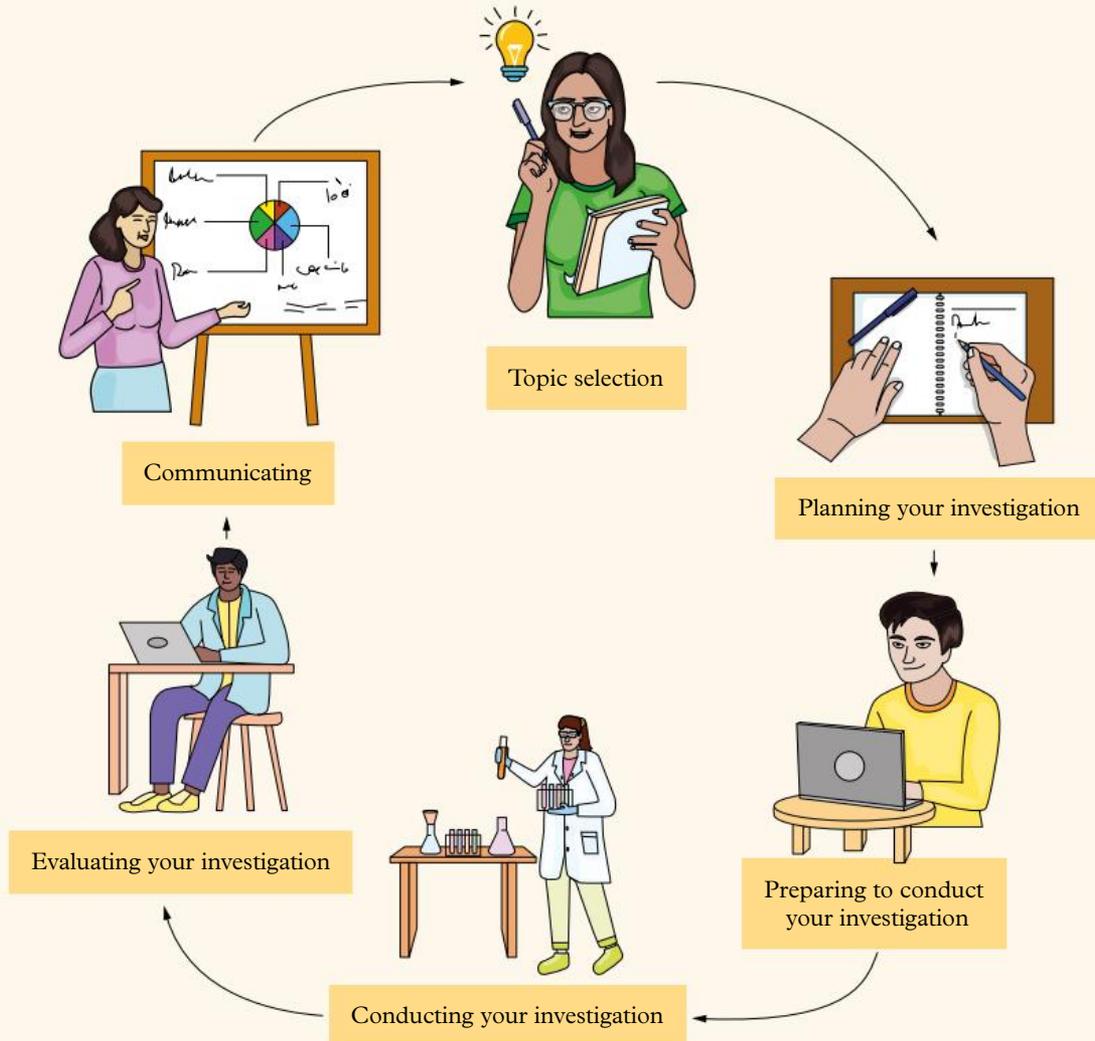
- the lab assistant who prepared all your equipment and materials
- your teacher for contributing ideas
- class members who helped with ideas
- people who helped proofread your poster.

### TO-DO LIST

- Keep to the 600-word limit.
- Format your list of references.
- Include an acknowledgment for everyone who helped you – do not forget your teacher!

Chapter summary

- 11.1 • As part of Unit 4 Area of Study 3, you will conduct a research investigation related to psychological concepts.
- For your research investigation, you will need to collect and analyse primary data; that is, data that has been generated from your own experimentation.
- To answer your investigation question, you can break down the question into smaller parts and generate expanding questions to guide your research.
- Planning your investigation by using a research outline is helpful to keep you on track.
- 11.2 • Annotating your results with detailed notes when collecting data for your investigation can make the research investigation process easier.
- 11.3 • Information can be organised in different ways to communicate your findings.
- You must acknowledge your sources by referencing them in the text and in a bibliography.



## Research investigation checklist

Use the following checklist to make sure you have completed the research investigation.

“I have ...”

- Written or decided on a scientific question to investigate.
- Defined the key scientific theories and terms that are relevant to my investigation topic.
- Analysed the criteria I will be marked on for this assessment.
- Chosen a methodology for my investigation that will best answer my research question.
- Identified the independent and dependent variables that I will be investigating and identified the variables I will control for my investigation.
- Written a testable hypothesis.
- Written a succinct and detailed method for my investigation.
- Conducted a risk assessment.
- Evaluated the ethics of my investigation.
- Set up a logbook to record all results and observations as I conduct the investigation.
- Determined the best way to display my data to best represent my results.
- Analysed my results by identifying key findings and linking key findings to theory.
- Evaluated my errors.
- Modified the method where needed.
- Identified whether my hypothesis was supported.
- Identified the limitations of my investigation design and proposed recommendations to overcome limitations.
- Used a poster format to communicate my findings.
- Formatted my list of references.
- Included acknowledgments.

## AREA OF STUDY 3

UNIT

# 4

# Sample poster

## Does a diet rich in fermented foods influence

Steph

1 Relevant background psychological concepts are outlined and defined in logical manner.

2 Clear aim incorporates IV and DV.

3 Hypothesis accurately defines IV and DV and predicts an outcome.

4 Method includes all necessary information (participants, materials and procedure).

5 Presentation of collected data/evidence is appropriately formatted (as a graph) to illustrate patterns, trends or relationships.

6 Results are clear and accurate.

### Introduction

1 Emerging research suggests the gut–brain axis, the bidirectional communication network between the gut microbiome and the brain, plays a pivotal role in mental health and stress <sup>[1]</sup>. Due to this, the potential impact of diet, particularly consumption of fermented foods, on mental wellbeing is a growing area of interest in stress research. Some strains of bacteria, including *Lactobacillus helveticus* and *Bifidobacteria longum*, which are often found in fermented foods, have been shown to have positive effects on sustaining a healthy gut, subsequently leading to improved levels of stress <sup>[2]</sup>. 2 The aim of this study was to investigate if a diet rich in fermented foods could influence perceived stress levels in adolescents. Based on previous research that supports the influence of gut health on stress <sup>[1, 3–5]</sup>, it was 3 hypothesised that adolescents who consumed a diet high in fermented foods would report lower levels of perceived stress and show signs of improved overall gut health.

### Method

#### Participants

The sample consisted of 10 Year 11 VCE students, evenly split between genders and with no reported gastrointestinal or mental health disorders. Participants were randomly assigned to the control ( $n = 5$ ) or experimental group ( $n = 5$ ).

#### Materials

- Pen
- Logbook to record results
- Perceived gut health questionnaires
- Food diary sheets
- Perceived Stress Scale questionnaires

#### Procedure

For two weeks, the experimental group was instructed to consume a diet rich in fermented foods (e.g. yoghurt, sauerkraut, kefir, kimchi), while the control group maintained their regular diet. To ensure adherence to the diet, participants kept food diaries and took part in weekly follow-up interviews.

Perceived stress levels were measured pre- and post-commencement of the experimental treatment, using the Perceived Stress Scale (PSS), a widely used psychological instrument for measuring the perception of stress. Gut health was indirectly measured both pre- and post-intervention through participants' self-reported gastrointestinal comfort and regularity. Participants rated their gut health on a Likert scale from 1 to 5, where 1 indicates poor gut health and 5 indicates optimal gut health.

### Results

The mean pre-intervention PSS score for the control group was 26.4; the PSS score increased slightly to 27.4 post-intervention. Average gut health scores of the control group also remained relatively stable, decreasing from 3 (pre-intervention) to 2.4 (post-intervention). Conversely, 4 the experimental group's average PSS score decreased from 26.4 pre-intervention to 22.8 post-intervention. Experimental group gut health scores also increased from 3 (pre-intervention) to 4.4 (post-intervention).

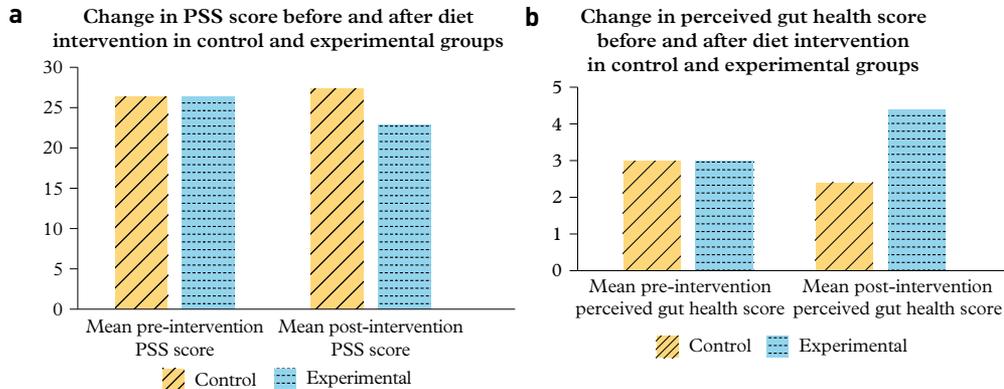
### References and acknowledgments

<sup>1</sup>Foster, J.A., Rinaman, L., & Cryan, J.F. (2017). Stress and the gut–brain axis: regulation by the microbiome. *Neurobiology of Stress*, 7, 124–136. <sup>2</sup>Takada, M., Nishida, K., Kataoka-Kato, A., Gondo, symptoms by modulating the gut–brain interaction in human and animal models. *Neurogastroenterology and Motility*, 28(7), 1027–1036. <sup>3</sup>Selhub, E.M., Logan, A.C., & Bested, A.C. (2014). Ferment conformity and independence. *Journal of Personality and Social Psychology*, 22(1), 18. <sup>4</sup>Casertano, M., Fogliano, V., & Ercolini, D. (2022). Psychobiotics, gut microbiota and fermented foods can help. Docklands, Vic.: Oxford University Press.

Diets  
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## perceived stress levels among adolescents?

Aureus



**FIGURE 1** **a** Change in PSS score in experimental and control groups; **b** change in perceived gut health in experimental and control groups

### Discussion

The results of the investigation supported the hypothesis that adolescents who consume a diet high in fermented foods would report lower levels of perceived stress and show signs of improved gut health. Notably, the intervention group displayed an average decrease of 3.6 points in Perceived Stress Scale scores, alongside an increase in gut health scores from an average of 3 to 4.4. These results suggest the potential role of diet, specifically fermented foods, in stress management among adolescents and can be explained through the gut–brain axis.

The fermented foods consumed by the experimental group were all rich in probiotics. Probiotics are beneficial bacteria that contribute to a healthy balance of microbiota<sup>[5]</sup>. Therefore, by consuming fermented foods, the experimental group is likely to have promoted a balanced gut microbiome, which can improve stress by promoting the production of neurotransmitters like GABA that help relieve anxiety and stress through inhibitory neuronal action<sup>[6]</sup>.

A potentially confounding variable was the participants' overall diet quality. If participants in the experimental group also tended to have a healthier overall diet, the observed reduction in stress levels might be due to the overall healthier diet rather than the fermented foods specifically. Limitations of the study included a small sample size and the inaccuracy of self-reported measures. Future research with larger, diverse samples, objective measurements (e.g. stool sample analysis for gut health) and matched participants could provide a more internally valid understanding of the relationship between diet, the gut–brain axis and stress. This information could benefit individuals looking to naturally improve their overall gut health and stress management through diet.

### Conclusion

This study provided evidence to suggest that a diet rich in fermented foods can influence perceived stress in adolescents through improved gut health. Although the study had limitations and the measurement of gut health lacked validity, findings provided valuable insight into the relationship between gut microbiota and stress.

1 Hypothesis is correctly supported or refuted.

2 Analysis of primary data is accurate.

3 Any outliers, extraneous variables or limitations in data and/or method are discussed.

4 Suggested improvements are provided.

5 Implications of findings are identified.

6 Conclusion reflects an appropriate response to the question.

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Y., Ishikawa, H., Suda, K., Kawai, M., Hoshi, R., Watanabe, O., Igarashi, T., Kuwano, Y., Miyazaki, K., & Rokutan, K. (2016). Probiotic *Lactobacillus casei* strain Shirota relieves stress-associated gut health, microbiota, and mental health: ancient practice meets nutritional psychiatry. *Journal of Physiological Anthropology*, 33, 1–12. Allen, V. L., & Newton, D. (1972). Development of preserving mental health. *Food Research International*, 152, 110892. Hong, L., Rock, M., Allen, J., Blaher-Lucas, E., Jessulat, P., Edwards, R. & Morey, K. (2024). *Psychology for VCE Units 3&4*.

UNIT

# 4

# Review

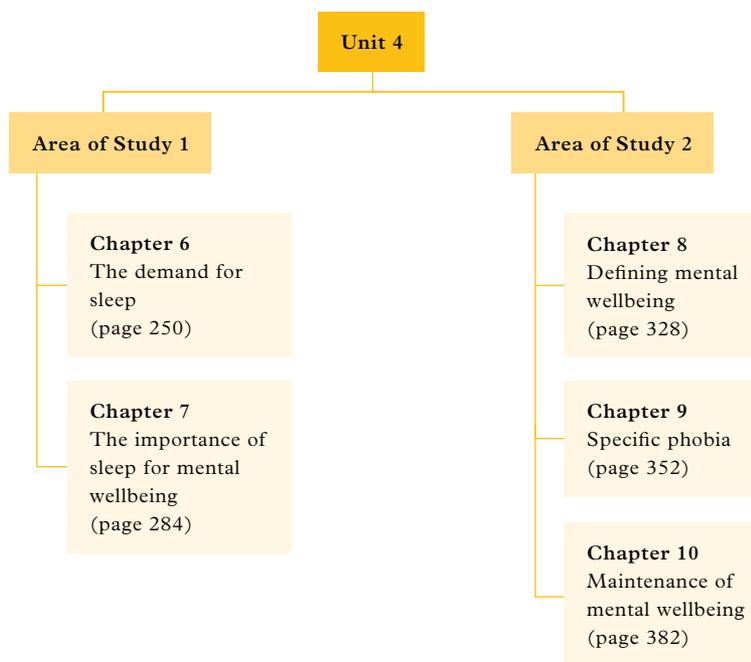
This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 4, learn some expert tips for answering exam questions, and practise your skills on a range of exam-style questions.

## Part A - Revisit and revise

Part A of the unit review will help you revisit and revise all the key concepts from Unit 4 and test your understanding to identify strengths and weaknesses in your knowledge so you can better inform your revision.

### Unit 4 Overview

The chart below shows all the areas of study for Unit 4 and the relevant chapters in your Student Book. Go to the pages shown to review the key concepts for each chapter.



## Test your understanding

Use the following table to guide your revision:

Step 1 – Read the key knowledge for this unit.

Step 2 – Test your understanding of the key knowledge by answering the question(s).

Step 3 – Rate your understanding of each key knowledge from low to high.

Step 4 – Use the topic and page numbers to revise the concepts for which you’ve identified you need practice.

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>sleep as a psychological construct that is broadly categorised as a naturally occurring altered state of consciousness and is further categorised into REM and NREM sleep, and the measurement of physiological responses associated with sleep, through electroencephalography (EEG), electromyography (EMG), electro-oculography (EOG), sleep diaries and video monitoring</li> </ul>	1 Explain how an EEG machine can recognise when someone is in REM and NREM sleep.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 6.2 Pages 261–268
	2 Describe two psychological changes between altered state of consciousness and normal waking consciousness.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 6.1 Pages 252–260
	3 Outline an example of a naturally occurring and an induced altered state of consciousness.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	
<ul style="list-style-type: none"> <li>regulation of sleep–wake patterns by internal biological mechanisms, with reference to circadian rhythms, ultradian rhythms of REM and NREM Stages 1–3, the suprachiasmatic nucleus and melatonin</li> </ul>	4 Discuss which structures in the brain regulate our circadian rhythm.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 6.3 Pages 269–274
<ul style="list-style-type: none"> <li>differences in, and explanations for, the demands for sleep across the life span, with reference to total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM)</li> </ul>	5 Distinguish between the sleeping patterns of an adult and a newborn child.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 6.4 Pages 275–279
	6 Identify the total sleep time for newborns, children, teenagers, adults and elderly people.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	

(continued)

TABLE 1 continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person's affective, behavioural and cognitive functioning, and the affective and cognitive effects of one night of full sleep deprivation as a comparison to blood-alcohol concentration readings of 0.05 and 0.10</li> </ul>	7 Outline an affective, a behavioural and a cognitive symptom of sleep deprivation.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.1 Pages 286–294
	8 State the number of hours of sleep deprivation that correlate to a BAC of 0.05 and 0.10.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	
<ul style="list-style-type: none"> <li>changes to a person's sleep–wake cycle that cause circadian rhythm sleep disorders (Delayed Sleep Phase Syndrome [DSPS], Advanced Sleep Phase Disorder [ASPD] and shift work sleep disorder [SWSD]) and the treatments of circadian rhythm sleep disorders through bright light therapy</li> </ul>	9 Distinguish between DSPS and ASPD with examples of how someone may experience these sleep disorders.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.2 Pages 295–303
<ul style="list-style-type: none"> <li>improving sleep hygiene and adaptation to zeitgebers to improve sleep–wake patterns and mental wellbeing, with reference to daylight and blue light, temperature, and eating and drinking patterns</li> </ul>	10 Outline four ways someone can improve the quality of their sleep using sleep hygiene.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.3 Pages 304–313
<ul style="list-style-type: none"> <li>ways of considering mental wellbeing, including levels of functioning; resilience, as the ability to cope with and manage change and uncertainty; and social and emotional wellbeing (SEWB), as a multidimensional and holistic framework for wellbeing that encapsulates all elements of being (body, mind and emotions, family and kinship, community, culture, country, spirituality and ancestors) for Aboriginal and Torres Strait Islander people</li> </ul>	11 Describe the difference between a mental health problem and a mental health disorder with use of examples.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 8.1 Pages 330–337

*(continued)*

**TABLE 1** continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>mental wellbeing as a continuum, with an individual’s mental wellbeing influenced by the interaction of internal and external factors and fluctuating over time, as illustrated by variations for individuals experiencing stress, anxiety and phobia</li> </ul>	12 Identify two examples of internal factors and two examples of external factors that can affect mental wellbeing.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 8.2 Pages 338–347
	13 Explain the difference between stress and a phobia by identifying one similarity and one difference between them.		
<ul style="list-style-type: none"> <li>the relative influences of factors that contribute to the development of specific phobia, with reference to gamma-aminobutyric acid (GABA) dysfunction and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, and cognitive biases including memory bias and catastrophic thinking (psychological); and specific environmental triggers and stigma around seeking treatment (social)</li> </ul>	14 Discuss how GABA dysfunction leads to someone being more susceptible to a mental health disorder.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 9.1 Pages 345–362
	15 Describe how operant conditioning can lead to avoidance behaviours for someone with a phobia.		
<ul style="list-style-type: none"> <li>evidence-based interventions and their use for specific phobia, with reference to the use of short-acting anti-anxiety benzodiazepine agents (GABA agonists) in the management of phobic anxiety and breathing retraining (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); and psychoeducation for families/supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social)</li> </ul>	16 Outline an example of a biological, a psychological, and a social treatment that can be used to help someone with a phobia.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topics 9.2–9.4 Pages 363–375

*(continued)*

TABLE 1 continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the application of a biopsychosocial approach to maintaining mental wellbeing, with reference to protective factors including adequate nutritional intake and hydration and sleep (biological), cognitive behavioural strategies and mindfulness meditation (psychological) and support from family, friends and community that is authentic and energising (social)</li> </ul>	17 Explain how someone could use a biological, a psychological and a social protective factor to improve their mental wellbeing.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topics 10.1–10.3 Pages 384–398
<ul style="list-style-type: none"> <li>cultural determinants, including cultural continuity and self-determination, as integral for the maintenance of wellbeing in Aboriginal and Torres Strait Islander peoples</li> </ul>	18 Compare cultural continuity and self-determination.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 10.4 Pages 399–403

## Part B – Exam essentials

Now you've completed your revision for Unit 4, it's time to learn and practise some of the skills you'll need to answer exam questions like a pro! To help you, our expert authors have created the following advice and tips to help you maximise your results on the end-of-year examination.

### Exam tip 1 : Linking symptoms to the contributing factors

- An important skill when addressing short answer questions is to structure your response so key terms are linked with examples or symptoms. If you do not show the link between a term and a symptom, factor or treatment, you may not receive full marks.

## See it in action

Read the real exam question below and see how the tip has made a difference between the high-scoring and low-scoring responses.

### QUESTION 5

(4 marks)

- c. Using examples, identify how the affective and behavioural functioning of doctors and/or nurses in a hospital setting may be impacted by partial sleep deprivation.

Source: *VCE 2020 Psychology Exam* reproduced by permission © VCAA

## High-scoring response

1 mark awarded for identifying a valid affective factor.

1 mark awarded for linking affective factor to a valid impact it could have in a hospital setting

 Affective functioning: A doctor might be snappy and irritable with a patient, which might affect the patient's willingness to speak about concerns.

Behavioural functioning: A nurse might be clumsy handling equipment and accidentally prick someone with a needle.

1 mark awarded for identifying a valid behavioural factor.

1 mark awarded for linking behavioural factor to a valid impact it could have in a hospital setting

## Low-scoring response

 Partial sleep deprivation might make doctors and nurses feel tired. They might make mistakes.

No marks awarded as student does not provide specific examples or link examples back to affective and behavioural factors.

## Think like an examiner

To maximise your marks on an exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

### QUESTION 7

(3 marks)

Shari moved interstate for her first job at an advertising company. She quickly found it difficult to work with the other people at the company as she considered them untrustworthy. A month after Shari started, the company underwent a restructure and Shari's job became more demanding. She struggled to meet deadlines and to think clearly. She became increasingly stressed and doubted her ability to do her job effectively. Concerned about her mental health, Shari organised an appointment with the company's psychologist.

c. Explain how one relevant psychological protective factor could influence Shari's resilience

Source: VCE 2018 Psychology Exam reproduced by permission © VCAA

Shari could try to be more optimistic. Optimism is a psychological protective factor and it could help her feel better about her job and cope with the stress.

## Marking guide

<b>Question 7c</b>	1 mark for identification of one relevant psychological protective factor (i.e. cognitive behavioural strategy)
	1 mark for explanation for how the cognitive behavioural strategy could be protective by preventing the occurrence or reoccurrence of symptom(s) from the scenario
	1 mark for knowledge that resilience influences the ability to respond to and overcome stressors

## Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

### Exam tip 2 - Using acronyms

- There are some key psychological terms in the study design that are listed with supporting acronyms in brackets. However, there are also other key terms that are often abbreviated but are not formally abbreviated in the key knowledge dot point. If the study design uses the term with a supported acronym, it is understood that you can use the acronym in your writing without having to spell the word out. For example, REM is first introduced in the study design as “REM”; therefore, you could use it in responses without spelling it out first.
- If a term does not have an acronym in the study design, you cannot do this because it is not known what the term means. However, once you have made the acronym evident in your writing for that question you can keep using the acronym.

## See it in action

Read the real exam question below and see how the tip has made a difference between the high-scoring and low-scoring responses.

### QUESTION 6

(3 marks)

- a. Identify **one** anterograde symptom that is likely to be experienced by people with Alzheimer’s disease and explain the role of the brain structure that is associated with this symptom.

Source: *VCE 2021 Psychology Exam* reproduced by permission © VCAA

### High-scoring response

Student has written out the full name of the disease before shortening it to an acronym or initialism.



Alzheimer’s disease [AD] affects the hippocampus (cells start to die due to plaques and tangles) so that people may lose the ability to consolidate new explicit memories. Patients diagnosed with AD may not remember the names of “new” people they meet, such as the doctors treating them after diagnosis.

As the student outlined what the acronym or initialism stands for earlier in the response, they can now use the shortened term.

### Low-scoring response



AD affects the hippocampus (cells start to die due to plaques and tangles) so that people may lose the ability to consolidate new explicit memories. Patients diagnosed with AD may not remember the names of “new” people they meet, such as the doctors treating them after diagnosis.

The student has lost a mark because an expanded definition was not presented in response and the examiner cannot assume what the acronym stands for.

## Think like an examiner

To maximise your marks on an exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guidance below to mark the response.

### QUESTION 1

(3 marks)

Watson and Rayner classically conditioned 11-month-old “Little Albert” to produce an emotional response to a white rat by pairing a loud noise with the presentation of a white rat. During conditioning, Little Albert’s response to the white rat was to startle and breathe heavily. After conditioning, he trembled and cried in fear every time he saw a white rat and, later, in response to other white, furry objects.

a. Outline the processes required during conditioning for the acquisition of Little Albert’s emotional responses.

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*The NS was paired with the loud noise and the NS and UCS were paired multiple times.*

### Marking guide

Question 1a	1 mark for identifying that the neutral stimulus (NS) (or white rat) was paired with the unconditioned stimulus (UCS) (or loud noise)
	1 mark for explaining that the NS and UCS were paired or associated multiple times
	1 mark for stating the NS (white rat) was presented before the UCS (loud noise)

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

## Part C – Practice makes perfect

Now it is time to put the tips and advice you’ve learnt into practice while you complete these exam-style questions!

### Multiple choice

Use the following information to answer questions 1 to 3.

A researcher investigated the effects of partial sleep deprivation on behavioural functioning. Thirty-four participants were selected via stratified sampling to take part in the controlled experiment. A between-subjects investigation design was employed.

#### Question 1

A possible dependent variable in this study is:

- A reaction time.
- B attention levels.
- C memory ability.
- D anxiety levels.

#### Question 2

A benefit of stratified sampling over random sampling is that:

- A a conclusion is more likely to be made.
- B it is cost effective.
- C it is less time consuming to conduct.
- D the sample often better represents the population.

#### Question 3

A feature of a between-subjects investigation is:

- A participants take part in the control and experimental conditions.
- B participants are randomly allocated into a control or an experimental group.
- C participants can choose whether they want to be placed into the control or the experimental group.
- D participants can move between the control and experimental groups throughout the investigation.

**Question 4**

NREM stage 3 sleep can often be referred to as slow-wave sleep. When an individual transitions into NREM stage 3 sleep, an EEG would detect waves for which the:

- A frequency had increased and amplitude had decreased.
- B frequency had increased and amplitude had increased.
- C frequency had decreased and amplitude had increased.
- D frequency had decreased and amplitude had decreased.

Use the following information to answer questions 5 to 8.

A Year 12 Psychology teacher asks seven of their students to maintain a sleep diary for a period of three weeks. Both quantitative and qualitative data are collected. The raw data in Table 1 represents the sleep duration for each student over a three-day period.

**TABLE 1** The sleep duration for participants

Participant	Sleep duration (hours)		
	Day 1	Day 2	Day 3
1	5.6	5.2	4.8
2	6.1	5.8	6.3
3	6.3	5.9	6.9
4	7.1	7.9	7.4
5	5.2	4.2	4.9
6	6.9	7.0	6.6
7	4.9	6.2	5.7

**Question 5**

The most appropriate measure of central tendency to describe the data set presented in Table 1 would be the:

- A mean.
- B median.
- C mode.
- D standard deviation.

**Question 6**

Analysis of the sleep diaries reveals that each participant is deprived of quality sleep, which will affect their mental wellbeing. In relation to mental wellbeing, quality of sleep is considered to be an:

- A internal factor, originating from inside the individual.
- B internal factor, originating from outside the individual.
- C external factor, originating from inside the individual.
- D external factor, originating from outside the individual.

**Question 7**

An example of qualitative data that could be recorded in the sleep diary is:

- A the number of times participants woke during the night.
- B how often participants feel drowsy throughout the day.
- C how participants felt upon awakening.
- D duration of sleep.

**Question 8**

Which of the following statements is true regarding qualitative and quantitative data?

- A Quantitative data is always objective, whereas qualitative data is always subjective.
- B Quantitative data is always subjective, whereas qualitative data is always objective.
- C Quantitative and qualitative data can be either objective or subjective.
- D Quantitative data can be either objective or subjective, whereas qualitative data is always subjective.

**Question 9**

As a person enters REM sleep:

- A an EMG recording would increase in frequency and decrease in amplitude.
- B an EOG recording would decrease in intensity as rapid eye movement occurs less.
- C an EOG recording would increase in intensity as rapid eye movement occurs more.
- D a video monitoring would show a person as more active and moving around more.

**Question 10**

Which of the following is considered the biological reason for adolescents going to bed at a later hour?

- A Too much sleep the previous night and sleeping in more
- B Later bedtime due to additional social commitments and demands of study
- C Delayed release of melatonin
- D Advanced release of melatonin

### Question 11

Which of the following is a possible change to affective functioning as result of sleep deprivation?

- A Reduced levels of attention
- B Appearing groggy and unbalanced
- C Increased emotional awareness
- D Increased agitation

### Question 12

Which of the following accurately describes someone experiencing a diagnosed sleep disorder?

- A Someone with Advanced Sleep Phase Disorder is unable to fall asleep at their desired bedtime of 10 p.m. and is often awake until 1 a.m.
- B A teenager with Advanced Sleep Phase Disorder has found her melatonin is being released one to two hours later.
- C A person who falls asleep early in the evening is experiencing Delayed Sleep Phase Syndrome.
- D Someone with Delayed Sleep Phase Syndrome is struggling to fall asleep before midnight and as a result is regularly suffering from sleep deprivation.

### Question 13

The type of data collected via video monitoring can be best described as:

- A objective and quantitative only.
- B objective and quantitative or qualitative.
- C subjective and quantitative only.
- D subjective and qualitative only.

### Question 14

Which of the following describes an external factor that could influence someone's mental health?

- A Remembering that you should take your medication
- B Your parents getting divorced
- C Becoming stressed because of an upcoming exam
- D An illicit substance altering your perception

*Use the following information to answer questions 15 to 19.*

Russel has an intense and irrational fear of jellyfish, which has been identified as a phobia. He thinks jellyfish will attack him and poison him if he goes into the ocean. He has even started experiencing fear when approaching a swimming pool. His heart beats faster, his hands are sweaty, and he refuses to enter the water.

### Question 15

Russel's reaction to walking towards the swimming pool is due to the:

- A flight-or-fight-or-freeze response.
- B release of cortisol.
- C dominance of the parasympathetic nervous system.
- D experience of eustress.

### Question 16

Russel's thoughts about jellyfish being likely to attack when he approaches a swimming pool are an example of:

- A self-efficacy.
- B catastrophic thinking.
- C environmental trigger.
- D memory bias.

### Question 17

Long-term potentiation is likely to have contributed to the development and maintenance of Russel's phobia.

Which statement best describes how long-term potentiation has affected Russel?

- A Due to the continual strengthening of neural connections in the amygdala, this would result in a more enhanced fear response.
- B Due to the continual weakening of neural connections in the amygdala, this would result in a more enhanced fear response.
- C Due to the continual strengthening of neural connections because of glutamate being released, this would result in a more enhanced fear response.
- D Due to the continual weakening of neural connections because of noradrenaline being released, this would result in a more enhanced fear response.

### Question 18

Russel's friends encourage him to visit a psychologist to help him manage his phobia. His closest friends attend the session with him. The psychologist informs Russel and his friends about strategies they can apply to support Russel and how to challenge catastrophic thinking.

This support is best described as:

- A anti-anxiety benzodiazepine agents.
- B psychoeducation.
- C stigma.
- D systematic desensitisation.

### Question 19

In preparation for going to the beach, Russel's psychologist recommends benzodiazepines and explains they are going to relax him.

This is because this drug is classified as a GABA:

- A antagonist and increases activity of the central nervous system.
- B agonist and decreases activity of the central nervous system.
- C antagonist and decreases activity of the central nervous system.
- D agonist and increases activity of the central nervous system.

Use the following information to answer questions 20 to 25.

A sleep scientist investigated the effect of room temperature on sleep latency (the time it takes for an individual to go from being fully awake to sleeping). The sleep scientist recruited 46 participants to take part in the study. Participants were randomly allocated to one of three groups.

- Group 1 was exposed to a room temperature of 14°C.
- Group 2 was exposed to a room temperature of 18°C.
- Group 3 was exposed to a room temperature of 22°C.

The sleep scientist used a digital thermometer to measure the temperature of each room before the experiment commencing and at 10-minute intervals over a 60-minute period.

### Question 20

The control group in the experiment is likely represented by:

- A Group 1
- B Group 2
- C Group 3
- D Groups 2 and 3

### Question 21

Which of the following statements about random allocation is true?

- A It increases the likelihood that participants will better represent the population.
- B Participants have an equal chance of being placed into either the control or experimental group(s).
- C The characteristics of the control group will always be equal to the characteristics of the experimental group.
- D Every member of the population has an equal chance of being selected for the study.

### Question 22

Which of the following findings would be expected if the results of the experiment support theory relating to the ideal room temperature for sleep?

- A Group 1 would record a shorter sleep latency than Groups 2 and 3.
- B Group 2 would record a shorter sleep latency than Groups 1 and 3.
- C Group 3 would record a shorter sleep latency than Groups 1 and 2.
- D There would be no difference in sleep latency between the three groups.

### Question 23

For Group 1, the researcher recorded the following temperatures with the digital thermometer before the commencement of the experiment and then at 10-minute intervals for a period of 60 minutes: 14°C, 13.9°C, 13.9°C, 14°C, 13.9°C, 14.0°C, 13.9°C. The true value of the room was 14°C.

This data can be described as:

- A accurate but lacking precision.
- B precise but not accurate.
- C both accurate and precise.
- D neither accurate nor precise.

### Question 24

When calculating the mean sleep latency for Group 1, the sleep scientist performed a miscalculation. This type of error is known as:

- A random.
- B systematic.
- C personal.
- D bias.

### Question 25

During the evening, one of the participants woke up and became upset. They told the researcher they wanted to leave the experiment. The participant also requested that their data be withdrawn. The researcher adhered to both these requests.

Which of the following ethical guidelines did the researcher adhere to when they withdrew the participant's data from the results?

- A Withdrawal rights
- B Voluntary participation
- C Informed consent
- D Confidentiality

### Question 26

Eric experienced a kangaroo attacking him when he was very young. He remembers being kicked viciously and being jumped on repeatedly by the kangaroo. Since this event, Eric struggles to see kangaroos in the wild and fears he will be attacked again.

Which factor tells you that Eric is experiencing a phobia and not anxiety?

- A Eric is experiencing positive stress.
- B The phobia is causing the activation of the flight-or-fight-or-freeze response.
- C The phobia is specific to one stimulus.
- D The source of the phobia is unknown.

### Question 27

A difference between random errors and systematic errors is:

- A random errors affect the precision of results, whereas systematic errors affect both the accuracy and precision of results.
- B random errors affect both the precision and accuracy of results, whereas systematic errors only affect the accuracy of results.
- C random errors affect the precision of results, whereas systematic errors affect the accuracy of results.
- D random errors affect the accuracy of results, whereas systematic errors affect the precision of results.

### Question 28

The Social and Emotional Wellbeing (SEWB) framework:

- A considers wellbeing as multidimensional and holistic.
- B considers wellbeing as static.
- C is a universal framework for understanding wellbeing.
- D consists of five domains.

### Question 29

Breathing retraining is used as an evidence-based intervention in the management of phobic anxiety.

The practice involves:

- A an individual hyperventilating to normalise the balance of oxygen and carbon dioxide in the body.
- B activating the sympathetic nervous system to reduce physiological responses within the body.
- C an individual consciously slowing their breathing, which activates the parasympathetic nervous system.
- D an individual thinking about their phobic stimulus and replacing dysfunctional thought patterns with more positive ones, leading to a reduction in anxiety.

### Question 30

A researcher developed a new treatment option that they thought would rival the use of benzodiazepines in individuals diagnosed with an anxiety disorder. When the treatment option was assessed via clinical trials, it was found to be ineffective at reducing the physiological symptoms associated with anxiety. Although extremely disappointed, the researcher honestly communicated the results of the research to the wider community.

The researcher has upheld the ethical concept of:

- A integrity.
- B justice.
- C non-maleficence.
- D respect.

### Short answer

#### Question 1 (16 marks)

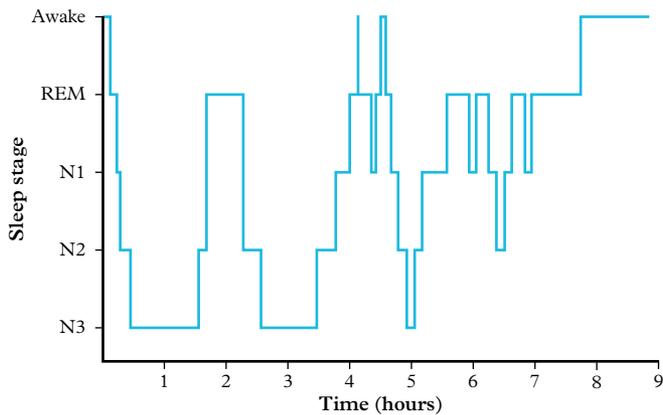
Hamish is a 22-year-old who recently graduated as a nurse. He has begun working at a hospital in Melbourne, where he is rostered to ongoing night shifts. Hamish often consumes caffeinated drinks throughout the shift to keep awake. Hamish finds it difficult to sleep during the day and is experiencing partial sleep deprivation.

- a Identify and describe an affective and cognitive change that is likely to affect Hamish's job as a nurse because of his partial sleep deprivation. (4 marks)
- b Describe two characteristics of Hamish's sleep that will differ from that of a 22-year-old who is not subjected to ongoing night shifts. (2 marks)
- c In response to advice given by a senior nurse, Hamish makes an appointment with a sleep specialist regarding his partial sleep deprivation. The sleep specialist recommends that Hamish participate in a sleep study investigating the impact of caffeine intake on partial sleep deprivation in shift workers. For the duration of the study, Hamish is admitted to a sleep clinic to investigate his sleep patterns. At the sleep clinic, Hamish is subjected to a variety of objective and subjective measures used to monitor his sleep patterns.
  - i Describe the informed consent procedures the sleep specialist would need to follow prior to Hamish taking part in the study. (2 marks)
  - ii Describe an objective measure that could be used to inform when Hamish transitions between REM and NREM sleep and explain how it could be used to do this. (3 marks)

- iii Explain how a subjective measure could be used to monitor Hamish's sleep patterns during the study. (2 marks)
- iv At the conclusion of the study, the sleep specialist outlined ways Hamish can improve his sleep after the completion of his night shifts. With reference to sleep hygiene, describe two strategies the specialist may have outlined. (3 marks)

**Question 2** (16 marks)

The hypnogram in Figure 1 is for Heidi, a teenager.



**FIGURE 1** Heidi's hypnogram

Since starting her final year of high school, Heidi has become concerned that she is not getting enough sleep. She often uses her laptop late at night to prepare for upcoming SACs.

- a Distinguish between REM and NREM sleep. (2 marks)
- b With reference to the hypnogram, provide three points to justify why Heidi shows the sleep characteristics of a teenager rather than an elderly person. (3 marks)
- c Heidi is going to bed too late and waking early for school, leading her to be sleep deprived. Identify the circadian rhythm sleep disorder Heidi may be experiencing. (1 mark)
- d Define "zeitgeber" and describe how the zeitgeber associated with Heidi's laptop use is affecting Heidi's sleep. (4 marks)
- e Identify two additional reasons for Heidi's late bedtime that relate to the demands of being a teenager. (2 marks)

- f Take the role of a sleep professional and describe a suitable treatment to help synchronise Heidi's sleep-wake cycle to the circadian rhythm. Explain how this could help Heidi meet the demands of her final year of school. (4 marks)

**Question 3** (14 marks)

Margot has just moved to a new town where she has started a job as a dentist. She was enjoying the move to begin with, but over the past few weeks has become quite stressed and noticed her performance at work is affected. She believes none of her new work colleagues like her despite being invited to work gatherings and social drinks that she is yet to attend. Margot is finding she is stressed because she misses her friends, as well as her old netball club. She is very wary of letting her "stress" get to her because her mother was diagnosed with an anxiety disorder after becoming overwhelmed in her teenage years. Concerned about her mental wellbeing and her family history of anxiety disorders, Margot makes an appointment to speak with her local doctor.

- a Describe where Margot would be positioned on the mental wellbeing continuum. Justify your response. (2 marks)
  - b Outline two characteristics that indicate that Margot is experiencing stress and not anxiety. (2 marks)
  - c Identify and describe a biological and social protective factor that Margot could incorporate into her life to reduce her stress levels. (4 marks)
- Late at night, Margot was researching ways to maintain her mental wellbeing when she came across an advertisement for volunteers to participate in a study investigating the effect of cognitive behavioural strategies on stress levels. Margot submitted her details and a few days later was contacted by the researcher, who informed her that she was eligible to participate in the study. Margot was randomly allocated to one of two groups.
- Group 1 underwent an education session with a psychologist, who explained what cognitive behavioural strategies are and how they can be incorporated into daily life.
  - Group 2 was not provided with any information regarding cognitive behavioural strategies and was asked to carry on with their normal daily activities.

Prior to the study commencing, participants were asked to rate their level of stress on a rating scale from 0 (not stressed) to 10 (very stressed). Once the study commenced, for a period of 3 weeks, participants rated their stress levels at the end of every week.

The results of the study are shown in Table 2.

**TABLE 2** Participants' stress levels over 3 weeks

Group	Mean stress levels (0–10)			
	Before start of study	End of Week 1	End of Week 2	End of Week 3
1 (use of cognitive behavioural strategies)	7.6	7.5	6.5	4.1
2 (no cognitive behavioural strategies)	7.8	7.7	7.2	8.0

**d** Use graphing conventions to represent the data for before the study commenced and at the end of Week 3. (3 marks)

**e** Using your knowledge of cognitive behavioural strategies, explain the results collected in this study. (3 marks)

**Question 4** (14 marks)

Mel plays the drums in a band with his friends. The band was asked to perform at his cousin's 21st birthday party. Mel felt nervous about performing in front of an audience. On the evening of the party, he felt sick when he stepped on the stage and immediately had a panic attack, forcing his band to perform without him. Mel left and went home instead of spending time at the party. The next time the band performed at a party, Mel began playing with the band but immediately experienced sweaty palms, an increased breathing rate and a rapid pulse as he stood in front of the audience. He stopped playing with the band, said that he felt sick and then went home.

Mel has subsequently continued to make excuses and stay at home every time he has been asked to perform with the band at a party because each time he thinks of playing in public, he experiences feelings of intense fear and worry, shortness of breath, sweating, trembling, nausea and dizziness.

**a** Outline three reasons why Mel is likely to be diagnosed with a specific phobia. (3 marks)

**b** Explain how GABA dysfunction would affect the stress response each time Mel goes on stage. (3 marks)

**c** When Mel retells his experience at his cousin's 21st, he often talks about drinks and bottles being thrown at him. Identify and describe the specific psychological factor which is having a negative impact when he is reliving this experience. (2 marks)

**d** Explain how systematic desensitisation could be used to help Mel overcome his phobia. (4 marks)

**e** To enable Mel to perform in front of crowds again, he practises breathing retraining and uses techniques he has learnt in psychoeducation sessions. Describe how breathing retraining and psychoeducation may positively contribute to Mel's mental wellbeing. (2 marks)

**Question 5** (10 marks)

Miles is a 15-year-old boy who is very active and enjoys school. Ever since he was young, Miles has been unable to eat fried chips. The sight of the drive-through restaurants and listening to his friends say, "Want to get some fried chips?" makes him feel sick. Over the past few years, his nausea related to fried chips has worsened. At times it is so severe that simply being in the car and driving past a fast-food drive-through gives him stomach cramps. Miles' mother will often look at maps or change roads to avoid driving past drive-through fast-food restaurants. A new fast-food restaurant has been built near Miles' school and his mother is worried about him having to walk past and smell the fried chips, or other students finding out and bullying him.

Concerned, Miles' mother wants him to get treatment because she isn't sure what is wrong with her son. Miles tells a psychologist that as a child he used to eat fried chips all the time until, on three separate occasions, he became violently ill after eating the fried chips.

Acting as Miles' psychologist, use the mental wellbeing continuum to suggest a diagnosis with suitable justification. Reference the behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning to explain how Miles' condition was developed and is maintained. Explain how cognitive behavioural therapy could assist Miles in managing his condition.

## 3&amp;4

## Practice exam

This practice exam is designed to help you revise your understanding of all key concepts of the content covered in Units 3 & 4 and practise your skills on a range of exam-style questions. A printable version of this practice exam is available in your obook pro.

**Practice examination**

Part	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	9	9	80
Total:	49	49	120

**Part A - Multiple choice**

Use the following information to answer questions 1 to 6.

Researchers investigated the effectiveness of systematic desensitisation on the severity of phobic symptoms. Thirty-one participants who had been diagnosed with a specific phobia of insects within the last 12 months were randomly selected to take part in the study.

Participants were randomly allocated to one of two groups. Group 1 attended eight sessions with a psychologist who applied the techniques of systematic desensitisation in relation to their specific phobia of insects. Group 2 were not exposed to any systematic desensitisation sessions.

Prior to the study commencing, participants' baseline heart rate and respiratory rate was measured when presented with a real-life insect. Their heart rate and respiratory rate were again recorded in the presence of a real-life insect at the end of the fourth week of the study and at the end of the eighth week of the study.

The results of the study for heart rate are presented in Table 1.

**TABLE 1** Heart rate when presented with a real-life insect

	Mean baseline heart rate (BPM)	Mean heart rate end of Week 4 (BPM)	Mean heart rate end of Week 8 (BPM)
No use of systematic desensitisation	145	151	155
Use of systematic desensitisation	148	134	110

**Question 1**

An appropriate hypothesis for this study is:

- A** individuals who participate in systematic desensitisation sessions will show a reduction in the severity of phobic symptoms compared to those who do not participate in systematic desensitisation sessions.
- B** individuals who participate in systematic desensitisation sessions will show an increase in the severity of phobic symptoms compared to those who do not participate in systematic desensitisation sessions.
- C** the use of systematic desensitisation will have an impact on the severity of phobic symptoms.
- D** the use of systematic desensitisation will have no impact on the severity of phobic symptoms.

### Question 2

The type of data collected by this study is:

- A primary, quantitative.
- B primary, qualitative.
- C secondary, quantitative.
- D secondary, qualitative.

### Question 3

If the data in the table was to be presented in graphical form, which of the following would be true?

- A A line graph would be used, with mean heart rate plotted on the  $y$ -axis.
- B A line graph would be used, with mean heart rate plotted on the  $x$ -axis.
- C A bar chart would be used with mean heart rate plotted on the  $y$ -axis.
- D A bar chart would be used with mean heart rate plotted on the  $x$ -axis.

### Question 4

Which of the following statements accurately explains the results obtained in the study?

- A In the presence of a real-life insect, the parasympathetic nervous system remained dominant for the group who did not use systematic desensitisation, whereas the sympathetic nervous system remained dominant for the group who did use systematic desensitisation.
- B A surge of adrenaline was experienced by the participants at the end of Week 8 in the systematic desensitisation group compared to the group who did not use systematic desensitisation.
- C In the presence of a real-life insect, the sympathetic nervous system remained dominant for the group who did not use systematic desensitisation, whereas the sympathetic nervous system response became less dominant for the group who did use systematic desensitisation.
- D The use of systematic desensitisation is useful in the short term but not in the long term.

### Question 5

A potential extraneous variable in the study is:

- A the small sample size.
- B the uneven number of participants in both groups.
- C only individuals with an insect-based phobia were included in the study.
- D whether any of the participants were taking medication for a pre-existing heart issue.

### Question 6

The participants potentially experienced psychological harm when faced with their phobic stimulus. Prior to commencing the study, the researchers submitted detailed plans of their research proposal to the human research ethics committee. They provided evidence that any benefits of their research would outweigh any resulting harm.

The ethical concept which the researchers adhered to was:

- A justice.
- B beneficence.
- C non-maleficence.
- D integrity.

### Question 7

Ken started learning kickboxing at the age of five. By age six, Ken could perform basic kicking techniques. By age eight, Ken could display more advanced kicking patterns and successfully compete against older students. Ken attributes his success to his parents, trained kickboxers who taught Ken by demonstrating kicking techniques and then verbally praising Ken if he reproduced a similar behaviour.

The strategy used by Ken's parents can best be described as:

- A operant conditioning and classical conditioning.
- B operant conditioning only.
- C observational learning and operant conditioning.
- D observational learning and classical conditioning.

*Use the following information to answer questions 8 to 10.*

Trinh works as a receptionist for a small business. Her job requires her to answer phone calls and perform computer work, which requires her to sit in front of a screen for extended periods. Recently, Trinh has been complaining of eye strain due to staring at the screen for too long. She visited an optometrist who recommended that when Trinh is at work, she should set an alarm on her phone to sound every twenty minutes. When the alarm sounds, Trinh should go for a walk and avoid looking at screens to minimise eye strain.

### Question 8

In the context of the three-phase model of operant conditioning, the antecedent and behaviour in this case are:

	Antecedent	Behaviour
A	Going for a walk	The alarm sounding
B	Seeing an optometrist	The reduction of eye strain
C	The alarm sounding	Going for a walk
D	The reduction of eye strain	Going for a walk

### Question 9

Which of the following would be most accurate if Trinh noticed that the strategy reduced her experience of eye strain? Repetition of the behaviour would be likely to:

- A increase due to positive reinforcement.
- B increase due to negative reinforcement.
- C decrease due to positive reinforcement.
- D decrease due to negative reinforcement.

### Question 10

During the process of acquisition in classical conditioning, which of the following sequences correctly represents the order of stimulus presentation?

- A Neutral stimulus followed by conditioned stimulus
- B Unconditioned stimulus followed by unconditioned response
- C Unconditioned stimulus followed by neutral stimulus
- D Neutral stimulus followed by unconditioned stimulus

*Use the following information to answer questions 11 to 13.*

A researcher wanting to find out more about aphantasia conducts in-depth unscripted interviews with five individuals who have been diagnosed with aphantasia.

### Question 11

The scientific investigation methodology employed by the researcher is:

- A a case study.
- B a correlational study.
- C fieldwork.
- D a literature review.

### Question 12

A strength and weakness of the scientific investigation methodology employed in question 11 is:

	Strength	Weakness
A	It uses secondary data to generate findings about participants living with aphantasia.	The artificial setting may influence the behaviour of the participants.
B	It provides in-depth qualitative data about aphantasia.	Results may be externally invalid.
C	It helps identify gaps in knowledge about aphantasia and inform direction of future research.	Results may be internally invalid.
D	It provides in-depth quantitative data about aphantasia.	Results may not be representative of the population of individuals living with aphantasia.

### Question 13

To adhere to the ethical concept of justice, the researcher must ensure that:

- A all participants are treated equally.
- B research results are communicated honestly.
- C participants are not harmed.
- D participants can make their own decisions.

### Question 14

Akuma has a dog named Bison that he walks every night. Immediately before going for a walk each night, Akuma switches on the telephone answering machine. Now, Akuma notices that every time he turns on the answering machine, Bison starts to wag his tail.

Turning on the answering machine is:

- A a neutral stimulus.
- B a conditioned response.
- C a conditioned stimulus.
- D an unconditioned response.

### Question 15

To remember its full name, many people often refer to the neurotransmitter gamma-aminobutyric acid as “GABA”. This is an example of a mnemonic device called:

- A an acrostic.
- B an acronym.
- C an initialism.
- D the method of loci.

Use the following information to answer questions 16 to 20.

An investigation was conducted with 20 participants who were randomly allocated into two groups of 10. They were asked to recall items from a shopping list of 12 items after looking at the list for three minutes. Before being shown the list, Group A was provided with coaching sessions, teaching them how to apply the method of loci. They were instructed to apply this technique when supplied with the shopping list. Group B was given no instructions before being shown the list and asked to recall the items.

**Question 16**

The type of experimental design used in this study is best described as a:

- A within-subjects design.
- B between-subjects design.
- C mixed design.
- D controlled experiment.

**Question 17**

A limitation of the experimental design identified in question 16 is that:

- A characteristics of the sample may not be representative of the population.
- B it is time-consuming to conduct the study.
- C findings can be difficult to interpret.
- D a large group of participants is required.

**Question 18**

Identify the independent and dependent variables in this study.

	Independent variable		Dependent variable
	Experimental group	Control group	
<b>A</b>	Application of method of loci	Method of loci not applied	Correct order of shopping list items recalled
<b>B</b>	Application of method of loci	Method of loci not applied	Number of shopping list items correctly recalled
<b>C</b>	Correct order of shopping list items recalled	Order of shopping list items incorrectly recalled	Application of the method of loci
<b>D</b>	Number of shopping list items correctly recalled	Number of shopping list items incorrectly recalled	Application of the method of loci

**Question 19**

One participant from Group B recalled all items correctly. When researchers asked him how he performed so well on the task, he said that the shopping list was almost identical to the one he uses every week for his personal grocery shop.

The participant's familiarity with items on the list is an example of:

- A a controlled variable.
- B an extraneous variable.
- C a confounding variable.
- D a systematic error.

**Question 20**

How does the response to question 19 affect the validity of the study?

- A It increases the external validity of the study.
- B It decreases the internal validity of the study.
- C It increases the internal validity of the study.
- D It does not affect the validity of the study.

**Question 21**

Simone is being assessed in a sleep laboratory to analyse her sleep cycle. She has several devices attached to her; the sensors of one device are placed around the muscles of her eyes.

This device would be specifically measuring the:

- A movement of the eye during REM sleep.
- B electrochemical energy of the brain during N2 sleep.
- C electrical and muscular activity of the eye during NREM and REM sleep.
- D movement and direction of the eye during REM and NREM sleep.

**Question 22**

Bilbo is having a vivid dream about being chased by a dragon in a field of burning gold.

During the dream, which of the following is likely to occur?

- A Very high-amplitude and low-frequency waves
- B A combination of very high-amplitude, low-frequency waves and very low-amplitude, high-frequency waves
- C A combination of high-amplitude, low-frequency and low-amplitude, low-frequency waves
- D Very low-amplitude and high-frequency waves

**Question 23**

For the past three months, Katia has been under significant amounts of stress at her new job. In the past week, Katia has not been able to go to sleep easily. Often, she goes to bed at 10 p.m., but is still awake at 12 a.m., even though she must get up at 7 a.m. to go to work.

It is likely that the cognitive effects of Katia's lack of sleep would be the equivalent to Katia having a BAC level of:

- A 0.50.
- B 0.05.
- C 0.10.
- D 0.01.

Use the following information to answer questions 24 to 26.

As a paramedic, 34-year-old Rami is required to work a range of different shifts over the month. Often, his monthly roster will be organised as follows.

Week	Start time	Finish time
1	9 p.m.	5 a.m.
2	9.30 p.m.	6 a.m.
3	6 a.m.	3 p.m.
4	6.30 a.m.	3 p.m.

To help reduce the adverse effects of sleep deprivation and changes in his sleep-wake cycles, Rami's employer provided him with a light box and instructions on when he should expose himself to light.

**Question 24**

During weeks 1 and 2 of his shift, Rami should expose himself to the light box at approximately:

- A 5 a.m.
- B 6 p.m.
- C 12 p.m.
- D 6 a.m.

**Question 25**

During week 3 of his shift, when should Rami expose himself to the light box?

- A At approximately 3 a.m.
- B At approximately 3 p.m.
- C At approximately 5 a.m.
- D Rami is not required to use the light box.

**Question 26**

Which of the following subjective measures will track the success of using the light box to reduce sleep deprivation and assist in managing Rami's sleep-wake cycle?

- A An EEG, EMG and an EOG
- B An EEG and video monitoring
- C An EEG and a sleep diary
- D A sleep diary

**Question 27**

A key characteristic of sleep over the life span is that the proportion of:

- A REM sleep for elderly adults is significantly less than that of middle-aged adults.
- B NREM sleep for infants is significantly less than that of adolescents.
- C REM sleep for young adults is significantly greater than that of children.
- D NREM sleep for adolescents is significantly greater than that of young adults.

**Question 28**

Which of the following is the most accurate description of the role of the neurotransmitter GABA (gamma-aminobutyric acid) in the central nervous system?

- A It promotes feelings of pleasure and reward.
- B It enhances memory and cognitive functions.
- C It inhibits brain activity and reduces neural excitability.
- D It stimulates the release of adrenaline during stressful situations.

**Question 29**

Juan is working a busy shift as a waiter when a colleague trips next to him and spills a very hot bowl of soup. As soon as a small splash of the hot liquid hits Juan's skin, he instantly moves his arm away without thinking. Which of the following is true of the situation?

- A Juan's arm movement was a conscious response.
- B Motor receptors on the surface of Juan's skin detected the heat from the hot bowl of soup.
- C Interneurons sent the sensory information received to Juan's brain so it could determine the type of response that should be made.
- D Interneurons transmitted the sensory information from sensory neurons to motor neurons so a response could be executed quickly.

Use the following information to answer questions 30 to 32.

A researcher was investigating whether a relationship existed between hours spent meditating weekly and perceived mental wellbeing in adolescents. They interviewed 16 participants and had them self-report the hours they spent meditating in a week. Participants also self-reported their perceived levels of mental wellbeing on a scale from 0 to 16 (where 0 = very low levels of mental wellbeing and 16 = very high levels of mental wellbeing). The results of the investigation are shown in Figure 1.

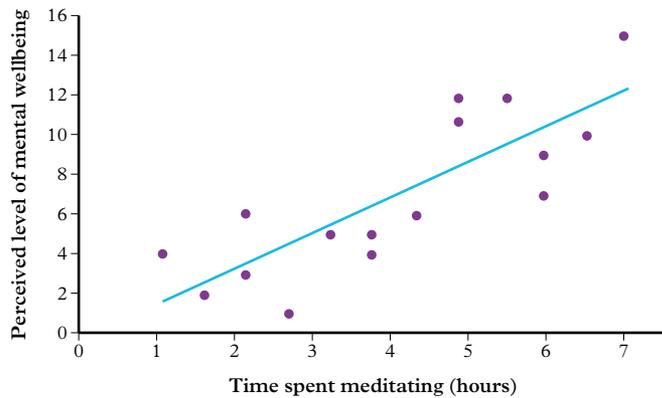


FIGURE 1 The results of the investigation

**Question 30**

What type of investigation methodology was used in this study?

- A Correlational study
- B Case study
- C Controlled experiment
- D Simulation

**Question 31**

What can be said of the relationship between hours spent meditating and perceived levels of mental wellbeing?

- A The results showed a strong positive relationship.
- B The results showed a weak positive relationship.
- C The results showed a strong negative relationship.
- D The results showed a weak negative relationship.

**Question 32**

The researcher decides that in their next investigation, they would like to examine whether a relationship exists between a biological factor and perceived levels of mental wellbeing. Which of the following is an example of a biological factor the researcher could investigate?

- A Nutritional intake
- B Perceived levels of support from family and friends
- C Mindfulness meditation
- D Cognitive behavioural strategies

**Question 33**

Which is true of operant conditioning and phobia?

- A Operant conditioning is the sole cause of specific phobia.
- B Operant conditioning can perpetuate avoidance behaviours related to a specific phobia.
- C Operant conditioning can be used to treat specific phobia by providing education to family, friends and others in the support network of someone diagnosed with a specific phobia.
- D Operant conditioning provides a way for individuals to focus on the now rather than dwell on the past or future.

**Question 34**

Which of the following is true of cultural continuity?

- A It is a cultural practice that can act as a mnemonic device.
- B It is a protective factor for maintaining social and emotional wellbeing.
- C It is a biological factor that contributes to wellbeing.
- D It describes the right for individuals to have self-governance.

**Question 35**

Which of the following is an example of a social protective factor for mental wellbeing?

- A Cognitive behavioural strategies
- B Authentic support from family and friends
- C Adequate nutritional intake
- D Adequate sleep

### Question 36

Keffi is collecting data on the perceived levels of mental wellbeing in his classroom. Rather than using a survey, Keffi decides to have conversations with his classmates and make notes on what they discuss. He later decides to look for commonalities between the descriptions his classmates gave him.

Which is true of the data Keffi has collected?

- A It is rich quantitative data.
- B Keffi can average this data to calculate measures of central tendency.
- C The interview process made use of Likert scales.
- D It is rich qualitative data.

### Question 37

Jasmine has aerophobia, a specific phobia of flying. She refuses to board any flights because she believes that as soon as she boards one, it will be destined to crash.

Jasmine's thoughts around flying are an example of:

- A catastrophic thinking.
- B memory bias.
- C actor–observer bias.
- D cognitive dissonance.

### Question 38

Which of the following best describes long-term potentiation in the context of learning and memory?

- A A temporary increase in synaptic strength that occurs after a single exposure to a stimulus
- B A persistent enhancement of synaptic transmission that strengthens neural connections over time
- C A decrease in synaptic efficacy resulting from prolonged low-frequency stimulation
- D A process of forgetting and weakening neural connections to make space for new memories

### Question 39

In the context of synaptic plasticity in response to damage, what do the processes of sprouting and rerouting refer to?

- A Sprouting is the formation of new neural connections. Rerouting is establishing connections using alternative existing neural pathways.
- B Sprouting is the strengthening of existing neural pathways. Rerouting is the formation of new neural connections.
- C Sprouting is the weakening of neural connections. Rerouting is the loss of synaptic plasticity.
- D Sprouting is the loss of synaptic plasticity. Rerouting is the weakening of neural connections.

### Question 40

Which of the following statements is true regarding the use of yarning circles?

- A Yarning circles have been practised in Western communities for thousands of years.
- B Yarning circles are always formal practices.
- C An individual must be a trained mental health professional to engage in a yarning circle.
- D Members of a yarning circle are free to discuss, receive and question information openly and without judgment from others.

## Part B: Short answer

### Question 1 (14 marks)

Raj is a 43-year-old lawyer in a busy law firm. He consistently works in a stressful, high-pressure environment that often requires him to work anywhere between ten and twelve hours a day. After working for THREE years without leave, Raj decides to take annual leave and have a break from the stress of his job. During the first week of his leave, Raj finds it difficult to settle into a more relaxed routine, often struggling to go to sleep. Moreover, when Raj does go to sleep, he finds that he cannot sleep for more than three or four hours.

- Identify one affective and one behavioural effect of partial sleep deprivation that Raj may display during his first week of leave. (2 marks)
- Sleep hygiene may be used to improve Raj's sleep quality and quantity. Propose two approaches that Raj may adopt to improve his sleep hygiene and adaptation to zeitgebers. (4 marks)
- In his third week of leave, Raj has settled into a sleep pattern in which he is asleep by 9 p.m. but wakes at 3 to 4 a.m.

Justify why Raj may be experiencing an advanced sleep phase disorder, referring to the regulation of sleep by the suprachiasmatic nucleus. (4 marks)

- Frustrated with his sleep patterns, Raj seeks assistance from a sleep psychologist. The sleep psychologist recommends Raj participate in a sleep study. Identify and outline one objective measure and one subjective measure used throughout the sleep study that will provide useful data about Raj's sleep patterns. (4 marks)

### Question 2 (7 marks)

During each sleep episode, we cycle through four different stages. A hypnogram shows the alternating cycles of NREM and REM sleep and how long a person spends in each stage.

- Construct a hypnogram to indicate the first two sleep cycles of a healthy adolescent. (3 marks)
- With specific reference to your hypnogram, provide two comparisons between the sleep patterns of a healthy adolescent to that of an infant. (4 marks)

### Question 3 (8 marks)

Yomi is attempting to learn and memorise a new song on guitar. To do this, Yomi reads two pages of sheet music with the notes of the song while playing the notes on her guitar. She repeats these processes multiple times. After an hour, Yomi can successfully play half of the song from memory, without looking at the sheet music.

- Outline the roles of the basal ganglia and cerebellum in memory as Yomi learns to play the new song. (2 marks)
- Explain how Yomi's short-term memory is assisting her to learn the notes of the new song. (3 marks)
- Provide three reasons why the learning process Yomi used to learn the song is not an example of observational learning. (3 marks)

### Question 4 (7 marks)

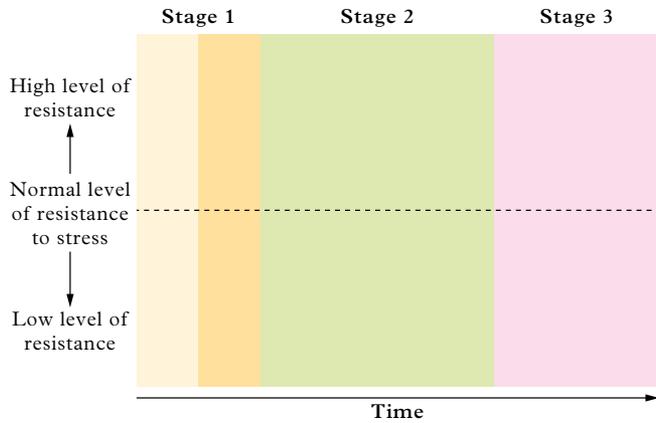
Edwina is a classroom teacher at a local high school. Although most of her classes are well behaved, one of her classes regularly misbehaves. The misbehaving class consists of 28 students, half of whom ignore Edwina when she attempts to teach them while the other half use abusive language at her.

- Outline how Edwina could effectively use positive punishment and negative reinforcement to deal with the students' use of abusive language. (4 marks)
- After attending a teacher's conference on classroom management, Edwina decides to conduct a controlled experiment with her class to investigate the effectiveness of positive reinforcement on student behaviour. Outline the informed consent procedures Edwina would need to implement before starting the study. (3 marks)

### Question 5 (8 marks)

Two weeks into the start of the school year, Felicity, a primary school teacher, has found that her workload has become very demanding and that managing her many classes has been more stressful than ever. Three months into the school year, Felicity consistently feels unwell, and she has been frequently experiencing back and shoulder pain and feeling fatigued.

- a Identify the three stages that occur in Selye's General Adaptation Syndrome (GAS). (1 mark)
- b Complete the graphical representation of Selye's GAS by drawing the missing curve. (1 mark)



- c Identify which stage of Selye's General Adaptation Syndrome Felicity was in when she started to experience back and shoulder pain and feeling fatigued. Justify your answer. (3 marks)
- d Felicity continues to work under these conditions for two years until her doctor diagnoses her with a serious digestive condition and recommends that she stop working. Identify which stage of Selye's General Adaptation Syndrome Felicity was in when diagnosed with a digestive condition. Justify your answer. (3 marks)

**Question 6** (11 marks)

Ricardo has been on a course of antibiotics for the last three months to treat an ongoing bacterial infection. He has been feeling increasingly stressed at work lately despite his workload remaining relatively consistent.

- a Describe the communication between the gut and the brain through the gut-brain axis. (2 marks)
- b Describe how changes in gut microbiota can influence stress perception and coping mechanisms in individuals like Ricardo and explain how changes in gut microbiota due to antibiotics may contribute to increased stress sensitivity and an altered stress response. (3 marks)
- c Ricardo makes an appointment with the organisational psychologist at his workplace to discuss his increased levels of stress. During one of the sessions, the psychologist suggests that Ricardo would benefit from participating in a focus group interview regarding workplace stress.

Identify the type of data obtained via a focus group interview and outline an advantage of this data type in relation to workplace stress. (2 marks)

- d Identify and describe two protective factors that could support Ricardo's mental wellbeing. (4 marks)

**Question 7** (8 marks)

Jono is scrolling through Instagram when he sees a post about evidence-based interventions for specific phobia (Figure 2). Jono, whose best friend Peter has a specific phobia of cats (ailurophobia), is contemplating whether he should share the post with Peter.

**Top three interventions for specific phobia**

1. Anti-anxiety benzodiazepine agonists – start a course of these and watch your phobia disappear.
2. Face the worst inclination of your fears head-on. Stop chickening out and just get on with it; once you've faced the worst, you're guaranteed to feel better!
3. Get educated; seek help from a psychologist to start psychoeducation with your support group. Support from friends is the most effective biological intervention!

**FIGURE 2** A post on interventions for phobia

- a Referring to the social media post shown in Figure 2, critically evaluate two of the claims by considering psychological information, theories and/or models. (6 marks)
- b Based on your evaluation of two claims in part a, what would you advise Jono to do – share the post or not share the post? Justify your answer. (2 marks)

**Question 8** (7 marks)

Jarrah is a proud Wadawurrung teenager who has recently moved to Melbourne to study as a boarder during his VCE. Jarrah, who has been missing his community, culture, friends and Country, decides to engage in several activities to improve his social and emotional wellbeing.

Jarrah:

- sets up regular video calls to see his friends, family and community
- works alongside his teacher to set up a yarning club where he can teach his new school friends about his culture in a safe space

- informs his teacher on the direction he feels they should take to improve the presentation of content related to Aboriginal and Torres Strait Islander peoples' knowledges, cultures and histories in VCE Psychology lessons.
  - a** Describe social and emotional wellbeing. (1 mark)
  - b** Describe cultural continuity with reference to an example shown by Jarrah. (2 marks)
  - c** Describe self-determination with reference to an example shown by Jarrah. (2 marks)
  - d** Use Jarrah's actions to explain whether you believe he has shown high or low levels of resilience. (2 marks)
- **Group A:** Participants receive a daily dose of probiotics containing specific strains known to influence gut–brain communication in a positive way.
  - **Group B:** Participants will receive a daily dose of a sugar pill with no active probiotic ingredients.
  - **Group C:** Participants will receive no treatment and act as a control group.
- All participants will self-report their stress levels on a perceived stress scale three times: at the beginning of the study, immediately after a three-month intervention period, and three months after the intervention ends.

**Question 9** (10 marks)

A group of researchers is planning to investigate the potential impact of probiotics on adolescents' perceived stress levels through the gut–brain axis. They intend to select a sample of 210 participants from respondents who replied to an advertisement on Facebook. Participants will randomly be assigned to one of three conditions for six months:

Evaluate the proposed study design, considering its investigation methodology and design and the potential effect(s) this has on the analysis and interpretation of results as well as the validity of conclusions that may be drawn. Use appropriate psychological terminology in your evaluation.

CHAPTER

# 12

## Investigations

To complete VCE Psychology, you will need to complete at least 10 hours of practical work for each of Units 3 and 4, plus at least 10 hours for Unit 4 Area of Study 3. Practical work can cover a range of scientific investigation methodologies, such as controlled experiments, modelling, case studies, classification and identification, literature reviews, fieldwork, correlational studies, simulations and product, process or system development. All investigations that are undertaken as part of your course, as well as School-assessed Coursework (SACs) should be written in a logbook that will be monitored and submitted to teachers. Before undertaking an investigation for the first time, ethical concerns should be considered, including the importance of sociocultural, economic, political and legal factors that may arise from science-related decision-making.



### SAFETY IN THE LABORATORY

This chapter will highlight key safety concerns for each investigation, though there are some general safety concerns to be considered before completing any practical work.

- Do not eat or drink in the lab.
- Always be aware of your peers and act in a way that will not cause harm.
- Wear a lab coat, safety glasses, close-toed shoes and gloves when appropriate.
- Review the school's safety procedures and location of the eyewash, shower, spill kits and first aid kits.
- Handle all materials with care and consult your teacher to help conduct risk assessments for all hazards involved with materials or procedures.
- Always check that electrical equipment is not damaged and that there are no exposed wires before use.
- Fieldwork should be completed in groups, with a full risk assessment completed before any excursion.

It is the responsibility of the teacher and school to conduct a risk assessment before any investigation covered in this book.

**FIGURE 1** In Unit 3, you may conduct an investigation on memory using memory tests.

## UNIT 3 INVESTIGATIONS

2.1	<b>SIMULATION</b>	Does activation of the sympathetic and parasympathetic nervous systems lead to a change in heart rate?	Page 468
2.3	<b>MODELLING</b>	How can neural transmission across a synapse be modelled?	Page 470
3.1	<b>PRODUCT, PROCESS OR SYSTEM DEVELOPMENT</b>	How can we teach primary school students about the flight-or-fight-or-freeze response?	Page 472
3.4	<b>LITERATURE REVIEW</b>	Can diets rich in healthy bacteria and probiotics be used to treat stress-induced gastrointestinal damage?	Page 474
4.1	<b>MODELLING</b>	How can we model the process of observational learning in practice?	Page 475
4.2	<b>SIMULATION</b>	How do different circumstances affect the time in which a conditioned response is learnt?	Page 476
4.3	<b>CASE STUDY</b>	Can pigeons learn to operate military weapons?	Page 478
5.4A	<b>CONTROLLED EXPERIMENT</b>	Can the method of loci improve memorisation of visual information?	Page 479
5.4B	<b>CASE STUDY</b>	How does Aboriginal peoples' use of Songlines improve memory?	Page 481

## UNIT 4 INVESTIGATIONS

6.2A	<b>FIELDWORK</b>	Does the time taken to fall asleep affect the duration of the first sleep cycle?	Page 482
6.2B	<b>CORRELATIONAL STUDY</b>	What factors are affecting the sleep of adolescents?	Page 483
7.3A	<b>CLASSIFICATION AND IDENTIFICATION</b>	How can the sleep of new shift workers be improved?	Page 485
7.3B	<b>PRODUCT, PROCESS OR SYSTEM DEVELOPMENT</b>	How can you improve sleep hygiene by modifying your diet?	Page 487
8.2A	<b>FIELDWORK</b>	Is there a correlation between stress and perceived mental wellbeing in the workplace?	Page 489
8.2B	<b>LITERATURE REVIEW</b>	How has the COVID-19 pandemic affected the mental wellbeing of students?	Page 491
9.4A	<b>CASE STUDY</b>	How does exposure to a phobic stimulus aid in the treatment of specific phobia?	Page 492
9.4B	<b>CLASSIFICATION AND IDENTIFICATION</b>	How can identification of biopsychosocial factors be used to inform the treatment of a specific phobia?	Page 493
10.1	<b>CORRELATIONAL STUDY</b>	Is there a relationship between daily water intake and perceived levels of mental wellbeing?	Page 494
10.2	<b>CONTROLLED EXPERIMENT</b>	Does mindfulness meditation improve relaxation?	Page 495

## 2.1

### INVESTIGATION: SIMULATION

# Does activation of the sympathetic and parasympathetic nervous systems lead to a change in heart rate?



#### Investigation worksheet 2.1

Does activation of the sympathetic and parasympathetic nervous systems lead to a change in heart rate?



#### Risk assessment 2.1

Does activation of the sympathetic and parasympathetic nervous systems lead to a change in heart rate?

## Context

There are two branches of the autonomic nervous system: the sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system prepares the body for action and regulates the flight-or-fight-or-freeze response. The parasympathetic nervous system calms the body after action and restores it to its normal state.

When you are faced with a threatening or stressful situation, your sympathetic nervous system automatically prepares your body for action. It makes the heart beat faster, opens up airways, dilates pupils and releases hormones such as adrenaline to energise the body, among other things. Once the threat has passed, the parasympathetic nervous system returns the body to its normal state of functioning. In this investigation, you will simulate the effect of riding a roller coaster to activate the sympathetic and parasympathetic nervous systems and determine what effect this activation has on heart rate.



**FIGURE 1** Riding a roller coaster is an activity that triggers our sympathetic and parasympathetic nervous systems.

## Aim

To determine whether the activation of the sympathetic and parasympathetic nervous systems leads to a change in heart rate.

## Materials

- Mobile phone
- Virtual roller coaster app (e.g. Roller Coaster VR Theme Park) downloaded and installed on a mobile phone
- VR goggles or headset to hold the mobile phone
- Stopwatch



**FIGURE 2** For this investigation, you will need a VR headset to hold the mobile phone.

## Method

- 1 As a class, form into two groups. Group 1 will be the researchers and Group 2 will be the participants.
- 2 Pair up with someone from the opposite group so that your pair consists of one researcher and one participant.
- 3 Ensure that your pair has access to a VR headset/goggles and a phone with the virtual roller coaster app downloaded and installed.
- 4 In your pair, the researcher records the participant's resting heart rate via pulse by placing two fingers on their wrist and counting how many beats occur for one minute (use a stopwatch to count one minute).
- 5 The participant begins the virtual reality roller coaster ride and the researcher starts the stopwatch.

- 6 Record the participant's heart rate (via pulse) after one minute as they continue to watch the roller coaster simulation. Place this information into the results table.
- 7 Record the participant's heart rate (via pulse) immediately after the ride concludes.
- 8 Record the participant's heart rate five minutes after the ride concludes.

## Results

- 1 Record heart rate in the following table.

Heart rate intervals	Participant 1
Resting heart rate	
Heart rate during roller coaster ride	
Heart rate immediately after ride concludes	
Heart rate 5 minutes after ride concludes	

- 2 Calculate mean heart rate for all participants in the class.

Heart rate intervals	Mean
Resting heart rate	
Heart rate during roller coaster ride	
Heart rate immediately after ride concludes	
Heart rate 5 minutes after ride concludes	

## Discussion

- 1 Identify the name of the nervous system branch that is responsible for accelerating heart rate and explain the role of this branch.

- 2 Identify the name of the nervous system branch that is responsible for decelerating heart rate and explain the role of this branch.
- 3 Discuss why heart rate increases to prepare the body for action and how this relates to riding a roller coaster.
- 4 Explain how changes in heart rate can be used to determine activation of the sympathetic and parasympathetic nervous systems.
- 5 Discuss, using examples from the data, whether the results support the role of the sympathetic nervous system in preparing the body for action.
- 6 Discuss, using examples from the data, whether results support the role of the parasympathetic nervous system in returning the body to its normal state.
- 7 Assess one benefit and one limitation of using a roller coaster simulator over the real thing.

## Conclusion

Provide a paragraph to summarise the aim of the experiment, your results and the key inferences that can be drawn from the experiment in relation to the role of the autonomic nervous system in controlling involuntary responses such as heart rate. Ensure you use data as evidence to support conclusions.

## 2.3

### INVESTIGATION: MODELLING

# How can neural transmission across a synapse be modelled?



#### Investigation worksheet 2.3

How can neural transmission across a synapse be modelled?



#### Risk assessment 2.3

How can neural transmission across a synapse be modelled?

### Context

A synapse is the site where neural communication occurs. Neurons send information from one neuron to the next neuron in the form of a chain. Each neuron passes the information across the synapse to the next neuron until the message has been delivered. The presynaptic neuron sends a message via neurotransmitters released at the axon terminals and the postsynaptic neuron receives the message via the dendrites. Dendrites then send the message along the soma to be released again to continue the chain.

### Aim

To model how neural transmission occurs across a synapse.

### Materials

- Coloured playdough
- Camera

### Method

- 1 Use playdough to build the first stage of synaptic transmission. This should include the synapse, presynaptic neuron with vesicles full of neurotransmitters and postsynaptic neuron (Figure 1). After you have built stage 1, take a photo of it and save it.

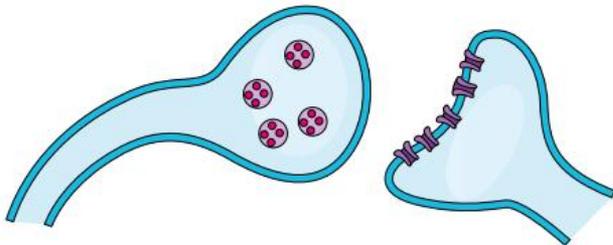


FIGURE 1 Your model of stage 1 should look something like this.

- 2 Use playdough to build the second stage of synaptic transmission. This should include the opening of the vesicles to release neurotransmitters into the synaptic cleft (Figure 2). After you have built stage 2, take a photo of it and save it.

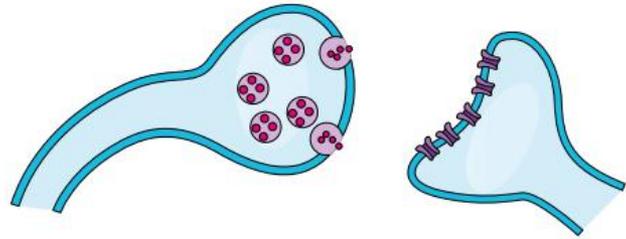


FIGURE 2 Your model of stage 2 should look something like this.

- 3 Use playdough to build the third stage of synaptic transmission. This should include neurotransmitters released into the synaptic cleft and binding to receptors on the postsynaptic neuron (Figure 3). After you have built stage 3, take a photo of it and save it.

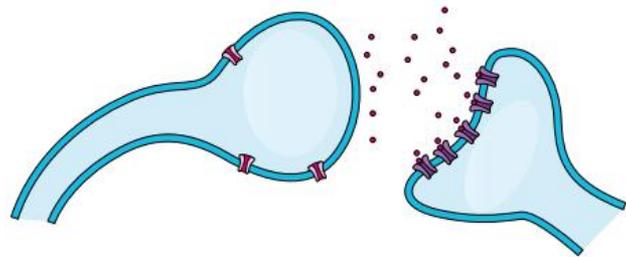


FIGURE 3 Your model of stage 3 should look something like this.

### Discussion

- 1 Place a photo of each stage in your logbook, a Word document or PowerPoint slides and describe what is happening at each stage.

- 2 Annotate stages 1 to 3 so that each of the following are clearly labelled.
  - Vesicles
  - Neurotransmitters
  - Presynaptic neuron
  - Postsynaptic neuron
  - Synaptic cleft
  - Receptor
- 3 Describe what will happen to the postsynaptic neuron after the neurotransmitters bind to it.
- 4 Using your model as a guide, write a detailed summary of how neural transmission occurs across a synapse.
- 5 Identify one benefit of using modelling as an investigation methodology to examine how neural transmission occurs.
- 6 Propose how you could use playdough and/or other materials to model processes of synaptic plasticity such as long-term potentiation and long-term depression.
- 7 Propose how you could use playdough and/or other materials to model neuromodulation. Discuss how this process differs from the process of neurotransmission you have modelled today.

# 3.1

INVESTIGATION:  
PRODUCT, PROCESS OR  
SYSTEM DEVELOPMENT

## How can we teach primary school students about the flight-or-fight-or-freeze response?



### Investigation worksheet 3.1

How can we teach primary school students about the flight-or-fight-or-freeze response?

### Context

In Years 5 and 6, Victorian primary school students learn about how living things have structural features and adaptations that help them to survive in their environment. The flight-or-fight-or-freeze response is one such example of an adaptive response our body undergoes when confronted by a threat or stressor to increase our chances of survival. In this investigation, you will design an engaging product or experience to teach Years 5 and 6 students about the flight-or-fight-or-freeze response.



**FIGURE 1** The flight-or-fight-or-freeze response helps us respond to threats such as predators.

### Aim

To design an engaging product or experience to teach Years 5 and 6 students about the flight-or-fight-or-freeze response.

### Method

**1** Revise and summarise the main ideas behind the flight-or-fight-or-freeze response. To design an effective educational product or experience, it is important that you have a strong foundation of knowledge about the concept you are trying to teach or communicate. This allows you to adapt the ideas behind the concept into a manner that suits your audience.

**2** Research your target audience. To ensure your product or experience is engaging, you need to have a strong understanding of your audience, including their education level, likes and dislikes and what they are interested in. Knowing your audience will help you to determine what level of information to share with them and the mode of delivery for doing so (e.g. an artwork, a comic, a play, a story, a song, an animation). You may wish to research the following either through using the internet or by interviewing individuals from your target audience:

- How much do Years 5 and 6 students know about the flight-or-fight-or-freeze response and stress?
- What sort of media formats do Years 5 and 6 students engage with?
- What are Years 5 and 6 students interested in outside of school?

**3** Select a format for your product or experience. Now that you have a better understanding of your audience, you should select a format for your educational product that will help engage them. You should also select a format that plays to your strengths; for example, if you are interested in drama, you may like to create a short play, or if you are interested in music, you could create a short song. Playing to your strengths can improve the quality of the product or experience you produce.

**4** Determine which ideas or concepts about the flight-or-fight-or-freeze response you will incorporate into your product or experience and brainstorm how you could do this.

**5** Create the prototype for your product or experience. Depending on the format you have selected, you may need to use art, software or musical instruments or even recruit other people to perform with you.

- 6 Show your prototype to at least three other individuals and collect their feedback on its strengths and weaknesses.
- 7 Develop your final product by modifying the prototype based on the feedback you received to enhance the strengths of your product.
- 8 Create a test to evaluate the effectiveness of your product or experience. Now that you have designed your product, you need to create a test to determine whether it was successful in addressing its purpose (to educate Years 5 and 6 students about the flight-or-fight-or-freeze response). For example, you could supply students with a short test to see how well they have learnt or interview students to see how well they have retained the information your product shares.

- 9 Demonstrate your educational product or experience to a Years 5 or 6 class and evaluate its effectiveness using your tests (optional).

### **Discussion**

- 1 What were the strengths and limitations of your final product or experience?
- 2 If you had more time and resources to redesign your product or experience, what would you change or improve about the product or design process?
- 3 Discuss how you might adapt your product to make it suitable for:
  - a a younger class (Prep and Year 1).
  - b an older class (Year 10).

## 3.4

### INVESTIGATION: LITERATURE REVIEW

# Can diets rich in healthy bacteria and probiotics be used to treat stress-induced gastrointestinal damage?



#### Investigation worksheet 3.4

Can diets rich in healthy bacteria and probiotics be used to treat stress-induced gastrointestinal damage?

## Context

The gut microbiome is made up of around 100 trillion microorganisms, including bacteria, fungi, protozoa and viruses. Emerging research has revealed the importance of the gut microbiome working with intestinal cells to assist in a range of critical functions. This includes functions related to our stress response. Chronic stress can damage the gut microbiome and lead to dysbiosis, irritable bowel syndrome, leaky gut syndrome and other gastrointestinal issues. This raises the question of whether diets rich in healthy bacteria and probiotics can reduce damage in the gut caused by chronic stress.

## Aim

To investigate whether diets rich in healthy bacteria and probiotics can be used to treat stress-induced gastrointestinal damage.



FIGURE 1 A variety of foods containing probiotics

## Method

1 Look for secondary sources of information in places such as the internet, books, scientific

magazines, videos, podcasts, or an interview with an expert.

- 2 Use the CRAAP method to evaluate the reliability of your sources. This method is outlined in Topic 11.1.
- 3 Make notes about what you have learnt. You can organise your information in different ways. Examples of how to organise information can be found in Topic 11.1.
- 4 Prepare a written report that answers the following questions.
  - a What are probiotics and healthy gut bacteria and why are they important for gastrointestinal health?
  - b What is the gut–brain axis?
  - c How does chronic stress affect gastrointestinal health?
  - d How do healthy gut bacteria and probiotics affect the damage caused to the gastroenteric system by chronic stress? What evidence/data exists to support this?
  - e If probiotics and healthy gut bacteria can be used to treat stress-induced gastrointestinal damage, how can individuals with stress-induced gastrointestinal damage incorporate healthy bacteria and probiotics into their diet?
- 5 Make sure to record the details of all the sources you use, including the title of the source, who it was written by, when it was written, page numbers or URLs and the date you accessed it. You will need this information to put together a bibliography.

## 4.1

INVESTIGATION:  
MODELLING

## How can we model the process of observational learning in practice?



## Investigation worksheet 4.1

How can we model the process of observational learning in practice?



## Video

How to make a paper origami heart

**Context**

Observational learning is a model of social-cognitive learning in which individuals learn by watching the behaviours of others. In observational learning, the learner watches a model, retains the information and attempts to reproduce the behaviour, providing they are motivated to do so. Reinforcement is a key part of this type of learning because it determines whether a behaviour will occur again. Behaviours that are reinforced are more likely to be repeated. As observational learning is a social form of learning, watching the consequences given to the model will inform whether the learner themselves will reproduce a behaviour that has been observed.

The five stages of observational learning determine whether learning has occurred. These stages are attention, retention, reproduction, motivation and reinforcement.

In this investigation, you will model the process of observational learning by monitoring someone as they attempt to learn how to make a paper heart by watching a video tutorial.

**Aim**

To model the process of observational learning by watching someone attempt to learn a new skill after viewing a video.

**Materials**

- One square piece of plain paper (15 cm × 15 cm)
- Access to YouTube tutorial clip “How to make a paper origami heart” (you can access this from the hotspot in your *obook pro*)
- Pen and paper for recording participant observations

**Method**

- 1 Select one participant to be your learner in the investigation. Ensure relevant informed consent

forms and procedures are followed before commencing.

- 2 Have the participant watch the entire video tutorial.
- 3 Provide the participant with one square piece of plain paper (15 cm × 15 cm) and instruct them to make a paper origami heart.
- 4 Take notes on the participant’s behaviour that you observe as they watch the video and subsequently make the heart.

**Results**

- 1 Use recorded observations of the participant’s behaviour to comment on what could be seen as they moved through each stage of observational learning: attention, retention, reproduction, motivation, reinforcement.

**Discussion**

- 1 Did the learner successfully acquire a new skill and learn how to make a paper origami heart? Justify your response.
- 2 Are the recorded observations a form of quantitative or qualitative data? Justify your response.
- 3 Describe which recorded observations support each stage of observational learning.
- 4 Explain, with reference to the results, why observational learning is a form of social-cognitive learning.
- 5 Discuss the implications of these findings on how people learn through observation.

**Conclusion**

Write a paragraph to summarise how new skills are acquired through observational learning and how the five stages of observational learning are important in the learning process.

## 4.2

INVESTIGATION:  
SIMULATION

## How do different circumstances affect the time in which a conditioned response is learnt?



## Investigation worksheet 4.2

How do different circumstances affect the time in which a conditioned response is learnt?

Simulator  
Pavlov's dog

## Context

Classical conditioning is a behaviourist approach to learning that occurs through the repeated association of two or more stimuli. Learning is said to have occurred when an involuntary response is produced to a stimulus that previously did not induce that behaviour.

In this investigation, you will use a simulation to investigate the conditions required for classical conditioning to take place.

## Aim

To investigate how different circumstances affect the time in which a conditioned response is learnt

## Materials

- Internet access and a computer
- Access to the classical conditioning simulator “Pavlov’s dog” (you can access this from the hotspot in your obook pro)
- Headphones (to listen to the sounds in the simulation)

## Method

## Part A

- 1 Open the “Pavlov’s dog” simulator and press “Play”. Once the simulator has loaded on the screen, click on the dog to enter the conditioning environment.
- 2 Click on the horn (Figure 1) so the dog is alert, and then quickly click and drag a sausage to the bowl for the dog to eat. Repeat this step until all the sausages are gone. Make sure the dog is asleep again before you click on the horn for pairing.



FIGURE 1 Clicking the horn to alert the dog

- 3 Click on the horn so the dog is alert, and then quickly drag a piece of ham to the bowl for the dog to eat. Repeat this step until all the pieces of ham are gone or until the dog begins to salivate at the sound of the horn before being presented with food. Record the number of pairings it took to condition the response.

## Part B

- 1 Reset the simulator.
- 2 Click on the bell so the dog is alert, and then quickly drag a sausage or piece of ham to the bowl for the dog to eat.
- 3 Click on the drum so the dog is alert, and then quickly drag a sausage or piece of ham to the bowl for the dog to eat.
- 4 Click on the horn so the dog is alert, and then quickly drag a sausage or piece of ham to the bowl for the dog to eat.
- 5 Repeat steps 2 to 4 in order until all the meat is consumed or until the dog becomes conditioned to the sound of the horn, bell or drum. Record the number of pairings it took to condition the response.

### Part C

- 1 Reset the simulator.
- 2 Click on the horn so the dog is alert, and then quickly drag a sausage or piece of ham to the bowl for the dog to eat.
- 3 Click on the horn so the dog is alert, and then quickly drag a banana to the bowl.
- 4 Repeat steps 2 and 3 in order until all the bananas are gone, and then continue to repeat step 2 until all the meat is gone. Record the number of pairings it took to condition the response.

### Discussion

- 1 Identify each of the following from Part A.
  - a Neutral stimulus (NS)
  - b Unconditioned stimulus (UCS)
  - c Conditioned stimulus (CS)
  - d Unconditioned response (UCR)
  - e Conditioned response (CR)
- 2 Are the NS and CS the same across all conditioning simulations (Parts A to C)? Describe how they are alike and how they are different.
- 3 Explain why it was important to feed the dog very quickly after it heard the noise of the horn.
- 4 Which conditioning simulation (Part A, B or C) required the least number of pairings to elicit a CR? Discuss what factors may have contributed to the other two conditioning simulations requiring more pairings to result in a CR.
- 5 Discuss why it is unlikely that the dog could be conditioned to salivate at the sound of a horn if it was only fed bananas at each pairing.
- 6 Identify two benefits of using a simulation to observe how a CR can be learnt.

### Conclusion

Summarise the process of classical conditioning using the NS, UCS, CS, UCR and CR from Part A.

## 4.3

INVESTIGATION:  
CASE STUDY

## Can pigeons learn to operate military weapons?



## Investigation worksheet 4.3

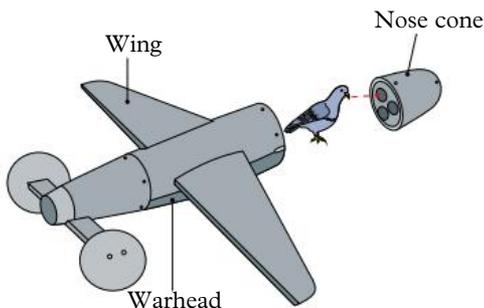
Can pigeons learn to operate military weapons?

**Context**

In this activity, you will strengthen your knowledge of operant conditioning by applying your understanding to the following case study.

**The case**

During the Second World War in the 1940s, the United States encountered difficulties in achieving precise targeting of bombs. These challenges prompted American psychologist B.F. Skinner to explore innovative approaches to improve the accuracy of targeting. Having already made significant advancements in operant conditioning by training animals to perform tasks in exchange for rewards, Skinner predicted that pigeons could be trained to guide bombs towards ground targets. This initiated “Project Pigeon”, an experiment in which Skinner applied operant conditioning principles to determine whether pigeons could be trained to improve bomb targeting capabilities.



**FIGURE 1** The proposed pigeon-guided missiles

Skinner experimented with pigeons by harnessing their pecking movements and their ability to repeat behaviours that have been positively reinforced. Through principles of operant conditioning, Skinner trained pigeons to recognise images of an outline of a target and to peck it with their beaks when they saw this target displayed on a screen. Skinner created a nose cone for missiles containing screens. Three pigeons were placed in

the nose cone and their pecking movements on the image of the target guided the missile. While the pigeons tapped on the image of the target, the nose of the missile continued to face the target. The pigeons were rewarded with food when pecking the target and therefore continued to peck and repeat this behaviour.



**FIGURE 2** Skinner trained pigeons to peck at targets presented on screen.

Skinner found that once the pigeons had been successfully conditioned to tap on the target they rarely, if ever, missed the target. Unfortunately, the government pulled the project in October 1948 to focus on other projects. Project Pigeon was revived by the Navy in 1948 and renamed Project Orcon.

Source: Adapted from Stromberg (2011)

**Discussion**

- 1 Identify the hypothesis of Skinner’s Project Pigeon experiment.
- 2 According to the three-phase model of operant conditioning, identify the antecedent, behaviour and consequence in Project Pigeon.
- 3 In terms of reinforcement, explain why Skinner gave the pigeons food when they pecked correctly at the target.
- 4 Determine the type of data that could be collected during Project Pigeon and discuss how this data supports the hypothesis.
- 5 Identify two limitations of Project Pigeon and suggest possible improvements.
- 6 Discuss whether you believe Skinner’s Pigeon Project would pass an ethical review board today.

**Conclusion**

Write a statement to summarise the findings of Project Pigeon and how these findings relate to principles of operant conditioning.

# 5.4A

INVESTIGATION:  
CONTROLLED EXPERIMENT

## Can the method of loci improve memorisation of visual information?



Investigation worksheet 5.4A

Can the method of loci improve memorisation of visual information?



Resource

Image stimulus printout

### Context

Memory mnemonics have been shown to improve the encoding, storage and retrieval of information from memory. Both research and anecdotal observations of participants who compete in memory competitions have provided evidence of mnemonics being used to increase the amount of information that is held in memory – individuals have been able to remember a significant number of cards, random letters and number combinations and words.

The use of mnemonics has tended to focus on the encoding, storage and retrieval of semantic and episodic information, with limited research on how mnemonics can improve memory for other forms of information. In this investigation, you will investigate whether mnemonics can be used to improve the encoding, storage and retrieval of visual, symbolic information from memory.

### Aim

To determine if the method of loci mnemonic can be used to improve memory for visual information.

### Materials

- Coloured marker pens or pencils
- Paper
- Stopwatch
- Copies of the Image Stimulus (see the hotspot resource in your obook pro)

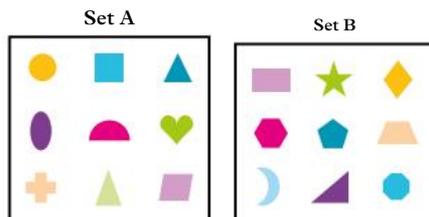


FIGURE 1 Card sets A and B contain visual stimuli.

### Method

- 1 Using a random sampling procedure, select at least twenty participants. Ensure all participants provide informed consent before starting the experiment.
- 2 Provide each participant with set A of the Image Stimulus. Allow them to view it for two minutes before removing it from sight. Have participants wait for a minute in silence. Then, provide them with coloured marker pens or pencils and a blank sheet of paper and instruct them to draw all images from set A from memory. Record how many shapes each person drew correctly (shapes must be in the correct colour and position to be awarded a mark).
- 3 After collecting results, provide a coaching session to all participants on how to generate a mind palace by applying the method of loci. Encourage participants to mentally create a familiar environment and to practise moving through this environment at least once an hour for the rest of the day.
- 4 On the following day, show all participants set B for two minutes and instruct participants to apply the method of loci to remember the shapes. Have participants wait for a minute in silence. Then, remove the cards and instruct them to draw all the images.
- 5 After all the participants have completed their drawings, record the results for each participant.
- 6 After the experiment, debrief all participants and analyse the data to obtain descriptive statistics.

## Results

- 1 Calculate the total scores for all sets of the Image Stimulus for each participant.
- 2 Calculate the mean and median scores for each condition (control and experimental).
- 3 Calculate the percentage increase or decrease from the control condition to the experimental condition.

## Discussion

- 1 Identify the independent and dependent variables of this investigation.
- 2 Summarise what the results of the experiment showed. Make direct reference to your results, including mean scores and percentage change of the mean.

- 3 Propose reasons why the method of loci was successful or not successful in improving memory for visual information.
- 4 Identify two issues or factors that may have affected your results and explain their potential impact.
- 5 Propose two improvements to the experiment to address the potential issues you identified in the previous question.

## Conclusion

Write a conclusion to summarise the aim of the experiment, results and key inferences that can be drawn from the experiment in relation to memory mnemonics.

**5.4B****INVESTIGATION:  
CASE STUDY****How does Aboriginal peoples' use of Songlines improve memory?****Investigation worksheet 5.4B**

How does Aboriginal peoples' use of Songlines improve memory?

**Video**

The science of memory

**Video**

Songlines

**Context**

A Songline is a sequence of short sung narratives associated with specific locations that are linked by a physically walked, or imagined, path through Country. Songlines contain a variety of information to help individuals navigate through life and connect to Country. The stories, characters, culture and links that tie locations together in Songlines improve their ability to be recalled and preserved across generations. In this case study, you will watch two video clips from the television series “The First Inventors” to investigate how Aboriginal peoples' use of Songlines improves memory.

**Aim**

To investigate how Aboriginal peoples' use of Songlines improves memory.

**Questions**

*Questions 1 to 4 relate to Video 1: “The Science of Memory” (available in your obook pro).*

- 1 Identify which memory techniques Lynn Kelly used to become an Australian Memory Champion.
- 2 Lynn describes that tying characters to locations helps to improve memory. Explain why this could improve the encoding of information.

- 3 Identify one similarity between the memory technique applied to the task and the method of loci.
- 4 Outline how different parts of the brain would be activated during the memory task to encode and recall memory of the countries.

*Questions 5 to 12 relate to Video 2: “Songlines” (available in your obook pro).*

- 5 Identify the name of the chemical that can be released through storytelling and describe what effect this chemical has on information.
- 6 Describe what Songlines are.
- 7 Identify the different sorts of information that can be stored in a Songline.
- 8 Identify the number of kilometres the Songline described by Yidumduma Bill Harney spans.
- 9 Describe what causes the fork in the river in the Songline.
- 10 Describe why the rock face is known as Yimirr.
- 11 Describe what the landmark in the final destination of the Songline resembles.
- 12 Explain why Songlines are important for preserving cultural knowledge.

## 6.2A

### INVESTIGATION: FIELDWORK

# Does the time taken to fall asleep affect the duration of the first sleep cycle?



#### Investigation worksheet 6.2A

Does the time taken to fall asleep affect the duration of the first sleep cycle?



#### Risk assessment 6.2A

Does the time taken to fall asleep affect the duration of the first sleep cycle?

### Context

On average, you experience four or five sleep cycles during one night of sleep. Each sleep cycle consists of a combination of the four stages of sleep: N1 sleep, N2 sleep, N3 sleep and REM sleep. In the first cycle of sleep, you typically enter N1 sleep first. You then transition through to N2 and N3 sleep, before REM sleep. The end of REM sleep typically marks the end of the first cycle, but sometimes, you may experience a short period of wake before your second sleep cycle.

Normal waking consciousness and the four stages of sleep are differentiated by brain activity (wave amplitude and frequency), eye movement and muscle movement. These characteristics can be measured by techniques such as EEG, EOG and EMG. In this investigation, you will visit a sleep laboratory (or use EEG, EOG and/or EMG kits available to your class) to study the relationship between time taken to fall asleep and the duration of the first sleep cycle.

### Aim

To investigate the relationship between time taken to fall asleep and duration of the first sleep cycle.

### Method

- 1 Visit a sleep laboratory or use EEG, EOG and/or EMG kits available to your class.
- 2 Select 10 participants to participate in the sleep study.
- 3 Measure physiological changes using EEG, EOG and/or EMG during 120 minutes of sleep. Lights out occurs at 0 minutes and participants are woken at 120 minutes.

- 4 Obtain the EEG, EOG and/or EMG readouts for the sleep study. Note: Additional readouts may be provided and could help to make identification of sleep stage easier. This could include heart rate, breathing rate, body temperature and blood oxygen level.

### Questions

- 1 Identify whether EEG, EOG and EMG are subjective or objective measurements of sleep. Justify your answer.
- 2 Annotate the EEG, EOG and EMG data – and any additional readouts provided – to show where each stage of sleep starts and ends. Use Figure 7 in Topic 6.2 and Worked example 6.2 to help you identify the sleep stages. This work could be completed in a group with the ten sets of data distributed across multiple students.
- 3 Construct a hypnogram for each participant.
- 4 Determine the time taken for participants to fall asleep and the duration of the first sleep cycle. Present this data in an appropriate way.
- 5 Describe the relationship between the time taken to fall asleep and the duration of the first sleep cycle.
- 6 Suggest a reason for the results.
- 7 Outline one limitation of the method and describe how the investigation could be adapted or extended to address this.

**6.2B**INVESTIGATION:  
CORRELATIONAL STUDY**What factors are affecting the sleep of adolescents?**

Investigation worksheet 6.2B

What factors are affecting the sleep of adolescents?



Resource

Sleep diary

**Context**

The amount of sleep that adolescents require is not always the same as the amount they get. There are several reasons for this.

- Adolescents often do not feel the urge to sleep until later in the evening, compared to people in other age groups.
- Especially if they are studying VCE, adolescents can be under a range of pressures such as homework, school time, part-time or casual work and social commitments that interfere with their ability to sleep the ideal amount of time.

The lack of appropriate sleep affects adolescents in ways beyond feeling tired the next day.

In this investigation, you will use sleep diaries, a subjective reporting tool, to explore the total sleep that adolescents experience, the factors that contribute to their sleep patterns and the effects of their sleep patterns.



**FIGURE 1** Adolescents typically do not get as much sleep as they require.

**Aim**

To determine the sleep patterns of adolescents, the factors that contribute to these patterns, and the consequences of these sleep patterns.

**Materials**

- Copies of the sleep diary (see the hotspot in your obook pro) Note: these can be printed or distributed electronically.
- Pen to record responses

**Method**

- 1 Using a sampling procedure of your choice, generate a sample of at least 15 participants. This ensures you have enough participants to provide enough data in the event of missed or inaccurate responses. Ensure informed consent forms are completed and procedures are followed before commencing the investigation.
- 2 Distribute the sleep diary to each participant in hard copy and/or electronic format. All participants are to complete the sleep diary over the same 7 days. For example, all participants can commence it on Thursday morning and conclude on Wednesday morning the following week. To complete the sleep diary, participants are to write or type their responses to the listed questions.
- 3 Instruct participants to be as honest and as detailed as possible in their responses.
- 4 Collate all completed sleep diaries by Wednesday afternoon. Do not include any incomplete diaries, nor provide extension of time for the diaries to be completed.
- 5 On completion of the study, debrief all participants.

## Results

- 1 Construct a hypothesis for the investigation.
- 2 Calculate the means for the following parameters.
  - a Bedtime
  - b Approximate time they fell asleep
  - c Wake times
  - d Total hours of sleep for each day
- 3 For each of the parameters in Question 2, identify the median.
- 4 Construct an appropriate graph to represent the means and median times/durations you calculated.
- 5 Summarise the following data by organising it in an appropriate table or graph.
  - a Quality of sleep for each day
  - b Productivity rating for each day
- 6 Summarise the factors that disturbed sleep onset and waking for each day.
- 7 Summarise the mood states for each day.

- 8 Summarise any other observations worth noting.

## Discussion

- 1 Determine whether your hypothesis was supported or refuted. In your answer, refer to the qualitative and quantitative data you have generated.
- 2 Discuss the factors that contributed to sleep onset and wake times, as well as to total sleep duration.
- 3 Outline any correlations between sleep patterns and participant mood and productivity.
- 4 Identify two factors that may have affected your results and describe the impact they may have had.
- 5 Propose two improvements to the investigation design to address the issues you identified in Question 4.

## Conclusion

Summarise the results of your investigation.

# 7.3A

INVESTIGATION:  
CLASSIFICATION  
AND IDENTIFICATION

## How can the sleep of new shift workers be improved?



### Investigation worksheet 7.3A

How can the sleep of new shift workers be improved?

### Context

To meet the demands of our everyday lives, good sleep hygiene is required. This helps us to consistently obtain an appropriate quantity and quality of sleep, which we know contributes to good levels of affective, behavioural and cognitive functioning. In this investigation, you will assess four unique cases. Each individual is starting a new job that requires shift work. You will evaluate each individual, then identify and classify elements of their functioning before and after commencing their new job. You will also identify strategies that they could implement to successfully perform their responsibilities at work.

Person 1		Person 2	
	<p><b>Age:</b> 19 years old</p> <p><b>Location:</b> Victoria, Australia</p> <p><b>Background:</b> Is studying at university part-time, Monday to Wednesday, and has been seeking casual work</p> <p><b>Requirements of new job:</b> 9 p.m. to 6 a.m. shifts, Friday to Sunday</p> <p><b>Important notes:</b> Generally, gets to bed by 11.30 p.m. each weeknight and wakes up at 7 a.m. regardless of whether they have class. Tends to go to sleep later (by 1 a.m.) and sleep in (until 9 a.m.) on weekends</p>		<p><b>Age:</b> 53 years old</p> <p><b>Location:</b> Victoria, Australia</p> <p><b>Background:</b> Recently quit her job at a local café where she worked 8 a.m. to 2 p.m., Monday to Friday</p> <p><b>Requirements of new job:</b> 9 p.m. to 6 a.m. shifts, Tuesday to Friday</p> <p><b>Important notes:</b> Is suffering from Advanced Phase Sleep Disorder, in which she feels sleepy by 9 p.m. and consistently wakes by 4 a.m.</p>
Person 3		Person 4	
	<p><b>Age:</b> 31 years old</p> <p><b>Location:</b> Victoria, Australia</p> <p><b>Background:</b> A nurse looking to transition out of her rotating shifts, which she has been working for the last two years</p> <p><b>Requirements of new job:</b> 9 p.m. to 6 a.m. shifts, Monday to Saturday</p> <p><b>Important notes:</b> Consistently sleeps five hours a night</p>		<p><b>Age:</b> 26 years old</p> <p><b>Location:</b> Reykjavik, Iceland</p> <p><b>Background:</b> Has just completed postgraduate study</p> <p><b>Requirements of new job:</b> 9 p.m. to 6 a.m. shifts, Monday to Thursday</p> <p><b>Important notes:</b> Does not have any existing sleep disorder and sleeps the required amounts per night. Will be starting her job just before the winter solstice, where the daylight hours occur between 11 a.m. and 4 p.m.</p>

## Aim

To identify and classify elements of functioning related to starting shift work, and identify strategies that individuals could implement to function optimally at work

## Questions

- 1 Compare affective, behavioural and cognitive functioning, using examples.
- 2 Identify the average amount of sleep that each individual should get based on their stage of the life span.
- 3 Evaluate the alignment of each individual's sleep–wake cycles with the day–night circadian rhythm, before they commence their new job.
- 4 Describe the ability of each individual to meet the demands of their everyday life before they commence their new job. In your response, provide examples of affective, behavioural and cognitive functioning.
- 5 Predict the affective, behavioural and cognitive effects that each individual may experience on day 1 at their job, assuming that they have not made any changes to their sleep.
- 6 Discuss the challenges each individual may have adjusting their sleep to meet the requirements of their new work.
- 7 Discuss the sleep hygiene strategies that each individual could implement to support the adjustment of their sleep–wake cycles. In your answer, identify the most appropriate strategy and its relevant zeitgeber, and explain how the strategy would help, with reference to the role of the suprachiasmatic nucleus.

## 7.3B

INVESTIGATION:  
PRODUCT, PROCESS OR  
SYSTEM DEVELOPMENT

# How can you improve sleep hygiene by modifying your diet?



### Investigation worksheet 7.3B

How can you improve sleep hygiene by modifying your diet?

## Context

During school days (Monday to Friday), you might find yourself keeping to a regular sleep schedule. However, it is not unusual for this consistent routine to change on the weekends, when you do not need to wake up early for school and you do not have set times for recess and lunch. If you find yourself still awake past 11 p.m. on a Sunday night, this could affect your mental wellbeing at school on Monday.

In Chapter 7, you learnt that **what** you eat and drink, **how much** you eat and drink, and **when** you eat and drink can affect your sleep. Your eating and drinking patterns are an important zeitgeber to improve sleep hygiene. You can take advantage of your body's ability to adapt to changes in eating and drinking patterns to take control of your sleep-wake cycles. This could be an important strategy to help get you back on track for Monday.



**FIGURE 1** You might find yourself having late-night snacks or meals more often during the weekend.

In this investigation, you will apply your understanding to propose a weekend diet for improving sleep quality and quantity. You will then design a controlled experiment to test the effectiveness of the diet. Note: You are required only to design the experiment, not to conduct it.

## Aim

To propose a weekend diet for improving sleep quality and quantity, and design a controlled experiment to test its effectiveness.

## Method

### Part A: Designing your weekend diet

- 1 Consider your current eating and drinking patterns and sleep-wake patterns during the weekend (Saturday and Sunday). Explain how your eating and drinking patterns may be influencing your sleep.  
To supplement your answer, conduct some research to determine the nutritional content of the foods and drinks you consume. Topic 7.3 is a good starting point for information on how different nutrients affect your sleep.
- 2 Identify the amount of sleep you should be getting and justify your response, with reference to mental wellbeing.
- 3 Describe how you could modify your eating and drinking patterns to improve your quantity and quality of sleep. For each modification, provide a justification that references the SCN and melatonin.
- 4 Map your proposed eating and drinking pattern to a schedule, such as the one shown in Figure 2.

### EATING AND DRINKING PLAN

Sat /	Sun /
00:00	
01:00	
02:00	
03:00	
04:00	
05:00	
06:00	
07:00	
08:00	
09:00	
10:00	
11:00	
12:00	
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	
19:00	
20:00	
21:00	
22:00	
23:00	
24:00	

**FIGURE 2** A schedule template

### Part B: Designing a controlled experiment to test your weekend diet

- 1 Construct a hypothesis and aim for your investigation.
- 2 List the materials required for your investigation.
- 3 Identify the factors you would need to consider when selecting participants. Use this information to outline any criteria for participant selection.
- 4 Determine whether a within-subjects or between-subjects investigation design would be more appropriate for your investigation. Justify your response.
- 5 Outline a method for your investigation.
- 6 Discuss any safety and ethical issues you would need to consider before commencing your investigation.
- 7 Construct a table that you could use to record your results.
- 8 Discuss the limitations of your weekend diet.

## 8.2A

INVESTIGATION:  
FIELDWORK

# Is there a correlation between stress and perceived mental wellbeing in the workplace?



### Investigation worksheet 8.2A

Is there a correlation between stress and perceived mental wellbeing in the workplace?



### Resource

Perceived Stress Scale



### Resource

Mental Wellbeing Score sheet

## Context

Some work environments and jobs are associated with particularly high levels of stress. Examples of careers that are often perceived as more stressful include construction work, paramedicine, financial management and mental health counselling.

People working in these roles and others may experience higher levels of stress, but does this necessarily mean that they have a low level of mental wellbeing?

In this investigation, you will visit workers in an industrial setting and collect data about their levels of stress and mental wellbeing. You will use the Perceived Stress Scale (PSS), which is designed to assess a person's perception of how stressed they have felt over the past month.

## Aim

To investigate the relationship between the level of perceived stress and mental wellbeing in the workplace

## Materials

- Perceived Stress Scale (see the hotspot in your obook pro). Note: These can be printed or distributed electronically
- Mental Wellbeing Score sheet (see the hotspot in your obook pro). Note: These can be printed or distributed electronically
- Pen to record responses
- Calculator to add up scores



**FIGURE 1** Train drivers may experience a high level of work-related stress.

## Method

- 1 Devise a hypothesis for your investigation.
- 2 Recruit at least five participants for your correlational study.
- 3 Supply each participant with a copy of the PSS and inform them of their participant rights.
- 4 Ask each participant to circle the number that best describes their experience with stress over the last month, using the following rating scale:

Never = 0
Almost never = 1
Sometimes = 2
Fairly often = 3
Very often = 4

- 5 On a separate form, ask each participant to rate their mental wellbeing from 0 (very low) to 4 (very high).

## Results

- 1 Calculate the final PSS scores.
  - a First, reverse the scores for questions 4, 5, 7 and 8 only. For each of these questions, change the 0 to a 4, the 1 to a 3, the 3 to a 1, and the 4 to a 0 (2 remains the same). Write these next to the relevant rows. The scores for all other questions remain the same.
  - b Add up the final scores for each item to get totals.
- 2 Create a scatterplot of your results. Plot the mental wellbeing score on the  $y$ -axis and the perceived stress score on the  $x$ -axis.

## Discussion

- 1 Explain where you would expect individuals with the following levels of stress to sit on the mental wellbeing continuum.
  - a Low stress (PSS of 0 to 13)
  - b Moderate stress (PSS of 14 to 26)
  - c High stress (PSS of 27 to 40).
- 2 Explain whether your results supported your hypothesis.
- 3 Explain how a person's understanding of mental wellbeing could influence their perceived mental wellbeing.
- 4 Discuss how a person's position on the mental wellbeing continuum could influence their perceived stress levels.
- 5 The PSS measures a person's subjective perception of stress. Research one objective measure of stress and outline the strengths and limitations of this measure compared to the PSS.

### Inquiry: Does the correlation between stress and perceived mental wellbeing differ across industries?

- 1 Write a hypothesis for your investigation.
- 2 Identify the independent variable that you will need to change to test your hypothesis.
- 3 Describe the changes you will need to make to the original method.
- 4 Discuss the expected results of the investigation.

## Conclusion

Write a statement to summarise your findings.

**8.2B**INVESTIGATION:  
LITERATURE REVIEW:**How has the COVID-19 pandemic affected the mental wellbeing of students?****Investigation worksheet 8.2B**

How has the COVID-19 pandemic affected the mental wellbeing of students?

**Context**

As the COVID-19 pandemic unfolded, we all had to change how we lived our lives. This included everything from our hygiene practices, how we learn at school, how we interact with our loved ones, and even what kinds of recreational activities we can participate in. Throughout the pandemic, these changes had significant impacts on mental wellbeing. Even in the “new normal” we live in today, there are long-lasting effects on how we carry out our lives and, potentially, on our mental wellbeing. In this investigation, you will research the impacts of the COVID-19 pandemic on the mental wellbeing of students.

**Aim**

To investigate the impacts of the COVID-19 pandemic on the mental wellbeing of students

**Method**

- 1 Look for secondary sources of information. These can include the internet, books, scientific magazines, videos, podcasts or interviews with an expert.
- 2 Use the CRAAP method to evaluate the reliability of your sources. This method is outlined in Topic 11.1.
- 3 Make notes about what you have learnt. You can organise your information in different ways. Examples can be found in Topic 11.1.

- 4 Prepare a written report that answers the following questions.
  - a How is mental wellbeing defined and measured?
  - b What were the levels of mental wellbeing of students before the pandemic?
  - c How did the mental wellbeing of students change during the pandemic?
  - d Are there long-term effects on mental wellbeing after the pandemic?
  - e What were the most important factors affecting the mental wellbeing of high school students pre-pandemic and did these change during the pandemic? If so, how?
  - f Compare how students who started Year 7 during the pandemic and students who started Year 7 before the pandemic have been affected.
  - g Were/are school students in different states of Australia affected differently by the pandemic?

You can add any questions you are interested in investigating, but check with your teacher if you want to make significant changes to the research question being answered.

- 5 Make sure you record the details of all of the sources you use, including the title of the source, who it was written by, when it was written, page numbers or URLs and the date you accessed it. You will need this information to put together a bibliography.

## 9.4A

### INVESTIGATION: CASE STUDY

# How does exposure to a phobic stimulus aid in the treatment of specific phobia?



#### Investigation worksheet 9.4A

How does exposure to a phobic stimulus aid in the treatment of specific phobia?



#### Video

Arachnophobia documentary

### Context

Specific phobia is a category of anxiety disorder characterised by an intense irrational fear of a stimulus. Arachnophobia is a type of specific phobia that describes when individuals have an intense fear of spiders. Specific phobia can interfere with daily functioning when active avoidance of a phobic stimulus becomes a burden or prevents healthy interactions. In this case study, you will watch the arachnophobia episode of the television program “Extreme Phobias” to investigate how exposure to a phobic stimulus can aid the treatment of a specific phobia.



**FIGURE 1** Arachnophobia is a specific phobia of spiders.

### Aim

To investigate how exposure to a phobic stimulus aids in the treatment of specific phobia

### Materials

- Arachnophobia documentary (available in your obook pro)
- Headphones

### Discussion

- 1 Describe two symptoms that an individual with arachnophobia may experience when exposed to a spider.
- 2 Describe the purpose of the first task (collecting a spider from the shed).
- 3 Provide one example of how arachnophobia has interfered with the normal daily functioning of one of the participants.
- 4 Describe how Jackie’s fear of spiders started.
- 5 Sarah Beth tried to avoid the second task of rehoming spiders. Discuss how avoiding a phobic stressor can work to maintain a phobia.
- 6 Describe how Sarah Beth felt after completing the second task.
- 7 Discuss why it was important that tasks gradually increased in difficulty rather than starting with the most difficult (or fear-inducing) task.

**9.4B****INVESTIGATION:  
CLASSIFICATION  
AND IDENTIFICATION:****How can identification of biopsychosocial factors be used to inform the treatment of a specific phobia?****Investigation worksheet 9.4B**

How can identification of biopsychosocial factors be used to inform the treatment of a specific phobia?

**Context**

Specific phobias are intense, irrational fears that significantly affect an individual's daily functioning and mental wellbeing. The development and maintenance of a specific phobia can often be attributed to a combination of biological, psychological and social factors. In this activity, you will read through a case study of a specific phobia and identify the biopsychosocial factors that may have contributed to and/or perpetuated the phobia. You will then evaluate how identifying these factors can be used to inform the treatment of a specific phobia.

**The case**

Rici, a 27-year-old male, has a specific phobia of sharks (galeophobia). Rici's fear of sharks began after witnessing a traumatic incident during childhood. While on a beach holiday in South Australia, Rici witnessed his older brother be attacked by a great white shark. His brother survived the incident but lost his left hand in the attack. Witnessing the event caused Rici to form an association between sharks and significant danger. Now, when Rici sees or even thinks about sharks, it triggers an intense fear response.



**FIGURE 1** Rici's fear of sharks (galeophobia) began after witnessing his brother being attacked by a great white shark.

Rici's mother, Sarah, was present during the incident. Though not afflicted with a specific phobia herself, Sarah developed a heightened sense of fear and anxiety surrounding sharks. Sarah's fears have been conveyed to Rici through her ongoing discussions about the incident,

emphasising the perceived danger and reinforcing negative thoughts about sharks. Additionally, following a recent neurologist appointment, Rici received a diagnosis of GABA dysfunction, a condition characterised by an imbalance of gamma-aminobutyric acid in the brain.

Rici has felt very insecure about his phobia for years, often worrying that if he shared his thoughts about sharks with a professional he might be perceived as paranoid or a "freak". Recently, Rici has been actively seeking treatment for his phobia. He is sick of his specific phobia causing him daily anxiety, preventing him from going to the beach, swimming and watching movies, and he wants to try to overcome his fear so he can improve his mental wellbeing.

**Aim**

To identify the biopsychosocial factors that may have contributed to the development or maintenance of a specific phobia and evaluate how these factors can be used to inform treatment.

**Discussion**

- 1 Identify and explain the biological factor(s) that have contributed to the development and/or maintenance of Rici's specific phobia.
- 2 Identify and explain the psychological factor(s) that have contributed to the development and/or maintenance of Rici's specific phobia.
- 3 Identify and explain the social factor(s) that have contributed to the development and/or maintenance of Rici's specific phobia.
- 4 Use your understanding of biological, psychological and social interventions for specific phobia to discuss (in detail) how a combination of treatments could help Rici overcome his specific phobia. In your discussion, make sure to address each biological, psychological and social factor identified in questions 1 to 3.

## 10.1

### INVESTIGATION: CORRELATIONAL STUDY

# Is there a relationship between daily water intake and perceived levels of mental wellbeing?



#### Investigation worksheet 10.1

Is there a relationship between daily water intake and perceived levels of mental wellbeing?



#### Resource

Mental wellbeing survey

### Context

Adequate hydration is necessary for our brains and bodies to function at their best. Dehydration (insufficient water intake) can have several negative side effects, including cognitive decline, fatigue and dizziness. In this correlational study, you will investigate whether a relationship exists between average daily water intake and perceived levels of mental wellbeing.

### Aim

To investigate whether a relationship exists between average daily water intake and perceived levels of mental wellbeing

### Materials

- Ten printed copies of the water intake and mental wellbeing survey (available in your [obook pro](#))
- Access to a computer with graphing software (e.g. Microsoft Excel)

### Method

- 1 Select ten participants to survey over the course of four days.
- 2 Provide each participant with a survey sheet and instruct them to complete the survey before bed each night for the course of one week.
- 3 After four days, collect the participant surveys.

### Results

- 1 Calculate each participant's average daily water intake and perceived level of mental wellbeing score.
- 2 Collate participant scores into one table. Make sure to deidentify participants.
- 3 Use Microsoft Excel or another graphing program to plot a correlation graph between participants' average daily water intake and average perceived mental wellbeing scores, and provide a correlation coefficient.

### Discussion

- 1 Interpret the correlation coefficient to describe the strength and direction of the relationship between daily water intake and mental wellbeing.
- 2 Data collected in this correlational study relied on self-reporting. Identify one strength and one limitation of self-reports.
- 3 Explain why it was important that participants completed the survey at the end of the day rather than at the start of the day.
- 4 Identify two implications of your findings.
- 5 Did the results of this investigation establish a causal relationship between daily water intake and perceived mental wellbeing? Discuss why or why not.

# 10.2

INVESTIGATION:  
CONTROLLED  
EXPERIMENT

## Does mindfulness meditation improve relaxation?



Investigation worksheet 10.2

Does mindfulness meditation improve relaxation?



Video

Mindfulness meditation

### Context

Practising mindfulness meditation has positive impacts on mental wellbeing in both the short and long term. Mindfulness meditation is often used to bring our awareness to the present and induce a state of calmness and relaxation. Some schools have started incorporating mindfulness meditation as part of their class time to reduce stress and increase relaxation.

### Aim

To investigate whether practising mindfulness meditation improves relaxation in high school students



FIGURE 1 Some high school students practising mindfulness meditation together

### Materials

- Comfortable place to sit or lie down
- Device to play meditation mindfulness video (available in your obook pro)
- Pen to record responses
- Calculator to calculate descriptive statistics

### Method

- 1 Use the following table to record your individual results, where 1 = not relaxed at all and 10 = extremely relaxed.

Condition 1: Self-rated relaxation level before completing mindfulness meditation										Condition 2: Self-rated relaxation level after completing mindfulness meditation									
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10

- 2 In the first column of the table, circle the number that best represents how relaxed you feel at the present moment (before completing the mindfulness meditation).
- 3 Complete the mindfulness meditation. Ensure you are seated comfortably in a quiet space when doing so.
- 4 In the second column of the table, circle the number that best represents how relaxed you feel at the present moment (after completing the mindfulness meditation).

### Results

- 1 Collate the class results. Use the table provided to record the class's raw data as well as the mean, median and mode for each condition.

	Condition 1 (before completing mindfulness meditation)	Condition 2 (after completing mindfulness meditation)
Class raw data		
Mean		
Median		
Mode		

- 2 Choose one measure of central tendency calculated from the results above and use it to graph a comparison between the two conditions. Ensure your graph is labelled appropriately.

### **Discussion**

- 1 Identify the independent and dependent variables for this study.
- 2 Write a hypothesis for this study.
- 3 Was your hypothesis supported? Suggest possible reasons for your answer.
- 4 Identify two extraneous variables that could have been present in your study and outline their likely effects on the DV.

### **Conclusion**

Write a statement to summarise your findings.

### **Inquiry: What if we practised mindfulness meditation for longer?**

- 1 Suggest three possible IV conditions for this investigation.
- 2 Suggest whether a between-subjects or within-subjects design would be best for this investigation. Justify your choice.
- 3 Write a hypothesis for this investigation that includes all three conditions.
- 4 With reference to psychological theory, justify your hypothesis.

# GLOSSARY

## 8 Ways of Learning

a framework to help understand and incorporate Aboriginal knowledge perspectives through Aboriginal learning processes

## A

### Aboriginal and Torres Strait Islander peoples

past and current descendants of the original inhabitants and custodians of the land we know today as Australia

### Aboriginal and Torres Strait Islander ways of knowing

the unique and diverse knowledge systems, beliefs, practices and cultural traditions of Aboriginal and Torres Strait Islander peoples

### acceptance

a component of mindfulness meditation that involves feeling comfort with the thoughts and feelings that come to mind

### accuracy

how close experimental data is to the true value

### acetylcholine

a neurotransmitter that plays an important role in brain and muscle function

### acquisition

the initial learning stage, when an individual associates a neutral stimulus or a behaviour with a specific outcome or consequence

### acronym

a mnemonic device that uses the first letters of a list of words to create a new word to aid in the encoding, storage and retrieval of information

### acrostic

a mnemonic device that uses the first letters of a list of words to create a sentence or phrase to aid in the encoding, storage and retrieval of information

### action potential

a neural message in the form of an electrical impulse that travels down the axon in response to signalling from another neuron

### active learning

learning for which the learner is required to do something intentional to engage in their learning

### acute stress

an intense, short-term stress response that is induced shortly after a perceived stressor

### adaptive response

an action that is considered to be appropriate or effective against the environmental stimulus

### adequate nutritional intake

a diet which involves eating a variety of foods which helps you maintain good health and makes you feel well

### adequate sleep

the quality and quantity of sleep that an individual requires to feel refreshed

### adrenal medulla

the inner part of the adrenal gland that can synthesise adrenaline and noradrenaline

### adrenaline

a hormone that is released from the adrenal glands during the stress response to increase energy; also known as epinephrine

### adrenocorticotropin (ACTH)

a hormone produced by the pituitary gland that acts on the outer part of the adrenal glands to stimulate cortisol secretion

### Advanced Sleep Phase Disorder (ASPD)

a circadian rhythm sleep disorder that results in a person sleeping and waking up two or more hours earlier than would be considered an acceptable or typical sleep-wake cycle

### affective functioning

all brain functions linked to the expression and experience of emotion

### after conditioning

the third phase of classical conditioning, when the neutral stimulus has become a conditioned stimulus, causing a conditioned response

### agonist

a substance or molecule that binds to receptors and increases the effect of a neurotransmitter

### aim

the primary focus of the research that states the purpose of the research

### alarm reaction

the first stage of the General Adaptation Syndrome, in which the body responds with shock and then counter shock

### altered state of consciousness

any state of consciousness that is a departure from normal waking consciousness in terms of level of awareness and experience

### Alzheimer's disease

a progressive neurodegenerative disease that results in cognitive decline and memory loss

### amplified emotional response

an emotional reaction to a stimulus, situation or event that is more intense than would typically be considered appropriate

### amplitude

the height of the peaks and troughs of waves

### amygdala

an almond-shaped structure located in the medial temporal lobe of the brain that is central to emotion, aggression and implicit learning

### amyloid plaque

a deposit of the beta-amyloid protein that attaches to axons and axon terminals, disrupting neural communication

### ancestor

(in the context of Aboriginal and Torres Strait Islander people's knowledges, histories and cultures) a spiritual being who guides and protects individuals and communities

### anecdote

a personal account or story that is often used to illustrate a point or make an argument

### antecedent

the first phase of operant conditioning; refers to what is happening before the behaviour occurs

### anxiety

a state of arousal characterised by apprehension and worry

### anxiety disorder

a cluster of mental health conditions characterised by excessive fear or apprehension about a real or perceived threat

### anxiety/fear hierarchy

where a person makes a list of anxiety-causing stimuli that are linked to their specific phobia, from least to most anxiety/fear-inducing (0–100)

### aphantasia

a psychological condition characterised by the inability to form voluntary visual imagery despite a person having intact semantic memory and visual perception

### appraisal

a subjective assessment of a stimulus or an environment made by an individual

### approach coping strategy

a cognitive and behavioural method for directly dealing with a stressor to reduce psychological/emotional distress

### association

where two or more stimuli are paired together to produce a learnt response

### attention

the stage of observational learning in which the learner actively watches the behaviour of a model; a component of mindfulness meditation that involves focusing on inner thoughts and the sensations around us

### authentic support

assistance or care that is genuine and sincere and encourages the sharing of true feelings and thoughts without fear of judgment or rejection

### autobiographical event

a past event that an individual has experienced

### autonomic nervous system

the subdivision of the peripheral nervous system responsible for controlling involuntary responses

### avoidant coping strategy

a cognitive and behavioural method for distracting or delaying dealing with a stressor

### **axon**

a nerve fibre that extends from the cell body of a neuron

### **axon terminal**

the end of an axon branch of a neuron

## **B**

### **bar chart**

a pictorial representation of data where the numeric values of variables are represented by the heights or lengths of bars

### **basal ganglia**

a group of subcortical nuclei that are responsible for motor control, learning and memory

### **before conditioning**

the first phase of classical conditioning, when the unconditioned stimulus causes an unconditioned involuntary response; the neutral stimulus does not cause any relevant response

### **behaviour**

what the learner does in response to the antecedent; refers to the action

### **behavioural functioning**

all brain functions linked to the way we act and move our bodies in response to stimuli (i.e. motor skills)

### **behaviourist approach to learning**

an approach to learning that describes behaviours learnt through interaction with the environment

### **beneficence**

the ethical principle of a commitment to minimising risk and doing good

### **benign/positive**

an appraisal in which an individual perceives a stressor to not have any negative effects or to benefit the individual

### **benzodiazepines**

a group of psychoactive drugs that act as depressants on the central nervous system and increase the inhibitory effects of GABA

### **between-subjects design**

a subject-selection procedure where participants are allocated at random to either the experimental group(s) or the control group

### **biological factor**

an internal, physiological factor that can affect a person's health, behaviour and overall wellbeing

### **biological intervention**

a treatment targeting the physiological causes or effects of a mental health disorder

### **biopsychosocial approach**

the interaction of biological, psychological and social factors in the diagnosis and treatment of mental health conditions

### **blood alcohol concentration (BAC)**

a measure of how much alcohol is in the bloodstream; expressed as grams of alcohol per 100 millilitres of blood

### **blue light**

light that is emitted naturally from the Sun and artificially from some electronic devices

### **brain**

the organ responsible for controlling almost our thoughts, emotions and memories

### **brain waves**

the electrical impulses produced by neurons in the brain

### **breathing retraining**

a relaxation technique to change an abnormal breathing habit to a normal breathing pattern that balances oxygen and carbon dioxide levels in the body

### **bright light therapy**

a treatment for circadian rhythm disorders that involves timed exposure to different intensities of light to adjust the sleep-wake cycle

## **C**

### **capacity**

the number of items that a memory store can hold

### **catastrophic thinking**

a tendency to ruminate obsessively and overestimate a perceived threat with irrational thoughts of worst-case scenarios

### **causation**

a cause-and-effect relationship, where changes in one variable lead directly to changes in another variable

### **central nervous system (CNS)**

a major division of the human nervous system, consisting of the brain and spinal cord

### **cerebellum**

a brain structure that is responsible for the encoding and storage of procedural memory and simple classically conditioned memories

### **challenge**

an appraisal that there is opportunity for personal growth, or something might have a positive outcome

### **chronic stress**

a prolonged physiological or psychological response induced by a long-term internal or external stressor

### **chunking**

grouping or combining small units of information into one bigger piece of information to increase the likelihood of retaining information in short-term memory

### **circadian rhythm**

any biological changes or activities that repeat every 24 hours

### **circadian rhythm sleep disorder**

a sleep disorder that involves a misalignment of the sleep-wake cycle to circadian times

### **classical conditioning**

a behaviourist approach to learning where an individual forms an association between two stimuli to produce a learnt response

### **classically conditioned emotional response**

an emotional response (e.g. fear, anxiety, excitement) that becomes associated with a neutral stimulus as a result of classical conditioning

### **classically conditioned memory**

an aspect of implicit memory that concerns our memory of associations between stimuli and responses

### **clinical interview**

a qualitative research technique where an interviewer has a dialogue or conversation with the participant that is not structured or contains unstructured questions

### **cognitive behavioural strategy**

a strategy derived from CBT that encourages people to identify unhelpful cognitions and behaviours and replace them with more helpful ones

### **cognitive behavioural therapy (CBT)**

a psychological therapy based on the premise that our thoughts influence how we feel and behave; combines both cognitive and behavioural therapies

### **cognitive bias**

a systematic error in thinking that affects a person's decisions and judgments

### **cognitive functioning**

all brain functions linked to our mental processes (i.e. thinking, problem-solving, logic and memory)

### **command term**

a verb that relates to performing a particular task, set of tasks or mental processes

### **Community Links**

centring local viewpoints, applying learning for community benefit; one of the eight ways of learning in the 8 Ways of Learning framework

### **concept**

a mental representation that organises ideas and observations into a clear structure or framework

### **conclusion**

a summary of the findings and results obtained from the study or investigation

### **conditioned response (CR)**

a learnt response that is triggered by the conditioned stimulus

### **conditioned stimulus (CS)**

a stimulus that, after conditioning, triggers a conditioned response

### **confidentiality**

participants must not be identified in any way in terms of test results, their involvement in the study or any other confidential data

### **confounding variable**

an unwanted variable that has a systematic effect on the value of the dependent variable. If a confounding variable exists, no valid conclusions about the research can be drawn

**conscious response**

a voluntary response controlled by the somatic nervous system that is performed with conscious awareness

**consciousness**

the subjective, private and constantly changing knowledge and awareness of your own self-existence, thoughts, perceptions and behaviours at any given moment

**consequence**

the response that follows the behaviour; refers to the outcome of the behaviour

**consolidation**

a series of neurological changes to the brain that results in short-term memory being stored in long-term memory

**context-specific effectiveness**

effective use of previously successful coping strategies in a new and comparable situation

**contradictory data**

incorrect data

**control group (C-group)**

the group of research participants not exposed to variations in the independent variable; the results are compared with the experimental group so that the effects of the independent variable can be determined

**controlled observation**

observation of voluntary behaviours within a structured environment such as a laboratory

**controlled variable**

a variable that a researcher keeps constant (controls) in an investigation

**cope**

exhibit thoughts and behaviours that help manage stress

**coping flexibility**

a person's ability to adapt effectively to a range of stressful situations

**coping strategy**

action or thought process used to help manage or eliminate stressors

**correlation**

a statistical measure of the strength and direction of the relationship between two variables; does not show a cause-and-effect relationship, but describes the way in which the variables are different in relation to each other

**corticotropin-releasing hormone (CRH)**

a hormone released by the hypothalamus that triggers the release of adrenocorticotropin to activate the adrenal cortex

**cortisol**

the main stress hormone released by the adrenal glands for a range of vital functions, including increasing blood glucose levels and regulating metabolism and the immune response

**counter shock**

the second phase of the alarm reaction, when the body activates the sympathetic nervous system to produce adrenaline and engage the flight-or-fight-or-freeze response

**counterbalancing**

a method for controlling order effects in a repeated measures design

**counter-conditioning**

when a person is taught a new association that replaces or counters the original learnt association

**Country**

an area (not just geographically) that is traditionally owned and looked after by an Aboriginal language group(s) or community; a place of spiritual meaning with deep feelings of spiritual, cultural and emotional connection and attachment, including all living beings, plants and natural elements within it

**cultural continuity**

the practice, preservation and transfer of cultural traditions and knowledge that act as protective factors for social and emotional wellbeing

**cultural determinants**

cultural factors that influence the health and wellbeing of Aboriginal and Torres Strait Islander peoples

**cumulative risk**

the chance of developing a health problem due to a build-up of risk factors

**D**

**debriefing**

the experimental process in which, after the experiment, subjects are told of the purpose of the research, and any deception is explained, a vital ethical component of any psychological research

**decay**

the fading and removal of an item from a memory store due to inattention or lack of use

**deception in research**

the provision of false or incomplete information for the purpose of misleading research participants

**Deconstruct/Reconstruct**

approaching learning through modelling and scaffolding, working from wholes to parts; begin with the whole structure, rather than a series of sequenced steps; one of the eight ways of learning in the 8 Ways of Learning framework

**deficit discourse**

a mode of thinking that frames and represents people through a negative or lacking perspective

**Delayed Sleep Phase Syndrome (DSPS)**

a circadian rhythm sleep disorder that results in a person sleeping and waking up two or more hours later than would be considered an acceptable or typical sleep-wake cycle

**dementia**

a general term that describes diseases that affect memory, cognitive ability and behaviour

**dendrite**

a branch coming off the cell body of a neuron

**denial**

ignoring the reality of a situation to avoid stress

**dependent variable (DV)**

the variable that is observed or measured when the independent variable is changed during an investigation

**depressant**

a chemical substance that decreases the activity of the nervous system; can make you feel more relaxed and sleepy

**descriptive statistic**

a measure or point of information that describes the characteristics of a data set

**Diagnostic and Statistical Manual of Mental Disorders**

a widely used classification system for psychological and neurodevelopmental disorders published by the American Psychiatric Association

**direct observation**

a research method in which the researcher watches and records behaviour as it occurs naturally without intervention or interference

**discrete categories**

groups of data that have gaps or spaces between values (are not continuous)

**displacement**

when information held in short-term memory is pushed out and replaced by new, incoming information

**dopamine**

a neuromodulator involved in coordinating smooth muscle control, motivation and the reward and pleasure centres in the brain

**Dreaming**

a belief system at the centre of some Aboriginal cultures; it connects all aspects of Aboriginal life, spirituality and law

**duration**

the length of time that items can be held in a memory store

**during conditioning**

the second phase of classical conditioning, when the neutral stimulus is paired with the unconditioned stimulus to cause an unconditioned response

**dysbiosis**

disrupted and reduced microbiome diversity in the intestinal tract

**E**

**echoic memory**

a part of sensory memory where auditory information can be held for a short time (3 to 4 seconds)

**elaborative rehearsal**

linking new information to existing information to increase the chance of it being encoded into long-term memory

### **Elder**

a respected and trusted leader in a community, who is seen as the holder of particular knowledge, and has the permission and authority to give advice and pass on this knowledge

### **electrode**

a material that conducts electricity; typically a metal

### **electroencephalogram**

a graph of EEG data, which shows brain activity over time

### **electroencephalography (EEG)**

a technique in which the electrical activity of the brain is detected, amplified and recorded

### **electromyogram**

a graph of EMG data, which shows muscle activity over time

### **electromyography (EMG)**

a technique in which the electrical activity of the body's muscles is detected, amplified and recorded

### **electro-oculogram**

a graph of EOG data, which shows eye muscle activity over time

### **electro-oculography (EOG)**

a technique in which the electrical activity of the muscles that control eye movement is detected, amplified and recorded

### **emotional awareness**

the ability of a person to recognise and make sense of their own emotions and the emotions of people they interact with

### **emotion-focused coping**

copings strategies that focus on regulating emotions and feelings about a stressor rather than addressing the stressor directly

### **encoding**

the process of converting raw, sensory information into a form that can be processed by the brain

### **encoding mnemonic**

a type of mnemonic device that involves manipulating information into a format that makes for easier storage and retrieval

### **endocrine system**

the network of glands and organs in the body that synthesise hormones and release them into the bloodstream

### **endocrinologist**

a medical professional who specialises in treating and diagnosing hormone-related conditions

### **energising support**

assistance or care that helps an individual feel revitalised and enthusiastic or provides them with energy to cope with stressors

### **enteric nervous system**

a division of the autonomic nervous system consisting of neurons that control the gastrointestinal tract

### **enteroendocrine cell**

a specialised cell in the gastrointestinal tract that produces and releases hormones in response to stimuli

### **environmental trigger**

a direct or an indirect circumstance, object or traumatic event that leads to a specific phobia

### **episodic memory**

an aspect of explicit memory that concerns memory of personal life experiences

### **error**

the difference between the measured value and the true value

### **ethical concept**

an idea that helps explore ethical conduct in investigations; can be used to decide whether an action or a course of action or action itself is ethically acceptable

### **Eurocentrism**

a worldview that focuses on or favours Western or European histories and thinking

### **evidence**

data, observations or facts obtained from valid research

### **evidence-based intervention**

a treatment to manage health conditions that has been empirically tested and shown to be effective in the scientific literature

### **excitatory effect**

an effect that increases the likelihood of a neuron firing an action potential

### **exhaustion**

the third stage of the General Adaptation Syndrome, in which resources are depleted, and serious illness can occur due to long-term suppression of the immune system

### **experimental group (E-group)**

the group of research participants exposed to the independent variable; the results are compared with the control group so that the effects of the independent variable can be determined

### **explanatory power**

the degree to which a model or theory can accurately explain the subject matter it relates to

### **explicit memory**

a memory of knowledge, facts and personal experiences that can be retrieved consciously

### **external factor**

an influence on mental wellbeing that originates from outside an individual (i.e. the environment)

### **external reinforcement**

reinforcement that occurs from receiving rewards or positive consequences from the external environment following a particular behaviour

### **external stressor**

a source of stress that comes from the environment

### **external validity**

the extent to which the investigation results are applicable to other settings outside of the experiment

### **extraneous variable**

a variable other than the independent variable that may cause changes in the value of the dependent variable

### **extrinsic**

something that comes from outside the individual; external factors or rewards that motivate behaviour

## **F**

### **flight-or-fight-or-freeze response**

the body's automatic physiological response to a stressor or threat, which results in a person escaping the stressor (flight), confronting the stressor (fight) or becoming immobile (freeze); also known as the stress response

### **focus group**

a research technique that involves collecting data from a small group of people as they discuss or respond to different ideas or products

### **frequency**

the number of cycles of waves per second

### **functioning**

how effectively a person can operate in their environment and meet the demands of their life

## **G**

### **GABA dysfunction**

lower levels of GABA caused by either insufficient production of GABA or an issue with it binding effectively to the receptor site on the postsynaptic neuron

### **gamma-aminobutyric acid (GABA)**

an inhibitory neurotransmitter involved in reducing symptoms of anxiety

### **gastrointestinal tract**

the digestive passage between the mouth and the anus

### **General Adaptation Syndrome (GAS)**

a biological model that describes the physiological changes the body undergoes during stress

### **generalisability**

the extent to which findings of research can be applied to other situations or populations

### **glutamate**

an excitatory neurotransmitter involved in learning

### **graph**

a pictorial representation that displays values and data in an organised way

### **guiding word**

a word used to ask a question, such as how, what, when, why, where, who

### **gut microbiome**

the entire community of microorganisms in the intestinal tract

### **gut microbiota**

the different microorganisms that make up the gut microbiome

### **gut-brain axis (GBA)**

a complex bidirectional communication system between the brain and enteric nervous system that occurs through the vagus nerve

## H

### **harm/loss**

an appraisal that some type of damage or loss has occurred

### **hippocampus**

a curved structure in the brain that is responsible for consolidation of explicit memories and aids in transferring explicit memories to parts of the neocortex for storage

### **historical determinants**

(in relation to SEWB) the influence of colonisation and long-lasting impact of past events

### **holistic**

an approach that considers the whole system rather than analysing or focusing on its individual parts in isolation

### **homeostasis**

the body's ability to maintain a stable internal environment in response to external changes

### **human genome**

the complete set of human genes and their nucleotide sequences

### **hydration**

the extent to which a person maintains an appropriate amount of water in their body

### **hyperventilation**

rapid or deep breathing that is usually triggered by anxiety or panic

### **hypnagogia**

the state in which you are preparing for deep sleep

### **hypnic jerk**

a falling sensation experienced in hypnagogia due to an involuntary muscle spasm

### **hypnogram**

a graphic representation of the transition between stages of sleep over time

### **hypothalamic-pituitary-adrenal (HPA) axis**

the interaction between the hypothalamus, the pituitary gland and the adrenal glands to produce cortisol in response to a perceived stressor

### **hypothalamus**

a region of the brain that has a vital role in coordinating many bodily functions, including hormone secretion from the pituitary gland

### **hypothesis**

a testable statement that includes a prediction about the outcome of an investigation based on scientific reasoning

## I

### **iconic memory**

a part of sensory memory where visual information can be held for 0.2 to 0.5 seconds

### **idea**

a mental construct representing a vague thought or notion that lacks a specific structure or framework

### **implication**

a potential consequence or effect of scientific results or conclusions

### **implicit memory**

a memory of a skill, an emotion or a disposition that is unconscious and automatically retrieved

### **incomplete data**

data that is missing or unfinished in some way due to errors in data collection, processing or limitations in the data itself

### **independent variable (IV)**

the variable that is changed or manipulated during an investigation

### **Indigenous knowledge systems**

Aboriginal and Torres Strait Islander traditional systems of knowledge, that include understandings, practices, skills, spirituality and innovations

### **informed consent**

the ethical basis for psychological treatment or experimentation requiring that the subject (or client) is fully aware of all procedures and their likely and possible effects, before they agree to participate

### **inhibitory effect**

an effect that decreases the likelihood of a neuron firing an action potential

### **initialism**

a shortened version of a phrase that is constructed from the first letter of each word in the phrase

### **insomnia**

a sleep disorder in which a person has difficulty falling asleep and staying asleep

### **integrity**

the ethical principle about the commitment to search for knowledge and be honest in the approach

### **intergenerational trauma**

trauma that is passed down from those who have directly experienced an incident to their future generations

### **internal factor**

an influence on mental wellbeing that originates from within a person's body or mind

### **internal stressor**

a source of stress that comes from our mind and body

### **internal validity**

the extent to which the investigation results truly measured what was intended to be measured

### **interneuron**

a neuron in the CNS that transfers information between sensory and motor neurons

### **intrinsic**

something that comes from within the individual, driven by internal motivations or interests

### **investigation design**

the framework of research methods and techniques used by a researcher to conduct an investigation

### **involuntary response**

a response that occurs automatically and is not under the control of an individual

### **irrelevant**

an appraisal in which an individual perceives a stressor to not present any issues

## J

### **jargon**

specific terminology or language relevant to a field of study that might be difficult for others to understand

### **justice**

the ethical principle to ensure a fair and equal consideration of all factors

## K

### **K-complex**

a short burst of low-frequency, high-amplitude brain waves; occurs during N2 sleep

### **key term**

a word that relates to the key topic you are investigating

## L

### **Land Links**

place-based learning, linking content to local land and place; one of the eight ways of learning in the 8 Ways of Learning framework

### **leaky gut syndrome**

a condition in which the intestinal permeability of the gut is disrupted and pathogens and toxins readily enter the bloodstream

### **learning**

a relatively permanent change in behaviour or knowledge in response to experience

### **Learning Maps**

approaching learning through explicitly mapping/visualising processes; one of the eight ways of learning in the 8 Ways of Learning framework

### **life span**

the length of time that an individual is expected to live

### **Likert-type scale**

a question that uses a scale for responses, ranging from one extreme to another

### **limitation**

a factor or condition that may affect the accuracy or validity of results

### **line graph**

a pictorial representation of data linking two variables, where one is plotted on the *y*-axis and the other on the *x*-axis

### **line of best fit**

a trendline that gives an approximation of the linear relationship between two variables on a graph

### **logbook**

a record of investigation ideas, events, results and interpretations

### **long-term depression (LTD)**

the long-lasting weakening of neural connections

### **long-term memory**

a memory store for information that has been encoded from short-term memory and that has potentially unlimited capacity and duration

### **long-term potentiation (LTP)**

the long-lasting strengthening of neural connections

## **M**

### **maintenance rehearsal**

repeating information over and over to help retain it in short-term memory and potentially increase the chance of it being encoded into long-term memory

### **mean**

the calculated central number or “average” of a set of numbers

### **measure of central tendency**

summary statistic that represents the central point of a data set

### **measures of variability**

summary statistics describing how spread out the data is in a data set

### **median**

the middle number in a set of numbers that are listed in ascending or descending order

### **melatonin**

a hormone released from the pineal gland that influences alertness and causes drowsiness to promote the onset and maintenance of sleep

### **memory**

the processes of receiving, encoding, storing and retrieving information

### **memory bias**

a tendency to selectively and inaccurately encode a memory that has been influenced by distorted thinking

### **memory palace**

the mental representation of a physical location or landmarks that are used as memory cues in the method of loci

### **memory store**

a site where information can be stored temporarily or permanently

### **mental disorder**

a psychological state characterised by atypical thoughts, feelings and behaviours associated with significant distress and which severely impairs functioning in everyday life

### **mental health problem**

a psychological state that negatively affects the way a person thinks, feels and behaves, but to a lesser extent and for a shorter duration than a mental disorder

### **mental wellbeing**

a general term used to describe a person’s overall mental state in terms of how content they are with themselves and their life, and their ability to realise their potential, cope with the normal stresses of life, work productively and make a contribution to their community, in order to maintain a healthy quality of life

### **mental wellbeing continuum**

a tool used to identify and describe a person’s mental wellbeing at any point in time

### **mentally healthy**

according to WHO, “a state of wellbeing in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community”

### **method of loci**

a mnemonic device that attaches items to be remembered to points of significance in a familiar location; items can then be easily retrieved when navigating mentally through the location

### **methodology**

the approach used to plan and conduct a scientific investigation

### **microbiome**

a community of microorganisms that can usually be found in a given habitat

### **microsleep**

a sudden period of severe drowsiness or sleep lasting from 1 to 15 seconds; episodes of microsleep cannot be controlled and some people may even appear to be awake during them

### **mindfulness meditation**

a practice designed to induce a state of calmness and relaxation by focusing attention on present feelings and sensations

### **misappropriate**

taking something that does not belong to you for personal gain

### **mixed design**

a study that combines features of both a between-subjects design and a within-subjects design

### **mnemonic device**

a mental technique or strategy for improving the encoding, storage or retrieval of memory

### **Mob**

a family unit, language group, Nation or wider community group that a First Nations person identifies with

### **mode**

the number that occurs most frequently in a data set

### **model**

a simplified representation of a complex system or phenomenon used to improve understanding of a complex construct or make predictions; the person who is demonstrating a behaviour being watched by the learner

### **motivation**

the desire of the learner to reproduce the behaviour themselves; it is influenced by the type of consequence the model receives

### **motor neuron**

a specialised nerve cell that transmits signals from the central nervous system to muscles and glands; also known as efferent neuron

### **motor skill**

a specific movement of the body’s muscles used to perform everyday tasks such as walking, writing with a pen, and driving a car

### **multidimensional**

complex and multifaceted; involves many dimensions

### **multimodal**

using many modes or forms of communication, representation and expression

### **multi-store model of memory**

a model that suggests that memory consists of sensory, short-term and long-term memory, which work together to encode, store and retrieve information

### **myelin**

a fatty substance covering the axons of most neurons

## **N**

### **N1 sleep**

Stage 1 of NREM sleep in which you transition from waking consciousness to sleep; the lightest type of sleep

### **N2 sleep**

Stage 2 of NREM sleep, which is considered “true” sleep; light sleep that progressively becomes deeper

### **N3 sleep**

Stage 3 of NREM sleep, which is also considered “slow-wave sleep”; a state of deep sleep

### **Nation**

a collective of language groups linked through geographic, social, political and/or linguistic ties

### **negative correlation**

a relationship in which the two variables change in the opposite direction – that is, as one increases, the other decreases

### **negative feedback loop**

a feedback mechanism to stabilise the body’s internal environment by opposing and counteracting the effects of external or internal disturbances or stimuli

### **negative punishment**

the removal of a pleasant stimulus that discourages a behaviour from occurring again

**negative reinforcement**

the removal of an unpleasant stimulus that encourages a behaviour to occur again

**neocortex**

the largest section of the cerebral cortex that is responsible for cognitive processes including attention, thought, perception and memory

**neonate**

a newborn child up to 28 days old

**nervous system**

the body's entire network of specialised cells called neurons that transmit signals between different parts of the body

**neural transmission**

the process where information is sent from one neuron to another

**neurofibrillary tangle**

a twisted segment of the insoluble tau protein that forms within a neuron and disrupts the transport of nutrients into and out of the cell

**neuromodulator**

a type of neurotransmitter that can modulate or modify the activity of neural circuits by influencing the release, reuptake or sensitivity of other neurotransmitters

**neuron**

a nerve cell; responsible for transmitting neural information

**neurotransmitter**

a chemical that carries neural messages across the nervous system

**neutral stimulus (NS)**

a stimulus that previously did not trigger a relevant response but becomes the conditioned stimulus during classical conditioning

**Non-linear**

producing innovations and understanding by thinking laterally; one of the eight ways of learning in the 8 Ways of Learning framework

**non-maleficence**

the ethical principle of avoiding harm or decreasing the amount of harm inflicted

**non-rapid eye movement (NREM) sleep**

a type of sleep that consists of three stages; characterised by the slowing of brain activity and absence of rapid eye movement

**non-scientific idea**

an idea or a theory that is not based on empirical evidence and has not been rigorously tested or supported through observation or scientific investigation; not supported by the scientific method

**Non-verbal**

applying intrapersonal and kinaesthetic skills to thinking and learning; one of the eight ways of learning in the 8 Ways of Learning framework

**non-vivid dream**

a sleep hallucination that consists of thoughts and memories; often not very memorable

**noradrenaline**

a hormone that is released from the adrenal glands during the stress response to increase arousal; also known as norepinephrine

**normal distribution**

a statistical distribution where data is symmetrically distributed around the mean

**normal waking consciousness**

the state of consciousness in which you are awake and aware of your internal and external state

**O**

**objective reporting**

the gathering of data through direct observation or measurement

**observational learning**

a type of learning that occurs by observing and imitating the behaviours of others

**operant conditioning**

a behaviourist approach to learning in which an individual learns through associating a behaviour with a consequence

**opinion**

a personal view or belief about a particular topic or issue

**oral culture**

a culture that primarily uses oral or spoken word to preserve and transfer information over time

**order effect**

an effect on results that is due to the order or sequence in which the treatments in an experiment are given

**organisational mnemonic**

a type of mnemonic device that uses a system to organise information so it can be more easily retrieved

**outlier**

a value that lies outside of the expected data set

**P**

**parasympathetic nervous system**

a branch of the autonomic nervous system responsible for maintaining homeostasis and day-to-day functioning

**partial sleep deprivation**

a condition that occurs when a person does not get the total amount and/or type of sleep they need within a 24-hour period

**participant characteristic**

individual factor such as age, sex, health levels, education and socioeconomic status

**participant observation**

a data collection method where the researcher immerses themselves or "participates" in a specific setting or group to make observations of the target of their research

**passive learning**

learning that involves listening and observing

**pathogen**

a bacterium, virus or other microorganism that can cause disease

**Pearson correlation coefficient (r)**

a measure of the strength of the linear relationship between two continuous variables

**percentage**

a number or ratio expressed as a fraction of 100

**percentage change**

the factor by which an initial data percentage changes after time or an event

**peripheral nervous system (PNS)**

a major division of the human nervous system, consisting of the somatic nervous system and autonomic nervous system

**perpetuating factor**

a factor or an event that sustains or prolongs the onset of an illness, a disorder or a disease

**personal error**

a mistake, a miscalculation or an observer error that occurs when conducting research

**phobia**

a mental disorder characterised by persistent, irrational and excessive fear of a particular object or situation

**phobic stimulus**

an object, a situation or an event that induces a persistent, irrational fear response

**physical wellbeing**

a general term used to describe a person's ability to complete daily physical activities without undue fatigue, pain or physical stress on the body, in order to maintain a healthy quality of life

**pineal gland**

a gland located in the brain that is responsible for the production and release of melatonin

**pituitary gland**

a small gland located at the base of the brain under the hypothalamus that controls several hormone glands in the body

**political determinants**

(in relation to SEWB) the influence of land rights, resource control, cultural security and rights to self-determination and sovereignty (independence)

**polysomnography**

a combination of multiple objective reporting tools (e.g. EEG, EMG, EOG, respiration rate, heart rate, body temperature), which provide an objective picture of sleep

**population**

the group of people about whom scientists want to draw conclusions

**positive correlation**

a relationship in which the two variables change in the same direction – that is, as one increases (or decreases), so does the other

**positive punishment**

the addition of an unpleasant stimulus that discourages a behaviour from occurring again

**positive reinforcement**

the addition of a reward or positive stimulus that encourages a behaviour to occur again

**possible imagined future**

a hypothetical scenario that an individual has formed in their mind

**post-mortem examination**

a medical assessment of a deceased body to determine cause of death

**postsynaptic neuron**

a neuron that is responsible for receiving a neural message

**precipitating factor**

a factor or an event that triggers the onset of an illness, a disorder or a disease

**precision**

how close a set of data values are to each other

**presynaptic neuron**

a neuron that is responsible for sending a neural message

**primary appraisal**

the initial stage of evaluating a stressor, during which an individual assesses whether the stressor is significant

**primary data**

data collected by the investigator from firsthand sources

**problem-focused coping**

copng strategies that focus on taking actions to address a stressor directly

**procedural memory**

an aspect of implicit memory that concerns our memory of how to perform particular tasks, skills or actions

**protective factor**

condition that promotes the health and wellbeing of an individual

**pruning**

the removal of excess neurons and synaptic connections to enable more efficient neural processing

**psychoeducation**

educating the person affected by a mental disorder and their support group so each person better understands the condition and treatment options

**psychological construct**

an abstract psychological concept that summarises a group of related phenomena or events that can describe and be used to predict human behaviour, but cannot be directly observed

**psychological factor**

an internal cognitive, emotional or behavioural factor that can affect a person's health, behaviour and overall wellbeing

**psychological intervention**

a treatment that targets the psychological causes or effects of a mental health disorder

**psychological test**

a type of assessment used to evaluate various aspects of emotions, cognitions or behaviours (such as a personality test or an intelligence assessment)

**psychology**

the systematic study of the mind (mental processes) and behaviour

**punishment**

an event or a stimulus that decreases the likelihood of a behaviour occurring again

**Q**

**qualitative data**

descriptive characteristics of what is being studied

**quantitative data**

measurements (numerical information) about the variables being studied

**questionnaire**

a list of questions used for data collection

**R**

**random allocation**

a subject-selection procedure where all participants who have been selected for an experiment have an equal chance of being in either the experimental group or the control group

**random error**

an error that affects the precision of the data set due to an unknown and unpredictable error in the experimental process

**random sampling**

a sampling procedure in which every member of the population has an equal chance of being selected

**range**

the difference between the lowest and highest value in a data set

**rapid eye movement (REM) sleep**

a type of sleep that is characterised by rapid eye movement beneath closed eyelids; also called paradoxical sleep

**raw data**

unprocessed data

**reductive**

a process that simplifies concepts, ideas or systems into smaller, more manageable parts or components

**refute**

contradicts or does not support (in relation to the hypothesis)

**rehearsal**

a mental process of repeating and/or manipulating information in short-term memory to enhance the length of time it is held in short-term memory and to increase the likelihood of it being transferred to long-term memory

**reinforcement**

an event or a stimulus that increases the likelihood of a behaviour occurring again

**repeatability**

the degree to which an experiment can produce the same results when repeated under the same conditions

**reproducibility**

the degree to which results can be independently confirmed by other researchers using different methods, techniques or instruments than the original conditions of the experiment

**reproduction**

the stage of observational learning in which the learner imitates or replicates the behaviour they have observed from what they have retained in their memory

**rerouting**

the formation of an alternative neural pathway by the removal of damaged neurons and the formation of a new pathway between healthy neurons

**research question**

a clear, focused and concise query that guides an investigation and forms the foundation of a research study

**resilience**

the ability to mentally cope with or adapt to uncertainty, challenges and adversity

**resistance**

the second stage of the General Adaptation Syndrome, in which the body adapts to a stressor and stress hormones continue to circulate to keep resistance levels high, continued cortisol suppresses the immune system and illnesses such as headaches and colds can occur

**respect**

the ethical principle that considers the value of living things and the ability for living things to make their own decisions where possible

**response**

a reaction to something/stimulus

**retention**

the stage of observational learning in which the learner forms a mental representation of what is being observed

**retrieval**

the process of accessing and diverting information from long-term memory to short-term memory so it can be used and/or manipulated

**retrieval cue**

a prompt or stimulus that improves the ability to recall information from long-term memory

**risk assessment**

a system or document that evaluates any potential risks involved with a particular activity, such as performing an experiment

**risk factor**

a biological, psychological or social factor that increases the chances of developing a mental health problem or lowers our levels of mental wellbeing

**robust**

the degree to which a result is consistent across different studies, methods and/or samples

**rumination**

thinking or focusing repeatedly on negative feelings or thoughts

## S

### **safety data sheet (SDS)**

a document that lists information related to hazardous and non-hazardous materials

### **sample**

the members of the population who have been chosen to take part in the research

### **scatterplot**

a diagram showing the values of the two variables for each result in the sample by representing the intersection of those two values with a dot on a graph

### **school-assessed coursework (SAC)**

an internal assessment that contributes to a subject's study score

### **scientific idea**

an idea or a theory that is based on empirical evidence that has been rigorously tested through observation or scientific investigation; supported by the scientific method

### **scientific method**

a standardised way of making observations, gathering data, testing hypotheses and interpreting results to establish theories in order to describe and measure behaviour

### **secondary appraisal**

the second stage of evaluating a stressor, during which an individual assesses whether they have the resources and capacity to cope with the stressor

### **secondary data**

data collected by another person, not the investigator, which is relevant to the scientific investigation

### **self-determination**

the right for people to determine their own political status and to direct their own economic, social and cultural development, without outside intervention

### **self-efficacy**

a person's belief in their abilities to complete specific tasks or achieve specific goals

### **self-reinforcement**

reinforcement that occurs from receiving intrinsic rewards following a behaviour

### **semantic memory**

an aspect of explicit memory that concerns memory of facts and general knowledge

### **sensory memory**

a memory store for incoming sensory information that is held for a short time (0.2 to 4 seconds)

### **sensory neuron**

a specialised nerve cell that transmits sensory information from sensory receptors to the central nervous system; also known as afferent neuron

### **serotonin**

a neuromodulator involved in regulating processes relating to mood and behaviour

### **shift work**

a business model in which employees work rotating, irregular, overnight, evening, afternoon,

morning or split shifts; a work schedule that falls outside of typical business hours

### **shift work sleep disorder (SWSD)**

a circadian rhythm sleep disorder caused by a work schedule that interferes with a person's typical sleep-wake cycle

### **shock**

the first phase of the alarm reaction, when the body reacts to a stressor as if it is injured, resulting in a decrease in blood pressure and body temperature

### **short-term memory**

a memory store that receives information from long-term and sensory memory stores and has a limited capacity of 5 to 9 items and a limited duration of 18 to 30 seconds

### **skeletal muscle**

a muscle connected to bone that coordinates movements

### **sleep**

a reversible, naturally occurring altered state of consciousness involving lowered awareness of and responsiveness to the external environment

### **sleep cycle**

one complete sequence of the different stages of sleep

### **sleep deprivation**

a condition that occurs when a person gets an inadequate quantity and/or quality of sleep

### **sleep diary**

a self-report of the quality and quantity of an individual's sleep over time

### **sleep disorder**

a medical condition that involves serious disruptions to the normal sleep-wake cycle and can have negative effects on wellbeing

### **sleep episode**

one session of sleep; typically lasts 8 hours during the night, and can also occur in shorter lengths (naps)

### **sleep hygiene**

the habits and strategies that can be used to improve the quality and quantity of sleep; good sleep habits

### **sleep inertia**

the state of mental fatigue experienced immediately after we are woken

### **sleep spindle**

a short burst of high-frequency, low-amplitude brain waves; occurs during N2 sleep

### **sleep-wake pattern**

an individual's sleeping schedule in which they alternate between hours of sleep and hours of wakefulness

### **social and emotional wellbeing**

a holistic understanding of wellness for Aboriginal and Torres Strait Islander peoples that includes intrinsic connections between the relational-self, mind-emotions, body, Country, community, culture, kinship and ancestry

### **social and emotional wellbeing (SEWB) framework**

a multidimensional and holistic framework that encapsulates all elements of being (body, mind and emotions, family and kinship, community, culture, country, spirituality and ancestors) and explores their interaction to affect and explain wellbeing from Aboriginal and Torres Strait Islander peoples' perspectives

### **social determinants**

(in relation to SEWB) the conditions in which one is born, grows, lives, works and ages

### **social factor**

an element of a person's environment that can influence their behaviour, attitudes, health and interactions with others; a factor that influences mental health and which originates from or relates to an individual's relationship with their external environment

### **social intervention**

a treatment that targets the social causes or effects of a mental health condition

### **social-cognitive approach to learning**

a perspective that stresses the importance of social interactions and cognitive processes in shaping human learning and behaviour

### **soma**

the cell body and largest part of a neuron

### **somatic nervous system**

the subdivision of the peripheral nervous system responsible for voluntary movements associated with skeletal muscles

### **Songline**

in Aboriginal culture, a sung narrative that maps Country and stores complex knowledge systems

### **specific phobia**

a type of anxiety disorder characterised by an intense and persistent fear that is triggered by facing or anticipating a specific stimulus

### **spinal cord**

a bundle of nerve fibres (neurons) that run down the spine beginning at the base of the brain

### **spinal reflex**

an involuntary response that is initiated in the spinal cord with no involvement of the brain

### **spirituality**

a way of understanding life and connection with others

### **sprouting**

the formation of new connections between neurons

### **standard deviation**

a measure that tells us how far, on average, scores are different from the mean

### **stigma**

negative attitudes, beliefs and stereotypes associated with certain individuals, conditions or groups that often lead to discrimination and social exclusion

### **stimulant**

a chemical substance that increases the activity of the nervous system; can make you feel more excited, active and alert

### **stimulus**

a thing or an event that triggers a response/behaviour by evoking a specific functional reaction in an organ or tissue

### **Stolen Generation**

Aboriginal and Torres Strait Islander people who were forcibly removed from their families and communities by government authorities and placed into institutional care or adopted by non-Indigenous families

### **storage**

the process of maintaining information in a memory store

### **Story Sharing**

approaching learning through narrative; one of the eight ways of learning in the 8 Ways of Learning framework

### **stratified sampling**

a sampling process by which the effects of a certain variable can be eliminated as a possible confound in an experiment

### **strengths-based approach**

a mode of thinking that frames and represents people through their resilience and strengths

### **stress**

the body's psychological and physiological response to an internal or external source of tension (stressor)

### **stressful**

an appraisal where the individual perceives a stressor to be a source of worry or emotional sensitivity

### **stressor**

a source of tension that challenges a person's ability to cope

### **structured interview**

a research technique that involves an interviewer asking a participant a set of pre-determined questions

### **study score**

a rank of how a student performed in a subject relative to all other students enrolled in that subject

### **subjective reporting**

the gathering of data that relies on an individual's perspective and interpretation of a personal experience

### **sung narrative**

knowledge that is shared through song, music, sound and rhythm

### **support**

agrees with (in relation to the hypothesis); the assistance people provide to each other

### **suprachiasmatic nucleus (SCN)**

a small structure in the brain that regulates the sleep-wake cycle and other biological rhythms; also known as the "body clock"

### **survey**

the collection and analysis of the experiences and/or opinions of participants who have been asked questions

### **Symbols and Images**

using images and metaphors to understand concepts and content; one of the eight ways of learning in the 8 Ways of Learning framework

### **sympathetic adreno-medullary system (SAM)**

the pathway used by the brain to activate the sympathetic branch of the autonomic nervous system and initiate a flight-or-fight-or-freeze response to acute stress

### **sympathetic nervous system**

a branch of the autonomic nervous system that activates the flight-or-fight-or-freeze response – the body's rapid involuntary response to stress

### **synapse**

the junction between two neurons where neural communication takes place

### **synaptic cleft**

a small gap between the presynaptic and postsynaptic neurons

### **synaptic plasticity**

structural changes that occur in the synapses

### **system of knowledge**

a structured and interconnected framework for understanding

### **systematic desensitisation**

a behavioural therapy to treat specific phobia; uses the principles of classical conditioning to counter-condition the phobic response

### **systematic error**

an error that affects the accuracy of the data by causing the reading to differ from the true value

## **T**

### **table**

a format of presenting data using rows (horizontal) and columns (vertical)

### **theory**

a well-supported reason or descriptive account of a phenomenon that has been established through rigorous scientific investigation

### **threat**

an appraisal that there may be harm or loss in the future

### **tonic immobility**

a state of temporary paralysis and muscle rigidity in response to the perception of a threat or danger

### **total sleep deprivation**

a condition that occurs when a person is completely deprived of sleep for at least one 24-hour period

### **traditional knowledge**

knowledge, understandings and skills that have been developed, maintained and passed on through generations of a culture

### **Transactional Model of Stress and Coping**

a psychological model of stress that proposes a person's ability to cope with stress is influenced by how they assess the stressor

### **true value**

the value that accurately represents the measurement if the experiment ran perfectly

### **tryptophan**

an amino acid obtained from the diet that can be converted by the body into serotonin, then melatonin

## **U**

### **ultradian rhythms**

any biological changes or activities that repeat more than once every 24 hours

### **uncertainty**

the degree to which the result of a measurement does not reflect the exact value of what is being measured

### **unconditioned response (UCR)**

an unlearned reflex behaviour that occurs naturally

### **unconditioned stimulus (UCS)**

a stimulus that naturally triggers a reflexive behaviour or unconditioned response

### **unconscious response**

an involuntary response controlled by the autonomic nervous system that is performed without conscious awareness

## **V**

### **vagus nerve**

a neural pathway consisting of afferent and efferent fibres that connect the brain to the enteric nervous system and other body regions

### **validity**

a measure of whether the investigation is sound

### **variable**

a factor, trait, or condition that can exist in differing amounts or types

### **variance**

a measure of how spread out data is from the mean

### **vasodilation**

the widening (dilation) of blood vessels that enables more blood flow

### **vicarious reinforcement**

reinforcement that occurs from observing another person's behaviour being reinforced

### **video monitoring**

the video recording and observations of posture changes and physical movements of an individual during sleep

### **visceral muscle**

a smooth muscle controlled by the autonomic nervous system that is found in the walls of organs and structures, including the digestive tract, blood vessels and respiratory airways

### **vidid dream**

sleep hallucination that consists of images, sounds and/or other sensory characteristics that form an, often illogical, narrative; memorable and intense

### **voluntary behaviour**

a deliberate or chosen response to a stimulus

**voluntary participation**

participants have the right to decline to participate in a study; they must not be pressured to take part in the study and must not be tricked into taking part

**W**

**wake after sleep onset (WASO)**

the state of wakefulness experienced by an individual after the onset of sleep that can occur periodically throughout an episode of sleep

**withdrawal right**

the right of participants to leave a study at any stage, including the right to withdraw their results after the study has been completed, regardless of the possible effects on the results

**within-subjects design**

a subject-selection procedure where each participant is part of both the experimental group and the control group

**written culture**

a culture that primarily uses written words, text and symbols to preserve and transfer information over time

**Y**

**yarning circle**

a harmonious, creative and collaborative way of communicating to encourage responsible, respectful and honest interactions

**Z**

**zeitgeber**

an environmental stimulus that helps set or reset the body clock

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