OXFORD PSYCHOLOGY

VCE UNITS 3 + 4

THIRD EDITION

ROGER EDWARDS
KAREN MARANGIO
VICKI MOORE
ELIZABETH BLAHER-LUCAS
FIONA GANINO-DAY

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Our partnerships

The Krongold Clinic, Monash University, provides psychology and guidance services for exceptional children and adolescents. Exceptionality includes learning and behavioural difficulties, various clinical conditions, such as autism spectrum disorders, fragile X, attention deficit hyperactivity disorder, anxiety disorders and sleep difficulties. Assessment and intervention is offered as part of an ongoing program where best practice is informed by the research and teaching expertise of available staff within the Institute of Human Development and Counselling in the Faculty of Education.

The partnership between Oxford University Press and the Krongold Clinic will ensure the *OxfordPsychology* series is accurate and as up-to-date as possible. Krongold Clinic staff, together with the authors and Oxford University Press, will provide teachers with ongoing professional development and updates on new research developments in the areas of the Study Design, so that this text series becomes a valuable companion to the psychology teacher and student. A percentage of the royalties of this book will further research in psychology carried out by staff at the Krongold Clinic.

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→INTRODUCTION

WELCOME AGAIN TO THE WORLD OF VCE PSYCHOLOGY!

This is the third edition of the Oxford Psychology Unit 3 & 4 Student Book and, like its predecessors, it is specifically designed and organised to make your journey through the VCE Psychology course as smooth and profitable as possible. The series has been revised to match the latest VCE Study Design, accredited from 2017–2021, and is also accompanied by powerful digital resources – obook assess – to help support your learning and revision.

obook is a cloud-based web-book version of the text that is available anywhere, anytime, on any device. assess is an indispensable online assessment tool, which includes exam-style questions in an interactive format.

Using obook assess, you can:

- navigate and search easily
- type, save and send answers to questions
- add notes, highlights or bookmarks
- complete practice tests to study and revise.

You will notice that this book proudly wears the logo of Monash University – one of the world's top 100 and Australia's top three universities. This is because each chapter has been evaluated by an academic member of the faculties of Education, Medicine or Psychology, to ensure that the content is accurate and relevant to current research findings.

Chapter 1: Research Toolkit is a standalone chapter, to be used literally as a toolkit for research. It is placed at the beginning so that it is easy to revisit throughout both units as you design and carry out your own research and evaluate research done by others.

The following chapters in the text closely follow the VCE Study Design – as you can see, each chapter begins with the relevant Key Knowledge 'dot points' from the Study Design, a chapter overview and concept map explaining exactly what is coming up. I believe that each chapter contains all the information you will need to prepare for your exam, as well as providing a sound explanation of the wide variety of topics in Psychology.

Each chapter finishes with:

- a summary of the chapter content.
- essential exam knowledge, including a list of key terms, key ideas and research methods relating to each chapter
- examination-style questions (multiple choice and short answer) with accurate weighting of marks to enable you to test and then consolidate your knowledge and understanding.

Of course, this is not just about a single examination, it aims to help you learn and understand the concepts that underpin all psychological knowledge. In each chapter there are some sections that have been put in Supporting Understanding boxes – this is material we believe will help you learn and understand, but is not directly mentioned in the Study Design and will not be in the examination.

As series editor of this and the Year 10 and Unit 1 & 2 texts, I was really delighted with what we produced in the first two editions – and we are always aiming to improve – incorporating some suggestions from teachers and students in the new edition. There are concept maps to outline each chapter, more review questions and Investigation activities, new charts and diagrams to clarify key points and the new digital components that take the content online.

I am confident that many students will be so enthusiastic as a result of what they learn with the assistance of this series, that they will finish VCE and take up a university course in Psychology. 'I picked up Psychology as my fifth subject in Year 12 but now it's going to be my major at university!' – I have heard that so often!

Even if students have no intention of studying Psychology beyond school, knowledge and understanding of the topics studied here will be important life skills. Students and parents have often asked, 'For which jobs is Psychology useful?' I've always answered, 'I can't think of a job that doesn't involve Psychology!'

Roger Edwards
Series Editor
Oxford University Press
and Monash University

CHAPTER 01

RESEARCH TOOLKIT

Psychology requires research skills to experiment and test theories in order to gain further knowledge. A true experiment always aims to discover natural laws of cause and effect – how do changes in one property cause changes in another?

This chapter will become a useful reference throughout Units 3 and 4 of VCE Psychology. Psychology applies the most rigorous of scientific methods in order to collect information and test theories, so in some ways this chapter tells you many of the most important things in all of psychology. It *should* come first!

This chapter is set out in a way that makes each piece of information easy to access. It is not meant to be read from beginning to end. Rather, it's like a toolbox – you dip your hand into it, get the tool you need, and then use it. This chapter has been deliberately created to be as similar as possible to the Research Toolkit in the Units 1 & 2 text so students can enhance their familiarity with content in the context of Units 3 & 4.

KEY SKILLS

Required research skills for Units 1–4 of VCE Psychology include the ability to:

- develop aims and questions, formulate hypotheses and make predictions
- plan and undertake investigations
- comply with safety and ethical guidelines
- conduct investigations to collect and record data
- analyse and evaluate data, methods and scientific models
- draw evidence-based conclusions
- communicate and explain scientific ideas.

Extract from the *VCE Psychology Study Design* (2016–2021), pp 11–12; © VCAA. Used with permission

CHAPTER OVERVIEW

The scientific method	
Variables	Operational definitions Forming a hypothesis Controlling extraneous variables Participant selection
Participant allocation – experimental and control groups	Random allocation
Experimental designs	Repeated measures design Matched participants design Independent groups design Twin and adoption studies
Controlling placebo and experimenter effect	Placebo effect Experimenter effect
Collecting data	Types of data
Data collection	Observation Interview Questionnaires Psychological tests: personality or multiple-choice IQ tests Technology in data collection Cross-sectional studies Longitudinal studies
Developmental research designs	Longitudinal design Cross-sectional design Sequential design
The quality of research	Reliability Validity
Drawing conclusions from research statistics	Descriptive statistics The normal curve Inferring from data Appropriateness of conclusions and generalisations based on results
Measures of relationship	Correlational studies
Ethical considerations in psychological research	The role of the ethics committee National Health and Medical Research Council

The scientific method

Psychologists, as scientists, will often approach and explore ideas using the scientific method. Whether it is to investigate the effects of a new wonder-drug or people's obedience to authority, you need to use the scientific method to discover the underlying natural laws and principles.

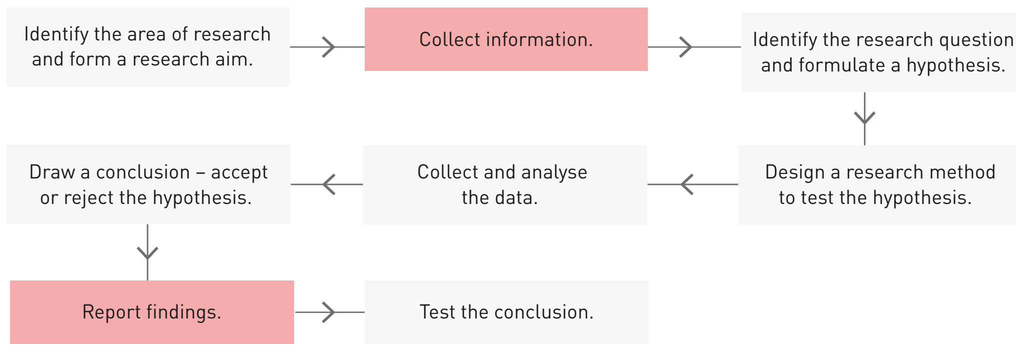


FIGURE 1.1 The scientific method

The **scientific method** is a logical process of problem-solving applied in all sciences. It involves eight steps. To see exactly how the scientific method works, consider the example of some interesting research by Judith Kearins (1981) in Western Australia.

1 *Identify the area of research and form a research aim*: Kearins wished to discover whether the skills of Indigenous people in visual tasks (especially visual memory) were better than those of non-Indigenous Australians.
2 *Collect information*: From previous research, it appeared that Aboriginal people brought up in bush communities were superior in their observational skills and interpretation of spatial cues.
3 *Identify the research question and formulate a hypothesis*: Kearins asked the question: 'Is there a difference in visual memory between Aboriginal Australians and other Australians?' She formed the **hypothesis** that the visual memory of Aboriginal Australians would be superior to that of other Australians.
4 *Design a research method to test the hypothesis*: Participants were 44 Aboriginal adolescents and 44 non-Aboriginal Australian adolescents. Kearins developed a test of visual memory in which 20 objects were placed on a board that was divided into 20 squares. After looking at the objects for 30 seconds, participants were asked to recall as many items as they could – in the correct location. The **experiment** was repeated using different types of objects: natural, manufactured or a combination of both.
5 *Collect and analyse the data*: It was found that, on average, the Aboriginal Australian participants recalled more than 16 items while the other participants recalled fewer than 12. This difference was found to be **statistically significant**.
6 *Draw a conclusion – accept or reject the hypothesis*: Kearins concluded that the culture and experience of Aboriginal Australians caused them to have superior visual memory to other Australians.
7 *Report findings*: This study was published in a journal called *Cognitive Psychology*.
8 *Test the conclusion*: Using a similar method, Klich and Davidson (1983) performed research on school children and found similar results.

Variables

Research is *all* about variables! But what is a variable?

A **variable** is a quantity or quality that can be different 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 could include:

- age
- race
- gender identification
- sexuality
- IQ
- income
- eye colour
- quality of life
- feelings of wellbeing.

Every experiment has at least one independent and one dependent variable.

- An **independent variable (IV)** is deliberately manipulated or varied in some way by the experimenter. This is planned before the experiment begins. Simple experiments use one independent variable with two values (male/female; yes/no); in the research by Kearins, it was Aboriginal Australians/non–Aboriginal Australians. 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, IQ, blood alcohol content (BAC), 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 a result of changes in the value of the IV. The DV is usually continuous (that is, it has any value within a certain range) and should be stated as an **operational definition**.

Operational definitions

Operationalisation of a variable means that the variable is stated in terms that show how it is measured. Ask yourself: how can I present this variable as a number? For example:

- age – operationalised as age in total months
- IQ – operationalised as the score on a 40-item multiple-choice test
- aggression – operationalised as the number of aggressive responses in an observed 30-minute period.

Forming a hypothesis

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 variables are not operationalised in the statement of the hypothesis, but they need to be clearly stated in operational terms in the introductory part of the research report. Examples of appropriate hypotheses are:

A That for adult drivers in Melbourne, an increase in blood alcohol level will cause a decrease in reaction speed.

B That for patients recovering from heart surgery, regular exercise will lead to improved cardiovascular health.

C That for students showing examination anxiety in VCE Psychology, rest periods taken during examinations will lead to decreased state anxiety.

D That Units 3 & 4 Psychology students who have regular study schedules throughout the academic year will achieve better study scores than those who cram in the last two weeks before the exams.

INVESTIGATE 1.1

WRITING A RESEARCH STATEMENT

Suppose a researcher had a theory that an increased intake of sugar improves people's problem-solving ability. We need to know how to define 'increased sugar intake' so that it is measurable. This could be operationalised as a 10 per cent increase in sugar intake per day. We also have to decide how we would measure 'problem-solving ability'.

Write a statement showing how 'problem-solving ability' could be operationalised in this research (this could be how many problems solved in a certain time or length of time taken to solve a particular problem).

You could also consider different types of problems, such as anagrams, jigsaw puzzles, Sudoku puzzles and crossword puzzles.

INVESTIGATE 1.2

VARIABLES IN A HYPOTHESIS

Identify the independent and dependent variables in the following hypotheses:

1 Primary school children who watch violent cartoons on television have more nightmares than those who watch humorous cartoons.
2 By the age of six, children who were in day care before the age of six months are socially better adjusted than those who stayed with a sole caregiver.
3 Children who sleep more than nine hours each night have better concentration in school than those who sleep less than nine hours.

Controlling extraneous variables

An **extraneous variable** is a variable other than ('extraneous to') the IV that could cause changes in the value of the DV. Extraneous variables are undesirable. When the potential effects of an extraneous variable have been removed from the experiment (usually by the experimental design), the variable is said to be a **controlled variable**.

A **confounding variable** is a variable other than the IV that has a systematic effect on the value of the DV (it acts as a second, unwanted, IV). If a confounding variable exists, the research is usually a waste of time and no valid conclusions can be drawn, so very stringent procedures are used to prevent this happening.

Participant selection

In research, we are always interested in drawing conclusions that are valid for a particular **group** or groups 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, we select a smaller number of individuals from the population to be participants in our 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).

TABLE 1.1 Extraneous and confounding variables using the examples specified in Forming a hypothesis.

TYPE OF VARIABLE	EXAMPLE	REASON
Extraneous	In sample hypothesis 'A', which novel has the participant read most recently?	It is unlikely that this will have any systematic effect on the value of the DV – yet it is obviously a variable!
Controlled	In hypothesis 'B', body mass	This is controlled by comparing scores of equivalent weights for participants.
Confounding	In hypothesis 'C', nature of food eaten for breakfast	If different participants eat different foods for breakfast, it is quite likely that they will have different blood-sugar levels and, hence, differently affected attention and concentration abilities.

RANDOM SAMPLING

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

Imagine, for example, that we wish to draw conclusions about all 50 000 students of VCE Units 3 & 4. VCAA has allocated a number to each VCE student, so all we need to do is put the VCAA numbers in a barrel – just like a huge Tattslotto barrel – roll the barrel and pull out one number at a time until we have enough for our experiment.

Obviously this would be very time-consuming, so we would use technology to help. All scientific calculators and computers have the capacity to generate a list of random numbers. If we just instruct the computer to give (for example) 500 random numbers between 1 and 50 000, we can then get a list of the population from VCAA and pick the persons whose VCE numbers appear in the 500 different positions shown in the random number list.

STRATIFIED SAMPLING

Also known as 'stratified random sampling', stratified sampling is a process by which the effects of a certain variable can be eliminated 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 Unit 3 & 4 Psychology students, we should first note that there are 17 000 of these, 12 000 of whom are female. This means that if our sample were 50:50 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 gender* would mean that we should take a sample of (for example) 170 students – 120 females and 50 males – in order to eliminate the possible confounding effects of gender.

Stratified sampling involves a number of procedures:

1 Identifying a property that we believe 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).

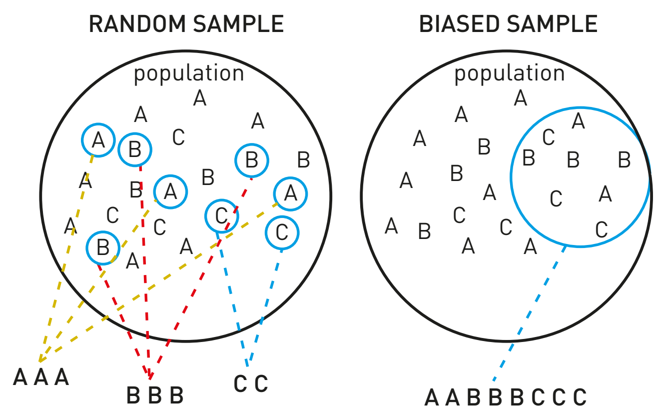


FIGURE 1.2 Personal characteristics are distributed in the random sample in the same proportions as in the population. The biased sample has certain elements over-represented (C) and under-represented (A).

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

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

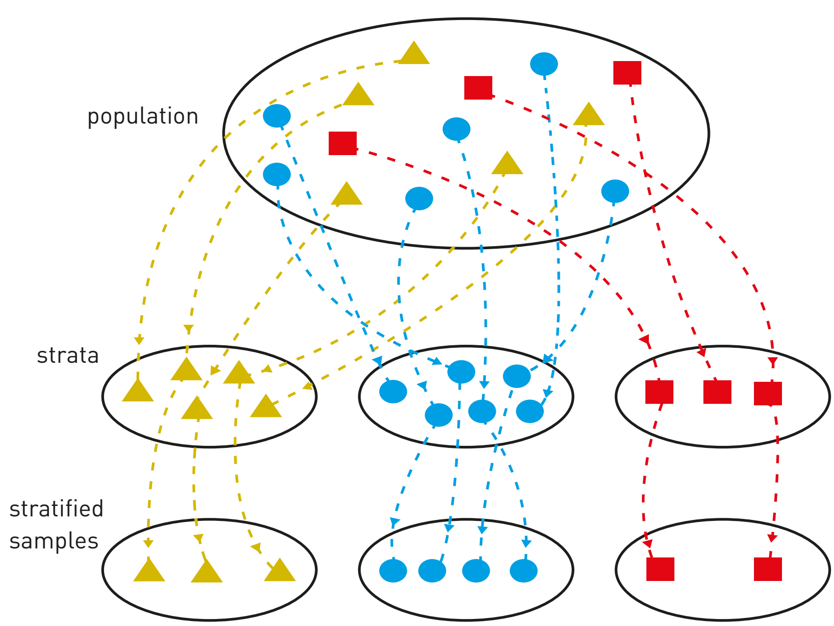


FIGURE 1.3 Stratified sampling involves dividing the population into distinct 'subgroups' and then selecting a separate sample from each subgroup in the same proportions as they occur in the population.

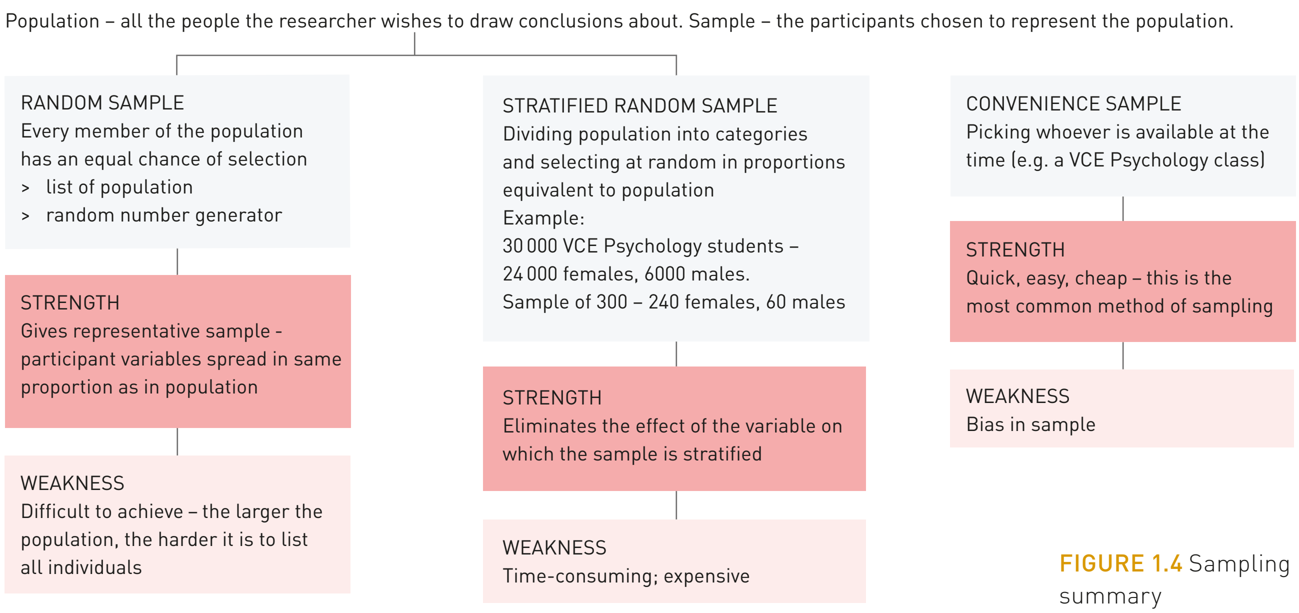


FIGURE 1.4 Sampling summary

IDENTIFY THE VARIABLE

1.3 INVESTIGATE

Identify at least one variable on which the sample should be stratified in the following research questions.

1. Does the 'Acme Reading Instruction Method' increase the rate at which Prep children learn to read?
2. Does consumption of one standard alcoholic drink interfere with an adult's problem-solving ability?
3. Do teachers who use PowerPoint presentations get better results than those who dictate notes?
4. Are girls better at VCE Maths Methods than boys?

1.1 REVIEW

1. What are the steps of the scientific method?
2. What is meant by the term *independent variable*?
3. What is meant by the term *dependent variable*?
4. In your own words, explain *operationalism*.
5. What is a *hypothesis*?
6. What is an *extraneous variable*?
7. What happens in research if a variable other than the independent variable affects the value of the dependent variable?
8. Answer the following questions about random sampling.
   a. What is a random sample?
   b. What is the purpose of the random sampling procedure?
   c. Describe how a researcher could obtain a random sample of all adults in Bendigo.
9. Answer the following questions about stratified random sampling.
   a. What is a stratified random sample?
   b. How could a researcher obtain a random sample, stratified by ethnic background, of Year 8 students from Somewhere Secondary College?

Participant allocation – experimental and control 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.

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.

The purpose of the C-group is to form a basis for comparison with the E-group.

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.

Random allocation

Random allocation means that all participants who have been selected for an experiment (the sample) must 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 equivalent 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 gender of the participants, rather than (or as well as) the effects of the sleep deprivation. We would say that these results were *confounded by gender.*

REVIEW 1.2

1. a What is a control group?
   b Explain the purpose of the control group.
2. a What is an experimental group?
   b Explain the purpose of the experimental group.
3. a What is the meaning of the term *random allocation*?
   b Explain why random allocation is a necessary part of the experimental process.

Experimental designs

Another method of controlling extraneous variables is by the *design* of the experiment. We shall examine three **experimental designs**, each of which has certain advantages and certain disadvantages. A researcher will choose a design that best suits the population and variables to be investigated.

The three experimental designs we shall look at are repeated measures, matched participants and independent groups.

Repeated measures design

In **repeated measures design** (also known as *within participants design*), each participant is part of both the E-group and the C-group. For example, in the research described previously, looking at the effects of sleep deprivation on problem-solving ability, all participants would be tested for problem-solving on two occasions (once in a normally rested state and once in a sleep-deprived state) and the results for each participant would be compared.

- Advantages: Using the same participants as the E-group and the C-group means that confounds caused by 'participant variables' will be eliminated. It is also possible to use fewer participants than with other designs.
- Disadvantages: The repeated measures procedure takes a long time – participants have to take part in both conditions, so 'drop-outs' are likely. The procedure can also 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*.
  - Participants may do worse the second time because of *fatigue* or *boredom*.

Obviously, the greater the time that passes between the two measurements being taken, the less chance there is that either practice or boredom will affect the results. The problem is, however, that increasing the interval between the two events increases the likelihood that participants will withdraw.

A better method of overcoming order effects is **counterbalancing**. In the counterbalancing procedure, half the participants will first perform the task with the IV present (experimental condition) and then perform the task with the IV absent (control condition). The other half of the participants will experience the conditions in the reverse order. Random selection should be used to decide which participants perform the tasks in which order.

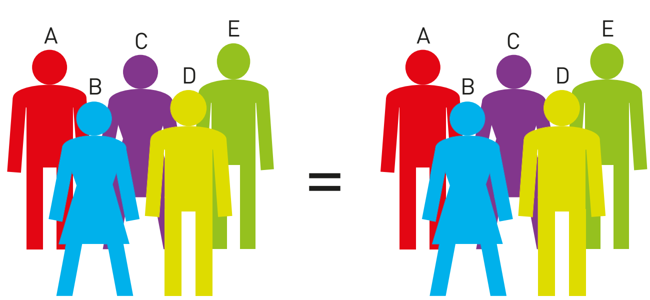


FIGURE 1.5 A repeated measures design involves using the same subjects in each condition of an experiment; for example, giving a group of subjects a driving test with no alcohol, followed at a later time by the same test after one alcoholic drink.

Matched participants design

In the **matched participants design** a researcher identifies a variable that is a likely confound, and eliminates the effects of this variable from the experiment. Participants can be ranked in accordance with their scores on this variable and then allocated to the respective groups.

> Advantage: The variable on which the participants are 'matched' will not influence the results because its effects will be the same in the E-group and the C-group.
> Disadvantages: It is very time-consuming (and therefore expensive) to find out the value of this variable for each participant. Also, if one of the pair drops out, the scores for the other must also be eliminated.

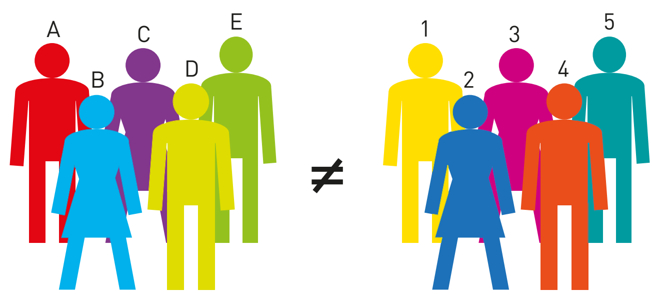


FIGURE 1.6 A matched participants design involves using different but similar subjects in each condition of an experiment. An effort is made to match the subjects in each condition in important characteristics that might affect performance, such as driving ability or alcohol tolerance.

For example, an educational psychologist had designed a program that she believed would increase the rate at which Prep children learned to read. She decided to test this by giving an E-group of children instruction using her program. As a C-group, she used children taught by traditional methods.

She believed that the intelligence (IQ) of each child could be a confounding variable, so she measured the IQ of each child. Then the two children with the highest IQ scores were randomly allocated, one to the E-group and one to the C-group. The two children with the third and fourth highest IQ 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 IQ of the E-group and the C-group were the same.

Independent groups design

The **independent groups design** (also known as *between participants design*) allocates participants to the E-group or the C-group at random.

This design is used when undertaking **cross-sectional studies** – drawing conclusions about a population in one moment of time.

> Advantage: The independent groups procedure can all be done at once and drop-outs are unlikely.
> Disadvantage: The procedure needs a large number of participants to ensure that the spread of participant variables in the sample will match the spread in the population.

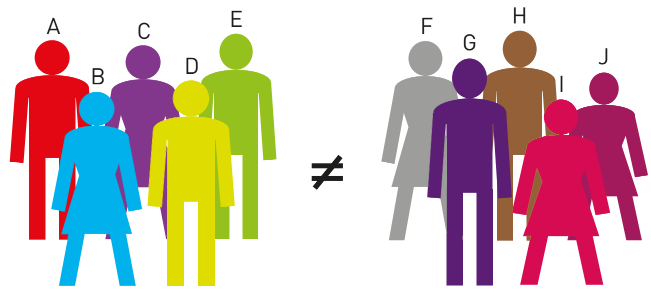


FIGURE 1.7 An independent groups design involves using different subjects in each condition of the experiment; for example, giving one group of subjects a driving test with no alcohol, and a different group of participants the same test after one alcoholic drink.

Twin and adoption studies

One way of eliminating interpersonal variables as potential confounding variables is to use participants who are as similar to each other as possible.

As you will have seen in Chapter 8 of Psychology Units 1 & 2, 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. Several of these studies are described in Chapter 10 of Psychology Units 1 & 2 ('Emotional, cognitive and psychosocial development across the lifespan').

1.3 REVIEW

Draw a table as shown below and complete the nine boxes:

EXPERIMENTAL DESIGN	REPEATED MEASURES	MATCHED PARTICIPANTS	INDEPENDENT GROUPS
Description			
Advantages			
Disadvantages			

Did you know?

Placebo is a Latin term meaning 'I shall please'. For thousands of years, doctors have known that sick people will often recover if they simply believe that the treatment they are getting will be effective. This is called the placebo effect. Do you remember in *Harry Potter and the Half-blood Prince*, when Harry pretended to give Ron the magic good-luck potion and Ron played the Quidditch match of his life? That was the placebo effect at work!

Controlling placebo and experimenter effect

Placebo effect

The **placebo effect** refers to the participants' behaviour being influenced by their *expectations* of how they should behave, caused by the belief that they have received some treatment. This means that the expectations of the participants, as well as (or instead of) the IV, may be affecting the value of the DV, and therefore that the results of the experiment are not valid.

The placebo effect can be eliminated by using a **single-blind procedure** in the experimental process – allocating participants to groups in such a way that they do not know whether they are in the E-group or the C-group.

Experimenter effect

The **experimenter effect** refers to the outcome of an experiment being unintentionally (or even intentionally) influenced by the experimenter. It occurs, for example, if the experimenter treats the members of the E-group and the C-group differently, and therefore influences the behaviour of the participants and the outcome of the experiment.

The experimenter effect can be addressed by using a single-blind procedure, where the experimenter is 'blinded', or by using a **double-blind procedure**, ensuring that neither the experimenter nor the participants are aware of which is the E-group and which is the C-group. This procedure is obviously most commonly used when there is a possibility that the expectations of either the experimenter or the participants will influence the outcome of the experiment.

Table 1.2 summarises the way in which psychologists control possible problem variables in research.

TABLE 1.2 Controlling extraneous variables and bias

SOURCE OF PROBLEM	DESCRIPTION OF PROBLEM	CONTROL PROCEDURES
Participants	Participant variables Interpersonal differences	Large sample (independent groups) Repeated measures Matched participants
Procedure	Artificial environment (laboratories or observation)	Use naturalistic observation (with observer not in environment)
Design	Order effects Placebo/experimenter effects	Counterbalancing Independent groups Single-blind Double-blind Inter-rater reliability check
Data collection	Bias/distraction/confusion	Standardised procedures and instructions

CASE STUDY

SINGLE-BLIND PROCEDURE: EXPERIMENTER UNAWARENESS

Although a 'single-blind design' usually refers to a procedure where the participants are unaware of the condition to which they are assigned, sometimes it refers to the case where the participants are aware of whether or not they received the treatment, but the experimenter is not.

For example, Dr Feng was investigating the effects of sleep deprivation on driving ability. Her experimental group set their alarms so they would wake up every 30 minutes during the night, while the control group had a normal night's sleep. The next day, all participants were taken for a trial drive by another researcher, Dr Shan. Dr Shan's assistants scored the participants' driving ability the same way that a driving examiner scores someone taking their test.

In this case, it was obviously important that those scoring the test were unaware of which condition the participant belonged to (to eliminate the experimenter effect), but it was not possible for the participants to be unaware.

The single-blind design was used and the experimenter is said to be 'blinded' to the condition.

1.4 REVIEW

1. What is meant by the term *placebo effect*?
2. What is the *experimenter effect*?
3. How would you control for the experimenter effect?
4. How would you control for the placebo effect?
5. How would you control for the experimenter *and* placebo effects?

Collecting data

Deciding what type of data to collect and how to collect that data is a very important part of research design.

Types of data

Researchers wish to be as accurate as possible in the data collected, so the variables must be measured as precisely as possible. There are various ways of describing different types of data.

Data can be classified as *qualitative* or *quantitative*.

> **Qualitative data** refer to descriptions of the characteristics of what is being studied. In psychological research this could be:
  - emotional state: happy/sad/angry, etc.
  - difficulty of task: easy/moderate/difficult/very difficult.

> **Quantitative data** refer to measurements – numerical information about the variables being studied. Most psychological research aims to gather quantitative data because we can perform statistical procedures on these and, provided the data are accurate and precise, we can determine whether our results are significant and our hypotheses can be supported.

Data can also be *subjective* or *objective*.

> **Subjective data** are based on opinion, and there is no external yardstick by which they are measured. If you asked all the people in your class how they feel about mathematics, you would collect a wide range of responses – all of which are correct because they are based on the individual's own feelings.

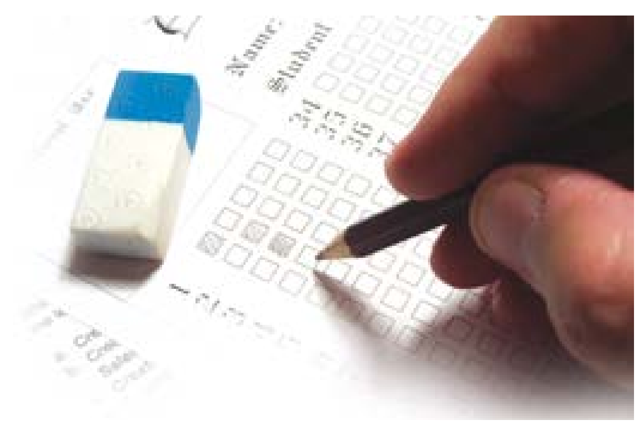


FIGURE 1.8 Self-report surveys collect subjective data.

> **Objective data** are measured according to an identifiable external criterion. Each person using an objective measure correctly will obtain the same result. In the simplest terms, if each person in the class measured the length and breadth of a desk, they would each obtain the same result.

Many standardised measures are used to gain psychological information in an objective way, so that any person using such a measure will obtain the same results – just as we use a ruler or tape-measure to measure length in centimetres.

REVIEW 1.5

Complete the following table:

TYPE OF DATA	CHARACTERISTICS	EXAMPLE
Qualitative		
Quantitative		
Subjective		
Objective		

SUPPORTING UNDERSTANDING

Scales of measurement

In order of increasing precision, the scales of measurement used are:

> **Nominal data:** If we separate individuals by a property that has no quantitative value and where there is no order implied, we are collecting nominal data. Examples include:
  - natural hair colour: brown/black/blonde/red/other
  - religion: Islam/Christianity/Hinduism/Buddhism/Sikhism/Judaism/other
  - type of school attended: state/Catholic/independent/Jewish/other religious denomination.

> **Ordinal data:** Where the data have a definite sequence, but the gap between one level and the next is not constant, we are dealing with ordinal data. Examples include:
  - ages of people in your classroom – there is no question about who is the oldest (your teacher!), but the gap between the age of the teacher and the next oldest is several years, while the oldest student may be only a week older than the next oldest, who may have been born on the same day but 10 minutes before the next oldest.
  - body mass of people in the room
  - cost of cars in a secondhand car yard.

> **Interval data:** In this case, the data are measured on a scale where each step is the same value, but zero doesn't mean zero! What does this mean? Think about shoe sizes: size 3 is much bigger than size 2, as size 2 is bigger than size 1 – but does size 0 mean that you have no feet? Of course not!
  - An example of such a scale is temperature. If today is 30°C, does that mean that it is twice as hot as yesterday when it was 15°C? Of course not! If you were talking to an American friend who measures temperature in degrees Fahrenheit, they would say today is 86° and yesterday it was 59° – obviously not the same quantities!

FIGURE 1.9 Hair colour is an example of nominal data that allows us to allocate individuals to groups.

> **Ratio data:** Ratio measurement is the most precise and rigorous. It is the strongest of all and we can perform the most powerful statistical tests with this data. Zero means 'zero' – the property does not exist – and each interval is the same. Ratio scales include length in centimetres (0 means zero and 1–2–3 etc. are all the same interval). Other examples include velocity, mass and score in VCE Psychology.

Data collection

Throughout this textbook you will find many research studies described. These show all the ways in which experiments are designed and data is collected. This section gives a brief outline of each method of data collection and a reference to where you can find a detailed example in the text.

Observation

> *Naturalistic observation*: Observation of voluntary behaviours occurring within the subject's **natural environment**
  - Strength: Highly realistic – especially if the observer is not visible
  - Weakness: Lack of ability to control the IV – must wait for naturally occurring variations in behaviour
  - Example: In-depth, detailed observation of individuals

> *Controlled observation*: Observation of voluntary behaviours within a structured environment, such as a laboratory
  - Strength: Control over environment enables more accuracy in observations
  - Weakness: Participant behaviour may be changed by the environment
  - Examples:
    - Skinner's experiments with pigeons and rats in operant conditioning
    - Bandura's experiments in observational learning

Interview

All interviews involve interaction between the researcher and the participant.

> *Structured interview*: Participants are asked a set of pre-determined questions with a fixed choice of response such as yes/no, or never/sometimes/often/always
  - Strength: Easy to compare among participants; easy to replicate
  - Weakness: Data may be missed through limited choice in response
  - Example: Market research interviews

> *Clinical interview*: Structured guidelines, but further questioning is used for clarification
  - Strengths: Flexible; high in validity with skilled interviewer
  - Weakness: Relies on the objectivity of the interviewer
  - Example: Diagnosis of mental disorders

Questionnaires

All **questionnaires** are methods of collecting written responses from participants.

> *Surveys:* May be question and answer or response to Likert-type scales (rating scales)
  - Strengths: Easy to replicate, easy to score; Likert scales provide a means of quantifying subjective data
  - Weakness: May be open to bias if participant is trying to appear in a particular way
  - Example: Mental health – obtaining psychosocial data to diagnose mental health conditions

Psychological tests: personality or multiple-choice IQ tests

> Strengths: Standardised; easy to replicate; easy to score
> Weakness: Difficult to construct and validate
> Examples: IQ tests; tests of personality

Technology in data collection

> *Computerised or automated data collection*: Sometimes a participant will respond to stimuli presented in a computer program or enter data onto a spreadsheet. In animal studies, responses such as pressing a button can be recorded.
  - Strengths: Efficiency – the researcher does not need to be present; accuracy – response rates can be timed to the millisecond; ease of analysis – once the computer program has been written, data analysis can be instantaneous
  - Weakness: The need for computer programming or specially constructed measuring devices
  - Example: Skinner's studies of learning

> *Video/audio taping*: For clinical interviews and certain case studies (such as sleep studies), these recordings are very useful
  - Strength: Large amounts of data can be collected and analysed in detail
  - Weakness: Analysis is time-consuming

Cross-sectional studies

In cross-sectional studies, data are collected at one time from participants of all ages and different age groups are compared. This is a form of independent groups design.

> Strengths: All data are collected at once and are readily available; cheaper and less time-consuming than **longitudinal studies**; less chance of participants 'dropping out' of the study
> Weakness: Large numbers of participants needed
> Example: Bandura's behavioural studies of aggression in children

Longitudinal studies

In longitudinal studies, the same participants are investigated over a period of time. Longitudinal studies involve a form of repeated measures design.

> Strengths: Less interference from personal characteristics; in studies of progressive mental health conditions, such as **Alzheimer's disease**, longitudinal studies are the only means of investigating how the condition progresses

> Weakness: Time-consuming; participant 'drop-out' likely

> Example: Developmental studies

REVIEW 1.6

1 Complete the following table for observational data collection methods.

METHOD OF OBSERVATION	PROCESS	ADVANTAGE	DISADVANTAGE	EXAMPLE
Naturalistic observation				
Controlled observation				

2 Complete the following table for interview and questionnaire data collection methods.

METHOD OF INTERVIEW	PROCESS	ADVANTAGE	DISADVANTAGE	EXAMPLE
Structured interview				
Clinical interview				
Surveys				
Likert scales				

Developmental research designs

Three research designs are mainly used to study developmental change: longitudinal, cross-sectional and sequential designs.

Longitudinal design

Have you ever watched the *Up* documentary series (S*even Up!*, *7 Plus Seven*, *21 Up*, *28 Up*, *35 Up*, *42 Up*, *49 Up*, *56 Up*)? This is an ongoing series where the lives of the same British people are documented every seven years. The first episode was screened in 1964 when 14 children, all seven years old, were interviewed in an attempt to show the influence of different social classes on development in the UK. The *Up* series continues to fascinate viewers.

Longitudinal studies take a similar approach. The same participants are monitored at different times in their lives. A considerable amount of time exists between each test, for instance a participant may be tested at five-year intervals for a number of years. A longitudinal design is a form of a repeated measures design.

Strengths of longitudinal designs:

> Participants are compared with themselves over several time periods.

> They look at direct changes in the participant.

> There is less bias from participant variables because participants are compared with their previous data, not someone else's data.

> If a researcher is interested in the relationship between early experiences and later outcomes, then a longitudinal design is necessary. For instance, does the quality of child care under the age of two years influence social and academic success at school? Does parenting style influence a child's self-esteem in early primary school years and academic success in secondary school? Does attempting crossword puzzles in early adulthood reduce the likelihood of dementia?

Limitations of longitudinal designs:

> Longitudinal designs are an expensive and time-consuming process, and participants may withdraw or drop out from the study between time periods: for instance, some participants may be unwilling to continue, others may be difficult to locate if they have moved and others may die.

> Repeating similar tests over several occasions may affect the results due to practice effects. It might even influence the participants' natural development because they know they are going to be tested.

> It is extremely difficult to replicate the tests exactly and a slight change may influence results.

> Generalising the findings from one particular cohort to another cohort may be difficult since the cohort that was tested would have had unique social and historical experiences that might have influenced the results. A cohort is a group of individuals who were born during the same time interval or generation.

> Longitudinal designs may be carried out retrospectively. If they are, they may be subject to memory distortion and lack of objectivity. For instance, a study may consider the participant's happiness in primary school compared with self-esteem and academic success in senior years at secondary school. Can you accurately recall how happy you were in Grade 6?

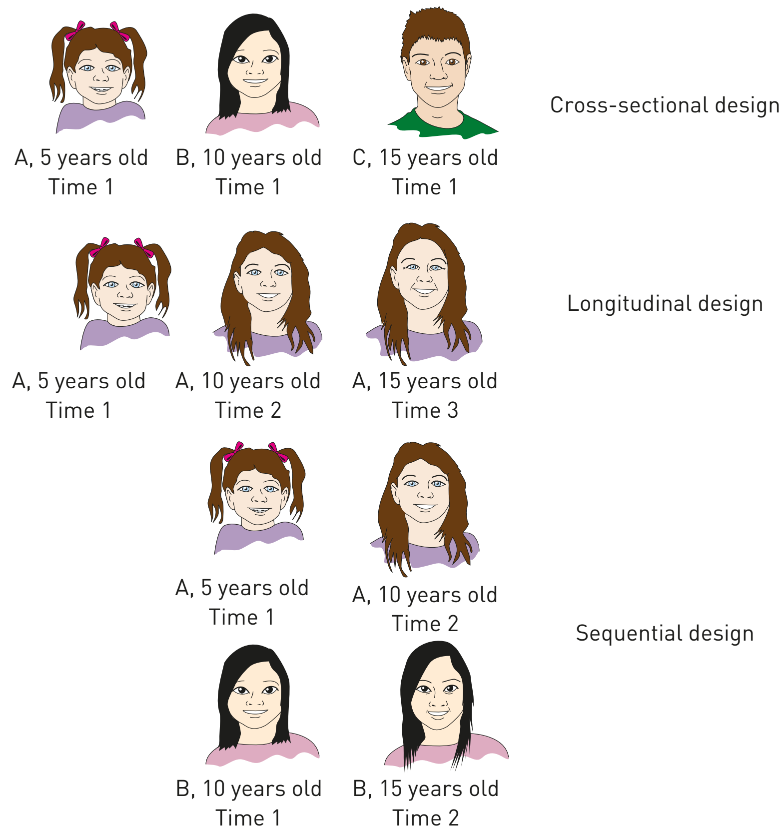


FIGURE 1.10
Developmental research designs

Cross-sectional design

In cross-sectional studies, participants of different ages, or cohorts, are investigated at one particular point in time. A cross-sectional design is a form of an independent subjects design.

Strengths of cross-sectional designs:

- Data are collected only once and therefore the results can be obtained immediately after collecting the data. It is not a lengthy, expensive, time-consuming process.
- There is less likelihood of participants withdrawing from the study than in longitudinal designs.

Limitations of cross-sectional designs:

- Cross-sectional designs have the disadvantages associated with independent subjects design, including participant variables confounding the results. To overcome bias of results due to participant variables, the participants need to be matched across the age groups (for example, same social status, race, culture, sex and other characteristics) to ensure that the only differences observed are due to age, not other variables. Matching participants can be a very difficult task.
- The results may be affected by cohort effects. Think of the comparisons between one cohort or generation and another. Growing up and life experiences can be very different. You are growing up in a technological world: this is quite a different experience from your parents' or grandparents' experiences in **adolescence**. Comparing data from one participant of a particular cohort to another of a different cohort can produce confounding variables, and this is known as the *cohort effect*.

1.4 INVESTIGATE

LEFT-HANDEDNESS OVER THE LIFESPAN

Before the 1950s, in countries such as Canada, the United States and Australia, left-handedness was strongly discouraged. Teachers were told to make sure that students wrote with their right hand. Some students were given harsh punishment and even had their left arm immobilised to ensure they used their right hand. In the 1950s, this attitude began to change and today people are encouraged to use their preferred hand at school, whether right or left.

The hand preferences of 2000 people of various ages were recorded (Porac *et al.*,) and the results are presented in Figure 1.11.

1 What type of research design was used in this study?
2 According to the graph, what appears to happen to left-handers as they age? Are they likely to become right-handed? What problems do you have with this assumption?
3 What is the cohort effect in this study?
4 Explain how social attitude change can account for the results in the table.
5 If this study were repeated today in Australia, what results would you expect? What about in 50 years' time?

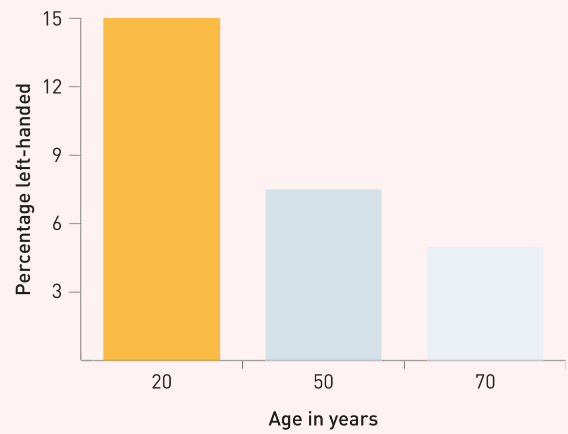


FIGURE 1.11 The hand preferences of 2000 people of various ages

Sequential design

Sequential designs attempt to overcome the limitations with both longitudinal and cross-sectional designs. They are a combination of both designs: for instance, the same participants from different cohorts may be tested over a long period of time. Sequential designs build on the strengths of both longitudinal and cross-sectional designs and eliminate many of the weaknesses such as cohort effects. They are still rarely used, however, because of the considerable time and expense involved in carrying out this type of design.

1.7 REVIEW

1 Describe the three research designs.
2 Longitudinal designs may be carried out retrospectively. Why might this cause a problem with the research?
3 What is a *cohort effect*? How can it affect the results in a cross-sectional research study?
4 How do sequential designs attempt to overcome the limitations with both longitudinal and cross-sectional designs?
5 Complete the following table for research designs.

DESIGN	FORM OF	ADVANTAGE	DISADVANTAGE	EXAMPLE
Cross-sectional	independent groups			
Longitudinal	repeated measures			

The quality of research

Research can only be as good as the measuring instruments used. The two indicators of the quality of a measurement scale are:

- **reliability** – meaning how *consistent* a measuring instrument is
- **validity** – meaning the extent to which an instrument measures what it is *supposed* to measure.

Reliability

- **Internal reliability**: This refers to the extent to which all the items in a research instrument contribute equally to the final score. A test would have a high internal reliability if the correlation between scores on the odd-numbered items and even-numbered items was high.
- **Inter-rater reliability**: Obviously, with an objective test the same result should be obtained by anyone administering the test. The procedures to be used are therefore standardised – they are the same each time the test is administered.
- **Parallel form reliability**: Some tests have more than one form that measures the same property. These can be very useful if the research is investigating *change* in the property measured. The property is measured before the treatment with the IV (pre-test) and again, with a parallel form, after the treatment (post-test).
- **Test-retest reliability**: Any test should be checked to ensure that it would produce the same result if readministered to the same person under the same conditions at a different time.

INVESTIGATE 1.5

MEMORY FOOD

A researcher is investigating whether eating the fruits of the Ginkgo biloba can improve memory. She has two parallel forms of a word-list memory test, Form A and Form B.

Why would it be best for her to pre-test half the participants with Form A and half with Form B, and then post-test each group with the other form?

FIGURE 1.12 Fruit from the Ginkgo biloba tree

Validity

- **Internal validity**: This examines whether the results gained from a measure are truly due to the variable that it is thought to be measuring. Two forms of internal validity are:
  - **content validity** (also known as *face validity*), which involves examining the instrument to decide whether it appears to be measuring what it is supposed to measure
  - **construct validity**, which involves deciding whether the test can be used to support the theory that is being tested; for example, does an IQ test measure all of the abilities that are considered to make up IQ?
- **External validity**: This is a criterion-related validity that refers to the extent to which results from this measure are comparable with other, established measures of the variable.

1.8 REVIEW

1 Answer the following questions.
   a What is meant by the reliability of a psychological measuring instrument?
   b Complete the following table:

FORM OF RELIABILITY	MEANING OF TERM	IMPORTANCE
Inter-rater reliability		
Parallel form reliability		
Test-retest reliability		
Internal reliability		

2 Answer the following questions.
   a What is meant by the validity of a psychological measuring instrument?
   b Complete the following table:

FORM OF VALIDITY	MEANING OF TERM	IMPORTANCE
Content validity		
Construct validity		
External validity		

Drawing conclusions from research statistics

Obviously, this is what research originally sets out to do – to draw conclusions and find out something useful about the population of interest.

Generalisation of results occurs after the research is complete. For this to be possible, the following criteria must be met:

> the results show statistical significance
> all sampling procedures were appropriate
> all experimental procedures were appropriate
> all measures were valid
> all possible confounding variables were controlled.

The good news is that in psychology, although we use statistics, we never have to calculate more than the very simplest of them. Computer programs and calculators do it all for us!

It is very useful, however, to know how these statistics work and what they mean.

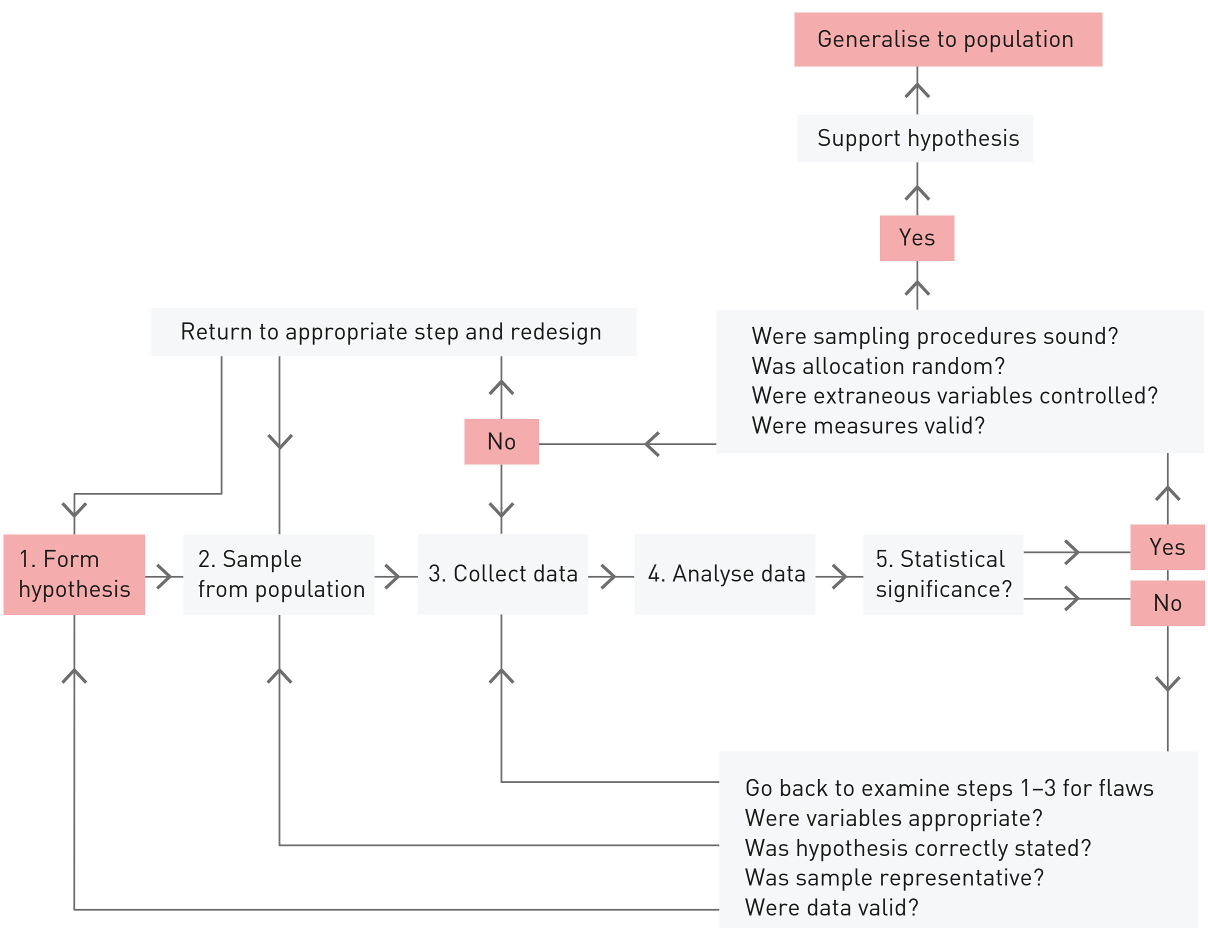


FIGURE 1.13 Decision-making in research

Descriptive statistics

FIGURE 1.14 Placing data from rolling a die into a frequency table makes calculations easier

When we collect data, it comes in a totally unorganised form. For example, Julie 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.

TABLE 1.3 Frequency table

NUMBER ON DIE	FREQUENCY
1	12
2	11
3	17
4	12
5	15
6	13

How can we sort out these data?

Placing the data into a frequency table will make it much easier to perform simple calculations on it. Compare the dataset above with Table 1.3. Which would you prefer to work with?

Often we need to calculate what percentage of a dataset is represented by a certain score. This is easy to do using the formula:

$$\frac{\text{Number of times the score occurs}}{\text{Total number of scores in dataset}} \times 100$$

If we wished to discover what percentage of rolls scored 6, the calculation is

$$\frac{13}{80} \times 100 = 16.25\%$$

CALCULATING PERCENTAGES

1.6 INVESTIGATE

Calculate the percentages for each number rolled. Add up all the percentages. What number will you have as your answer?

NUMBER ON DIE	FREQUENCY	PERCENTAGE
1	12	
2	11	
3	17	
4	12	
5	15	
6	13	16.25
Total	80	

REPRESENTING THE DATA

The frequency table made the data better organised, but it still doesn't tell us much. So we can use a **histogram** or a *frequency polygon* – which are graphical representations of how often each score appears – to get a clearer picture of which the numbers rolled on the die. We could also show the data as a *pie chart*. It is always important to use a type of graph that communicates the information clearly and accurately.

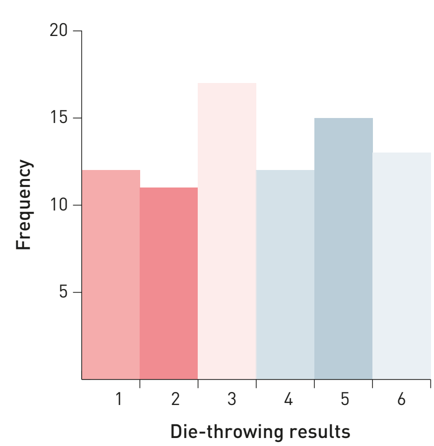


FIGURE 1.15 Histogram showing the number of occasions each number was thrown in 80 rolls of one die

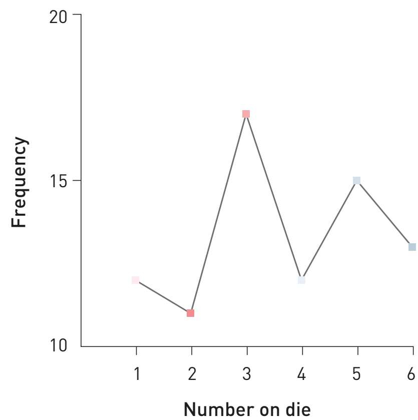


FIGURE 1.16 Frequency polygon showing the number of occasions each number was thrown in 80 rolls of one die

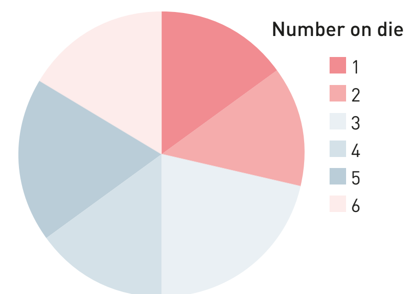


FIGURE 1.17 The pie chart makes it easier to register relative proportions.

Where one variable is *continuous* (meaning that it can have any value within a certain range) – such as body mass, age in months or IQ – we can express it in a table or on a line graph. For example, suppose your psychology teacher sets you a group classwork assignment and you want to find what size of group is the most efficient. The time taken to complete the assignment is the continuous variable.

The data in Table 1.4 is presented as the line graph shown in Figure 1.18.

TABLE 1.4 Time taken to complete class work for different-sized study groups

GROUP SIZE	TIME TAKEN TO COMPLETE (HOURS)
2	5.0
3	3.0
4	2.5
5	2
6	2.5
7	5.0

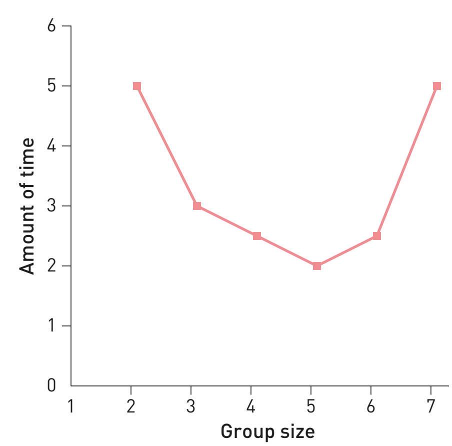


FIGURE 1.18 Time taken to complete class work for different-sized study groups

The normal curve

When all scores in a set of data are plotted in a graph, psychologists hope that they will form a *normal curve* – also known as a *bell curve* because of its shape (Figure 1.19). This is because statistical procedures can be applied to the bell curve without further manipulation of the data.

MEASURES OF CENTRAL TENDENCY

Measures of central tendency tell us how the data are clustered near the central point of the dataset. You will notice that for this curve, the three measures – *mean*, *median* and *mode* – are all at the same point.

The dataset in Table 1.5 represents the IQ scores of 12 students in a Grade 6 class. Using the data, we can calculate these three measures:

> **Mean** – the average of all the scores, calculated by adding up all the scores and dividing that total by the number of scores.

$$88 + 94 + 99 + 102 + 105 + 111 + 111 + 111 + 119 + 125 + 125 + 130 = 1320$$

$$\frac{1320}{12} = 110$$

The mean IQ score for this group of children is 110. We write this as $M = 110$ or $\overline{X} = 110$

> **Median** – the middle number (or mean of the two middle numbers) of a series listed in numerical order. For this data set, the median is:

88, 94, 99, 102, 105, **111**, **111**, 111, 119, 125, 125, 130

$$\frac{(111+111)}{2} = 111$$

> **Mode** – the most commonly occurring score in the dataset. For this dataset, the mode is 111.

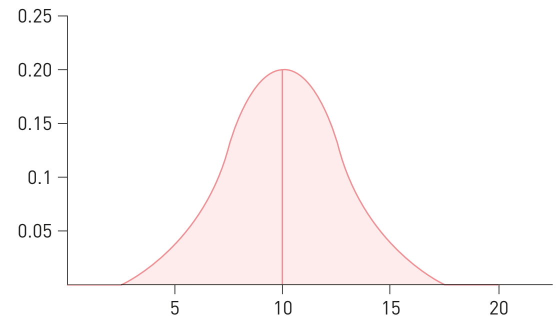


FIGURE 1.19 The normal curve

TABLE 1.5 IQ scores of 12 students in a Grade 6 class

STUDENT	IQ SCORE	STUDENT	IQ SCORE
John	88	Hanna	111
Robert	94	Jacob	111
Kiet	99	Adelina	119
Luke	102	Ahmed	125
Kerry	105	Arisa	125
Shelley	111	Akash	130

MEASURES OF VARIABILITY (DISPERSION)

Measures of variability tell us about how scores are spread out. When used along with measures of central tendency, they tell us a great deal about the features of the dataset.

Three such measures are *range*, *variance* and *standard deviation*.

> **Range**: The most basic of these measures, range is simply the difference between the highest score and the lowest score in the dataset. In the IQ scores above, the range would be 130 – 88 = 42.
  - This is not a very informative measure as it gives no indication of how the scores are spread along the range.

> **Variance**: Variance is a more useful measure than range because it uses information from each score in the dataset and gives us a measure of how much, on average, the scores differ from the mean.
  - But there is a problem! Some of the scores are higher than the mean (*positive difference*) and some are lower (*negative difference*). So if we just take the average difference, the negatives and positives will tend to even out and the 'mean difference' that we calculate will be incorrect. The way we overcome this is to square the differences, so that all figures are positive. (Remember, $-X$ times $-X = +X^2$.)

- Calculating the variance in our set of IQ scores, with a mean of 110, we find the data in Table 1.6.
- For the set of scores in Table 1.6, the mean variance is 157. This score is an indication of the spread, but it is very hard to compare it with the original IQ scores as it is in squared units which don't mean much, so we need to go one step further and calculate the **standard deviation**.

TABLE 1.6 Variance of IQ scores in Grade 6 class from Table 1.5

SCORE	DIFFERENCE FROM MEAN	SQUARED DIFFERENCE FROM MEAN (VARIANCE)
88	−22	484
94	−16	256
99	−11	121
102	−8	64
105	−5	25
111	+1	1
111	+1	1
111	+1	1
119	+9	81
125	+15	225
125	+15	225
130	+20	400

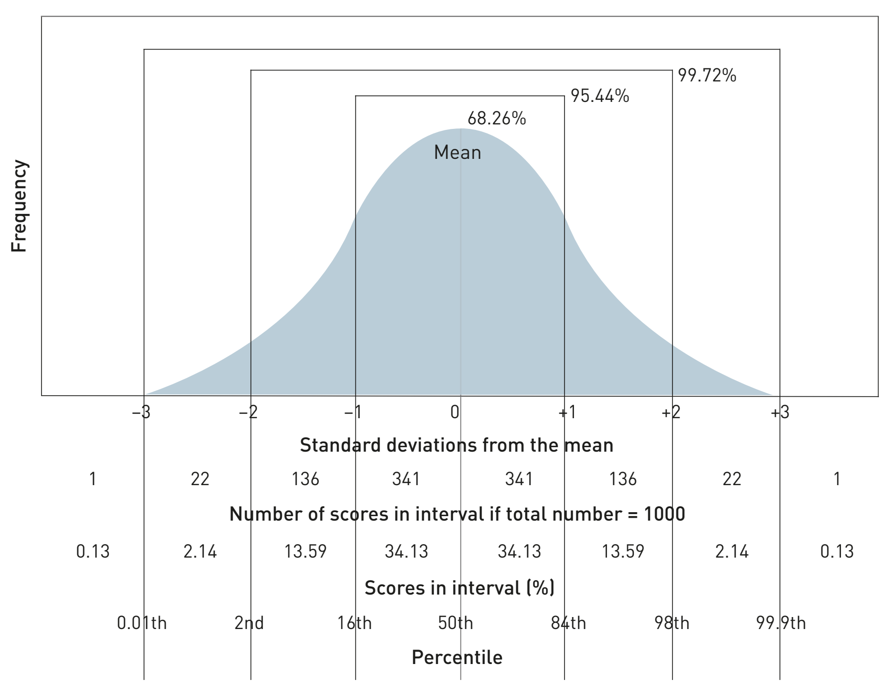


FIGURE 1.20 Distribution in a normal curve, showing percentiles by standard deviation

> Standard deviation: The standard deviation is a very useful measure that tells us how far, on average, scores are different from the mean. This is done by taking the square root of the mean variance. So in this case, the standard deviation is 157 = 12.5.

In a normal curve, a certain set percentage of scores will fall within one, two, three or four standard deviations of the mean, as shown in Figure 1.20.

SKEW OF A CURVE

Of course, it is rare for all the data in a dataset to be able to be plotted into a smooth, well-balanced curve like the one in Figure 1.20. More often the plot is biased or *skewed* one way or the other.

Sometimes a dataset will have more than one 'peak'. The curve in Figure 1.23 shows a **bimodal distribution** – this often occurs where two distinct populations are plotted on the same curve. What we need to do in this case is to sort out the members of the two different populations.

For example, if you were presented with a graph like that in Figure 1.23 and told that it was the average age at which children go through their growth spurt, you would easily guess what had happened – and separate the girls' data from the boys' data to make two graphs that are meaningful (Figure 1.24).

Data in this form could be very difficult to work with, but fortunately there is a simple method of converting scores so that they form a bell curve. For VCE Psychology, we need only to learn about the features of a normal distribution.

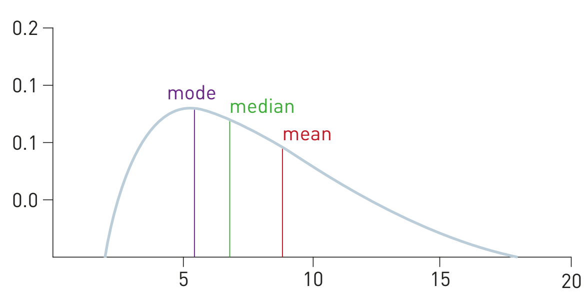


FIGURE 1.21 Positive skew

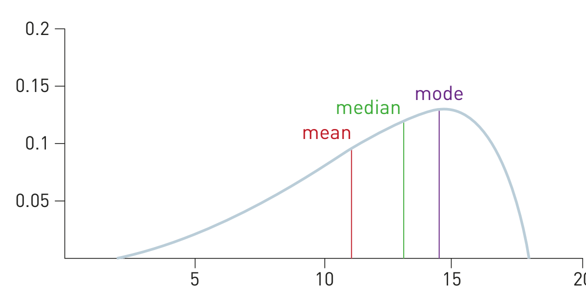


FIGURE 1.22 Negative skew

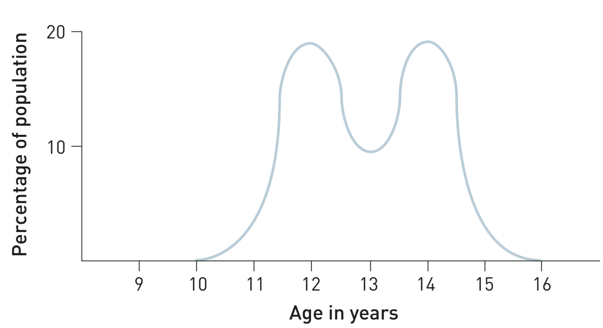


FIGURE 1.23 This bimodal distribution shows children have two growth spurts.

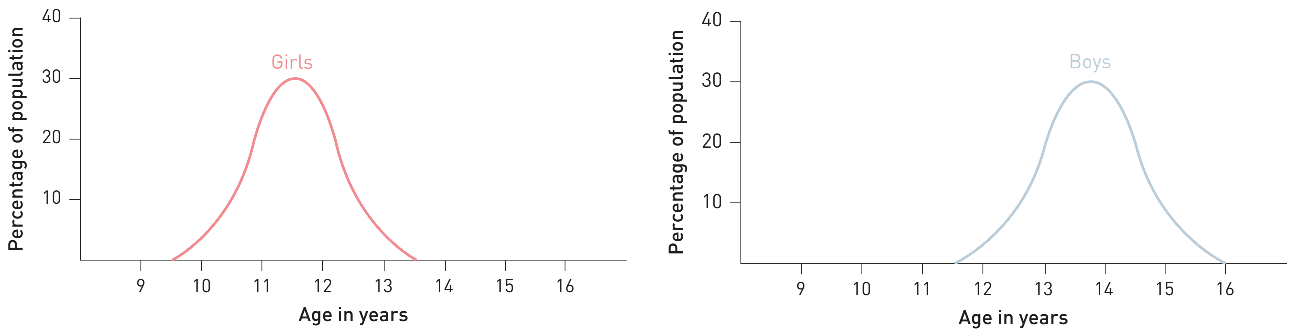


FIGURE 1.24 The onset of growth spurts in girls occurs about two years earlier than boys.

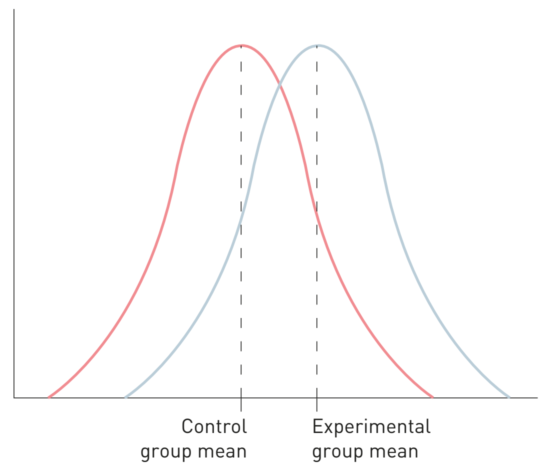


FIGURE 1.25 While the C-group and the E-group have different means, the importance of the difference depends on the sample size.

Inferring from data

As we have seen, psychological research is always testing hypotheses – and all our efforts in research design aim to make sure that our conclusions are accurate.

After the experiment, the researcher needs to decide whether the results could be due to chance alone – in which case no cause-and-effect relationship can be **inferred**.

To do this, the researcher calculates the mean score for the E-group and the C-group, and uses **inferential statistics** to decide whether the difference is statistically significant or is likely to have been caused by pure chance.

Obviously, the means are different. The question is, are they different enough to show that the IV has caused a significant change?

In Figure 1.25, the E-group mean is higher than the C-group mean, but is this statistically significant? This will depend on the size of the sample as well as the difference. The *larger* the sample, the *less* difference is needed to reach statistical significance.

SUPPORTING UNDERSTANDING

P-values

The inferential tests will give a **probability** that the difference is caused by chance. This is expressed as a *p*-value, where $p = 0.03$ means that there are three chances in 100 (3 per cent) that this difference would be achieved by chance alone.

Psychologists are generally prepared to accept that a difference is statistically significant if the difference could have been caused by chance alone on five or less times in 100. This is stated as $p \leq 0.05$.

The following *p*-values have been found after different research procedures:

$p = 0.01$ $p = 0.50$

$p = 0.10$ $p = 0.005$

$p = 0.05$ $p = 0.02$

1 Put them in order from *lowest* to *highest* in terms of the probability that the results are due to chance.
2 Indicate which results are statistically significant (SS) and which are non-significant (NS).

Appropriateness of conclusions and generalisations based on results

A **conclusion** is the final decision about what the results mean. This conclusion must be stated in terms of the original hypothesis. So a conclusion would be that the hypothesis is *rejected* or *supported*.

Psychologists never say that a hypothesis has been ‘proven’ or ‘disproven’. After all, there may be another hypothesis that explains the relationship even better than the one that was tested.

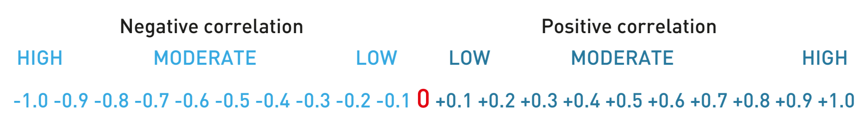
A generalisation is a judgement about the extent to which the research findings can be applied to the population represented by the sample. The ability to generalise from a sample relies on all the following conditions being met:

> The sample must represent the population of interest.
> The results must reach statistical significance.
> The effects of all potentially confounding variables must have been controlled.

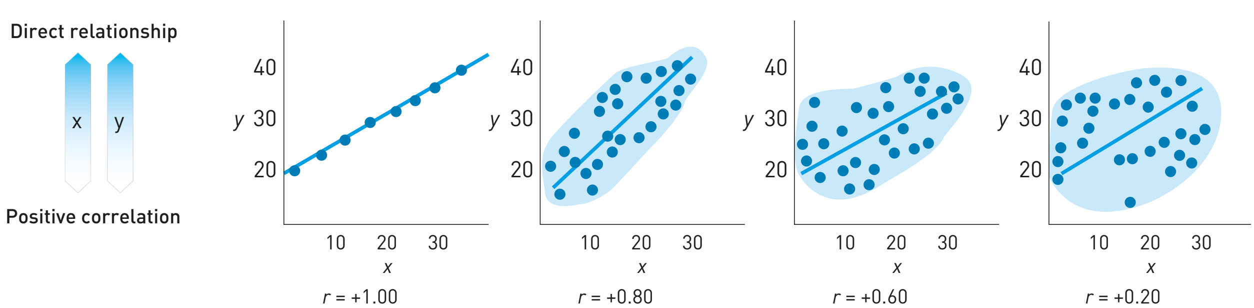
Measures of relationship

Correlational studies are intended to identify and describe the relationship between two variables. Unlike the experimental method, the correlational method makes no attempt to manipulate variables. Rather, the intent of such a study is usually to establish the *strength* and *direction* of any correlation that may exist between the two variables.

- **Correlation**: A correlation is a statistical measure of how much two variables are related. A correlation does not show a cause-and-effect relationship; it simply describes the way in which the variables vary in relation to each other.
- **Positive correlation**: A positive correlation is one in which the two variables change in the same direction – that is, as one increases, so does the other; or as one decreases, so does the other. For example, we might expect to find a positive correlation between hours spent studying each week and study scores in VCE – meaning that as the number of hours spent studying each week increases, the average study score in VCE will increase.
- **Negative correlation**: A negative correlation is one in which the two variables change in the opposite direction – that is, as one increases, the other decreases. For example, we might expect to find a negative correlation between hours spent playing online games and study scores for VCE – meaning that as the number of hours spent playing online games increases, the average study score in VCE will decrease.
- **Strength of correlation**: Correlation also shows the strength of the relationship. This is indicated by a *correlation coefficient*, expressed as a decimal number in the range of −1.0 to +1.0.
  - The (+) or (−) sign before 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 0.0 indicates that the two variables are not related in any way.



- **Scatter diagrams (scatter plots)**: Correlational data are often represented graphically by a scatter diagram. A scatter diagram shows the values of the two variables for each participant in the sample by representing the intersection of those two values with a dot on a graph.



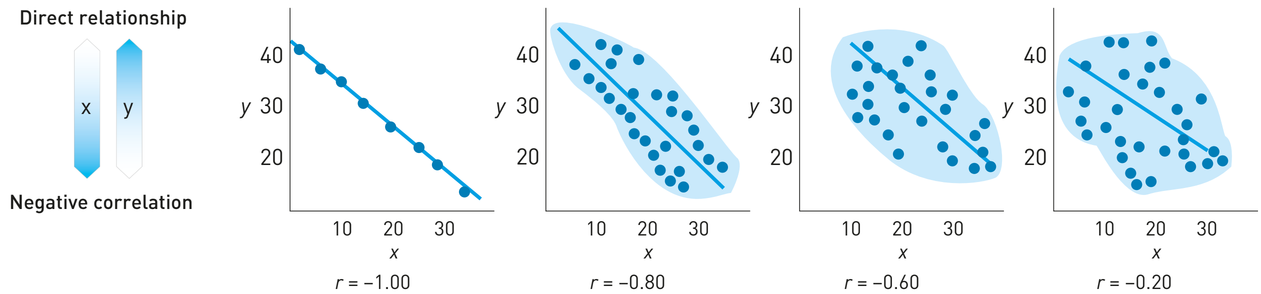


FIGURE 1.25 Scatter diagrams showing relationship and correlations. They show various strengths and directions of correlation, from perfect positive correlation to perfect negative correlation.

1.9 REVIEW

Consider the following brief descriptions of research and results. For each one, indicate whether the generalisation of findings is appropriate.

1 Professor Prada investigated whether personality type is related to the proportion of income spent on clothes. She assessed participants on the *extroversion–introversion* scale and found the following results:

GROUP	PROPORTION OF NET INCOME SPENT ON CLOTHES
Extroverts	45%
Introverts	33%

Professor Prada uses a t-test and finds that, for this difference, $p = 0.06$. She concludes that **extroverts** spend significantly more on clothes than introverts.

2 Miss Motley noticed that some children in her Grade 4 class at Valley Primary School were almost falling asleep by recess. She thought that the sleepiness might be due to the fact that they did not eat breakfast before coming to school.

To investigate this, she used a random number generator to select 10 children from each class, from Kinder to Grade 6. She asked the classroom teachers to keep a tally, for one week, of the number of times each of the 10 children participants in their class showed sleepy or drowsy behaviour. She also surveyed the children each day to see who had eaten breakfast and who had not. She discovered the following results:

GROUP	SLEEPY BEHAVIOURS PER DAY
Children who eat breakfast	2
Children who do not eat breakfast	9

Miss Motley calculated the significance of this difference as $p = 0.05$. She concluded that for children at Valley Primary School, failure to eat breakfast caused increased sleepiness.

Ethical considerations in psychological research

In psychological research there are **ethical considerations** involved in working with both animals and humans.

> Research with animals: Although animals are used in research today, the guidelines protecting them are much more strict than they were when Harlow did his experiments with monkeys in the 1950s and 1960s. Animals must be protected, pain must be minimised and the animals must be well cared for.

> 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 role of 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.

FIGURE 1.27 Monash University – one of the world's top 100 universities. All universities conducting research will have an HREC.

The Australian Psychological Society publishes a 'Code of Ethics' for psychologists. This includes a section on the conduct of psychological research, and draws together regulations and guidelines from bodies such as the National Health and Medical Research Council (NHMRC) and guidelines such as the National Privacy Principles (NPPs).

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

> *The role of the experimenter*: 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 by deception.
  - **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 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.
> *Deception in research*: 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**; 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 and participants are told the 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.

National Health and Medical Research Council

The National Health and Medical Research Council (NHMRC) is the Australian Government body that oversees all research with human subjects.

The NHMRC's National Statement on Ethical Conduct in Human Research (2007) is organised around four values.

1 *Research merit and integrity*

> Research that has merit is:
  - justifiable by its potential benefit, including its contribution to knowledge and understanding, social welfare and individual wellbeing
  - designed or developed using methods appropriate for achieving the aims of the proposal
  - based on a thorough study of the current literature, as well as previous studies
  - designed to ensure that respect for the participants is not compromised by the aims of the research, its procedures or results.

2 *Justice*

> In research that is just:
  - the selection of research participants is fair
  - the process of recruiting participants is fair
  - there is fair distribution of the benefits of participation in research
  - there is no exploitation of participants in the conduct of research
  - there is fair access to the benefits of research.

3 *Beneficence*

> The likely benefit of the research must justify any risks of harm or discomfort to participants. The likely benefit may be to the participants, to the wider community, or to both.
> Researchers are responsible for:
  - designing the research to minimise the risks of harm or discomfort to participants
  - clarifying for participants the potential benefits and risks of the research
  - the welfare of the participants in the research context.

4 *Respect for human beings*

> Researchers must provide:
  - voluntary participation
  - withdrawal rights
  - protection of vulnerable participants
  - consideration of welfare of participants – physical/social/emotional/cultural.

NATIONAL PRIVACY PRINCIPLES

The National Privacy Principles (NPPs) came into effect in December 2001, as an amendment to the *Privacy Act 1988*. The aim of the NPPs is to ensure that organisations that hold information about people handle that information responsibly. They also give people some control over the way the information about them is handled. The NPPs apply to conventional, electronic and digital environments.

Some of the NPPs are as follows:

> *Collection of data* must be necessary.
> *Data use* must be only for the purposes specified.
> *Data quality* must be accurate, complete and up to date.
> *Data security* is essential for storage and destruction of data.
> *Openness* – informed consent must be obtained.
> *Anonymity* of participants must be maintained.

Further details can be found on the web by searching for 'National Privacy Principles' or following the link in your obook.

REVIEW 1.10

1 What is the overriding ethical consideration in psychological research?
2 List the ethical considerations that fall into the category of participants' rights.
3 What is meant by the role of the researcher?
4 What is the role of the ethics committee of a research institution?
5 What must be included in informed consent procedures?
6 When does debriefing occur and what does it involve?
7 When is deception permitted in research? What provisions must be made when deception is to be used?

CHAPTER SUMMARY 01

- Psychological research is based on the scientific method, which involves eight steps: identify the area of research; collect information; identify the research question and formulate the hypothesis; design the research method to test the hypothesis; collect and analyse the data; draw a conclusion – support or reject the hypothesis; report findings; and test the conclusion.
- 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). Every experiment has at least one of each.
- An extraneous variable is a variable other than the IV that could cause changes in the value of the DV.
- Random sampling and stratified sampling are used in participant selection so that a sample is chosen to represent the population.
- Experiments have two different groups: the experimental group (E-group) and the control group (C-group). The E-group is exposed to the independent variable and the purpose is to show the effects of the IV on the value of the DV. The C-group is not exposed to the IV.
- There are various types of data: qualitative data, quantitative data, subjective data, objective data.
- Collection of data is completed through observation, interviews, questionnaires, surveys, psychological tests and technology of data collection, and is measured through cross-sectional studies or longitudinal studies. The quality of data collection and its reliability and validity are essential to the success of the research.
- Three research designs are mainly used to study developmental change: longitudinal, cross-sectional and sequential designs.
- Generalisation of results to the population occurs after the research is complete, provided: results show statistical significance; all sampling procedures were appropriate; all experimental procedures were appropriate; all measures were valid; and all possible confounding variables were controlled.
- Correlational studies are intended to identify and describe the relationship between two variables, without manipulating them, to establish the strength and direction of any correlation.
  - Positive correlation: the two variables change in the same direction – as one increases or decreases, so does the other.
  - Negative correlation: the two variables change in the opposite direction – as one increases, the other decreases.
- The overriding principle in all psychological research is that there must be no physical or psychological harm to participants.
  - Researchers must always maintain respect for the participants.
  - Participants must not be identified in any way.
  - Participants have the right to refuse to take part in a study.
  - Participants have the right to leave a study at any stage.
  - Participants must be given information about a study before they agree to take part.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate.

case study
conclusion
confidentiality
confounding variable
control group
controlled variable
convenience sample
counterbalancing
debriefing
deception in research
dependent variable
double-blind procedure
ethical principles
experiment
experimental design
experimental group
experimenter effect
extraneous variable
generalisation
independent groups
independent variable
informed consent
matched participants
mean
measures of central tendency
median
mode
normal curve
observational studies
operationalisation of variables
order effects40
participant effect40
participants' rights40
placebo (& placebo effect)40
population
probability (p-value)40
qualitative data
quantitative data
questionnaire
random allocation sample
random sample
repeated measures
scientific method
self-reports
single-blind procedure
standardised instructions and procedures
statistical significance
stratified random sample
stratified sample
variables
voluntary participation
withdrawal rights

KEY IDEAS

For the exam you must know:

- the purpose of the scientific method
  - different variables involved in research (IV, DV, extraneous, controlled, confounding)
  - procedures for operationalisation of variables
  - statements of research hypotheses
  - procedures for controlling for possible counfounds
  - sampling procedures
  - allocation procedures
  - single-blind procedures
  - double-blind procedures
  - counterbalancing
- experimental design – advantages and disadvantages of
  - independent groups
  - matched participants
  - repeated measures
- methods of data collection
  - case studies
  - observational studies
  - self-reports
  - questionnaires
  - statistics
  - measures of central tendency
  - probability (p-values)
  - conclusions
  - generalising to the population
- ethical considerations
  - participants' rights (confidentiality, voluntary participation, withdrawal rights, informed consent procedures, debriefing)
  - use of deception in research

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

Questions 1–3 refer to the following information:

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, for learning a list of 40 botanical names of plants, of students who spent more than five hours per week playing games with the memory skills of students who spent less than five hours per week playing games. When a test of significance was run, it was found that the difference in the mean scores for the two groups was statistically significant. The researcher claimed this showed that playing online games causes reduced academic success for students.

1 **Was the researcher correct? Why or why not?**
   - a Yes, because the results reached statistical significance.
   - b No, because learning the names of 40 plants is not a valid measure of academic success.
   - c Yes, because learning the names of 40 plants will correlate with academic success.
   - d Unlikely, because he had not matched participants on any other variables so the results were likely to be confounded.

2 In this research the independent variable is:
   - 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 hours students spent playing online games.

3 In this research the dependent variable is ________________ operationalised as ________________.
   - a excessive time spent playing online games; number of hours per week spent playing online games
   - b students who play online games; over 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

4 Inferential statistics are statistical procedures that allow us to:
   - a prove or disprove a hypothesis
   - b draw conclusions from data
   - c describe the properties of the data gathered
   - d manipulate data and calculate standard scores.

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 repeated measures
   - b independent groups
   - c matched participants
   - d independent measures

6 The purpose of the experimental group in research is to:
   - a ascertain the effects of the dependent variable
   - b eliminate the effects of the dependent variable
   - c ascertain the effects of the independent variable
   - d eliminate the effects of the independent variable.

7 The best definition of a *random sample* is:
- a a group of participants selected from the population by picking names at random from the phone book
- 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.

8 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 visual puzzles on a computer, but in reality the computer would 'crash' near the end of the test and their emotional response to the frustration 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.

9 What type of research design involves testing different age groups only once?
- a longitudinal
- b cross-sectional
- c sequential
- d matched-pairs

10 Ashley tests the same participants at different ages for a number of years. He then compares participants born in different years to one another when they are a certain age. The differences among the same-age participants are more likely to be due to:
- a age rather than cultural change
- b cultural change rather than unique historical events
- c cultural change rather than age
- d age rather than the environment.

Questions 11–12 refer to the following information:
Professor Plum 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 awakening from a full night's sleep. To investigate this, he gives each of his first-year university Psychology students a card and instructs them to attend the experimental session and hand in the numbered card, which will prevent them from being penalised 5 per cent from their semester mark.

11 Which ethical principle is Professor Plum violating in terms of 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

12 Later in the year, another researcher wishes to do further research and feels that the data collected by Professor Plum will be useful. The kind professor gives his colleague a list of the students and the data collected. Which further ethical consideration(s) of participant rights has/have now been violated?
- a voluntary participation in research
- b informed consent from participants
- c confidentiality of participant information
- d both informed consent and confidentiality of participant information

13 A random sample is needed in order to:
- a select subjects to take part in research so that there are equal numbers of males and females
- b ensure that experimenter bias does not occur
- c ensure that experimental and control groups are similar in terms of participant variables
- d ensure that different characteristics occurring within the population also occur within the participants in the research.

14 Professor Peabrain is researching the effects of increased vitamin intake, through drinking carrot juice, on the functioning of the rods in the eye. He gives his experimental group 125 ml of carrot juice each day, while he gives the control group carrot juice that has been boiled and cooled so that the vitamins are inert. The purpose of the control group in this experiment is to:
- a show the effects of the independent variable
- b control or eliminate the effects of participant variables
- c form a basis for comparison with the experimental group
- d show the effects of the dependent variable.

15 Doctor Jekyll is trying to discover the way in which a person's visual perception is affected by their expectations. To do this without biasing the participants' answers, he informs participants that they are doing an experiment investigating their visual acuity. This would be ethical only under the following circumstances:
- a Dr Jekyll has permission from the ethics committee of his university.
- b Dr Jekyll has permission from the ethics committee of his university and has put appropriate debriefing and counselling procedures in place.
- c Dr Jekyll has put appropriate debriefing and counselling procedures in place.
- d Deceit in psychological research is never ethical.

Questions 16–18 refer to the following information:

A researcher is investigating the effects on the sleep cycle of subjects using a lavender-scented pillow, which she believes will decrease nightmares. She has two groups of subjects. Subjects in one group have lavender-scented pillows and in the other they have pillows scented with other herbs. The researcher analyses subjects' dreams for negative content the next day. The subjects are not aware of which herbs are thought to reduce nightmares and the researcher is not aware of which subjects are using lavender and which are using other herbs.

16 The researcher is using
- a a single-blind design to eliminate the placebo effect
- b a single-blind design to eliminate subject expectations
- c a double-blind design to eliminate experimenter bias
- d a double-blind design to eliminate placebo and experimenter effects.

17 Which of the following ethical guidelines has *not* been covered by the researcher?
- a confidentiality of participant information
- b informed consent from participants
- c voluntary participation in the research
- d withdrawal rights for participants.

18 What additional procedure should the researcher follow with this sample?
- a She must obtain consent from participants' parents or guardians if participants are less than 21 years of age.
- b She must obtain consent from participants' parents or guardians if participants are less than 18 years of age.
- c She must obtain consent from participants' parents or guardians if participants are less than 16 years of age.
- d She must obtain consent from participants' parents or guardians if participants are less than 14 years of age.

SHORT ANSWER

19 It is thought that adolescents will sleep for longer periods after they have spent the day studying or in intense physical activity, rather than after a normal day's activity. A researcher wished to study this.

a Why would an independent groups design be *less* appropriate than a repeated measures design?

1 mark

b Name and describe a process that could be used to eliminate order effects.

2 marks

20 What are cohort effects? Give an example.

2 marks

21 Answer the following questions.

a What is the meaning of the ethical consideration of withdrawal rights in psychological research?

1 mark

b What is meant by the ethical requirement of confidentiality in psychological research?

1 mark

Questions 22–30 refer to the following description of research:

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 obtained the figure by giving a 40-item 'mood test' from the internet.

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. This difference was statistically significant.

22 What was the population in this research?

1 mark

23 Was Richard's sampling procedure appropriate? Explain your answer.

2 marks

24 What was the independent variable in this research?

1 mark

25 What was the dependent variable in this research?

1 mark

26 How was the dependent variable operationalised?

1 mark

27 State an appropriate experimental hypothesis for this research.

1 mark

28 Answer the following questions about experimental design.

a What experimental design was used in this research?

1 mark

b Why did Richard make 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'? What name is given to this procedure?

3 marks

29 In calculating the statistical significance, Richard found that his results were *statistically significant*. What does this mean?

2 marks

30 Would it be appropriate for Richard to generalise his conclusions to all Year 6 students in the school? Explain your answer.

3 marks

Report writing for VCE Psychology

If you read through some psychological journals, you will see that there is a regular format followed by all the authors – all must follow the American Psychological Association (APA) guidelines, even in Australia.

Each paper has the six sections: Abstract; Introduction; Method; Results; Discussion; and References. The headings are always set out in the same way, starting with a capital letter and centred on the line.

> Abstract: The abstract occurs on a page of its own and summarises the whole paper. For a report on a VCE Research Investigation, it would be written as a single paragraph, no longer than 150 words.

> Introduction: Note that in a journal article the Introduction does not have a heading. It must:
- state the research aim
- explain the main concepts involved in the research
- define all terms used in the research
- summarise previous relevant research
- explain why the research was considered necessary
- state the independent variable and the dependent variable and indicate how they are operationalised
- state the experimental hypotheses it is testing.

> Method: The Method section is intended to allow other people to understand your methodology and be able to replicate it. Method can be subdivided into: participants, measures and procedure.
- Details of the age, sex, years of education and other common characteristics of the participants in the sample should be given.
- The tests and measures used must be described in detail. Any evidence of their validity or reliability should be quoted. Sources must be acknowledged.
- In the procedure section, the method used is described in detail. A future researcher should be able to reproduce your method in precise detail. If procedures such as counterbalancing have been used to control extraneous variables, this is where they are described.

> Results: Step by step, hypothesis by hypothesis, the results found must be shown. There must be no discussion in the Results section. There must be a table of descriptive statistics, showing who the participants were, and their scores on any tests or measures. There must be analytical statistics that show whether there is any significance in the differences identified between either 'before' and 'after' or 'experimental' and 'control' conditions.
- Where appropriate, the information should be expressed visually, as a graph. A graph must always be preceded by a table that shows the graphed information in detail, and must be appropriate to the type of information it is intending to illustrate. It must include labelling of axes, title, constant intervals on axes (unless it is a logarithmic graph) and origin point at zero where possible.

> Discussion: The Discussion is based on the hypotheses that were stated in the final part of the Introduction.
- Each hypothesis must be supported or rejected in specific terms. If the hypothesis is supported, then no explanation is needed. If the hypothesis is rejected, it is necessary to provide a full explanation of why the error of judgement occurred. An alternative hypothesis to replace the one that has been discredited should be suggested and rationalised. There should also be an explanation of the importance of the findings – what they mean and how they can be applied to the real world.
- There should be comments noting any identified weaknesses in the current research and suggestions for further research in this area.

> References: The convention for acknowledging sources is very precise.
- Journal article: Author's name, and initial(s)., (Date). Title of the paper with no capitals or underlining. The Name of the Journal with Capitals and Underlined or Italicised. Volume number. Article pages from–to.
- Book: Author's name, and initial(s)., (Date). Title of the Book With Capitals and Italics or Underlining. Publisher: City.

HOW DOES EXPERIENCE AFFECT BEHAVIOUR AND MENTAL PROCESSES?

→UNIT 03:

How do we interact with the world around us?

We are composed of amazing organs, structures and infrastructures that enable us to make sense of an incredibly complex world. Some of the experiences and challenges that we come up against can cause us worry and stress. Management techniques and coping strategies help us to navigate stress and inhibit any long-term effects. In this unit we look at what stress is: its causes and how it affects our daily functioning, both physically and psychologically.

How can we learn and remember, so that we repeat our successes, but avoid repeating our failures? Our memory mechanisms can be fickle: why do we remember some things vividly, but have vague and sometimes faulty memories of others? In this unit, we examine the biological, psychological and social factors of memory and apply them to our ability to learn and remember information.

We explore the interaction with our world and how we use physiological and psychological strategies to interpret and understand our environment as well as cope with adversity.

AOS1
HOW DOES THE NERVOUS SYSTEM ENABLE PSYCHOLOGICAL FUNCTIONING?

Imagine you're in a plane, flying over Melbourne at night. As you look down, you can see the amazing network of communication and transport infrastructure: car headlights dotted along freeways and side streets; trains speeding along their designated routes; and arterial roads and converging on transport hubs.

Imagine that all this is being controlled from one central point. Now you have an idea of the intricacies of your brain and nervous system – only yours would be more than 20 000 times larger and more complex!

Sometimes extra pressure can be put on the system – comparable to how a freeway car accident can cause gridlocked delays all around the city. The system is subjected to stress and the same can occur with a person. Strategies to deal with such stressors and return the system to normal can be implemented through our understanding of psychological processes.

Outcome 1

On completion of this unit the student should be able to explain how the structure and function of the human nervous system enables a person to interact with the external world and analyse the different ways in which stress can affect nervous system functioning.

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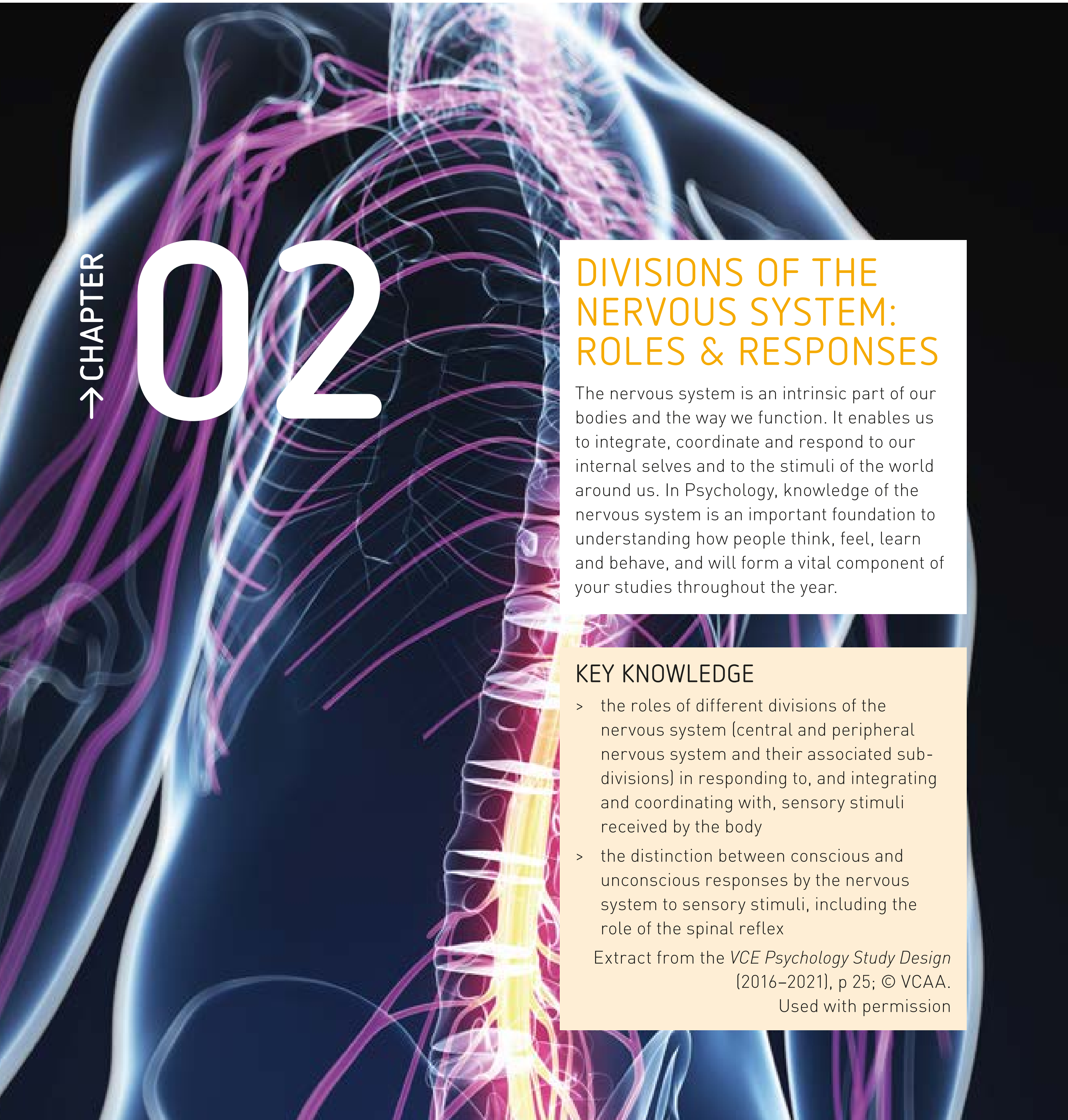

→CHAPTER 02

DIVISIONS OF THE NERVOUS SYSTEM: ROLES & RESPONSES

The nervous system is an intrinsic part of our bodies and the way we function. It enables us to integrate, coordinate and respond to our internal selves and to the stimuli of the world around us. In Psychology, knowledge of the nervous system is an important foundation to understanding how people think, feel, learn and behave, and will form a vital component of your studies throughout the year.

KEY KNOWLEDGE

> the roles of different divisions of the nervous system (central and peripheral nervous system and their associated sub-divisions) in responding to, and integrating and coordinating with, sensory stimuli received by the body

> the distinction between conscious and unconscious responses by the nervous system to sensory stimuli, including the role of the spinal reflex

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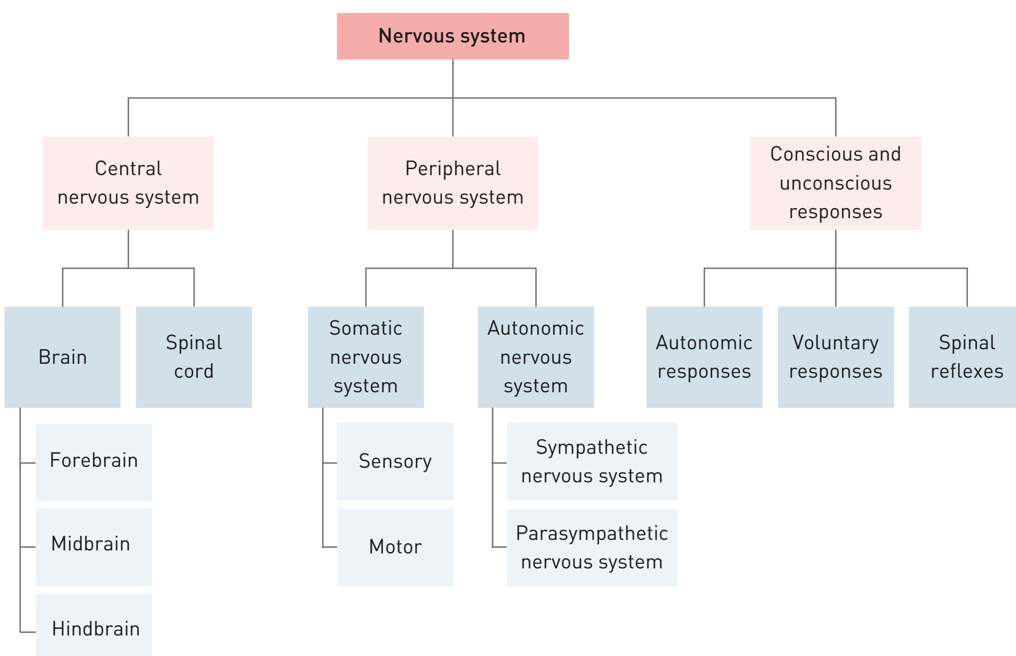
CHAPTER OVERVIEW

The nervous system	The central nervous system The peripheral nervous system
The role of the cerebral cortex in sensory processes	Lobes of the cerebral cortex Association areas of the cerebral cortex
Conscious and unconscious responses to sensory stimuli	Autonomic responses Voluntary responses Spinal reflexes

CONTENT MAP



The nervous system

The nervous system can be divided into two major sections: the **central nervous system** and the **peripheral nervous system**. The peripheral nervous system is further divided into the **somatic nervous system** and the **autonomic nervous system**. In turn, the autonomic nervous system has two branches, known as the **sympathetic nervous systems** and **parasympathetic nervous system**.

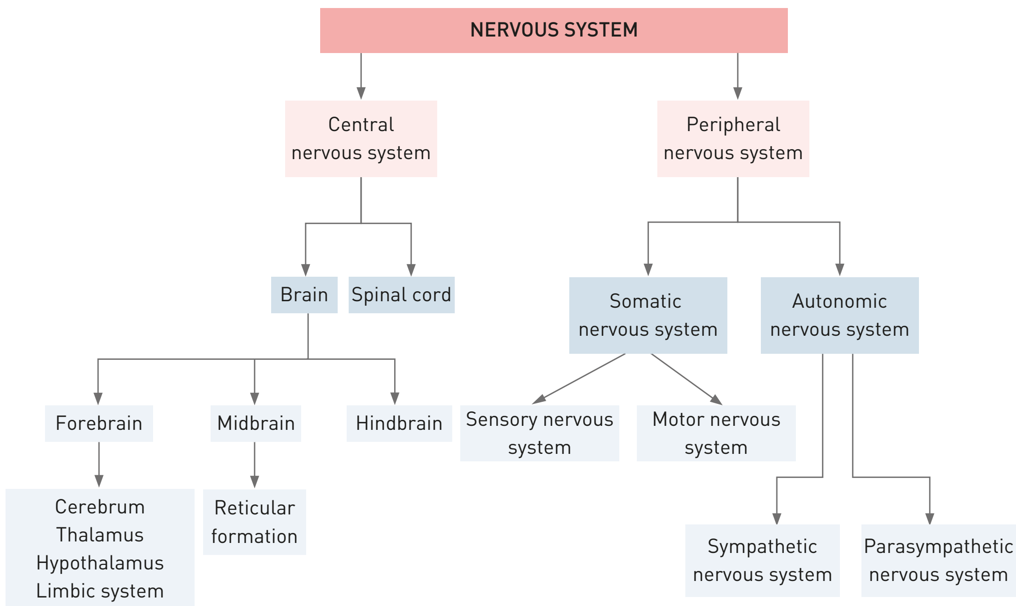


FIGURE 2.1 The overall structure of the nervous system

Did you know?

Many people confuse the *spinal cord* with the *spinal column*. The spinal column consists of our vertebrae and the discs between them. It holds the body upright and protects the spinal cord.

In studying the relationship between the processes of the brain, it is sometimes helpful to consider each of its structures as separate entities with individual responsibilities. However, this is not how it operates in reality. Neuroimaging techniques have enabled scientists to observe the parts of the brain that are active during different types of **cognitive processes**, and it is apparent that many are active at any given time during sensation and cognitive processing. Therefore, it is important to remember that different parts of the brain interact with each other and are not discrete, isolated structures.

The brain does not act in isolation. It needs to receive information from the body's sense organs – the eyes, ears, skin, nose and tongue – which are constantly receiving information from the environment. The brain is also connected with the muscles and glands in the body so that an organism is able to respond to and act on the environment.

The central nervous system

The central nervous system comprises the **brain** and the **spinal cord**. It enables the brain to communicate with the rest of the **body** by conveying messages to the peripheral nervous system described below.

THE BRAIN

The brain itself is made up of the **hindbrain**, the **midbrain** and the **forebrain**. These structures are covered in detail in Unit 1. The hindbrain is the link between the spinal cord and the rest of the brain and is important for movement and balance. The midbrain coordinates movement, **sleep** and arousal. The forebrain is responsible for receiving and processing sensory information and for higher order thinking processes including problem-solving and planning, as well as **memory**, language and emotions.

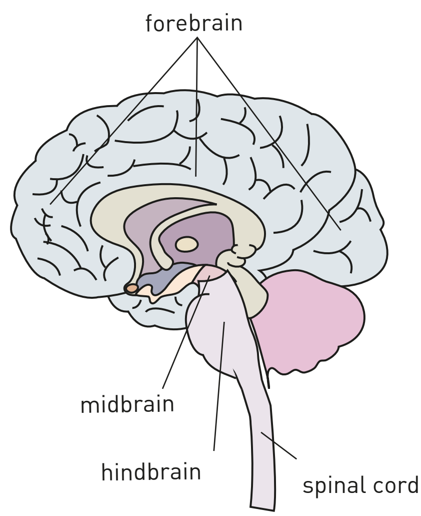


FIGURE 2.2 Forebrain, midbrain, hindbrain and spinal cord

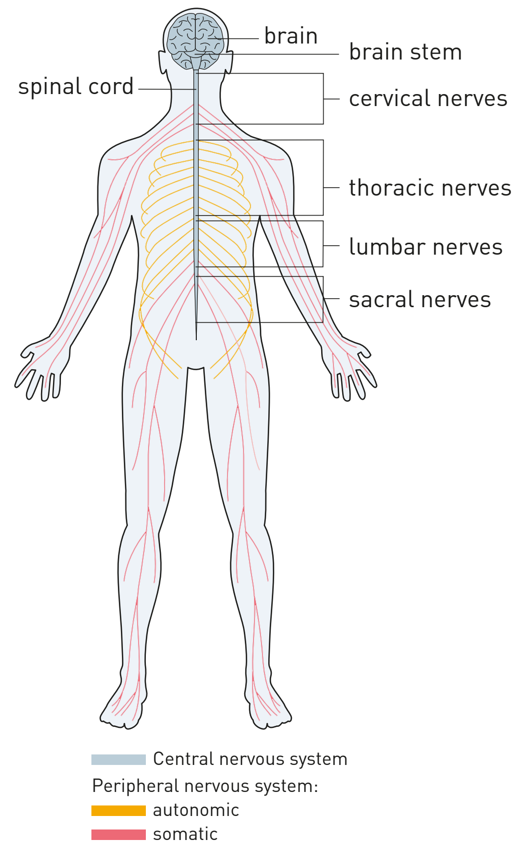


FIGURE 2.3 The human nervous system and spinal cord

THE SPINAL CORD

The spinal cord runs from the base of the brain (**brain stem**), inside the vertebrae to the lower middle section of the spine. The upper section is responsible for communication between the brain and the upper parts of the body, and the lower section is responsible for communication between the brain and the lower parts of the body, such as the legs, toes and feet (see Figure 2.3).

The peripheral nervous system

The peripheral nervous system works with the central nervous system to enable you to interact with your environment. Imagine you find a feather. You pick it up and stroke it and find that it feels soft on your fingers. In this scenario, the **motor neurons** of your peripheral nervous system are responsible for initiating the movement of your muscles in your arm and hand so you can touch the feather. The **sensory neurons** of your peripheral nervous system convey the sensation of the feather from the sensory receptors in the skin on your hand to the brain via the central nervous system. Your brain then registers the feather as being soft.

The peripheral nervous system has two subdivisions: the somatic nervous system and the autonomic nervous system.

Did you know?

Motor and sensory neurons do not communicate directly with each other but through interneurons, which exist only in the central nervous system.

SOMATIC NERVOUS SYSTEM

The somatic nervous system controls the voluntary movement of skeletal muscles (striated or striped muscles). Motor neurons communicate messages from the central nervous system to the particular muscles that an organism intends to move at any particular moment.

AUTONOMIC NERVOUS SYSTEM

The autonomic nervous system is mostly responsible for the communication of information between the central nervous system and the body's non-skeletal muscles (also known as smooth or visceral muscles) such as the heart and stomach, together with the internal organs and the glands that carry out basic bodily functions such as digestion and the heartbeat.

For the most part, the autonomic nervous system operates without the organism's voluntary control or conscious awareness, enabling it to pay attention to other matters, such as responding to **threats** in the environment. However, some actions of the autonomic nervous system, such as breathing and blinking, can be voluntarily influenced. For example, you generally don't notice each time you inhale and exhale but, during a medical examination, you can deliberately hold your breath and then breathe out on demand.

TABLE 2.1 Muscles and glands controlled by the autonomic nervous system

MUSCLES	GLANDS
> In the skin (around hair follicles; smooth muscle) > Around blood vessels (smooth muscle) > In the eye (the iris; smooth muscle) > In the stomach, intestines and bladder (smooth muscle) > Of the heart (cardiac muscle) > Gastrointestinal tract > Gall bladder > Liver	> Pancreas > Adrenal medulla (adrenal gland) > Sweat gland

The sympathetic and parasympathetic nervous systems

The autonomic nervous system is further divided into two branches: the sympathetic nervous system and the parasympathetic nervous system. These two systems have different roles, which are, however, complementary to each other.

The **fight–flight–freeze response** is activated by both the sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system is like an emergency system that becomes active when the organism is threatened. It prepares the body for action, such as running away or fighting the threat. In contrast, the parasympathetic nervous system controls the freeze response. This is activated when you are aware that you are unable to fight or outrun the threatening stimulus.

The parasympathetic nervous system is also responsible for **homeostasis**; that is, maintaining balance in automatic day-to-day bodily functions such as digestion, and normal heart rate and breathing.

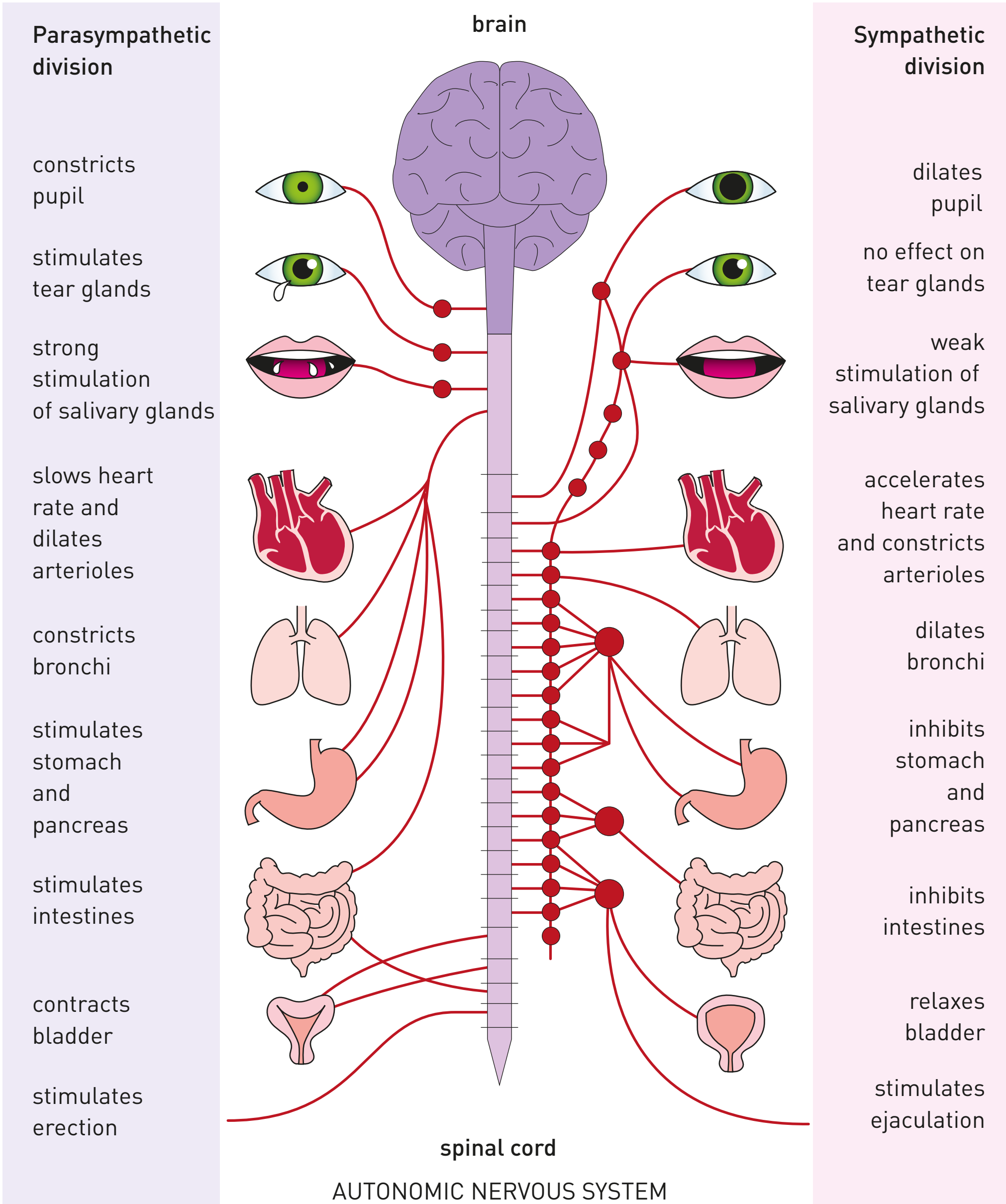


FIGURE 2.4 The role of the autonomic nervous system during different levels of arousal

2.1 REVIEW

1. Draw a labelled diagram (similar to Figure 2.4) to illustrate your understanding of the structure of each component of the nervous system. Make sure that you include the:
   - central nervous system (brain and spinal cord)
   - peripheral nervous system
   - somatic nervous system
   - autonomic nervous system (sympathetic and parasympathetic).
2. Use dot points to explain the function of each of these systems.
3. When a person has a bad accident and severs their spinal cord, some may become paraplegic and others may become quadriplegic. Go online to investigate these conditions further and explain the type of injury that may cause each.
4. What are motor neurons and sensory neurons?

Did you know?

People with damage to their right parietal lobe (after a stroke or physical injury) tend to be aware of only the right half of their environment and even of their own body. They will draw only the right half of a picture, rather than the whole – this is referred to as 'left neglect'.

The role of the cerebral cortex in sensory processes

The cerebral cortex is crucial to our understanding of how we process sensory information and how we move and speak. It also enables us to detect the difference between pieces of information, to understand the meaning of this information and to think in abstract and symbolic ways, enabling creativity in art, writing, debating and the use of metaphor (Burton *et al.*, 2009).

The cerebral cortex is the name given to the outer area of the cerebrum. The cerebrum itself, which is located in the forebrain, is separated into the left and right **cerebral hemispheres**. These hemispheres are almost symmetrical in appearance and are joined by a set of neural fibres known as the corpus callosum.

Lobes of the cerebral cortex

The cerebral cortex of each hemisphere of the brain is made up of four distinct regions, or lobes. These are the frontal lobe, the parietal lobe, the occipital lobe and the temporal lobe (each named after the plate of the skull protecting it). Both the right and left hemispheres of the brain have one of each of these lobes, making eight lobes in total.

From the sensory receptors (for all senses except smell), signals are sent to the thalamus, located deep beneath the cerebral cortex. The thalamus then relays this information to the primary cortex of the relevant lobe, which then processes and interprets it. We are constantly bombarded by stimuli – sights, sounds, smells, feelings and tastes – and we cannot possibly pay full attention to each one. The thalamus is also responsible for selecting which incoming information requires most of our attention at any given moment.

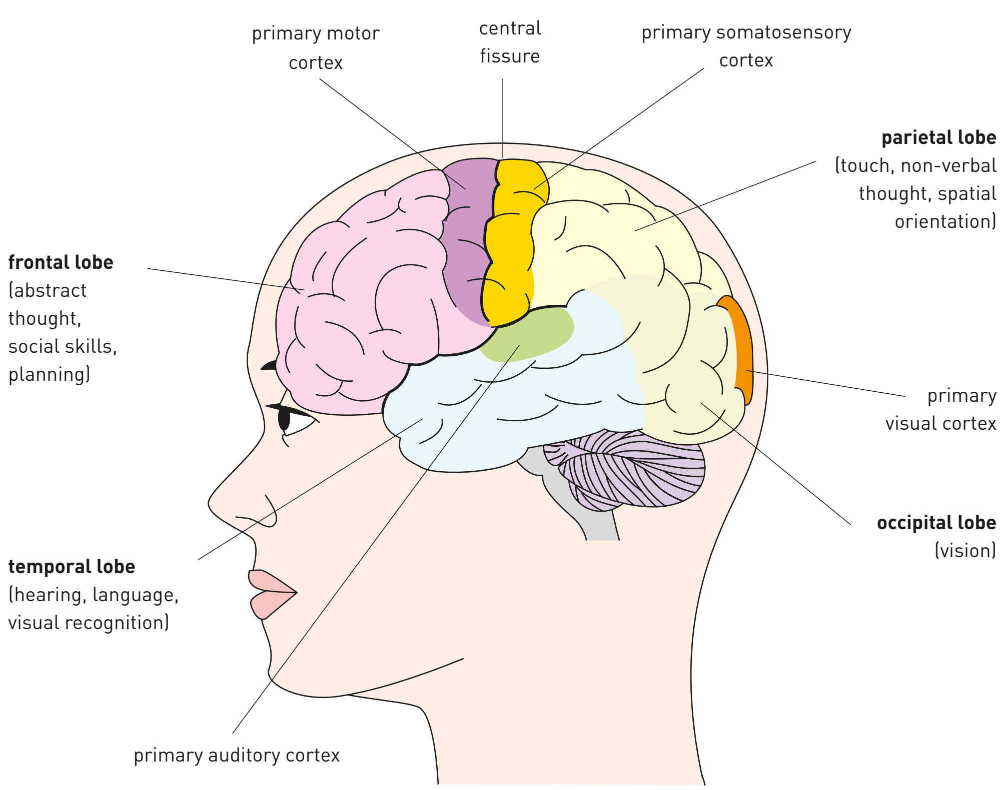


FIGURE 2.5 The sensory functions of the lobes of a typical left cerebral cortex

FRONTAL LOBES

The **frontal lobes** are the largest of the lobes and are responsible for speech, abstract thought, planning and social skills. The **primary motor cortex** is situated at the rear of each frontal lobe, adjacent to the central fissure and is responsible for the movement of the skeletal muscles of the body (see Figure 2.5). The primary motor cortex functions contralaterally, meaning that the left primary motor cortex is responsible for the movement of the right-hand side of the body, and vice versa.

PARIETAL LOBES

The **parietal lobes** enable a person to perceive three-dimensional shapes and designs. They also enable you to perceive your own body, be aware of the space around yourself and the location of objects in your environment.

The **primary somatosensory cortex** is situated at the front of each parietal lobe, adjacent to the central fissure (see Figure 2.5). It is responsible for processing sensation such as touch, pressure, temperature and pain from the body. Like the primary motor cortex of the frontal lobes, it functions contralaterally – the left primary somatosensory cortex is responsible for processing sensation in the right-hand side of the body, and vice versa.

If the right primary somatosensory cortex is damaged, a person will be unable to process sensation from parts of the body on the left side, and the relevant body part will be numb. The reverse will happen if the left primary somatosensory cortex is damaged. Like the primary motor cortex, the cortical area responsible for sensation on the toes is located at the top of the somatosensory cortex, and the area responsible for sensation in the mouth is located at the bottom.

TEMPORAL LOBES

The **temporal lobes** are mainly responsible for processing auditory information – sensations received by the ears. The **primary auditory cortex** is in the upper part of the temporal lobes (see Figure 2.5). The temporal lobes perform the complex auditory analysis that is necessary for understanding human speech or listening to music. Parts of the lobes are specialised in sensitivity to particular types of sounds. People with a damaged right temporal lobe tend to be unable to recognise songs, faces or paintings. People with a damaged primary auditory cortex are likely to experience forms of deafness, or complete deafness if the entire primary auditory cortex is removed.

OCCIPITAL LOBES

The **occipital lobes** are responsible for vision. Information from the left side of each retina is processed in the left occipital lobe and information from the right side of each retina is processed in the right occipital lobe. Information from the centre of the visual field and the centre of each retina is processed in both occipital lobes.

The primary visual cortex is located at the back of the occipital lobes (see Figure 2.5). Different parts of the **primary visual cortex** process different types of visual stimuli. A person who has a completely damaged primary visual cortex would be unable to process any visual stimuli that their eyes see, so it would be as if they were blind. If just a part of an occipital lobe were damaged, the person would have a gap in their visual field where there would be some specific visual stimuli that would not be processed.

Did you know?

Brain surgery is often performed on conscious patients! There are no pain receptors in the brain, so only a local anaesthetic is needed for the scalp and the skull.

Association areas of the cerebral cortex

The parts of the cerebral cortex that are not taken up with the lobes are comprised of the **association areas**. The **neurons** in the association areas are typically less specific in their function than the neurons in the primary cortices. The neurons in the association areas that are located closest to a primary cortex for a specific sense usually specialise in analysing and interpreting that particular sensory information (see Figure 2.6). The neurons in the association areas that are further from a primary cortex might be more involved in the integration of information from several senses and memories.

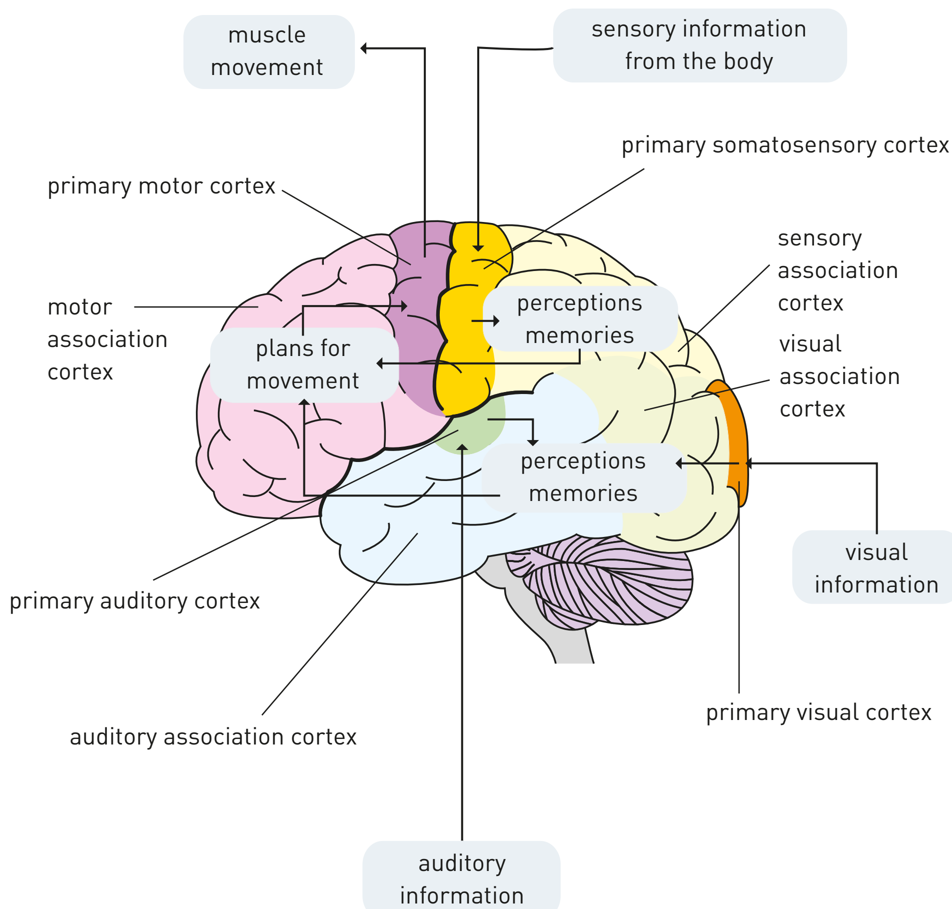


FIGURE 2.6 The association areas in the left hemisphere of the brain. The arrows indicate the communication channels.

Much of the frontal lobes are taken up by the association area that is responsible for higher order mental processes such as language, reasoning, planning, attention, judgement, problem solving, and aspects of personality. People with damaged frontal lobes may be unable to learn from experiences. For example, if they attempt a problem-solving task they will be unable to evaluate which of their strategies was most successful and will therefore have to go through a trial-and-error process each time they are confronted with the same problem. They are also likely to make mistakes in planning because they lack foresight.

The association areas of the parietal lobes integrate sensory information to form a single perception. They also construct a spatial coordinate system to represent the world around us (Kandel *et al.*, 1991). The association areas of the temporal lobes are important for the processing and encoding of memory, and the association areas of the occipital lobes are involved with the integration of visual stimuli.

2.1 INVESTIGATE

Go online and search for 'The Man Who Mistook His Wife for a Hat' or follow the link in your obook.

Oliver Sacks was a famous author, doctor and neurologist who spent a lifetime investigating strange sensory phenomena.

Write a brief summary of one of the case studies Sacks wrote about, then nominate and justify which part of the brain you think it involves.

2.2 REVIEW

1 Complete the following summary table:

	FUNCTION
FRONTAL LOBES	
Primary cortex	
Association area	
PARIETAL LOBES	
Primary cortex	
Association area	
TEMPORAL LOBES	
Primary cortex	
Association area	
OCCIPITAL LOBES	
Primary cortex	
Association area	

2 Identify which lobe(s) would be involved in processing the following sensory information:
   a listening to music on the radio
   b navigating a crowded room
   c looking at beautiful scenery.

3 What is the role of the thalamus?

4 Choose one of the lobes of the brain and describe its importance in responding to, and integrating and coordinating with, sensory stimuli received by the body.

Conscious and unconscious responses to sensory stimuli

Conscious responses

The somatic nervous system controls our conscious *voluntary* responses, such as when we perceive a potential danger and, without experiencing any **autonomic arousal**, take deliberate action to avoid it. This might occur, for example, if you see a nail sticking up on your deck and you hammer it back in so that no one will get hurt, or you feel cold so you put on a jumper. Such responses always involve the brain, though some voluntary movements (such as walking) require less conscious attention.

Unconscious responses

AUTONOMIC

As we have seen, the autonomic nervous system directs our unconscious functioning, such as heartbeat, temperature control and breathing (though we can also take conscious control of many of these functions if we wish to). Autonomic responses help to keep our body's internal environment in a homeostatic state.

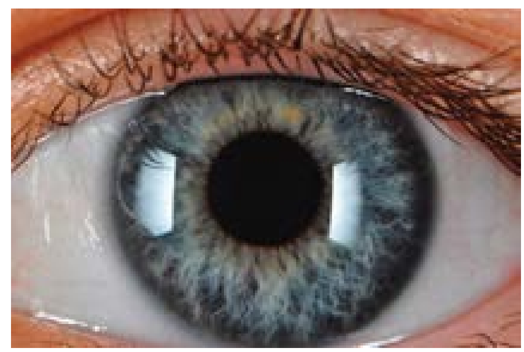


FIGURE 2.7 The dilation and constriction of our pupils are unconscious responses.

Receptors in the body receive sensory stimuli from the environment such as temperature, and from internal factors such as oxygen levels and blood-sugar levels, and there is an unconscious or autonomic response. An example is the pupillary response in which our pupils expand or contract depending on the amount of available light. We don't consciously decide to widen or constrict our pupils, rather our sympathetic nervous system controls pupil dilation and our parasympathetic nervous system controls pupil constriction.

SPINAL REFLEXES

Reflexes are responses to sensory stimuli, which are unlearned and innate. These responses tend to be simple behaviours that contribute to our safety and survival. Many of these are controlled within the spinal cord without involving the brain and are therefore referred to as **spinal reflexes**. This enables an organism to respond faster than if a nerve impulse needed to be sent to the brain. This means that pulling away from a hot or sharp object, for example, can be almost instantaneous.

The process of receiving a sensation and responding to it reflexively involves a reflex arc. There are two forms of reflex arc:

> **monosynaptic reflex arc**: involving only one synapse, where an **affector neuron** brings a sensation from receptors in the body and an **effector neuron** carries motor messages to the muscles of the body

> **polysynaptic reflex arc**: involving **interneurons** connecting the affector and effector neurons, and, therefore, at least two synapses.

Only a few of the simplest reflexes, such as the 'knee-jerk' or patellar reflex are monosynaptic.

The role of the synapse in transmitting neural impulses, such as those in a reflex arc, are explained in detail in the next chapter.

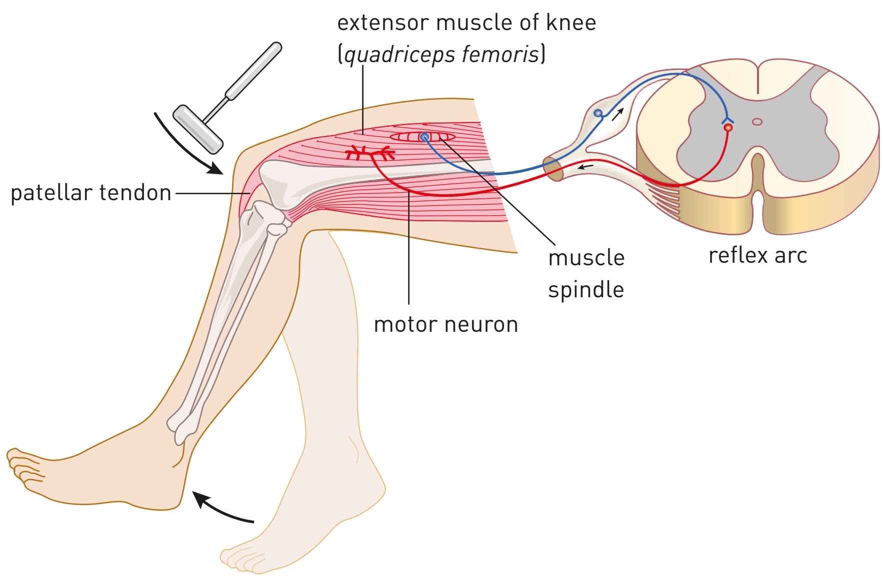


FIGURE 2.8 A two-neuron reflex arc

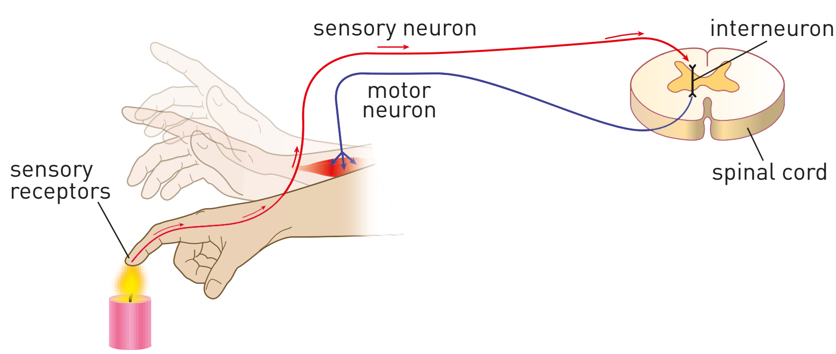


FIGURE 2.9 Three-neuron reflex arcs are more common than two-neuron reflex arcs.

2.3 REVIEW

1 What is the difference between conscious and unconscious responses to sensory stimuli?
2 Describe the spinal reflex.
3 Give two examples of the spinal reflex in action.

CHAPTER SUMMARY 02

- The nervous system comprises the central nervous system, which includes the brain and spinal cord and the peripheral nervous system, which includes the remainder of the body (such as limbs, facial nerves, skeletal muscles, organs and glands).
- The brain comprises the hindbrain, the midbrain and the forebrain. The hindbrain links the spinal cord and the rest of the brain and is important for movement and balance. The midbrain includes the reticular activating system, which is responsible for arousal and sleep. The forebrain includes the thalamus, the cerebrum and the cerebral cortex. The thalamus acts as a relay station for incoming sensory information onto the relevant parts of the cerebral cortex for further processing.
- The peripheral nervous system is divided into the somatic nervous system, which controls voluntary movement of the skeletal (striated) muscles, and the autonomic nervous system, which controls involuntary muscles (smooth muscles), organs and glands.
- The autonomic nervous system is divided into the sympathetic nervous system, responsible for activating the body in times when alertness and arousal is required (for example the fight-flight-freeze response), and the parasympathetic nervous system, which is involved in maintaining the body's regular, day-to-day levels of arousal, and homeostasis.
- The frontal lobe in each hemisphere is responsible for higher thinking processes and includes the primary motor cortex, which is responsible for body movement.
- The parietal lobe in each hemisphere contains the primary somatosensory cortex and responds to sensory receptors in the body. Association areas in the parietal lobes integrate sensory input from all senses except smell.
- The temporal lobe in each hemisphere contains the primary auditory cortex and processes sounds.
- The occipital lobe in each hemisphere receives visual information from the eyes.
- Conscious responses are controlled by the somatic nervous system. This is where you voluntarily act in response to sensory stimuli.
- There are two types of unconscious responses: autonomic, which regulate vital body functions such as blood pressure; and spinal reflexes, which use the spinal cord to bypass the brain for a quicker response.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the examination, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- association areas
- autonomic nervous system
- central nervous system
- cerebral cortex
- cerebral hemispheres
- frontal lobes
- occipital lobes
- parasympathetic nervous system
- parietal lobes
- peripheral nervous system
- primary auditory cortex
- primary motor cortex
- primary somatosensory cortex
- primary visual cortex
- reflex arc
- somatic nervous system
- spinal reflex
- sympathetic nervous system
- synapse
- temporal lobes.

KEY KNOWLEDGE

For the examination, you must be able to show your understanding and apply your knowledge of the relationship between the brain and behaviour, and describe the contribution of selected studies and brain research methods to the investigation of brain function. You must be able to demonstrate an understanding of the interaction between cognitive processes of the brain and its structure, including the:

- central and peripheral nervous systems
- cerebral cortex, including lobes, primary cortices and association areas
- specialisation of hemispheres of the cerebral cortex
- spinal reflex.

RESEARCH METHODS

For the examination, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 The central nervous system consists of which two parts?
   a the brain and spinal column
   b the autonomic and somatic nervous systems
   c the brain and spinal cord
   d the cerebral cortex and the spinal cord

2 The peripheral nervous system consists of which two parts?
   a the brain and spinal cord
   b the central and somatic nervous systems
   c the sympathetic and parasympathetic nervous systems
   d the somatic and autonomic nervous systems

3 Moving your leg is an action that is made by which system?
   a somatic nervous system
   b autonomic nervous system
   c sympathetic nervous system
   d parasympathetic nervous system

4 Motor neurons enable us to:
   a feel the silky coat of a puppy
   b smell the scent of a flower
   c play the piano
   d see a ball when it is thrown.

5 Sensory neurons in your toes are part of which nervous system?
   a central
   b peripheral
   c autonomic
   d sensory

6 Which of the following is a true statement about the parasympathetic nervous system?
   a In normal daily life it has nothing to do; it is used to return the body functions to their normal levels after sympathetic arousal.
   b In normal daily life it works all the time to ensure that the body's metabolic systems are in balance.
   c It operates at a level of conscious awareness.
   d It is part of the somatic nervous system that operates on the body.

QUESTIONS 7–8 REFER TO THE FOLLOWING SCENARIO:

Henry was on a hike when he saw a tiger snake. He quickly picked up a stick and tried to hit it. His friend Tom, who also saw the snake, quickly ran away to a safer place on the track.

7 Which division of the nervous system was most likely in control of their reactions to the snake?
   a central nervous
   b autonomic
   c somatic
   d limbic

8 Henry and Tom were demonstrating the:
   a reticular activating system
   b fight-flight-freeze response
   c reflex response
   d sympathetic arousal response.

9 The left cerebral hemisphere generally controls the right side of the body and vice versa. This is known as ________________ organisation.
   a unilateral
   b contralateral
   c ipsilateral
   d bilateral

10 Damage to the ________________ can result in deficits in the ability to plan and problem solve.
   a temporal lobe
   b occipital lobe
   c thalamus
   d association area

SHORT ANSWER

11 In the peripheral nervous system, the ________________ nervous system involves voluntary activity whereas the ________________ nervous system involves involuntary activity.

2 marks

SHORT ANSWER

12 Complete the following table:

16 marks

	STRUCTURE	FUNCTION
Cerebral cortex		
Thalamus		
Primary cortices		
Association areas		

13 A patient has a head injury that resulted in an inability to move his left hand. Which part of his brain is most likely to have been damaged?

1 mark

14 Explain the term *spinal reflex*. Use a diagram to illustrate a polysynaptic reflex arc.

4 marks

15 What is the difference between a monosynaptic reflex arc and a polysynaptic reflex arc?

4 marks

16 Why are conscious responses to sensory stimuli also known as voluntary responses?

2 marks

17 Describe why responses controlled by the autonomic nervous system would be considered unconscious responses? Give two examples of autonomic responses.

4 marks

18 The lobes of the cerebral cortex play a role in processing and responding to sensory information. Identify the role of the following primary cortices in processing information from our external environment:

a primary somatosensory cortex

b primary auditory cortex

c primary visual cortex.

6 marks

19 Noah tries to pick up a hot saucepan, but burns his hand and quickly retracts it. What kind of response has occurred in this instance?

2 marks

20 Describe the differences between the Central Nervous System and the Peripheral Nervous System, and identify their major components.

12 marks

→ CHAPTER 03

THE ROLE OF NEURONS & NEUROTRANSMITTERS

The neurons and neurotransmitters in our body are a crucial part of our internal and external experience. The messages we send from our brain to our body, and from our body to our brain, are dictated by the structure and proper functioning of these miniscule components.

KEY KNOWLEDGE

> the role of the neuron (dendrites, axon, myelin and axon terminals) as the primary cell involved in the reception and transmission of information across the synapse (excluding details related to signal transduction)

> the role of neurotransmitters in the transmission of neural information between neurons (lock and key process) to produce excitatory effects (as with glutamate) or inhibitory effects (as with gamma amino butyric acid [GABA])

> the effects of chronic changes to the functioning of the nervous system due to interference to neurotransmitter function, illustrated by the role of dopamine in Parkinson's disease

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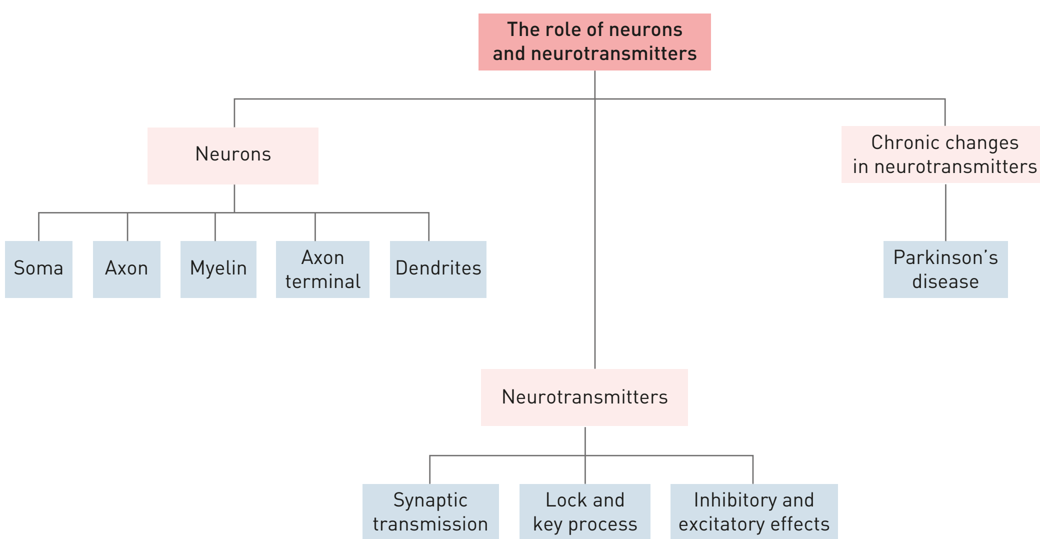
CHAPTER OVERVIEW

The role of neurons in transmitting information	Neuron structure
The role of neurotransmitters in transmitting information	The lock and key process Transmitting neural information between neurons > glutamate and GABA Neurotransmitters and their effects
Changes to neurotransmitter function	Dopamine and Parkinson's disease

CONTENT MAP



The role of neurons in transmitting information

To understand how information is processed in the brain, it is important to know that it is a physiological process. Cells called neurons receive information from other neurons, process this information, and then communicate it to other neurons. These cells share similarities with other cells in the body in that they are surrounded by a cell membrane, have a nucleus that contains genes, and are made up of cytoplasm, mitochondria and other organelles. However, they also differ in structure and the manner in which they communicate with each other.

Neuron structure

The structure of neurons is important knowledge to recall from VCE Psychology Units 1&2. Although there are many types of neurons of all different shapes and sizes, they are generally comprised of **dendrites**, the **soma**, the **axon** and the **axon terminals**. Most axons are coated with **myelin** (a myelin sheath). Table 3.1 describes the different elements that make up the structure of a neuron.

TABLE 3.1 The structure of a neuron

STRUCTURE	DESCRIPTION
Dendrites	A neuron can have hundreds or thousands of dendrites that look like branches coming off the soma (the word *dendron* is Greek for 'tree'). The dendrites receive information from other neurons, which they carry from the synapse to the soma.
Soma	The largest part of the neuron is the soma or cell body. It controls the metabolism and maintenance of the neuron. In most neurons, the soma receives messages from other neurons.
Axon	The axon is a nerve fibre that extends from the soma and carries information towards the cells that communicate with that neuron. Some axons have two or more offshoots, and some can be up to a metre long.
Myelin	The axons of most neurons are covered in a myelin sheath, which is a coating of cells that facilitates the transmission of information to other neurons. Axons with myelin are white rather than grey. Myelin protects the axon from potential chemical and physical interference to the electrical impulses that travel along it. The insulation provided by the myelin sheath also enables information to travel much faster – up to 400 kph.
Axon terminals	Axon terminals are found at the end of the axon branch and function to transmit messages to the next neuron. Axon terminals have **terminal buttons**. These terminal buttons have sacs that secrete a chemical called a **neurotransmitter** whenever electrical impulses are sent down the axon (see Figure 3.3). Although they never actually touch, the axon terminals of one neuron link with the dendrites of the next neuron.

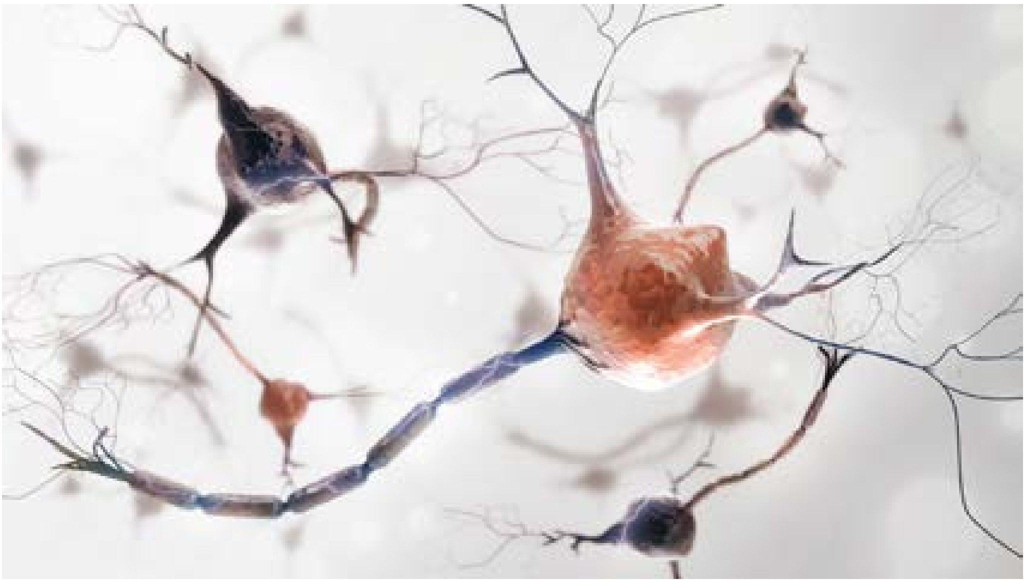


FIGURE 3.1 A neuron is typically made up of dendrites, a soma, an axon and axon terminals.

Did you know?

Not all synapses are the same. In the brain, the synapses are often located on other parts of the cell, besides the dendrites. Additionally, in other parts of the nervous system, neurons might send their signals to the glands or muscles rather than other neurons.

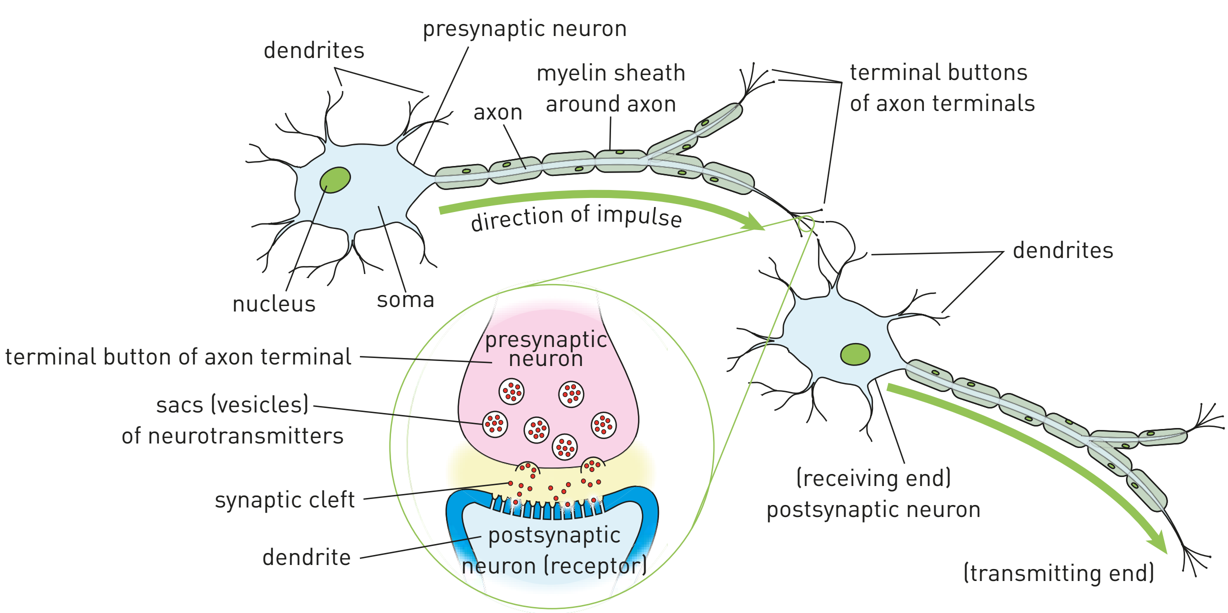


FIGURE 3.2 Information received by dendrites travels along the axon to the axon terminals.

1 Describe the structure of a neuron.
2 What is the function of the myelin sheath?
3 Where are terminal buttons and what is their function?

3.1 REVIEW

The role of neurotransmitters in transmitting information

Neurotransmitters are chemicals that transmit information from one neuron to the next. Neurons do not actually come into contact with each other, rather there is always a tiny space, or **synapse**, between them. The exact location of synapses along the neuron can vary, but it is easiest to think of communication between neurons beginning with information being transmitted from the synapse to the dendrites. This information, in the form of an electrical impulse, is then passed through the soma and along the axon. A neurotransmitter is then secreted from the terminal buttons on the axon terminal to a synapse shared with the dendrites of another neuron. The process of neurons transmitting information between each other is known as **synaptic transmission**.

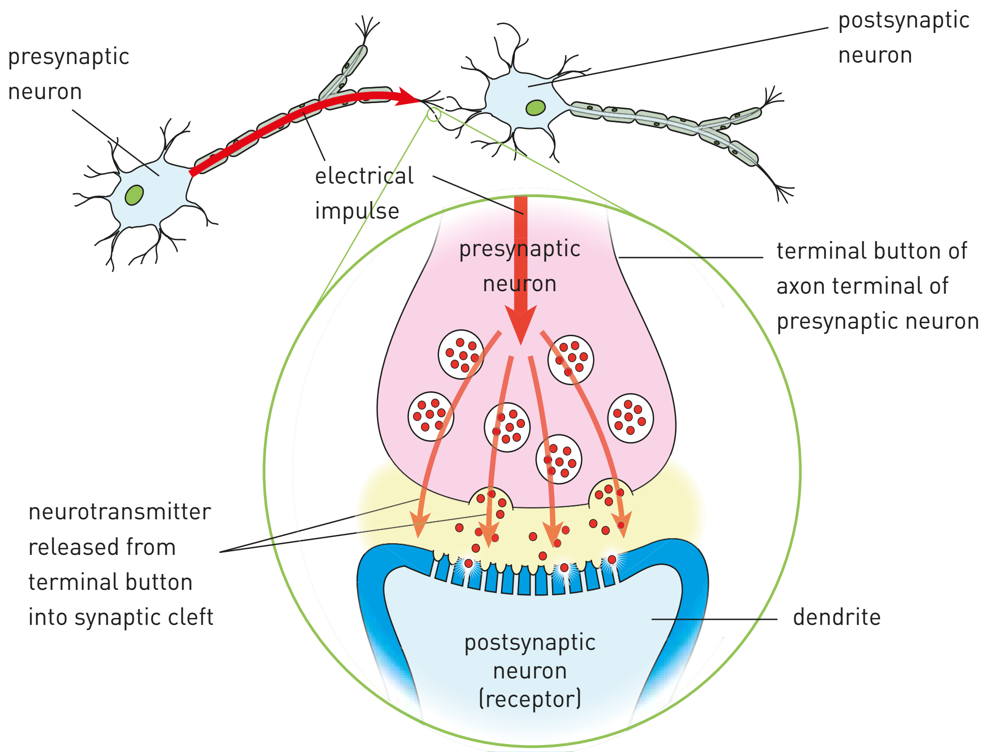


FIGURE 3.3 The presynaptic neuron releases neurotransmitters that fit into receptor sites on the postsynaptic neuron.

The lock and key process

Neurotransmitters are contained in small sacs known as synaptic vesicles within the terminal button of each neuron's terminal axon. When a **presynaptic neuron** fires, the synaptic vesicles move towards the presynaptic membrane. Some synaptic vesicles stick to the membrane and break open to release the neurotransmitter into the **synaptic cleft**. Once in the synaptic cleft, some of the neurotransmitters will bind with protein molecules known as 'receptors' that are located in the dendrites of the **postsynaptic neuron**. The receptors act like locks that can only be opened with one particular 'key' or neurotransmitter. When a receptor binds with the neurotransmitter that 'fits' it (that is, has the appropriate molecular structure and electrical charge), the postsynaptic neuron is either activated or inhibited. This is referred to as the 'lock and key process'.

Transmitting neural information between neurons

In communication between neurons there are either synapses that are *excitatory* and cause the neuron to fire or synapses that are *inhibitory* and reduce this likelihood.

When an axon of a neuron fires, the terminal buttons of the excitatory synapses release a neurotransmitter that 'excites' the postsynaptic neuron or causes it to reach its **action potential**. This 'excitement' increases the amount of firing of the axon of the postsynaptic neuron.

In contrast, when inhibitory synapses are activated the 'firing' rate of the postsynaptic neuron is reduced, and sometimes it does not fire at all.

How much a neuron 'fires' will depend on the amount of activity of all of the synapses on the dendrites of the neuron, and also how active the soma of the neuron is. For example, if the excitatory synapses are mostly active, the neuron will fire much more than if the inhibitory synapses are mostly active. The excitation or inhibition effects produced by a synapse only last for a fraction of a second.

GLUTAMATE AND GABA

Glutamate can excite almost every neuron in the brain and the rest of the nervous system. It is involved in many psychological processes but has an important role in learning and memory.

GABA has an inhibitory effect on the brain. Approximately one third of all neurons in the brain use GABA and it is important in regulating anxiety.

Neurotransmitters and their effects

A single neuron can release more than one neurotransmitter. So far, research has identified more than 100 neurotransmitters in existence. Table 3.2 outlines the effects of some neurotransmitters and hormones. Although hormones and neurotransmitters are different kinds of chemical messengers, some molecules function as both hormones and neurotransmitters. For instance, norepinephrine is excreted as a hormone by the adrenal glands, but it can also be excreted as a neurotransmitter by **nerve** endings.

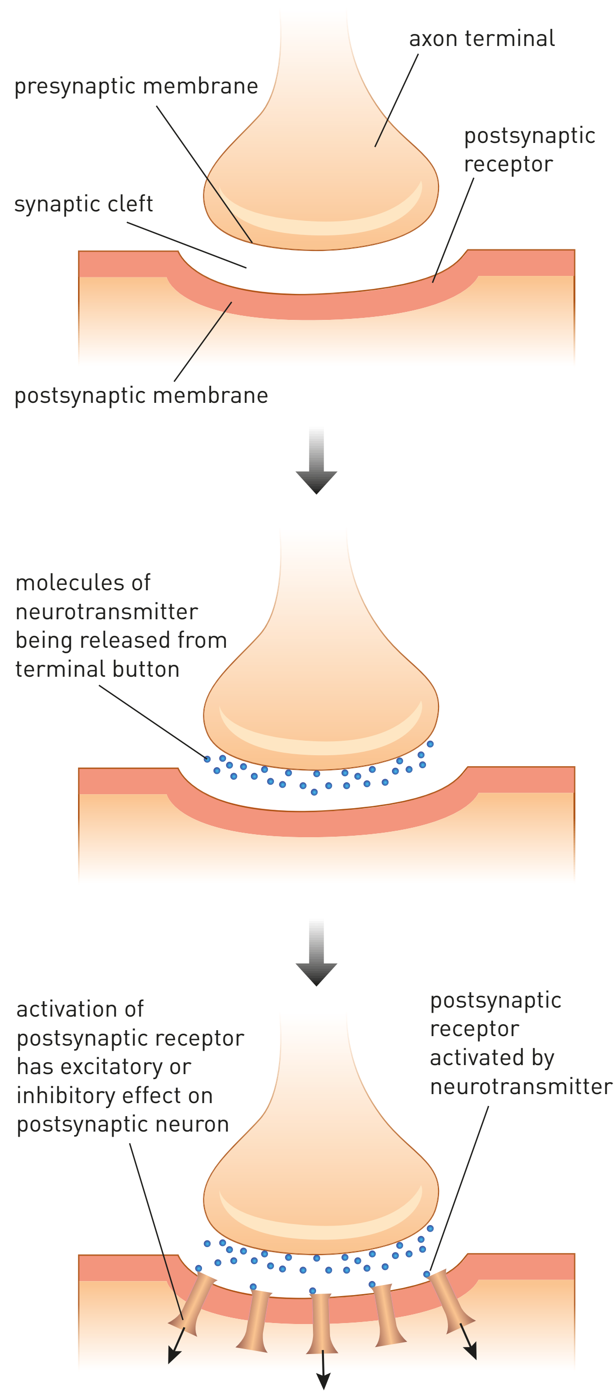


FIGURE 3.4 The lock and key process

Did you know?

Monosodium glutamate (MSG) is commonly found in Chinese food. After eating it, some people display neurological symptoms such as tingling or a feeling of numbness in the face, neck and chest because their glutamate receptors have been activated.

TABLE 3.2 The effects of neurotransmitters and hormones

NEUROTRANSMITTER	EFFECTS
Acetylcholine	> Memory and memory loss, learning > Muscle movement > Activates cerebral cortex > Controls REM sleep > Controls hippocampus
Dopamine	> Emotional arousal, pleasure and reward, voluntary movement, attention > Facilitates movement, attention, learning, reinforcement of learning > Deficiency in dopamine is related to epilepsy, and an increase in dopamine is known to assist in the treatment of Parkinson's disease
Serotonin	> Regulates mood > Controls eating, sleep, arousal, pain
Gamma-amino butyric acid (GABA)	> The main inhibitory neurotransmitter that calms nervous activity > Responds to alcohol, benzodiazepines
Glutamate	> Excitation of neurons throughout the nervous system > Necessary for the changes in synapses that occur with memory formation
Norepinephrine (noradrenalin)	> Hormone released by the adrenal medulla that affects emotional arousal, anxiety, fear
Epinephrine (adrenalin)	> Hormone released by the adrenal medulla that affects emotional arousal, anxiety, fear
Cortisol	> Repairs the body
Endorphins	> Pain relief and elevation of mood (often after intense physical exercise or activity)

INVESTIGATE 3.1

Select three neurotransmitters or hormones from the list above.

Use the internet to research each one. Develop a list of their effects on the human body and another list of the problems that might arise if that neurotransmitter or hormone was not present in the body.

You may present your information in a table, as a presentation to the class or as a poster.

REVIEW 3.2

1 What are neurotransmitters?
2 Identify the pathway that an electrical impulse might take through the structures of a neuron to get to the next neuron.
3 What is synaptic transmission?
4 Describe the lock and key process.
5 What are GABA and glutamate?

Changes to neurotransmitter function

Neurotransmitters that do not function normally can cause problems for the nervous system. For instance, acetylcholine affects many things including memory. A decrease in the concentration of acetylcholine in the central nervous system is the hallmark of both progressive **dementia**, and Alzheimer's disease, a condition associated with severe memory loss and disorientation.

Interference in the nervous system caused by neurotransmitter malfunction is thought to stem from both environmental and genetic factors. Anything from ongoing high levels of stress to simple things such as diet (like too much sugar or caffeine) can have an impact. However, some people are just born without the ability to synthesise certain neurotransmitters.

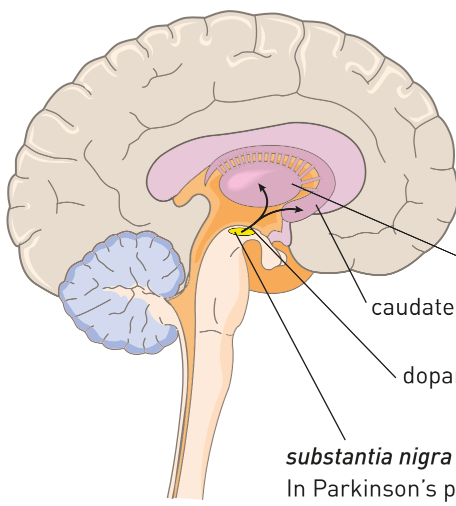


FIGURE 3.5 The *substantia nigra* is located in the midbrain and is affected by Parkinson's disease.

Dopamine and Parkinson's disease

Parkinson's disease is a progressive neurological condition that affects more than 80000 people in Australia. Symptoms are caused by the degeneration of **dopamine**-releasing neurons in the *substantia nigra*. The *substantia nigra* is part of the **basal ganglia**, located in the midbrain, and is responsible for **reward**, addiction and, most importantly to Parkinson's disease, the coordination of movement. Dopamine is a neurotransmitter that helps control the brain's reward and pleasure centres, including the *basal ganglia*. Dopamine is needed to control messages as they pass between neurons in the *substantia nigra* and the striatum (responsible for balance and control of movement). Without enough dopamine, the neurons of the striatum fire uncontrollably, which essentially prevents a Parkinson's disease sufferer from adequately controlling their movement.

People with Parkinson's disease develop symptoms such as slowness of movement, rigidity, and involuntary movement of the hands, arms, feet, legs, jaws or head. They might also experience difficulty starting or stopping body movements such as walking. They can also experience non-motor symptoms including reduced facial expressions, pain, depression, dementia and difficulty sleeping. Symptoms of Parkinson's disease only develop when the drop in dopamine levels is significant enough to affect functioning. This usually equals an approximate 80 per cent drop, accompanied by a 50 per cent drop in the *substantia nigra* neurons.

A drop in dopamine also influences acetylcholine, a neurotransmitter that also affects movement. The striatum requires a balance of dopamine and acetylcholine for effective motor function. The imbalance of these neurotransmitters therefore contributes to the progression of Parkinson's disease and its symptoms.

CAUSES OF PARKINSON'S DISEASE

Scientists are still searching for the cause of Parkinson's disease, however it appears to be activated by a combination of factors including those outlined in Table 3.3.

Treatment of Parkinson's disease includes drugs that are precursors of dopamine. These precursors are then converted into dopamine so there is an increase in the level of dopamine that reaches the brain. Other treatment involves drugs that block the action of other chemicals that affect dopamine.

Did you know?

Consumption of caffeine has been found to decrease the risk of developing Parkinson's disease. A trial in Japan found that suffers of the disease who were administered a pill equivalent to three cups of coffee a day over six weeks showed a decrease in their tremors and an increase in mobility.

TABLE 3.3 Suspected causes of Parkinson's disease

Genetics	> Protein mutations have been linked to the disease where this blocks the disposal of abnormal cells.
Environmental factors	> The pesticide Rotenone (which is used in Australia to control pests on fruit and vegetables) has been found to cause Parkinson's disease in rats. > MPTP, a common contaminant found in street drugs causes Parkinson's disease in users.
Diet	> Vitamin B (folic acid) deficiency has been linked with the development of Parkinson's disease.

FIGURE 3.6 Celebrity Michael J. Fox was diagnosed with Parkinson's disease in 1991 and now works extensively with his foundation to find a cure.

CASE STUDY

A NEW TREATMENT FOR PARKINSON'S DISEASE

Scientists at Rutgers and Stanford universities have created a new technology that could someday help treat Parkinson's disease and other devastating brain-related conditions that affect millions of people.

The technology – a major innovation – involves converting adult tissue-derived stem cells into human neurons on 3D 'scaffolds', or tiny islands, of fibres, said Prabhas V. Moghe, a distinguished professor in the departments of Biomedical Engineering and Chemical and Biochemical Engineering at Rutgers University ...

'If you can transplant cells in a way that mimics how these cells are already configured in the brain, then you're one step closer to getting the brain to communicate with the cells that you're now transplanting,' said Moghe ... 'In this work, we've done that by providing cues for neurons to rapidly network in 3D.'

In their multidisciplinary study, published online today in Nature Communications, a dozen scientists from several Rutgers teams and Stanford discuss the 3D scaffolds and their potentially widespread benefits.

Neurons, or nerve cells, are critical for human health and functioning. Human brains have about 100 billion neurons, which serve as messengers that transmit signals from the body to the brain and vice versa.

Moghe said a 3D scaffold, developed by the scientists, consists of tiny polymer fibres. Hundreds of neurons attach to the fibres and branch out, sending their signals. Scaffolds are about 100 micrometers wide – roughly the width of a human hair.

'We take a whole bunch of these islands and then we inject them into the brain of the mouse,' he said. 'These neurons that are transplanted into the brain actually survived quite miraculously well. In fact, they survived so much better than the gold standard in the field.'

Indeed, the scaffold technology results in a 100-fold increase in cell survival over other methods, Moghe said.

And that may eventually help people suffering from Parkinson's disease, multiple sclerosis, amyotrophic lateral sclerosis (ALS), or Lou Gehrig's disease, Alzheimer's disease, spinal cord and traumatic brain injuries, and concussions, he said.

These diseases and conditions often arise from the loss of brain cells. Parkinson's disease, for example, is caused by the loss of brain cells that produce dopamine, a key neurotransmitter ...

The next step would be to further improve the scaffold biomaterials, allowing scientists to increase the number of implanted neurons in the brain. 'The more neurons we can transplant, the more therapeutic benefits you can bring to the disease,' Moghe said. 'We want to try to stuff as many neurons as we can in as little space as we can.'

The idea is to 'create a very dense circuitry of neurons that is not only highly functioning but also better controlled,' he said, adding that testing of mice with Parkinson's disease is underway to see if they improve or recover from the illness.

Eventually, with continued progress, the researchers could perform studies in people. Moghe estimated that it would take 10 to 20 years to test the technology in humans.

Todd B. Bates, *Rutgers Today*, 4 April 2016

3.2 INVESTIGATE

1 What was the aim of this Parkinson's study in the case study article?
2 What is a 'scaffold' in the context of this research?
3 What does this research hope to achieve and how might it help sufferers?
4 Describe the possible ethical issues surrounding this research.

3.3 REVIEW

1 Why is it important for neurotransmitters to function as they are supposed to?
2 What is Parkinson's disease? List some of its symptoms and what causes them.
3 What are some of the factors thought to cause Parkinson's disease?
4 Describe the role of dopamine in Parkinson's disease and its treatment.

03

- The neuron is comprised of dendrites, the soma, the axon and axon terminals. (Most axons are coated in a myelin sheath). One neuron communicates with another through synapses, which are gaps located between the axon terminal of one neuron and the dendrites of a neighbouring neuron.
- Synapse communication happens through chemicals known as neurotransmitters that are released by the terminal buttons of a firing presynaptic neuron into the synapse, and then taken in by the neighbouring dendrites of the postsynaptic neuron.
- Molecules of a specific neurotransmitter released by the terminal buttons bind with relevant neurotransmitter receptors located in the postsynaptic membrane and then either excite or inhibit firing of the postsynaptic neuron.
- The molecules of neurotransmitters bind with the neurotransmitter receptor much like the way that only a specific key will fit a particular lock. This is known as the 'lock and key process'.
- Whether or not a neuron fires depends in part on whether the synapse is excitatory or inhibitory. Excitatory synapses will cause the neuron to fire, whereas synapses that are inhibitory reduce this likelihood.
- Glutamate is an excitatory neurotransmitter whereas GABA is an inhibitory neurotransmitter.
- More than 100 neurotransmitters have been identified. Each has a specific effect on the brain and body.
- Neurotransmitters that don't function normally can cause problems for the nervous system. A decrease in acetylcholine is implicated in Alzheimer's disease, and acetylcholine and dopamine have key roles in Parkinson's disease.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- axon
- axon terminals
- dendrite
- dopamine
- glutamate
- lock and key process
- myelin
- neurotransmitter
- Parkinson's disease
- synapse
- synaptic cleft
- terminal button.

KEY IDEAS

For the exam, you must be able to show your understanding and apply your knowledge of the neural basis of learning.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study
- identify ethical considerations in relation to researching the role of neurons and neurotransmitters in memory.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 A neuron comprises:
   a soma, neurotransmitter, synapse and axon terminals
   b soma, axon, synaptic cleft and terminal buttons
   c soma, synapse, dendrites and axon terminals
   d soma, axon, GABA and acetylcholine.

2 Most axons are coated with:
   a GABA
   b adrenalin
   c myelin
   d noradrenalin.

3 The ________________ is the primary cell involved in the ________________ of information across a synapse.
   a neuron; transmission
   b neuron; reception
   c soma; firing
   d soma; inhibiting

4 What is the direction of transmission of the neural impulse across a synapse?
   a postsynaptic neuron – presynaptic neuron
   b either presynaptic neuron – postsynaptic neuron or postsynaptic neuron – presynaptic neuron, at random
   c presynaptic neuron – postsynaptic neuron
   d either presynaptic neuron – postsynaptic neuron or postsynaptic neuron – presynaptic neuron, depending on whether the neurotransmitter is an agonist or antagonist

5 Synaptic transmission can best be described as:
   a the path of an electrical impulse along a neuron
   b the process by which one neuron can transmit a message to another neuron.
   c the space between the presynaptic neuron and the postsynaptic neuron
   d the formation of neurons.

6 The information carried along a neuron, which consists of brief changes in the electrical charge of the axon is called:
   a the action potential
   b the axon potential
   c synaptic transmission
   d axon transmission.

7 Neurotransmitters include:
   a GABA, glutamate and dopamine
   b GABA, glutamate and synapses
   c GABA, dopamine and nitrogen
   d dopamine, glutamate and potassium.

8 Parkinson's disease is associated with a reduction of dopamine-producing cells in the:
   a amygdala
   b terminal button
   c *substantia nigra*
   d striatum.

9 Changes to levels of ________________ and ________________ have key roles in Parkinson's disease.
   a dopamine; acetylcholine
   b serotonin; acetylcholine
   c dopamine; melatonin
   d dopamine; serotonin

10 Parkinson's disease is characterised most by:
   a deterioration in the myelin sheath
   b memory loss
   c deterioration of dopamine-releasing neurons
   d immune system breakdown.

SHORT ANSWER

11 List and describe five structures of a neuron.

5 marks

12 Why is myelin important in the transmission of information?

2 marks

13 What is the effect of the excitatory and inhibitory synapses on a neuron?

2 marks

14 How do neurotransmitters influence the transmission of messages between neurons?

3 marks

15 What are the possible treatments for Parkinson's disease?

2 marks

16 Why is the lock and key process important for biological functioning?

2 marks

17 Describe the process of synaptic transmission.

3 marks

18 What is the difference between the effects of glutamate and GABA?

2 marks

19 What is Parkinson's disease and how is it affected by the presence or absence of neurotransmitters?

4 marks

20 If the neurotransmitter acetylcholine facilitates muscle movement, what might occur if neurons producing acetylcholine are damaged?

2 marks

STRESS: SOURCES, MODELS & COPING STRATEGIES

What is stress and what are stressors? Can daily pressures cause us to feel stressed? What about more significant events such as bushfires or earthquakes that affect entire communities? Can belonging to a minority cultural group be a source of stress? How do different stressors affect the way we think and respond? What are the biological processes involved in the stress response? How do different models of stress explain the biological processes involved and how we interpret and cope with stress?

KEY KNOWLEDGE

Stress as an example of psychobiological process:

- sources of stress (eustress and distress) including daily pressures, life events, acculturative stress, major stress and catastrophes that disrupt whole communities
- models of stress as a biological process, with reference to Selye's General Adaptation Syndrome of alarm reaction (shock/counter shock), resistance and exhaustion, including the 'fight-flight-freeze' response and the role of cortisol
- models of stress as a psychological process, with reference to Richard Lazarus and Susan Folkman's Transactional Model of Stress and Coping (stages of primary and secondary appraisal)
- context-specific effectiveness, coping flexibility and use of particular strategies (exercise and approach and avoidance strategies) for coping with stress

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CHAPTER OVERVIEW

Sources of stress	Eustress and distress
Models of stress as a biological process	Fight-flight-freeze response Hans Selye's General Adaptation Syndrome
Model of stress as a psychological process	Lazarus and Folkman's Transactional Model of Stress and Coping
Coping with stress	Context-specific effectiveness Coping flexibility Strategies for coping with stress

CONTENT MAP

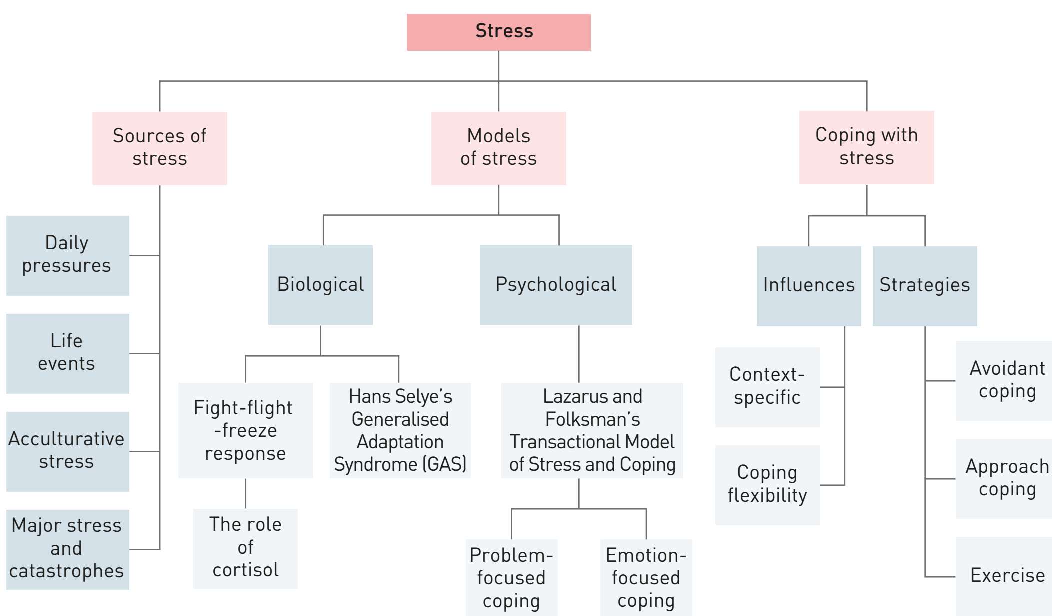

FIGURE 4.1 Stress affects a person's physical and mental wellbeing.

Sources of stress

'I'm so stressed!'

How often do we hear our friends, family or even ourselves say these words? But what does this actually mean? What is stress?

Stress is frequently described as feeling pressure or anxiety. Some say that they feel overwhelmed and unable to cope. Stress is not limited to particular ages or stages in life, nor is it restricted to particular social or cultural groups. The common signs of stress are outlined in Table 4.1.

The stimulus that causes our stress is usually referred to as a **stressor**, which is a 'situation, circumstance or any stimulus that is perceived to be a threat … or which causes and promotes stress' (Seaward, 2015). It can be positive or negative, environmental, psychological or social/cultural in nature.

Although a finite definition for stress can be elusive, there are common themes. Stress is defined as 'any uncomfortable experience accompanied by predictable biochemical, physiological and behaviour changes' (Baum, 1990), or 'a psychological and physical response to internal or external sources of tension (stressors) that

TABLE 4.1 Common signs of stress

PHYSICAL	COGNITIVE	EMOTIONAL	BEHAVIOURAL
Rapid heart rate/heart palpitations	Poor concentration	Apprehension/anxiety	Change in physical activity levels
Increased blood pressure	Loss of self-confidence	Feeling overwhelmed	Sleep disturbances
Headaches	Memory impairment	Agitation/irritability	Change in usual style of communication
Nausea/vomiting	Increase/decrease in awareness of surroundings	Panic	Loss of interest in previously pleasurable activities
Dizziness/fainting	Difficulty making decisions	Fear	Change in eating habits
Chest pain	Poor abstract thinking	Anger	Emotional outbursts
Difficulty breathing	Blaming others	Hopelessness	Antisocial behaviour
Muscle twitching/erratic movements	Difficulty identifying familiar objects or people	Depression	Inappropriate use of humour
Fatigue	Racing thoughts	Denial	Substance use (caffeine, smoking, alcohol, drugs)
Visual difficulties	Disturbed thinking	Inappropriate emotional response	Nervous mannerisms (foot tapping, nail biting, teeth grinding, hair pulling, hand wringing, etc.)

challenge a person's ability to cope/adapt to changing conditions, whether those conditions be real or perceived' (Selye, 1936).

Stress involves a psychobiological process: psychological, because of the initial mental processes involved in the perception and interpretation of the stressor, and biological due to the activation of the autonomic nervous system. Another key element is the notion of subjectivity or how we interpret the stressor in the first place. This can be influenced by our personality and/or past experiences.

Is all stress bad for you? The answer is no. A little stress can be beneficial, especially if it helps us to perform well on a test or in a triathlon! However, particularly intense and/or prolonged stress can lead to negative effects on our immune, cardiovascular, endocrine and central nervous systems (Anderson, 1998). Ultimately, it can also lead to ailments such as ulcers, high blood pressure, diabetes and even heart attack.

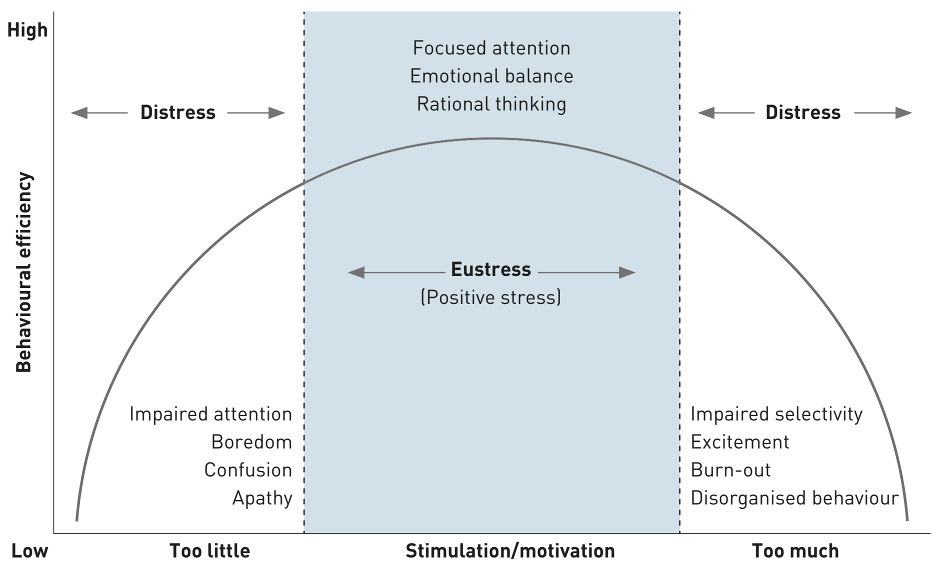

FIGURE 4.2 Eustress and distress

Eustress and distress

We know from our own experiences that if we are distressed about something, such as the death of a beloved pet, we can feel emotionally and physically drained. Yet, if we perform well on an exam or win a competition this is often accompanied by a boost in our energy levels and enthusiasm. The experience of stress is different to other physiological phenomena because bodily arousal, initiated by the sympathetic nervous system's fight-flight-freeze response, can occur regardless of whether a person receives good or bad news. Scientist Hans Selye (1975), considered 'the father of stress research', called stress that is experienced as a result of bad news 'negative stress' or *distress* and coined the term **eustress** to describe positive stress. The prefix *eu* is derived from the Greek meaning 'well' or 'good'.

FIGURE 4.3 For some people, waiting in line can be a source of stress.

DAILY PRESSURES

Any idiot can face a crisis; it is the day-to-day living that wears you out.

Attributed to Anton Chekhov

We can experience both eustress and distress in our day-to-day lives such as lining up for tickets to a concert or missing the bus to school. These types of hassles or pressures seem fairly unimportant in the scheme of things and certainly do not rate highly when you consider life-threatening situations like floods and earthquakes. In fact, research has found that some people seem to be able to cope with major life events as most usually occur one at a time. However, the little irritations experienced each day can have a cumulative effect on our levels of stress and, ultimately, will negatively affect our mental and physical wellbeing (Salleh, 2008; Schwarzer & Schulz, 2012).

Examples of daily pressures include:

> fighting with friends/family/work
> losing important items (phone, keys, wallet, etc.)
> time pressures/deadlines
> lack of sleep
> crowds
> fears (of crime, loneliness, illness, etc.)
> traffic jams
> gossip
> problems with relatives (children, parents, extended family, etc.)
> working in extreme temperatures or conditions
> excess noise
> car breakdown
> chores (cooking, cleaning)
> job dissatisfaction
> difficulty accessing the internet
> social media issues.

FIGURE 4.4 Significant life events, such as going to jail, can have a major impact on stress.

LIFE EVENTS

The next level of stressor generally involves significant life events, which can be positive or negative, such as death of a loved one or a beginning a new job. In 1967, Holmes and Rahe developed a questionnaire known as the Social Readjustment Rating Scale. They believed that both positive and negative common life events are stressful and allocated a different numeric value to them, based on their perceived strength (Schwarzer & Schulz, 2012). They identified 43 negative and positive 'critical life events' (see Table 4.2).

By adding up all the life events over the past 12 months, the Social Readjustment Rating Scale provides an estimate of the level of stress that a person experiences. Its value is limited, however, as it does not consider the amount of stress experienced due to the individual's perception of the event; nor does it consider cultural, social and environmental factors or chronic stressors lasting more than 12 months.

TABLE 4.2 The first 30 items on the Holmes–Rahe Social Readjustment Rating Scale

RANK	LIFE EVENT	MEAN VALUE
1	Death of spouse	100
2	Divorce	73
3	Marital separation	65
4	Jail term	63
5	Death of close family member	63
6	Personal injury or illness	53
7	Marriage	50
8	Fired at work	47
9	Marital reconciliation	45
10	Retirement	45
11	Change in health or family member	44
12	Pregnancy	40
13	Sex difficulties	39
14	Gain of new family member	39
15	Business readjustment	39
16	Change in financial state	38
17	Death of close friend	37
18	Change to different line of work	36
19	Change in number of arguments with spouse	35
20	Mortgage over $100 000*	31
21	Foreclosure of mortgage or loan	30
22	Change in responsibilities at work	29
23	Son or daughter leaving home	29
24	Trouble with in-laws	29
25	Outstanding personal achievement	28
26	Wife begins or stops work	26
27	Begin or end school	26
28	Change in living conditions	25
29	Revision of personal habits	24
30	Trouble with boss	23

*has been adjusted for inflation

You can measure your personal stress score with the Holmes–Rahe Social Readjustment Rating Scale by indicating the events that have occurred to you over the last 12 months and then add the values to obtain a single score. Table 4.3 interprets these scores.

TABLE 4.3 Levels of life stress and risk of developing stress-related illness

RANGE	LEVEL OF LIFE STRESS	RISK OF DEVELOPING STRESS-RELATED ILLNESS
0–150	Not significant	Little to no risk
150–199	Mild	Little risk
200–299	Moderate	Moderate risk
300+	Major	High risk

Source: Holmes & Rahe, 1967

ACCULTURATIVE STRESS

Were your parents born in another country? Did they migrate to Australia during the last century? Or, did your family come to Australia as refugees? Over the decades, Australia's population has become extremely diverse, with each ethnic group contributing to its social and culinary fabric.

Many such Australians had to go through a process of learning a new language and adapting to customs and laws very different from their own, known as *acculturation*. New arrivals may begin by wearing clothing typical of that nation, celebrating local religious/cultural events such as Christmas or adopting some unique sayings such as 'G'day mate' or 'Fair dinkum'! So-called **acculturative stress** can arise as a person adapts to these changes. Often, the greater the differences between the immigrant's old and new countries, the greater the difficulty they experience.

FIGURE 4.5 Refugees from Syria have been exposed to extreme levels of stress as they try to leave their homeland.

The movement of people around the world is a common phenomenon. This can be related to work, educational opportunities, environmental events (drought, earthquake, tsunami), civil wars or political persecution. When people are forced to leave their homeland, like a significant proportion of the Syrian population in recent times, they are subjected to extreme levels of stress over a prolonged period. Not only are they affected by the traumatic experiences leading up to and during their migration, they also need to adapt and integrate into the new society when they are particularly vulnerable.

Many new immigrants, unfortunately, also experience discrimination or racism. In addition, those who have left family and friends behind often experience great guilt, especially if their loved ones are still in a dangerous environment. These factors contribute further to their levels of stress (Graham & Khosravi, 1997; Lipson, 1993).

A study that examined the acculturative stress of Afghan and Kurdish refugees who resettled in Australia and New Zealand found that the 'post-migration experience' can be just as difficult and traumatising as those experiences leading up to the initial immigration (Sulaiman-Hill & Thompson, 2012). This study used a sample of 193 participants aged between 18 and 70 years, with family sizes ranging from 1 to 10. Participants were interviewed and completed the Kessler-10 Psychological Distress Scale (K-10) questionnaire. The overall findings of the study revealed that refugees experienced high levels of psychological stress due to a number of factors including poor English language skills, unemployment, lower educational level and being female (see Table 4.4).

TABLE 4.4 Major sources of stress from a study of Afghan and Kurdish refugees who resettled in Australia and New Zealand

THEME	FEATURE
Cultural/religious	> Lack of respect in society, especially for elders > Culture clash, community too small, concern that children are influenced by negative Western traditions
Resettlement issues/ concerns	> Economic difficulties, system keeps people poor, expensive to live, housing shortages and remote locations, lack of safety in some areas, perceived discrimination (especially since 9/11), government agencies difficult to deal with
'Thinking too much'	> Past experiences and current reminders/re-traumatisation, time to think at home, generally feeling sad and depressed
Separation	> Being away from family, home, past lifestyle – 'homesick'
Feeling overwhelmed	> Feeling without aim, hopeless, no way to improve future, daunted by new life
Relationships	> Family and community tensions, dealing with racism, challenge of family power structure, lack of acceptance by locals > Breakdown of family power structure as government supports children who want to leave home
Status difficulties	> Employment, social position, expectations
Loss of empowerment	> Lack of control, reliance on others, dependence on welfare, feeling humiliated
Social isolation	> Language barrier, especially for women and the elderly > Living in more remote areas without a car or driver's licence
Cultural/social change	> Social problems associated with alcohol, drugs and gangs > Lack of cultural understanding of government and agency staff
Other	> Immigration detention/criminalisation, difficulties in 'getting ahead' financially, economic hardship, children from detention centres continue to suffer emotional stress

Source: Sulaiman-Hill & Thompson, 2012

Acculturative stress is not limited to those of our population who have come from overseas. Indigenous populations all over the world, including Australia, have at some point been invaded or colonised. Many Indigenous Australian communities continue to struggle with acculturative stress because of the significant differences in religious beliefs, values and traditions and the fact of being colonised in the first place.

Did you know?

According to the Australian Bureau of Statistics, at 30 June 2014, approximately 28 per cent of Australia's population (6.6 million people) was born overseas compared with 23.8 per cent in 2004 (4.8 million people).

This part of the Australian community experiences very similar issues and symptoms reported by those who have come as migrants or refugees. This phenomenon is reflected in unique tests and assessments including the Acculturative Stress Scale for Aboriginal Australians (Westerman, 2003) and the Aboriginal Mental Health and Cultural Assessment (Westerman, 2003) that enables diagnosis across major **disorders**. This latter test is a little different from the **DSM-5** that most psychologists and psychiatrists use as it also takes into account 'spiritual visits' and other culturally specific beliefs.

INVESTIGATE 4.1

Work with a partner to write a research analysis of 300–400 words.

1 Using the internet, research an article on acculturative stress in Indigenous Australians.
2 Make sure that you note down the title, source and year of the article.
3 Explain why Indigenous Australians experience 'acculturative stress' and examine the differences and similarities between the experiences of refugees/migrants and Indigenous Australians.
4 Discuss your findings with your partner before presenting these to the class.
5 As a class, complete a Venn diagram of the differences and similarities in the experiences of refugees/migrants and Indigenous Australians.

MAJOR STRESS AND CATASTROPHES THAT DISRUPT ENTIRE COMMUNITIES

What would you consider to be a 'major stress'? Quite clearly, the death of a loved one, loss of employment, or having your home broken into while you are in it would rate considerably. Stress can be intensified when the individual doesn't feel as though they have any control. This is a particular characteristic of natural disasters or other such catastrophes. When earthquakes, cyclones, bushfires or tsunamis occur in populated areas, there are great human and environmental losses. In Australia, we are familiar with the devastation of bushfires, floods and cyclones. Not only is property lost, but many lives as well. Once the 'event' has come to an end, those who survive continue to experience intense stress.

FIGURE 4.6 The Black Saturday Bushfires in 2009 devastated 51 townships.

A study by Kimerling, Clum and Wolfe (2000) suggested that, following a major disaster, there were at least three groups who could suffer stress: those who witnessed the event, those who were affected by the disaster but not present, and those who were part of the rescue team who dealt directly with the devastation. They found that individuals who were exposed to 'extreme stressors' were particularly susceptible to developing **post-traumatic stress disorder** (PTSD). The symptoms of this **anxiety disorder** can include nightmares, flashbacks of the event, severe anxiety as well as an inability to control their thoughts about the traumatic experience. Hand tremors and panic attacks (extreme physiological psychological arousal) are also very common. Some individuals may also suffer a form of **amnesia**, being unable to recall some or all of the event.

Immediately following a natural disaster, the community, volunteer organisations and government bodies rally together to assist those who remain. A good example is that of the Black Saturday Bushfires that devastated Victoria on 7 February 2009. A total of 51 townships were affected, with the death of 173 people and the loss of 2030 homes, businesses, schools and kindergartens. The Australian public were so moved by this devastation that, together with the government's efforts, a total of $400 million dollars was donated for the rebuilding of these communities. Short-term assistance was also given in the form of clothing, food and toys.

When there are natural disasters, people usually accept that they had no control over the situation. However, a technological disaster is usually attributed to people. Technological disasters include the release of radiation from a nuclear power plant, (for example, Chernobyl and the Fukushima nuclear disaster), aviation accidents (for example, the disappearance of Malaysian Airlines flight MH370), oil spills, toxic waste release and mining explosions. The key point with technological disasters is that they are often deemed to be preventable by those affected. Consequently, blame can be attributed – whether it be to an individual, organisation or government. Technological disasters appear to have longer lasting effects on a person than natural disasters, with greater levels of extreme stress reported (Green, 1995). Typical long-term major stress symptoms are similar to those for natural disasters and include high levels of anxiety, depression, panic attacks, rumination (thinking about the event over and over again), anger, frustration and sadness.

We cannot discuss natural and technological disasters without mentioning the impact of war and genocide (the systematic killing of a group of people of a particular ethnic group and/or religion). Unfortunately, this is something that we read and hear about through the media on a daily basis, whether it be the latest bombing by ISIS or some bloody conflict in the Middle East. Interest in the effects of war began last century, with a particular focus on those who came back from the two world wars. Following World War I, psychiatrists investigated 'shell shock', a term then used to describe the psychological impairment of soldiers who had experienced frequent bombardment during active warfare. Traumatised soldiers returning home displayed symptoms such as shaking, fatigue, nightmares, anxiety, depression, mental confusion, difficulty focusing, and problems with their sight and hearing. Many also experienced 'survivors' guilt', or feeling intensely distressed at having survived when others had died. Shell shock could be considered a form of what is now termed PTSD.

Whether the catastrophe is due to natural causes, technological disaster or war, the effects on the individual, their loved ones and their community can lead to the long-term activation of the fight-flight-freeze response, which is linked with psychological impairment and physical illness.

Did you know?

A condition such as PTSD that may manifest itself some years after the event is said to have a *latency period*; in this case the latency period can be several years.

4.1 REVIEW

1. Is stress always considered to be bad for us? Explain.
2. Can you think of a real-life situation where a person needs to feel some stress? Provide an example and indicate how the stress might be beneficial.
3. Give two examples that might cause stress for each of the following:
   - daily pressures
   - life events
   - acculturative stress
   - major stress and catastrophes that disrupt entire communities.

Models of stress as a biological process

Fight-flight-freeze response

In 1932, physiologist Walter Cannon carefully monitored the physiological and behavioural responses of a number of cats after confronting them with different dogs. He observed that the cats would elect to either confront the dog (fight) or run away (flight). Cannon was the first researcher to refer to these reactions as the *fight-or-flight response* and the first to use the term *stress* to refer to a physiological reaction caused by perceiving a threatening situation. Today, the fight-or-flight response is also referred to as the fight-flight-freeze response because some organisms, including humans, can become paralysed in the face of danger, like the stunned 'deer in the headlights'.

The fight–flight–freeze response is controlled by the autonomic nervous system. When a threat occurs, both the sympathetic and parasympathetic branches of the autonomic nervous system are activated. The fight and flight responses are initiated by the sympathetic branch of the autonomic nervous system, which prepares the body for action. The freeze response is activated by both branches, but is observed when the parasympathetic branch dominates. The fight–flight–freeze response is an innate and evolutionary phenomenon that is critical for survival. It is referred to as an 'adaptive response' because, in the early days of human and animal evolution, those with a rapid response of sympathetic arousal had a greater chance of survival. Today, there are many reasons why we experience the fight-flight-freeze response that are not necessarily due to impending danger. It can be triggered by physical activity, illness or instances of negative or positive stress.

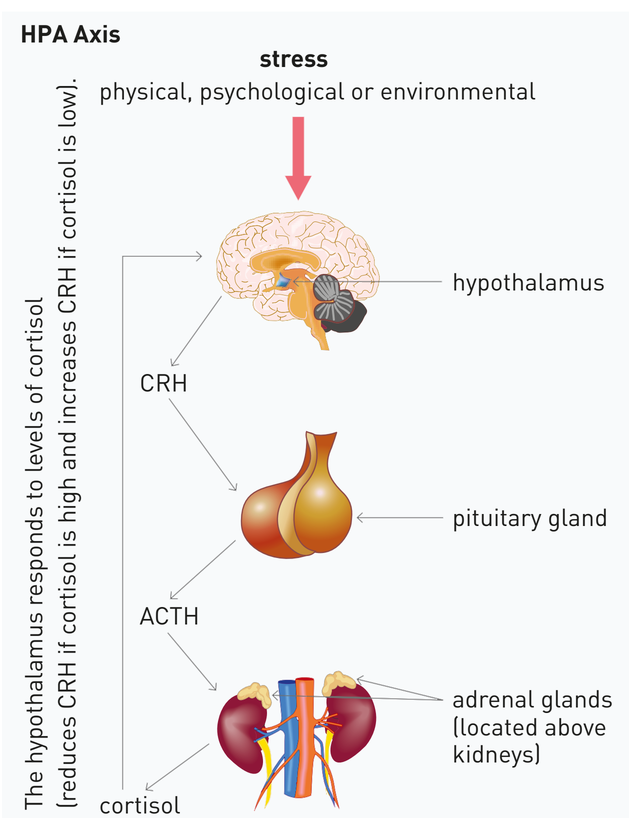

FIGURE 4.7 Cortisol plays an important role in our response to stress.

THE ROLE OF CORTISOL

Also known as 'the stress hormone', **cortisol** plays an essential role in our response to stress. When there is a stressor present, the **hypothalamus** releases corticotropin-releasing hormone (CRH), which in turn activates the pituitary gland to release adrenocorticotropic hormone (ACTH). ACTH passes through the bloodstream to the adrenal glands, which in turn release stress hormones such as adrenaline, noradrenaline and cortisol.

The release of **adrenalin** and **noradrenalin** leads to an increase in our respiration and heart rates so that oxygenated blood travels around our body, resulting in increased alertness. Glucose is also released into the bloodstream to provide us with more energy to either run from or confront the aggressor. In addition, our pupils dilate to allow more light into our eyes for greater visual acuity, while bodily functions such as digestion are suppressed.

Cortisol is released into the bloodstream to maintain blood-glucose levels during fight or flight. However, during prolonged stress, it also has the effect of suppressing the immune system and making us vulnerable to both minor and major illnesses, depending on how long the cortisol remains in our bloodstream. When the cause of stress is removed, acetylcholine is released and the levels of cortisol, adrenalin and noradrenalin lower as the body returns to normal.

ANALYSIS OF RESEARCH

INVESTIGATE 4.2

Using the internet, find a research article on a topic related to stress and answer the following questions:

1 What is the research article about (provide the title and a brief outline of the topic)?
2 If the research article is based on an experiment, write an aim and hypothesis (make sure to include the independent and dependent variables).
3 Write a method section for the research (participants, materials, procedure).
4 Outline the findings of the article (conclusion).
5 What are the implications of this research?

HOMEOSTASIS AND ALLOSTASIS

Each time we are late, have an argument or fail to meet a deadline, our fight-flight-freeze response is activated. **Allostasis** is the process of change that needs to occur to return the body to homeostasis. Our body tries to maintain homeostasis or internal biochemical stability to allow us to manage stressors (Sterling & Eyer, 1988). However, the frequent activation of the fight-flight-freeze response (which include our cardiovascular system, endocrine system and limbic system) can lead to an increase in our **allostatic load**. Since these internal systems were not designed to be repeatedly activated for long periods of time, there can be cumulative negative effects, such as a weakened immune system, as the allostatic systems attempt to re-establish homeostasis.

The greater the number, duration and intensity of stressful events a person experiences, the greater the allostatic load. When we are no longer able to deal with these pressures, and our physical reserves are depleted, we go into **allostatic overload**.

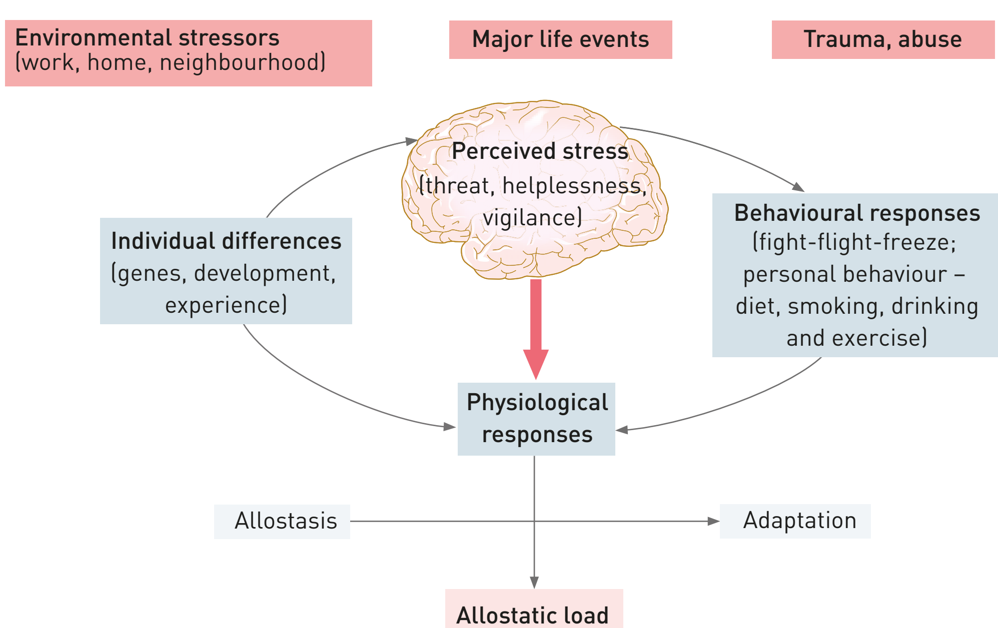

FIGURE 4.8 The frequent activation of the fight-flight-freeze response has a cumulative negative effect and can lead to allostatic overload.

Hans Selye's General Adaptation Syndrome

> Every stress leaves an indelible scar, and the organism pays for its survival after a stressful situation by becoming a little older.
>
> Hans Selye

Hans Selye (1907–1982) contributed to our understanding of how the biological processes involved in the stress response could potentially lead to illness and death. He stumbled across this 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 cold, surgical injury, excessive exercise or the injection of a range of different drugs. He identified a predictable three-phase pattern of physiological responses that he called **General Adaptation Syndrome (GAS)**, which consists of alarm, 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. In line with the concept of allostasis, GAS is the body's way of adapting and dealing with a perceived stressor or stressors. The resistance stage of GAS corresponds with a person having an increased allostatic load, while the exhaustion phase corresponds with the concept of allostatic overload.

FIGURE 4.9 Family arguments are stressful.

ALARM

Alarm is the first stage of GAS when a person/organism first realises that there is a threat or stressor. The fight-flight-freeze response is activated via the hypothalamic–pituitary–adrenal **(HPA) axis**, a self-regulating system involving the sympathetic nervous system and adrenal glands. During this phase, adrenalin, noradrenalin and cortisol are released into the bloodstream giving the individual an increase in energy. Alarm is experienced in two phases: *shock*, then *countershock*.

In the shock phase, the body responds as though it is injured. Body temperature and blood pressure momentarily drop as the person or organism becomes aware of the situation. It is during this stage that people who are given bad news have been known to faint or, in extreme circumstances, have a heart attack. This effect lasts for a relatively short period of time.

During the following countershock phase, the body increases its resistance to the stressor with the release of adrenalin, noradrenalin and cortisol into the bloodstream. This effectively increases the heart and respiration rates, and releases more glucose into the bloodstream by diverting it from the gastrointestinal tract to muscles and other parts of the body in preparation for an emergency response. In other words, our fight-flight-freeze response is activated.

Often, after the initial stress encounter, if the situation is dealt with, then the person or organism does not enter the next stage, resistance. For example, a student might be temporarily shocked and upset by a test result but, after possibly a few minutes, their bodily systems return to normal and they are able to continue on to their next class.

RESISTANCE

As the alarm stage cannot last for long, the body soon enters the second stage of GAS: **resistance**. During this 'adaptive' stage, the parasympathetic nervous system reduces the heart and respiration rates, while blood glucose levels and some stress-related hormones such as adrenalin and cortisol continue to circulate through the body, keeping it prepared for action and increasing the person's stress tolerance. If the stress continues, the person remains in an elevated state of arousal with greater energy resources at their disposal to deal with the situation and adapt physiologically to the higher levels of stress.

FIGURE 4.10 People who are given bad news are vulnerable.

However, the body cannot continue to remain physiologically aroused for long periods of time. Even though the person or organism has adapted to the increased demands of their environment, the continued circulation of adrenalin, the pituitary hormone ACTH and cortisol in particular can depress the immune system. During this stage, a person is susceptible to colds, influenza or any other bacterial infections circulating in their environment. This stage is also characterised by 'energy conservation' as the individual tries to focus on the stressor(s) at hand. The person may begin declining social invitations or becoming absent from work or school, and may experience difficulty focusing or **remembering**. They may appear withdrawn, tearful or angry.

For example, Tess is a Year 12 student who has three exams to prepare for in two weeks. She works part time and lives in a single-parent home where she is often left to care for her two younger siblings. Although she is managing to juggle her responsibilities, she sometimes feels tired. The extra effort of preparing for exams has added to her load and left her feeling particularly stressed. On the day before her first exam, Tess wakes up with a temperature and a sore throat. While Tess's body has given her much-needed resources to deal with the challenges of study, family and work, it has also left her vulnerable to infection.

FIGURE 4.11 According to the GAS model, the stage of resistance is where signs of illness begin.

EXHAUSTION

If the resistance stage lasts for an extended period of time, there will be prolonged and elevated levels of physiological arousal due to stress hormones in the bloodstream. The body's ability to meet the demands of the stressor begins to decline as the person enters the stage of **exhaustion**.

As the person's biological resources become severely depleted, they become susceptible to more serious life-threatening illnesses and, in extreme circumstances, death. Organs such as the heart that are particularly vulnerable to environmental or genetic factors, often show the first signs of serious illness (for example, a heart attack). If a person reaches this stage of GAS, they are often psychologically exhausted and may show signs of depression.

STRENGTHS AND LIMITATIONS OF SELYE'S GENERAL ADAPTATION SYNDROME

The strengths and limitations of Selye's General Adaptation Syndrome are outlined in Table 4.5.

TABLE 4.5 Strengths and limitations of Selye's General Adaptation Syndrome

STRENGTHS
It provided rich, empirically based information about the physiological processes involved in an animal's response to a range of stressors.
It provided laboratory evidence of the role of the brain, endocrine system and autonomic nervous system in the three phases of GAS.
It found that the greater the intensity of the stressor, the greater the physiological response.
It identified the important connection between extreme prolonged stress and certain diseases.
It was able to demonstrate that exposure to prolonged stress could lead to death in laboratory rats.
LIMITATIONS
Selye over-emphasised the significance of the biological processes.
His model was based on research conducted on rats and could not be generalised to human subjects.
Selye did not consider that a rat's responses to stressors are less varied than a person's stress response.
Selye applied his model to humans without considering key psychological and environmental factors that are unique to them, such as the perception and interpretation of the situation.
The model failed to recognise the role of emotion and cognition.

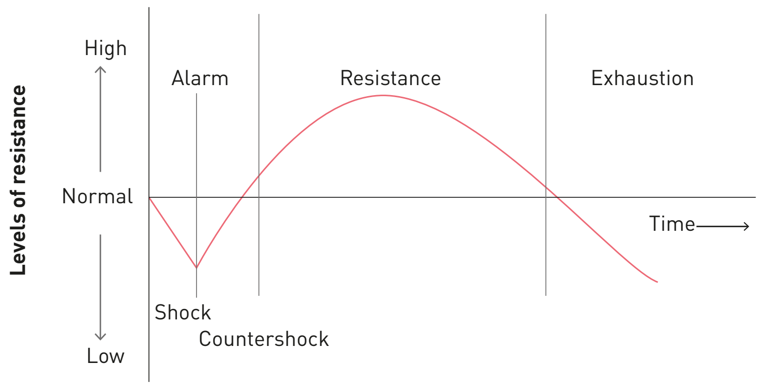

FIGURE 4.12 Selye's General Adaptation Syndrome

4.2 REVIEW

1 What is the fight-flight-freeze response?
2 Describe the role of cortisol as the 'stress hormone'.
3 Complete the following table to reflect aspects of Selye's General Adaptation Syndrome model of stress.

STAGE OF GAS	PHYSIOLOGICAL PROCESSES/ EVENTS	ASSOCIATED AILMENTS/ ILLNESSES
STAGE 1		
Alarm		
Shock		
Countershock		
STAGE 2		
Resistance		
STAGE 3		
Exhaustion		

4 Cody has decided to repeat Year 12 to improve his overall ATAR and better his chances of gaining entry to a prestigious university. This is a decision that has been met with some opposition from his family. Cody begins the new school year with some anxiety. He wants to make sure that he does the best he can as well as continue his part-time job and involvement in the local football team. During the first week he receives his timetable and realises that there are three SACs scheduled all on the same day! What phase of Selye's GAS model is Cody in? Explain the physiological processes involved.
5 Lucy has two part-time jobs as she is trying to save as much money as she can to travel overseas at the end of Year 12. She is finding juggling these and her schoolwork difficult. On the morning of her Psychology SAC, she wakes up with a temperature, headache and a very sore throat. Which stage of Selye's GAS is in Lucy in? Explain your answer describing the biological processes involved.
6 Outline two key strengths and two key limitations of Selye's GAS model.

Did you know?

The first two stages of Lazarus and Folkman's Transactional Model of Stress and Coping involve **emotional forecasting**. In the primary appraisal phase, the person experiences an emotional response to the given situation. In the secondary appraisal phase, the person predicts the possible emotional impact of each potential response.

Model of stress as a psychological process

Lazarus and Folkman's Transactional Model of Stress and Coping

Selye's General Adaptation Syndrome provides a rich biological explanation for the physical processes involved in an organism's response to stress. However, it does not provide any information regarding how a stressor is interpreted. Richard Lazarus and Susan Folkman (1984) shifted from the traditional **biological approach** to stress and emphasised the importance of the psychological or cognitive processes involved in dealing with a stressful situation. Lazarus and his colleagues also moved away from working with non-human subjects and focused on working with people. It became apparent that it was not just the response to the stressor or the stressor itself that was important but, rather, the individual's perception and assessment of that stressor.

Lazarus and Folkman realised that different people could evaluate a potentially stressful situation in their own unique way. According to their model, stress is regarded as a 'transaction' between the person and the environment (Lazarus, 1981; 1993; Lazarus & Folkman, 1984) where the person's individual interpretation or **cognitive appraisal** determines how they will deal with the situation.

> It is the perception of 'potential harm', threats and challenges, together with how confident we are in dealing with these, that determine our ability to cope with stress.
>
> Anthony James Curtis

This appraisal is influenced by the person's beliefs, goals, personal circumstances, life experiences and personality. For example, being made redundant from your job can be very stressful, especially for an individual with a family and a mortgage or someone with skills that are difficult to transfer to a different position. For such a person, a redundancy could bring financial ruin and so the level of stress is immense. However, a person who is single and still living at home with their parents might regard the same situation as simply an irritation or possibly even an opportunity to find a more interesting job.

FIGURE 4.13 Being made redundant can be stressful.

Lazarus and Folkman's model outlines two main stages of cognitive assessment of a situation: primary appraisal and secondary appraisal, which may occur separately or simultaneously.

The **primary appraisal** stage tends to be quite rapid, involving little reflection as people are usually able to interpret situations efficiently due to their past experiences. During this stage, the significance of a situation can be classified as:

> harm/loss – as assessment that some type of damage has been done such as an illness or poor test result; for example, 'I just failed a major test.'

> threat – an assessment that there may be a future harm or a loss; for example, 'I might fail the next major test.'

> challenge – an assessment that there is opportunity for personal growth or something might have a positive outcome; for example, 'I didn't do well on the practice test but, with a bit of hard work, I'll do better next time.' An upcoming marriage or a change of employment with a pay rise and greater status can also be perceived as a **challenge**.

> neutral/irrelevant/benign – an assessment that this event is of little or no personal importance or relevance and therefore does not go beyond primary appraisal; for example, 'My neighbour did poorly on his test.'

The **secondary appraisal** is made at a more conscious level as the person assesses what resources and energy they have to deal with the event and what strategies they can use to effectively cope with it. For example, a student who fails a major assessment task might consider asking their teacher if they can resubmit it and accept the associated penalty for doing so.

PROBLEM- AND EMOTION-FOCUSED COPING STRATEGIES

Lazarus and Folkman's Transactional Model of Stress and Coping also outlines methods of coping with a stressor or perceived stressor. The key theme to note is that it is a dynamic and adaptive process in which people may choose to use either problem-focused or emotion-focused strategies. The concept of coping is discussed in more depth later in this chapter.

Problem-focused coping is considered to be a constructive type of coping where reduced stress is achieved by using **behaviour modification** to deal with the situation. Problem-focused strategies include:

> taking control – for example, a student who has performed poorly on an assessment task may decide to spend less time on Facebook and redirect that energy into revising more thoroughly

> information seeking – looking for additional information to know how to deal with the stressor. For example, someone who has just been diagnosed with an illness might decide to see a specialist

> evaluating the pros and cons – taking a sheet of paper and dividing it so that on one side, the person writes down the positives about the situation/stressor and on the other side, the negatives.

While problem-focused coping is viewed as an adaptive form of coping, emotion-focused coping strategies can be either adaptive or maladaptive. **Emotion-focused coping** involves trying to reduce the negative feelings associated with the stressor such as embarrassment, fear, anxiety, depression, excitement or frustration. Adaptive or 'approach' emotion-focused coping strategies are where the individual uses proactive strategies to help reduce their emotional distress. Maladaptive or 'avoidant'

Did you know?

Like Selye, Lazarus and Folkman accepted the notion that stress could be positive or negative. They identified 15 basic emotions that may contribute to arousal:

> **positive emotions**: happiness, pride, love, relief, hope and compassion

> **negative emotions**: anger, anxiety, disgust, envy, fright, guilt, jealousy, sadness and shame.

strategies such as denial or distraction tend to delay or prevent the person from dealing or adjusting to the stressful situation. Interestingly, research has found that females tend to use emotion-focused coping strategies more than males (McLeod, 2015; Billings & Moos, 1981). Approach and avoidant emotion-focused coping strategies are discussed in further detail in the last section of this chapter.

STRENGTHS AND LIMITATIONS OF LAZARUS AND FOLKMAN'S TRANSACTIONAL MODEL OF STRESS AND COPING

The Transactional Model of Stress and Coping accepted Hans Selye's physiological reactions to stress and introduced the cognitive processing and emotional elements that were missing. It explained the interaction or transaction that occurred between the individual and their environment, giving a greater focus to how the person perceived the situation. The strengths and limitations of Lazarus and Folkman's Transactional Model of Stress and Coping are outlined in Table 4.6.

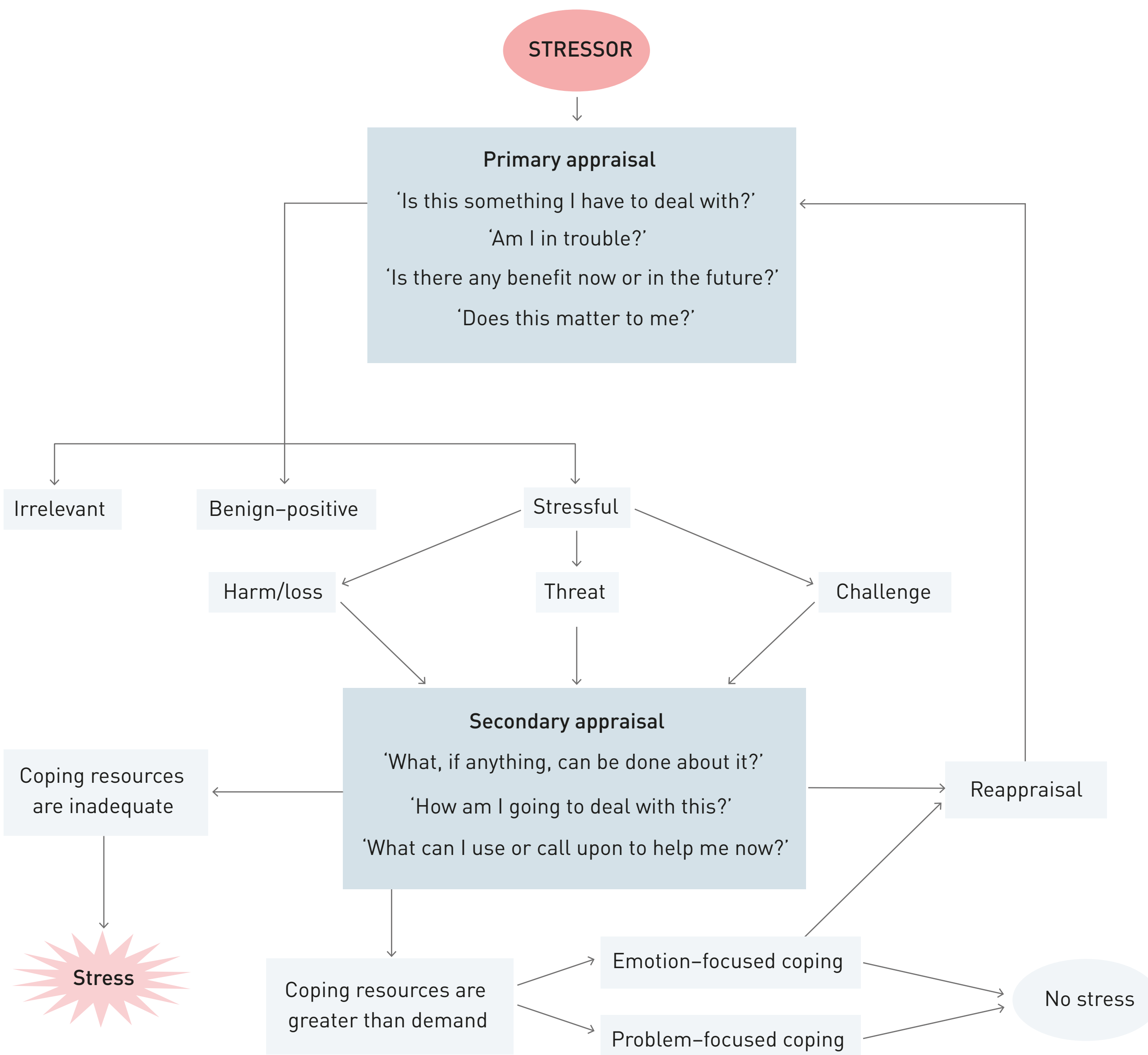

FIGURE 4.14 The Transactional Model of Stress and Coping in action

TABLE 4.6 Strengths and limitations of Lazarus and Folkman's Transactional Model of Stress and Coping

STRENGTHS
It used human subjects in developing the model.
It focused on the psychological aspects of the stress response where the person has some measure of control.
It viewed the perception and response to a stressor as an 'interaction' or 'transaction' between the individual and their environment.
It used a cognitive approach to stress with a focus on how people cope with the psychological stressors.
It took both mental processes and emotions into account when examining how an individual interprets a situation as stressful or not.
It acknowledged that the appraisal and response to a stressor can be highly individual, based on that person's unique circumstances, perceptions and past experiences.
It provided a framework that accepted that stressors or the situations/environments under which they occur can change so that there is the opportunity or possibility for the person to reappraise the situation and alter their perception and response accordingly.
It suggested emotion-focused and/or problem-focused coping methods/options for dealing with the psychological reaction to the stressor.
LIMITATIONS
The initial primary appraisal of a stressor may not be clear-cut – a person may experience a stress response without being consciously aware of its origins.
Due to the subjective manner in which an individual perceives and responds to stress, it is difficult to test experimentally.
The greater focus on psychological factors meant that less emphasis was placed on the physiological elements of the stress response.
Primary appraisal and secondary appraisal can occur simultaneously.

4.3 REVIEW

1. What does the 'transactional' element in the Transactional Model of Stress and Coping refer to?
2. Using an example, illustrate your understanding of the steps involved in Lazarus and Folkman's model. You may use a diagram to assist you.
3. Outline two strengths and two limitations of the Transactional Model of Stress and Coping.
4. Miles is distressed at having lost his part-time job at Coles. Suggest one problem-focused coping strategy and one emotion-focused strategy he could use to deal with this situation.
5. Why is emotion-focused coping sometimes considered 'maladaptive'? Use your own example to illustrate your understanding.
6. Zahra received a call from a well-respected university with a provisional offer for the following year as long as she achieves a very high score. As Zahra is a positive person, she perceived this news as a challenge. Using the Transactional Model of Stress and Coping, explain the mental processes and coping strategies that Zahra might have gone through on hearing the news. You may present this in the form of a flow chart or paragraph.
7. Outline two key differences between Selye's Generalised Adaptation Syndrome model and Lazarus and Folkman's Transactional Model of Stress and Coping.

Coping with stress

According to Lazarus and Folkman (1984), coping refers to the 'constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person'.

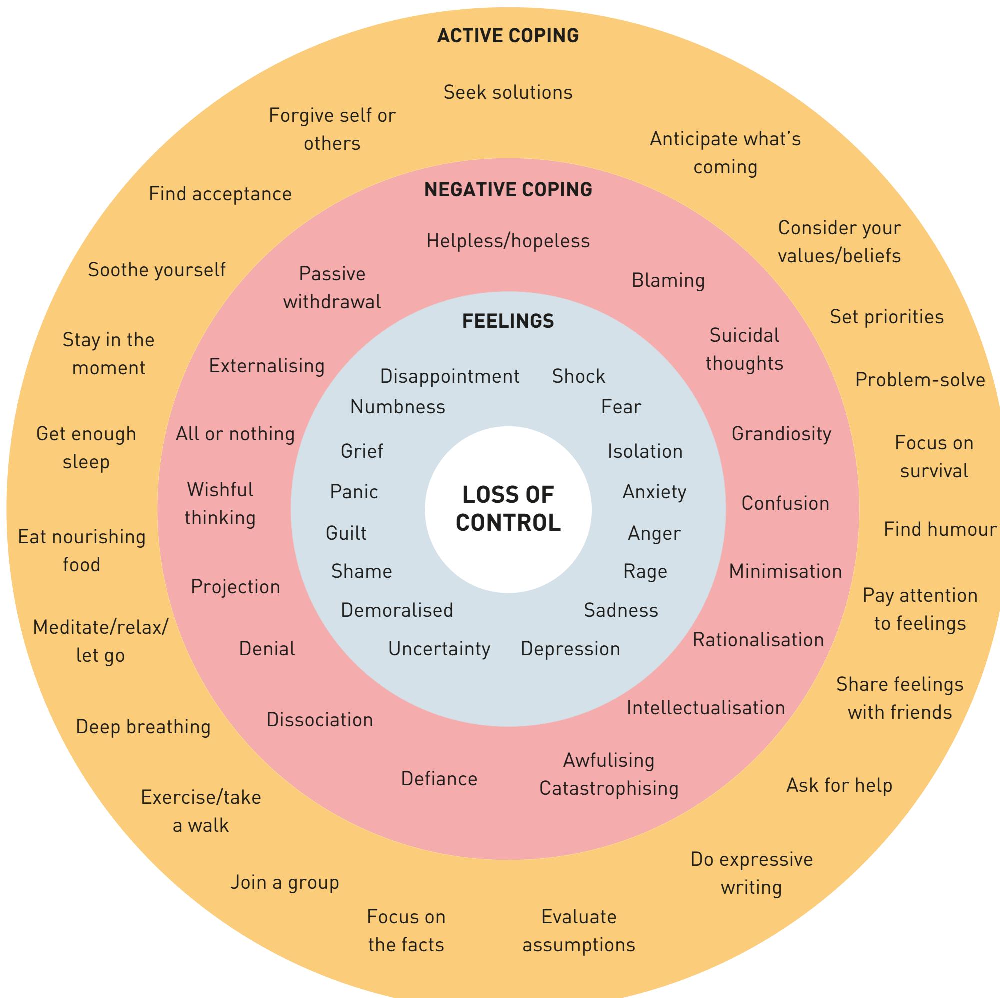

FIGURE 4.15 Coping skills wheel

Context-specific effectiveness

Context-specific effectiveness considers the unique characteristics of a situation or environment that the person is required to adapt to. How effectively an individual can implement coping strategies will be determined by past experience and whether the strategies previously used were appropriate and useful in managing a similar situation (DeLongis & Holtzman, 2005). When the same type of situation or stressor occurs again, the person has a repertoire of coping strategies that they can use, which may be problem focused, emotion focused or a combination.

For example, let us consider 'George', the father of a young family who has just experienced a significant life event – retrenchment. George has been in this position before, however, and used a combination of coping strategies that allowed him to find alternative employment – reducing his financial and emotional stress at the time. As a proactive person, George used active problem-focused coping strategies such as rewriting his resume and uploading it online, checking newspaper and 'Seek' online advertisements and contacting companies directly.

To manage his anxiety about the situation, he also used active emotion-focused coping strategies such as seeking advice from his family and friends, riding his road bike to expend stress hormones from his body and attending meditation classes. As these strategies previously helped him manage his stress and find a new job, it is likely that he will use similar adaptive strategies to find a new job again.

FIGURE 4.16 Problem-focused coping strategies can reduce stress during times of hardship such as following retrenchment.

Now consider 'Freddie', who also has a dependent family and has just been retrenched. Even though the circumstances are similar, due to 'Freddie's' personality and past experiences, he has developed poor coping strategies. Last time he was retrenched it took him almost a year to find a new job. He did not tell his family of his situation for two months and pretended to go to work each day. He has been drinking more heavily and occasionally smoking marijuana in the garage. These substances allow a person to 'escape' from the reality of the situation and enable 'avoidant' thinking (passive emotion-focused coping). Freddie also did not update his resume or actively look for another job, but eventually he was offered employment through a family friend. As Freddie had previously lost his job and used unhelpful coping strategies, the likelihood of him again using unhelpful strategies is very high. Past experience has also taught him that someone might come to his aid, thereby reinforcing his maladaptive coping behaviours and lack of positive action.

Coping flexibility

Coping flexibility refers to the individual's ability to adapt effectively to a range of stressful situations. They develop a repertoire of both problem-focused and emotion-focused coping strategies and are able to implement these to manage various stress-inducing events. According to some theorists, coping flexibility is an 'adaptive personality quality that enables individuals to meet the specific constraints of a variety of situations' (Cheng, 2001).

As mentioned earlier, in terms of the Transactional Model of Stress and Coping, coping is considered a dynamic process because the person's appraisal and coping responses reflect an understanding that the environment is ever-changing and the individual needs to remain flexible in managing these changes. Reappraisal of the stressful event is also part of coping flexibility – especially when we realise that it's not as bad as we originally thought or decide to reinterpret the situation as a challenge.

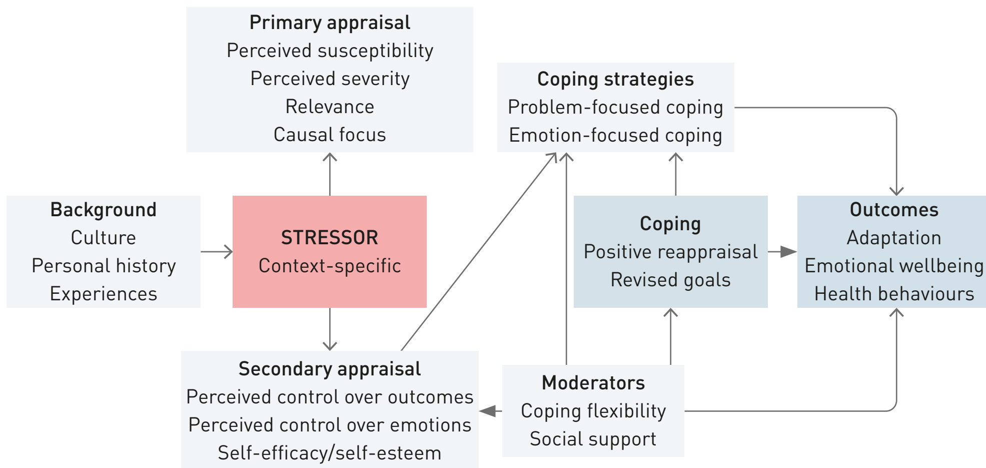

FIGURE 4.17 Context-specific effectiveness and coping flexibility in Lazarus and Folkman's Transactional Model of Stress and Coping

Strategies for coping with stress

People have a variety of options when it comes to reducing the amount of stress in their lives, including exercise, or avoidant and approach strategies such as those discussed in relation to Lazarus and Folkman's model.

EXERCISE

Have you ever had the experience of feeling so stressed that you just want to go for a run or repeatedly hit a punching bag? Well, these options are actually quite useful in reducing your level of stress.

Once we perceive a stressor, our body responds with a predictable sequence of biological processes to help us mobilise our physical resources to deal with it. If we are not physically active during one of these physiologically arousing events, then we may find ourselves feeling agitated and anxious. We may also experience hand tremors and sweaty palms. As discussed earlier, if our allostatic systems are repeatedly activated over long periods of time, the presence of stress hormones can have a cumulative negative effect, both physically and psychologically.

Animal studies have enabled us to understand the importance of **physical exercise** in regulating **mood** and managing anxiety. Further research using human subjects has confirmed these findings. One such animal study involved examining the phenomenon of 'learnt helplessness' that was induced by exposing animals to unavoidable electric shocks. After a while, the animals realised that there was no escape from the shocks and became listless, depressed and sad. From a biochemical

FIGURE 4.18 Exercise is a good strategy for reducing stress and improving mood.

point of view, researchers discovered that the chronic stress led to the depletion of norepinephrine, which is involved in the fight-flight-freeze response, vigilance, blood-pressure regulation and glucose levels. It also lead to depleted **serotonin**, which is linked with mood, appetite, sleep, memory and learning. However, when the animals were exposed to regular aerobic exercise, it was found that their levels of serotonin and norepinephrine increased, with positive antidepressant effects (Anderson & Shivakumar, 2013).

The importance of regular aerobic exercise

Chronic stress can affect the cardiovascular system and lead to high blood pressure and heart disease. Studies have shown that regular aerobic exercise, where there is an increased heart rate and amount of oxygen consumed, reduces the reactivity of the sympathetic nervous system and the HPA axis response to stressors (Anderson & Shivakumar, 2013).

When a person engages in regular exercise, the physiological arousal necessary to run, cycle or swim laps is activated. This greatly increases the efficiency of the cardiovascular system, which leads to lower blood pressure due to improved blood circulation and strengthens the heart muscle with the added benefit of reducing the risk of heart disease. The resting heart rate of a fit person is generally lower than the resting heart rate of someone who doesn't exercise. So, when faced with a stressful situation, the body's physiological response is less intense and potentially harmful.

TABLE 4.7 Effects of exercise on the cardiovascular system from aerobic exercise

IMMEDIATE EFFECTS	LONG-TERM EFFECTS
Increased heart rate and cardiac output	Increased strength and size of heart muscle and increased cardiac output
Increased blood pressure	Reduction in resting heart rate
Blood distributed to working muscles	Increased aerobic capacity
Blood flow to non-essential organs reduced	Increased oxygen delivery to muscles
Increased oxygen sent to working muscles	Reduced recovery time
Dilation of blood vessels to allow for increased blood flow to working muscles	Reduced risk of coronary heart diseases such as heart attack
Increased blood flow to skin to allow the body to cool down	Healthy veins and arteries

The role of endorphins

Have you ever experienced a natural high after vigorous exercise? This feeling of euphoria following strenuous physical activity is due to a group of 'opioids' or natural painkillers broadly known as *endorphins*. These chemicals, which are similar to morphine, usually interact with the receptors in the brain and can reduce the sensation of physical pain following injury. Research has discovered that beta-endorphins are produced during physical exercise, and that these – along with the release of serotonin and dopamine – work together to improve mood and give

Did you know?

In the 1970s, scientists began to wonder why drugs like morphine could kill pain so effectively. They searched and finally found proteins called *endorphins*, a word that combines *endogenous*, meaning 'naturally occurring within the body', and *morphine*.

a sense of euphoria after exercise. Vigorous exercise is also a great way of using and reducing stress hormones such as cortisol. This, in part, explains why, following a good exercise session, people feel a sense of wellbeing and may even feel better able to manage the stressors they face.

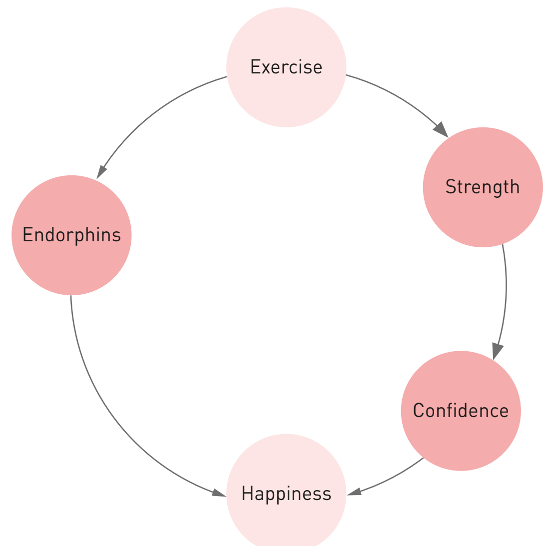

FIGURE 4.19 Aerobic exercise for more the 20 minutes will release endorphins, the 'feel-good' chemicals that make you feel happy.

AVOIDANCE AND APPROACH STRATEGIES

As mentioned earlier in the chapter, avoidant coping strategies tend to be emotion focused as the fundamental goal is to avoid feelings of distress and emotional upset – even for a short period of time. Adaptive or approach emotion-focused coping strategies are where the individual uses proactive strategies to help reduce their emotional distress. Although these are an indirect way of dealing with a stressor, once the person feels better about the situation, they are in a better frame of mind to reappraise the stressor and use more direct problem-focused coping measures to take control of the situation such as seeking additional information.

Research has found that avoidance strategies tend to inhibit the development of more effective cognitive strategies to deal with long-term situations (Taylor & Clarke, 1986). Sometimes, when we try to stop thinking about something upsetting, like a disappointing ATAR, we may begin thinking about it even more! Interestingly, even though people who use avoidance as a coping mechanism indicate that they experience lower levels of stress, they show greater physiological responses than those who use more direct and proactive strategies (Nyklicek *et al.*, 1998). Essentially, they 'bottle' up their anxiety and stress, which can cause illness in the long term.

TABLE 4.8 Avoidant and approach emotion-focused coping strategies

AVOIDANT EMOTION-FOCUSED COPING STRATEGIES
Wishful thinking and fantasy – where the person imagines different scenarios to the one upsetting them
Denial – pretending that the stressor doesn't exist
Distancing – person places distance between the stressor and themselves so they can manage the situation, achieving temporary relief from the distress
Procrastination – putting off what needs to be done until the last minute
Escape/distraction – shifting focus away from the stressor and not dealing with it
Reframing/rationalising – changing the way a stressor is viewed. This may involve giving up a cherished goal
Substance abuse – excessive drinking of alcohol and/or drugs as a form of escape from emotional distress
Oversleeping – using sleep to avoid stressful situations
Renouncing any connection to the stressor; for example, 'I had nothing to do with it.'
APPROACH EMOTION-FOCUSED COPING STRATEGIES
Accepting responsibility or blame where this is appropriate
Meditation/relaxation – helps shift the focus away from thinking about the distressing event
Physical exercise – assists in reducing the stress hormones in the body while also releasing feel-good endorphins
'Getting it off your chest' – speaking to a friend or family member about the problem
Seeking advice from a psychologist or counsellor

4.4 REVIEW

1 Outline the difference between the concepts of 'context-specific effectiveness' and 'coping flexibility'.
2 How do context-specific effectiveness and coping flexibility together influence an individual's ability to cope?
3 Explain the difference between approach and avoidant emotion-focused coping strategies.
4 Think about a recent event where you were upset. Which coping strategies did you use to deal with your stressor?
5 Why is exercise so important in managing stress?

CHAPTER SUMMARY 04

- Stress is a psychological and physical response to internal or external sources of tension that challenge a person's ability to cope.
- The term *eustress* was coined to refer to the perception of good stress, while *distress* has been used to refer to the perception of bad stress.
- Stresses can be relatively minor such as lining up for tickets, or more significant such as the breakdown of a relationship or a redundancy. However, daily stresses can have a negative cumulative effect, which may be more pronounced in the long term than seemingly more significant stressors.
- Stress can affect individuals or whole communities or countries, as in the case of a natural disaster or war.
- Acculturative stress occurs as a result of a person migrating to another country and experiencing the pressures of learning a new language, unfamiliar customs, cultural norms, values and legal system.
- When an organism encounters a threat or stressor, the fight-flight-freeze response is often activated. The hormones adrenalin, noradrenalin and cortisol are released into the bloodstream, increasing the heart and respiration rates.
- Allostasis refers to the body's attempts to maintain homeostasis in a stressful environment and involves the cardiovascular, endocrine and limbic systems. If these systems are overloaded, there can be negative effects on the body.
- Seyle's General Adaptation Syndrome (GAS) is a framework for describing the biological aspects of stress and consists of the stages of alarm, resistance and exhaustion.
- In Lazarus and Folkman's Transactional Model of Stress and Coping stress is regarded as a 'transaction' between the person and the environment, where the person's individual interpretation of the stressor determines how they deal with the situation.
- In problem-focused coping, the aim is to alter or get rid of the stressor by implementing adaptive behaviours. In emotion-focused coping, the aim is to reduce the unpleasant or distressing emotions elicited by the source of stress.
- Adaptive or approach emotion-focused coping strategies include meditation, relaxation, physical exercise, venting and talking to a friend. Avoidant coping strategies include wishful thinking, denial, distancing, procrastination, distraction, rationalisation, substance abuse and oversleeping.
- Context-specific effectiveness refers to the appropriateness of a given coping strategy to the characteristics of the situation.
- Coping flexibility refers to the individual's ability to effectively adapt to a range of situations.
- Exercise is effective in managing stress. It expends stress hormones and releases natural opioids known as endorphins.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- adaptive coping strategies
- adrenalin
- approach coping strategies
- avoidant coping strategies
- beta-endorphins
- cardiovascular system
- context-specific effectiveness
- coping flexibility
- cortisol
- distress
- emotion-focused coping
- endorphins
- eustress
- exercise
- fight-flight-freeze response
- HPA axis
- immune system
- Lazarus and Folkman's Transactional Model of Stress and Coping
- noradrenalin
- norepinephrine
- problem-focused coping
- primary appraisal
- secondary appraisal
- Selye's General Adaptation Syndrome (GAS)
- serotonin
- stress
- stress response
- stressor.

KEY IDEAS

For the exam, you must know:

- the fight-flight-freeze response
- the role of cortisol
- the difference between eustress and distress
- the different sources of stress
- the psychological determinants of the stress response
- Hans Selye's General Adaptation Syndrome
  - the concept of context-specific effectiveness
  - the concept of coping flexibility
  - the difference between problem-focused coping strategies and emotion-focused strategies
  - the different types of avoidant emotion-focused coping strategies
- Lazarus and Folkman's Transactional Model of Stress and Coping.

RESEARCH METHODS

For the exam, you must be able to understand how stress can affect nervous system functioning.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Which of the following best describes stress?
   a a psychological response that occurs when a person is overloaded with responsibilities
   b a psychological and physiological response to internal and/or external sources of tension that challenges a person's ability to cope
   c a psychological and physiological response to internal and/or external sources of tension that stops a person from coping
   d a psychological and physiological response to internal and/or external sources of tension that allows a person to cope

2 Ellen is taking the train to school one morning and notices a man staring at her. Every time she looks his way, she feels a shiver up her spine. When Ellen arrives at her station, she sees the man get up from his seat to follow her. She panics and runs. Which of the following responses has occurred?
   a fight-flight-freeze response
   b fear response
   c somatic arousal response
   d sympathetic nervous response

3 Which branch of the autonomic nervous system is activated when Ellen first notices the man staring at her and she feels nervous?
   a central nervous system
   b peripheral nervous system
   c somatic nervous system
   d autonomic nervous system

4 Which of the following is not a physiological process of the fight-flight-freeze response?
   a dilation of pupils
   b stimulation of digestion
   c release of glucose into the blood stream
   d increased respiration rate

5 Which of the following is an example of a situation that would lead to eustress?
   a receiving a telephone call with news of a much-wanted job
   b failing an important exam
   c being bullied at school
   d skydiving

6 Which of the following best defines distress?
   a stress that is experienced as negative
   b stress that can be positive or negative
   c stress that can lead to crying
   d stress that is also known as good stress

7 Selye's General Adaptation Syndrome has three distinct stages in the following order:
   a exhaustion, shock, countershock
   b alarm, resistance, exhaustion
   c alarm, shock, countershock
   d resistance, alarm, exhaustion

8 Which of the following statements about Selye's General Adaptation Syndrome is not correct?
   a Not all people go through its three stages.
   b If a person remains in the resistance stage for an extended period of time, their resources to deal with the stressor may become depleted and lead to the final stage of exhaustion.
   c When a person first becomes aware of a stressor, they enter the alarm stage where they immediately go into countershock.
   d People who are exposed to prolonged stress are more vulnerable to a stress-related illness.

9 Lazarus and Folkman's Transactional Model of Stress and Coping was:
   a based on the idea that the perception of stress is a uniquely individual experience
   b based on the idea that stress is due to a transaction between the environment and the stressor
   c developed to allow a person to use problem-focused strategies for coping and not emotion-based strategies
   d developed to better understand the biological processes involved in the stress response.

10 An individual might use an emotion-focused coping strategy to assist them to manage a stressful event. An example of an emotion-focused strategy would be:
   a working out what to do by writing up a list and looking at the pros and cons
   b looking for information on the internet to give further information on how to deal with the stressor
   c talking to family and friends
   d writing a resume and looking for a new job following a redundancy.

11 According to Lazarus and Folkman's Transactional Model of Stress and Coping, the recognition of a potentially stressful situation where the individual assesses whether or not the circumstances are stressful is known as:
   a fight-flight-freeze response
   b autonomic arousal
   c secondary appraisal
   d primary appraisal.

12 Which of the following statements is correct?
   a During stress the brain releases adrenalin, noradrenalin and cortisol.
   b During stress the pupils dilate, heart rate increases and digestion is suppressed.
   c During stress the bladder tenses and suppresses the urge to urinate.
   d During stress skin temperature decreases and glucose is released into the bloodstream.

13 Problem-focused coping strategies are usually viewed as:
   a practical and adaptive so that we can take charge of the situation
   b methods of managing the negative emotions that are elicited during stress
   c avoidant strategies where we deny that there is a stressor present
   d maladaptive because they don't let us deal with the stressor directly.

14 Zoe has decided to go on exchange during her second year at university. She is looking forward to going to a new country and making new friends as she has done this in the past. Zoe's ability to adapt to this potentially stressful situation demonstrates:
   a a love of travelling abroad and making new friends
   b coping flexibility where she is able to use a range of different coping strategies to deal with the situation
   c an emotion-focused coping strategy
   d none of these answers are correct.

15 The 'feel-good' chemicals that are released during strenuous exercise are known as:
   a endorphins
   b neurotransmitters
   c hormones
   d dopamines.

SHORT ANSWER

16 Explain the biological processes involved in the fight-flight-freeze response.

5 marks

17 Outline how Selye's General Adaptation Syndrome model contributed to our understanding of the relationship between stress and illness.

4 marks

18 Explain Lazarus and Folkman's Transactional Model of Stress and Coping in your own words, using a real-life example.

2 marks

19 Provide an example of how a person can alleviate stress by using emotion-focused coping strategies.

2 marks

20 If you were a health professional and a client came to see you suffering symptoms associated with prolonged stress, what would your recommendations be? Write a step-by-step program to help the person manage this stress more effectively.

6 marks

21 Using a real-life example, outline the potential problems that may arise if a person uses avoidant emotion-focused coping strategies to deal with a stressful situation.

4 marks

AOS 2
HOW DO PEOPLE LEARN AND REMEMBER?

Learning and memory are very complex functions that are essential for survival.

'Learning' refers to any lasting change in behaviour or knowledge that occurs as a result of experience.

'Memory' refers to the encoding, storage and retrieval of information, as well as retaining the ability to perform certain actions.

In this Area of Study, we examine the biochemistry and the psychology of how we learn, how we remember or forget, and how we can influence the extent to which we are able to maximise and minimise these processes.

Sometimes memory can fail – biological, psychological and social factors can influence the extent to which an accurate memory can be retrieved.

Outcome 2

On completion of this unit the student should be able to apply biological and psychological explanations for how new information can be learnt and stored in memory, and provide biological, psychological and social explanations of a person's inability to remember information.

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→ CHAPTER 05

THE NEURAL BASIS OF LEARNING & MEMORY

Imagine what it would be like to need to repeatedly learn the names of your friends and family, how to clean your teeth or how to use cutlery. For learning to stick, it needs to be stored in memory. Memory enables us to perform daily tasks and to remember information without having to learn it afresh every time we need to use it.

To understand how learning and memory-making actually occur, it is important to understand the changes that happen in the neurons of the brain.

KEY KNOWLEDGE

- neural plasticity and changes to connections between neurons (including long-term potentiation and long-term depression) as the fundamental mechanisms of memory formation that leads to learning
- the role of neurotransmitters and neurohormones in the neural basis of memory and learning (including the role of glutamate in synaptic plasticity and the role of adrenalin in the consolidation of emotionally arousing experiences)

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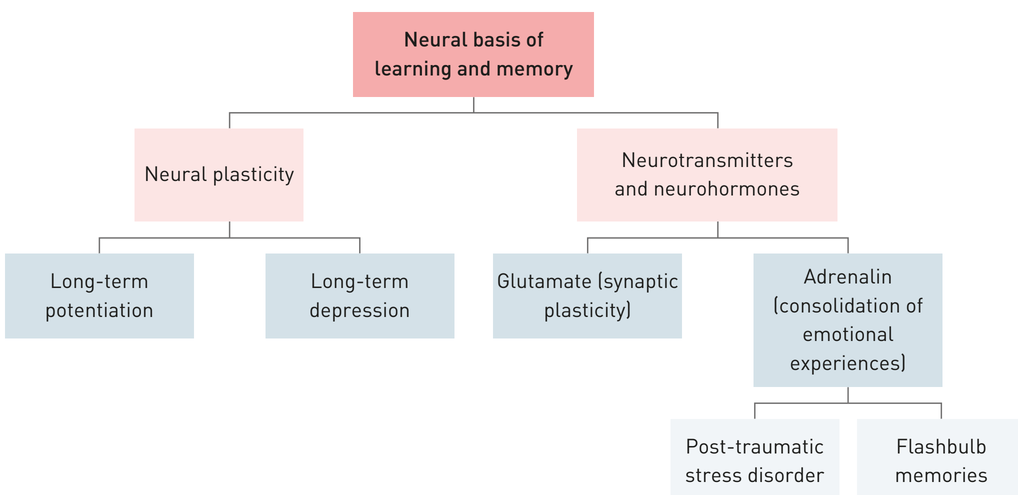
CHAPTER OVERVIEW

Neural plasticity in learning and memory formation	Long-term potentiation and long-term depression Synapse formation
Neurotransmitters and neurohormones in memory and learning	Glutamate and synaptic plasticity Adrenalin and emotional arousal

CONTENT MAP



Neural plasticity in learning and memory formation

The brain is capable of learning throughout the lifespan because of its **neural plasticity**. Neural plasticity refers to the way the brain changes in response to stimulation from the environment and is linked to the ability of the brain's synapses to be modified (Garrett, 2009). In the process of neural plasticity, **neural connections** are formed, removed and remade on a continual basis. Although researchers have yet to identify exactly how these changes occur, they have been able to identify the role of certain neurotransmitters and hormones in the process and the importance of the phenomenon of **long-term potentiation** described below.

Changes to the brain occur more frequently in the foetal stage and in babies, children and adolescents. This process, known as **developmental plasticity**, will diminish with age, however the association areas of the cerebral cortices retain plasticity throughout life as a result of what is known as **adaptive plasticity**. During this process, adult humans continue to develop synapses as a result of stimulating experiences and changes in their environment.

FIGURE 5.1 A child's brain has more plasticity than an adult's brain.

SUPPORTING UNDERSTANDING

Developmental plasticity refers to the sequence of stages that the human brain progresses through from **infancy** to adulthood. This sequence is:

> proliferation – in the foetus where neurons grow and divide
> migration – where the cells move to the position they will occupy in the developed nervous system
> circuit formation – where axons grow outwards and connect to adjacent neurons – neural impulses travel along these connections
> circuit pruning – at about ages two or three and again during early adolescence, circuits that have not been used are 'pruned'
> **myelination** – from childhood to early adulthood (about age 23), myelin sheathing is growing and insulating the axons.

SUPPORTING UNDERSTANDING

The work of Eric Kandel

The work of Eric Kandel and his colleagues showed the cellular basis of learning and memory formation in the aplysia (also known as the giant sea hare, or sea slug). The aplysia is ideal to study because its nervous system has only 20 000 very large neurons compared to more than one billion neurons in humans.

Kandel found that learning in the aplysia was demonstrated by strengthened synapses in the sensory neurons and motor neurons in response to the repeated touch of a glass rod. The greater the number of learning trials, the more readily activated its presynaptic and postsynaptic neurons became. The experiments by Kandel showed that the changes in the neurons of the aplysia lasted for several weeks. This was evidence of primitive long-term memory.

For more information, search PBS's NOVA website for 'The Memorable Snail' or follow the link in your obook.

Kandel was the first to show that in long-term memory formation and in learning, individual neurons change in their structure, increase the number of synaptic connections with other neurons, and strengthen the synaptic connections between each other. Kandel's research was done with a simple organism (aplysia), which has a brain structure that is very limited in its capacity to encode and store long-term memory. Human long-term memory formation and learning requires a highly sophisticated brain that has a large and complex cerebral cortex.

Kandel's work built on the research findings made 60 years earlier by Donald Hebb, who coined the Hebb (1949) rule: 'if an axon of a presynaptic neuron is active while the post synaptic neuron is firing, the synapse between them will be strengthened'.

According to the Hebb rule, memories are formed by anatomical changes to the neurons and their synapses. The stimulation of particular neurons leads to an increase in both the quantity and sensitivity of particular neuron receptors. The changes strengthen the synapse (the link between neurons) within a neuron network. The changes to the synapses also reduce the need for as much stimulation in one neuron to excite another in the future.

It is only in more recent times that the Hebb rule has been able to be investigated through the use of modern research techniques. The work by Kandel with a very simple organism like the aplysia enabled future research on the neural basis of memory and learning.

Did you know?

In the context of brain plasticity, **reorganisation** refers to a shift in synaptic connections that might alter the function of a particular area of the brain (Garrett, 2009). **Age-related memory decline** is not inevitable. The more different cognitive activities a person undertakes throughout life, and the more active their brain remains, the more plastic their brain will be.

Long-term potentiation and long-term depression

Before studying the role of neural pathways in learning it is essential that you refresh your knowledge of the anatomy of neurons and how information is passed between them (see Chapter 3).

LONG-TERM POTENTIATION

Long-term potentiation is the increased tendency of a group of neurons to fire together after they have been electrically stimulated at a particular electrical frequency (Bliss & Lomo, 1973; Teyler *et al*., 2005). This is because the synapse between them has been strengthened due to the previous 'firing' of them all in response to that frequency. Each time the same electrical frequency is administered, the same neurons 'fire' and the synapses between them become stronger again.

In long-term potentiation there is an increased release of the relevant neurotransmitter, increased receptor sensitivity, and increased changes to the structures of the relevant synapses. Long-term potentiation can last from a few minutes to a few months. It has mostly been studied in the hippocampus, but has also been found to occur in other parts of the cerebral cortex that are associated with memory and learning, including the visual, motor and auditory cortices.

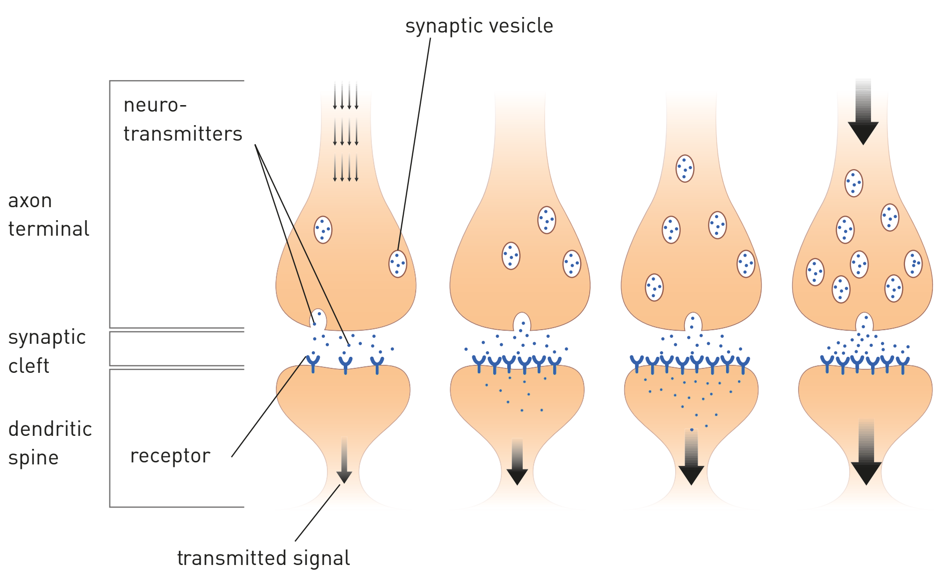


FIGURE 5.2 In this diagram of long-term potentiation, the arrows represent signal strength. As the neural pathway is used more and more, the signal transmitted across the synapse become stronger.

LONG-TERM DEPRESSION

Just as long-term potentiation can strengthen a synapse, a similar process can weaken an existing synapse – all that has to happen is for the frequency of the electrical stimulation to be reduced. Researchers have deliberately produced **long-term depression** by activating the presynaptic neuron with a low-frequency stimulation. In reality, it is more likely that long-term depression occurs because a neuron is firing out of synchronisation with other neurons. Some have argued that long-term depression plays an important role in clearing the brain of old memories to make room for new information to be learnt and new memories to be formed or older memories to be modified.

Synapse formation

Now that you have some understanding of long-term potentiation, it is easier to see how plasticity might occur and how important it is in the process of learning and memory formation at the synapse. Long-term potentiation results in either the creation of new **neural pathways** or the strengthening of existing ones. A neural pathway (also referred to as a neural tract) is a bundle of myelin-covered neurons (white matter) that provide a connection between one part of the nervous system and another.

When learning takes place (and depending on the type of learning), existing synapses are sometimes moulded or new synapses are formed in a process known as **synaptogenesis**. Synaptogenesis is particularly evident during early **childhood** but it is also evident in parts of an adult brain.

As you learnt in Chapter 3, the zone that acts as a link between two neurons is the synapse. It comprises the axon terminal of the presynaptic neuron, the synaptic gap, and the dendrite of the postsynaptic neuron. During learning, the terminal buttons of the presynaptic neuron release a neurotransmitter called glutamate into the synapse between the presynaptic neuron and the dendrites of a neighbouring postsynaptic neuron. As the process of learning and forming memory for new information or a new skill is acquired, the neurons form new connections with each other. This means that new 'sprouts' called 'filigree appendages' begin to grow from the axon terminal of a presynaptic neuron towards the dendrites of neighbouring postsynaptic neurons. This enables the newly learnt information to be transferred from one neuron to the next more efficiently. The more a particular neural pathway is activated during learning, the more likely it is to be strengthened, and the less likely the learning will be forgotten. This is what happens when, for example, you learn spelling, the multiplication tables or how to play a piece of music.

The research on the neurobiological basis of learning has really only just begun and there is much that still needs to be understood. As increasingly sophisticated research technology becomes available, a clearer picture will emerge of precisely what happens to neurons during the learning process. This might lead to all sorts of practical applications such as treatment of learning disabilities and psychological disorders such as anxiety, phobias and addictions.

Did you know?

Research has suggested that new neural pathways that are formed during learning will remain in place even if they are rarely used. The inactive neural pathway can sometimes be reactivated, enabling relearning of the same material at a faster rate.

FIGURE 5.3 Learning new things, such as how to play an instrument, requires the creation of new neural pathways or the strengthening of existing ones.

REVIEW 5.1

1 Explain what is meant by the term *neural plasticity*.
1 Distinguish *developmental plasticity* from *adaptive plasticity*.
2 Draw or use a graphics/multimedia package to create a detailed directional flow chart to show the neural steps involved in learning.
3 Explain the physical changes that take place in the brain as new learning occurs.

Neurotransmitters and neurohormones in memory and learning

Some neurotransmitters help memory storage while others can disrupt it. It is known that different types of memory and learning are assisted by the neurotransmitters, glutamate, serotonin and acetylcholine and the hormone adrenalin.

Glutamate and synaptic plasticity

Glutamate is the main excitatory neurotransmitter in the brain for learning. The role of glutamate in synaptic plasticity can be demonstrated using Skinner's study of rats in operant conditioning (see Chapter 7). As the hungry rat has learnt that it will receive a tasty food pellet each time it presses a lever, it is likely to press the lever repeatedly. In the rat's brain, the learnt behaviour (pressing the lever) to get the reward (food) causes the release of glutamate from the presynaptic neurons into the synaptic gap between the presynaptic and postsynaptic neurons.

The glutamate acts on two types of glutamate receptors in the rat's postsynaptic neuron: the AMPA receptor, which activates the postsynaptic neuron, and the NMDA receptor, which produces long-lasting modifications to the synapse. The repeated glutamate release also stimulates the release of dopamine, which in turn prompts growth in the rat's postsynaptic neuron of an increased number of dendritic spines. Dendritic spines are outgrowths from the dendrites in the synaptic gap (see Figure 5.4). These make the postsynaptic neuron more sensitive to future firing by neighbouring presynaptic neurons. Altogether, this process has the effect of increasing the efficiency of the neural pathways for the learnt behaviour.

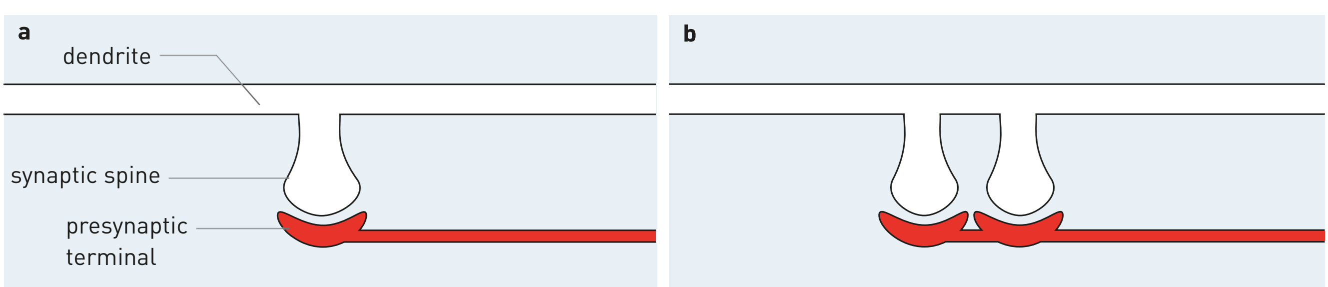


FIGURE 5.4 (a) A single synaptic spine on a dendrite (white) and a presynaptic terminal (red), and (b) the same spine split into two

Adrenalin and emotional arousal

Low amounts of adrenalin, secreted within 30 seconds of learning, have a role in the consolidation of memory. Emotions that produce adrenalin therefore have an effect on the strength of a newly forming memory. The memories that are formed under circumstances of emotional arousal are often vital to survival. For example, memory of an aggressive dog helps us to show caution about aggressive dogs in the future. Similarly, animals learn to fear predators when they are emotionally aroused through the release of adrenalin. However, too much adrenalin at the time of memory formation can be counterproductive to the consolidation of the memory.

THE ROLE OF ADRENALIN AND EPISODIC MEMORIES

Episodic memories are a form of declarative memory and encompass the autobiographical information we collect from our life experiences, such as of events and places. This is different from **semantic memory**, the other form of declarative memory, which relates to our knowledge of the world that we have not necessarily personally experienced, such as facts or concepts.

The role of adrenalin has also been investigated in relation to encoding episodic memories. If this hormone is present in the bloodstream during a highly emotional event, then it might enhance the encoding of the event. In some instances this can be helpful, such as learning to avoid a dangerous situation in future. However, in other circumstances it can be a problem, such as in the case of post-traumatic stress disorder (PTSD), which is a condition where victims suffer symptoms such as sleep disturbances and flashbacks due to a traumatic event.

FIGURE 5.5 Soldiers are at risk of developing post-traumatic stress disorder when exposed to traumatic situations.

FLASHBULB MEMORIES

Flashbulb memories are detailed, vivid and long-lasting memories of important or emotional events in our lives. Cahill and his colleagues (1994) investigated the **adrenalin** hormone that is released in the fight-flight-freeze response and found evidence to support the notion that flashbulb memories are indeed affected by adrenalin. The researchers found that participants who were shown an emotionally arousing image of a boy in an accident had a more enhanced memory of the event than the participants who were shown images that were not emotionally arousing.

INVESTIGATE 5.1

POST-TRAUMATIC STRESS DISORDER

A recent study (Maheu *et al.*, 2004) investigated the possibility that medication that blocks particular hormones in the body might assist in the treatment of PTSD. The research suggested that if a patient were given the medication within hours of the trauma, then their memory of the event may have been less intense than it otherwise would have been. Researchers also achieved some success in the treatment of patients with longstanding PTSD (Brunet *et al.*, 2008).

1 What was the aim of this research?
2 Write an experimental hypothesis for this study.
3 What did the researchers conclude?
4 Discuss two potential ethical issues that could arise in conducting this experiment.

REVIEW 5.2

1 What is glutamate and what role does it play in synaptic plasticity?
2 What hormone is linked with the fight-flight-freeze response?
3 How does emotional arousal influence the formation of memories?
4 How can the formation of memories during times of great emotional distress be problematic?

CHAPTER SUMMARY 05

- Neural plasticity refers to the way the brain can be modified.
- A neural pathway, or *neural tract*, is a bundle of myelin-covered neurons that join one part of the nervous system to another.
- Developmental plasticity refers to the development and consolidation of neural pathways in babies, children and adolescents.
- Adaptive plasticity refers to changes to the adult brain in response to interaction with the environment.
- Memory is formed due to biochemical changes in the synapses of the brain. These changes occur in response to the release of particular neurotransmitters and hormones such as serotonin, acetylcholine, glutamate and adrenalin.
- Long-term potentiation and long-term depression help our understanding of the neurological nature of learning and memory formation in humans and other mammals. Long-term potentiation describes the phenomenon whereby synapses are strengthened due to the fact that the associated neurons have fired together in the past. Long-term depression relates to a weakening of the synapse due to the related neurons having not fired together in the past.
- Changes at the synapse during learning include an increase in the number and sensitivity of receptors, the amount of a neurotransmitter that is released, and the number of dendritic spines in a neuron.
- The main excitatory neurotransmitter associated with learning is glutamate.
- Low amounts of adrenalin released shortly after learning has taken place are involved in consolidating memory.
- The encoding of memories due to adrenalin in times of high emotional arousal can be a problem, as in the case of post-traumatic stress disorder.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- adaptive plasticity
- adrenalin
- developmental plasticity
- glutamate
- long-term depression
- long-term potentiation
- neurohormone
- neuron
- neurotransmitter
- synapse
- synaptic plasticity
- synaptogenesis.

KEY KNOWLEDGE

For the exam, you must be able to show your understanding and apply your knowledge of:

- neural plasticity and changes to connections between neurons in memory and learning
- long-term potentiation and long-term depression in learning and memory
- neurotransmitters and neurohormones in memory formation and learning:
  - glutamat in synaptic plasticity
  - adrenalin in the consolidation of emotionally arousing experiences.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study
- be aware of ethical considerations in relation to researching neural plasticity of the brain.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Memory formation involves changes in the ____________ of the brain in response to certain ____________ being released.
- a structures; neurotransmitters
- b neurotransmitters; structures
- c synapses; neurotransmitters
- d structures; synapses

2 What does synapse formation during learning and memory formation involve?
- a proliferation
- b priming
- c myelination
- d strengthening of neural pathways

3 Which of the following neurotransmitters is most important in the neural basis of learning and memory formation?
- a adrenalin
- b seratonin
- c glutamate
- d melatonin

4 Studies have shown that learning often results in relatively permanent changes in the ____________ of animals' neurons.
- a myelin
- b synapses
- c neurotransmitters
- d soma

5 Plasticity of the brain is thought to occur:
- a only in children
- b only in response to medication
- c as a result of head injury
- d throughout life.

6 Long-term potentiation ____________________ synaptic strength, and long-term depression ____________________ it.
- a increases; also increases
- b increases; reduces
- c reduces; also reduces
- d reduces; increases

7 When learning occurs and memory is formed, changes occur in the brain, including:
- a pruning of synapses
- b formation of new synapses
- c long-term depression
- d myelination.

8 A 36-year-old man and a six-year-old boy are admitted to the emergency ward with identical brain injuries after falling from their bikes. The six-year-old is likely to recover more quickly because:
- a young people always heal more quickly than adults
- b the boy's brain is still undergoing developmental plasticity
- c adult brains lack plasticity
- d the boy will experience adaptive plasticity.

9 During learning all of the following will occur except:
- a an increase in neurotransmitter production
- b an increase in the sensitivity of the dendrites of the postsynaptic neurons
- c an increase in the number of synapses
- d a decrease in the sensitivity of the dendrites of the postsynaptic neurons.

10 Flashbulb memories are:
- a fleeting memories from when we were a baby
- b short-term memories that are formed when we are in danger
- c vivid, long-term memories of significant events in our life
- d short-term memories.

SHORT ANSWER

11 Describe a neural pathway.

2 marks

12 What is *synaptogenesis*?

1 mark

13 Research suggests that, as a result of learning, there is a strengthening of the neural pathways between neurons. What is likely to happen if the same type of learning continues?

2 marks

14 Two neurotransmitters that seem to enhance neural transmissions associated with memory and learning are ______________ and ______________.

2 marks

15 Describe the process of long-term potentiation and how it relates to learning.

4 marks

16 What is the difference between long-term potentiation and long-term depression?

2 marks

17 Why is glutamate so important for synaptic plasticity? What would happen to the brain without glutamate?

3 marks

18 What role does adrenalin play in forming memory and how might this assist in our survival?

3 marks

19 Describe how post-traumatic stress disorder might develop. Illustrate your answer with an example.

5 marks

→ CHAPTER 06

CLASSICAL CONDITIONING & THE 'LITTLE ALBERT' EXPERIMENT

Do you get a feeling of excitement when you smell newly cut grass at the beginning of spring? Does the sound of cicadas cause the same feeling? Do you know anyone who is allergic to cats or dogs? When people develop such an allergy, they often begin to sneeze as soon as they see one.

Stimulation of any of our senses can cause a reflexive response; this is the result of classical conditioning. Any time a stimulus that was originally neutral (that is, had no effect) now causes a behavioural or emotional reaction, classical conditioning has occurred. The conditioned responses may be physical (for example, sneezing) or emotional (for example, excitement).

KEY KNOWLEDGE

- 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, including stimulus generalisation, stimulus discrimination, extinction and spontaneous recovery
- the 'Little Albert' experiment as illustrating how classical conditioning can be used to condition an emotional response, including ethical implications of the experiment

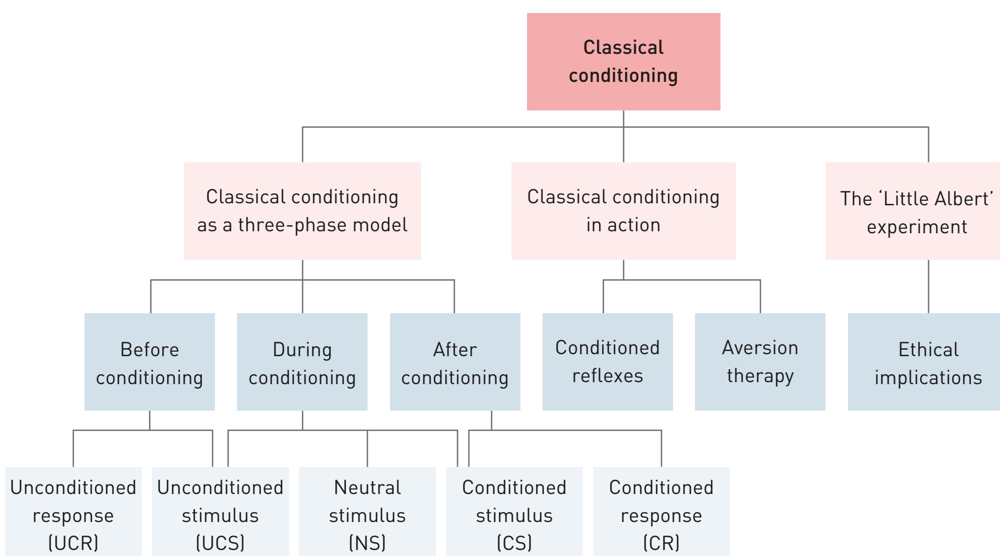
Extract from the *VCE Psychology Study Design* (2016–2021), p 25; © VCAA. Used with permission

Note: The 'Little Albert' experiment does not appear next to classical conditioning in the Study Design, but is presented in this chapter as it is a key example of classical conditioning.

CHAPTER OVERVIEW

Classical conditioning as a three-phase process	Pavlov's research > extinction > spontaneous recovery > stimulus generalisation > stimulus discrimination
Classical conditioning in action	Conditioned reflexes Aversion therapy
The 'Little Albert' experiment	John B. Watson and classical conditioning Ethical implications

CONTENT MAP



Classical conditioning as a three-phase process

> You start to feel anxious when you walk through the entrance of a hospital, even though you are only going to visit an aunt who has a new baby.
> You are driving with your P-plates when you hear a siren and see flashing lights behind you. You get a sinking feeling in your stomach but then realise, with relief, that it's a fire engine and not the police, so you pull over to let them through.
> Your dog salivates when he hears the microwave 'ping'.

All of these behaviours have been *learned* through a simple process known as **classical conditioning**.

Classical conditioning is a three-phase process that involves developing an **association** with a stimulus (or stimuli) that results in a learned response. These three phases are outlined in Table 6.1.

TABLE 6.1 The three phases of classical conditioning

PHASE	DESCRIPTION
First phase (before conditioning)	> Involves a response to a stimulus that has not yet been conditioned. It is natural or automatic > This is explained as an unconditioned stimulus (UCS) that results in an unconditioned response (UCR) > During this phase there is also a neutral stimulus (NS) that causes no response
Second phase (during conditioning)	> Involves the development of an association between the neutral stimulus (NS) and the unconditioned stimulus (UCS) > This causes the neutral stimulus (NS) to become a conditioned stimulus (CS)
Third phase (after conditioning)	> Results in the now conditioned stimulus (CS) producing a conditioned response (CR) as a result of its association with the unconditioned stimulus (UCS)

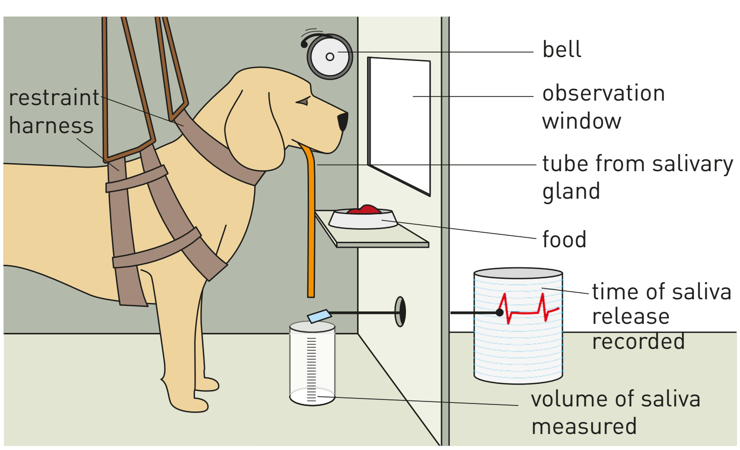


FIGURE 6.1 Pavlov's research with dogs provided evidence for a very simple type of learning that was based on the repetitive association of different stimuli.

Pavlov's research

Classical conditioning was first described in the early twentieth century. Ivan Pavlov, who had won the Nobel Prize for physiology in 1904, was continuing his research on the digestive system of dogs when he noted that the dogs salivated before they received food.

Pavlov hypothesised that the dogs had come to associate the footsteps of the laboratory technician who fed the dogs with the presence of the food that was given to them, and that this sound had been conditioned to cause the reflex response of salivation.

Originally, the stimulus (food) produced the response (salivation). Eventually, the sight or sound of the laboratory technician became the stimulus, which produced salivation. The salivation response, which is biologically based in the nervous system and occurs involuntarily (that is, it is a reflex response), had now been conditioned to become a new stimulus (the sight or sound of the technician).

Pavlov began to experiment by associating various sounds (a bell, a tuning fork and a metronome) with the food and found that, after a few trials, the dogs could be conditioned to respond to these sounds by salivating.

As a result of Pavlov's work, clear evidence was provided for a very simple type of **learning** that was based on the repetitive association of different stimuli – classical conditioning.

Pavlov also discovered that **extinction** would occur if the bell was rung many times without ever again being paired with the food. The amount of saliva produced each time the bell was sounded would gradually reduce until ringing the bell did not cause salivation at all.

Before conditioning

neutral stimulus (NS) *bell* → no response

unconditioned stimulus (UCS) *food* → unconditioned response (UCR) *salivation: due to food*

During conditioning

NS *bell* + UCS *food* → UCR *salivation: due to food*

Repeated pairings of these two stimuli

After conditioning

conditioned stimulus (CS) *bell* → conditioned response (CR) *salivation: due to bell*

FIGURE 6.2 The three-phase process of classical conditioning in Pavlov's experiment

After a pause of some hours, during which the bell was never sounded, ringing the bell again caused a small amount of saliva to be produced and **spontaneous recovery** had occurred.

Pavlov discovered that after a dog had been conditioned to salivate in response to the sound of a bell, it would also salivate when a buzzer was sounded, even though the buzzer had never been paired with the unconditioned stimulus of food. This was a demonstration of **stimulus generalisation**. If the buzzer was frequently sounded but never paired with the food, the dog would soon learn not to respond with salivation – extinction of that response would then occur. If the bell were still occasionally paired with the food, the dog would salivate to the sound of the bell but not the buzzer. **Stimulus discrimination** had now taken place.

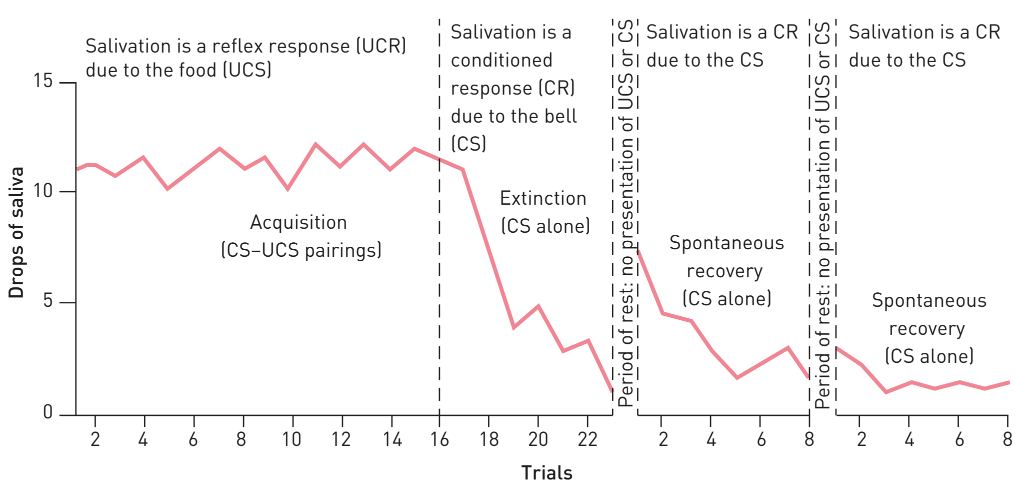


FIGURE 6.3 Learning (acquisition), extinction and spontaneous recovery in classical conditioning

1 Define *classical conditioning*.
2 Explain the difference between the neutral stimulus and the conditioned stimulus.
3 What happens at each of the three phases of the classical conditioning process?
4 Using your own examples, explain the following terms: extinction, spontaneous recovery, stimulus generalisation and stimulus discrimination.

6.1 REVIEW

Classical conditioning in action

Classical conditioning is happening all around us – and to us – all the time. For example, if you start to feel happy because you are walking down the street where your boyfriend/girlfriend lives, that's because you've been classically conditioned!

CASE STUDY

HUGO'S STORY

Consider the following true story.

Hugo, a middle-aged man, was walking along the footpath lost in thought, when a girl walked past him in the opposite direction. Hugo didn't even notice her but suddenly he caught her scent and experienced a feeling of pleasure. Realising that there was no obvious reason for this feeling he asked his friend, a psychologist, what had occurred.

'Did you recognise the scent?' asked the psychologist.

'Yes, it was the perfume my first girlfriend used to wear when I was 17!' Hugo laughed.

'That's it then,' replied the psychologist. 'You have been conditioned to experience feelings of pleasure in response to that particular scent!'

'What, after 30 years?'

'Oh yes, it has become a classically conditioned response. Unless it is extinguished, it will continue to happen – forever!'

Conditioned reflexes

The following are some common examples of the effects of classical conditioning:

> Any mother who has breastfed her baby will tell you about this response: when it is approaching feeding time and she hears or sees her baby, her breast milk will be suddenly 'let down' and start to flow from her.

> People who have been swooped by magpies will often develop feelings of anxiety when they see a magpie sitting in a tree and may even experience the anxiety when other birds are seen (stimulus generalisation). If this fear is reinforced by extreme swooping events, it may become strong enough to be a **specific phobia**.

Aversion therapy

Aversion therapy is an application of classical conditioning where a person with an unwanted behaviour learns to associate the unwanted behaviour with an unpleasant event. For example, in order to get a little boy to stop biting his fingernails, his parents may paint his fingernails with 'bitter aloes', a substance that tastes very bitter and causes a gag reflex, so that every time he bites his nails he almost vomits! This repeated association between fingernails in the mouth and gagging will soon cause the very act of bringing his hand to his mouth to stimulate gagging and the nail-biting behaviour will quickly stop.

Before conditioning

neutral stimulus (NS) → no response
fingers to mouth

unconditioned stimulus (UCS) → unconditioned response (UCR)
bitter aloes → *gagging reflex: due to bitter aloes*

During conditioning

NS + UCS → UCR
fingers to mouth + *bitter aloes* → *gagging reflex: due to bitter aloes*
Repeated pairings of these two stimuli

After conditioning

conditioned stimulus (CS) → conditioned response (CR)
fingers to mouth → *gagging reflex: due to fingers in mouth*

FIGURE 6.4 Aversion therapy: classical conditioning in practice

Did you know?

Phobias are created by classical conditioning.

A snake (**neutral stimulus**) can be associated with horror stories about snakes and danger (**unconditioned stimulus**), creating fear (**unconditioned response**). After several such stories, the snake (conditioned stimulus) creates fear (conditioned response) and classical conditioning has occurred.

6.2 REVIEW

1 List three examples of how classical conditioning may be used by parents to teach their children.
2 Explain the process used in aversion therapy in terms of the three-phase model of classical conditioning.
3 How is aversion therapy usually applied?

The 'Little Albert' experiment

In 1920, American psychologist John B. Watson carried out one of the most famous (and infamous) pieces of research in the area of classical conditioning and behaviourism.

'Little Albert' (a pseudonym), who was nine months of age, was 'borrowed' from a child care facility at the prestigious Johns Hopkins University. Little Albert, a placid child who was selected on the grounds that he had never been seen to cry, was placed on the floor in Watson's laboratory and allowed to play with a white rat. Little Albert showed no fear; nor did he respond negatively to other animals and objects such as a rabbit, a dog, a monkey, cotton wool and human masks. He did, however, show fear when a steel bar was struck with a hammer, making a loud noise just behind his back.

Two months later, Watson paired the rat with a loud noise by striking a steel bar with a hammer just behind Albert's head when he touched the rat. At first, although this caused Albert to jump in fear, he did not cry. After seven pairings of the rat and the noise (over two sessions, one week apart), Albert did cry. Soon afterwards, when the rat was presented but no noise sounded, Albert cried and tried to crawl away from it.

Little Albert also showed fear when presented with a dog, a rabbit, a fur coat and a Santa Claus mask, though it is interesting to note that the fear response was much reduced when he was in a different and much larger laboratory.

Details of the **'Little Albert' experiment** can be found on the York University website or via a link in your obook.

FIGURE 6.5 John B. Watson

Ethical implications

The research conducted by Watson in his 'Little Albert' experiment would certainly contravene many ethical principles that are in place today and is specifically addressed in the section on 'Research methods and ethical principles' (pages 36–38).

By today's standards, it is extremely unlikely that an ethics committee would approve an experiment such as Watson's. One of the most important ethical considerations in research, that no physical or psychological harm must come to participants, was undoubtedly ignored. Little Albert came away from the study psychologically damaged, with a fear of rats among other furry creatures and objects.

In addition, Watson failed to obtain **informed consent** from its participant, since Albert was too young to understand the terms of the experiment. Nor was permission sought from Albert's mother on his behalf. Additionally, Watson also failed to properly debrief Little Albert, which in this case would involve extinguishing the conditioned response to fear white and fluffy objects.

INVESTIGATE 6.1

VISUAL PRESENTATION

1 Use PowerPoint to create an animation or draw a series of cartoons to show the sequence of Little Albert's conditioning. Set your cartoon out in terms of the three phases of classical conditioning:

- before conditioning
- during conditioning
- after conditioning.

Use speech balloons or comment bubbles to explain each step in terms of classical conditioning and apply the following terms: neutral stimulus, unconditioned stimulus, unconditioned response, conditioned stimulus and conditioned response.

2 Conduct some research to find out who Little Albert was and what ended up happening to him.

REVIEW 6.3

1 What was the aim of the 'Little Albert' experiment?
2 Identify two ethical principles that were breached.
3 Explain why the 'Little Albert' study should not be considered a proper experiment according to scientific methods and principles you have learned in VCE Psychology.

CHAPTER SUMMARY 06

- Many behaviours can be learnt through a very simple process known as classical conditioning, discovered by Ivan Pavlov in the early twentieth century.
- Classical conditioning involves three phases: before conditioning, during conditioning and after conditioning.
- In his work with dogs, Pavlov experimented by associating various sounds with food and found that after a few trials the dogs could be conditioned to salivate when the sound occurred.
- Extinction will occur if the conditioned stimulus occurs many times without ever again being paired with the unconditioned stimulus.
- Spontaneous recovery is said to have occurred if, after a pause of some time during which the conditioned stimulus is never presented, reintroduction of the conditioned stimulus will again cause a low level of the conditioned response.
- If the stimulus that is similar to the conditioned stimulus is frequently presented but never paired with the unconditioned stimulus, there will soon be no response. If the conditioned stimulus is still occasionally paired with the unconditioned stimulus, the conditioned response will occur only with the conditioned stimulus, not with a similar stimulus. Stimulus discrimination has now occurred.
- Aversion therapy is an application of classical conditioning where a person with an unwanted behaviour (for example, nail-biting, alcoholism) learns to associate the unwanted behaviour with an unpleasant event. The repeated association between the unwanted behaviour and the unpleasant outcome stops the unwanted behaviour.
- One of the most famous cases in the area of classical conditioning was the research conducted by John B. Watson with Little Albert. When Little Albert was allowed to play with a white rat, he showed no fear. He did show fear, however, when a steel bar was struck with a hammer, making a loud noise just behind his back. When Watson paired the rat with a loud noise, Albert cried and, soon afterwards, when the rat was presented but no noise sounded, he cried and tried to crawl away from it. Albert also showed fear when presented with a dog, a rabbit, a fur coat and a Santa Claus mask, showing that stimulus generalisation had occurred. This experiment contravened many ethical principles that are in place today.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- after conditioning
- association
- before conditioning
- classical conditioning
- conditioned response
- conditioned stimulus
- during conditioning
- extinction
- the 'Little Albert' experiment
- neutral stimulus
- spontaneous recovery
- stimulus discrimination
- stimulus generalisation
- unconditioned response
- unconditioned stimulus.

KEY KNOWLEDGE

For the exam, you must be able to show your understanding and apply your knowledge of:

- classical conditioning as a three-phase process
- the 'Little Albert' experiment as an example of classical conditioning.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study.
- identify flaws in the experimental design of the Little Albert Study, including ethical considerations.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Classical conditioning was first described by:
  a B. F. Skinner
  b Ivan Pavlov
  c Sigmund Freud
  d Carl Jung.

2 Before conditioning involves a response to a stimulus that has not yet been conditioned. This can also be referred to as:
  a the unconditioned stimulus that results in the unconditioned response
  b the unconditioned response that results in the unconditioned stimulus
  c the unconditioned stimulus that results in the conditioned stimulus
  d the neutral stimulus that results in the unconditioned response.

3 After classical conditioning, learning not to respond to a stimulus that is similar but not identical to the conditioned stimulus is called:
  a response generalisation
  b stimulus generalisation
  c response discrimination
  d stimulus discrimination.

QUESTIONS 4 AND 5 REFER TO THE FOLLOWING INFORMATION:

Max, who was one of the first in his year to pass his test for his P-plates, was driving his friends home one day when one of them in the back seat turned on a blue flashing light. Max immediately went into a panic: his heart raced and his hands started to sweat. Soon, however, he realised that this was not a police car following him and he calmed down.

4 In terms of classical conditioning, what was Max's emotional reaction an example of?
  a an unconditioned response to the blue flashing light
  b a conditioned response to the blue flashing light
  c a neutral stimulus causing fear
  d an unconditioned stimulus causing fear

5 The fact that the response was shown to be a harmless stimulus that had not been experienced before suggests that this was a case of:
  a stimulus generalisation
  b stimulus discrimination
  c response discrimination
  d response generalisation.

6 In the process of classical conditioning, what is it an example of when the organism shows the response to a stimulus that is neither the original unconditioned stimulus nor the conditioned stimulus?
  a response generalisation
  b stimulus generalisation
  c response discrimination
  d stimulus discrimination

7 For several weeks, Tom's grandmother has been boarding his dog while he's been away on holidays. Tom's grandmother opens cans of dog food with her electric can-opener. When he brings his dog home, Tom notices that it begins to salivate when Tom turns on the electric fan in the laundry. After about five times of doing this, Tom turns on the fan and the dog does not respond. What has the dog demonstrated?
  a response discrimination followed by response generalisation
  b response generalisation followed by response discrimination
  c stimulus discrimination followed by stimulus generalisation
  d stimulus generalisation followed by stimulus discrimination

8 After two days in which he does not turn on the fan, Tom uses the laundry again. He turns on the fan and the dog begins to salivate. The dog has now shown:
  a response re-generalisation
  b response reacquisition
  c response relearning
  d spontaneous recovery.

9 In the process of classical conditioning, which of the following is likely to occur when the conditioned stimulus and unconditioned stimulus are no longer paired?

a The rate of responding will immediately decline.
b The rate of responding will become erratic at first and then show steady decline.
c The rate of responding will remain constant for a few trials and then decline.
d The rate of responding will decline at first and then remain steady.

10 Aversion therapy could be used to:

a help alcoholics to stop drinking alcohol
b help people to quit smoking
c stop children from biting their fingernails
d all of these answers are correct.

SHORT ANSWER

11 What is the three-phase model of classical conditioning?'

1 mark

12 Using the language of classical conditioning, explain exactly how Pavlov's dogs were conditioned to salivate at the sound of a bell.

3 marks

13 Gustav sometimes experiences headaches for which he takes paracetamol tablets. These work well and the headaches become much less severe. One day, he takes tablets and his headache clears as usual, but he later finds that he took sugar pills rather than paracetamol. Using the language of classical conditioning, explain why Gustav's headache may have been cleared by the familiar action of taking a tablet.

3 marks

14 Mary wants to stop smoking. She wears a thick rubber band on her wrist and every time she feels that she wants a cigarette, she snaps the rubber band. This causes a sharp pain that makes her feel anxious. After a few weeks, she does not think about cigarettes as the thought is unpleasant for her. Explain how Mary has successfully used classical conditioning to help her stop smoking cigarettes and provide the term for this type of therapy.

3 marks

15 Copy the following diagram and complete it to show how an advertising firm could use classical conditioning with the unconditioned stimulus of an attractive model to help sell a new sports car.

Before conditioning

NS ____________

UCS ____________ UCR ____________

During conditioning

NS

+

UCS ____________ UCR ____________

After conditioning

CS ____________ CR ____________

7 marks

16 The 'Little Albert' experiment breached some significant ethical guidelines. Suggest an alternative method of conducting this research that does not breach any of them.

3 marks

CHAPTER 07

OPERANT CONDITIONING AS A THREE-PHASE MODEL

We do the things we do because we have learnt to repeat the behaviours that bring the results we want and avoid the results we don't want.

- We study – to get good marks.
- We tell jokes – to make our friends laugh.
- We eat – so that we won't feel those nasty pangs of hunger.

The list of these is almost endless – and it's not only us. Our pets, farm animals, wild animals and any organism capable of performing a voluntary behaviour has learnt, through operant conditioning to repeat the actions that bring good results and to avoid performing those actions that bring unpleasant results.

Operant conditioning is also deliberately applied to help people and animals learn processes and procedures that improve quality of life.

Operant conditioning is a form of learning in which behaviour becomes controlled by its consequences.

KEY KNOWLEDGE

- operant conditioning as a three-phase model (antecedent, behaviour, consequence) involving reinforcers (positive and negative) and punishment (including response cost) that can be used to change voluntary behaviours, including stimulus generalisation, stimulus discrimination and spontaneous recovery (excluding schedules of reinforcement)

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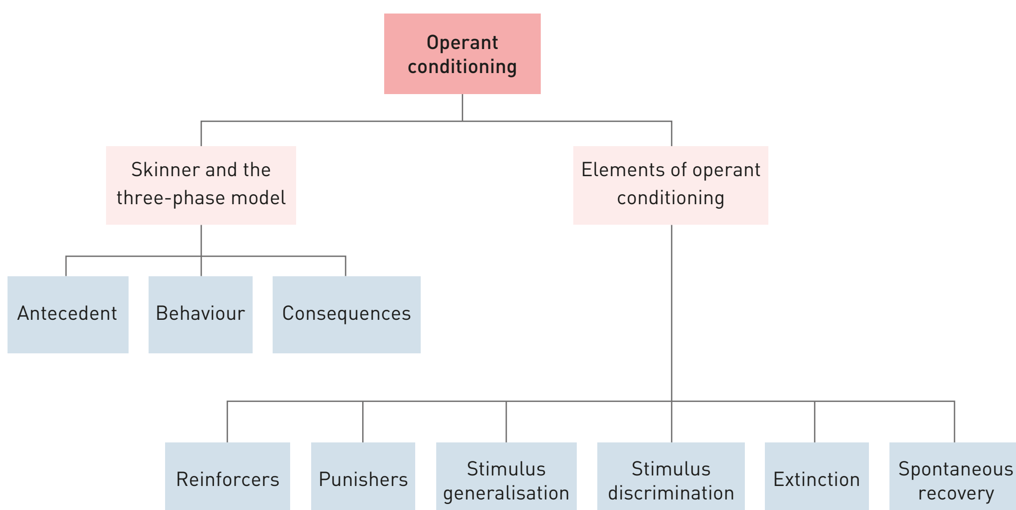
CHAPTER OVERVIEW

The three-phase model of operant conditioning	The A-B-C of operant conditioning
Elements of operant conditioning	Reinforcers and punishers > positive and negative Generalisation and discrimination Extinction and spontaneous recovery

CONTENT MAP



Did you know?

Unlike classical conditioning, the responses conditioned in operant conditioning must be voluntary behaviours (not reflexive behaviours). This means that the learner must be *active* for the learning to occur.

The three-phase model of operant conditioning

B. F. Skinner began experimenting with rats and pigeons in the 1930s.

He trained the animals to perform certain voluntary behaviours, such as turning in a circle when a light flashed or pressing a lever when a bell rang. He trained them by simply rewarding them with food if they performed the behaviour. After only a few training trials, the animals would perform the behaviour every time.

This type of learning is called **operant conditioning** because animals and people learn to operate on their environment to produce desired consequences. An operant is a response that occurs without any stimulus – this is a **voluntary behaviour** that acts upon the environment in the same way each time.

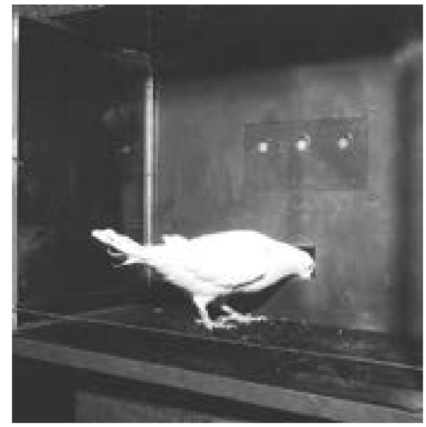


FIGURE 7.1 Skinner used pigeons in his experiments. The pigeons could be trained to press either the red or blue button to receive a food reward.

The A-B-C of operant conditioning

One thing that Skinner noticed was that the conditions needed to be right before the behaviour occurred. This can be referred to as the **three-phase model** or **A-B-C of operant conditioning**: the **A**ntecedent (the environment) that makes conditions right for the **B**ehaviour to follow and be reinforced (or extinguished) by its **C**onsequences.

Skinner used the term 'discriminative stimulus' to describe the antecedent (or the condition that influences behaviour by predicting the likely outcome of a behaviour). A good example of this is found when person Y wants to ask person Z out on a date. If Z has smiled at Y, laughed with Y and Z's body language generally has shown encouragement, Y will be more likely to show the behaviour (asking) that will lead to the consequence (accepting the invitation). The identification of the antecedent as a **discriminative stimulus** is important when we come to consider stimulus generalisation and stimulus discrimination in operant conditioning.

FIGURE 7.2 B.F. Skinner (Burrhus Frederic Skinner) was an American psychologist, behaviourist and author.

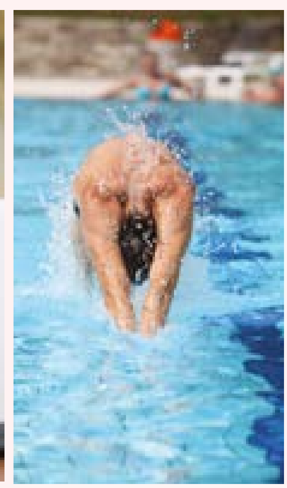
INVESTIGATE 7.1

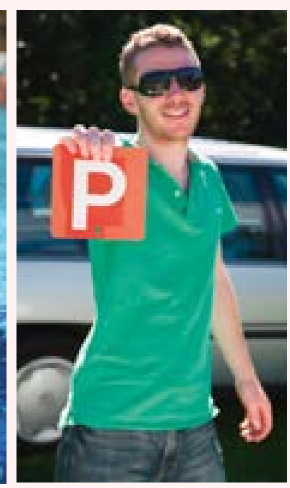
Consider the following scenarios:

- Scenario 1: Your blind friend's guide dog stops at the edge of the pavement until there are no cars passing.
- Scenario 2: You bring your girlfriend/boyfriend a special card for your six-month anniversary and you get a huge, loving hug.
- Scenario 3: Your parents offer to give you $50 for every SAC in which you get an A+; you work very hard!
- Scenario 4: You are training more than four hours each day to get into the AIS swimming squad.
- Scenario 5: When you first got your P-plates, you were excited to drive to all your friends' houses. A few weeks later, you got a letter saying you had been 'pinged' by a speed camera for doing 65 kilometres per hour in a 60 kilometres zone. You were fined over $175 and you lost one demerit point. Since then, you have become a very careful and observant driver.

  For each of the above scenarios, identify the behaviour and the consequences.

  Can you think of any scenarios of your own?





REVIEW 7.1

1 What is operant conditioning?

2 Identify the A, B and C in the following examples:

   a As I am driving to work, I see that the traffic light is red. I stop the car (and therefore avoid a traffic accident).

   b I am cold. I put on a jumper and feel warm.

   c Your mobile phone rings so you press the 'receive' button and talk to your friend.

   d Penny's mother often buys her a doughnut when they go to the shopping centre. When they went shopping the other day, Penny screamed and screamed until her mother gave her a doughnut. (Note: two people are being conditioned here. Provide an answer for both Penny and her mother.)

Elements of operant conditioning

Reinforcers and punishers

Reinforcers and punishers are key elements in operant conditioning. They may be either positive or negative.

Reinforcer: any stimulus (action or event) that strengthens or increases the likelihood of a response (behaviour).

> **Positive reinforcer**: a reward that strengthens a response by providing a pleasant or satisfying consequence. If you take a bite of a delicious piece of cake, you are very likely to have another bite.

> **Negative reinforcer**: the removal, reduction, or prevention of an unpleasant stimulus. If you wake up with a headache the day after a rock concert and are able to fix it by taking a headache tablet, it makes it very likely that you will take a headache tablet any time you want to get rid of a headache.

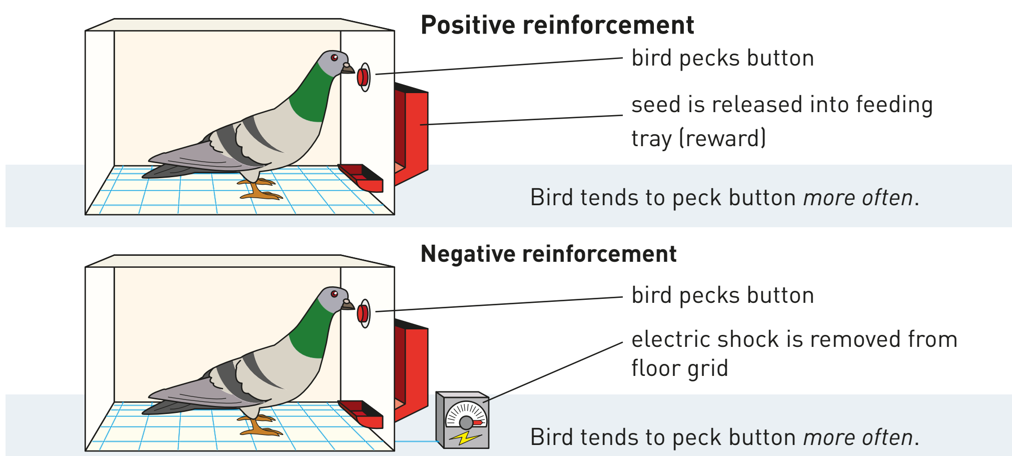


FIGURE 7.3 Positive and negative reinforcement

Punisher: any stimulus (action or event) that weakens or decreases the likelihood of a response (behaviour). Punishers are any consequences that lead to a decrease in a given response. The consequence does not need to be intended as a punisher! For example, a quiet student who is 'fussed over' by the teacher every time she offers a response in class, may see such attention as threatening (punishing) rather than rewarding (reinforcing), as the teacher had probably intended.

> Punishment (sometimes called positive punishment): a behaviour followed by a negative experience. For example, if you stand up quickly in an aeroplane and bang your head on the overhead luggage-locker, you will probably stand up more slowly and carefully next time! A parent yells at a child who has drawn on his bedroom wall; a mother cat picks up a kitten that has run away and shakes him.

> **Response cost** (could be called negative punishment): a form of punishment that entails something desirable being removed, such as being grounded (losing freedom), having your mobile phone taken away, or being fined for speeding on the roads (losing money).

PUNISHMENT AND NEGATIVE REINFORCEMENT

Punishment is distinct from negative reinforcement. Punishment decreases the probability of the response, while negative reinforcement (like positive reinforcement) increases the probability of a response.

Although both negative reinforcement and punishment involve an unpleasant stimulus (for example, a reprimand or a fine), it is considered punishment when this unpleasant stimulus follows the response (such as an inappropriate behaviour). It is considered negative reinforcement when the response (the behaviour) stops an existing unpleasant stimulus.

Several side effects result from punishment. Frustration, aggression and feelings of helplessness may develop in a person who is punished frequently, with the punished person feeling aggrieved and aggressive towards the person administering the punishment. For example, judges are sometimes targeted as victims by criminals they have sentenced to prison. Children may resent teachers or parents who have punished them – even if the punishment was fair and appropriate – and the effects on their interpersonal relationships may be wide-ranging and long-lasting.

Punishment can also have unintended outcomes. Administering the punishment may be an outlet for the frustrations of the punisher. Sometimes punishment is administered simply because it makes the punisher feel better, not because the person being punished deserves it.

Effective punishment needs to be brief, immediate and linked to the undesired behaviour in the mind of the person (or animal) being punished. It is only effective if a positive behaviour can be developed to replace the negative behaviour.

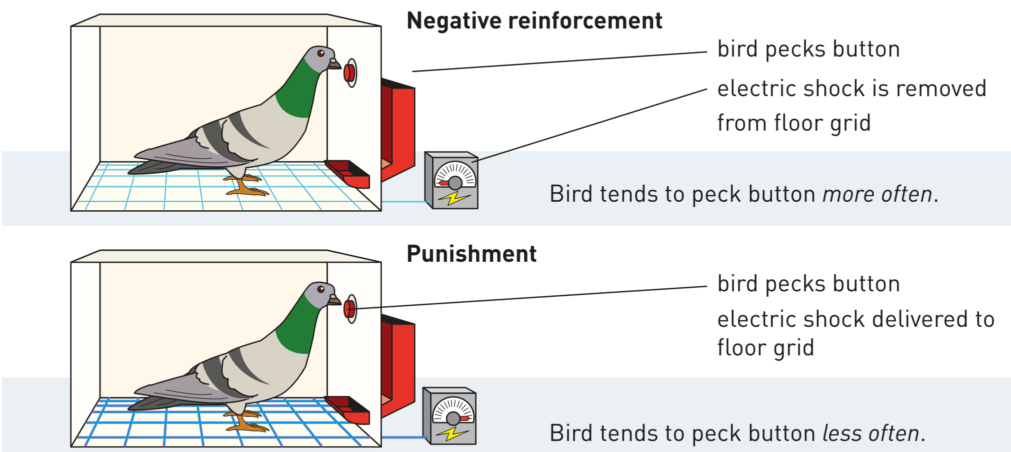


FIGURE 7.4 Negative reinforcement and punishment

INVESTIGATE 7.2

1 Identify which elements of operant conditioning (positive reinforcer, negative reinforcer, punishment and response cost) are present in the following scenarios:
   - a patting your dog on the head when he sits on command
   - b receiving a high score on your exam
   - c having your mobile phone confiscated after it rings during class
   - d turning the air conditioning on because you are hot.

2 Using the internet, research parenting strategies on how to discipline bad behaviour in children. You might find a blog, a newspaper article, or an online forum to answer the following questions.
   - a Identify one parenting strategy suggested for badly behaved children.
   - b Does it involve punishers or reinforcers?
   - c Apply what you know about operant conditioning to change or improve this strategy.

SUPPORTING UNDERSTANDING

Shaping – an application of operant conditioning

Shaping is a procedure in which a reinforcer is given for any response that gets closer and closer and eventually leads to the desired response or target behaviour. This is also known as the method of successive approximations.

Shaping in everyday life

Shaping is a very common and successful way of teaching children. We use shaping ourselves, all the time, to help us learn new skills.

For example, consider this situation. You are learning to play piano and you have a new piece of music you want to play perfectly. You attempt the new piece and play until you make a mistake. Next, you try again, making it a little further through the piece before making a mistake and feel good about your progress. The next time, you get a little further and feel good again. This goes on until you play it perfectly. You have been using shaping.

In terms of operant conditioning, the antecedent is that the piano is available for you; the behaviour is attempting the piece to be learnt; and the consequence is feeling good (positive reinforcement).

Animal training

You may have seen movies and television shows in which animals perform complicated and apparently very intelligent actions. You might have seen guide dogs helping their vision-impaired owners to live active lives. Perhaps you have seen *Border Security* or *Dog Squad* where working dogs perform amazingly skilful acts. All of these dogs have been trained using shaping procedures.

Dogs are not the only animals trained by this method – dolphins, cats, horses, birds, reptiles and even fish have been trained to perform on command.

The procedure for shaping is as follows:

1 Identify the 'target' or desired behaviour:
2 Identify steps that lead from the present behaviour to the target behaviour.
3 Reinforce the first step, then do not reinforce until the second is performed, and so on.

For example, imagine you are trying to train your dog to 'drop' on command. You might use the following shaping procedure:

1 Say 'drop' and give the dog a treat when he begins to put his haunches on the ground.
2 Say 'drop' but don't reinforce until his chest touches the ground.
3 Say 'drop' but don't reinforce until he stays down for two seconds.
4 Increase the time to 4, then 10, then 20 seconds before reinforcement.

Generalisation and discrimination

In operant conditioning, the terms 'stimulus generalisation' and 'stimulus discrimination' refer to the antecedent (the discriminative stimulus).

Stimulus generalisation is where a behaviour is elicited as a result of a discriminative stimulus that is similar (but not identical) to the original. For example, your dog, who normally comes running when the electric can-opener is used, might come running at the sound of the blender. Soon, if there is no reinforcement when responding to this noise, the dog will no longer act in this way with the blender, only with the can-opener – the dog has learnt stimulus discrimination.

Extinction and spontaneous recovery

Extinction is when the conditioned response disappears over time after reinforcement has ceased. For example, a child may learn that their use of a bad word causes the adults around them to laugh. They continue this behaviour for weeks, until the child's mother tells the adults to stop laughing and ignore the bad behaviour. After another few weeks, the child no longer says the bad word for attention. The child has learned a behaviour, which has later become extinct because it is no longer receiving reinforcement.

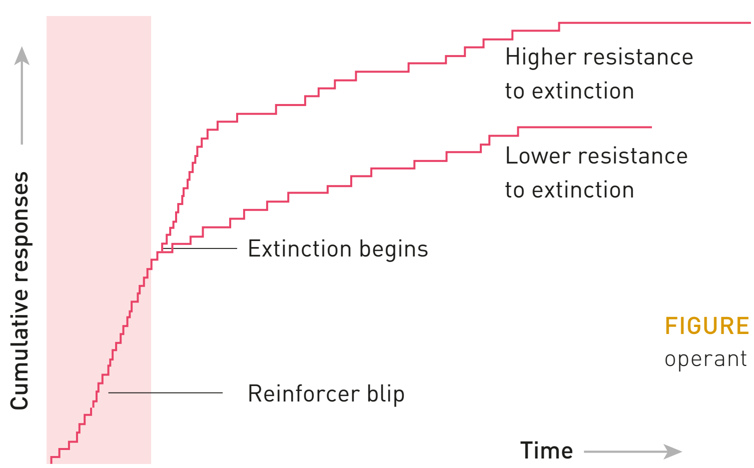


FIGURE 7.5 Extinction in operant conditioning

Spontaneous recovery is the reappearance of an extinguished response after a rest period. This might occur if the child from the previous example starts to use that same bad word after a break, regardless of it not getting a reaction from adults.

Spontaneous recovery shows that extinction of a behaviour is not 'unlearning'. Even though a behaviour or response might not occur for a time, it does not mean that the response has been forgotten.

Did you know?

For the most part, more than one complex behaviour cannot be taught at the same time. First, one simple behaviour is shaped, then another is added to it in the process referred to as *chaining*.

Suppose that you want your dog to 'drop and roll over'. First, you train the dog to drop. The next step is to train him to roll over, and add it to the 'drop' behaviour he has already been trained in.

7.2 REVIEW

1. What is the key difference between a reinforcer and a punisher?
2. Outline some possible side effects of punishment.
3. Outline the conditions necessary for punishment to be effective.
4. What is the difference between negative reinforcement and punishment?
5. Define *stimulus generalisation* and *stimulus discrimination*.
6. Explain the concept of extinction, giving two examples.
7. What does spontaneous recovery teach us about conditioning?

CHAPTER SUMMARY 07

- Operant conditioning is a form of learning in which consequences determine behaviour.
- Skinner trained animals to perform voluntary behaviours by rewarding the response with food. After only a few training trials, the animals performed the behaviour every time.
- Skinner developed the system of teaching and learning referred to as operant conditioning. He referred to the three-phase model, known as the A-B-C of operant conditioning, as involving:
  - the antecedent condition (discriminative stimulus)
  - the behaviour
  - the consequence.
- A reinforcer is a stimulus that strengthens or increases the likelihood of a response (behaviour). There are two types of reinforcers:
  - positive reinforcers: rewards that strengthen a response by providing an agreeable consequence
  - negative reinforcers: outcomes that strengthen a response by removing a disagreeable consequence.
- A punisher is a stimulus that weakens or decreases the likelihood of a response (behaviour). There are two types of punishers:
  - punishment (sometimes called positive punishment), which occurs when a behaviour is weakened because it is followed by a negative experience
  - response cost, which occurs when a behaviour is weakened because something desirable is removed.
- Side effects of punishment include frustration, aggression, feelings of helplessness and displacement of anger onto the person doing the punishing.
- Effective punishment needs to be short in duration, immediate and connected to the undesirable behaviour in the mind of the person (or animal) being punished. It is only effective if a positive behaviour can be developed to replace the negative behaviour.
- Stimulus generalisation is where a behaviour occurs as a result of an antecedent that is similar (but not identical) to the original.
- Stimulus discrimination is where the organism learns to avoid responding to an antecedent that is similar (but not identical) to the original.
- When the conditioned response disappears over time, after reinforcement has ceased, extinction is said to have occurred.
- When the extinguished response reappears after a rest period, spontaneous recovery is said to have occurred.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- A-B-C of operant conditioning
- antecedent conditions (discriminative stimulus)
- effective punishment
- extinction
- negative reinforcers
- operant conditioning
- positive reinforcers
- punisher
- punishment (positive or applied punishment)
- reinforcer
- response cost
- side effects of punishment
- spontaneous recovery
- stimulus discrimination
- stimulus generalisation
- three-phase model (of operant conditioning)
- voluntary behaviours.

KEY KNOWLEDGE

For the exam, you must be able to show your understanding and apply your knowledge of:

- operant conditioning
- the A-B-C of operant conditioning
- reinforcers and punishers
- extinction and spontaneous recovery
- stimulus generalisation and stimulus discrimination.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of operant conditioning to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 After a response has been extinguished, so that the antecedent no longer causes it to occur, it is possible that it may reappear when the stimulus is repeated after a few days. This is referred to as:
- a stimulus recovery
- b spontaneous recovery
- c stimulus relearning
- d spontaneous relearning.

2 In operant conditioning the learner must:
- a intend to learn
- b be active
- c know that learning is taking place
- d want to learn.

QUESTIONS 3 – 6 REFER TO THE FOLLOWING INFORMATION:

Jimmy is two years old and when his mother took him to the supermarket one day he saw some chocolate frogs and started screaming, 'Want frog! Want frog!' After 5 minutes trying to ignore him, his mother went to the checkout and bought a chocolate frog, which she gave to Jimmy. Jimmy sat quietly in the trolley and ate the chocolate.

3 Jimmy receiving the chocolate frog is likely to lead to:
- a Jimmy screaming out the next time they go to a supermarket
- b Jimmy screaming out the next time he sees a chocolate frog
- c Jimmy's mother feeling stressed the next time she has to go shopping
- d Jimmy being better behaved on the next visit to a supermarket, hoping to be rewarded with a chocolate frog.

4 In terms of operant conditioning, what has Jimmy's mother experienced?
- a punishment for the action of taking Jimmy to the supermarket
- b positive reinforcement for the action of giving Jimmy the chocolate frog
- c negative reinforcement for the action of giving Jimmy the chocolate frog
- d reinforcement for the action of taking Jimmy to the supermarket

5 The next week, Jimmy and his mother go shopping at a hardware store. As soon as he is put in the child seat in the trolley, Jimmy starts screaming, 'Want frog! Want frog!' In terms of operant conditioning, Jimmy is exhibiting:
- a response generalisation
- b stimulus discrimination
- c response discrimination
- d stimulus generalisation.

6 When Jimmy and his mother went shopping at the hardware store, the entrance to the shop and being put in a trolley acted as a(n):
- a generalised response
- b antecedent
- c behavioural consequence
- d predictive stimulus.

7 Specific phobias are very difficult to treat because every time a person encounters the phobic object, they become anxious and avoid it, which makes them feel relief. This means that people with specific phobias are:
- a negatively reinforced for avoiding the phobia object
- b positively reinforced for avoiding the phobia object
- c maintained by classical conditioning
- d acquired by operant conditioning.

8 A Grade 2 teacher has set up a star chart for her whole class. There is a long list of behaviours for which children can earn a star and, at the end of each day, they can exchange their stars for treats. This system is a form of ______________ and the stars are ___________________.
- a operant conditioning; negative reinforcers
- b behaviour therapy; positive rewards
- c operant conditioning; positive reinforcers
- d behaviour management; negative rewards

9 A major difference between negative reinforcement and punishment is that:
- a negative reinforcement requires delivery of a negative consequence
- b negative reinforcement weakens a response
- c punishment requires removal of a positive consequence
- d punishment weakens a response.

10 Extinction of a behavioural response may be achieved through:
- a removal of all reinforcers for the behaviour
- b reinforcing only alternative behaviours
- c punishing the behaviour
- d all of the answers are correct.

SHORT ANSWER

11 Negative reinforcement and punishment are often confused with each other.
- a Identify two ways in which negative reinforcement and punishment are different.

  2 marks
- b Show these differences by giving an example of negative reinforcement and an example of punishment.

  2 marks

12 Dorothy is teaching her dog Toto to sit. Every time Toto sits when he is told to do so, Dorothy gives him a treat.
- a What form of conditioning is being used?

  1 mark
- b What form of reinforcement is being used?

  1 mark

13 What is meant by extinction in operant conditioning? Explain using an example.

2 marks

14
- a Give an example to show stimulus generalisation in operant conditioning.

  1 mark
- b Give an example to show stimulus discrimination in operant conditioning.

  1 mark
- c Give an example to show spontaneous recovery in operant conditioning.

  1 mark

15 Use an example to explain the concept of response cost as a punishment.

1 mark

16 What is a possible unexpected outcome of punishment as it relates to the punisher themselves?

2 marks

17 Describe three characteristics of effective punishment.

3 marks

18 Suggest a method for training a dog to bark using the three-phase model of operant conditioning.

3 marks

19 What is one key difference between operant conditioning and classical conditioning?

2 marks

CHAPTER 08

OBSERVATIONAL LEARNING AS A METHOD OF SOCIAL LEARNING

Is it possible to learn without direct participation in the process? Do classical and operant conditioning theories explain all forms of learning? How do people learn to use machinery or even simple items such as cutlery? Would it be wise for a learner driver to simply hop in a car and learn how to drive or for a child to use power tools, such as electric drills or electric knives, by trial and error?

KEY KNOWLEDGE

> observational learning as a method of social learning, particularly in children, involving attention, retention, reproduction, motivation and reinforcement

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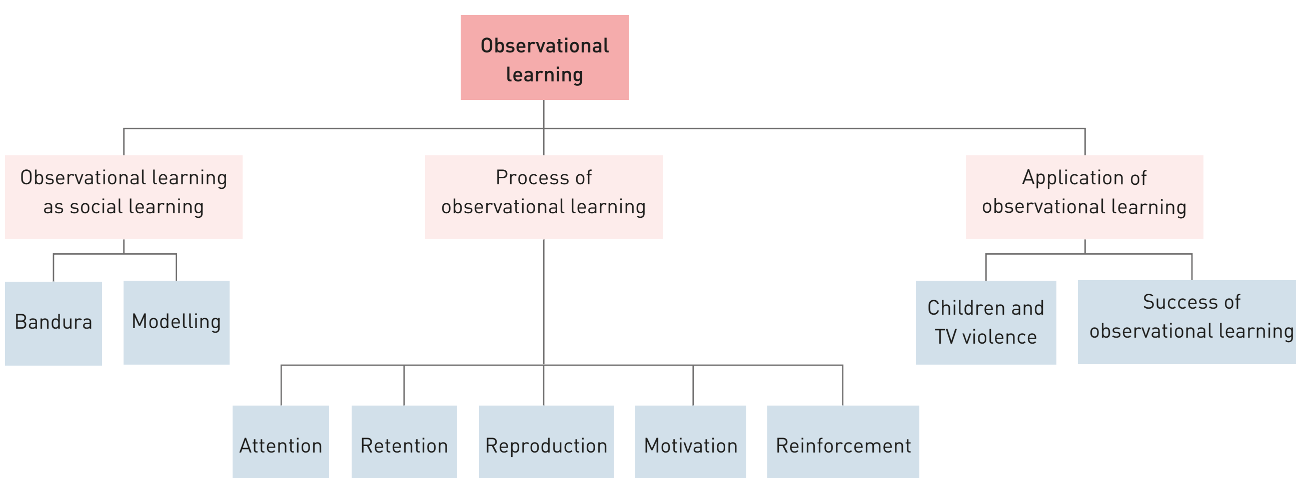
CHAPTER OVERVIEW

Observational learning as a form of social learning	Social learning theory and the 'Bobo doll' experiments Observational learning
The process of observational learning	Attention Retention (in memory) Reproduction (of the behaviour) Motivation Reinforcement
Application of observational learning	Children and television violence Success of observational learning Comment on observational learning

CONTENT MAP



Observational learning as a form of social learning

Most people learn to use cutlery by observing other experienced people using it. Similarly, it is common for children to spend many years as a passenger in a motor vehicle observing their parents' driving. This tendency to observe and mimic others is known as **observational learning** and is highlighted by advertising campaigns aimed at reducing the likelihood of children growing up adopting, for example, the same unhealthy **alcohol** consumption habits as their parents.

FIGURE 8.1 How do people using powerful machinery or motor vehicles first learn to operate them?

Social learning theory and the 'Bobo doll' experiments

FIGURE 8.2 The Bobo doll is an inflatable toy about 1.5 metres tall, designed to spring back upright when knocked over.

In the 1960s, psychologist Albert Bandura and his colleagues conducted a series of experiments in which they observed that children appeared to learn by watching the behaviour of others. Bandura's experiments have become classic studies and are known as the 'Bobo doll' experiments because they involved a large, inflatable plastic doll named 'Bobo' that was about 1.5 metres high and designed to spring back upright when knocked over. In the experiments, the children were shown an adult (the model) behaving aggressively to a **Bobo doll** – hitting it, throwing it, sitting on it, etc. The children were then placed in a room alone with a Bobo doll and their behaviour was observed. There was evidence that learning had occurred when the children behaved aggressively to the Bobo dolls just as they had observed the models doing.

The results of the 'Bobo doll' experiments led Bandura to develop **social learning theory** in which he acknowledged the importance of classical conditioning and operant conditioning in learning, but added that learning also occurred through direct observation or observational learning (Bandura, 1977).

INVESTIGATE 8.1

Do an internet search to find an audio recording of Albert Bandura describing the 'Bobo doll' experiments. You may also be able to find a video clip. Write out the steps in the experiment in your own words.

Observational learning

Social learning is the process by which social influences alter people's thoughts, feelings and behaviour. Observational learning is defined as the means of acquiring this social learning. Children develop their attitudes by observing those expressed by other people who are important to them – such as parents and teachers – and by the consequences they observe for these people when they express these attitudes (Bandura, 1977). When the observer demonstrates the learnt behaviour by imitating it, this is referred to as **modelling** (Bandura, 1967).

FIGURE 8.3 Children learn by imitation.

The four principles of observational learning are as follows:

1 Learning occurs by observing the behaviour of others and the consequences of those behaviours.
2 Learning can occur without there being an immediate change in behaviour – it can remain *latent*.
3 Cognition plays a role in observational learning because the learner has awareness and expectations of future reinforcements or punishments, and these can influence whether the learnt behaviour will be demonstrated.
4 Observational learning is a link between the behaviourist theories of learning (classical conditioning and operant conditioning) and cognitive learning theories.

REVIEW 8.1

1 Describe observational learning as a form of social learning.
2 Who are the main sources of models for observational learning?
3 How does the concept of modelling relate to observational learning?
4 Create one of the following to illustrate your understanding of the steps involved in the observational learning process. You must use your own example:
   - directional flow chart with text and pictures
   - PowerPoint presentation with text and pictures
   - animation with figures and captions/bubbles.

The process of observational learning

In observational learning, as in operant conditioning, the learner plays an active role in the learning. There are five key processes that are necessary for observational learning: attention, **retention,** reproduction, motivation and reinforcement (see Figure 8.4).

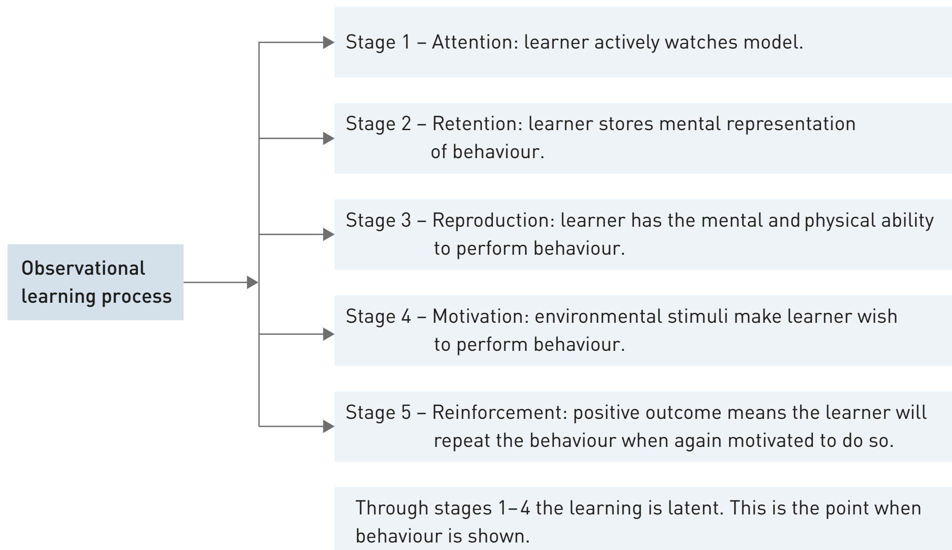


FIGURE 8.4 The key stages of observational learning

Attention

Attention must be paid to the model's behaviour and its consequences. This is a *cognitive* aspect of observational learning. For example, a child might concentrate on a parent (model) making pancakes for breakfast. Attention can be influenced by characteristics of the observer such as perceptual and cognitive capabilities, and arousal level. It is also important to consider characteristics of the model – if the learner likes the model and wishes to be like them, the learner is likely to pay careful attention. The observational learning process can also be influenced by characteristics of the event.

Retention (in memory)

The learnt behaviour must be stored in memory as a **mental representation** (understanding of what to do in the mind of the learner) so that the observed learning can be utilised at a later time. This is also a *cognitive* aspect of observational learning because the memory must be stored and later retrieved to reproduce the behaviour. For example, the child might remember the ingredients and procedure for making pancakes.

Reproduction (of the behaviour)

Note that the learner does not perform this behaviour at this time. Reproduction simply means that they have the physical and intellectual ability to convert these mental representations into actions. For example, the child must be old enough to be able to use the kitchen equipment for making pancakes.

Motivation

The learner must *want* to imitate the learnt behaviour. This will depend on whether the learner believes that there will be a desirable consequence (reinforcement) for reproducing it.

Reinforcement

When there is the prospect of a positive result for imitating the behaviour (that is, a reward for the learner), it is likely that the learner will do so. In contrast, if there is a prospect of punishment for reproducing the learnt behaviour, it is less likely that the behaviour will be imitated. For example, the child must perceive that praise will be given for making the pancakes or that there will be personal pleasure in eating the pancakes.

Reinforcement influences the likelihood that a learner will imitate an observed model's behaviour. The *expectation* of reinforcement or punishment influences the cognitive processes of the observer and this affects how well the learner pays attention to and retains the memory of the model's behaviour.

Reinforcement for imitating the model's behaviour can come from several sources:

> the model – for example, a parent praises the child for imitating their behaviour
> a third person – the observer might have imitated the behaviour of another person, such as a television personality or leader, but receives praise for the behaviour from a parent or teacher
> personal – the imitator receives satisfying consequences as a result of imitating the model's behaviour
> vicariously – positive consequences received by the model increase the likelihood of the observer imitating the model's behaviour, whereas negative consequences for the model's behaviour will decrease the likelihood of the observer imitating the model's behaviour.

FIGURE 8.5 Observational learning process: (a) Attention – the child actively watches the model's behaviour; (b) Retention – the child must store a mental representation of the learnt behaviour; (c) Reproduction – the child must be physically and mentally capable of reproducing the learnt behaviour; (d) Motivation and reinforcement – the child must perceive that there will be a reward for reproducing the learnt behaviour. After producing the behaviour, a positive outcome will cause it to be repeated (reinforcement).

8.2 REVIEW

1 How is observational learning similar to operant conditioning?
2 Describe the role of attention in observational learning.
3 Give an example of each of the following in action:
  a attention
  b retention (in memory)
  c reproduction (of the behaviour)
  d motivation
  e reinforcement.

Did you know?

Research has indicated that, for observational learners, some of the same neurons are active when observing the learning of others as when the observer is conducting the same behaviour themselves. When a model receives conditioned reinforcers for a behaviour, similar neurons in the observer's brain also strengthen.

Carlson *et al.*, 2007

Application of observational learning

Observational learning means that role models (both fictional and real) are powerful sources of influence on the behaviour of others, especially impressionable people, including children. This helps to explain why physical punishment might lead to aggressive behaviour on the part of those who were punished – for example, parents who physically punish their children may unintentionally be modelling aggressive behaviour that their children will imitate. Examples where models can influence the *positive* behaviour of observers include parents reading to their children, demonstrations of problem solving, moral thought and behaviour, and appropriate social behaviour.

FIGURE 8.6 Basketball star Liz Cambage is a relevant model for sports fans, and her image ensures desired attention and retention for advertisers.

Children and television violence

Bandura's work had important implications for the debate about the influence of television violence on young children. Children are more likely to pay attention to advertisements where relevant models are present in them. Bandura explored the idea that televised aggression may have adverse effects on children's behaviour. He found, for example, that children are more likely to copy another's behaviour if the model is similar to them in age and sex or if the model has desirable characteristics and is seen as attractive (Bandura, 1977). This is particularly important when considering the number of hours children spend watching visual media each week.

The good news is that if a child's development is influenced through observational learning and by their media viewing, then it also has the potential to act as a positive influence.

Success of observational learning

According to social learning theory, the following elements are important for observational learning to be successful or not:

- For the behaviour to be copied, the model must be seen to be rewarded for the appropriate or inappropriate social behaviour. Models who are seen to be rewarded for their behaviour are more likely to be copied than models who are seen to be punished, or where there is no follow-up.
- The model must be appropriate for the learner (appropriate models for a child might be parents, siblings or peers).
- The learning can occur in real life, or through behaviour modelled in film or on television.

This is why, for society, it is important to be aware of the potential influence of role models, especially on children. It is also important that role models who behave in anti-social ways are seen to receive negative consequences.

Bandura's research has had a major influence on the study of aggression. If violence is learnt, then exposure to people behaving aggressively may lead others to imitate the aggression. Being aggressive can also become an established way of behaving within families and social groups. However, on a positive note, if violent behaviour can be learnt, then it can also be controlled, reduced or managed through appropriate social learning.

The following article reports research suggesting that children learn their attitudes to smoking from their parents' responses to other people smoking (operant conditioning). In addition, where parents are smokers, it is more likely that their children will smoke and vice versa (observational learning, discussed below).

Read the article, and think about how it demonstrates observational learning in attitude formation.

FIGURE 8.7 Children are more likely to copy another's behaviour if the model is similar to them in age and sex.

TEENAGERS DO LISTEN TO THEIR PARENTS WHEN IT COMES TO SMOKING

BMC Public Health
3 March 2009

Parents can help their teenagers to never start smoking. A Swedish study published in the open access journal *BMC Public Health* has found that adolescents respond positively to their parents' attitudes towards smoking.

The research, carried out by a team led by Maria Nilsson of Umea University, Sweden, used statistics obtained from three national surveys conducted by the National Board for Health and Welfare and the Swedish National Institute of Public Health in 1987, 1994 and 2003. The surveys explored the attitudes, beliefs and tobacco use of teenagers across Sweden. Responses were obtained from young people aged 13, 15 and 17 years old, with 1500 adolescents in each age group. A total of 13 500 adolescents were surveyed. The aim of the study was to determine adolescent attitudes towards parental intervention on tobacco use in Sweden and to see if these have changed over time.

Teenagers are more positive today towards their parents' attempts to discourage them from smoking, regardless of whether or not they smoked, than in the past. The most effective actions parents could take include dissuading their children from smoking, not smoking themselves and not allowing their children to smoke at home. Younger children were more positive about these approaches than older children. Levels of smoking among participants were stable at 8 per cent in 1987 and 1994, but halved in 2003. The decrease in the proportion of teenagers smoking is thought to result from a number of factors, including changes in legislation and the decreasing social acceptability of smoking.

Use of snus, a type of moist snuff, remained relatively constant. Fewer teenagers thought their parents would be concerned about snus use, probably reflecting a general perception that snus is less of a health hazard than smoking. Unsurprisingly, older children were more likely to smoke or use snus than younger children.

The authors of the study concluded that the prevalence of smoking in adolescents in Sweden has fallen and an increasing number of teenagers have never smoked. 'The fact that adolescents respond positively to parental attitudes to smoking is encouraging,' says Nilsson. 'Parents should be encouraged to intervene with respect to their children's tobacco use.' The findings are contrary to suggestions that children resent interventions by their parents to discourage them from smoking.

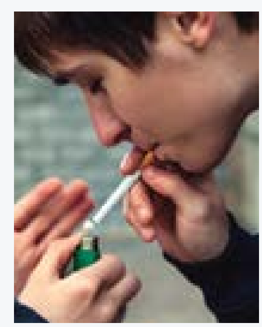


FIGURE 8.8 Teenagers may listen to parents about the dangers of smoking, but it is still more likely that children of smokers will also smoke.

SUPPORTING UNDERSTANDING

Observational learning versus operant conditioning

Differences

Direct versus indirect learning

While operant conditioning emphasises the importance of the organism's *direct* experience when learning, observational learning suggests that learning can occur *indirectly* through observation. For example, an employee who sees a colleague receive a promotion for hard work might also begin to work harder to receive a promotion.

Observable versus unobservable evidence of learning

Unlike operant conditioning, in observational learning there is a distinction between *learning* and *performance*. In observational learning, learning can occur but is not necessarily demonstrated or observed unless there is a motivation for the organism to demonstrate the learnt behaviour. There are many examples where people have learnt through observation but never actually perform the learnt behaviour. Therefore, a distinction is made between the *acquisition* and *performance* of a behaviour that has been learnt through observation.

The role of cognition in learning

Unlike operant conditioning, observational learning includes the role of *cognition* (thinking and memory) in the learning process. In observational learning, the learner must attend to a model's behaviour and its consequences and then store a mental representation of it.

Similarities

Active learning: the role of the learner

Observational learning is similar to operant conditioning in that the learner is active in both of these learning processes. For example, the employee who observes a colleague being rewarded with a promotion for hard work will deliberately work hard or change their working habits so that they might also be rewarded with a job promotion.

Reinforcement

As with operant conditioning, in observational learning it is *reinforcement* rather than the learning itself that influences the likelihood of the observed behaviour being imitated by the observer. If the learner observes a model receiving a favourable consequence for the behaviour, the learner will be more likely to imitate their behaviour. This is known as *vicarious conditioning* where an observer learns the consequences of a behaviour by observing its consequences for another.

Comment on observational learning

Observational learning introduces the role of cognition to the theories of the learning process. Unlike operant conditioning, Bandura's work has shown that people are active in their learning, and that observational learning is not simple mimicry alone. Instead, the learner retains in memory the general principles of what they have observed. However, observational learning does not provide us with information about the nature of these cognitive processes. Instead, it tends to emphasise the role of the environment and factors external to the learner.

8.3 REVIEW

1 Describe three ways in which parents may influence their children as a result of observational learning.
2 Explain what would be expected to happen if a child watched a lot of violence on television, according to social learning theory.
3 What conditions are required for observational learning to be successful?

CHAPTER SUMMARY 08

- Social learning theory suggests that it is possible for people, especially children, to learn through observing the behaviour of others.
- Observational learning occurs when someone uses observation of another person's actions and the resulting consequences to guide their future actions.
- When the observer copies the observed behaviour, this is referred to as modelling.
- Observational learning is dependent on the processes of attention, retention, reproduction, motivation and reinforcement. Learners play an active role in the learning process. They must:
  - pay attention in order to observe the modelled behaviour
  - mentally represent and retain what has been observed
  - convert these mental representations into actions (that is, reproduce them).
- Reinforcement influences the learner's motivation to perform the learnt behaviour.
- According to social learning theory, the following elements are important for the success of observational learning. The model:
  - must be seen to be rewarded for the appropriate or inappropriate social behaviour
  - must be appropriate for the learner (for a child, this might be parents, siblings or peers)
  - could be from real life or from the media.
- Observational learning has a cognitive component, which is evident in the attention and retention processes. However, social learning theory does not attempt to explain the nature of children's cognitive processing when learning is taking place.
- Bandura's 'Bobo doll' experiments informed debate on the effect of both live and television role models on the learning of children.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- attention
- modelling
- motivation
- observational learning
- reinforcement
- reproduction
- retention
- social learning.

KEY KNOWLEDGE

For the exam, you must be able to show your understanding and apply your knowledge of:

- observational learning – principles and processes
- the role of attention, retention, reproduction, motivation and reinforcement in observational learning
- the application of observational learning in children, including examples.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Who was the psychologist who pioneered the research on observational learning?
   a Thorndike
   b Skinner
   c Pavlov
   d Bandura

2 Observational learning suggests that people imitate a model because of ______________ and ______________: those received by the model as well as by the imitators.
   a reflexes; punishments
   b aggression; rewards
   c rewards; punishments
   d reinforcers; aggression

3 Observational learning might help explain why ______________ parents might have ______________ children.
   a abusive; passive
   b passive; abusive
   c abusive; aggressive
   d aggressive; aggressive

4 Models are most effective when they are perceived as ______________ or ______________ by the observer.
   a similar; successful
   b similar; male
   c male; consistent
   d successful; flattering

5 Observational learning differs from operant conditioning because it includes a ______________ process.
   a cognitive
   b passive
   c respondent
   d reinforcement

6 Which is the correct sequence for learning by observational learning?
   a attention, retention, reproduction, motivation, reinforcement
   b attention, retention, motivation, reproduction, reinforcement
   c attention, retention, reinforcement, reproduction, motivation
   d attention, retention, reproduction, reinforcement, motivation

7 Which of the following statements about observational learning is incorrect?
   a Learning takes place through the observation of another's behaviour and the consequences of that behaviour.
   b In order for the process to be described as observational learning, there must be an immediate change in the observer's behaviour as a result of the learning.
   c Whether or not the learnt behaviour is demonstrated is partly due to the learner's awareness and expectations of resulting reinforcements or punishments.
   d Observational learning links the behaviourist theories of learning (classical conditioning and operant conditioning) and cognitive learning theories.

8 Which of the following might be a definition of modelling?
   a a form of learning in which the learner watches another person perform a task and then imitates their action when the occasion is right
   b a form of learning in which the learner watches another person perform a task and forms a mental image of the action
   c a form of learning in which the learner is a passive participant observing an action being performed
   d a form of learning in which the learner watches another person perform a task and gets reinforced for it

9 Sally decides she likes the music of a new band because all her friends do. This is an example of:
- a modelling
- b reactance theory
- c potency
- d classical conditioning.

10 Children are likely to adopt the attitudes of those people they admire and observe. This is known as:
- a operant conditioning
- b observational learning
- c person-positivity bias
- d none of these answers are correct.

SHORT ANSWER

11 Marg wants to use observational learning to teach her five-year-old daughter Gemma how to tie her shoelaces. Name stages 2 and 4 of observational learning and, for each of these, show how Marg could teach the skill of tying shoelaces.

2 marks

12 Gary wants to use observational learning to teach his four-year-old son Jake how to make his bed in the morning. Name stages 1 and 5 of observational learning and, for each of these, show how Gary could teach the skill of bed-making.

2 marks

13 Using examples, explain the following processes involved in observational learning:
- a retention
- b reproduction.

2 marks

14 In observational learning, there is a stage where learning has occurred but the behaviour has not yet been shown.
- a Which processes involved in observational learning must occur immediately before the behaviour is shown?

1 mark

- b Which of the processes involved in observational learning must occur if the behaviour is to be shown more than once?

1 mark

- c Explain exactly what is meant by what is necessarily the first of the observational learning processes.

1 mark

15 Briefly explain the five key processes involved in observational learning.

5 marks

16 How might watching glorified violence on television impact a child's behaviour?

3 marks

17 How is observational learning different from operant conditioning?

2 marks

CHAPTER 09

SENSORY, SHORT-TERM & LONG-TERM MEMORY: THE MULTI-STORE MODEL

> Memory … is the diary that we all carry about with us.
>
> Oscar Wilde

There have been several models proposed by researchers to describe memory. One well-understood model of memory was developed by Atkinson and Shiffrin (1968) who suggested that it comprises three stores: a brief and fleeting sensory memory, a slightly longer lasting short-term memory, and a long-term memory store that is virtually unlimited in both capacity and duration. This is referred to as the multi-store model of memory.

KEY KNOWLEDGE

> the multi-store model of memory (Atkinson–Shiffrin) with reference to the function, capacity and duration of sensory, short-term, and long-term memory

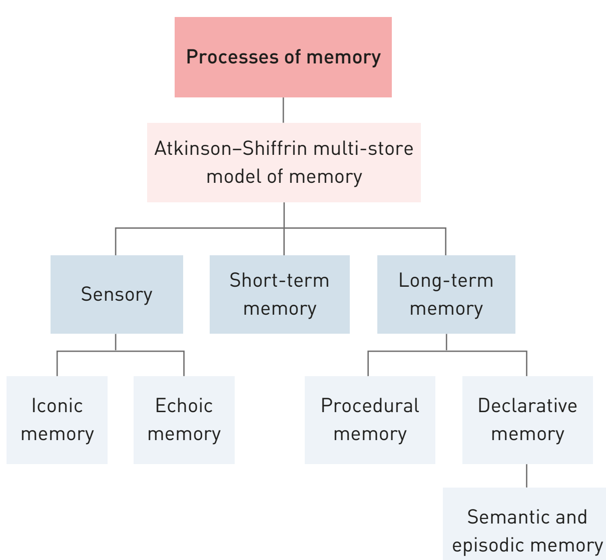
> interactions between specific regions of the brain (cerebral cortex, hippocampus, amygdala and cerebellum) in the storage of long-term memories, including implicit and explicit memories

Extract from the *VCE Psychology Study Design* (2016–2021), p 26; © VCAA. Used with permission

CHAPTER OVERVIEW

The processes of memory	Encoding Storage Retrieval
Atkinson–Shiffrin's multi-store model of memory	sensory memory short-term memory long-term memory
Sensory memory	Functions of sensory memory Iconic memory Echoic memory
Short-term memory	Duration and capacity of short-term memory
Long-term memory	Duration and capacity of long-term memory Different types of long-term memory
Brain structures involved in long-term memory	The role of the cerebral cortex The role of the hippocampus The role of the amygdala The distinction between the hippocampus and the amygdala The role of the cerebellum

CONTENT MAP



The processes of memory

To understand the different models of memory, it is helpful to be familiar with the memory process. In fact, it is similar to the way we use a computer. Memory depends on three sequential processes called **encoding**, **storage** and **retrieval**.

Encoding

Encoding refers to the process of putting information into a form which will allow it to fit in with your personal storage system. If you strike the 'X' key on your computer and press 'Enter', an electronically coded message representing 'X' goes into the computer memory. The same happens when we put an idea into our brain, but for us the idea is changed into an electrochemical code.

FIGURE 9.1 Encoding – putting into memory

Storage

Storage is keeping information in the brain so that we can use it later on – like saving it to the hard drive of a computer. We store the information in an organised way to make it easier for us to recover memories when we need them.

FIGURE 9.2 Retrieval is getting information back from memory so that we can use it – like opening a file on a computer.

Retrieval

Retrieval is the process of getting information back from memory so that we can use it – like opening a file on a computer and getting a document on the screen.

Retrieval relies on using the right cues so that we can get to the correct location in our brain; again, just like using the correct folder and file name to open a computer file.

The analogy of a computer for memory fits quite well for encoding and retrieval, but it is inadequate for storage. The brain does not store a memory like an object in one place. Each memory is spread out over a huge population of cells throughout different regions of our brain. Storage is also a dynamic process whereby human memories change over time and, again – unlike a computer hard drive – human memories are rough copies rather than exact replicas of information.

REVIEW 9.1

1 What are the three key processes involved in memory? Explain what happens in each process.
2 Why is the computer analogy useful for explaining these processes?
3 Why is this analogy also inadequate?

Atkinson–Shiffrin's multi-store model of memory

The analogy of a computer as a model for human memory is useful because, as research progresses, it can be modified and adapted to include new findings. **Atkinson and Shiffrin's multi-store model of memory** describes three stores of memory that are separate but function simultaneously to create our ability to encode, store and retrieve information.

Sensory memory is a very brief memory store (like a computer's buffer). Information enters this register and may then be transferred to the short-term memory if the person pays attention to it.

Short-term memory is a limited store of actively conscious memory (like the computer's random access memory [RAM]). Information is then transferred to the long-term memory if it has been encoded.

Long-term memory can be compared with a computer hard drive. However, this store of information has a virtually limitless capacity. It needs retrieval to bring it back into conscious awareness.

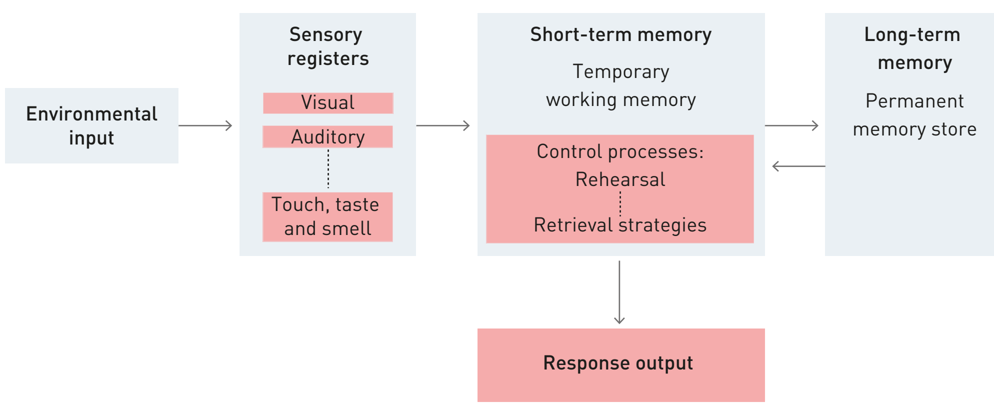


FIGURE 9.3 The Atkinson–Shiffrin multi-store model of memory

The model describes memory as a flow of information with inputs, processes and outputs. Environmental input, or information from our surroundings, enters through our sensory memory, also called our sensory register. The short-term memory then processes and stores this input. In our short-term memory, information is rehearsed and can then be stored more permanently in our long-term memory to retrieve later on.

The short-term memory retrieves information from the long-term memory to output information such as when we reminisce with friends, remember formulas for an exam or recall someone's name.

9.2 REVIEW

1 Draw a labelled diagram to illustrate your understanding of Atkinson–Shiffrin's multi-store model of memory.

2 What limitation does a computer hard drive have that the human long-term memory does not?

Sensory memory

According to the multi-store model of memory, sensory memory is the first stage of memory. Sensory memory relates to memory within our sense organs. It is where information in our environment is received by our senses. If the information is unique, different, interesting, relevant or in some other way attracts our attention, then it is transferred to short-term memory. Sensory memory is different from short-term and long-term memory because it has an unlimited capacity but only a very brief duration.

We have a sensory store for each of the five senses. Each sensory store is able to hold information for anything between a fraction of a second to several seconds (it varies from one sense to another). The information held in sensory memory has not yet entered our awareness and, if we don't pay attention to it, it never will! The information in sensory memory is not processed. We say that the energy is briefly stored in its raw form before the traces fade or decay.

FIGURE 9.4 Sensory memory is of a brief duration.

Functions of sensory memory

Sensory memory prevents us from being overwhelmed by the huge amounts of incoming sensory information. Its duration is very brief, but long enough for our brain to determine whether it is important enough to be transferred to our short-term memory. Our senses are bombarded with information every second of our normal waking consciousness. It is impossible for us to pay attention to all of this information, so our sensory registers act like filters for what is relevant to what we are doing or thinking at any given moment. The brief duration (rapid decay) of sensory memory is necessary. Otherwise, we would be unable to process new incoming information. The rapid decay also allows us to perceive our world as smooth and ongoing, and to hear sounds just long enough to understand whole words and sentences.

Just imagine what it would be like if sensory memory was not short in duration – while you were listening to the end of your teacher's lesson on psychology, you would still be hearing the first words she uttered – there would be chaos in your mind!

Two examples of sensory memory that relate respectively to our visual and auditory sensory systems are **iconic memory** and **echoic memory** (see Table 9.1).

TABLE 9.1 Summary of the characteristics of sensory memory

TYPE OF SENSORY MEMORY	PROPERTIES		FORM OF ENCODING	FORGETTING	EXAMPLE
	DURATION (SECONDS)	CAPACITY			
Iconic memory	0.3	Unlimited	Visual	Fades rapidly	Waving a sparkler in the dark and briefly experiencing an after-image
Echoic memory	3–4	Unlimited	Acoustic	Fades rapidly	Retaining the sounds of words for long enough to understand the whole word or phrase that has been spoken

Source: Sperling, 1960

Iconic memory

Iconic memory refers to our visual sensory memory. *Icon* is from the Greek word meaning 'image'.

Iconic memory lasts for about 0.3 seconds. This explains why we can see moving pictures from a series of still shots projected onto a movie screen. We are still storing the image of one still shot when it is replaced by the next frame, so the illusion of movement is created. This is why movies run at 64 frames per second. Research on people with reading disorders such as dyslexia suggests that the duration of their iconic sensory memory is too long and, therefore, the images of words and letters persist too long to enable them to process the next words in a reading passage (DiLollo, Hanson & McIntyre, 1983).

APPLICATION OF ICONIC MEMORY

9.1 INVESTIGATE

Try the following activities.

- Shut your eyes and try to describe what after-image remains. It is likely that you will be unable to describe all of it because it has faded faster than you have the time to remember.
- When at home, use a torch or a sparkler in the dark: wave it around in circular movements. You will notice an after-image in circles of light in the dark atmosphere.
- Hold a pencil loosely between your thumb and index finger and shake it. The pencil will appear to be floppy because of the after-image it leaves on the sensory receptors in the retinas of your eyes.

SPERLING'S STUDY OF ICONIC MEMORY

In his experiment on memory, Sperling was able to demonstrate the existence of iconic memory by using a *tachistoscope*, a device that flashes visual stimuli onto a blank screen for a specific, very brief period of time.

Sperling asked participants to remember as many symbols (letters or numbers) as they could from a grid of 12 that he displayed for 1/20 second with the tachistoscope. He found that participants could remember about four of the symbols before the remaining items had faded from their sensory memory. Sperling concluded that iconic memory has a *duration* of approximately 1/20 second. However, participants said that they saw more symbols than they could report before they faded. Therefore, Sperling also tested the *capacity* of the iconic memory.

He presented the 12-item grid for 1/20 second, followed by a high-, medium- or low-sounding tone that signalled to the participants which of the three rows of four symbols to attend to and report. He found that the mean number of symbols reported was three out of four from the specified row.

Sperling further tested the duration of the iconic memory by allowing a delay between the sounding of the tone and the presentation of the grid in the tachistoscope. He found that the longer the delay, the more symbols were forgotten, with only 50 per cent recalled after a 0.3 second delay and 33 per cent after a 1 second delay.

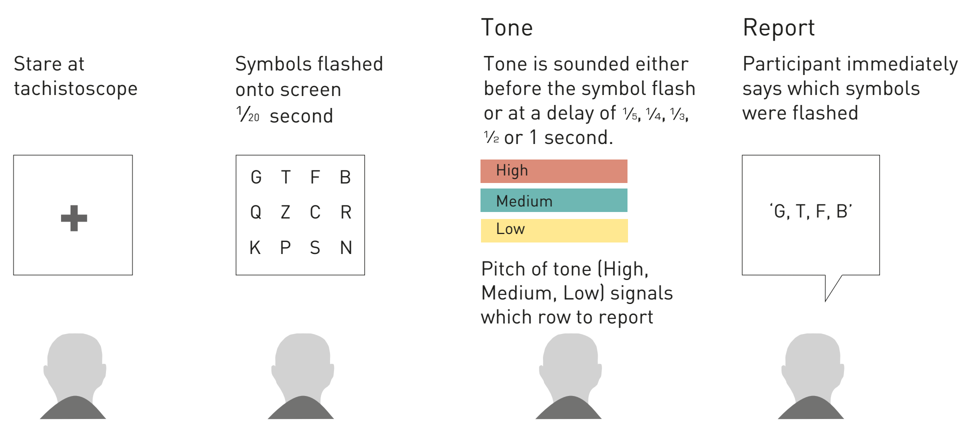


FIGURE 9.5 Participants relied on the after-image of the symbols projected by the tachistoscope to report what symbols they could remember.

Step 1 Use the tachistoscope to flash the grid to participant.	**Step 2** Ring the tone to signal to the participant which row to attend to.	**Step 3** Participant recalls the symbols from the relevant row in the grid.
G T F B Q Z C R K P S N	e.g. High tone for top row Medium tone for middle row Low tone for bottom row	If medium tone is sounded ? ? ? ? Q Z C R ? ? ? ?

FIGURE 9.6 Steps in Sperling's study

SPERLING'S STUDY OF ICONIC MEMORY

9.2 INVESTIGATE

Write a report about Sperling's study of iconic memory. Answer the following questions:

1 Write the three experimental hypotheses.
2 Name the independent and dependent variables.
3 How was the dependent variable operationalised?
4 What was the experimental design for this study?
5 Identify one limitation and one advantage of using this experimental design.
6 Were there any potential confounding variables?
7 How might the encoding and retrieval for iconic memory be affected if Sperling's participants were shown pictures instead of symbols? To answer this question, consider the amount of time it takes to identify and name a picture compared to a symbol.

Echoic memory

FIGURE 9.7 Echoic memory lasts just long enough for us to retain the detail of what has been said and to link it with what is said next.

Does this scenario sound familiar?
Person 1: Which class do you have after lunch?
Person 2: Sorry, what did you say—oh, Psychology.
This is the most common example of echoic memory. Sperling's studies on iconic memory led to further investigations on other sensory memory processes. Cognitive psychologist Ulric Neisser popularised the term 'echoic memory' in 1967. Echoic memory refers to our auditory (sound) sensory memory and is essentially the auditory equivalent of visual sensory memory.

Echoic memories are typically stored in our sensory memory for a slightly longer period than iconic memories: about 3–4 seconds. This is necessary because we need to register information in its entirety before we can make it meaningful; hence the delayed reaction. We may appear not to hear a question, but as we focus, we realise we can actually make sense of what was said and are able to give an answer – often interrupting the speaker who is in the process of repeating the question! This occurs because the sound is 'held' long enough in echoic memory. If we then consciously attempt to remember the question, the information is moved to short-term memory. If not, it is lost.

9.3 REVIEW

1 Outline the function of sensory memory.
2 What happens to information that is not attended to in sensory memory?
3 Explain the difference between iconic and echoic memory.
4 What is the capacity and duration of iconic and echoic memory?

Short-term memory

Short-term memory is often likened to the RAM in a computer because it is where mental manipulation takes place. Short-term memory allows us to retain information for enough time to use it; for example, looking up a telephone number and keeping it in your awareness long enough to dial it.

Incoming sensory information that is sufficiently attended to may pass into the short-term memory. We routinely draw information from the long-term memory to the short-term memory to evaluate and understand information that we are working on at a given moment; for example, reading comprehension questions or mental arithmetic.

Although we know that both visual short-term memory and auditory short-term memory exist, auditory short-term memory has been more intensively researched.

INVESTIGATE 9.3

MEMORY SPAN

1 Complete the following activities about short-term memory capacity:

a Have a partner read aloud each row of the digits below, with you repeating them immediately. Your partner should proceed through this list until you make errors in two successive sets of digits. This will provide you with an indication of your memory span. Consider whether there was any interference in your ability to retain the information.

9, 3
7, 4, 6
5, 0, 3, 7
2, 6, 8, 1, 4
7, 3, 9, 0, 2, 5
8, 5, 3, 0, 1, 6, 2
9, 5, 3, 2, 4, 8, 0, 6
2, 5, 7, 1, 0, 8, 3, 6, 4
9, 2, 5, 7, 3, 1, 0, 8, 4, 6

b Read each row of letters, then look away and try to repeat them.

L J G V Q
A F T E H O
J O Q R D W Y
M D F T U W C H
A S D T H J Q Y O

As the number of letters in each row increases, you will find it more difficult to retain all of them. Most people can retain the 'magic' seven items in short-term memory, plus or minus two items.

2 One limitation is that short-term memory is influenced by how long it takes to say a word or sound. For example, the letter 'a' is quicker to say than the letter 'w'. Similarly, short-term memory capacity is reduced when people try to remember complex visual patterns because they have to retain so much detail in each pattern. Work with a partner to design your own experiment, using words rather than letters or numbers. You can use the internet for research.

Remember to think about the number of syllables in each word. Include the following:

- an aim for the experiment
- an experimental hypothesis
- the independent and dependent variables
- results presented in a table (you may also include a graph)
- a conclusion for your experiment.

You do not need to write a formal report. Present your work as a Word document.

Duration and capacity of short-term memory

Short-term memory is distinguished from sensory memory and long-term memory because it has only a brief duration of approximately 12–30 seconds and a brief capacity of only 5–9 pieces of information. When this capacity is reached, new information can only be put into the short-term memory by displacing existing information.

For short-term memory to last its potential of approximately 12–30 seconds, there must be no interference. Interference occurs when new information enters the short-term memory and pushes out information that is in our immediate awareness. To retain information in our short-term memory, we usually find ourselves using a process called maintenance **rehearsal**. If you say something over and over (either aloud or sub-vocally in your head) that you want to keep in your immediate awareness, then you may also increase the chances of this information being moved into your long-term memory. (Maintenance rehearsal is discussed in more depth in Chapter 11.)

FIGURE 9.8 We use maintenance rehearsal to remember directions after we've looked them up.

TABLE 9.2 Methods of maintenance rehearsal

METHOD	EXAMPLE
Verbal (using words)	> Vocal – saying words out loud > Sub-vocal – thinking words silently to oneself
Non-verbal (using visual or spatial information)	> Visualising – keeping an image in one's mind > Muscular – imagining how it feels to perform an action

9.4 REVIEW

1. How does sensory memory differ from short-term memory?
2. What function does short-term memory play in our ability to remember things?
3. As short-term memory has a limited duration and capacity, what method can be used to increase its efficiency?

Long-term memory

We use long-term memory for conducting our everyday lives and without it we cannot function. It works very much like the hard drive on your computer – the information is encoded and stored and, as long as you know enough about it (like the name of a document or the folder it is in), you can retrieve it.

The way information is stored in long-term memory is different from sensory memory and short-term memory. In long-term memory, information is encoded by its meaning (that is, semantically) and stored in **semantic networks**.

Duration and capacity of long-term memory

It is hard to identify just how long the duration of long-term memory might be. Sometimes, previously stored memories are thought to be forgotten but, with the appropriate cues, they will suddenly come flooding back into conscious awareness. Long-term memories are maintained because of physiological changes to the neurons and their connections with other neurons.

Similarly, it is difficult to determine the capacity of long-term memory and there is probably no way of finding its limits. It is generally considered that 'forgetting' long-term memories is due to poor **retrieval cues** rather than capacity limitations. There are also difficulties in measuring the capacity of long-term memory, where different methods of retrieval (see Chapter 10) will produce different results.

Different types of long-term memory

To understand the next part of this chapter – interactions between specific regions of the brain in the storage of long-term memories – you first need to be familiar with the different types of long-term memory. These are identified as **procedural memory** and **declarative memory**.

Long-term memory

Declarative memory
> Memories of personal experiences (events) and facts

Procedural memory
> 'How to' memories
> Occurs after practice
> Examples
  - riding a bicycle, once the skill has been learnt
  - using cutlery to eat

Semantic memory
> Memories of facts (or knowledge)
> Examples
  - *knowing that Canberra is the capital city of Australia*
  - *knowing the times tables*
  - *'encyclopaedic' memory*

Episodic memory
> Personalised memories of events
> May be related to knowledge of facts if the memory is also of how and where you learnt them
> 'autobiographical' memory
> Examples
  - *your first day at school*
  - *a first romantic kiss*

FIGURE 9.9 Organisation of long-term memory

PROCEDURAL MEMORY

Procedural memory involves knowing how to do things – yet we might still find it hard to describe how to do them.

The procedural memory system houses memory for actions, skills, operations and conditioned responses. It is very resistant to **forgetting** – people rarely forget how to ride a bicycle, for example.

Some theorists believe that there is a link between **implicit memory** (see below) and the procedural memory system (Squire, Knowlton & Musen, 1993) because memory for skills is largely unconscious. People use skills such as keyboard skills or cleaning teeth with little conscious awareness of what they are doing. Furthermore, memory for these skills does not decline much over time. Sometimes people are surprised that they can still perform an activity such as skiing, playing music or driving a car, even after many years of not doing it. This is because procedural memory is a store of routines that can be accessed and retrieved.

FIGURE 9.10 Declarative memory can involve a past event being remembered because of a current event.

DECLARATIVE MEMORY

Declarative memory involves memory for facts, events and general knowledge. It generally refers to information associated with learning for school, reading, mathematics and higher order thinking, which is associated with intelligence. It includes semantic and episodic memory. Semantic memory is memory for facts, worldly knowledge or general knowledge. **Episodic memory** refers to memories of particular events and is often autobiographical, such as birthdays, your first day of school or your first romantic kiss.

A distinction can be made between two types of episodic memory:

> retrospective memory – remembering past events
> prospective memory – remembering things to do in the future.

IMPLICIT AND EXPLICIT MEMORY

Information from the long-term memory can be retrieved and expressed either implicitly or explicitly. Implicit memory is unconscious; that is, it does not require intentional, deliberate **recall**. **Explicit memory** is the conscious retrieval of memory. This includes recall and **recognition**.

Implicit memory and explicit memory are not memory systems. They are observable behaviours that appear to be handled, respectively, by the procedural and declarative long-term memory systems. The demonstration of the differences between implicit and explicit memory is evidence to suggest that people may have several separate memory systems.

FIGURE 9.11 When learning a new task, such as swimming, a conscious and deliberate effort is often required. However, after practice, the retrieval of this knowledge becomes implicit.

Implicit memory includes procedural memory, motor learning and classical conditioning. Recent research has shown that the **amygdala** is the key brain structure involved in implicit memory. The emotional aspects of memory are also the role of the amygdala, together with the hippocampus.

Explicit memory includes declarative memory and is shown to be the responsibility of the **hippocampus**.

SUPPORTING UNDERSTANDING

PHOTOGRAPHIC MEMORY

Photographic memory is the ability to form and later recall sharp, detailed visual images of a picture or notes from a page after examining them for only a short period of time. There are very few reports of people who truly have this type of memory. Sometimes people with exceptional memories are described as having photographic (sometimes called eidetic) memories.

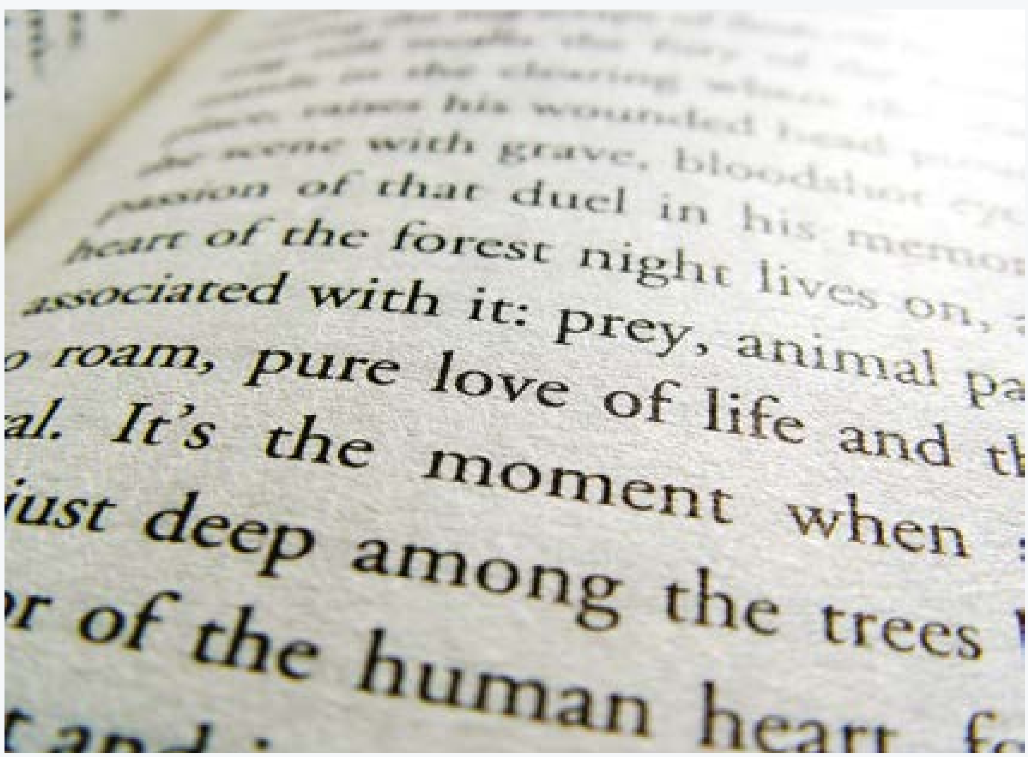


FIGURE 9.12 A photographic memory would allow accurate recall of this text after a quick read.

9.4 INVESTIGATE

TEST YOUR LONG-TERM MEMORY

Work with a partner and follow the instructions below. You might be quite surprised by the results!

1 Remember these numbers in order: 0963157208.
2 Sit on your hands while you answer the following questions:
   - Do you turn your front-door key clockwise or anticlockwise when entering your house?
   - Do you rotate a tap clockwise or anticlockwise to turn it off?
   - How do you use a knife and fork? (Remember to use words only.)
   - How do you use chopsticks? (Remember to use words only.)
3 What does the image below mean?

4 What was the name of your Grade 1 school teacher?
5 What was the name of the horse that came fifth in last year's Melbourne Cup?
6 Describe the front cover of this book without looking at it. How much can you recall?
7 Recite the national anthem out loud without singing the melody.
8 Name the highest mountain in Australia.
9 Cover question 1 above and write the numbers in the exact order as presented.

9.5 REVIEW

1 Outline two key differences between short-term memory and long-term memory.
2 How is information stored in long-term memory?
3 Draw a diagram to show our long-term memory stores (procedural, declarative, explicit and implicit).
4 Explain what procedural memories are and provide an example.
5 Outline what declarative memories are and how they differ from procedural memories.

Brain structures involved in long-term memory

The physiological make-up of memory is such that it is not possible to find the exact locations in the brain where it is stored. However, neuroscientists have made advances in discovering the key brain structures that are involved and recognise that this varies according to the type of memory and whether it is in the process of being encoded or stored (see Table 9.3 and Figure 9.13).

TABLE 9.3 Structures of the brain that are responsible for memory

TYPE OF MEMORY	GENERAL LOCATION IN THE BRAIN
> Storage, processing and encoding of procedural memories > Episodic memory (a form of declarative memory) > Memory for language > Memory of motor skills tasks	Frontal lobes
> Memories for pictures	Occipital lobes
> Spatial memory (awareness of oneself in space)	Parietal lobes
> Memories for sound > Memory for the names of colours	Temporal lobes
> Forming explicit memory > Consolidating and retrieving long-term declarative memories	Hippocampus
> Forms of long-term implicit memory including emotional memories such as recognising emotions in faces > Procedural memories such as skill-learning and classical conditioning	Amygdala
> Long-term procedural memory > Movement	Basal ganglia
> Encoding, processing and storing of procedural memories > Classically conditioned responses (a form of implicit memory) > Memory of motor skills tasks	Cerebellum

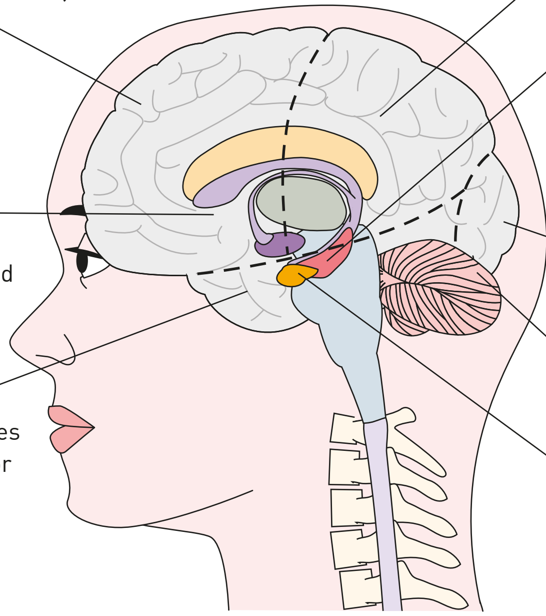


FIGURE 9.13 Cross-section indicating the location of key structures of the brain responsible for memory

The role of the cerebral cortex

In Chapter 2 you learned of the location of the four lobes of the cerebral cortex. Researchers have been able to establish that different long-term declarative memories are stored in the different cortical areas generally according to where the type of information was processed, and that procedural memories are stored, processed and encoded in the frontal lobes of the cerebral cortex.

When we learn a new language it is stored in the Broca's area of the left frontal lobe, which is responsible for language. Memory for the names of colours is stored in the part of the temporal lobe that is close to the occipital lobe. Spatial memories (awareness of one's self in space) are stored in the parietal lobe. Memory for sounds is stored in the temporal lobes, and memory for pictures is stored in the occipital lobe.

Two structures within the medial (middle) temporal lobe of the temporal lobe have key roles in the encoding and formation of declarative and emotion-related long-term memories, respectively: these are the hippocampus and the amygdala.

The role of the hippocampus

Unlike the cells in other structures of the brain, the cells of the hippocampus are able to reproduce and, therefore, enable new memories to be formed. The hippocampus is important for forming explicit memory and for memory for complex tasks that require declarative memory; for example, a child learning to spell unfamiliar words (Reed & Squire, 1999). There is a point in the encoding and storage process of declarative memories that takes place in the hippocampus, before these memories are transferred for more permanent storage in relevant parts of the cerebral cortex (Garrett, 2009).

The hippocampus is also involved in establishing the background or context for each new memory, such as the location, situation and memory for places. A study by McGuire and colleagues (1997) found the hippocampi of London taxi drivers to be larger than those in people who worked in other professions (see **case study**).

CASE STUDY

THE HIPPOCAMPUS AND MEMORY

Maguire and colleagues hypothesised that, just as with other animals, there also might be an increase in the size of human brain areas, such as the hippocampus where memories are formed.

Their research found that this was the case for 16 London taxi drivers who were expected to memorise the streets of London before they could obtain a licence to drive a taxi cab (known in London as 'doing the Knowledge'). The researchers found that the drivers had more activation in the hippocampus for a navigation memory task than for other types of memory tasks (Maguire, Frackowiak & Frith, 1997).

Further research using MRI scans of the drivers found that the posterior part of the hippocampus, an area of the brain that is involved in spatial navigation, was larger than in males of a similar age who were not taxi drivers. It was also found that this area of the brain was largest in the most experienced drivers. However, the overall size of the hippocampus was not different from non-taxi-driving males (Maguire, Mummery & Beuchel, 2000).

This research was helpful in understanding the role of the hippocampus in memory, but could not be used to determine whether the taxi drivers' hippocampal changes were *caused* by memorising the maps or by some other variable such as walking the streets of London frequently.

INVESTIGATE 9.5

CASE STUDY: THE HIPPOCAMPUS AND MEMORY

1 What was the aim of the researchers in the case study?
2 Write a simple hypothesis for this study.
3 Were there any physiological changes to the hippocampus in London taxi drivers? Explain.
4 Can the researchers conclude that changes in the taxi drivers' hippocampi are caused by the memorisation of maps?
5 What were the researchers able to conclude about this particular experiment?

THE ROLE OF CONSOLIDATION IN THE STORAGE OF EXPLICIT MEMORIES

The process of **consolidation** (see Chapter 10) of explicit memories takes place in the hippocampus. Neuroscanning techniques have enabled researchers to observe this process. In one study, participants were asked to learn words or pictures that were shown to them. How well the words were remembered later on could be predicted from how much activation occurred in the hippocampus during the presentation (Alkire *et al.*, 1998; Brewer *et al.*, 1998).

LINKING EMOTION TO MEMORY

Through its close relationship with and proximity to the amygdala, the hippocampus plays an important role in the relationship between emotion and memory, including the emotions that are generated by particular memories and vice versa.

FIGURE 9.14 Has thinking about a sad event in the past ever brought you to tears? This response is triggered by the hippocampus and the amygdala.

TRANSFERRING NEW MEMORY FOR STORAGE

The hippocampus transfers declarative memory to other relevant parts of the brain for permanent storage as long-term memory, such as the lobes of the cerebral cortex. A study found that, in mice, the neural activity in the hippocampus gradually diminished 25 days after the initial memory was formed; however, neural activity for the memory increased in areas in the cerebral cortices of the mice (Bontempi *et al.*, 1999).

In another study, the researchers lesioned (damaged) the pathway between the hippocampus and the cerebral cortex in rats. For the first 24 hours, this did not affect the rats' ability to learn the location of the platform for them to stand on in a water maze. However, after four weeks, they had lost their memory of its location. The results of this study suggest that memory formation (encoding) is dependent on the hippocampus, but long-term memory storage requires interaction between the hippocampus and cerebral cortex over time. To explore this further, the researchers lesioned another group of rats 24 hours after learning the water maze. They found that the rats' performance on the maze was poor four weeks later, whereas another group that was lesioned three weeks after training performed just as well as a control group of rats with intact brains (Remondes & Schuman, 2004).

Research suggests that the transfer of declarative memory from the hippocampus to other relevant parts of the brain occurs at times when it is less busy, such as during sleep (Lisman & Morris, 2001). The hippocampus is active during slow-wave sleep, when it is considered that memories are being processed. Researchers have found that human performance on a visual discrimination task continued to improve two to four days after the initial training and even with no additional practice, but only if the participants had slept within the first 30 hours after training (Stickgold, James & Hobson, 2000).

The role of the amygdala

The amygdala is essential for the formation of implicit memories including those formed during classical conditioning (see case study) and emotional memory. The amygdala also regulates emotions such as pleasure, fear and aggression. The amygdala also has a special role in the memory for emotions shown on faces (Markoswitsch *et al*., 1994). In activating the hippocampus, the amygdala also plays a part in the consolidation of declarative memory with emotional content, such as winning an important sports competition (Garrett, 2009).

CASE STUDY

THE ROLE OF THE AMYGDALA AND CEREBELLUM IN CLASSICAL CONDITIONING

In 2001, researchers Neufeld and Mintz conducted an experiment on two groups of rats to investigate the role of the amygdala and cerebellum in the acquisition of emotional and motor responses through classical conditioning.

The rats in the experimental group had damaged amygdalae and cerebella. First they were subjected to a fear preconditioning session and then to four eye-blink conditioning sessions. The rats in the control group were subjected to the eye-blink session only. In the fear conditioning session the conditioned stimulus was a tone and the unconditioned stimulus was a loud, unpleasant noise. In the eye-blink sessions the conditioned stimulus was the tone and the unconditioned stimulus was an electric shock.

Results showed that the rats in the experimental group did not develop a fear response. This demonstrated that the amygdala has a key role in classically conditioning emotion (in this case, fear) and the subsequent fear-related motor response (eye-blinking) activated by the cerebellum.

FIGURE 9.15 Once you learn how to ride a bike, you never forget.

The distinction between the hippocampus and the amygdala

Patients with damage to their hippocampus have enabled researchers to realise that there were two types of long-term memory: explicit memory and implicit memory. To further understand the brain structures that are involved in implicit memory processing, researchers studied PET scans of participants while they undertook activities that required the use of explicit and implicit memory. They found that the hippocampus was active for explicit memory tasks, but other parts of the brain were active for procedural memory tasks. For example, the cerebellum was, in part, responsible for remembering motor skills tasks (Sanes, Dimitrov & Hallett, 1990; Schachter *et al*., 1996).

People with hippocampal damage are still able to learn and remember procedural information such as motor skills or habits (bike-riding, playing table tennis). If asked, however, these people cannot remember actually performing the skill because their memory of it is declarative (Zola & Squire, 2000).

Bechara and colleagues (1995) demonstrated the important role of the amygdala for emotional memory. This research included one participant with damage to the amygdala on both sides of the brain and another participant whose hippocampus was damaged on both sides of the brain.

The researchers tried to link responses in the participants by making a loud, unpleasant noise when a blue slide was shown to them, but no noise when a slide of a different colour was shown.

The participant with the damaged amygdala reacted emotionally to the loud noise and was able to tell the researchers which slide was followed by the unpleasant noise. However, when the same blue slide was presented without the loud noise, he did not react emotionally. In other words, he had no emotional memory (reflex response) associated with the blue slide and so did not react to it when it was not accompanied by the unpleasant noise.

In contrast, the participant with the damaged hippocampi showed an emotional response to the noise and also to the blue slide (the conditioned stimulus) but, when asked later, could not remember which colour slide was associated with the loud noise. In other words, his brain had not consolidated declarative memory for the colour that was associated with the noise (Bechara *et al.*, 1995).

This study found that people with a damaged amygdala are incapable of fear conditioning, indicating that this part of the brain is important for the formation of this type of memory.

The role of the cerebellum

Procedural memories are processed, encoded and stored by the cerebellum, as well as the putamen, the caudate nucleus, and the motor cortex in the frontal lobes of the cerebrum. Patients with **anterograde amnesia** have provided evidence for a difference between short- and long-term memory. This type of amnesia results from brain damage where there is injury to the hippocampus. Often these patients can only remember information up to the time of the head injury, although they can still carry out many procedures learnt prior to the brain damage, such as using cutlery. They can also form new procedural memories that then enable them to learn a simple skill in a ball game. In contrast, however, these patients are unable to form new declarative memories (Baddeley & Warrington, 1970).

The cerebellum has a role in classical conditioning (see case study). A study found that rabbits with damaged cerebella were not able to be classically conditioned to the blink response when given a puff of air to the face (Green & Woodruff-Pak, 2000). The cerebellum also has a role in the memory of how to perform a motor skill; it works with the motor cortex of the frontal lobes.

9.6 REVIEW

1. What structures of the human brain are involved in memory?
2. Where are the key parts of the temporal lobes for memory located? What do they include?
3. Summarise the role of the hippocampus in memory.
4. Summarise the role of the amygdala in memory.
5. Summarise the role of the cerebellum in memory.

CHAPTER SUMMARY 09

- Information in memory must be encoded and stored so that it may be retrieved for use at a later time. The way we use our memory is similar to the way we use a computer.
- The Atkinson–Shiffrin model of memory suggests that there are three separate stores of memory: sensory, short term, and long term.
- Sensory memory has a brief duration and an unlimited capacity. It relates to the five senses, including iconic memory for sight and echoic memory for sound.
- Short-term memory has a limited capacity and duration.
- Long-term memory is thought to have an unlimited capacity and an unlimited duration.
- Long-term memory is further organised into procedural memory and declarative memory. Declarative memory has two subsystems: episodic memory and semantic memory.
- Brain structures involved in memory formation and storage include the lobes of the cerebral cortex, especially the medial temporal lobe (which includes the hippocampus and amygdala), the cerebellum and the basal ganglia.
- The hippocampus consolidates declarative long-term memories and transfers them to the cerebral cortex for storage.
- The amygdala adds emotional content to memories.
- Both the amygdala and the cerebellum are involved in classical conditioning.
- The cerebellum has a role in the processing, encoding and storage of procedural memories.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- amygdala
- cerebellum
- cerebral cortex
- declarative memory
- echoic memory
- episodic memory
- explicit memory
- hippocampus
- iconic memory
- implicit memory
- long-term memory
- maintenance rehearsal
- medial temporal lobe
- multi-store model of memory
- procedural memory
- semantic memory
- sensory memory
- short-term memory.

KEY KNOWLEDGE

For the exam, you must be able to show your understanding and apply your knowledge of:

- Atkinson–Shiffrin's multi-store model of memory
- function, capacity and duration of sensory, short-term and long-term memory
- declarative (including semantic and episodic) memory
- procedural memory
- the role of the lobes of the cerebral cortex in memory storage including the medial temporal lobe within the temporal lobe
- the role of the cerebellum in memory storage
- the interaction between different parts of the brain in memory storage
- the distinction between the different types of long-term memory and which part of the brain the different types are stored in.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study related to the models of human memory
- apply your knowledge and understanding from this chapter to a related research study
- understand and identify any ethical considerations in relation to researching human memory and establishing a model of human memory.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 In the multi-store model of memory, what are the three divisions considered to be, in order of initial processing?
- a sensory memory, short-term memory, working memory
- b episodic memory, semantic memory, procedural memory
- c short-term memory, declarative memory, procedural memory
- d sensory memory, short-term memory, long-term memory

2 Transfer of material from short-term to long-term memory requires which of the following processes?
- a encryption
- b encoding
- c transmission
- d transduction

3 Iconic images are considered to be those that register in which type of memory?
- a sensory memory
- b short-term memory
- c long-term memory
- d implicit memory

4 What is the duration of short-term memory for the average adult considered to be?
- a 7 + 2 seconds
- b 30 minutes
- c 12–30 seconds
- d 5 minutes

5 Loss of information from short-term memory is considered to be due to which of the following processes?
- a proactive or retroactive interference
- b anterograde amnesia
- c decay
- d displacement

6 The roles of the hippocampus and amygdala in memory formation can be summarised as:
- a hippocampus: implicit, declarative memories; amygdala: explicit, declarative memories
- b hippocampus: implicit, procedural memories; amygdala: explicit, declarative memories
- c hippocampus: explicit, procedural memories; amygdala: implicit, declarative memories
- d hippocampus: explicit, declarative memories; amygdala: implicit, procedural memories.

7 Where would you expect to find the greatest amount of brain activity for a person learning French verbs for the first time?
- a cerebellum
- b hypothalamus
- c right frontal lobe
- d hippocampus

8 The hippocampus is particularly active during ________________. This is also a time when ________________ is likely to be taking place.
- a concentration; attention
- b sleep; consolidation
- c concentration; consolidation
- d sleep; ageing

9 The cerebellum has a key role in the processing, encoding and storage of:
- a short-term memories
- b explicit memories
- c procedural memories
- d declarative memories.

10 Tony is an elderly retired plumber. He can easily remember how to attach a new tap to a water pipe but he cannot recall the names of his new neighbours. Tony's ________________ memory is better than his ________________ memory.
- a implicit; explicit
- b explicit; implicit
- c prospective; retrospective
- d episodic; prospective

SHORT ANSWER

11 Name and describe two structures of the brain that are involved in memory.

2 marks

12 The hippocampus functions as a part of the brain that ________________ (temporarily/permanently) stores new memory. However, memories are transferred to other parts of the brain for ________________ (temporary/permanent) storage in ________________ (long-term/short-term) memory.

3 marks

13 People with damage to the ________________ are likely to be incapable of fear or other emotional forms of conditioning.

1 mark

14 Describe the Atkinson–Shiffrin's multi-store model of memory, using an example to illustrate your answer.

5 marks

15 Describe the difference in capacity of sensory, short-term and long-term memory.

3 marks

16 What is maintenance rehearsal and what kind of situation might it be used for?

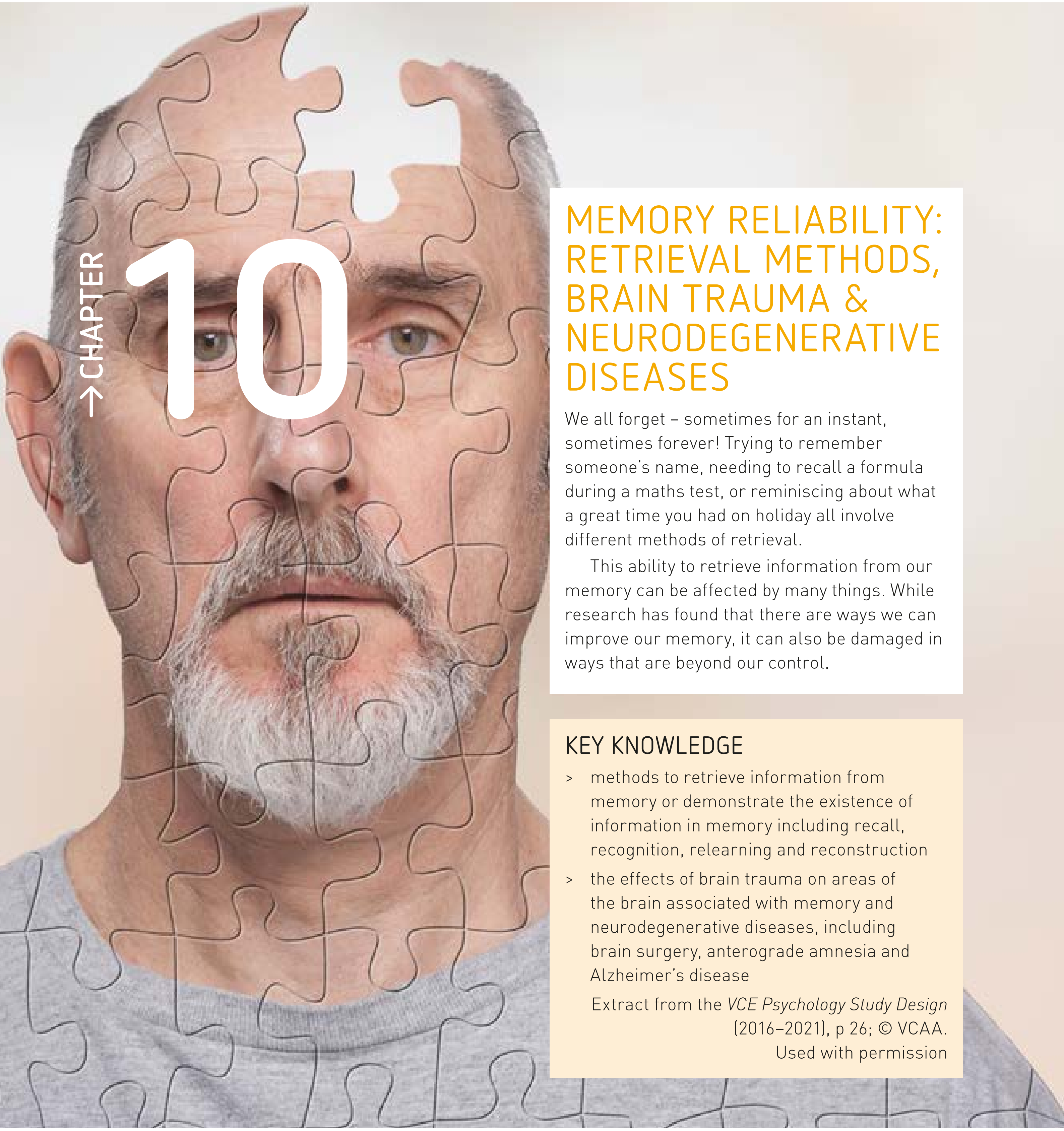
2 marks

17 What is the difference between explicit and implicit memory?

2 marks

18 Compare the function of semantic memory and episodic memory.

2 marks



CHAPTER 10

MEMORY RELIABILITY: RETRIEVAL METHODS, BRAIN TRAUMA & NEURODEGENERATIVE DISEASES

We all forget – sometimes for an instant, sometimes forever! Trying to remember someone's name, needing to recall a formula during a maths test, or reminiscing about what a great time you had on holiday all involve different methods of retrieval.

This ability to retrieve information from our memory can be affected by many things. While research has found that there are ways we can improve our memory, it can also be damaged in ways that are beyond our control.

KEY KNOWLEDGE

> methods to retrieve information from memory or demonstrate the existence of information in memory including recall, recognition, relearning and reconstruction

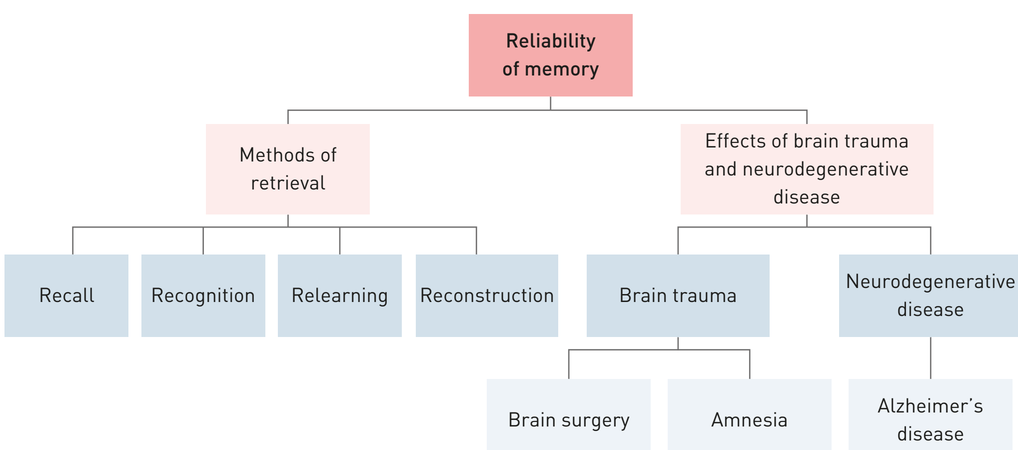
> the effects of brain trauma on areas of the brain associated with memory and neurodegenerative diseases, including brain surgery, anterograde amnesia and Alzheimer's disease

Extract from the *VCE Psychology Study Design* (2016–2021), p 26; © VCAA. Used with permission

CHAPTER OVERVIEW

Methods of memory retrieval	Recall Recognition Relearning Reconstruction
Brain trauma and neurodegenerative disease	Memory loss due to brain trauma Memory loss due to neurodegenerative disease
The hippocampus and consolidation	Factors affecting the functioning of the hippocampus Consolidation theory

CONTENT MAP



Did you know?

Forgetting refers to an inability to retrieve information at a particular time, rather than the total disappearance of that information from memory.

Methods of memory retrieval

Memory research acknowledges the following four methods of memory retrieval:

> recall
> recognition
> relearning
> reconstruction.

FIGURE 10.1 'Method is the mother of memory' (Thomas Fuller, 1608–1661).

Recall

Recall requires the person to retrieve stored information using a minimal amount of cues. There are three main types of recall:

> **Free recall** is involved in a task in which the participants are required to retrieve as much information as they can in any order (for example, a list of items to purchase from the supermarket).
> **Serial recall** involves recalling information in the order in which it was presented (for example, the names of cities visited on an overseas journey).
> **Cued recall** uses various prompts (cues) to assist the retrieval process (for example, 'The surname is short and begins with a D').

Recognition

Recognition refers to identifying the correct information among a list of incorrect pieces of information; for example, being able to pick the correct answer to a multiple-choice question from a list of four alternatives.

Recognition is generally more accurate than recall because it provides more cues to assist retrieval. For example, if you were asked to name the students in your English class in Year 7, what percentage of the class do you think you could recall? If, on the other hand, you were given a list of 50 names and asked to identify (recognise) those who were in your English class in Year 7, the number of names that you remember would certainly be much higher.

Recognition and cued recall are sometimes confused and it is important to distinguish between the two. Think of the example of remembering the names of students in your Year 7 English class. Recognition would involve you being given a list of names that included those who were in the class with many other names. Cued recall would involve you being given clues to the information but not the evidence of the items to be remembered, such as a class photograph or the initials of the class members.

FIGURE 10.2 Cued recall: a photo makes it easier to recall the names of all the people in your class, especially if it is a class from a previous year.

SUPPORTING UNDERSTANDING

Ebbinghaus and the forgetting curve

Herman Ebbinghaus was the first person to perform systematic research into remembering (or forgetting), publishing his findings in 1885.

Ebbinghaus experimented using only one participant – himself. He did not want previous knowledge to interfere with his results, so he learnt lists of nonsense syllables – pronounceable, three-letter combinations such as *bup*, *tov*, *ruj* and *lev*. Having tested himself until he had perfect scores for remembering the 'words' on each list, he waited for various periods of time – ranging from 20 minutes to 31 days – and then tested himself again to see what percentage of the learnt material he had retained. His results (see Figure 10.3) show that forgetting occurred most rapidly in the first 20 minutes, at a moderate rate until 1 hour had passed, and then very gradually for the next 31 days.

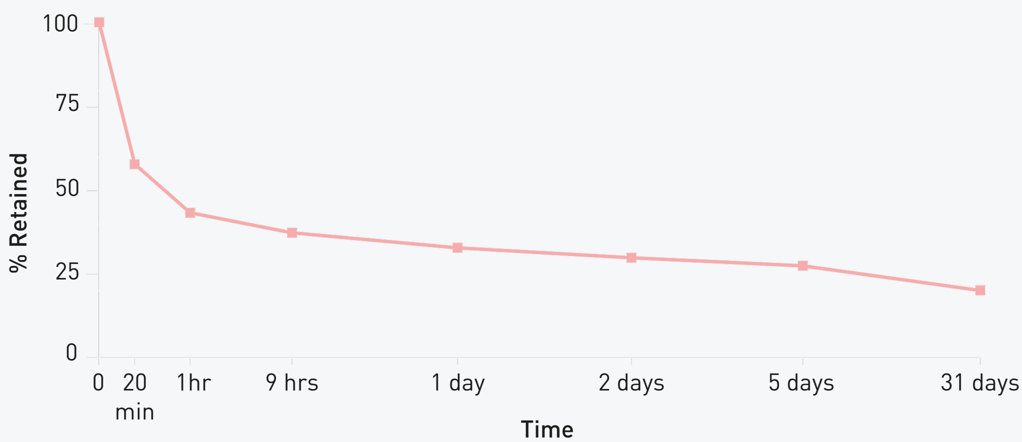


FIGURE 10.3 Ebbinghaus's results

Since the publication of Ebbinghaus's forgetting curve, the same features have been shown in other research, no matter what form of memory is tested:

> Most forgetting occurs immediately after the information has been learnt, so the beginning of a forgetting curve has the steepest slope.
> More than 50 per cent of the material is forgotten within the first hour.
> If the material was originally overlearned (that is, learnt over and over even when already well known), then it is likely to be retained for longer and with greater accuracy.
> Factors such as the complexity of the material learnt and even the intelligence of the learner do not seem to affect the rate of forgetting.

Relearning

Relearning, which refers to learning again something that has previously been committed to memory, is easier than learning something for the first time. This is the case with all aspects of memory but is especially true of procedural memory. Have you ever returned to a previously learnt skill, like a sport or playing a musical instrument, after a period of time and picked it up really quickly? This is the savings effect of relearning. Many people find the same with speaking a foreign language.

If the time taken to learn the material originally can be measured and compared with the time taken to relearn the same material, then a savings score can be calculated:

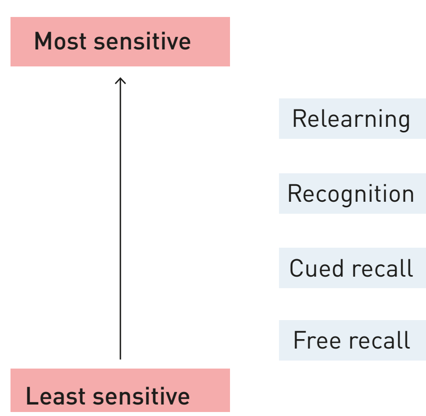
$$\text{Savings score} = \frac{(\text{Time for original learning}) - (\text{Time for relearning})}{(\text{Time for original learning})} \times 100\%$$

As an alternative, 'Trials' can be substituted for 'Time':

$$\text{Savings score} = \frac{(\text{Trials needed for original learning}) - (\text{Trials needed for relearning})}{(\text{Trials for original learning})} \times 100\%$$

It is worth noting that relearning is the most sensitive measure of retrieval, while recall is the least sensitive measure of retrieval. This means that if a very small amount of the memory remains, relearning will identify that it is there – even if recognition and recall cannot.

A **more** sensitive measure will register that a memory is present even if only a small amount of the memory remains. A **less** sensitive measure will only register that a memory is present when a large proportion of it remains.



Reconstruction

Our memories are constructed each time we remember them. **Reconstruction** refers to the way we can change a memory based on the way we recall it. For instance, if a memory is not recalled often, we may add or omit details when we finally do recall it. Memories can be distorted in our minds based on the way we reconstruct them. You might remember a fight with your friend as being much more aggressive or hostile than it actually was, or you might think they have said something, that in reality was never said. Another example might be when a friend tells you a funny story about what happened to them on the weekend. If you relate to that story well, or if you developed a vivid image of it, you might feel as though you remember it happening yourself, even though you were never there!

Reconstruction of memories also plays a major role in our consolidation of memory. **Consolidation** of memory is explored in more detail later in this chapter, and the reconstruction of memories is revisited in Chapter 11, when discussing eyewitness testimony.

FIGURE 10.4 If you stop playing guitar for a year, you may need to relearn the chords but it will be easier than the first time.

INVESTIGATE 10.1

Together with a classmate, choose a memory that you both share. It might be something that has happened in class, on school camp, or outside of school.

Answer the following questions separately.

1 When did the event happen?
2 Why did the event happen?
3 Who was there? What were they wearing?
4 What was the weather like?
5 What was said at the time of the event?
6 How did everyone feel about the event?

Now compare your answers and see if they are similar or different. Discuss why you think your recollection of this event is either similar or different.

REVIEW 10.1

1 Why is recall considered to be the least sensitive measure of retrieval? Explain your answer.
2 What is the difference between free recall and serial recall? Give an example of each to demonstrate your understanding.
3 Which of the following is the most sensitive measure of retrieval: free recall, cued recall or relearning? Why?
4 Vicki was anxious about sitting her Psychology exam. However, she felt better when she noticed that a large proportion of the exam was multiple choice. What type of memory do multiple-choice questions test?
5 What would Roger's savings score be if it took him eight hours to learn a list of Australian native plant names at the beginning of term, and then only four hours to relearn the same Australian native plant names for his exam? Calculate the savings score using the formula and explain its meaning.

Brain trauma and neurodegenerative disease

Studies of memory usually fall into two groups:

> studies of patients with specific memory loss due to brain trauma
> studies of patients with neurodegenerative diseases.

The first group makes a more powerful contribution to research because the location of lesions in specific parts of the brain will often provide a pure memory deficit of a specific memory or type of memory. Nevertheless, this does not automatically mean that a patient with a pure deficit will have specific brain damage. This is because the human brain is complex. Often, the memory functions of different parts of the brain are interrelated or another part of the brain has compensated for the damaged part. Nevertheless, study of brain-damaged patients such as H. M. (see case study) enables researchers to establish better generalities about memory and to develop and test theories about which areas of the brain play important roles in particular types of memory (Baddeley, Eysenck & Anderson, 2009).

The second group includes studies of patients with diseases such as Alzheimer's disease. This type of memory deficit is rarely 'pure', however, and it is common for Alzheimer's disease to be accompanied by other cognitive deficiencies besides simple memory loss. This makes it difficult to identify exactly which aspect of the patient's problems is based on memory. This also means that although case studies of diseased patients are valuable, it is difficult for researchers to develop and test theories about the mechanism of memory.

Memory loss due to brain trauma

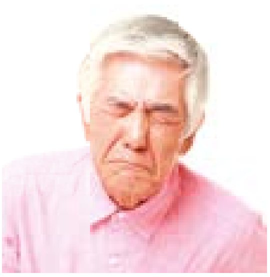


FIGURE 10.5 Brain trauma can cause organic memory loss.

Brain trauma (damage to the brain) can be caused by traumatic head injury, disease, seizure, malnutrition, stroke or chemical damage due to drugs including alcohol. Total amnesia (no memory of anything at all) is extremely rare. **Organic amnesia** (memory loss due to damage to the organ responsible for memory) is usually partial and selective.

Head injuries are common forms of brain damage that may cause amnesia. Severe head injuries are likely to cause greater memory loss. Stroke, anoxia (damage due to lack of oxygen) and severe injuries that damage the brain directly are clear in the nature of the damage.

Concussion, where a person experiences loss of consciousness for a period of time, may lead to temporary or permanent memory loss or permanent brain damage. Mild concussion will disrupt the consolidation process and cause retrograde amnesia for the events that took place just prior to the head injury occurring as well as anterograde amnesia for some minutes or sometimes hours after the event. This is common among sports players in contact sports such as Australian Rules football and rugby. Sports-medicine doctors in attendance will ask the player if he is able to remember particular details of the game during the minutes preceding the injury. For boxers, the ongoing effect of severe hits to the head can, in some individuals, lead to brain damage and result in a range of impairments such as poor memory, especially the ability to form new memories, permanently slurred speech and other cognitive deficits. In athletes, this condition is often referred to as being **punch-drunk**.

BRAIN SURGERY

Although it can be a necessary and life-saving event, brain surgery can also cause problems for patients when it interferes in some way with the structure or function of the brain. For example, it is not uncommon for patients who have had brain tumours removed to report some kind of memory loss, either short term or long term.

As mentioned earlier in this chapter, damage to any structure of the brain, such as the frontal lobes of the cerebral cortex, is likely to cause impairment of the form of memory with which it is involved. Even though surgeons are continually developing new techniques and procedures to reduce the risk of damaging the brain during surgery, it is still a real possibility associated with the delicate and difficult procedures performed by neurosurgeons.

FIGURE 10.6 Changes or damage to the structure of the brain during brain surgery can cause memory failure in patients.

AMNESIA

Amnesia refers to the inability to remember. There are two forms of amnesia: **retrograde amnesia** and anterograde amnesia. People with forms of amnesia have a range of types of memory loss and cognitive deficits.

Note: Although only anterograde amnesia is mentioned in the Study Design, to understand amnesia and its effects on people, it is important to be aware of retrograde amnesia and its characteristics.

FIGURE 10.7 Anterograde and retrograde amnesia

Did you know?

The term *cornus ammonis* comes from *Ammon* – a Greek god who possessed ram horns!

Anterograde amnesia

Anterograde amnesia is the inability to encode and store new memories. Typically, people can retrieve memories they had prior to the trauma but cannot learn anything new. This amnesia is commonly associated with Alzheimer's disease. Case studies and modern brain-scanning techniques show that damage to the temporal lobe and hippocampus is often related to anterograde amnesia. These structures are involved in the consolidation process, especially for encoding and storage of long-term declarative memories. In particular, damage to the part of the hippocampus called CA1 (*cornus ammonis 1*), which is linked to the cortex, is likely to cause anterograde amnesia but not much retrograde amnesia.

CASE STUDY

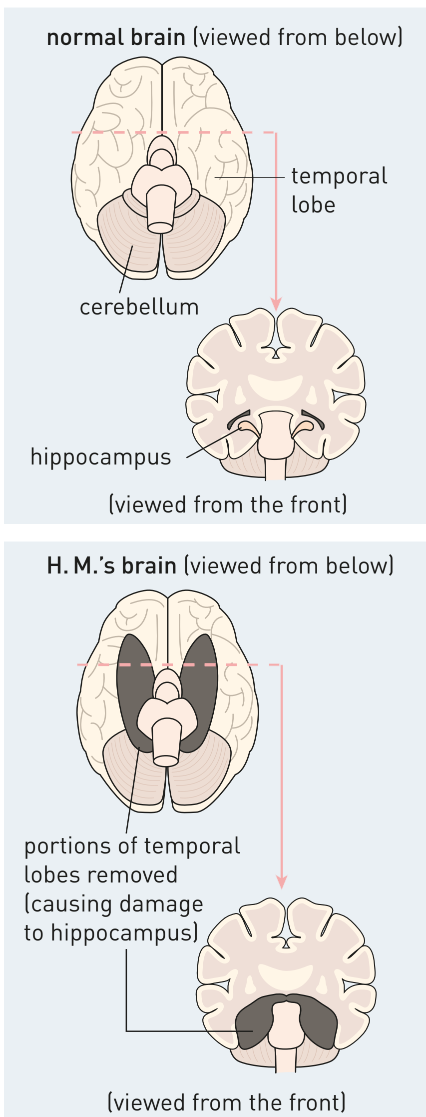


FIGURE 10.8 The changes to H. M.'s brain after his temporal lobes were removed

THE EXPERIENCE OF H. M.

'H. M.' was a patient who suffered severe temporal lobe epilepsy. His experience has provided a wealth of information for researchers of the human brain, and we are indebted to him for the contribution that he has made through allowing himself to be studied. This has been particularly important in assisting researchers to understand human memory.

In 1957, at the age of 27, patient H. M.'s epilepsy had reached the point where he was unable to conduct a normal life and he consented to experimental surgical treatment to remove portions of both his temporal lobes (Scoville & Milne, 1957). After he recovered from the surgery, he was tested to assess the effects of the procedure on his brain functioning. His short-term memory and intellectual ability remained intact and normal, except for his score on the memory aspect of the intelligence test, which was now way below average and much lower than it had been prior to the operation. Furthermore, after taking the memory test, he could not remember that he had taken it; he could be given the test repeatedly as though for the first time. He did not recognise the doctors who were treating him, he could read the newspaper repeatedly as if it was new, he could not recall what he did the day before, and he would return to his previous family home because he was unable to remember that his family now lived at a new address.

As a result of the surgery, H. M. was now suffering a severe form of anterograde amnesia, where he had great difficulty remembering events that occurred from the time of his surgery onward. However, he had full recollection of his life before the operation. It is now understood that the surgery damaged each hippocampus (located in the medial temporal lobe). The hippocampus plays a role in the process of forming new memories, and this is why H. M. suffered anterograde amnesia after the surgery.

Despite H. M. being unable to store new explicit memories, he *was* able to learn new procedural skills (implicit memory) such as writing upside down. Each time he was asked to perform this task he was better at doing it, but he could never remember having been taught how to do it. In other words, his ability to encode and store new implicit memory, such as procedural memory, had not been damaged by the surgery. This helped researchers to realise that explicit memory and implicit memory are processed and stored in different parts of the brain (Garrett, 2009).

Today, such crude surgery is not carried out on patients. Techniques have become much more sophisticated so that surgery for epilepsy ensures that there is minimal damage to parts of the brain other than those that are the source of the epilepsy. (An internet search of 'H. M.' will provide you with further information about this case.)

SUPPORTING UNDERSTANDING

Retrograde amnesia

Retrograde amnesia is difficulty in recalling previously stored memories. Usually, retrograde amnesia involves the loss of memories from a period before the time when the person's brain was damaged. Patients usually have no memory of the period just prior to the injury, but sometimes the amnesia can go back several years. Generally, older memories are less affected.

Strokes, brain tumours, surgery and electroconvulsive therapy (ECT) are all common causes of this type of amnesia. When this amnesia is caused by head injury, such as trauma or stroke, some memories might eventually return, with the older memories generally returning first. The events that occurred just prior to the injury, however, are unlikely to be recovered because the consolidation of these would have been disrupted.

Sadly, when retrograde amnesia has been caused by degenerative diseases such as Alzheimer's disease, the memory loss may be more fragmented and it is unlikely that memories will ever be recovered.

Anterograde and retrograde amnesia together

Damage to the whole of both hippocampi will cause severe anterograde amnesia and also some retrograde amnesia. H. M. had both of his temporal lobes and hippocampi removed and this caused his severe anterograde amnesia. He had difficulty encoding and storing new long-term declarative memories, but was able to form short-term, procedural and implicit memories.

H. M. also suffered a degree of retrograde amnesia; he had very little memory for events that occurred prior to the operation. His retrograde amnesia extended back to the age of 16, so he was able to remember events and information learnt up until then, but after that his memory loss was severe. He could not remember the end of World War II, when he finished school or his high-school classmates when he attended a school reunion.

Anterograde amnesia is often accompanied by retrograde amnesia – for example, in Alzheimer's patients – but it is less common to find the reverse. When it does occur, a clinician may be suspicious that the patient is trying to feign amnesia in order to cover for some criminal or unacceptable behaviour. Andrewes (2001) reported a case of a patient who claimed he could not recall stealing a car or assaulting his father-in-law. Subsequent assessments showed that he was faking amnesia.

Post-traumatic amnesia

Post-traumatic amnesia is a form of amnesia that people may have when they are emerging from a coma. It may last for minutes or years, depending on the nature of the head injury that caused the coma. Its symptoms include disorientation, confusion, fatigue, agitation and the inability to form new memories.

Memory loss due to neurodegenerative disease

Dementia refers to a disorder affecting higher mental functions (Morris & Baddeley, 1988). It can occur in various forms and may be caused by disease, brain damage, reduced blood supply to the brain or toxins such as alcohol. The most common form of dementia is Alzheimer's disease.

ALZHEIMER'S DISEASE

This neurodegenerative disease occurs mostly in **old age** and involves gradual, severe memory loss, confusion, impaired attention, disordered thinking and depression (Kalat, 2008). It involves both anterograde and retrograde amnesia because the disease affects both the hippocampus and the pre-frontal cortex. The earliest symptom is usually impaired declarative memory, where the patient has difficulty remembering events from the day before, forgets names and has difficulty finding the right word when speaking. Next, the patient might repeat stories or questions, and eventually will fail to recognise familiar people and family members.

Amyloid plaques (proteins that form among axon terminals and interfere with communication between neurons) typify Alzheimer's disease. In addition, patients' brains have **neurofibrillary tangles** (an **abnormal** build-up of protein inside the neurons) and these are associated with the death of brain cells. Alzheimer's patients also have lower levels of important memory neurotransmitters, especially acetylcholine.

One of the first brain structures to be affected by Alzheimer's disease is the hippocampus. When the cells are lost here, it causes the brain to atrophy (shrink) and the damage to the temporal lobes means that the hippocampus becomes isolated. This is probably why there is early memory loss (Hyman *et al.*, 1984). Plaques and tangles in the frontal lobes cause more memory problems and difficulty in attention and motor coordination. In the occipital lobes, the disrupted link between the primary visual cortex and the visual association areas in the parietal and temporal lobes can cause reading and other visual problems for the patient. Altogether, the nature of the brain damage caused by Alzheimer's disease means that declarative memory in particular is impaired.

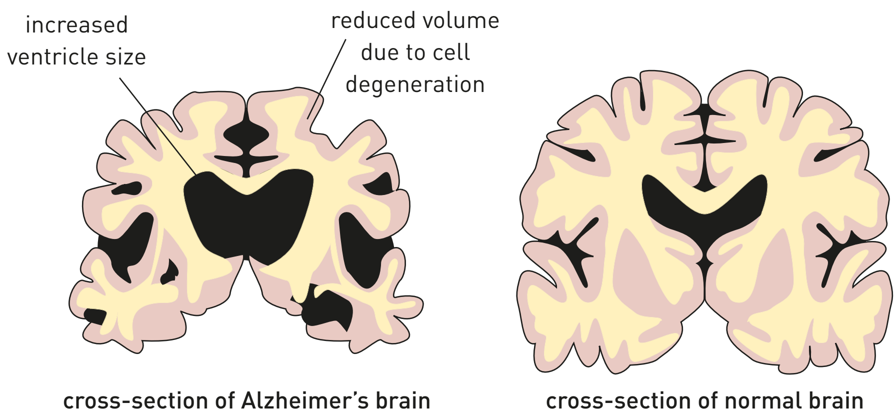


FIGURE 10.9 The brain on the left indicates the cell loss by the decreased size of the cortex compared to the normal brain on the right.

10.2 INVESTIGATE

Using the internet:

1. Identify symptoms that may be shown in the initial stages of Alzheimer's disease.
2. As the disease progresses, indicate what may be noticed by those closest to the patient.
3. What symptoms are likely to be shown when the disease has progressed to its most severe form?

10.2 REVIEW

1. What form of amnesia is represented in the film 'The Bourne Identity'? (If you have not seen the film, you may search the internet to find a description of the plot.)
2. What form of amnesia is represented in the film 'Fifty First Dates'? (If you have not seen the film, you may search the internet to find a description of the plot.)
3. a. What was the purpose of H. M.'s surgery in 1957?
   b. What structures of the brain were damaged?
   c. The operation caused H. M. to suffer from anterograde amnesia. Explain the symptoms and the difficulties H. M. experienced after the operation.
   d. What type of memories could H. M. form after the operation?
   e. Discuss two ethical considerations that may have been neglected in this case.
4. Complete the following table:

MEMORY DECLINE	DESCRIPTION	BRAIN STRUCTURES AFFECTED
Anterograde amnesia		
Brain surgery		
Alzheimer's disease		

The hippocampus and consolidation

As we saw in Chapter 9, structures within the temporal lobes play a key role in memory: the hippocampus in consolidation of declarative memories and the amygdala for emotion-related memories. For declarative memories, there is a point in the encoding and storage process that happens in the hippocampus, followed by a transfer to more permanent storage in the cerebral cortex (Garrett, 2009).

Did you know?

Because the hippocampus is involved in the formation of new memories, researchers are currently exploring the possibility that drugs that assist the growth of neurons might provide treatment for victims of Alzheimer's disease and other diseases that reduce memory (Frielingsdorf *et al.*, 2007).

Factors affecting the functioning of the hippocampus

The functioning of the hippocampus can be disrupted by psychological factors such as stress, anxiety, depression and post-traumatic stress disorder (PSTD). It can also be damaged through brain trauma such as head injury. Health-related conditions such as Alzheimer's disease, viruses such as herpes and encephalitis can also cause the hippocampus to be adversely affected. Prolonged stress may cause the hippocampus to shrink and thereby disrupt its role in memory formation (see Chapter 4 for more information about stress).

Consolidation theory

Consolidation theory proposes that memory is permanently stored through a process where there are physical changes to neurons (Andrewes, 2001). It refers to the strengthening of memories over time (from brief periods to several years). It is thought that any memory that is permanently stored will involve the process of consolidation. The hippocampus is one particularly important structure that is involved in this process (Andrewes, 2001; Garrett, 2009).

When new information such as a telephone number or a mathematical formula is learnt for the first time, it is temporarily held in the short-term memory. It does not always become a permanent memory – and if it does, the process takes time. This is the period in the transfer of information into long-term memory when the 'setting' of the information is necessary for a permanent memory to be established. The case of H. M. demonstrated the period of extended consolidation in which human memories are vulnerable to disruption and disturbance because he had retrograde amnesia for some events that happened up to three years prior to his surgery.

FIGURE 10.10 Consolidation theory explains why people often don't recall events when they have suffered a head injury (concussion) because the lost information had not yet been consolidated and so the long-term memory had never formed.

According to consolidation theory, three conditions – physical change, no disruption and time – are required for memory to be permanently stored (see Table 10.1).

To date, most research on the consolidation process has focused on declarative memory. No clear evidence has emerged to indicate that a process of consolidation happens for non-declarative memory.

TABLE 10.1 Consolidation theory: conditions necessary for permanent storage of memory

CONDITION	DESCRIPTION
Physical change (A physical change must occur in the synapses.)	> Consolidation mostly happens through the hippocampus, which converts information from the short-term memory into permanent memory codes that are gradually stored in the long-term memory. > The short-term memory changes the strength of the existing synapses in the brain, whereas long-term memory involves the growth of new connections between neurons (Kandel, 2001). > Long-term memories are probably stored in the same areas of the cerebral cortex that were originally involved in processing the sensory input of the information (e.g. visual information in the occipital lobe).
No disruption (If the process is disrupted, long-term memory is unlikely to form.)	> There is a period where memories are less consolidated or 'set'. These memories are susceptible to alteration by new relevant information. > The process may be disrupted by a head injury, the amount of attention that is paid to the information, or the arousal level due to anxiety and alertness. > Information can be altered or completely lost during this process.
Time (Consolidation takes time.)	> Neural connections that have had more time to strengthen are less likely to be disrupted. This explains why head injury patients can still remember their names, family members and address, but not the events that led to the head injury happening. > Researchers are still identifying the period of time it takes for consolidation to take place to the point where it is no longer vulnerable to disruption or change. Some research suggests that it is a process that can occur over a 30-minute period. Yet there is also evidence that it can take several years.

10.3 REVIEW

1. What are some of the causes of disruption to the functioning of the hippocampus?
2. What are the three conditions necessary for memory to be permanently stored in the brain?
3. According to consolidation theory, why can head injury patients still remember family members and names?
4. Lee wakes up after a car accident to be told she has experienced severe brain trauma, specifically to her hippocampus. What does this mean for Lee?

CHAPTER SUMMARY 10

- Methods of memory retrieval include:
  - recall, which refers to retrieving information with a minimum of cues
  - recognition, which refers to drawing the required information out of a more expansive list that is presented to the person doing the recalling
  - relearning, which refers to the process of retrieving information through the prompt of setting about learning a task again
  - reconstruction, which refers to the way we can tend to alter a memory in the process of recalling it.
- There are three methods of recall:
  - Free recall involves recalling as much information as possible, without prompts, and in any order.
  - Serial recall involves recalling information in the order in which it was presented.
  - Cued recall takes place with the assistance of prompts or cues.
- Relearning is the most sensitive measure of retrieval while recall is the least sensitive measure of retrieval.
- Organic memory loss may be due to physical, chemical or biological damage to the brain.
- Anterograde (and retrograde) amnesia may be caused by brain trauma.
- Alzheimer's disease is the most common form of biological brain trauma, or dementia.
- Consolidation theory refers to the strengthening of memories over time. The permanent storage of memories involves physical changes to neurons.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- Alzheimer's disease
- anterograde amnesia
- free recall
- methods of retrieval
- neurodegenerative disease
- overlearning
- recall
- recognition
- reconstruction
- relearning
- retrograde amnesia
- savings score
- trauma.

KEY KNOWLEDGE

For the exam, you must have an understanding of:

- methods of retrieval
- relative sensitivity
- recall
- recognition
- relearning
- calculation of savings score
- organic memory loss
- physical trauma
- biological (disease) trauma.

RESEARCH METHODS

For the exam, you must be able to:

- understand the need for research into methods of retrieval
- indicate methods of research into brain trauma.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Carl is trying to list all the people who attended his 11th birthday party 10 years ago so that he can invite them to his 21st birthday celebration. He knows they all went to his school. Which of the following would be most useful in helping him remember who went to his party?
  a a photograph of his Year 6 class when he was 11
  b a list of all the names of the students in his Year 6 class when he was 11
  c a photograph of the parents of the children who attended Carl's 11th birthday party
  d an invitation list for the 11th birthday party that only has the first names of the guests

2 If Carl was presented with an invitation list from his 11th birthday that had only the first names of the guests, which method would he use to assist him to retrieve the full names?
  a free recall
  b cued recall
  c recognition
  d relearning

3 Lori was shopping at the supermarket and was almost finished when she realised that she had forgotten to pick up a tub of chocolate ice cream. Her basket was very heavy so she decided to leave it at the front of the store while she quickly collected the ice cream. When she returned, she found a second basket containing similar items and she couldn't immediately pick which was hers. Which method of memory retrieval is Lori likely to use to identify her basket?
  a free recall
  b reconstruction
  c recognition
  d relearning

4 Anterograde amnesia refers to inability to:
  a recall memories from before a trauma
  b recall information from before or after a trauma
  c form new memories after a trauma
  d form memories from before or after a trauma.

5 Which of the following groups has made the most powerful contribution towards the study of memory?
  a patients with epilepsy
  b patients who have had a corpus callosotomy
  c patients with specific memory loss due to brain trauma
  d patients with a neurodegenerative disease

6 An early manifestation of Alzheimer's disease is difficulty:
  a forming new declarative memories
  b forming new procedural memories
  c retrieving recent episodic memories
  d retrieving old episodic memories.

7 In Alzheimer's disease, proteins called *amyloid plaques* form in which part of the patient's neurons:
  a the dendrites
  b the soma
  c the axon terminals
  d the synapses

8 One reason that Alzheimer's patients suffer loss of brain cells is:
  a neurofibrillary tangles
  b build-up of GABA in the cells
  c they atrophy because of disuse
  d trauma.

9 Which part of the brain is most involved in the process of consolidation?
  a the hippocampus
  b the amygdala
  c the cerebellum
  d the cerebral cortex

10 When studying the consolidation process, the form of memory at the centre of almost all studies is:

- a procedural
- b episodic
- c semantic
- d declarative.

SHORT ANSWER

11 What is meant by the term 'savings score'?

2 marks

12 What is the difference between cued recall and free recall? Explain using an example.

2 marks

13 What is the difference between cued recall and recognition? Explain using an example.

2 marks

14 List three characteristic symptoms of Alzheimer's disease.

3 marks

15 Explain what is meant by the expression *organic causes of amnesia*.

3 marks

16 According to consolidation theory, what are the three conditions that have to be present for memory to be permanently stored?

3 marks

17 Explain the role of the hippocampus in memory consolidation and what would happen if the hippocampus were damaged.

4 marks

18 Suggest four possible causes for brain trauma that might affect memory.

4 marks

19 Brain trauma can result in anterograde amnesia. Which areas of the brain are linked to the condition and how does it affect memory?

2 marks

20 Studying the effect of brain trauma on memory function can be difficult. Imagine you are researching the correlation between brain trauma experienced by athletes and memory loss and complete the following:

a Write a hypothesis for your research.

2 marks

b Identify the population of your research.

2 marks

c Suggest a possible method for collecting the data.

2 marks

d What kind of issues may arise when doing this kind of research?

4 marks

→ CHAPTER 11

METHODS OF RETRIEVAL & RECONSTRUCTION OF MEMORY

Humans have developed strategies to improve memory. This includes cues to assist with both their encoding and retrieval. However, our memories are not always reliable. We reconstruct them each time we access them, and they are also vulnerable to being influenced by others, whether this influence is intentional or not.

KEY KNOWLEDGE

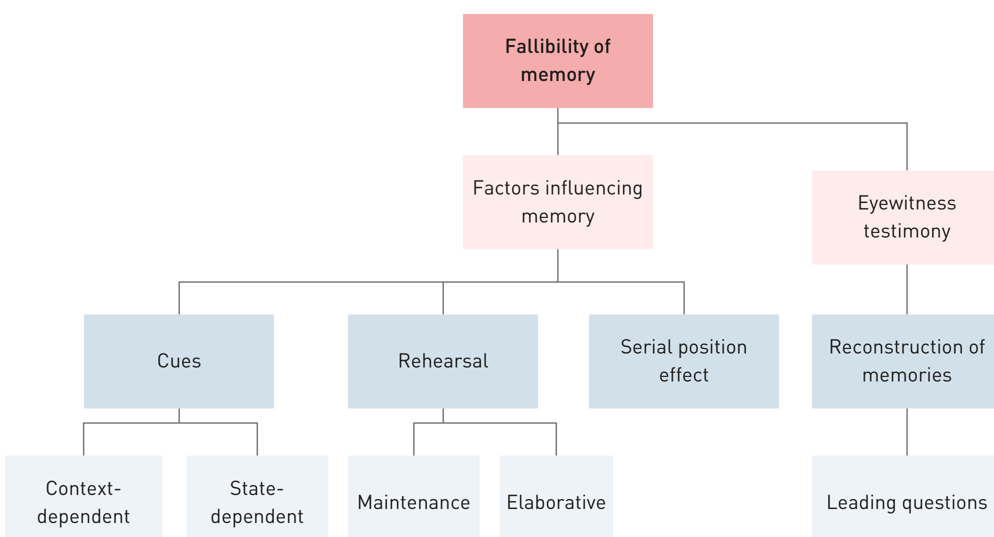
> the factors influencing a person's ability and inability to remember information, including context- and state-dependent cues, maintenance and elaborative rehearsal, and serial position effect

> the reconstruction of memories as evidence for the fallibility of memory, with reference to Loftus's research into the effects of leading questions on eyewitness testimonies

CHAPTER OVERVIEW

Factors influencing memory	Context-dependent cues State-dependent cues
Rehearsal and memory	Maintenance rehearsal Elaborative rehearsal
The serial position effect	Primary effect Recency effect Asymptote
Eyewitness testimony	Reconstruction of memories Why does eyewitness testimony fail? Leading questions and the misinformation effect

CONTENT MAP



Factors influencing memory

The **encoding specificity principle** (Tulving & Thomson, 1973) states that the associations formed at the time of encoding new memories will be the most effective retrieval cues.

This means that items are stored in memory according to their meaning at the time of encoding. For example, consider the following list of words: *spectacles*, *monocle*, *glasses*, *vision*, *eyes*, *contact lenses*. You are likely to associate the word *glasses* with eyewear.

Now consider this list: *mugs, goblets, glasses, beakers, tumblers*. This time you might associate the word *glasses* with drinking vessels.

Another aspect of the encoding specificity principle is that if we are trying to retrieve information under conditions that are similar to those under which it was learnt, we will retrieve it more easily than under different conditions.

The two main conditions that assist retrieval are the learner's external environment (the *context*) and the internal environment (the internal *state*). Consequently, we refer to these conditions as **context-dependent cues** and **state-dependent cues**.

TABLE 11.1 Examples of context-dependent and state-dependent cues

CONTEXT-DEPENDENT CUES (EXTERNAL ENVIRONMENT)	STATE-DEPENDENT CUES (INTERNAL ENVIRONMENT)
Brightness of light	Mood
Smells	Level of anxiety
Noises	State of tiredness

FIGURE 11.1 What steps do you take when you can't find your house key? Do you put them in the same place each night to avoid losing them?

Context-dependent cues

Context-dependent cues refer to the learner's external environment (the context) in which the memory was formed. Environmental cues include sounds, smells, temperature, sights and other environmental stimuli that were linked to the material being learnt at the time. At a later time, context cues can stimulate memories – these are often especially vivid if a smell is the stimulus.

People can also appear to have forgotten details of an event, but upon returning to the place where the original memory was formed they are flooded with detailed memories. This will often happen if you return to a street where you lived as a child, or if you are taken to the scene where you witnessed a crime.

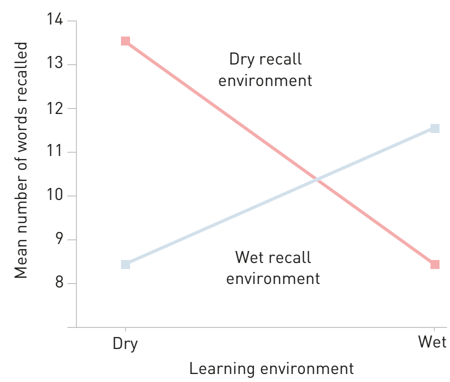
We are likely to use context-dependent cues in everyday life. Imagine that you can't recall where you put your keys: you set about retracing your steps and, suddenly, you remember that you were wearing your blazer when you were at your locker. Sure enough, your keys are in your blazer pocket!

In the investigation of the murder of Peter Falconio in the Northern Territory on 14 July 2001, the sole eyewitness was his girlfriend Joanne Lees. As part of the investigation, the police took her back to the scene of the crime so that the context might assist her to retrieve important details to assist in the hunt for the murderer.

CASE STUDY

GODDEN AND BADDELEY

Godden and Baddeley (1975) found that divers who had learnt a list of words on land recalled them almost twice as well when they were tested on land than when tested under water. However, divers who learnt the words under water recalled the words almost twice as well when tested under water. In this study, the context in which the learning took place served as a retrieval cue.



INVESTIGATE 11.1

1. What was Godden and Baddeley's aim in conducting their experiment?
2. Identify the independent variable and the dependent variable in this experiment.
3. Write an experimental hypothesis for this experiment and state how the dependent variable is to be operationalised.
4. What did the researchers conclude from their experiment and why did they reach this conclusion?

State-dependent cues

State-dependent cues refer to the 'internal environment', which are factors within the person – in other words, the physiological and/or psychological state that they were in at the time of learning, such as their mood, level of anxiety, and whether they were intoxicated, medicated or sober. For example, it has been found that when we are happy we are more likely to remember happy events, but if we are sad we tend to have unhappy memories.

State-dependent learning and retrieval cues might help explain why some people have difficulty recalling information when they are in examinations. In the exam they might be highly aroused, whereas when the learning of the material took place they were in a more relaxed emotional state.

REVIEW 11.1

1. Explain what Tulving and Thomson were proposing with the encoding specificity principle.
2. Explain the difference(s) between context-dependent and state-dependent cues. Use examples to illustrate your understanding.

Rehearsal and memory

We use a technique known as *rehearsal* to help us to encode material in our brain that we want to remember. **Maintenance rehearsal** relates to short-term memory and **elaborative rehearsal** relates to long-term memory.

Maintenance rehearsal

As we saw in Chapter 9, maintenance rehearsal is a technique that helps keep the information in our immediate awareness (short-term memory) for a longer period of time. It simply means repeating the information over and over again. As long as we are not interrupted, we can keep information in our short-term memory almost indefinitely by this method. However, we can't spend our lives thinking about the same five to nine pieces of information, so new information displaces the old. This happens frequently, especially if new information or other people or things in our environment particularly catch our attention.

Maintenance rehearsal does not add meaning to the information or link it to other material already in long-term memory, it just holds it in short-term memory for a longer time. When we stop maintenance rehearsal, the information will be lost from our immediate awareness within 12–30 seconds.

If we repeat something often enough, however, maybe tens or hundreds of times, transfer to long-term memory can occur.

FIGURE 11.2 We can keep a phone number in our short-term memory by using maintenance rehearsal.

Elaborative rehearsal

Elaborative rehearsal refers to the way we encode material when we are transferring it into long-term memory. During elaborative rehearsal we actively make meaningful associations between new information to be remembered and old or familiar information that is already in the long-term memory. By thinking of examples of concepts as we are learning them, we tend to process the information at a deeper level. We also create cues to help us locate and retrieve this information from long-term memory at a later time.

Salience, or personal relevance, is another way we can improve encoding of information. This means mentally involving ourselves in an example connected with the material being learnt.

INVESTIGATE 11.2

ELABORATIVE REHEARSAL

Ask a classmate to give you a mobile phone number to remember. You could use maintenance rehearsal to try to remember it, but later you will probably find that you have forgotten it. However, you might be able to link the numbers with the birthdays or ages of family and friends, or you might convert the numbers into a song with a familiar tune. Test your memory for the number at the end of the lesson to measure the effectiveness of your method of elaborative rehearsal.

SUPPORTING UNDERSTANDING

Levels of encoding and processing: Craik and Lockhart

This model of memory storage suggests that memory does not comprise any specific number of separate memory stores, but instead is a continuous dimension in which memories are encoded in relation to the ease with which they can be retrieved: the deeper the processing of information, the greater the chance of it being retrieved. **Levels of encoding and processing** refers to the number and types of associations made between new knowledge and previous knowledge. Research by Craik and Lockhart (1972) suggests that there are three levels at which we encode material and the deeper the processing, the better the chance of retrieval from memory at a later time.

This model has practical applications. For example, when you are studying, the deeper and more elaborately you encode information, the more likely it is that you will understand it and remember it later on. Actually thinking about and using the information to be remembered is much more productive for encoding than just looking at or repeating the information.

TABLE 11.2 Levels of encoding and processing

LEVEL OF ENCODING	LEVEL OF PROCESSING	EXAMPLE		RECALL
Structural (Words are learnt by remembering their physical features, such as whether they were in upper or lower case, started with a vowel or consonant, or were long or short.)	Shallow	> pOTato > brick > BOOK > Apple	Participants were asked to remember whether the word contained upper case letters.	Only about 20% of words were recalled after structural encoding.
Phonemic (Words are learnt by their sounds.)	Moderate	> bull > style > amazing > radio	Participants were asked to think of a rhyme (bull/full; style/smile) for the word, or perhaps rhyme and rhythm (What a song/I love the phrasing/and the tune/is just amazing!).	Approximately 50% of words were recalled after phonemic encoding.
Semantic (Words are encoded by their meaning, which allows them to be placed directly in our semantic networks.)	Deep	> gate > yacht > truck > apple	Participants were asked to put the words into a sentence where the meaning of the word would be important to the meaning of the sentence, such as 'She opened the gate and entered the garden'.	80% or more of words were retrieved after semantic encoding.

11.2 REVIEW

1. What is the function of maintenance rehearsal and why is it important?
2. Give two examples of maintenance rehearsal in action.
3. Explain what elaborative rehearsal involves and give an example to illustrate your understanding.

The serial position effect

A number of research studies have identified the **serial position effect** as a factor in memory recall. This is where the immediate free recall of items at the beginning or at the end of a list are remembered better than those in the middle of the list (Glazner & Cunitz, 1966; Postman & Phillips, 1965). The serial position effect provided evidence that there might be short-term and long-term memory systems (see Chapter 9).

The serial position effect was demonstrated when participants were given a list of 20 words to learn and then asked to recall them immediately. When the recall of words was graphed, a pattern referred to as the serial position curve emerged.

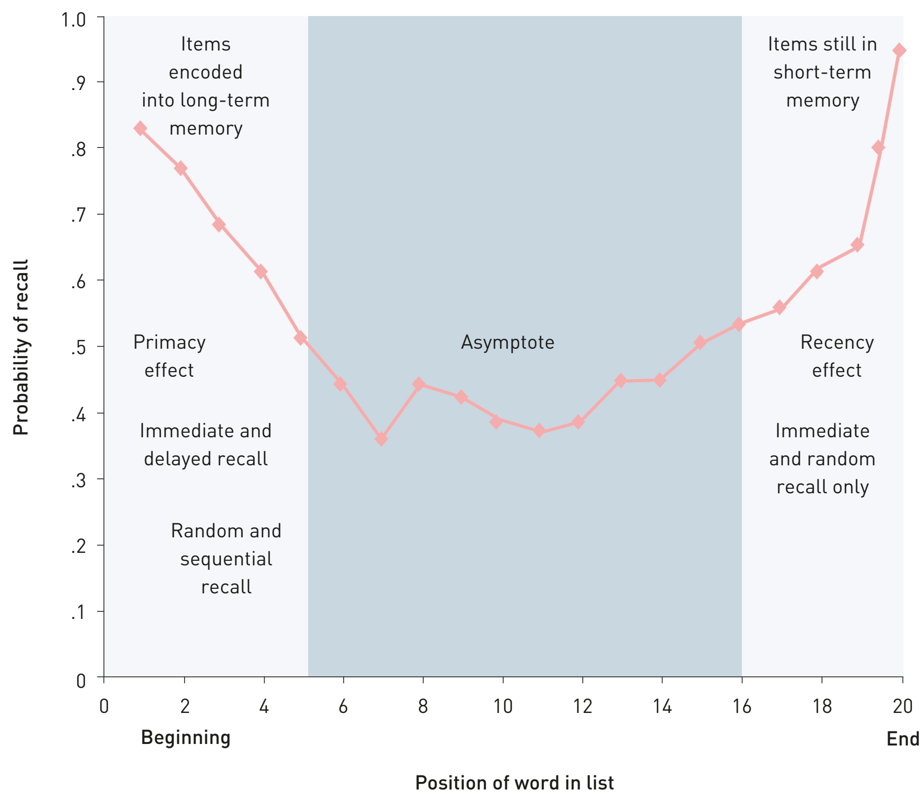


FIGURE 11.3 The serial position curve

To observe the serial position effect, the words or items in the list need to have similar characteristics and significance for the learner. For example, they might all be three-letter words such as 'cat', 'pen' and 'try'. On the other hand, a word such as 'elephant' placed in the middle of a list of three-letter words will be remembered because it stands out from the rest of the list (the von Restorff effect).

Table 11.3 provides a summary of the serial position effect, which includes the **primacy effect**, the **recency effect** and the asymptote.

TABLE 11.3 Summary of the serial position effect

EFFECT	DESCRIPTION	ENCODING	EXPLANATION
Primacy effect	Superior recall for items at the beginning of a list compared to items in the middle of a list	Items at the beginning of a list are stored in and retrieved from long-term memory	> Items have probably been rehearsed and transferred into long-term memory before the capacity of the short-term memory was full. > If list lasts longer than approximately 30 seconds (duration of short-term memory), it is likely that items from the start of the list will be forgotten unless they have been stored in long-term memory. > The primacy effect will still occur if there is a delay of more than 12–30 seconds between learning and reporting items.
Recency effect	Superior recall for items at the end of a list compared to those in the middle of the list	Items at the end of a list are retained in short-term memory. There is a tendency to get more of these items correct than items presented earlier in the list	> Items from the end of the list are recalled first. > The recency effect will still occur even if the list of items is increased. > Maintenance rehearsal has probably been used. > The recency effect will not occur where there is a delay of more than 12–30 seconds between learning and reporting the items (delayed free recall).
Asymptote	On a graph, this shows inferior recall for items in the middle of a list compared to those at the start and end of a list	Items are either not stored in long-term memory or are displaced from short-term memory	> As short-term memory reaches capacity, items are displaced before they can be adequately rehearsed and stored in long-term memory.

11.3 REVIEW

1 Describe the serial position effect.
2 Does it relate to short-term memory or long-term memory?
3 What are the primacy and recency effects? How are they different?
4 What is the asymptote on the serial position curve?

Eyewitness testimony

'I know it's true – I saw it with my own eyes!'

Can anyone make a stronger declaration of certainty than that? Almost certainly not, yet we know that many people convicted of crimes on the basis of **eyewitness testimony** have later been found to be innocent. How can this happen?

In her book *Eyewitness Testimony*, Elizabeth Loftus reports a case from 1975 in which eyewitness testimony was the only factor leading to a conviction.

FIGURE 11.4 Eyewitness testimony is only as good as the memory of the person who saw the event.

Richard Hinson, assistant manager of a department store in North Carolina, was forced into a car at gunpoint by two men who quickly pulled stocking masks over their faces. They forced him to lie down on the back seat of the car and drove him back to the store. Hinson claimed not to know the combination needed to unlock the store's safe, so the men stole all the money he had on him ($35) and left in the car, which Hinson recognised as a 1965 Dodge (Chrysler) Dart.

When Hinson reported the crime to police, he indicated that he had seen the men briefly before the masks obscured their faces. One of them 'looked Hispanic' and one looked like someone who had applied for a job at the store a short time before. From this meagre information, an artist's impression of one of the perpetrators was constructed.

Three days later, Sandy (20 years old) and Lonnie (18 years old) Sawyer were arrested driving their 1965 Plymouth Valiant. Neither of them looked like the artist's picture, neither had applied for a job at the store and both proclaimed their innocence. At the trial, four witnesses testified that Sandy was at home at the time of the kidnapping and another four testified that Lonnie was at a printing plant, visiting his girlfriend. The jury retired and after two hours were deadlocked – nine of the jury were in favour of conviction, three against. The judge instructed them to attempt to reach a unanimous verdict and a few minutes later they returned with a verdict of 'guilty'. Sandy was sentenced to 32–40 years and Lonnie to 28–32 years in jail. As they were taken from the court, the brothers cried out to their parents to prove their innocence.

Usually there is little hope for an appeal in these cases, but this time, a year later, another prisoner, Robert Thomas, confessed to a fellow inmate that he was responsible for the crime. Subsequently, it was discovered that the police had concealed certain parts of the evidence including the artist's sketch and the job applications from a week before the crime. None of the applications had come from the brothers but there had been one from Thomas.

It was not until January 1977 that the brothers received a pardon and were released from jail. (Note that a pardon does not mean that they were declared innocent – only that they were released without further punishment!)

The impoverished Sawyer family was ruined by having to find money to conduct the investigation and to pay a private detective and lawyers to conduct the defence.

This case demonstrates the weight that is given to eyewitness testimony by judge and jury. The major question is, of course, why did the jury accept the evidence of *one* eyewitness and reject the evidence of *eight* independent people who provided alibis?

Reconstruction of memories

A very common experience of police involved in investigating a motor accident and subsequently bringing prosecution to court is the **reconstruction of memories**, illustrated by the following:

John was witness to a motor vehicle accident – no one was injured, but there was significant damage to some vehicles.

After agreeing to give a statement, John waited for several minutes and then described what he had seen to the investigating officer.

Almost a year later, the case came up in court. John was called as a witness and, under oath, gave a much longer and more detailed description than he had done at the scene almost a year before.

What caused this difference? John was under oath and believed that he was telling 'the truth, the whole truth and nothing but the truth …'

In the months since the accident, John could possibly have:

FIGURE 11.5 Reconstruction of memories is a common phenomenon in court proceedings following motor accidents.

> seen news reports of traffic accidents
> read newspaper descriptions of accidents
> seen TAC advertisements concerning traffic accidents
> seen traffic accidents in movies
> discussed this and other accidents with his friends
> discussed the evidence with solicitors for the prosecution or defence.

In each of these situations it is likely that his memory of the event was influenced by new information and he is now in the situation of recalling *not* the original event, but his latest *reconstruction* of it.

When he gave evidence he truly believed that what he was saying was entirely accurate!

Why does eyewitness testimony fail?

One major cause of the failure of eyewitness testimony lies in the reconstructive nature of such memories. Usually the eyewitness sees the perpetrator for only a few seconds, often in very poor viewing conditions such as in shadow or dim light, partially obscured or from a distance. When asked to describe the scene and the perpetrator, therefore, the witness will build on their own expectations, created by similar experiences from the past, from stories in books, films and on television, or even their own feelings at the time.

Police procedures in identification line-ups need to follow strict guidelines. Where this is not done, it is almost certain that the person the police have as a suspect will be identified by the witness as the perpetrator; this is especially due to the reconstructive nature of such memories. Consider the following real-life example.

On 24 March 1985, a 24-year-old student, Michele Mallin, was parking her car when an African American man approached, reached in through the car window and unlocked the door. She bit his thumb but then noticed that he had a knife. He forced her to lie down in the car while he drove her to a deserted paddock and raped her – chain-smoking throughout the ordeal. The perpetrator then stole Michele's watch, a ring and $2 before escaping on foot.

Michele called the police and two weeks later Timothy Cole was arrested. Cole had been studying at home at the time of the offence while his brother and several friends were in the house. He also suffered severe asthma and could not be in the presence of cigarette smoke without a serious reaction.

FIGURE 11.6 Police line-up

When Michele went to the police precinct, she was shown six photographs: five were side-on black-and-white 'mugshots' of criminals and one was a full-face colour photograph of Cole. Michele indicated that she thought the colour photograph might be her attacker. The next day the police conducted a line-up with six individuals, including Cole. Michele picked him out of the line-up (not surprisingly, since none of the others in the line-up had been in the photographs) and again identified him when in court at his trial.

This shows the reconstruction of memory at work. In court, Michele was accessing her memory of the line-up, and at the time of the line-up she had remembered Cole from the colour photograph shown to her earlier at the police precinct. These memories built up until she had reconstructed her memory of the rape.

In 1986, Timothy Cole was sentenced to 25 years in jail. He died there of an asthma attack in 1999. In 2008, DNA evidence proved his innocence and he was declared innocent by a Texas judge in April 2009.

THE INNOCENCE PROJECT

INVESTIGATE 11.3

The Innocence Project founded in 1992 by Barry C. Scheck and Peter J. Neufeld at the Law School at Yeshiva University has a mission to assist prisoners who can be proven innocent through DNA testing.

Since 1992 in the United States, 250 convicted 'criminals' have been proven innocent by DNA testing – 17 of whom even served time on death row. On average, these people had served 13 years in prison before their innocence was proven. In 50 per cent of these cases, eyewitness testimony was the sole evidence on which the accused was convicted, while in a further 25 per cent eyewitness testimony was used in conjunction with other biased, false or fabricated evidence.

Source: www.innocenceproject.org

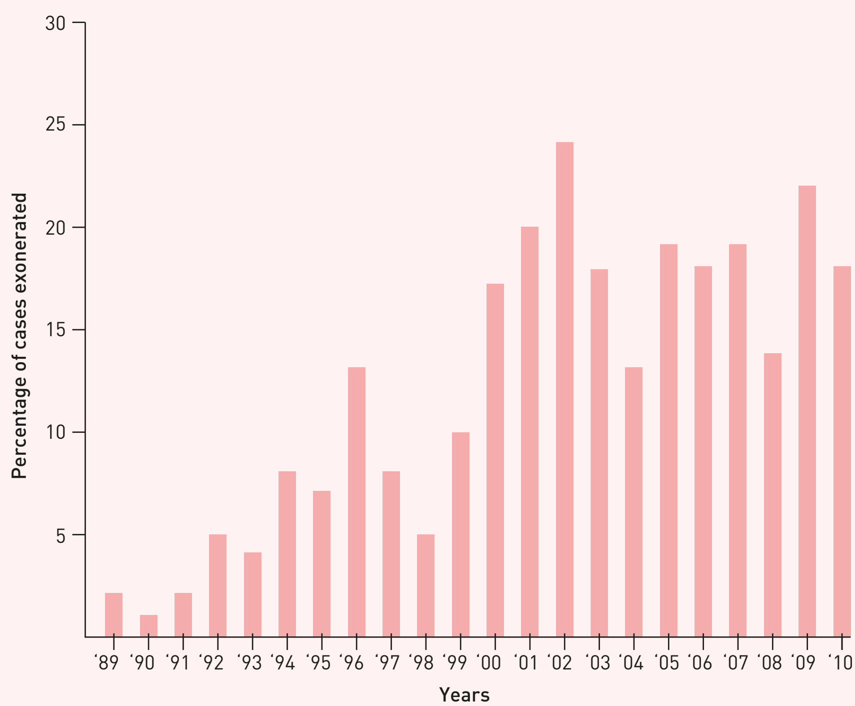


FIGURE 11.7 DNA exonerations by year in the United States

Go online and search for 'Spotlight on Eyewitness ID Reform' on the Innocence Project website (www.innocenceproject.org), then answer the following questions.

1 Why is *sequential* presentation of persons or photographs likely to lead to more reliable identification than *simultaneous* presentation?

2 What does 'double-blind procedure' refer to in this case? Why is this so critical?

3 Why is it important that the witness is aware that the suspect may not be in the line-up?

4 Why is there a problem if 'fillers' (non-suspects) are chosen for their likeness to the suspect, rather than their similarity to the witness's description of the perpetrator?

5 Explain how these procedures can help overcome the problems encountered with reconstruction of events in memory.

Leading questions and the misinformation effect

A 'leading question' is a question that, because of the way it is phrased, suggests what the answer should be:

> 'Did you see the defendant running from the scene of the crime?' suggests that the defendant was at the scene.
> 'Did you see anyone running from the scene of the crime?' does not identify any individual.

During questioning in court or, prior to that, during the police investigation, it is possible for misinformation to be implanted in the witness's memory. This can gradually take on greater significance for the witness until they begin to believe that the implanted information is a genuine memory. This is known as the **misinformation effect**.

Loftus and Palmer (1974) demonstrated this in an experiment where they showed participants a video of a motor accident, after which they interrogated them as if they were being cross-examined in court.

Some participants were asked, 'How fast were the cars going when they *collided with* each other?', while others had other words such as *bumped into*, *hit*, *contacted*, and *smashed into* substituted for 'collided with'. The speeds reported by the participants, presented in Table 11.4, showed that the more the word implied increased severity, the greater the estimate of the speed. One week later, the participants were asked, 'Did you see any broken glass in the accident?' The percentage reporting broken glass is presented in Table 11.5.

TABLE 11.4 Estimates of speed of cars in collision according to keyword in question

WORD USED TO DESCRIBE COLLISION	ESTIMATED SPEED (KPH)
'Contacted'	49.59
'Hit'	54.74
'Bumped into'	61.34
'Collided with'	63.27
'Smashed into'	65.69

TABLE 11.5 Percentage reporting seeing broken glass by keyword in question

WORD USED TO DESCRIBE COLLISION	PERCENTAGE REPORTING BROKEN GLASS
'Hit'	14
'Smashed into'	32

The language used does not even need to be as descriptive as in the experiment above. In another experiment, Loftus and Zanni (1975) showed 100 participants a film in which a car turned quickly into traffic and caused a five-car nose-to-tail collision. Afterwards, participants were asked about certain details of the accident, including whether certain items were present or not.

FIGURE 11.8 Loftus and Zanni (1975) showed 100 participants a film of a five-car collision.

The only difference in questioning was that 50 per cent of the questions were phrased as 'Did you see *the* (broken headlight)?' and the other 50 per cent as 'Did you see *a* (broken headlight)?'

Even this small difference had a significant effect on the responses, as shown in Table 11.6.

TABLE 11.6 Effect of certain words on response

RESPONSE	ITEM PRESENT	ITEM PRESENT	ITEM NOT PRESENT	ITEM NOT PRESENT
	'the'	'a'	'the'	'a'
'Yes'	18%	15%	20%	6%
'No'	62%	28%	69%	56%
'I don't know'	20%	57%	11%	38%

Clearly, participants were much more comfortable responding 'I don't know' when there was no suggestion that there had been a broken headlight: '… *a* broken headlight' than when this specific suggestion did exist '… *the* broken headlight'.

Harris (1975) also demonstrated this by asking participants questions such as 'How tall was the basketball player?', which drew an average 200.7 centimetres as opposed to 'How short was the basketball player?', which resulted in a mean response of 175.3 centimetres. This is a difference of 11.5 per cent.

Other questions showed similar results:

> The mean response to the question 'How long was the movie?' was 130 minutes while 'How short was the movie?' elicited a mean response of 100 minutes.

> 'How many other products have you tried? One? Two? Three?' gained a mean response of 3.3, while 'How many other products have you tried? One? Five? Ten?' gained a mean response of 5.2.

> The mean response to the question 'Do you get headaches occasionally? If so, how often?' was 0.7 times per week while 'Do you get headaches frequently? If so, how often?' had a mean response of 2.2 times per week.

It is clear from the examples given above that eyewitness testimony should be regarded with scepticism by judges, juries and the general public. Even when the eyewitness is convinced that they are correct, research has shown there can be considerable differences between reality and recall. Yet the vast majority of judges and prosecutors believe that a conviction should be possible even if the only evidence available is eyewitness testimony.

11.4 REVIEW

1 Why is eyewitness testimony not always a reliable source of evidence?
2 What could witnesses do to improve their memories of an event?
3 Explain the reconstruction of memories and give an example of how this might affect a witness's statement.
4 What is a leading question and how can it influence a witness's recollection of events?

CHAPTER SUMMARY 11

- The encoding specificity principle states that the associations formed at the time of creating new memories will be the most effective retrieval cues.
- Retrieval is more efficient under conditions that are similar to those in which learning took place.
- Two significant conditions that assist retrieval are the learner's external environment (the context) and internal environment (the internal state); that is, context-dependent and state-dependent cues.
- Maintenance rehearsal influences how well an item will be maintained in short-term memory.
- Elaborative rehearsal influences how well an item will be encoded into long-term memory.
- The serial position effect refers to the fact that the position of an item in a list influences how well it will be remembered.
- Eyewitness testimony often fails because of the reconstructive nature of memories. The witness builds on their own expectations, created by past experiences, stories and their own current feelings.
- Where police procedures in line-ups and identification are not strict and scientific, the witness will almost always identify the prime police suspect.
- Since 1992, 250 convicted 'criminals' in the United States have been proven innocent by DNA evidence. In 50 per cent of these cases, eyewitness testimony was the sole evidence on which they were convicted.
- It is clear that eyewitness testimony should be regarded with scepticism by judges, juries and the general public – even when the eyewitness is convinced that they are correct.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- context-dependent cues
- elaborative rehearsal
- encoding specificity principle
- eyewitness testimony
- maintenance rehearsal
- misinformation effect
- primacy effect
- recency effect
- reconstruction of memories
- serial position effect
- state-dependent cues.

KEY KNOWLEDGE

For the exam, you must have an understanding of:

- the encoding specificity principle, including:
  - associations formed at the time of encoding
  - state-dependent cues
  - context-dependent cues
- eyewitness testimony and how memories can be manipulated:
  - the reconstructive nature of memory
  - leading questions
  - the misinformation effect.

RESEARCH METHODS

For the exam, you must be aware of research into:

- encoding specificity:
  - Godden and Baddeley (1975)
  - Miles and Hardman (1998)
- eyewitness testimony:
  - Loftus and Palmer (1974)
  - Loftus and Zanni (1975)
  - Harris (1975).

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Inspector Cluseau is trying to solve a murder. He takes witnesses to the scene of the crime and asks them to tell him everything they can remember. Soon, a witness provides accurate information that leads to an arrest. The strategy used by the inspector was aimed at:
  - a stimulating the procedural memories of the witnesses
  - b stimulating the semantic memories of the witnesses
  - c stimulating context-dependent cues to assist memory
  - d stimulating state-dependent cues to assist memory.

2 Jane studied hard for her boat operator's licence and went to the traffic office to sit the test. While waiting for her appointment, she became increasingly anxious but did as her Psychology teacher had advised and imagined that she was sitting at her desk at home, relaxing and studying the regulations. When it was time for her to answer the questions, she passed the test. Jane's strategy enabled her to remember material by using:
  - a state-dependent cues to assist memory
  - b cued recall to assist memory
  - c context-dependent cues to assist memory
  - d context-dependent and state-dependent cues to assist memory.

3 Elaborative rehearsal is the process used to assist us to:
  - a encode information into our short-term memory
  - b encode information into our long-term memory
  - c retain information in our short-term memory
  - d retain information in our sensory memory.

4 What does semantic encoding refer to?
  - a processing in terms of the meaning of a word
  - b processing in terms of the shape or form of a word
  - c processing in terms of the sound of a word
  - d remembering a word according to its place in our memory network

5 What does phonemic encoding refer to?
  - a processing in terms of the meaning of a word
  - b processing in terms of the shape or form of a word
  - c processing in terms of the sound of a word
  - d remembering a word according to its place in our memory network

6 What does structural encoding refer to?
  - a processing in terms of the meaning of a word
  - b processing in terms of the shape or form of a word
  - c processing in terms of the sound of a word
  - d remembering a word according to its place in our memory network

7 In the serial position effect the:
  - a recency effect is related to short-term memory and the primacy effect is due to long-term memory
  - b primacy effect is related to short-term memory and the recency effect is due to long-term memory
  - c recency effect and the primacy effect are related to long-term memory
  - d recency effect and the primacy effect are related to short-term memory.

8 Eyewitness testimony is often unreliable due to:
  - a the way in which questions are phrased
  - b deliberate misrepresentation of the truth by witnesses
  - c the stress of speaking in a courtroom
  - d deliberate coaching of witnesses by police.

9 Reconstruction of memories involves:
- a putting together fragmentary memories and filling in the gaps
- b remembering according to one's preconceived ideas
- c gradual build-up of memories over time
- d all of these answers are correct.

10 In his research into eyewitness testimony, Harris discovered that if people were asked 'Did you see *a* broken headlight?' rather than 'Did you see *the* broken headlight?' they were most likely to respond:
- a 'Yes.'
- b 'No.'
- c 'I don't know.'
- d All responses were equally common.

SHORT ANSWER

11 Use an example to show how memory may be improved by using state-dependent cues.

2 marks

12 Use an example to show how memory may be improved by using context-dependent cues.

2 marks

13 We refer to the type of memory used in eyewitness testimony as 'reconstructive'. What factors are involved in this memory reconstruction? Explain using an example.

3 marks

14 What is the encoding specificity principle?

1 mark

15 How can short-term memory be improved? Give an example.

2 marks

16 What technique can we use to improve long-term memory? Give an example.

2 marks

17 What is the serial position effect?

1 mark

18 Describe the difference between the primacy effect and the recency effect.

2 marks

19 What is the misinformation effect?

2 marks

20 Henry is put on the stand to testify about a robbery he witnessed three months ago. He has had many interviews with police and lawyers since then and believes he will be able to identify the culprit in a line-up even though he only saw their face for a few seconds. Is Henry a reliable witness for the court? Explain your answer.

4 marks

HOW IS WELLBEING DEVELOPED AND MAINTAINED?

→UNIT 04:

How do we maintain our wellbeing?

Consciousness at different levels affects our mental processes and behaviour. Why are we sometimes alert, energised and 'raring to go', and at other times calm and relaxed? Why can we sometimes concentrate really well and at other times can't keep our thoughts from wandering? Our behaviour changes when we don't get enough sleep. We become irritable and dysfunctional – in other words, our mental wellbeing is impacted. In this unit we explore the effects of interrupted and lack of sleep on our psychological health, using contributions that classical and contemporary research made to the understanding of consciousness.

What does it mean to be mentally healthy? Thirty per cent of Australians will suffer a mental disorder at some time in their life. Biological, psychological and sociocultural factors all contribute to our mental wellbeing. A simple phobia represents disturbance in the biopsychosocial balance of an individual. Using specific phobias, we analyse mental health and disorder, and their management, by applying a biopsychosocial approach.

If a state of wellbeing is to be developed and maintained, there is a need to understand the interaction of all aspects of an individual as well as their interaction with the world.

AOS 1
HOW DO LEVELS OF CONSCIOUSNESS AFFECT MENTAL PROCESSES AND BEHAVIOUR?

Consciousness can be defined as 'our awareness of internal and external stimuli and our thoughts and feelings about them'.

Psychologists and medical scientists have devised and developed technologies and research methods (for example, brain scanning techniques) to enable the systematic study of normal waking consciousness and altered states of consciousness.

Throughout the day and night, our level of consciousness will vary: from heightened awareness as we experience arousal and focus; to drowsiness and then unconsciousness through sleep, a state that is vital for our efficient functioning.

When a 'normal' sleep cycle is disturbed – especially over a period of time – this may contribute significantly to mental health issues and mental disorders, thus the treatment of sleep disorders is vitally important.

Outcome 1

On completion of this unit the student should be able to explain consciousness as a continuum, compare theories about the purpose and nature of sleep, and elaborate on the effects of sleep disruption on a person's functioning.

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→CHAPTER 12

STATES OF CONSCIOUSNESS

Consciousness relates to our awareness of our thoughts, feelings, perceptions and surroundings at any one moment in time. It creates our reality (what we believe to be real) and our sense of self. This chapter examines the psychological construct of consciousness, including normal waking consciousness and altered states of consciousness. It considers different states of consciousness – from when we are alert, to being not fully aware and even lacking awareness altogether.

KEY KNOWLEDGE

> consciousness as a psychological construct that varies along a continuum, broadly categorised into normal waking consciousness and altered states of consciousness (naturally occurring and induced)

> changes in a person's psychological state due to levels of awareness, controlled and automatic processes, content limitations, perceptual and cognitive distortions, emotional awareness, self-control and time orientation

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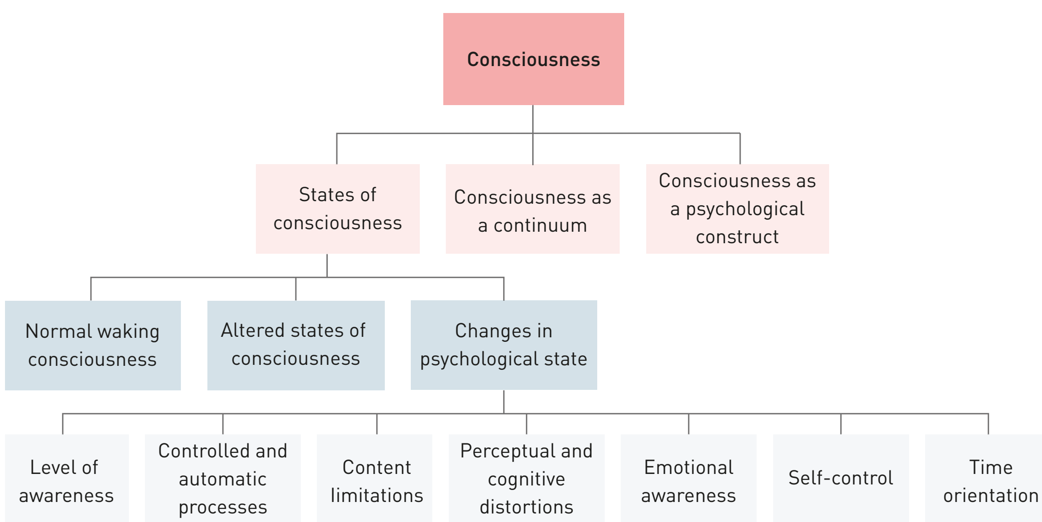
CHAPTER OVERVIEW

Consciousness as a psychological construct	What is consciousness? Why is consciousness a psychological construct? Consciousness as a continuum
States of consciousness: two broad categories	Normal waking consciousness Altered states of consciousness
Changes in psychological state	Level of awareness Controlled and automatic processes Content limitations Perceptual and cognitive distortions Emotional awareness Self-control Time orientation

CONTENT MAP



Consciousness as a psychological construct

Are you conscious? If you are reading this, the answer is most definitely yes! You probably already have a good idea about the meaning of the word 'conscious' and, indeed, the word 'unconscious'. In everyday conversation, we tend to use 'conscious' interchangeably with the word 'aware'. For example, how aware are you at this moment? Your answer will be subjective – it depends on what you are experiencing. It is also often difficult to describe to others and for others to completely comprehend.

What is consciousness?

Consciousness can be defined as the awareness of our own thoughts, feelings and perceptions (internal events) and our surroundings (external stimuli) at any given moment. It creates our reality (what we believe to be real and happening at this moment) and is central to our sense of self. Our sense of self is developed through being aware of what we are doing, why we are doing it and the awareness that others are probably observing, evaluating and reacting to it. Take a look around you. Can you describe your surroundings? Are you aware of what is going on in your environment? How do you feel about it?

Others cannot directly know what you are thinking, feeling or perceiving and most of us have some difficulty conveying this to others. Our own conscious experience is personal and private, and it is difficult to measure accurately or compare with other people's.

Why is consciousness a psychological construct?

Psychological constructs are used to understand or explain things that we believe exist but cannot see, touch or measure in any way. Consciousness is a psychological construct because it is believed to exist, but we are unable to physically measure it, so descriptions are 'constructed' to explain it.

Consciousness as a continuum

Right now you are paying attention to the words on this page, but what were you focusing on a moment ago? Maybe you were **daydreaming** or thinking about an assessment task due today, making plans for the weekend or waking up from sleep. All these different mental activities represent different states of consciousness.

Our level of awareness of internal events and external surroundings varies throughout the day. You will have times when you are alert (such as during your Psychology class, of course!) and others when you are feeling quite drowsy. Consciousness can be thought of as operating on a continuum from a high level of consciousness or awareness through to the point of being unconscious (being totally unaware), as shown in Figure 12.1. The more aware we are of our thoughts, feelings, perceptions and surroundings, the higher the level of consciousness. Our level of awareness of internal events and external surroundings is known as a **state of consciousness**.

States of consciousness can also be divided into two broad categories – normal waking consciousness and altered states of consciousness. We will focus on these in detail in the second half of this chapter. **Normal waking consciousness** tends to occupy the middle part of the continuum in Figure 12.1 (the awake to alert zone).

An **altered state of consciousness** exists both on the lower part of the continuum (during reduced awareness) and the upper part of the continuum (during heightened awareness).

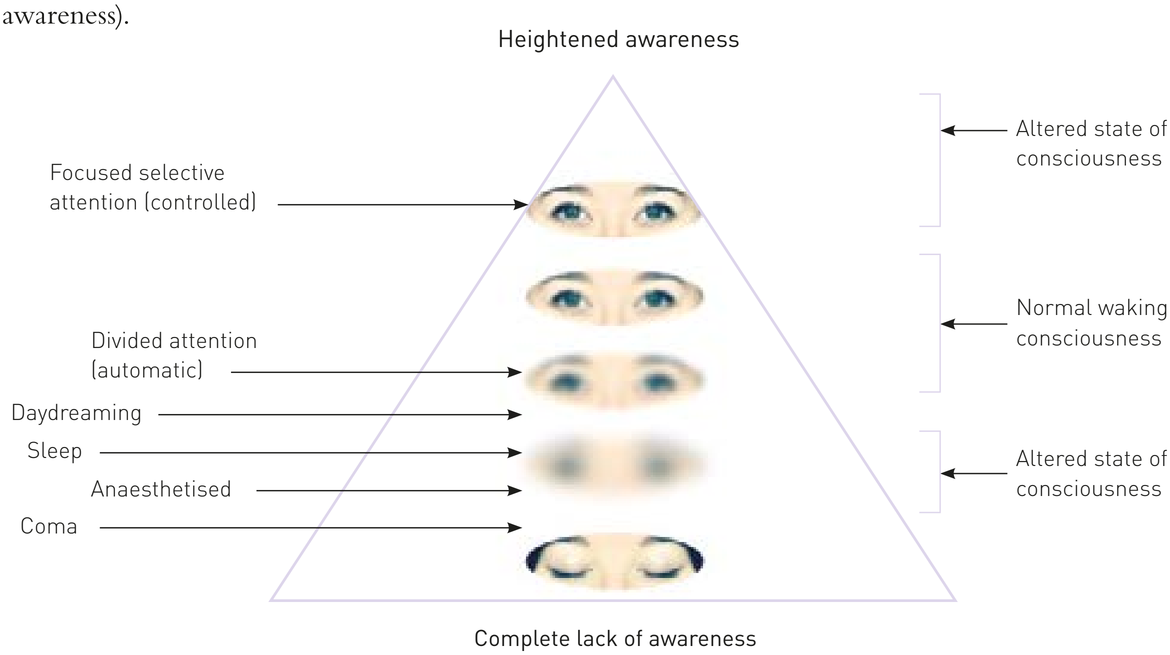


FIGURE 12.1 The continuum of awareness

OUT THE WINDOW!

12.1 INVESTIGATE

- Stand up and look out the window.
- Imagine that some animals have escaped from the zoo and you can see them there.
- For two minutes, think about what the consequences of this would be. For example, what could it look like outside this window?
- Pay attention to your thoughts and write brief points down on paper, making sure the order of your thoughts as they flow from one to another is evident. You might like to share some of your thoughts with the class.

QUESTIONS

1. What types of animals did you imagine? What were they doing?
2. Did your thoughts wander off track or did they focus on answering the question?
3. Was it easy, almost automatic and involuntary, to shift your awareness from one event to another?
4. At times, did you find yourself concentrating on internal events (for example, whether or not you are hungry, what homework you need to do tonight)?
5. At times, did you find yourself concentrating on your external surroundings (for example, what other students were doing, a noise outside the room, people walking outside)?
6. Read about William James on page 226. While initially you were forced to think about a question, the activity went for long enough for it to be part of a stream of consciousness. Explain how this activity relates to James's notion of 'stream of consciousness'.

WILLIAM JAMES: THE STREAM OF CONSCIOUSNESS

William James (1842–1910) studied the conscious experience. He coined the phrase **stream of consciousness** as he viewed consciousness as an ever-changing series of thoughts that can shift smoothly and effortlessly from one moment to the next, just like water flowing in a stream.

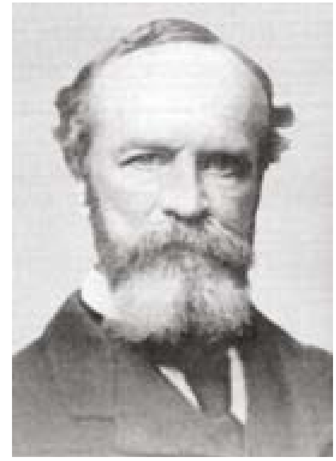


FIGURE 12.2 American psychologist William James (1842–1910)

According to James, our conscious experience is:

> *continuous*: it is never empty; thoughts are not isolated and can flow easily from one topic to another without interruption

> *ever-changing*: it rarely travels along one line of thought and constantly changes as we become aware of new information

> a highly *personal experience*: it relies on our own thoughts, feelings and perceptions

> *selective*: we can usually choose to focus on some things and ignore others; we can focus on *internal* events (thoughts, feelings and perceptions) and/or *external* surroundings

> *active*: consciousness has a purpose to allow us to function in our world.

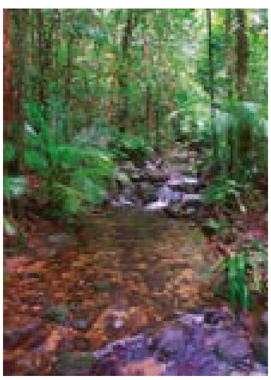


FIGURE 12.3 James likened consciousness to a series of ever-changing thoughts that flow smoothly from one to the next.

Consciousness … does not appear to itself chopped up into bits … a 'river' or a 'stream' are the metaphors by which it is most naturally described … as the brain changes are continuous so do all these consciousnesses melt into each other like dissolving views. Properly they are but one protracted consciousness, one unbroken stream.

William James, 1890

When you looked out of the window during the exercise in Investigate 12.1, what did you think of? Did your mind keep track and focus on the question? The odds are that it didn't. Initially, you might have thought of the type of animals that could be outside, what they were eating. Your consciousness might then have shifted to wondering what you would have for lunch. You may be planning to eat with a friend. Next, you could have focused on the other students in the class to see if they were still looking out the window. In the above scenario, your consciousness focused on internal and external events and consisted of an ever-changing stream of thoughts that shifted from one moment to the next with relative ease. It drifted along the stream at different paces.

REVIEW 12.1

1 Define *consciousness*.
2 Why is consciousness considered a psychological construct?
3 Consciousness is considered to be varied on a continuum of awareness. How does this relate to James's idea of the 'stream of consciousness', including his ideas of our conscious experience?

States of consciousness: two broad categories

States of consciousness are viewed as constantly changing on a **continuum of awareness**. Two broad categories exist on this continuum – normal waking consciousness and altered states of consciousness.

Normal waking consciousness

Think about how aware you are of your thoughts and feelings and what is happening around you at the moment. You have a real understanding of where you are, what time it is, what you are thinking, how you are feeling and who you are with. That is, you are experiencing normal waking consciousness – a state that is relatively organised, meaningful and clear. Normal waking consciousness can be loosely defined as the state of consciousness you experience when you are awake and aware of your thoughts, feelings and perceptions from internal events and the surrounding environment. Your experience during normal waking consciousness creates your reality and provides a baseline from which to judge other states of consciousness.

Throughout the day, and even throughout a lesson, your level of awareness will vary. You may focus intently on reading your textbook but later feel a bit drowsy and find yourself distracted by noise in the corridor outside. These changes are part of normal waking consciousness.

Altered states of consciousness

An altered state of consciousness can be defined as any state of consciousness that deviates from normal waking consciousness, in terms of marked differences in our level of awareness, perceptions, memories, thinking, emotions, behaviours and sense of time, place and self-control. As such, this could include states produced by the learnt technique of meditation, psychological drugs (including alcohol), fever, psychosis (a serious condition where the sense of reality is lost) and even daydreaming and sleep. Altered states are often culturally significant and can happen through religious experiences. An altered state of consciousness can be induced deliberately or occur naturally.

SUPPORTING UNDERSTANDING

Meditation – an example of an altered state of consciousness

While meditation is not explicitly mentioned in the Study Design, it is an example of an altered state of consciousness that is a different experience from daydreaming or alcohol-induced states.

Meditation induces an altered state of consciousness in which a person uses mental exercises to become highly focused on a single thought to the exclusion of others. This single thought may be a stimulus that is usually ignored, such as breathing, or a simple stimulus such as a pattern or a word. As a result, meditation encourages a heightened awareness and brings cognitive processes under greater control. The normal flow of consciousness is disrupted and, with practice, meditation prevents the ever-changing stream of thoughts from entering consciousness.

INVESTIGATE 12.2

GUIDED MEDITATION

Guided meditation exercises encourage a relaxed state and are particularly good for someone who is new to meditation and prefers listening to a soothing, relaxed voice. Meditation is a trained skill and it takes practice to become good at it. Meditation can help you become calmer and your thoughts clearer.

Before you start, take the following measurements:

- your level of anxiety, on a scale of 1 = very calm, 2 = calm, 3 = slightly tense, 4 = tense, 5 = very tense
- your heart rate (beats per minute).

Your teacher will take you through a meditation exercise. Follow their instructions and then answer the questions about your experience.

Discussion

1 First take your measurements:
   - your anxiety levels
   - your heart rate
   - an estimate of how long the exercise took.
2 Consider your measurements:
   a Were you able to relax during this activity? Did your anxiety level reduce?
   b Did the meditation exercise reduce your heart rate?
   c Did you accurately guess the amount of time that passed during the meditation exercise?
3 Collect class results. Work out the mean for each type of measurement.

	DIFFERENCE IN ANXIETY LEVELS	DIFFERENCE IN HEART RATE	PERCEIVED LENGTH OF TIME	DESCRIPTION OF THE EXPERIENCE
Individual results				
Class results (means)				

4 Discuss the results. To what extent did participants experience an altered state of consciousness?

REVIEW 12.2

1 Outline the two broad categories of states of consciousness.
2 Where does normal waking consciousness tend to lie on the continuum of awareness? Where are you more likely to find an altered state of consciousness on the continuum?
3 Give three examples of factors or influences that might cause an altered state of consciousness.

Changes in psychological state

Think of a time when you were sick with a high fever. What did you experience? Did you lose track of where you were and what was happening around you, your sense of time and the ability to think clearly?

Now think of a time you were at a party with lots of people, loud music and flashing lights. Did you 'absorb' yourself into the scene? If so, did the time fly? Were you extremely happy and less inhibited than usual? If you answered yes, then you experienced an altered state of consciousness. You don't need drugs to deliberately alter your state of consciousness: an environment such as this one can do it for you.

FIGURE 12.4 Being sick with a fever is an example of an altered state of consciousness.

The following characteristics help determine whether you are experiencing normal waking consciousness or an altered state of consciousness and highlight the changes in psychological state. The differences between these characteristics in terms of normal waking consciousness and altered state of consciousness are also summarised in Table 12.2 on page 236.

Level of awareness

Awareness relates to how conscious or aware you are of internal (within your body) and/or external (within your environment) events. A number of levels of awareness exist during normal waking consciousness, from having little awareness of internal and external events to being tuned in to specific ones. It is not unusual to swap 'consciousness' with the term 'awareness' since they are linked together. Your level of awareness influences the other characteristics of consciousness.

Look back at the continuum of awareness (Figure 12.1). In an altered state of consciousness, your level of awareness either decreases or increases compared to normal waking consciousness. You become more or less aware of your perceptions and/or surroundings. When suffering from a fever, for example, you become less aware of what is happening in your environment. If you are experiencing heightened awareness, you can become more aware of certain events that are happening around you.

INVESTIGATE 12.3

LEVELS OF AWARENESS

Study the following pictures. Place the pictures in an order along a continuum, from total awareness (highly alert) to complete lack of awareness (unconsciousness or in a coma). Are some easier to place on the continuum than others? Explain.

SUPPORTING UNDERSTANDING

Attention

At any given time, an enormous amount of information is available from our senses, memories and other cognitive processes. It is impossible to attend to all of this information. Your attention can be focused on events that are taking place in the environment (external) or inside your mind (internal) and attention can shift *consciously* or *unconsciously*.

Attention relates to the information that you are *actively processing*, either consciously or even outside your conscious awareness. Attention overlaps with consciousness, as what you are consciously aware of is often also the focus of attention. For example, try recalling what you ate for dinner last night. The answer requires attention in order to reach your conscious awareness.

A range of stimuli can attract our attention, including:

- novel stimuli (such as something new or unusual)
- changes in stimulation (such as the volume on a radio suddenly increasing)
- something that is personally meaningful to us (such as our name being mentioned across a crowded room) or important for us to attend to at the time.

Attention may be broadly classified into the following types:

- **Selective attention** refers to the *limitations* placed on how much we can focus at any given moment on one stimulus or event to the exclusion of others.
- **Selective inattention** refers to the way we attend to (or do not attend to) information that may be relevant but emotionally upsetting.
- **Divided attention** refers to the capacity to attend to and perform two or more activities at the same time.

Controlled and automatic processes

When you write a sentence, you pay attention to its meaning or the spelling of a word rather than the process of forming each letter. The act of writing each letter or word is automatic, with little mental effort or conscious awareness. **Automatic processes** require very little awareness or mental effort to be performed well and they generally don't interfere with other automatic or controlled processes. In other words, automatic processes require little attention and little thought, and can allow you to do two things at once.

Another example of an automatic process is texting on a mobile phone. Many people are very fast and efficient at doing this. They are well practised and know exactly where the keys are and so can create the message with ease. For them, texting is a simple task that requires little mental effort.

Compare this to someone who is learning how to write text messages. This could be someone who has a new mobile phone or a person who rarely sends text messages. The person must concentrate on how to create the message – it requires their full attention. For this person, texting is a complex task as it is yet to be learnt or mastered and requires greater mental effort. It is an example of a **controlled process**. This person needs to be consciously aware of what they are doing and concentrate on how to perform the task. They are unable to complete another controlled process at the same time as both would require their full attention and therefore would interfere with each other. A person sending a text message for the first time is unlikely to be able to listen to an important announcement simultaneously.

Learning how to drive provides a very good example of how an activity can become automatic. At first, you can feel awkward and experience difficulties

FIGURE 12.5 Learning to drive is a complex process. With practice, the basic skills of driving become automatic.

monitoring your hands and feet, especially if you are learning to drive a manual vehicle. At this stage, operating the car requires your full attention because it is a controlled process. You might even find it hard to talk to your instructor or read road signs. As your skills develop, you will find it easier to steer, indicate, check the rear-view mirror and change gears. Finally, you will find yourself doing these things automatically and be able to concentrate on the traffic and other driving conditions. The basic skills of driving the car are now automatic processes.

Attention relates to our ability to undertake controlled and automatic processes.

> Controlled processes require selective attention – a person must actively focus attention in order to successfully complete the task.
> Automatic processes enable us to have divided attention – if a task requires little mental effort and attention, we can often engage in other tasks at the same time.

TABLE 12.1 The differences between automatic and controlled processes

	AUTOMATIC PROCESS	CONTROLLED PROCESS
Amount of conscious awareness	Requires little, if any, conscious awareness	Requires full conscious awareness
Attention	Requires little attention or mental effort (enables us to have divided attention)	Requires selective attention (must actively focus attention on the task)
Task difficulty	Simple (easy) or mastered tasks	Usually complex (difficult) or novel (new or yet to be mastered) tasks

In an altered state of consciousness, you usually find it difficult to carry out controlled processes. Your ability to perform some automatic processes can also be impaired. In some altered states of consciousness, however, you may be so focused (high level of awareness) that you find some tasks easier.

INVESTIGATE 12.4

MEDIA RESPONSE: ON THE PHONE? GET OFF THE ROAD!

The use of mobile phones, either handheld or hands free, is banned for L-plate and P1-plate drivers. It is also illegal for all drivers to touch a mobile phone while in control of a motor vehicle, even when stopped at traffic lights.

Go to the TAC website and navigate to the section on distractions under the Road Safety tab.

Is this law fair? Is driving while using a mobile phone dangerous? Obviously, physically touching a mobile phone is dangerous – a driver has to take a hand off the steering wheel and eyes off the road. Therefore, it is physically impossible to carry out the tasks simultaneously. But what about the use of hands free mobile phones for inexperienced drivers?

Prepare a supporting document that justifies the banning of mobile phones while driving laws. Outline the laws and the reasons for implementing them. Using psychological terms, relate your argument to the relevant characteristics of normal waking consciousness.

What other laws exist that are applicable for inexperienced drivers only? Can these laws be justified using the same psychological reasoning? Discuss.

Content limitations

During normal waking consciousness, we mainly control what we focus our attention on, and our thoughts tend to be organised and logical. For instance, to read this page you must focus your attention on it to be able to see the print. You need to think logically and limit your attention to what is written in order to fully understand it. The content (type of information) of normal waking consciousness is therefore generally *more limited* (restricted) than the content of altered states of consciousness. Our thoughts tend not to be as creative, bizarre, unrealistic or impossible as our thoughts during an altered state of consciousness.

FIGURE 12.6 During normal waking consciousness, we control what we focus our attention on, such as the words we are reading or writing while doing homework.

During an altered state of consciousness, your ability to pay attention to certain tasks can be increased or decreased compared to normal waking consciousness. In normal waking consciousness you can usually prevent yourself from focusing your attention on issues, thoughts or events that are unpleasant. During an altered state of consciousness, whether it is naturally occurring (such as sleep) or artificially induced (such as by drugs), your mental defences are lowered and the content of your thoughts and dreams may be both broader and deeper than in normal waking consciousness. The content of your consciousness when in an altered state of consciousness is often disorganised and senseless, or bizarre and unusual. Or, to the other extent, its content could be extremely narrow (limited) as you concentrate intently on one thing.

Tasks that require selective attention may be impaired during an altered state of consciousness. It can also be very difficult to divide attention, even between automatic processes.

Perceptual and cognitive distortions

Perception is the process of organising sensory input and giving it meaning. During normal waking consciousness, our perceptions are usually clear and rational. We can make sense of sensory input and have a real awareness of our internal state and any external stimuli.

Your perception of sensory input is often quite different in an altered state of consciousness. For instance, you may perceive colours as being more vivid or duller. You might not perceive pain or you might have a stronger reaction to it. Vision, hearing, touch, taste, smell and balance can all be affected in an altered state of consciousness.

Cognition is a broad term that relates to mental activities such as thinking, problem-solving, language, analysis and reasoning. During normal waking consciousness, we have a sense of reality. Our thoughts are usually rational, clear and meaningful. During normal waking consciousness, the brain actively stores information in the memory and retrieves it for use in thinking. Memory is a vital component of normal waking consciousness as it is involved in nearly every activity we undertake. We can generally access our memories and remember events and experiences processed into long-term memory in this state.

There is a tendency for cognitive functions to become distorted during an altered state of consciousness. Thoughts may become disorganised, as evidenced during some dreams. Thinking may lack logic and problem-solving may be impaired. The memory of events that occurred during an altered state of consciousness might not be accurate and we might not even be able to recall them at all during normal waking consciousness. Furthermore, we may have difficulty remembering things that we usually remember in normal waking consciousness, such as a good friend's name or our telephone number.

Emotional awareness

During normal waking consciousness, we are generally aware of our feelings and usually show a range of emotions that are normal for us and appropriate for the situation. We can usually monitor our emotions and even hide our true feelings from others.

The way emotions are experienced is often different during altered states of consciousness.

Emotions can be heightened. This means they can become more intense, such as being much happier or sadder.

Emotions can also be dulled to the extent that people feel emotionally numb. This can happen, for example, when someone is in a state of shock following a crisis or personal tragedy.

Emotions might also be inappropriate as there can be a lack of understanding of the emotional reality of the situation.

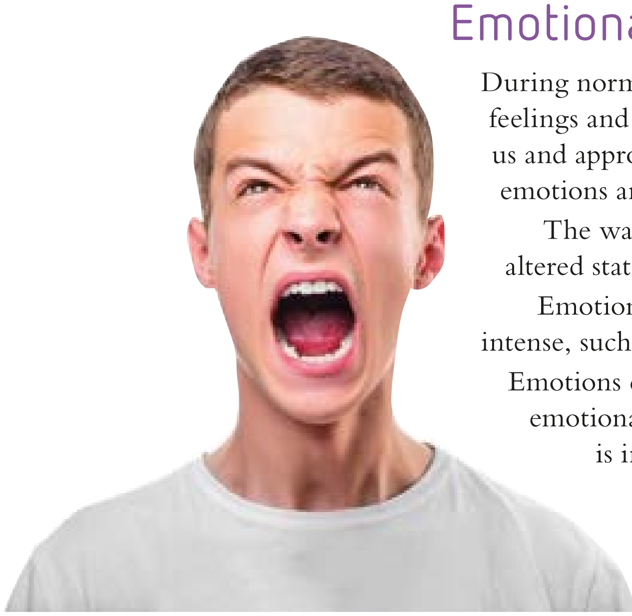


FIGURE 12.7 Emotions can be heightened when experiencing an altered state of consciousness.

Self-control

Consciousness allows us to direct our thinking and monitor our impulses and behaviours. During normal waking consciousness, our ability to maintain **self-control** is usually maintained. We tend to be quite reserved and avoid doing anything that we think is risky or embarrassing.

Our ability to maintain self-control is often reduced during an altered state of consciousness. Our inhibitions are lowered and we might do things we would not do during a normal state of consciousness. We might be more open to suggestion, meaning that we are more likely to follow instructions with little resistance or thought about the consequences. However, this is not always the case: some people gain greater self-control in certain altered states of consciousness.

Time orientation

During normal waking consciousness, we usually have a good awareness of the passage of time. It is perceived to move in 'real' time. For example, when it feels as if 10 minutes have passed, about 10 minutes have actually passed. We understand where we are in time (night or day, year and hour) and are able to focus on the past, present and future.

FIGURE 12.8 Time can seem to slow down when in some altered states of consciousness, such as when you are bored.

Time tends to be experienced at a different speed when in an altered state of consciousness. For example, when woken from sleep after just one hour, you may be surprised that you haven't yet had an entire night's sleep. On other occasions, you can't believe that a whole night has passed when the alarm sounds to herald the start of another day of school.

It is difficult to differentiate between the infinite number of states of consciousness that we experience. Therefore, we tend to divide them into the two broad categories of normal waking consciousness and altered states of consciousness. Some of the differences between these two categories are summarised in Table 12.2 on the next page.

TABLE 12.2 Comparisons between normal waking consciousness and altered states of consciousness

CHARACTERISTIC	NORMAL WAKING CONSCIOUSNESS	ALTERED STATE OF CONSCIOUSNESS
Level of awareness (awareness of internal and external events)	Awake and generally aware of internal and external events. A good sense of place, time and reality	May be increased or decreased compared to normal waking consciousness. Most often, level of awareness is lowered during an altered state but can be increased when a person experiences heightened awareness
Controlled and automatic processes (your ability to effectively perform two or more tasks at once depending on the level of complexity)	Able to perform controlled and automatic processes within normal limits. Attention is focused or highly selective and can be divided between tasks	Usually less (although sometimes more) able to perform controlled processes and automatic processes. Usually less control over attention, which may be highly selective but less able to be divided between tasks
Content limitations (the amount of control you have to limit what you attend to)	More constrained and controlled. Can selectively process different parts of what is in consciousness	May be more or less than in normal waking consciousness. Usually less constrained or controlled, with reduced ability to process information but fewer limitations on content
Perceptual and cognitive distortions (the degree of awareness and efficiency of your perceptions and cognitions, i.e. memory and thought processes)	Perceptions (including of pain) are realistic and normal. Effective control of the memory processes of storage and retrieval. Thought processes organised and logical	Perception (including pain) may be altered. Memory processes may be disrupted or distorted: storage and recall may be more fragmented or less accurate. Thought processes disorganised and less logical
Emotional awareness (the experience of emotions, i.e. feelings)	Greater awareness of emotions and control of emotional awareness	Less (although sometimes more) control of emotions, e.g. more or less affectionate, aggressive, anxious
Self-control (the ability to maintain self-control, usually in terms of monitoring behaviours)	More control over actions and movements, e.g. you are able to make yourself walk in a straight line	Usually less control over actions and movements, e.g. not able to make yourself walk in a straight line. Less control over emotions and thoughts but greater susceptibility to suggestion may increase self-control
Time orientation (your ability to correctly perceive the speed at which time passes)	Clear sense of time, e.g. the passage of time, including past, present and future	Distorted sense of time, e.g. time may appear to speed up or slow down

12.5 INVESTIGATE

RESEARCH INVESTIGATION: SHEEP DASH! GAME

Go to the Sheep Dash! game on the BBC website or find a similar media game that measures your reaction time. Your level of alertness depends on your state of consciousness at the time and therefore will affect your reaction time.

Play this game under different conditions, for example, at a time when you:

- are drowsy (for example, after lunch or on a hot afternoon)
- are alert (for example, mid-morning)
- have recently had caffeine or sugary food (for example, chocolate).

Before playing the game, rate your state of consciousness by completing the information in the table.

To measure awareness, use the scale: 1 = asleep, 2 = drowsy, 3 = relaxed, 4 = intense, 5 = hyper-aroused.

To measure heart rate, tilt your head up and place two fingers against the carotid artery on one side of your neck. Count the pulses for 30 seconds, then multiply this by two to get the number of beats per minute.

Other physiological measurements such as body temperature, blood pressure and respiration rate may also be measured.

DATE	TIME	LEVEL OF AWARENESS	HEART RATE	CONDITIONS (INCLUDE ACTIVITY PRIOR TO THIS ONE THAT MAY ALTER YOUR STATE OF CONSCIOUSNESS, E.G. SLEEP, MEAL, SPORT, CONCERT)	SHEEP DASH! REACTION TIME

Questions

1 Under what condition(s) was your reaction time:

  a the fastest?

  b the slowest?

2 Was there evidence that your level of awareness affected your reaction time?

3 Was there an association between your level of awareness and your heart rate?

4 Were there any environmental conditions (potentially confounding variables) that may have affected your performance during one of the trials?

12.3 REVIEW

1 List some of the characteristics of consciousness that may change as a result of changes in psychological state (changes in states of consciousness).

2 In terms of self-control, how do we tend to behave during normal waking consciousness?

3 In terms of controlled and automatic processes, explain why learner drivers must log 120 hours of supervised driving time.

CHAPTER SUMMARY 12

- Consciousness is an awareness of our own thoughts, feelings and perceptions (internal events) and our surroundings (external stimuli) at any given moment.
- Consciousness is a psychological construct because it is believed to exist but cannot be directly observed or measured. Descriptions are 'constructed' to explain it.
- Consciousness can be thought of as operating on a continuum, from a high level of consciousness (awareness) through to a low level and even on to the point of being unconscious (totally unaware).
- Normal waking consciousness is the state of consciousness we experience when we are awake and aware of our thoughts, feelings and perceptions generated from internal events and the environment.
- If we deviate from this normal baseline of waking consciousness, we experience an altered state of consciousness, which may reflect either heightened or reduced awareness.
- Differences in psychological states of consciousness can be described in terms of the following characteristics:
  - level of awareness: that is, more or less aware of internal and external events
  - controlled and automatic processes: ability to effectively perform two or more tasks at once, depending on their level of complexity, is more likely to decline and it is more difficult to perform automatic processes
  - content limitations: that is, usually less (though sometimes more) control to limit what you want to attend to
  - perceptual and cognitive distortions: the degree of awareness and efficiency of your perceptions and cognitions (thoughts and memories) is often more distorted
  - emotional awareness: the experience of emotions (feelings) is more or less in an altered state
  - self-control: the ability to maintain self-control, usually in terms of monitoring behaviours, is affected
  - time orientation: the ability to correctly perceive the speed at which time passes.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- altered states of consciousness
- attention
- automatic processes
- cognition
- consciousness
- continuum of awareness
- controlled processes
- divided attention
- normal waking consciousness
- perception
- selective attention
- state of consciousness.

KEY IDEAS

For the exam, you must know:

- the reason why consciousness is a psychological construct
- that consciousness varies on a continuum of awareness
- the difference between normal waking consciousness and altered states of consciousness
- the ability to classify examples of a state of consciousness as normal waking consciousness or altered state of consciousness with reference to possible differences in the following characteristics:
  - level of awareness
  - controlled and automatic processes
  - content limitations
  - perceptual and cognitive distortions
  - emotional awareness
  - self-control
  - time orientation.

RESEARCH METHODS

For the exam, you must be able to:

- understand the challenges that surround studying consciousness
- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study
- understand ethical considerations relating to studying consciousness.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Johannes is sitting in class, trying to listen to what the teacher is saying, but he is also aware that he is feeling warm in the sunshine, he is looking forward to a game of tennis after school, the new girl in the row in front of him has sparkling highlights in her hair and the chair he's been sitting in for the double lesson has a hard seat! Johannes is most likely experiencing:
   a normal waking consciousness
   b an altered state of consciousness showing reduced awareness
   c an altered state of consciousness showing heightened awareness
   d distortions of cognition and perception.

2 Ravi is experiencing an altered state of consciousness. He does not notice that the temperature has dipped to below 4°C. Which of the following explains his experience according to the characteristics of an altered state?
   a Ravi's self-control is reduced.
   b Ravi's controlled processes require increased attention.
   c Ravi's perception of the passage of time is distorted.
   d Ravi's perceptions are distorted.

3 Which of the following is likely to be true for a person in an altered state of consciousness?
   a The person may find it easy to judge the passage of time.
   b The person may have more control over emotions.
   c The person may be more open to suggestion.
   d The person may find that their powers of thought and reasoning are enhanced.

4 Which of the following is unlikely to be true for a person in an (heightened awareness) altered state of consciousness?
   a The person may find it difficult to judge the passage of time with accuracy.
   b The person may be more sensitive to noise than in normal waking consciousness.
   c The person may be more (or less) emotional than they are when in normal waking consciousness.
   d The person may find that they are paying selective attention to several automatic processes.

5 Which of the following scenarios displays the highest level of awareness?
   a Emma is bored in class and puts her head down on the desk to fall asleep.
   b Justin is watching his favourite show on TV while eating chips.
   c Cadence is about to jump out of a plane to go tandem skydiving.
   d Will is reading a book while he is on the train.

6 Sacha is sitting in class one afternoon after having an iced coffee at lunchtime. She hears what the teacher is saying, and is very interested as she takes notes rapidly. Sacha can be described as being in:
   a an altered state of consciousness of heightened awareness
   b an altered state of consciousness of reduced awareness
   c a state of normal waking consciousness
   d a state of heightened waking consciousness.

7 Which of the following is a true statement?
   a Controlled processes require no attention.
   b Automatic processes require little attention.
   c Controlled processes require little attention.
   d Both controlled and automatic processes require full attention.

8 When Erwin was first learning to play the guitar, he found it impossible to change chords and sing at the same time. Now that he has been in a rock band for two years, he finds it easy to play, sing and even perform complex sequences of steps on stage. The explanation for this is:
   a an automatic process has become a controlled process, requiring little attention
   b a controlled process has become an automatic process, requiring full attention

c an automatic process has become a controlled process, requiring full attention
d a controlled process has become an automatic process, requiring little attention.

9 Miranda has been driving a manual car for several years; Hugo has just passed his test for his P-plates. When Victor is a passenger in their cars, he finds that he can have a sensible conversation with Miranda, but Hugo does not seem to pay any attention to him. Which of the following is the most likely explanation for this?
a For Miranda, driving is a controlled process enabling divided attention.
b For Miranda, driving is a controlled process requiring selective attention.
c For Hugo, driving is a controlled process enabling divided attention.
d For Hugo, driving is a controlled process requiring selective attention.

10 Tia is taking her first driving lesson in a manual car. Which of the following is not likely to be true?
a Tia finds it difficult to judge the passage of time.
b Tia finds it difficult to hold a sensible conversation with the instructor.
c At the end of the lesson, Tia finds it difficult to remember features of the buildings they have passed.
d At the end of the lesson, Tia can recall all the features of the route they have taken.

SHORT ANSWER

11 Define 'consciousness' and outline the idea that consciousness varies according to states.

1 mark

12 a Explain the concept of a psychological construct, using consciousness as an example.

1 mark

b Name some other psychological constructs you have been studying in Psychology this year.

1 mark

13 Describe the defining difference between normal waking consciousness and altered states of consciousness.

2 marks

14 a What is the 'continuum of awareness'?

1 mark

b Where does altered states of consciousness tend to be situated on the continuum of awareness?

1 mark

15 Can we experience more than one state of consciousness during normal waking consciousness? Explain your answer.

2 marks

16 Give one example of naturally occurring altered states of consciousness and one example of deliberately induced altered states of consciousness.

2 marks

17 Our psychological state of consciousness is tied to a number of different characteristics. Name and describe some of these characteristics.

3 marks

18 Playing 'Advance Australia Fair' on the piano can change with experience from being a controlled process to being an automatic process. Explain what this means.

2 marks

19 Marcel is working outside on an extremely hot day. As a result, he is experiencing an altered state of consciousness. What is he likely to experience, in terms of:
a content limitations?

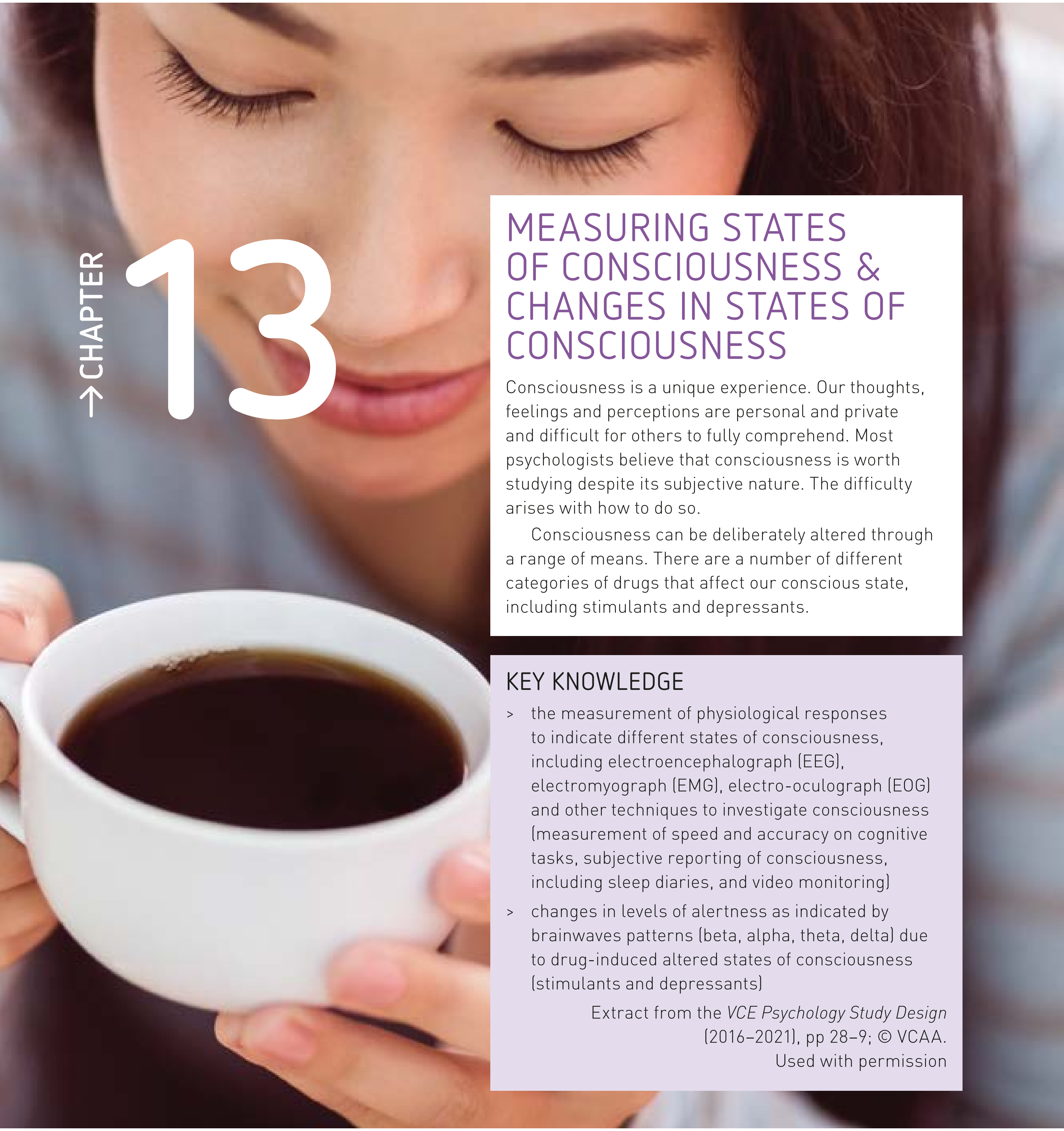
1 mark

b perceptual and cognitive distortions?

1 mark

c perception of time?

1 mark



CHAPTER 13

MEASURING STATES OF CONSCIOUSNESS & CHANGES IN STATES OF CONSCIOUSNESS

Consciousness is a unique experience. Our thoughts, feelings and perceptions are personal and private and difficult for others to fully comprehend. Most psychologists believe that consciousness is worth studying despite its subjective nature. The difficulty arises with how to do so.

Consciousness can be deliberately altered through a range of means. There are a number of different categories of drugs that affect our conscious state, including stimulants and depressants.

KEY KNOWLEDGE

> the measurement of physiological responses to indicate different states of consciousness, including electroencephalograph (EEG), electromyograph (EMG), electro-oculograph (EOG) and other techniques to investigate consciousness (measurement of speed and accuracy on cognitive tasks, subjective reporting of consciousness, including sleep diaries, and video monitoring)

> changes in levels of alertness as indicated by brainwaves patterns (beta, alpha, theta, delta) due to drug-induced altered states of consciousness (stimulants and depressants)

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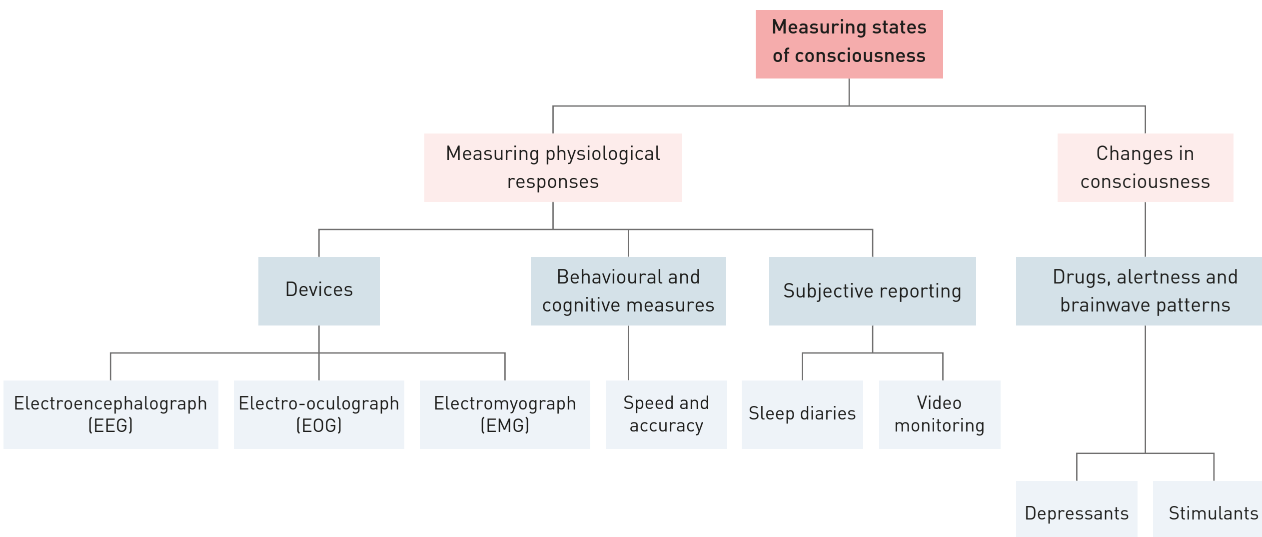
CHAPTER OVERVIEW

Measurement of physiological responses	Electroencephalograph Electro-oculograph Electromyograph
Behavioural and cognitive measurements	Speed and accuracy on cognitive tasks
Subjective reporting	Self-reporting Video monitoring
Changes in consciousness: drug-induced states	Psychoactive drugs

CONTENT MAP



Measurement of physiological responses

As we know from Chapter 12, consciousness is a subjective and private experience and is ever-changing (dynamic), self-reflective and central to our sense of self. But how do psychologists study consciousness?

The methods used can include (but are not limited to):

> measurement of physiological responses, such as electroencepholgraphy (EEG), electro-oculography (EOG) and electromyography (EMG)

> behavioural and cognitive measures, such as measurement of speed and accuracy on cognitive tasks and video monitoring

> self-report (subjective) measures, such as sleep diaries.

Measurable changes in physiological responses are probably the most reliable and least subjective means of indicating different states of consciousness during sleep and wakefulness. Typically, the data is consistent and stable and it can be recorded and usually interpreted consistently between researchers and on different occasions.

However, there are weaknesses with using this method alone. First, it is limited in its ability to identify the participant's private and personal conscious experience. Remember: consciousness is our awareness of internal and external stimuli and our thoughts and feelings about them. Researchers may be able to observe physiological changes, but they won't really know about the experience unless they ask the participants! Second, changes in physiological events may be due to other reasons such as the person having a fever.

Many **physiological measures** provide psychologists with information about how bodily functions change during normal waking consciousness and altered states of consciousness. Such bodily functions include brainwave patterns (caused by changes in the electrical activity of the brain), eye muscle movement, body muscle movement, heart rate, body temperature, electrical conductivity of the skin (galvanic skin response), respiration rate and blood pressure.

The three main devices used to study states of consciousness, especially sleep, are the **electroencephalograph**, the **electro-oculograph** and the **electromyograph**.

FIGURE 13.1 As our state of consciousness or alertness level changes, so do our brainwave patterns.

Electroencephalograph

The electroencephalograph (EEG) is a device that detects, amplifies and records electrical activity in the brain in the form of brainwaves. It does this by monitoring the electrical activity of the brain that is detectable on the outside of the skull. Many tiny electrodes are placed on the skull in a symmetrical pattern (see Figure 13.2). These electrodes measure the very small voltages created by the synchronised activity of large numbers of neurons in the cerebral cortex.

EEG recordings indicate changes in **brainwave activity** associated with changes to states of consciousness, such as when a person is drowsy or alert, falls asleep, and the various stages of sleep, including the stage in which we are most likely to experience dreaming.

BRAINWAVE PATTERNS

Brainwave patterns may vary in **frequency** (that is, the number of brainwaves per second). High-frequency brainwave patterns indicate faster brainwaves as demonstrated by more waves per unit of time (usually seconds). Frequency is measured in hertz (Hz: vibrations per second).

Brainwaves may also vary in **amplitude** (that is, the height of the peaks and troughs of the curved graph that represents brainwave activity). Amplitude is measured in microvolts (μV).

When we are awake and alert, we exhibit fast (high-frequency) and small (low-amplitude) brainwaves, known as **beta waves**. When we are awake but relaxed, we tend to exhibit **alpha waves**. In deep NREM sleep, we exhibit slow (low-frequency) and big (high-amplitude) brainwaves, known as **delta waves**. During stage 2 of NREM we experience medium-frequency **theta waves**.

FIGURE 13.2 Many tiny electrodes are placed on the skull in a symmetrical pattern to record brainwave activity.

Table 13.1 outlines five of the broad types of brainwave activity that are associated with certain states of consciousness, especially during normal waking consciousness and sleep. However, the concept of these broad brainwave patterns is somewhat antiquated. We do not produce just one brainwave at any one time and producing too much or too little can create issues. Our brainwave patterns, as measured by an EEG, consist of a mixture of types at any one time, and the mixture varies from person to person and can vary over time and within and between tasks and situations.

Modern high-resolution EEGs have recognised more than 42 000 individual frequencies and the association between different frequencies and how we think, feel and behave is far more complex. Today, the emphasis is on the relationship between different frequencies within and between specific locations in the brain and the associated psychological processes.

TABLE 13.1 Five broad types of brainwave activity and their association with consciousness

BRAINWAVE PATTERN	DESCRIPTION	ASSOCIATION WITH CONSCIOUSNESS
Gamma waves	Highest frequency (40–100 Hz per second) (very high brain activity)	> Hyper-alert > A brainwave pattern involved in cognitive functioning such as memory and learning, 'higher virtues' such as altruism and universal love, and simultaneous processing of information from different areas of the brain > 40 Hz gamma waves associated with perception and learning new material, modulating consciousness and perception > Seen when awake and asleep (REM sleep) but not under anaesthesia > Too much associated with anxiety and stress > Too little associated with ADHD and depression
Beta waves	High frequency (12–40 Hz per second) and low amplitude (small) (high brain activity)	> Awake and alert > The typical brainwave pattern during normal waking consciousness, associated with being alert, attentive, active, anxious and paying (selective) attention > Involved in conscious thought, logical thinking and problem solving > Eyes are open; person is awake and alert > Too much associated with anxiety and stress > Too little associated with ADHD and depression

Alpha waves	Reasonably high frequency (8–12 Hz per second) (but not as high as beta waves) and low amplitude (slightly higher than beta waves, but not as high as theta) (medium–high brain activity)	> Relaxed wakefulness > The typical brainwave pattern when awake but very relaxed, such as in a meditative state, having quiet flowing thoughts, very drowsy or when we're about to fall asleep > Associated with relaxation, aiding mental coordination, calmness and learning > May be seen in people in a coma > Too much associated with inability to focus > Too little associated with anxiety, insomnia
Theta waves	Medium frequency (4–8 Hz per second) and mixed amplitude (some high, some low) (medium brain activity)	> Asleep (stage 2 NREM) > The typical brainwave pattern during the early stages of sleep. May be present when daydreaming and associated with experiencing emotions and deep meditation > Also seen in young children and psychopaths, may be caused by frustration > Too much associated with ADHD, impulsivity, inattentiveness > Too little associated with anxiety, stress, poor emotional awareness
Delta waves	A steady pattern of low frequency (1–4 Hz per second) and high amplitude (low brain activity)	> Deep sleep > The typical brainwave pattern associated with NREM deep sleep > Associated with very deep relaxing and restorative (rejuvenating) sleep > Very limited, if any, external awareness > May be associated with healing and regeneration > Also mainly seen in babies and adults with brain tumours > Too much associated with brain injuries, inability to think > Too little associated with poor sleep, inability to revitalise brain or body

Other patterns or features, usually not very long-lasting, can occur during these brainwaves. For instance, **K-complexes** (sharp rise and fall in amplitude, lasting for about two seconds) and **sleep spindles** (periodic bursts of rapid frequency) are indicative of stage 2 non–rapid eye movement (NREM) sleep. **Sawtooth waves** are random, fast waves that are slightly bigger than alpha waves. They resemble waves for being awake but occur among the beta-like waves observed during rapid eye movement (REM) sleep. Sawtooth waves are associated with dreaming.

FIGURE 13.3 A simple memory trick to help associate beta waves with alertness

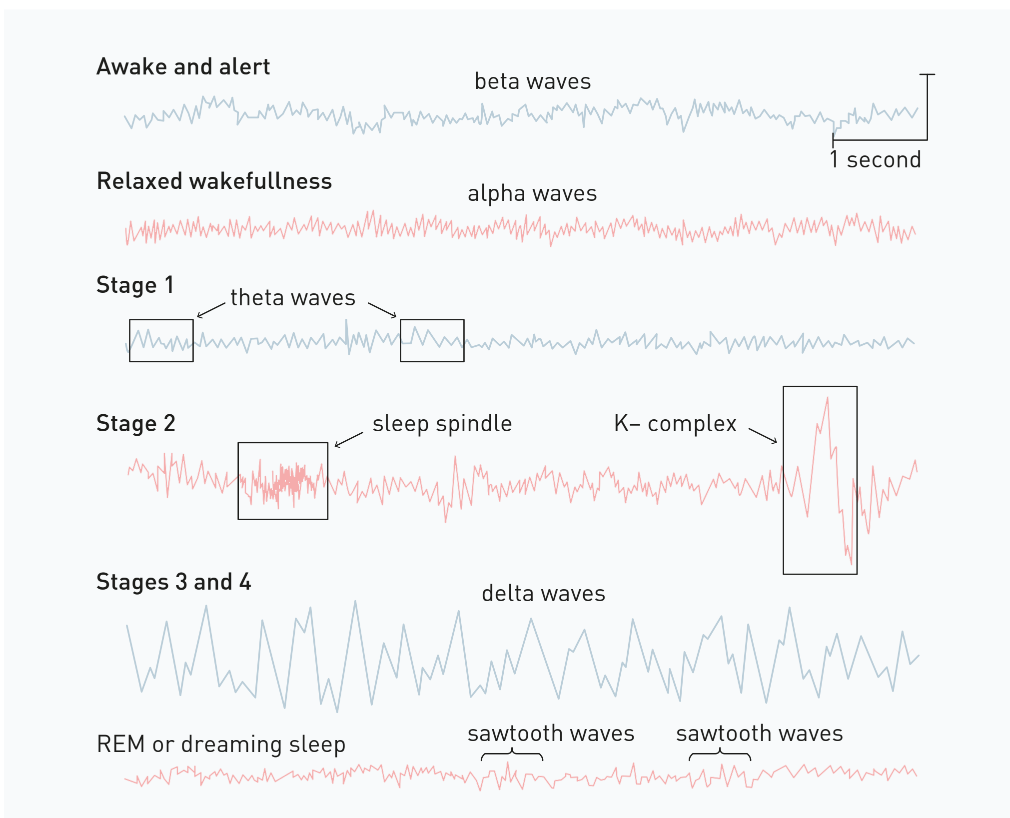


FIGURE 13.4 Different brainwave patterns are associated with different stages of consciousness.

In other words, our degree of alertness is associated with a range of different brainwave patterns. These patterns will be discussed further when we look at the effect of drugs on consciousness, later in this chapter and also Chapters 14 and 15. A brief summary associating alertness with brainwave pattern is shown in Table 13.2.

TABLE 13.2 Alertness and associated brainwave patterns

ALERTNESS	DOMINANT BRAINWAVE PATTERN	DEGREE OF BRAINWAVE ACTIVITY
Hyper-alert	Gamma and beta waves	Very high
Awake and alert	Beta waves	High
Awake and drowsy	Alpha waves	Medium–high
The flow state (being in 'the zone' – ideal for optimal performance and creative insight; work seems effortless)	Alpha–theta (borderline) waves Some gamma waves	Medium–high
REM sleep (typically dreaming)	Beta-like waves	High
Stages 1 and 2 NREM sleep	Theta waves	Medium (less than in waking and REM sleep)
Stages 3 and 4 NREM sleep (deep sleep)	Delta waves	Low
General anaesthesia	Gamma waves	Reduced
Vegetative state (coma)	Alpha waves	Very reduced

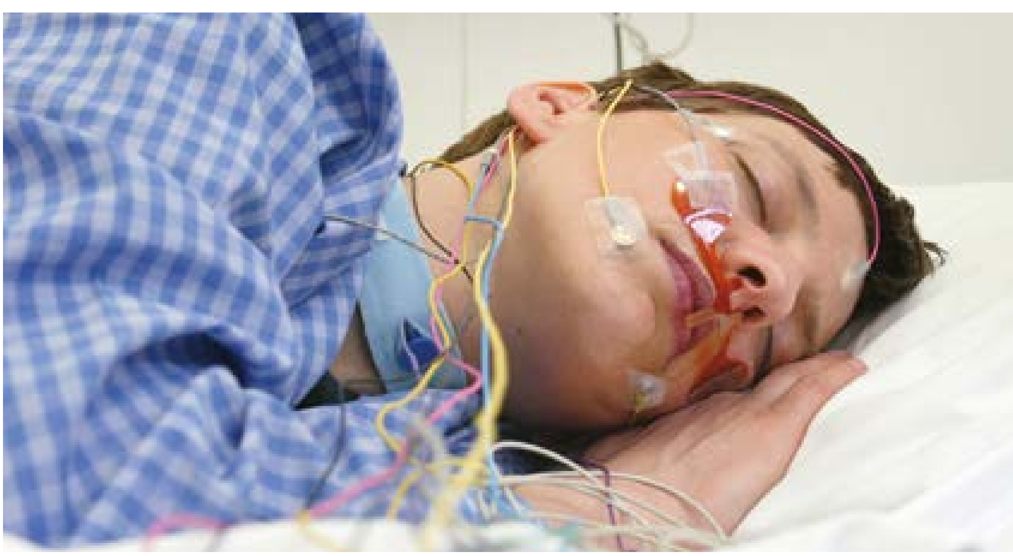


FIGURE 13.5 This sleeping participant is wired up to collect EEG, EOG and EMG information.

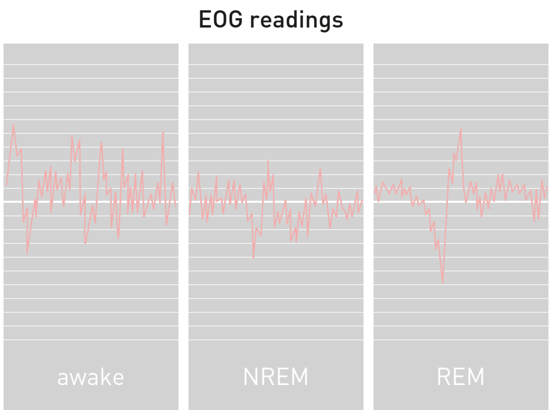


FIGURE 13.6 EOG recordings for someone who is awake and asleep (REM and NREM sleep)

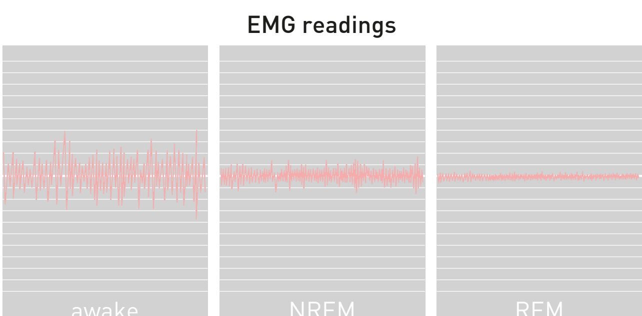


FIGURE 13.7 EMG recordings for someone who is awake and asleep (REM and NREM sleep)

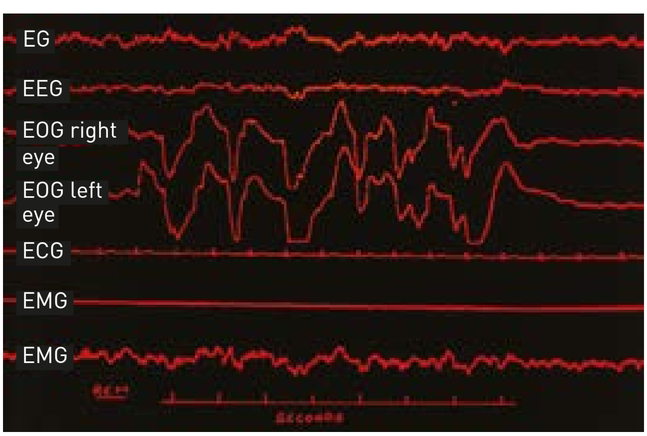


FIGURE 13.8 Look closely at the data on this polysomnogram. Can you determine when the participant entered REM sleep (in this case determined by the high amplitude waves in the EOG data)?

Electro-oculograph

The electro-oculograph (EOG) is a device that detects, amplifies and records electrical activity in the muscles that allow the eye to move. It measures changes in voltage as the eyes move and rotate in their sockets. Electrodes are attached to areas on the face around the eyes and the recording procedure is similar to that used for the EEG.

The EOG is particularly useful to determine whether a person is in REM or NREM sleep. When we are awake, our eyes may move rapidly depending on what we are doing visually at the time. For instance, if you are staring out a window or thinking deeply about an issue, there will be little eye movement. If you are looking for a friend in a crowd, you would expect more eye movement.

Electromyograph

Another device commonly used to measure the stages of sleep is the electromyograph (EMG). The electromyograph is a device that detects, amplifies and records the electrical activity of muscles. Electrodes are attached to the skin directly above the muscles (usually the ones located under the chin) and the recording procedure is similar to that of an EEG and EOG.

The EMG can be useful to determine whether a person is awake or asleep and, if asleep, whether it is REM or NREM sleep. When someone is awake, activity on the EMG recordings varies between moderate and high, depending on the activity at the time. During sleep, the activity is moderate to low during NREM sleep (with some mild spasms associated with light sleep) and virtually non-existent during REM sleep.

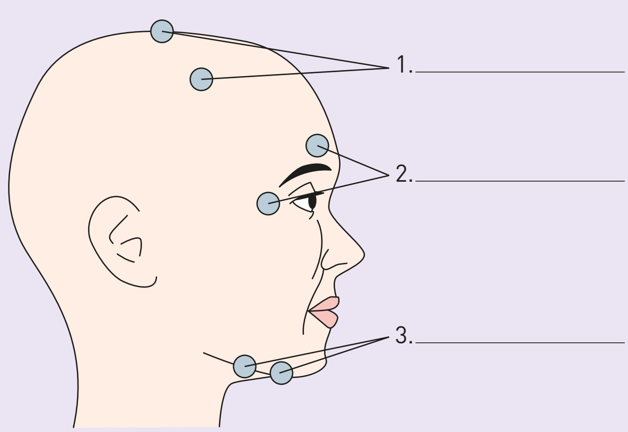
Data can be collected simultaneously from the EEG, EOG, EMG and any other devices and displayed on a continuously moving chart, known as a **polysomnogram**. This allows a researcher to compare corresponding data at once and make more informed decisions about the state of consciousness and any underlying problems.

TABLE 13.3 Physiological measurements used to research states of consciousness

PHYSIOLOGICAL MEASUREMENT	WHAT IS MEASURED	NORMAL WAKING CONSCIOUSNESS		SLEEP	
		ALERT	DROWSY (RELAXED)	NON-RAPID EYE MOVEMENT (NREM)	RAPID EYE MOVEMENT (REM)
Electroencephalograph (EEG)	Detects, amplifies and records electrical activity in the brain in the form of brainwaves	Beta waves	Alpha waves	Alpha, theta and delta waves, sleep spindles and K-complexes, depending on the stage of NREM sleep	Similar to being awake, including random and fast sawtooth waves
Electro-oculograph (EOG)	Detects, amplifies and records electrical activity in the muscles that allow the eye to move	Depends on the activity, rapid if involves eye movement	Little	None or very little	Bursts of rapid movement
Electromyograph (EMG)	Detects, amplifies and records the electrical activity of muscles	Moderate and high depending on the activity at the time	Moderate	Moderate to low	Virtually non-existent

13.1 REVIEW

1 Why are physiological measurements used to study consciousness?
2 What information cannot be obtained about consciousness from physiological measurements?
3 What are the five major patterns of brainwave activity?
4 Look carefully at the following illustration of a participant wired up with the EEG, EOG and EMG devices and decide which electrodes are collecting which data. Write a definition for each device.



5 What is a polysomnogram? Why are they useful when studying sleep?

Behavioural and cognitive measurements

We can use behavioural and cognitive measures to study consciousness, such as measuring a person's performance on certain tasks. Behavioural and cognitive measures are more **objective measurements** than self-reports, because we are likely to record similar findings over time and between researchers. However, they have their limitations; such measures still require us to record observations and then infer what they mean in terms of consciousness.

Speed and accuracy on cognitive tasks

Measuring the speed and accuracy of cognitive tasks such as thinking, problem solving, language and reasoning during different times of the day or different states of consciousness can inform us of the characteristics associated with normal waking consciousness and altered states of consciousness.

COMPARING STATES OF CONSCIOUSNESS

There are many possible changes to behaviour and cognition in an altered state of consciousness. Also, there are differences even within normal waking consciousness. How do you think you would perform on a simple short test when alert compared to when drowsy? What about a short complex test? Or a long and complex task? A long and routine boring task? What does research suggest about performance on these tasks?

SELECTIVE AND DIVIDED ATTENTION

FIGURE 13.9
How could you measure the effects of practising a new skill such as 'hoverboarding' over time? How could you tell if or when the task involves more automatic than controlled processing?

Consciousness is intricately tied to our awareness of ourselves and our environment at any one moment. Therefore selective attention – what we focus our attention on at any one time, to the exclusion of other stimuli – becomes an important link to our state of consciousness.

In Chapter 12 we discussed controlled (conscious) and automatic (unconscious) processing. Controlled processing is slower than automatic processing as we need to pay much more attention to what we are doing in order to learn the task. With practice, in most cases we are able to perform the task more quickly and efficiently. It is like going on 'automatic pilot' as we can do the task with very little conscious effort or awareness. Therefore, we can measure the speed and accuracy on performing the task over time, with the idea that as the task becomes more automatic, we become quicker and more accurate. In addition, studies have found that certain parts of the brain involved in conscious processing become less active as the task becomes more familiar.

As discussed in Chapter 12, divided attention refers to our capacity to attend to and perform more than one activity at the same time. Automatic processing facilitates divided attention. In 1975, Shaffer conducted a well-known experiment that tested divided attention using a process called dichotic listening. We cannot fully attend to two different messages delivered simultaneously through two earphones. Proficient typists performed a test in which they had to type the information being presented via headphones in one ear while simultaneously performing a second task. This second task included two different conditions:

> Condition 1: a shadowing task in which unrelated information was presented via headphones to the other ear; the typist had to say aloud the information presented in this ear

> Condition 2: a reading task in which the typist had to read aloud visual information that was presented to them.

In both cases, the typists' performance on the test was poorer compared to their performance when carrying out the three tasks separately. Shaffer suggested that performance was poorer because of the similarity of the tasks. In the first condition, the material was similar in the way it was presented (a listening task) and thus interfered with the ability to receive the auditory information. The second condition interfered with the typists' ability to produce the typed information as both required verbal and written skills.

FIGURE 13.10 We are not very good at attending to two different messages delivered simultaneously through two earphones.

ACQUIRED BRAIN DAMAGE

Acquired brain damage, caused by stroke or injury, has been known to disrupt the way a person attends to the world and therefore affects the speed and accuracy of cognitive tasks. Studying such cases can offer important insights into our conscious experience, and often this research includes administrating cognitive tasks and self-reports. For example, in some rare situations, a person may systematically ignore certain aspects of their world. The following extract is about Mrs S., an intelligent woman in her sixties who had suffered a massive stroke affecting the right hemisphere of her brain.

> Sometimes, she will put on lipstick, and make up the right half of her face, leaving the left half completely neglected: it is almost impossible to treat things, because her attention cannot be drawn to them and she has no conception that they are wrong.
>
> Sacks, 1985

Mrs S.'s problem is a striking case of spatial neglect, a disorder in which the person affected systematically ignores stimuli on one side of their body because they are consciously unaware of stimuli on that side. The location and extent of the damage is likely to influence the degree of neglect, which can range from mild to severe.

13.2 REVIEW

1 Why are speed and accuracy on a cognitive test sometimes used to study states of consciousness?
2 Explain the difference between selective and divided attention.
3 Read the following statements and identify whether they are true or false.
   a In normal waking consciousness, behaviour remains constant.
   b Controlled processing is slower than automatic processing because we focus on the task more closely in order to learn it.
   c Practising a task does not increase the efficiency of processing it.

Subjective reporting

Subjective reporting measures, such as self-reporting or video monitoring, are also used to measure states of consciousness. While they may not be as accurate as EEG, EMG and EOG, they can still provide significant insight into our experience of consciousness.

Self-reporting

Rate the quality of your sleep last night on the following scale: 1 (very poor), 2 (poor), 3 (fair), 4 (good) or 5 (very good). Comment.

You have just completed a **self-report**, an example of subjective reporting of consciousness. Self-reports are statements and answers to questions made by the participants concerning their psychological experience (thoughts, feelings and behaviours) in relation to a psychological phenomenon. They can be in the form of questionnaires (with open and/or closed questions), diary entries or interviews. Psychologists may use *experience-sampling techniques*, in which participants are asked to self-report consciousness experiences at specific times. For instance, participants may carry electronic devices that 'beep' at certain times to advise them to complete a survey that may ask what they are doing, thinking and feeling at the time of the beep (often called beeper studies).

Self-reports can indicate whether or not a person is experiencing normal waking consciousness. If they are in an altered state of consciousness and asked to tell a story about something that happened yesterday, it is likely to generate a response that is missing pieces or does not make complete sense.

FIGURE 13.11 Self-reports are often used to study consciousness, including a person's sleep experience.

Sleep diaries are often used when a person is experiencing sleep troubles such as insomnia (see Chapter 16), and these can help sleep experts understand the participant's experience.

Self-reports can provide extremely valuable information about what the participant is experiencing. However, like all research methods, there are drawbacks.

It is a measurement, based on personal judgments that may be difficult to communicate and compare with others. Self-reports have other limitations:

> Will the participant remember to complete the report? If the participant is carrying out a self-report sleep study over a week, it is likely that they will have to find ways to remind themselves to complete it.
> Are participants able to describe the experience accurately? For many of us, accurately describing our dreams or what we are thinking and feeling can be difficult.
> Are participants telling the truth? Sharing your personal and private thoughts or dreams can be challenging.
> Can participants remember? This is unlikely if they were in an altered state of consciousness, such as sleep. Dreams are usually quickly forgotten, if remembered at all.
> Have participants unintentionally left out key information? Sometimes we just forget.
> Can the researcher interpret the descriptions accurately and reliably? It can be very difficult to interpret self-reports objectively.

FIGURE 13.12 Self-reports are a valuable research method as they attempt to capture the person's psychological experience (thoughts, feelings and behaviours).

INVESTIGATE 13.1

SLEEP DIARY

For the next five days, keep a pen and paper next to your bed. Upon waking up, write down as many dreams as you can remember. Each night, answer the following questions.

> What time did you go to bed?
> Did you go to sleep quickly?
> How long did you sleep for (in total) last night?
> On a scale of 1 to 5, with 1 being very anxious/negative and 5 being very calm/positive, how did you feel when you went to bed?
> On a scale of 1 to 5, with 1 being very anxious/negative and 5 being very calm/positive, how did you feel when you woke up this morning?
> Did you wake up during the night? If yes, how often and how did you feel upon waking?
> Did you dream during the night? If yes, can you recall parts of your dreams? Write them down.

1 Collate your results and, where possible, calculate averages and themes, including the most common events.
2 When studying sleep (Chapters 14, 15 and 16), refer back to this sleep diary. How do your results compare to a typical night's sleep as outlined in these chapters? Did you notice aspects of your sleep and dreaming that you previously had not?
3 Were there any problems with collecting the results?

Video monitoring

Video monitoring can provide an insight into how we behave in different states of consciousness. Researchers can observe participants when they are awake, including differences between their levels of alertness. For example, are you more likely to move around when you are feeling alert or drowsy?

Video monitoring is now a common method that can be used to study sleep. They can be used both in **sleep laboratories** (an artificial environment) and in the participant's own home. This method uses infrared cameras (or cameras in a room lit with infrared light) that operate silently to allow footage to be seen and taped in the dark without disturbing the participant. The recordings can be observed at any time after the period of sleep and given to other researchers to interpret. Recordings can also be shown to the participant to help them become aware of and understand their behaviour, for example, showing what they do when sleepwalking or even observing the effects of a snoring partner on their sleep.

FIGURE 13.13 Which sleeping position do you prefer?

Often the data is recorded alongside physiological measurements such as photographs that are taken every few seconds. If done at home, video monitoring allows the participant to sleep in their natural environment. This way, the participant is more likely to sleep as they normally do and the researcher is more likely to collect realistic data.

However, there are limitations with video monitoring. Like other behavioural observations, video monitoring cannot tell us what is going on inside the body or what the participant is experiencing – it relies on the researcher to interpret the behaviour. Therefore, the observations may be subjective (open to bias). In an attempt to overcome this, researchers often devise standard methods of measuring and interpreting behaviour. For instance, what constitutes a major shift in body position? Is it when you change trunk position, major limb position or head position, or a combination? In an attempt to combat subjectivity, researchers might also get two or more colleagues to independently interpret the data.

CASE STUDY

DO YOU ROLL OVER IN YOUR SLEEP?

Yes, you do! In a pioneering study, Hobson, Spagna and Malenka (1978) used timelapse photography with EEG recordings and self-reports to investigate sleep. Cameras were installed in a sleep laboratory to take photographs of sleeping participants at regular intervals and the photographs were displayed simultaneously with the EEG recordings.

This study demonstrated the association between major body movements (postural shifts), such as rolling over, and particular sleep phases. It showed that we regularly change our body position during the night and also go through periods of immobility. In addition, the researchers found that participants who report a better night's sleep tend to change their body position fewer times than those who don't. So there is now evidence that tossing and turning all night is linked with the feeling of poor-quality sleep.

This work demonstrated the usefulness of video monitoring and the possibility of recording participants sleeping in their own bed without being 'wired up'.

TABLE 13.4 Advantages and disadvantages of some methods used to research sleep

RESEARCH METHOD	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Physiological measurements, including EEG, EOG and EMG	Recording of physiological (physical body) events	> Most objective and reliable means of indicating different states of consciousness	> Cannot describe the person's private and personal conscious experience (thoughts and feelings) > Changes in physiological events may be due to other reasons besides a change in state of consciousness
Measurement of speed and accuracy on cognitive tasks	Administration of test or a task; monitoring speed and accuracy on this test or task, often over time or within different states of consciousness	> More objective in nature than self-reports, because likely to record similar findings over time and between researchers > May offer closer insight into an individual's conscious experience (thoughts and behaviours) than physiological measurements	> However, cannot get inside a person's mind. Such a measure still requires us to record observations (performance) and then infer what they mean in terms of consciousness
Video monitoring	Using infrared cameras (or cameras in a room lit with infrared light) that operate silently to allow footage to be seen and taped in the dark without disturbing the sleeping participant	> Insight into observable behaviour during sleep > Can be undertaken in sleep laboratory or in natural setting > Researchers can continuously monitor the behaviour, either at the time of collection, at a later stage or both > Data can be recorded alongside the physiological measurements at the time	> Data can be open to interpretation so requires clear definitions for a specific behaviour > May miss important events if only considering still photographs every few seconds/minutes. Otherwise, lots of information to sift through > Participant's behaviour may be blocked from view of the camera
Self-reports, including subjective measures such as sleep diaries	Statements and answers to questions made by the participants concerning their thoughts, feelings and behaviours	> Gives a rich and important insight into actual thoughts, feelings and behaviours experienced by the participants	> A subjective measure that is open to interpretation and difficult to communicate and compare with others > Onus on participant to be self-aware and able to complete the task honestly and at the times required

REVIEW 13.3

1 What are self-reports? Outline two disadvantages of using them.
2 Why are self-reports, such as sleep diaries, used in sleep research?
3 Why are video monitors often used in sleep laboratories?
4 What information is likely to be displayed alongside the video taken in a sleep laboratory?

Changes in consciousness: drug-induced states

Prescribed and legal drugs play a central role in our medical practice, having enormous benefits for our health and wellbeing, but also serious side effects as all drugs have hidden (or not so hidden) dangers. Illegal and prohibited substances have also infiltrated our society, often in unsavoury and dangerous ways.

FIGURE 13.14 Both legal and illegal drugs can be used to affect our state of consciousness in dangerous ways.

Psychoactive drugs

Psychoactive drugs are chemical substances that affect the nervous system and brain activity. They cross the blood–brain barrier and then alter our brain chemistry, usually by modifying (increasing or decreasing) the activity of certain neurotransmitters (see Chapter 3). As a result, they impact on our consciousness by altering thoughts, feelings, perceptions and behaviours.

Most of the drugs that are abused by users produce addiction and many of these also create withdrawal reactions. Regular use of most drugs creates an increased tolerance over time, which can lead to overdose and death.

In our society, psychoactive drugs include:

> *depressants*, which decrease nervous system activity; for example, alcohol, barbiturates (sleeping pills) and benzodiazepines (tranquillisers)
> *stimulants*, which increase nervous system activity; for example, caffeine, amphetamines, cocaine and ecstasy
> *opiates*, which provide pain relief and cause mood changes; for example, opium, morphine and codeine
> *hallucinogens*, which cause hallucinations, a distorted sensory experience and loss of reality; for example, LSD
> *marijuana*, which produces an uninhibited euphoric state and impaired judgment and thinking.

The way psychoactive drugs affect an individual depends on a number of factors including the type (and dose) of drug administered and previous drug use (for example, addiction, withdrawal and tolerance) and a range of biological, individual and sociocultural factors. Some are commonly used, including for medical purposes. Others are prohibited. Many have permanent, life-threatening risks, especially if taken in high doses or chronically (ongoingly).

ALERTNESS AND BRAINWAVE PATTERNS

Psychoactive drugs alter our state of consciousness and, in doing so, affect our alertness and brainwave patterns. Our degree of alertness is associated with a range of different brainwave patterns, as summarised in Table 13.2.

For general health and wellbeing, our brain must function efficiently and the balance of different brainwave patterns is the key. Our brain must adjust this balance depending on our needs and wishes. Remember, brainwave patterns associated with different states of consciousness may vary from person to person and even within the same person over time.

Being alert (aware and ready to respond to stimuli) is generally associated with dominant beta-wave activity as opposed to being drowsy and less aware (which is consistent with alpha-wave activity). Too much beta-wave activity is associated with stress, anxiety, panic attacks, insomnia, mental fatigue, muscle tension and high blood pressure. Too much theta-wave activity is associated with attention deficit problems and hyperactivity. Too much alpha-wave activity could leave you in a dreamy state, tired and unable to focus on work or study.

DEPRESSANTS

Depressants decrease (depress) nervous system activity. As such, they tend to decrease levels of alertness and can increase the presence of lower frequency brainwaves, such as delta, theta and alpha. Depressants can be prescribed to help treat anxiety and insomnia and play a role in anaesthetics. They are dangerous in high doses as they may slow down the nervous system to the point of death. Alcohol, barbiturates and benzodiazepines are depressants commonly used in our society.

Barbiturates and benzodiazepines

Barbiturates and benzodiazepines slow down brain function and produce muscle relaxation. In lower doses, a barbiturate may be used as a mild sedative because of its calming effect; in higher doses it can be used as a sleeping pill. As such, barbiturates can be used to treat acute anxiety, tension and sleep issues, and also act as an anticonvulsant. Very short-acting barbiturates are used in general anaesthesia as they reduce the anxiety associated with pain (other drugs are included in anaesthetic to reduce the pain).

FIGURE 13.15 It is believed that Marilyn Monroe died from a barbiturate overdose.

Benzodiazepines are tranquillisers, which may be prescribed to treat anxiety, panic attacks and stress reactions. Well-known benzodiazepines Valium, Serapax, and Rohypnol (the notorious date-rape drug) are widely used and abused. They are addictive; a tolerance develops and the user becomes physiologically and psychologically dependent on the drug.

Barbiturates may initially trigger excitement and euphoria, but this is followed by impaired thinking and memory, depressed feelings, drowsiness, slurred speech and uncoordinated movement. Or, sometimes, a person may have a paradoxical reaction and become agitated and aggressive. Due to their highly addictive nature and potential for overdose, many barbiturates have been replaced by benzodiazepines, although these are also addictive and can cause mental confusion.

When combined with alcohol, the depressive effects of both benzodiazepines and barbiturates on the nervous system are magnified and may lead to overdose, unconsciousness, coma and even death. Often the user does not recognise that they are dependent until they attempt to stop taking the drug. Serious withdrawal symptoms can occur, including anxiety, insomnia and seizures.

Alcohol

FIGURE 13.16 Altering consciousness with alcohol is common in our society, despite awareness of the dangers.

Deliberately altering consciousness with alcohol is a widely accepted practice in our society, despite the growing awareness of the dangers associated with it. The psychological and physiological effects of alcohol can create devastating long-term physical, social and personal problems.

Alcohol is a depressant – it slows or depresses the nervous system. Many people mistakenly believe that alcohol is an 'upper' or a stimulant. This misconception is probably because, in low doses, alcohol reduces inhibitions and may cause a feeling of relaxation and wellbeing. Thus, a person who has consumed alcohol may seem more stimulated, active and more talkative than usual. In high doses, alcohol depresses the nervous system so much that it slows down vital life processes and can cause blackouts, comas and even death.

The relationship between percentage of **blood-alcohol concentration** (BAC) and behaviour can be seen in Table 13.5. During adolescence, a time of rapid brain development, alcohol can have permanent negative effects.

Alcohol is often consumed to deliberately alter that person's state of consciousness. The degree to which a person experiences the effects of alcohol depends on the rate of consumption, together with other factors including tolerance levels, gender, height and weight (York & Welte, 1994).

TABLE 13.5 Relationship between blood-alcohol concentration and behaviour, including driver performance

CATEGORY	BLOOD ALCOHOL LEVEL	GENERAL EFFECT ON BEHAVIOUR	EFFECTS ON DRIVER PERFORMANCE
Feeling of wellbeing	0.02–0.05	> Lowered alertness > Talkative > Relaxed > More confident	> Difficulty seeing or locating moving lights > Difficulty judging distances > Tendency to take more risks > Decreased ability to respond to several stimuli
At-risk state	0.05–0.08	> Talkative > Acts and feels self-confident > Judgement and movement impaired > Inhibitions reduced	> Ability to judge distances is further reduced > Sensitive to red lights > Slower reaction times > Shorter concentration span > Five times more likely to have an accident at 0.08 BAC than those not under the influence
Risky state	0.08–0.15	> Slurred speech > Balance and coordination impaired > Reflexes and reaction times slowed > Visual attention impaired > Unstable emotions > Nausea, vomiting > Less cautious	> Euphoria sets in > Overestimation of one's ability leads to reckless driving > Very poor peripheral vision > Impaired perception of obstacles > 10 times more likely to have an accident at 0.12 BAC than those not under the influence
High-risk state	0.15–0.30	> Unable to walk without help > Apathetic, sleepy > Laboured breathing > Unable to remember events > Loss of bladder control > Possible loss of consciousness including blackouts	> Driving ability is extremely impaired and, with likely loss of consciousness, impossible
Death	Over 0.30	> Coma > Death	> Unconscious

INVESTIGATE 13.2

ALCOHOL-INDUCED ALTERED STATE OF CONSCIOUSNESS

Study Table 13.5 and do the following.

1 Consider the likely effects of alcohol consumption on driving performance. Categorise each effect into one or more of the following characteristics of consciousness: level of awareness, controlled and automatic processes,

content limitations, perceptual and cognitive distortions, emotional awareness, self-control, time orientation. (You may wish to revisit Chapter 12 to remind yourself of the definitions of these terms.)

2 How does this support the notion that an alcohol-induced state is an altered state of consciousness?

STIMULANTS

Stimulants increase (stimulate) nervous system activity. As such, they tend to increase the level of alertness and the presence of higher frequency brainwaves, such as alpha, beta and gamma. They also increase autonomic nervous system activity, such as blood pressure and heart rate. There is a wide range of stimulants, and how and why they are used and the dangers involved vary. Some stimulants, including nicotine, cocaine and amphetamines, are highly addictive and pose very serious and life-threatening side effects.

FIGURE 13.17 The stimulant caffeine is widely used in our society.

Caffeine

Many Australians, as in other places around the world, enjoy a morning brew of coffee that contains caffeine.

When you have caffeine, your nervous system is quickly aroused and your brain's beta-wave activity, and often gamma-wave activity, are increased, especially for those who are regular caffeine users. It is rapidly absorbed into the bloodstream and can still be traced some 24 hours after consumption.

Caffeine increases alertness and reduces sleepiness. In small doses, it may help you concentrate and may improve memory. However, high doses can make you feel very anxious and give you incredible trouble in sleeping. While caffeine can trigger a 'feel good' reaction, it can also cause 'the jitters': trembling hands, heart palpitations, irritability, restlessness, anxiety symptoms and panic attacks.

Typical withdrawal symptoms include headaches, dizziness, fatigue, shakiness, crankiness, anxiety, feeling less alert, difficulty concentrating and 'cravings' for the next caffeine hit. Typically, this can last for a week. Studies have shown increased theta brainwaves during this state of withdrawal.

TABLE 13.6 Caffeine levels within common substances

SUBSTANCE	CAFFEINE LEVEL (APPROXIMATE)
Instant coffee	60–100 mg/250 ml cup
Drip, percolated or espresso coffee (including latte and cappuccino)	90–200 mg/shot (50–250+ ml)
Tea (including black, green and white tea)	30–100 mg/250 ml cup
Decaffeinated coffee	2–4 mg/250 ml cup
Chocolate drink	30–60 mg/250 ml cup
Energy or sports drinks	80–120 mg/250 ml can
Cola drinks	35–55 mg/375 ml can
Milk chocolate	20 mg/100 g bar
Dark chocolate	20–60+ mg/100 g bar

Cocaine

Derived from the South American coca plant, cocaine was once seen as a helpful substance. For centuries, native South Americans chewed on the leaves to help them through hardship, and the Inca in Peru (AD500) used the plant during religious ceremonies and as payment and treats. Since isolated as a drug in the 1800s, it went through a stage where it was seen as a wonder drug. During this time it was used as a local anaesthetic and put in medicines to relieve pain (see Figure 13.18). In 1885, John Pemberton developed Coca Cola by mixing cocaine with kola nut and syrup. Sigmund Freud prescribed cocaine for a brief period, but soon recognised the incredible dangers with using this drug.

Cocaine is usually injected, smoked or inhaled. It produces a short but very intense stimulant effect. This hyper-arousal state increases alertness, and is therefore associated with increased brainwave activity. Cocaine produces immediate and intense euphoria. It relieves fatigue and dulls pain. It increases confidence as it diminishes judgment and creates an inflated sense of one's own self. The 'rush' can last for a few minutes to several hours.

The risks of using cocaine cannot be underestimated. The 'crash' that follows leaves a person depressed, anxious, unmotivated, bored and craving more. Large doses can cause paranoia, convulsions, vomiting, heart failure and death. Regular use can lead to heart and respiratory complications, brain damage, psychosis and chronic depression.

Cocaine is now known as one of the most addictive drugs ever. It is very hard to treat cocaine addiction and often the person with the addiction has a range of other complications, including psychological disorders and addictions to other drugs that also require treatment. Cocaine is known to build up a 'selective tolerance' in users. With further use, more cocaine is needed to get the 'rush', while dangerously (at the same time), less cocaine is needed to produce seizures and cardiac arrest. This makes it easier to overdose.

FIGURE 13.18 Cocaine, once in many medicines, is now seen as an incredibly dangerous drug.

Amphetamines

Amphetamines increase alertness and arousal. They can boost mood and reduce sleepiness, inducing a feeling of euphoria and confidence, and intense concentration. Originally, they were used to increase stamina in soldiers.

Amphetamines are widely overused and abused. A person can develop tolerance and psychological addiction to the drug and crave the surge of energy and intense pleasure that a dose can bring. However, amphetamines are very taxing on the body – both physically and psychologically. The drug increases physiological arousal (for example, increasing blood pressure and heart rate), and this puts the user at high risk of heart failure, stroke and brain damage. Nicknamed 'speed', amphetamines can create the feeling that everything is moving quickly, and therefore it can induce a hyper-alert state with the inability to concentrate or pay attention. Large amounts can also lead to psychosis, a loss of reality with similar symptoms to paranoid schizophrenia, which includes **hallucinations**. An increased sensitivity to the drug develops, so that smaller amounts in the future can revive symptoms. A form of amphetamine, ecstasy, appears to cause long-term brain damage, particularly to the axon that releases the neurotransmitter serotonin. Continued use is associated with a host of issues including impaired memory and sleep difficulties.

While there is an increase in alertness initially, coming off amphetamines can cause the user to 'crash'. They can become exhausted, depressed and irritable and these symptoms worsen with continued use. These rebound effects are a huge worry. In the last decade, drivers of heavy vehicles in Australia reported using speed to stay awake. After a while, a rebound effect can be experienced where drivers are at risk of falling asleep at the wheel.

TABLE 13.7 General effects of depressant and stimulant drugs

	EFFECT ON NERVOUS SYSTEM	INITIAL EFFECT ON ALERTNESS	INITIAL EFFECT ON BRAINWAVE ACTIVITY
Depressants	Decreased (depressed) nervous system activity	Decreased alertness	Decreased brainwave activity (including decreased beta waves)
Stimulants	Increased (aroused) nervous system activity	Increased alertness (and/or a feeling of being alert, or in a hyper-alert state; gamma- and beta-wave activity is increased)	Increased brainwave activity (may lead to hyper-arousal)

13.4 REVIEW

1. Some drugs are psychoactive. What does this mean?
2. What do depressants do to our nervous system? How is this connected to alertness and brainwave activity?
3. What are the risks of high doses or chronic use of barbiturates and benzodiazepines?
4. What effect does alcohol have on a drinker's level of alertness? How does this vary with the blood-alcohol content?
5. What do stimulants do to our nervous system? How is this connected to alertness and brainwave activity?

CHAPTER SUMMARY 13

- States of consciousness can be measured by monitoring physiological responses.
- The electroencephalograph (EEG) detects, amplifies and records the brain's electrical activity in the form of brainwaves.
- The electromyograph (EMG) detects, amplifies and records the muscles' electrical activity.
- The electro-oculograph (EOG) detects, amplifies and records the electrical activity in the eye muscles.
- Basic patterns of brainwave activity are associated with certain states of consciousness, especially during normal waking consciousness and sleep; the most common are gamma, beta, alpha, theta and delta waves.
- Behavioural and cognitive measures are often used to study consciousness. This includes speed and accuracy on cognitive tests and observing behaviours via video monitoring.
- Self-reports, subjective reporting of conscious experiences, are statements and answers made by the participants concerning their psychological experience (thoughts, feelings and behaviours).
- Sleep diaries are an example of a self-report. Participants are usually asked to monitor their sleep and related aspects over a period of time.
- Video monitoring is now a common method used to study consciousness and may occur in natural or artificial environments such as a sleep laboratory.
- Psychoactive drugs affect alertness and brainwave activity. The way they affect an individual depends on the amount of drug administered, previous use, and a range of biological, individual and sociocultural factors.
- Depressant drugs decrease (depress) nervous system activity. Therefore they decrease brainwave activity and alertness.
- Stimulant drugs increase (arouse) nervous system activity. Therefore they increase brainwave activity and alertness.
- Alcohol is a drug of dependence. It is a depressant, slowing or depressing the nervous system and, as a result, alters our state of consciousness.
- Caffeine is a stimulant drug that is commonly used and accepted in our society. It arouses the nervous system, and, as a result, alters our state of consciousness.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- alertness
- alpha waves
- amplitude
- artificial environment
- beta waves
- delta waves
- depressants
- electroencephalograph (EEG)
- electromyograph (EMG)
- electro-oculograph (EOG)
- frequency
- gamma waves
- objective measurements
- physiological measurement
- polysomnogram
- psychoactive drugs
- sawtooth waves
- self-report
- sleep laboratory
- speed and accuracy on cognitive tests
- stimulants
- subjective measurements
- theta waves
- video monitoring.

KEY IDEAS

For the exam, you must know:

- the reasons why a number of research methods are used to study consciousness
- that sleep is an altered state of consciousness and consists of a number of different stages
- the advantages and limitations of using physiological measurements to study consciousness
- the use of physiological measurements in research and how each differs in its measurement between levels of wakefulness, and REM and NREM sleep
- how to describe the five major types of brainwave patterns: gamma waves, beta waves, alpha waves, theta waves and delta waves
- the use of video monitoring, including use for different states of consciousness (including sleep); use in natural and artificial environment conditions; description of how they are usually set up; how the data is usually displayed; reasons for video monitoring; limitations with the use of video monitoring
- the use of self-reports, including self-reports as a subjective way to report consciousness and some ways self-reports can be carried out (including the use of sleep diaries):
  - reasons for using self-reports
  - limitations with the use of self-reports.
- the effect psychoactive drugs, such as depressants and stimulants, have on alertness and brainwave patterns.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- use your knowledge and understanding from this chapter to apply to a related research study
- understand why consciousness is difficult to study
- be aware of ethical considerations relating to studying consciousness.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 The ________________ is a device that detects, amplifies and records electrical activity in the brain.
   a electroencephalograph
   b electro-oculograph
   c electromyograph
   d galvanic skin response

2 Which of the following is true about the electrodes used for an electroencephalograph?
   a The electrodes are inserted into the skull to measure brainwave patterns.
   b The electrodes deliver a very small electric shock to the brain.
   c The electrodes are arranged in a symmetrical pattern.
   d The electrodes are placed under the chin.

3 Which one of the following is not one of the five basic types of brainwave patterns?
   a beta waves
   b alpha waves
   c theta waves
   d sawtooth waves

4 Which of the following brainwave patterns are indicative of being alert and awake?
   a beta waves
   b alpha waves
   c theta waves
   d delta waves

5 The sleep diary is an example of:
   a a physiological measure
   b video monitoring
   c an objective test
   d a self-report.

6 The advantage of asking different researchers to 'score' sleep diaries is to minimise:
   a experimenter effects
   b subject expectations
   c the placebo effect
   d objectivity.

7 The best *physiological* measure to use to examine whether a person meditating had entered an altered state of consciousness would be:
   a an EEG
   b an EOG
   c to ask them
   d to measure their speed and accuracy on a numeracy test.

8 A(n) ________________ in brainwave activity is likely to be associated with increased ________________.
   a increase; alertness
   b decrease; awareness
   c increase; drowsiness
   d decrease; alertness

9 Stimulant drugs ________________ nervous system activity, with a tendency to initially ________________ brainwave activity.
   a increase; increase alpha, beta and gamma
   b increase; increase theta, beta and delta
   c decrease; decrease alpha, beta and gamma
   d decrease; decrease theta, beta and delta

10 Which one of the following statements is true?
   a Our brain produces only one brainwave pattern at a time.
   b All stimulant and depressant drugs are prohibited in our society.
   c The psychoactive drugs that alter our state of consciousness are either stimulants or depressants.
   d The right balance of brainwave activity to meet our needs at that particular time is key to optimal health and wellbeing.

SHORT ANSWER

11 Describe how an EEG can indicate whether a person is awake or has just fallen asleep.

2 marks

12 Name one device used by researchers in a sleep laboratory to investigate eye movements. How would this device indicate NREM sleep?

2 marks

13 Self-reports are subjective measures for researching consciousness.

a Explain why sleep diaries are an example of a self-report (subjective reporting of consciousness).

2 marks

b Why are self-reports a valuable research method?

2 marks

c What are some possible limitations with using self-reports?

2 marks

14 Liam plans to study the effects of different states within normal waking consciousness (drowsy and alert) on learning and enjoying music. He plans to collect physiological measurements, cognitive and behavioural measures and self-reports.

a Why would he want to collect different types of data for his research?

2 marks

b Give an example of a physiological measurement he may use in his study. Why is this measurement used to study consciousness?

1 mark

c Give an example of a cognitive and behavioural measure he may use in his study? What could be the value of using this measure?

1 mark

d Liam plans to use 'beepers' (an experience-sampling technique) to aid subjective reporting at certain times. What will the participants be required to do?

3 marks

15 What might be the benefits of video monitoring in reporting on sleep patterns?

2 marks

16 What kind of brainwaves are we likely to exhibit during the following states of consciousness:

a awake and alert

1 mark

b awake and relaxed

1 mark

c in a deep sleep

1 mark

17 What does EOG measure and how is it used by sleep researchers?

3 marks

18 What is a polysomnogram and why is it useful for researchers?

2 marks

19 Describe selective and divided attention and give an example of each.

4 marks

20 What are some of the problems with self-reporting?

2 marks

→ CHAPTER 14

SLEEP: PURPOSE & FUNCTION

Sleep is simply irresistible. We all need it and, even when we try to stay awake, sleep eventually takes over. Sleep is an example of an altered state of consciousness. During sleep, we are almost – but not totally – unaware of our surrounding environment. Much happens to our mind and body when we drift off to sleep. This chapter considers why we sleep and looks at the various different states we are in when asleep: states known as the stages of sleep.

KEY KNOWLEDGE

> sleep as a regular and naturally occurring altered state of consciousness that follows a circadian rhythm and involves the ultradian rhythms of REM and NREM Stages 1–4 sleep excluding corresponding brainwave patterns and physiological responses for each stage

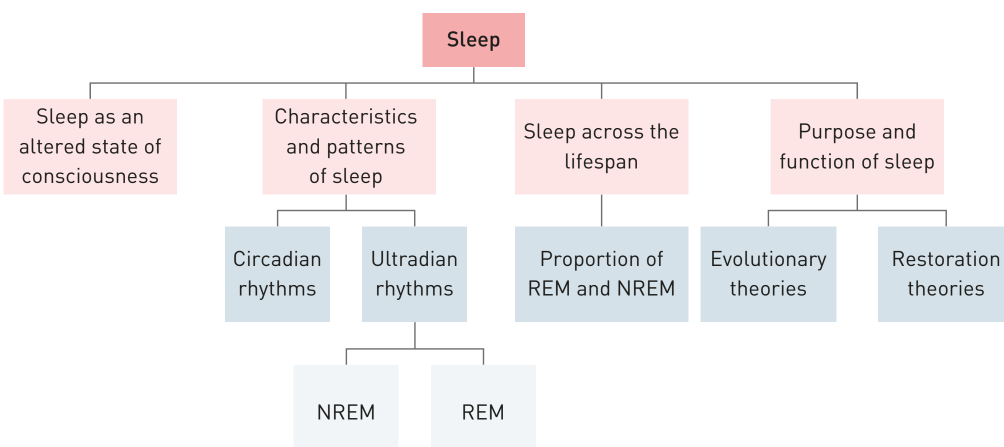
> theories of the purpose and function of sleep (REM and NREM) including restoration theory and evolutionary (circadian) theory

> the differences in sleep across the lifespan and how these can be explained with reference to the total amount of sleep and changes in a typical pattern of sleep (proportion of REM and NREM)

CHAPTER OVERVIEW

Sleep as an altered state of consciousness	Level of awareness Content limitations Controlled and automatic processes Perceptual and cognitive distortions Emotional awareness Self-control Time orientation
Characteristics and patterns of sleep	Sleep and circadian rhythms Sleep and ultradian rhythms
Sleep patterns across the lifespan	Proportion of REM and NREM sleep in a typical pattern of sleep
Purpose of sleep	Evolutionary theory of sleep Restoration theories of sleep

CONTENT MAP



Sleep as an altered state of consciousness

On average, we spend about one-third of our lives asleep. If you are 17 years old, you have probably spent more than 5.5 years asleep. A person who is 45 years old has spent about 15 years asleep and someone who is 75 years old has slept for 25 years. We spend up to one-third of our waking time daydreaming, or more than 5 hours per day (1 year every 4.5 years). Add this up. How many years have you spent sleeping and daydreaming?

To nod off to sleep is to temporarily lose normal waking consciousness, including some awareness of yourself and your environment. Below is an outline of the characteristics of sleep that define it as an altered state of consciousness.

Level of awareness

Sleep is a unique state of awareness. Each night we fall into this altered state of consciousness. It is certainly not a period of being awake, nor are we in a coma (unconscious). We have some, albeit very little, awareness of our external environment when we are asleep. At times, we may incorporate what is happening around us into a dream or we may suddenly be woken from a **deep sleep** by something highly personally relevant (such as a parent responding to their baby's crying).

INVESTIGATE 14.1

HOW MUCH SLEEP DID YOU HAVE LAST NIGHT?

Think about your sleep last night.

- What time did you go to bed?
- How long did you sleep?
- Did you wake up during the night? If so, at what time(s)?
- What time did you wake up in the morning to start the day?
- Did you wake at the sound of your alarm clock?
- Did you wake up feeling refreshed and ready to start the day?
- Did you sleep walk or sleep talk during the night?
- Collate your results as a class. Look for patterns in the data, then discuss the findings. Refer to your answers and the class results while working through Chapters 15 and 16.

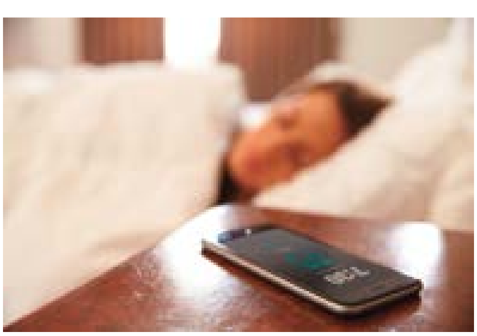


FIGURE 14.1 Do you often wake up just as the alarm is about to sound?

Content limitations

When we sleep, we relinquish conscious control of our thoughts. Everyone dreams and the dreams we remember tend to be bizarre. The contents of our dreams tend to be much broader and deeper than our thoughts in normal waking consciousness.

Controlled and automatic processes

Performing other tasks is probably impossible. It is interesting to note that most sleep walkers, known as **somnambulists**, usually carry out routine, automatic processes when they sleep walk.

Perceptual and cognitive distortions

Our attention to sensory stimuli is lowered during sleep, including our perception of pain. Our thoughts are more likely to be disorganised and unrealistic during our dreams. Although most of us dream about four or five times a night (about 2 hours in total), we remember little upon awaking.

Emotional awareness

Our emotions can be more or less intense or flattened during sleep. A nightmare can make us feel very scared and a good dream can make us feel terrific. There is some evidence that sleep can help us deal with our emotions (Cartwright, 1998). Have you ever felt very anxious about something late at night, but woken up the next morning after a good night's sleep feeling better?

Self-control

Our ability to maintain self-control, including monitoring our own behaviour, is lowered during sleep. For instance, we may snore, grind our teeth or talk during our sleep.

Time orientation

Our ability to perceive the speed at which time passes may be affected. Time can seem to fly and, on other nights, it can feel as if it takes forever to reach the morning. Despite this, there is growing evidence that suggests we have the ability to estimate the amount of time that has elapsed during sleep (Aritake-Okada *et al.*, 2009). Often, we are able to wake up at a predetermined time without the use of an alarm clock. It appears that the ability to estimate time is associated with our deep (stages 3 and 4 NREM) sleep and is more likely when we follow a regular sleep routine, including going to bed at the same time each night.

14.1 REVIEW

Fill in the following table that compares normal waking consciousness (NWC) with sleep.

CHARACTERISTIC	NWC	SLEEP
Level of awareness: Awareness of internal and external events		
Content limitations: Amount of control you have to limit what you attend to		
Controlled and automatic processes: Ability to perform two or more tasks at once, depending on complexity		
Perceptual and cognitive distortions: Degree of awareness, and efficiency of your perceptions and cognitions		
Emotional awareness: Experience of emotions (feelings)		
Self-control: Ability to maintain self-control		
Time orientation: Ability to correctly perceive the speed at which time passes		

Did you know?

The word *circadian* comes from the Latin *circe* (about) *diem* (a day), so a circadian cycle lasts, literally, about one day. Other natural cycles are *infradian*, which occurs less than once per day (*infra* for 'below'), and *ultradian*, which occurs more than once per day (*ultra* for 'beyond').

Characteristics and patterns of sleep

Sleep is not just one state of consciousness; it comprises a number of predictable states and follows a highly organised sequence of events. Throughout sleep, our bodies shift through a number of stages, each with its own unique characteristics. The different stages of sleep are usually identified by measurable changes in physiological responses (many of which are discussed in Chapter 13). Physiological changes include changes in brainwave patterns, muscle tension, eye movement, body temperature, heart rate, blood pressure, respiration and hormone release.

Sleep and circadian rhythms

Our bodies are attuned to a sleep–wake cycle that revolves around night and day. This regular cycle, an example of a **circadian rhythm** (see Table 14.1), is determined by an internal body clock (the **suprachiasmatic nucleus**) located in the hypothalamus in the brain. Levels of arousal, hormone secretions, metabolism, heart rate and body temperature are largely influenced by this clock. For most people, the circadian cycle peaks (awake and alert) during the day (usually the afternoon), with the lowest point being early in the morning (drowsy and sleepy).

TABLE 14.1 The body's biological rhythms

BIOLOGICAL RHYTHM	LENGTH OF CYCLE	EXAMPLES
Circadian rhythms	24 hours	> Sleep–wake cycle > Alertness > Body temperature > Growth hormone secretion
Ultradian rhythms	Less than 24 hours	> REM and NREM sleep cycles
Infradian rhythms	More than 24 hours	> Migration patterns of some animals > Seasonal variations in mood and appetite > Female menstrual cycle

Hormones including cortisol and **melatonin** are regulated by the suprachiasmatic nucleus. Cortisol levels link with our level of alertness, with higher levels associated with greater alertness. Melatonin, a sleep hormone, causes sleepiness and is released when it is dark. It is secreted from a small structure in the brain called the pineal gland. Light stops melatonin secretion and therefore light can prevent sleepiness. Adrenalin is also involved, influencing such properties as blood pressure and heart rate.

Our internal body clock does not appear to be synchronised with the clock on the wall. The clock runs a 24-hour cycle, whereas our bodies – in the absence of environmental cues about the time – run close to a 24.2-hour cycle (Czeisler *et al.*, 1999) or even longer (up to 25 hours). This small deviation from the 24-hour clock is significant.

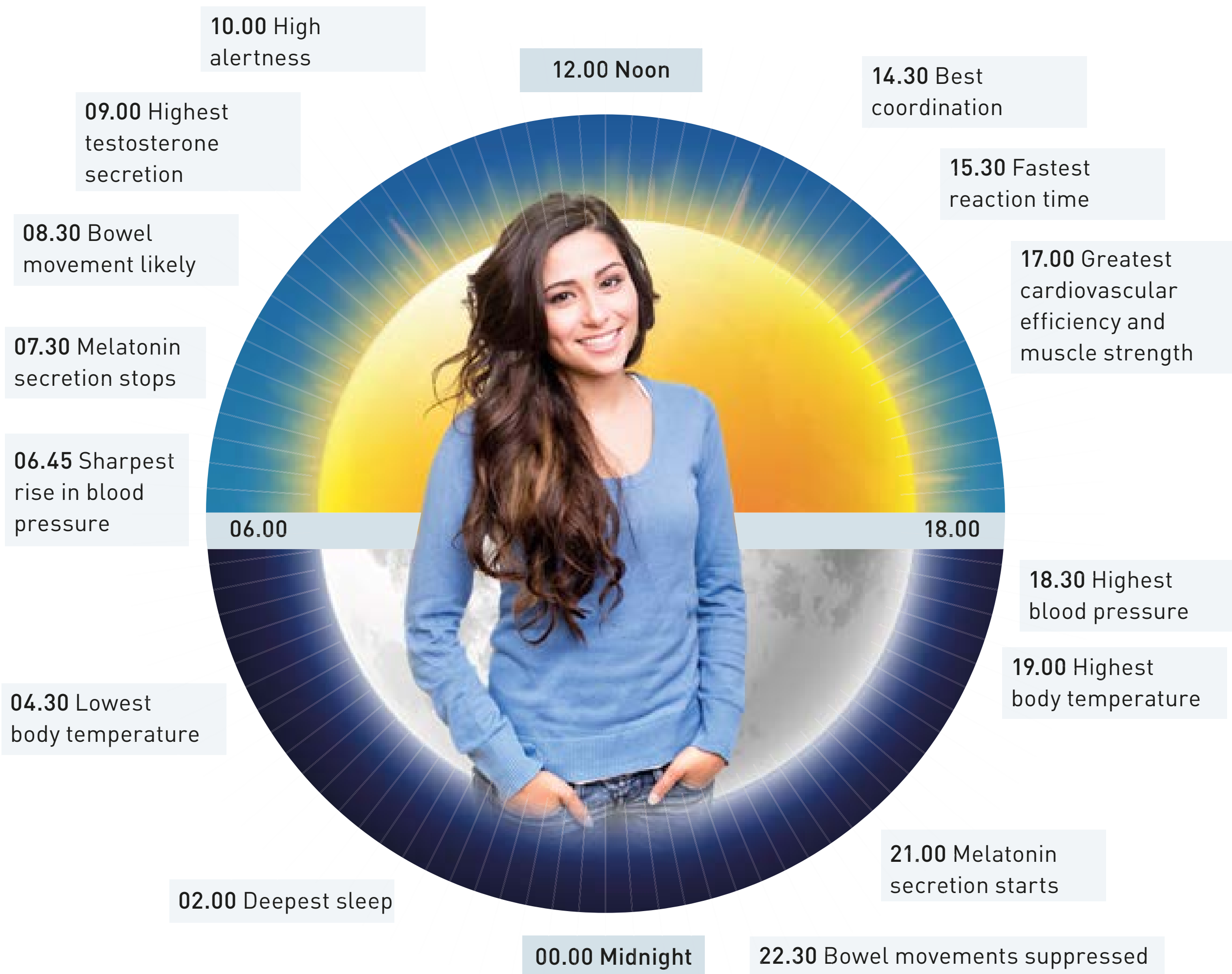


FIGURE 14.2 Circadian rhythms occur across a period of between 24 and 25 hours.

This means that our natural **sleep–wake cycle** is slightly longer than 24 hours. If we were able to follow this natural cycle, we would be going to bed at noon and awakening at midnight within a couple of months. This explains why it is often easier to fall asleep slightly later than usual rather than earlier than usual at night. It suggests that our sleep–wake cycle is largely **endogenous**, meaning it is based on internal biological factors. However, external (environmental) cues, such as light and dark, partially influence the sleep–wake cycle. Such cues are known as **zeitgebers**.

The zeitgeber sunlight appears to readjust this small mismatch between day and night and our natural sleep–wake cycle. Light sensors in our eyes (and even the back of our knees!) inform our brain when it is light, which then adjusts our internal body clock accordingly. This means detection of light is the primary external signal for the suprachiasmatic nucleus. The suprachiasmatic nucleus then signals to the pineal gland to stop the release of melatonin, the hormone responsible for making us sleepy.

Exposure to light at different times in the day has different effects. Early morning light can cause a phase shift, leading to waking. Light in the middle of the day does not affect us too much. Light in the evening, however, causes a phase delay by keeping us awake (preventing us from sleeping).

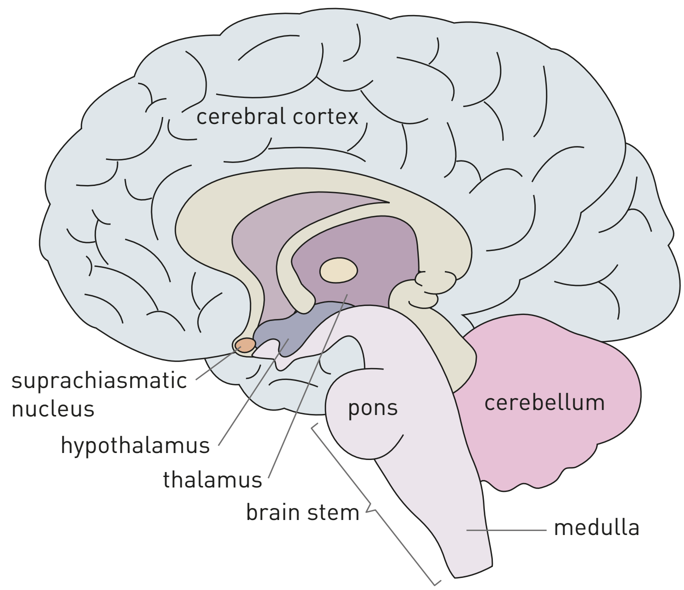


FIGURE 14.3 The internal body clock, the suprachiasmatic nucleus, is located in the hypothalamus. It governs the release of melatonin from the pineal gland.

Sleep and ultradian rhythms

Throughout sleep, we shift between **non-rapid eye movement (NREM)** and **rapid eye movement (REM) sleep**, beginning with NREM sleep. The primary distinguishing feature between NREM and REM sleep is that rapid eye movement occurs in REM sleep. When investigated further, however, there are other physiological and psychological differences between the two.

On average, we go through one cycle of NREM and REM every 90 minutes. The NREM/REM cycle is an example of an **ultradian rhythm** (see Table 14.1), a **biological rhythm** that is shorter than 24 hours. Most adults typically experience four to six NREM/REM cycles per night. The amount of time spent in REM sleep increases and NREM sleep decreases as the night progresses. This means that we typically spend more time in REM sleep in the cycle *just before* we wake in the morning compared to cycles earlier in the night.

NON–RAPID EYE MOVEMENT SLEEP

Once asleep, we enter NREM sleep. NREM sleep consists of four stages and accounts for about 80 per cent of our total sleep time.

Stage 1 NREM sleep

During the transition from being awake to being asleep, or falling asleep, we enter a relaxed state known as a **hypnogogic state**. During this state, we may experience hallucinatory images, such as flashes of light and vivid images. **Hypnogogic (hypnic) jerks** – involuntary muscle twitches that cause us to jolt – are common. When falling asleep, usually at the beginning of the night as your muscles relax, have you ever felt like you were falling and woken with a jump? The hypnogogic state is often considered to be part of stage 1 NREM sleep.

Stage 1 NREM sleep is brief, lasting around 5 minutes for most people, but it can range from 30 seconds to 10 minutes. It is a very light sleep from which we can be easily awakened. If this happens, we often think we haven't been asleep at all. It is sometimes called the *presleep* stage.

FIGURE 14.4 You are often jerked awake from dreams about falling before you 'hit' the ground.

Stage 2 NREM sleep

Many consider the start of stage 2 NREM sleep as the point at which true sleep begins. We spend about 20 minutes in stage 2 NREM sleep in our first NREM/REM sleep cycle and it is still fairly easy to be woken up at this stage, despite it being a deeper stage of sleep. If we are woken, it is likely that we still won't believe we were asleep.

As we slip further into stage 2 NREM sleep, our eyes stop rolling, our muscles become further relaxed and our breathing and heart rate continue to decrease. Stage 2 NREM sleep accounts for about 50 per cent of our total sleep.

Stage 3 NREM sleep

Stage 3 NREM sleep is a brief transitional stage that marks the start of deep sleep. During stage 3 NREM sleep, we become less responsive to external stimuli and more difficult to awaken. If we are woken from stage 3 NREM sleep, we feel very groggy and disorientated.

In stage 3 NREM sleep, our eyes do not move, our muscles are relaxed and heart and breathing rates continue to become slower and more regular.

Stage 4 NREM sleep

Stage 4 NREM sleep is the deepest sleep and, as in stage 3 NREM sleep, it is extremely difficult to wake someone who is in this sleep stage. This is when we are 'fast asleep' or 'sleeping like a log'. Although our level of conscious awareness is very low, we can still be sensitive to certain stimuli, such as a baby crying or a smoke alarm.

In the first NREM/REM sleep cycle, we spend about 30 minutes in stage 4 NREM sleep and it has probably been about an hour since we first fell asleep.

Rather than remaining in stage 4 NREM sleep, we quickly cycle back through the sleep stages: stage 4 NREM to stage 3 NREM to stage 2 NREM, then skipping stage 1 NREM and going straight into REM sleep.

Did you know?

In the middle of last century, two sleep researchers noticed that, at certain times, the eyeballs under a sleeper's eyelids would move rapidly to and fro (Aserinsky & Kleitman, 1953). At the same time, they noted a change in brainwave patterns, decided it was a distinct stage of sleep, and aptly named it 'rapid eye movement sleep'. This simple observation changed the whole course of sleep research.

RAPID EYE MOVEMENT SLEEP

FIGURE 14.5 Rapid eye movement occurs during REM sleep.

As the name suggests, rapid eye movement (REM) sleep is a period of sleep when your eyes move rapidly, for short bursts of time. The first cycle of REM sleep lasts for about 10 minutes. REM sleep is a lighter sleep than stages 3 and 4 NREM sleep and therefore easier to wake from. Unlike NREM sleep, if we are woken during REM sleep, we are likely to report that we were dreaming. This is true for everyone, even those who say they don't usually dream.

During REM sleep there are marked physiological changes. There are repetitive bursts of rapid eye movement, and heart rate, blood pressure and respiration increase and fluctuate. Body temperature tends to match the surrounding environment and genitals are aroused. There is, however, no muscle tension – the muscles that move voluntarily, especially those below the neck, are very relaxed to the point of being almost paralysed (except for the occasional twitching). This paralysis is known as **muscle atonia** or **cataplexy**.

REM sleep is often referred to as *paradoxical* sleep. This is because the body can appear calm on the exterior (virtually no muscle activity) but other bodily systems and the brain are highly active, having many features that are similar to being awake.

It appears that most dreaming occurs during REM sleep. Dreams during REM sleep tend to follow a storyline (though a bizarre one at times) and the dreamer often feels as if they are experiencing a different world. The final dream of the night tends to be the longest, strangest and most exciting – elements that make it more likely to be remembered. Therefore, the dreams you remember and repeat to other people are most likely to be your last REM dreams in the night. In reality, though, we remember very few of our dreams. Can you remember the four or five dreams you had last night? You probably spent about 2 hours dreaming. That adds up to about 6 years of dreaming in a lifetime.

People who are lighter sleepers and people who are anxious are more likely to dream in NREM sleep. Have you ever felt as if you have been awake all night thinking about a problem? The chances are that you did sleep and some of this thinking occurred during an NREM dream.

TABLE 14.2 Physiological characteristics of the stages of sleep

CHARACTERISTIC	NREM SLEEP				REM SLEEP
	STAGE 1	STAGE 2	STAGE 3	STAGE 4	
Sleep state	Drifting in and out of sleep	Light sleep (real sleep starts)	Moderately deep sleep	Deep sleep	Light sleep
Heart rate	Irregular	Slower and more regular	Slower and more regular	Slow and regular	Increases and fluctuates
Breathing rate	Irregular	Slower and more regular	Slower and more regular	Slow and regular	Increases and fluctuates
Muscle tension	Relatively tense	Lower muscle tension	Lower muscle tension	Relaxed (low tension)	Virtually non-existent
Body temperature	Normal	Lower	Lower	Lowest	Unregulated

14.2 INVESTIGATE

WATCH YOUR PET SLEEP

Have you ever watched a sleeping dog that appears to be dreaming about a terrific chase? They might make snorting noises and twitch their paws. At the same time they might twitch their legs as though they are trying to run.

Like humans, dogs experience REM sleep, as do all mammals except dolphins and echidnas.

Get some students in your class to video their dogs asleep and dreaming.

1 Briefly describe the video.
2 In the footage, what do you think indicates that the dog is dreaming?
3 When is dreaming more likely to occur?
4 During REM sleep, what happens to the muscles that move voluntarily?
5 Why do you think it is important that this happens to these muscles when the dog is dreaming?

FIGURE 14.6 Dogs dream of the big chase.

14.2 REVIEW

1 What is meant by a circadian rhythm? Give a sleep-related example.
2 What is meant by an ultradian rhythm? Give a sleep-related example.
3 What is a zeitgeber?
4 What is the distinguishing feature between NREM and REM sleep?

Sleep patterns across the lifespan

Sleep patterns change with age. You probably do not need as much sleep now as you used to and can go to bed later than when you were little.

Newborns spend about 16 hours per day sleeping, with about half of this time in REM sleep. Young children also spend a lot of time in deep NREM sleep, but as they grow up the type of sleep they experience changes. Evidence suggests that REM sleep helps with brain development, particularly in early life. This would explain why infants need so much more.

Adults sleep for about 8 hours, with about a quarter of this in REM sleep. By the age of 60 years, very little time, if any, is spent in stage 4 NREM sleep, with sleep lasting for about 6 hours – still with 20–25 per cent in REM sleep. As we can see in Figure 14.7, the amount of REM sleep we experience decreases as we get older. Although this does not mean we need less sleep, rather it means our sleep becomes more fragile.

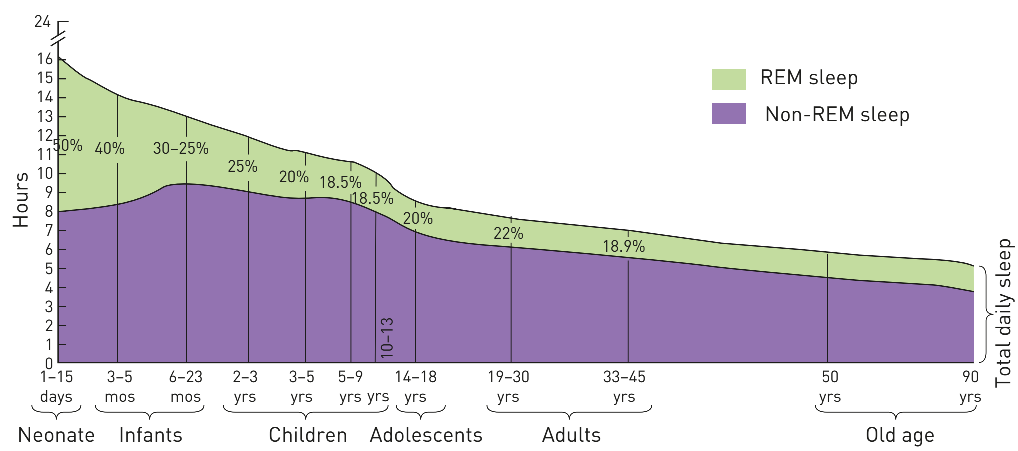


FIGURE 14.7 Changes in sleep patterns with age

INVESTIGATE 14.3

SLEEP PATTERNS AND AGE

Using Figure 14.7, write responses to the following questions.

1 What proportion of time do neonates (newborn babies) spend in REM sleep?

2 By the time people reach late childhood, they spend about 20–25 per cent of time in REM sleep. Write a sentence to summarise the proportions of NREM and REM sleep from late childhood to old age (Hint: don't try to provide exact figures from the graph for every age, instead recognise the general patterns in the graph and give an overview).

3 How much sleep time is needed by each of the following groups?

a one-year-old babies

b five-year-old children

c adolescents

d people in middle adulthood (40–50 years)

e the elderly (70+ years)

Proportion of REM and NREM sleep in a typical pattern of sleep

As discussed, sleep cycles consist of REM sleep and NREM sleep. NREM sleep is broken down into stages 1, 2, 3 and 4. When we first fall asleep, we tend to experience NREM stage 1, then stage 2, stage 3, stage 4, stage 3, stage 2 and finally REM sleep. This is our first NREM/REM cycle and lasts for about 90 minutes.

After the first NREM/REM cycle, we often skip stage 1 NREM sleep and enter stage 2 NREM sleep again. We then descend through stages 3 and 4 NREM sleep before returning via stage 3 to Stage 2 to REM sleep. This cycle can be plotted on a graph known as a **hypnogram** (refer to Figure 14.8). Return to stage 2 NREM sleep marks the start of the third cycle and, this time, we stay in this stage for about an hour, often not descending into stages 3 and 4 NREM sleep. We spend a longer period of time in REM sleep and, again, the end of REM sleep marks the end of the cycle.

The fourth, fifth and (sometimes) sixth cycles are similar; we are unlikely to enter stages 3 and 4 NREM sleep and increasingly more time is spent in REM sleep. We have a tendency to wake briefly (usually without conscious awareness) before or after a period of REM sleep (Zepelin, 1986). We might wake up in the fifth sleep cycle, either directly from stage 2 NREM sleep or REM sleep, but often roll over and go back to sleep and start another cycle.

While the exact pattern of sleep varies from person to person and from night to night, the following features are the same:

> stages 3 and 4 NREM sleep typically occur in the first two cycles of the NREM/REM sleep cycle
> we spend more time in REM sleep as the night progresses.

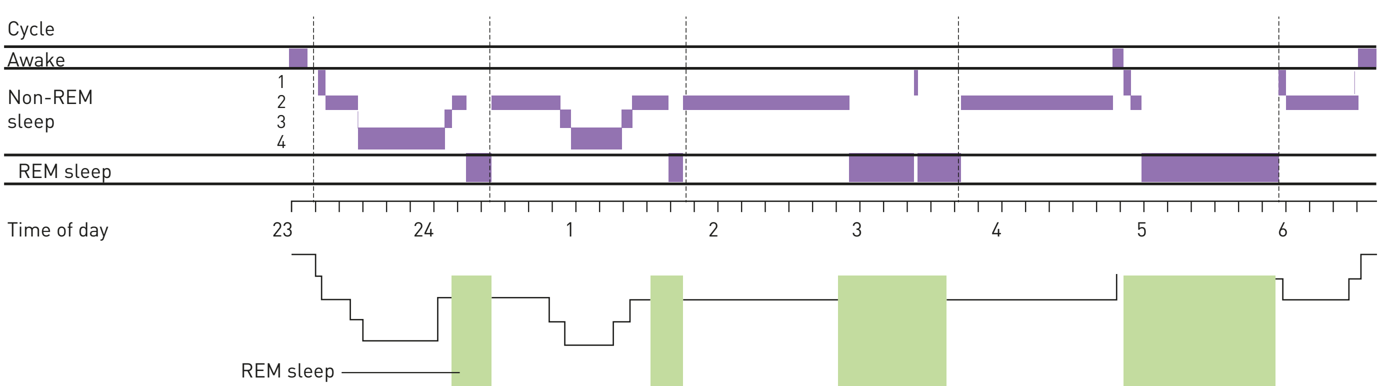


FIGURE 14.8 A typical hypnogram of a night's sleep

INVESTIGATE 14.4

WHEN DO YOU WAKE UP?

Have you ever noticed that it is harder to wake up at some times of the morning than others?

Throughout the night, we often awaken briefly before or after a REM cycle, which occurs about every 90 minutes. We are unlikely to remember waking, especially when we are young. However, it is easier to get out of bed in the morning if our wake-up time coincides with the end of a 90-minute NREM/REM cycle.

1 Tonight write down the time you go to bed. Then, if you wake up during the night, jot down the time. Also, jot down the time you wake in the morning.
   - Did you wake in the morning at the end of a 90-minute cycle or was it interrupted midway?
   - Was it difficult to wake up in the morning? If it was difficult, was your NREM/REM sleep interrupted?
   - If you woke during the night, was it around the end of a 90-minute cycle?

2 The following night, set a time to go to bed. Make sure that a series of 90-minute cycles will bring you to your chosen waking time. For example, go to bed at 10.00 p.m. and wake at 7.00 a.m. Best to make it earlier than later – we don't want you sleep-deprived at school!
   - Was it easier to wake in the morning at the end of a NREM/REM sleep cycle?

3 Some people with routine sleep habits have the ability to wake naturally at close to a desired time and never use an alarm clock (Moorcoft & Breistenstein, 2000). Do you think you have this ability? Do you think you can wake yourself at a time in line with the 90-minute cycle? Imagine you are a sleep psychologist and design a test to find out.

INVESTIGATE 14.5

EVALUATION OF A RESEARCH DESIGN

House fires are regularly reported in the media and there have been tragic reports of deaths despite working smoke alarms. Most of these deaths have occurred early in the night, a time when we are likely to be in deep sleep. To what extent can we rely on smoke alarms waking us in the middle of the night? Can they rouse us even from our deepest sleep? Is there a better signal to help us wake from our deepest sleep?

A team of Melbourne sleep psychologists investigated this critical issue (Bruck *et al.*, 2008). They tested a number of different signals, varying in pitch and complexity, for their ability to wake people from the deepest sleep (stage 4 NREM sleep). They believed that a higher pitch and more complex tones were more likely to wake a person during stage 4 NREM sleep than a lower pitch with less complex (more pure) tones.

Thirty-nine volunteers (18 males and 21 females) participated in the study. All were healthy young adults (18–27 years old) not on medication, not suffering from a sleep disorder and having normal hearing. They were paid $80 per night with a bonus of $180 on completing the study. The research was approved by the ethics committee of their university.

Most of the participants were tested in their own home, with a few deciding to be tested in the sleep laboratory. For the study, recording devices were attached to the participants and the researcher sat in the hallway monitoring their brainwaves. They were tested one night per week for three weeks, and were allowed to recover from any sleep loss between tests. Conditions were kept similar on each testing night (same diet, exercise, bedtime, door closed, etc.) and all the participants were administered the same test.

FIGURE 14.9 Smoke alarms save lives.

During the testing, four different signals were tested per night at different times and the order of these signals was counterbalanced between participants. When each participant entered stage 4 sleep, one of the signals was switched on. It became louder until the participant pressed a button by their bedside to turn it off. The length of time it took for beta brainwave patterns to appear was recorded.

Analysis of the results found that a low pitch and a complex tone were significantly more likely to wake people. Standard smoke alarms are currently high pitched with pure tones and are at least seven times less likely to wake an adult in deep sleep. Professor Bruck and her team are calling for changes to Australian smoke detector signals.

You can learn more about Professor Bruck's studies on YouTube.

1 What was the aim of the experiment?
2 Write an experimental hypothesis for this study.
3 What was the independent variable?
4 What was the dependent variable?
5 What was the name of the experimental research design used in this study?
6 What is counterbalancing? How is counterbalancing used in this study? What are the advantages of counterbalancing?
7 In terms of characteristics of altered states of consciousness, how does level of awareness during sleep differ from normal waking consciousness?
8 When are we more likely to experience deep sleep (stage 3 and 4 NREM sleep) in a typical night of sleep?
9 Is it difficult or easy to wake someone in stage 4 NREM sleep?
10 What is the advantage of testing participants in their own home?
11 What were the findings of this study?
12 What was the conclusion for this study?
13 What relevance does this finding have to Australians' everyday lives?

14.3 REVIEW

1 How does the length of time sleeping change over the lifespan?
2 How does the proportion of time spent in NREM and REM sleep change:
   a during a night's sleep?
   b over the lifespan?

Purpose of sleep

Picture this scenario between a parent and child: preschool-aged Emily 'snaps' at her mother when told to pick up her toys. Her mother says to her visitor, 'Oh, she is just tired. She stayed up late last night.'

FIGURE 14.10 We can be more irritable when we're tired.

Have you ever been told your behaviour indicates that you need more sleep? Or have you ever justified your poor behaviour by blaming a lack of sleep? If so, it shows that you, like most of us, have some understanding of the need for sleep and know what happens if you don't get enough. While the quality or quantity of sleep should not justify bad behaviour (for example, 'I didn't mean to hurt your feelings. I'm just tired'), it can highlight the importance of sleep. Feeling grumpy, tired, irritable, antisocial and unmotivated are just some of the consequences – you can probably think of more. On the other hand, you have probably noticed that too much sleep can also make you feel sluggish and irritable.

Sleep is a necessity, not a luxury. While sleep is essential to being healthy, alert and happy, the overriding purpose of sleep is much debated. We know we need sleep but we are still unclear about exactly *why*. The amount of sleep we need also varies markedly from one person to another.

There are several theories of sleep function, including the **evolutionary (circadian) theory of sleep** and **restorative (restore and recover) theories of sleep**.

Evolutionary theory of sleep

According to the evolutionary (circadian) theory of sleep, sleep is a means of increasing an animal's chances of survival in its environment. Animals sleep patterns, periods of activity and inactivity, have *evolved* around the *circadian* day–night period to match periods of light and darkness.

Sleep allows us to change to meet the demands of our environment and it depends on how much food we need, how available it is (we may need to conserve energy) and our safety when we sleep. These sleep requirements have evolved over time in order for the species to hunt food, hide and conserve energy. The periods of wakefulness occur when it is safer to do so and sleeping when it is more hazardous to be awake.

Sleep patterns have *adapted* in terms of whether the animal in question is predator or prey, their food requirements and methods of defence from attack. Within a population of a certain animal species, individuals with certain sleep patterns (traits) have survived over time. They have offspring who are likely to inherit these sleep traits and survive and reproduce. Therefore the species have adapted their sleep patterns to their environmental conditions over time and their chances of survival have increased.

BAT: 19.9 HOURS

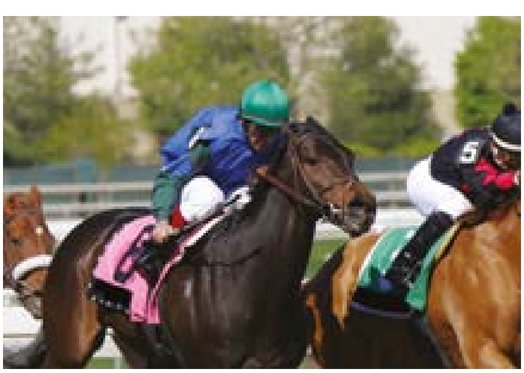
KOALA: 19.0 HOURS

CAT: 13.2 HOURS

RED FOX: 9.8 HOURS

HUMAN: 8.0 HOURS

COW: 3.9 HOURS



HORSE: 2.5 HOURS

KANGAROO: 1.5 HOURS

FIGURE 14.11 Different animals need different amounts of sleep. Which animals need to work harder to get enough food? Which are vulnerable to predators? Which have a higher metabolic rate?

Consider the different sleep needs for different animals (refer to Figure 14.11). The evolutionary theory posits:

> *Sleep depends on an animal's vulnerability to predators.* Small animals that are very vulnerable to predators, such as mice, sleep more so that they can hide safely from carnivores that will eat them. Larger prey animals, such as deer, sleep less because they are more exposed in their environment and need to be ready to escape from predators. Those with few natural predators, such as bears and lions, often sleep for long periods (12 to 15 hours) each day. From an evolutionary stance, our prehistoric ancestors were more vulnerable to predators at night. They relied heavily on vision, a sense that is not very good in the dark. To avoid predators, they carried out duties (hunting and gathering food) during the safe daylight hours and slept quietly and safely at night, a time when their vision was poor.

> *Sleep depends on the need to find food.* Animals that need to graze for hours, such as cows, sleep less. They sleep less because they need to find more food to survive.

> *Sleep conserves energy.* When an animal sleeps, its metabolism slows, thus reducing the need for food – a human's metabolic rate during sleep is about 10 per cent less than when awake (Wouters-Adriaens & Westerterp, 2006). Sleeping is a means of conserving energy in hibernating animals, such as squirrels or grizzly bears, which sleep during winter months when food is scarce and the weather conditions are harsh.

CRITICISMS OF THE EVOLUTIONARY THEORY

The evolutionary theory has attracted criticism including the assumptions that sleep is:

> very useful but not essential. This theory does not explain why we *must* have sleep. All species sleep, despite the amount of food (abundant or scarce) or danger they are in

> a way to hide safely from predators. For animals that are highly preyed upon, sleeping can be dangerous. The loss of awareness during sleep makes the animal very vulnerable to predators and unlikely to be able to respond to danger.

TABLE 14.3 Summary of main theories on purpose and function of sleep

THEORY OF SLEEP	PURPOSE	FUNCTION
Evolutionary theory	> To increase chances of survival > Explains *when* and *why* different species sleep	> Sleep to hide and conserve energy, wake to safely find food
Restoration theories	> To recharge, grow and recover from the physical and psychological work during the day > Explains *why* sleep is important	> Sleep repairs and replenishes the body and prepares it for action the next day
Memory consolidation theory	> To create new and lasting memories from the day	> To allow time for the brain to process and transfer information into long-term memory
Sleep to dream	> To experience dreaming	> Dreaming fills our psychological needs

Restoration theories of sleep

FIGURE 14.12 Research shows that activities that are more physically demanding should increase the need for sleep.

According to restoration (restore and recover) theories, sleep allows us to recharge our bodies: to grow and recover from the physical and psychological work during the day. Think about how you feel when you wake up after a good night's sleep: refreshed, re-energised and ready to start the day. It is like undergoing a routine check-up and maintenance every time we sleep!

According to the restoration theories:

> *Sleep repairs and replenishes the body and prepares it for action the next day.* Sleep looks after the health of the physical body. Activities that are more physically demanding should increase sleep. A study of marathon runners supports this view (Shapiro *et al.*, 1981). They slept 90 minutes longer and doubled their deep sleep (stages 3 and 4 NREM) for the two nights after running a 107.8 kilometre marathon.

> The neurotransmitter adenosine may provide further evidence for the restorative theory. Adenosine is produced when our cells use energy – it is suspected to be a cellular waste product that accumulates when we are awake. The more energy we spend, the more adenosine is produced. Adenosine is linked to making us feel sleepy and the longer we are awake, the sleepier we get. When asleep, adenosine levels decrease and we wake feeling refreshed and alert (Rainnie *et al.*, 1994; Alanko *et al.*, 2004). It is a bit like taking out the rubbish – sleep gets rid of the waste products! Lack of sleep will affect our energy levels and make us feel drowsy and fatigued. Caffeine increases alertness (as discussed in the Chapter 13) and also blocks adenosine, further adding support to the theory of adenosine's role in making us feel sleepy.

> *Sleep increases alertness.* Sleep keeps our minds alert and assists our psychological state. When we are not getting enough sleep, we tend to be inattentive and more easily distracted (Jennings *et al.*, 2003; Kendall *et al.*, 2006). Neurotransmitters, including norepinephrine, play a major role in keeping us alert during the day. It has been found that our bodies are more sensitive to norepinephrine when our sleep is adequate (Steriade & McCarley, 1990). Therefore, less norepinephrine is required to make us feel alert after a good night's sleep compared to a poor night's sleep. Other neurotransmitters such as adenosine (mentioned previously) are also involved in determining our alertness after sleep.

> *Sleep enhances mood.* Are you grumpy, short-tempered or miserable? Perhaps you need more sleep! Many hormones and neurotransmitters influence your mood and emotions. A number of these are activated during sleep. As a consequence, not getting enough sleep can lead to negative thoughts, feelings and behaviours, making us cranky, irritable and unhappy (Boivin *et al.*, 1997; Durmer & Dinges, 2005).

> It has also been found that mammals with higher metabolic rates like dogs and cats are likely to spend more time sleeping, especially in deep sleep (stages 3 and 4 NREM sleep), than mammals with lower metabolic rates such as cows and kangaroos (Allison & Cicchetti, 1976). This finding may suggest that animals with a higher metabolic rate need more sleep to recover. Look at Figure 14.11 again. Which animals have a high metabolic rate and spend more time asleep?

- *Sleep activates growth hormone.* Growth hormone is responsible for physical growth. It has been linked with sleep, especially during the early years and adolescence, and the more you sleep (especially stages 3 and 4 NREM sleep), the more likely you are going to grow and meet your potential growth (Gais *et al.*, 2006).
- Growth hormone is also involved in controlling our metabolism. This means that sleep increases growth hormone levels and therefore helps control metabolism, including our energy levels (Pekkanen, 1982).
- *Sleep increases immunity to disease.* For good reasons, we are often told to rest and sleep when we are ill. Sleep is a natural medicine as it appears to help our immune system become stronger. Immune cells that fight disease and infections are produced during sleep (Motivala & Irwin, 2007). If we go without sleep, our immune system will often reduce its natural response, causing us to be more susceptible to disease and infection (Irwin *et al.*, 2003). We are more prone to heart disease if we sleep either too much or too little.

FIGURE 14.13 Getting adequate sleep increases our level of alertness when we are awake.

CRITICISMS OF THE RESTORATION THEORIES

Not all research has supported restoration theories, and there are criticisms of some of the underlying assumptions:

- *The assumption that more sleep is needed to recover when we are physically active.* Unless we partake in extreme physical activities (such as a 100 kilometre marathon), there is little evidence that we need more sleep when we exercise. A review of research in this area concluded that we tend to sleep longer – by about 10 minutes – on days we have exercised (Youngtedt, 1997), which is a small difference from the days we don't exercise.

> If this assumption is true, we might expect that those who do little exercise, including people who are disabled or confined to bed, would sleep less, but there is no evidence to support this statement: bedridden people show sleep patterns that are similar to those of normally active individuals. The need for sleep is not reduced with lack of exercise.
> *The assumption that the body rests during sleep.* The brain is active during sleep. Increased blood flow and energy expenditure occurs during REM sleep and this slows down the synthesis of proteins, assisting the body in getting ready for the next day.

The evolutionary and restoration theories address different issues about the purpose of sleep. The evolutionary theory focuses on *when* and *why* different species sleep, whereas the restoration theories help to explain *why* sleep is important. While the two sets of theories give different views of the purpose of sleep, they are complementary and both contribute to our understanding of why we sleep. Other sleep theories also work in a complementary manner (see Table 14.3). There is certainly a need for further research to better understand the purpose of sleep.

14.4 REVIEW

1 In the following table, briefly explain each theory and the arguments that support and limit its usefulness.

THEORY OF SLEEP	EXPLANATION (PURPOSE AND FUNCTION)	SUPPORT	LIMITATIONS
Evolutionary theory			
Restoration theories			

2 For each of the following statements, indicate whether it supports the evolutionary or restoration theories of sleep.
  a Sleep increases alertness.
  b Sleep enhances mood.
  c Sleep conserves energy.
  d Sleep depends on the need for food.
  e Sleep increases immunity to disease.
  f Sleep activates growth hormones.
  g Sleep depends on an animal's vulnerability to predators.
  h Sleep repairs and replenishes the body and prepares it for the next day.

3 The purpose of sleep is to survive. What do you think of this statement? Justify your answer using scientific evidence (you may need to conduct outside research).

CHAPTER SUMMARY 14

- Sleep is an altered state of consciousness. It differs markedly from normal waking consciousness in terms of level of awareness, content limitations, controlled and automatic processes, perceptual and cognitive distortions, emotional awareness, self-control and time orientation.
- The sleep–wake cycle is an example of a circadian rhythm.
- The regular sleep–wake cycle is controlled by the suprachiasmatic nucleus, located in the hypothalamus in the brain.
- Melatonin is a hormone released from the pineal gland that induces sleep, and is secreted in dark conditions. Upon light, melatonin ceases to be released.
- Humans shift between non-rapid eye movement (NREM) and rapid eye movement (REM) sleep, beginning with NREM sleep. There are four stages of NREM sleep, which together account for about 80 per cent of our total sleep time.
- We go through one cycle of NREM and REM sleep every 90 minutes on average. This cycle is an example of an ultradian rhythm. Typically, most adults have four to six NREM/REM cycles per night. The percentage of time spent in REM sleep increases and NREM sleep decreases as the night progresses.
- Sleep patterns change with age, including the total time spent sleeping and the proportion of REM and NREM sleep. Newborns sleep for about 16 hours per day, with about half of this time in REM sleep. Adults sleep for about 8 hours, with about a quarter of this time spent in REM sleep. By the age of 60 years, very little time, if any, is spent in stage 4 NREM sleep. Sleeps lasts for about 6 hours with about the same proportion of time spent in REM sleep as younger adults.
- Stage 4 NREM sleep is the deepest of sleeps. In the first NREM/REM sleep cycle, we spend about 30 minutes in stage 4 NREM sleep, usually from about an hour since we first fell asleep. In the last two or three cycles of NREM/REM sleep, we often do not descend into stages 3 or 4 NREM sleep.
- The first cycle of REM sleep is about 10 minutes in duration. REM sleep is easier to wake from than Stages 3 and 4 NREM sleep. Unlike NREM sleep, if we wake during REM sleep we are likely to report that we were dreaming.
- There are a number of theories of sleep function, including the evolutionary (circadian) theory of sleep and the restoration theories of sleep. Evolutionary theories focus on when and why different species sleep, whereas the restoration theories focus on why sleep is important.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

> circadian rhythm
> endogenous
> evolutionary (circadian) theory of sleep
> hypnogogic (hypnic) jerks
> hypnogogic state
> infradian rhythm
> melatonin
> non-rapid eye movement sleep (NREM sleep)
> rapid eye movement sleep (REM sleep)
> restoration theories of sleep
> sleep–wake cycle
> ultradian rhythm
> zeitgebers.

KEY IDEAS

For the exam, you must know:

> the characteristics that define sleep as an altered state of consciousness
> sleep as a circadian rhythm
> the REM and NREM stages of sleep
> sleep patterns in terms of:
  - NREM/REM cycles throughout the night
  - changes throughout the lifespan (age) including the total amount of time spent sleeping and the proportions of REM and NREM sleep
> the two broad theories that attempt to explain the purpose and function of sleep:
  - evolutionary (circadian) theory such as: sleep depends on the need to find food; sleep depends on the animal's vulnerability to predators; sleep conserves energy
  - restoration (restore and recovery) theories such as: sleep repairs and replenishes the body; sleep activates growth hormone; sleep increases immunity to disease; sleep increases alertness; sleep enhances mood
  - the limitations of each of these theories
> proportion of NREM and REM sleep.

RESEARCH METHODS

For the exam, you must be able to:

> apply your knowledge and understanding from this chapter to a related research study
> understand why consciousness is difficult to study
> identify ethical considerations relating to studying consciousness.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 The amount of time we spend in NREM sleep ____________ throughout a night's sleep.
  a remains stable
  b increases
  c decreases
  d fluctuates

2 Sleep is:
  a a deliberately induced altered state of consciousness
  b a natural altered state of consciousness
  c part of normal waking consciousness
  d an unconscious state.

3 In a normal night's sleep, an adult will go through one cycle, from stage 1 to stage 4 NREM sleep and through the first REM sleep period in approximately how many minutes?
  a 20
  b 50
  c 90
  d 200

4 The sleep–wake cycle is an example of a(n) ____________ rhythm, and the NREM/REM cycle is a(n) ____________ rhythm.
  a infradian; ultradian
  b circadian; infradian
  c ultradian; circadian
  d circadian; ultradian

5 What is the name given to the mechanism that controls our sleep–wake cycle and where in the brain is it located?
  a suprachiasmatic nucleus; hypothalamus
  b Broca's area; frontal lobe
  c medulla; hindbrain
  d amygdala; temporal lobe

6 Which of the following statements is true of our internal body clock?
  a Our internal body clock has a slightly shorter cycle than the clock on the wall.
  b Our internal body clock has a significantly shorter cycle than the clock on the wall.
  c Our internal body clock has a slightly longer cycle than the clock on the wall.
  d Our internal body clock synchronises perfectly with the clock on the wall.

7 Which of the following statements is true?
  a A zeitgeber is an internal cue that affects our sleep–wake cycle.
  b A zeitgeber is an external cue that affects our sleep–wake cycle.
  c A zeitgeber is either an internal or an external cue that affects our sleep–wake cycle.
  d A zeitgeber is an external cue that affects the quality of our sleep.

8 Which of the following is true of stages 3 and 4 NREM sleep?
  a They usually occur in only the first two cycles of NREM/REM sleep.
  b They are collectively known as light-wave sleep.
  c It is relatively easy to wake a person during these stages of sleep.
  d They increase in time throughout a night's sleep.

9 According to the ____________ , sleep serves to restore energy to our bodies after the physical and emotional fatigue that occurs when we are awake.
  a evolutionary theory
  b restoration theories
  c restoration and evolutionary theories
  d dream theories

10 Which of the following statements supports the evolutionary theory of sleep?
  a Animals that are more susceptible to predators tend to sleep for longer periods than those that are less susceptible.
  b Animals with higher metabolic rates need more sleep than those with lower ones.
  c Growth hormone is released during stages 3 and 4 NREM sleep and this aids growth.
  d Sleeping enhances mood and can aid memory.

SHORT ANSWER

11 Is our perception of time distorted during sleep? Discuss.

2 marks

12 Patricia was sleeping soundly, and had been asleep for about 2 hours when a loud noise occurred outside her house. How likely is it that Patricia would wake up instantly and easily? Justify your answer with reference to the REM and NREM sleep cycles.

2 marks

13 Despite much sleep research, the exact purpose of sleep is still unclear.

a Name two theories that attempt to explain the purpose and function of sleep.

1 mark

b For each theory, give one piece of evidence that supports the theory.

1 mark

c Outline one criticism of each theory.

2 marks

d Do you think it is possible that both theories can be used to help explain the purpose of sleep? Give reasons for your answer.

3 marks

14 Joseph is a healthy one-year-old baby, Nancye is a healthy 30-year-old adult and Arthur is a healthy 82-year-old adult. How would you expect their sleep patterns to differ? Refer to the total sleep time and proportions of time spent in REM and NREM sleep.

3 marks

15 Explain why sleep is considered an altered state of consciousness.

3 marks

16 Identify and describe the four stages of NREM sleep.

8 marks

17 Alice is three months old and spends about 14 hours a day sleeping.

a What proportion of Alice's sleep is likely to be REM sleep?

1 mark

b How will Alice's sleeping patterns change when she is a teenager?

1 mark

c How will Alice's sleeping patterns be different when she reaches middle age?

1 mark

18 Gerry is currently 26 and experiences about 7 hours of sleep each night. Referring to the proportion of REM and NREM sleep, what could you expect to happen to Gerry's sleep patterns as he approaches old age?

4 marks

19 What is the purpose and function of sleep according to the evolutionary theory?

4 marks

→ CHAPTER 15

THE EFFECTS OF SLEEP DEPRIVATION

Our society doesn't switch off at night – we can work, shop, email, text, blog, post, go to a venue and be entertained by the media 24/7. Our society promotes this flexible lifestyle as being convenient, efficient and exciting. But it is one that seems to overlook the need for sleep. Is a lifestyle, one that seems to devalue sleep, good for us? Is there room in our busy lives for good quality sleep? In this chapter we will investigate the effects of sleep deprivation.

KEY KNOWLEDGE

> the effects of partial sleep deprivation (inadequate sleep either in quantity or quality) on a person's affective (amplified emotional responses), behavioural and cognitive functioning

> the effects on consciousness (cognition, concentration and mood) of one night of full sleep deprivation as a comparison with effects of legal blood-alcohol concentrations

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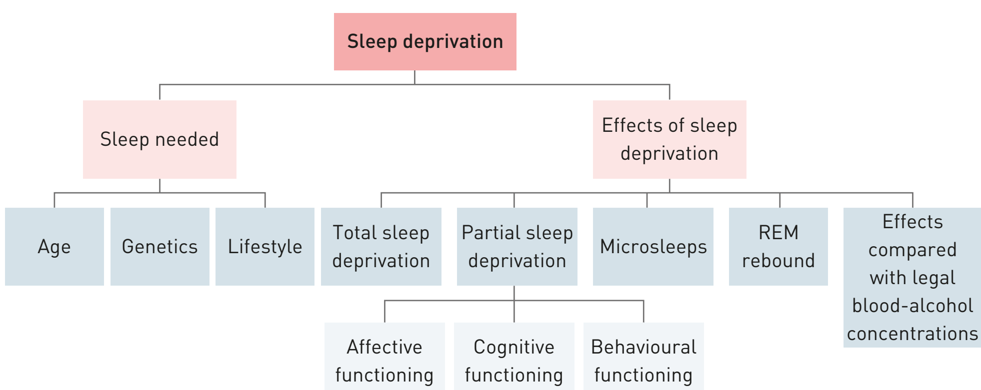
CHAPTER OVERVIEW

How much sleep do we need?	Age Lifestyle Genetics
What happens if we don't get enough sleep?	Partial sleep deprivation Sleep debt Total sleep deprivation Loss of REM and NREM sleep
Effects of sleep deprivation on consciousness	Driving while sleep deprived Sleep deprivation compared with blood-alcohol concentration

CONTENT MAP



How much sleep do we need?

William Dement, a pioneer in sleep research, decided to test himself and see if he could stay awake for a long period of time (Goleman, 1982). As much as he tried, he could not fight off sleep. He found that, just as we cannot hold our breath until we die, neither can we stay awake. In the end, sleep sets in and saves us.

Dement's experience of sleeplessness probably does not surprise you. Take a moment to think about how you think, feel and behave when you are tired. We all know the groggy feeling that lack of sleep can cause and how it affects our ability to concentrate. We dislike being forced to stay awake when we are very tired.

The media sometimes portrays examples of well-known people who function well on very little sleep. Political figures such as Kevin Rudd, Barack Obama, Margaret Thatcher, Winston Churchill and Bill Clinton are often noted for only needing (or claiming to need) four hours of sleep per night. But these are rare examples and most of us need much more sleep.

> The amount of sleep we require is what we need not to be sleepy in the daytime.
>
> Jim Horne, sleep researcher

There are no hard and fast rules about the exact amount of sleep we need. Sleep needs vary between individuals and depend on a number of factors such as age, lifestyle and genetics.

Age

As a guide, most teenagers need 9–10 hours of sleep per night. A young child needs more and an adult needs less to perform at their best. Mason (2005) found that 80 per cent of teenagers in the United States wish they slept more on school nights. This echoes the love–hate relationship some of us have with sleep. We love the feeling of being well rested but dislike sleep interfering with things we enjoy or our time completing work.

FIGURE 15.1 Babies require more sleep than adults.

Lifestyle

Our lifestyle influences the amount of sleep we need. For instance, working day or night shifts, sleeping in quiet or noisy places, leading an active versus inactive lifestyle, and having a stressful versus low-key way of life all influence our individual need for sleep (Bronzaft *et al*., 1998). People tend to alter their sleep routines as responsibilities, relationships and stressors change with age. However, good sleepers are more likely to have a regular bedtime and rise time than poor sleepers (Carney *et al*., 2006).

FIGURE 15.2 Afternoon naps are popular in some cultures.

Genetics

Our genes also may influence our sleep–wake cycle. Surveys of twins in Australia and Finland found that identical twins tend to have more similar sleep patterns (going to bed at the same time and sleeping the same length of time) than fraternal (non-identical twins) (Heath *et al*., 1990). Some studies suggest that females tend to need more sleep than males and therefore are more likely to be sleep deprived (Wever, 1984).

INVESTIGATE 15.1

Find out your sleep needs: Try going to bed 15 minutes earlier each night this week. Add another 15 minutes the following week and continue each week until you can wake without an alarm clock and feel alert all day. You will then know how much sleep you really need!

REVIEW 15.1

1 Describe how the following factors might influence an individual's need for sleep. Give an example for each:
   - a age
   - b lifestyle
   - c genetics.

FIGURE 15.3 Empty kindergarten in Chernobyl after the nuclear accident

What happens if we don't get enough sleep?

Do you like to sleep in on the weekends? Do you find it hard to wake up on Monday morning? Do you often press the 'snooze' button on your alarm clock? Do you feel sleepy during the day?

If you answered yes to any of these questions, then you are probably not getting enough sleep. While the exact reasons for sleep are unclear, what we do know is that it is crucial that we sleep. Sleep deprivation, not getting the amount of sleep you need, involves partial or total loss of sleep. Both partial and total sleep deprivation can have serious consequences.

Sleep deprivation has been associated with personnel involved in a number of international disasters, including the oil spill of the *Exxon Valdez*, the destruction of the space shuttle *Challenger* and the nuclear accident at Chernobyl which cost over 50 000 lives (Coren, 1996).

Partial sleep deprivation

People who do not get enough sleep are likely to suffer the effects of **partial sleep deprivation**. **Total sleep deprivation**, which may last for one or two nights, is much more rare. Partial sleep deprivation is experienced when a person does not get the amount of sleep they need (poor quantity sleep) or are deprived of one particular stage of sleep (poor quality sleep).

We need good quality sleep to survive, to recover both mentally and physically from the day's activities, and to grow. When we don't get enough sleep, we tend to get bored more easily. Activities we usually enjoy can seem dull. We are likely to feel unmotivated in class. Even the simplest of tasks can become difficult. Paying attention and concentrating on routine, simple, boring, repetitive and self-motivated tasks is difficult. There may be memory problems, emotional issues and poor motor coordination. Our feelings of self-worth, our relationships with family and friends and our schoolwork can suffer. Interestingly, however, short performances on more physically or intellectually challenging tasks are usually not affected.

EFFECTS OF PARTIAL SLEEP DEPRIVATION

The effects of partial sleep deprivation can vary from one person to the next but may include the following.

Psychological effects

Psychological effects include:

- affective (feelings) disturbances
  - mood disturbances – amplified emotional responses, confusion and irritability, feelings of sadness
  - previously enjoyed activities seem boring
  - lack of motivation
  - feelings of fatigue

- behavioural difficulties
  - slowed performance
  - clumsiness, injuries
  - risk-taking behaviour
  - problems performing tasks, especially *simple monotonous* tasks and ones requiring *sustained* attention or concentration
- cognitive difficulties
  - difficulty paying attention and concentrating
  - difficulty processing information
  - difficulty thinking and reasoning, poor decision-making
  - memory problems
  - impaired creativity
  - distorted perceptions.

Physiological effects

Physiological effects include:

- slower physical reflexes
- hand tremors
- droopy eyelids
- difficulty in focusing eyes
- a heightened sensitivity to pain
- headaches
- lower energy levels.

Note: There is little change, if any, in heart rate, respiration, blood pressure and body temperature.

FIGURE 15.4 Sleep deprivation can affect your ability to concentrate.

FACE MEMORY TEST

INVESTIGATE 15.2

Too tired to remember? Our memory is affected when we are tired. Go online to BBC website www.bbc.co.uk/science/humanbody/sleep and attempt the 'face memory test'. See if you can find evidence that links your score to tiredness.

While you are at this site, try working out your 'personal sleep profile'.

EFFECTS OF CHRONIC SLEEP DEPRIVATION

At first, the effects of sleep deprivation appear to be more psychological than physiological. However, **chronic sleep deprivation** (not having enough sleep over an extended period of time) is associated with several serious psychological and physiological conditions.

There is increasing evidence that chronic sleep deprivation is linked to:

> depression
> hypertension
> heart disease
> diabetes
> heartburn
> obesity
> some forms of cancer
> anxiety disorders
> sleep disorders such as insomnia
> accelerated ageing process.

These conditions also suggest a link between sleep loss and stress-related conditions, including cardiovascular diseases, mood disorders and immune deficiencies (Meerlo *et al*., 2008). Lack of sleep increases the levels of cortisol, a stress-related hormone (related to alertness and discussed in more detail in Chapter 4) that interferes with immune functioning. After several days of partial sleep deprivation, there will be an effect on immunity (Irwin, 2002). This may explain why we are more susceptible to colds in the lead-up to exams, a time when we are more likely to be sleep deprived. In addition, increased levels of cortisol have been linked to damage of the brain cells responsible for learning and memory (Leproult *et al*., 1997).

FIGURE 15.5 Students can be susceptible to colds if they are sleep deprived in the lead-up to exams.

INVESTIGATE 15.3

ARE YOU SLEEP DEPRIVED?

Try the Epworth Sleepiness Scale to find out if you are sleep deprived. This popular scale was designed by Dr Murray Johns, a leading Melbourne sleep researcher. You can complete it online at www.sleepservices.com.au/patients/epworth-sleepiness-scale or answer the questions below.

Epworth Sleepiness Scale

Name: ______________________ Today's date: ______________

Your age (yrs): ______________ Your sex (Male = M, Female = F): ________

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired?

This refers to your usual way of life in recent times.

Even if you haven't done some of these things recently, try to work out how they would have affected you.

Use the following scale to choose the most appropriate number for each situation:

0 = would never doze

1 = slight chance of dozing

2 = moderate chance of dozing

3 = high chance of dozing

It is important that you answer each question as best you can.

SITUATION	CHANCE OF DOZING (0–3)
Sitting and reading	
Watching TV	
Sitting, inactive in a public place (e.g. a theatre or a meeting)	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after a lunch without alcohol	
In a car, while stopped for a few minutes in the traffic	

THANK YOU FOR YOUR COOPERATION

Add up your score. The higher the score, the higher the level of daytime sleepiness.

Less than 10 = you are probably getting adequate sleep

10 to 16 = you are suffering from excessive daytime sleepiness

16 + = you are dangerously sleepy and should seek professional help

This score provides an estimate of sleepiness in your daily life, which can be influenced by many factors. This survey does not identify these factors.

Sleep debt

The accumulated amount of sleep loss from insufficient sleep is known as **sleep debt**. Not getting enough sleep night after night adds to this sleep debt. The good news is that sleep debt, like other debt, can be repaid. Even better news is that, unlike other debt, it does not accumulate in a direct fashion or attract interest. In other words, if you have been missing out on one hour of sleep for seven nights in a row, you definitely need extra sleep but not an extra seven hours.

Unfortunately, there is no sleep bank – we cannot open a sleep savings account! Sleeping longer than we need on one day will not counteract the late nights that follow. The best we can do is go to bed early the night before to make sure we are not sleep deprived to begin with.

Usually, a good night's sleep and being able to sleep in is enough to recover from sleep deprivation. Depending on the amount of sleep deprivation, a few more nights of slightly longer sleep than usual may be required. Most sleep deprivation effects are temporary and we are likely to fully recover without any long-term psychological and physiological problems.

The difficulty arises when a person may be suffering from a sleep disorder (such as insomnia) or another condition that is affecting their quality of sleep over an extended period of time. Lack of sleep is also often linked with other conditions such as depression and anxiety disorders, and recovering from sleep loss may improve the condition or make it worse. In these cases, people often need professional intervention to help deal with these conditions and recover lost sleep. If a few good sleeps do not help you recover from the effects of sleep deprivation, please seek professional help.

SUPPORTING UNDERSTANDING

Total sleep deprivation – Classic case studies

Total sleep deprivation for an extended period of time is likely to lead to death. Obviously, for ethical reasons, investigating total sleep deprivation and its link to death with human participants is impossible. There are, however, reported cases that highlight the need of sleep. For instance, a 52-year-old man suddenly began to lose the ability to sleep (Lugaressi *et al.*, 1986). Not surprisingly, he quickly became totally exhausted and could not function normally. He developed a lung infection that eventually led to his death. An autopsy revealed that his suprachiasmatic nucleus, the area of the brain that governs the internal biological clock, had been destroyed. Whether the sleep loss itself was fatal or other aspects of the brain damage were to blame is not clear. Distinguishing the effects of sleep loss from the effects of stress that the man experienced during his horrific ordeal is also impossible.

Randy Gardner

In 1964, Randy Gardner, a 17-year-old student, entered the *Guinness Book of Records* for staying awake for 264 consecutive hours (11 days) without the use of any stimulants (even coffee). His physical health and thoughts, feelings and behaviours were scientifically monitored (Gulevich *et al.*, 1966). He underwent significant and uncharacteristic mood changes, had difficulties concentrating and short-term memory problems. He also suffered delusions (such as believing he was a famous sportsperson) and hallucinations (he once thought a street sign was a person). He was often disorientated and developed finger tremors and slurred speech. However, he was still able to play pinball on day 11 (winning 100 consecutive times against one of the researchers) but had difficulty with some other simple tasks. After giving a press conference, Randy collapsed into a deep sleep and slept for almost 15 hours.

FIGURE 15.6 Randy Gardner stayed awake for 264 hours.

Within a few days his sleep patterns returned to normal. Randy slept longer than usual for the next few nights (Horne, 1988). While he missed out on about 85 hours of sleep during the 11 days, he only recovered about 20 hours (25 per cent) of the loss during the subsequent nights. So it does not appear to be essential that a person catches up with the entire amount of sleep lost. We can be sure, however, that Randy would have experienced microsleeps during the experience (see page 305). What is also interesting is that Randy Gardner's sleep consisted of more REM and stages 3 and 4 NREM sleep. In the end, he recovered about 70 per cent and 50 per cent of these respectively, but there were only very small increases in the other stages of sleep. This suggests that REM and stages 3 and 4 NREM sleep are of significant importance..

Non-human studies

FIGURE 15.7 Non-human studies often involve mice or rats.

Non-human studies offer a window into the effects of total sleep deprivation. A study on rats showed that those who were not allowed to sleep died within 33 days, while those allowed to sleep remained in good health (Rechtschaffen *et al*., 1983). The rats were placed on a disk above a water container and their brainwaves were monitored via an EEG. When sleep was detected, the disk started to rotate causing the rat to fall in the water and wake. The rats' physical health declined throughout this time and their deaths were probably due to overheating of the body. Again, it is very hard to distinguish between stress-related illnesses and those due to sleep loss, as the rats were living under extreme stress conditions. Interestingly, non-human studies have shown that the animals usually die faster from lack of sleep than they do if totally deprived of food but allowed to sleep normally.

Did you know?

Total sleep deprivation has been used in warfare throughout history. The ancient Romans used *tormentum vigilae* (the waking torture) as a method to extract secretive information from their enemies. In the Korean War of 1950–53, North Koreans 'brainwashed' captured American pilots by depriving them of sleep.

Total sleep deprivation

It is likely that you have thought about staying up all night to study before an exam, believing that this will help your performance. But will it? In one study, college students were either deprived of sleep or allowed to sleep the night before a critical thinking task (Pilcher & Walters, 1997). Those forced to forego sleep ended up performing poorly on the task compared to the sleepers. More interestingly, those who were sleep deprived thought they had performed better than they actually did, a result not seen in the group that slept.

The good news is that, in the event that we have to stay up all night, we can do so with no serious side effects other than those associated with feeling extremely sleepy at the time (trusting we don't drive a vehicle or have any other accident). We would probably struggle to stay awake for a second night, however, and find it almost impossible after four days. At this time, we are likely to be irritable and confused and suffer from the 'hat phenomenon', a feeling of tightening around the head as though a hat that is too small is being worn. Further days without sleep can cause 'sleep deprivation psychosis' where the person experiences a loss of sense of personal identity and increased difficulty in coping with other people and the environment. A long night's sleep followed by a few good nights' sleep tends to overcome most, if not all, the effects of sleep deprivation. Hüber-Weidman (1976) reviewed a large number of studies and summarised the effects of total sleep deprivation (refer to Table 15.1)

TABLE 15.1 The effects of total sleep deprivation

NIGHTS WITHOUT SLEEP	SYMPTOMS
1	> Discomfort felt but is tolerable
2	> Urge to sleep, especially between 2.00 and 4.00 a.m. (when body temperature is at its lowest)
3	> Tasks requiring concentration (sustained attention) are seriously impaired, especially if they are simple, repetitive or boring
4	> Periods of microsleep (about 3 seconds of staring blankly into space and losing awareness) are unavoidable > Person becomes irritable and confused > The 'hat phenomenon' is experienced (a feeling of tightening around the head as though a hat that is too small is being worn)
5	> Still irritable and confused > May become delusional
6	> There may be depersonalisation, with a loss of sense of personal identity and increased difficulty in coping with other people and the environment. This is referred to as 'sleep deprivation psychosis'

Source: Hüber-Weidman, 1976

Loss of REM and NREM sleep

Both REM and stages 3 and 4 NREM sleep play crucial roles in allowing us to function properly. Depriving someone of these sleep stages can have alarming consequences. Speak to new parents and they will probably tell you about the difficulties of coping with inadequate sleep. They are likely to be REM sleep deprived, as their sleep is consistently interrupted throughout the night for months on end. When their baby settles into a sleep routine, many parents experience a marked improvement in their psychological and physical wellbeing with no long-lasting ill effects.

It has been suggested that REM sleep is more critical for psychological wellbeing and NREM sleep (especially stages 3 and 4 NREM) for physiological wellbeing. Other psychologists argue against this idea (Siegel, 2003). Some of the questions that have been raised in the debate are discussed below.

FIGURE 15.8 Good quality and quantity sleep helps you fully recover from sleep deprivation.

REM SLEEP AND THE LINK WITH MEMORY AND LEARNING

Many psychologists believe that the high level of brain activity during REM sleep helps newly learnt information to be consolidated (transferred) into long-term memory. This leads to the idea that not getting enough REM sleep will cause memory problems. Such an idea is not without controversy, however, it has been demonstrated that performance on some tasks improves after a marked increase in both REM sleep and stages 3 and 4 NREM sleep (Walker & Stickgold, 2006). Other research has failed to find a link between loss of REM sleep and memory problems (Siegel, 2001). People who have brain damage that prevents REM sleep or who are on medication that prevents REM sleep do not experience more memory problems than usual. Animals such as dolphins and whales do not appear to have REM sleep but are considered to be intelligent and able to learn.

LACK OF REM SLEEP AND THE LINK WITH MOOD DISTURBANCES

REM sleep interrupts the release of some neurotransmitters (such as norepinephrine, also known as noradrenalin) and this might allow the brain receptors to recover and become more sensitive to their release (that is, more likely to react) after a break. Interruptions to the release of these neurotransmitters are likely to affect mood and learning. Being deprived of REM sleep may lead to mood disturbances such as grumpiness, irritability and sadness.

FIGURE 15.9 A lack of sleep affects your mood.

HOW THE BODY TRIES TO COMPENSATE FOR LOSS OF REM SLEEP

REM sleep is essential, as demonstrated by **REM rebound**, an effect that follows a loss of REM sleep. When we sleep after being deprived of REM sleep, we experience a significantly larger amount of time in REM sleep – more frequent and longer episodes. It is as if our bodies need to catch up on this loss of REM sleep.

Dement (1960) first noticed REM rebound. For five nights, he woke participants each time they entered REM sleep. He found many of the participants experienced significant difficulties, including trouble with their memory, motor coordination and perception of time, and a tendency to hallucinate. Many also reported feeling irritable and anxious. These findings support the value of REM sleep as discussed earlier. When participants were allowed to have REM sleep on the sixth night, they engaged in much more REM sleep than usual, creating a rebound effect.

THE EFFECTS OF LOSS OF NREM SLEEP

During NREM sleep, the body replenishes itself physically and restores body tissues. It does this in several ways, including via the release of growth hormones. Being deprived of NREM sleep, especially stages 3 and 4, may interfere with this process.

REVIEW 15.2

1 How does sleep deprivation affect our performance on:
   a repetitive, simple and boring tasks?
   b short complex tasks?
2 How much sleep do we need to recover from sleep deprivation?
3 How is partial sleep deprivation related to chronic sleep deprivation?
4 How is a lack of REM sleep linked to mood disturbances?
5 What is REM rebound?

Effects of sleep deprivation on consciousness

Driving while sleep deprived

When going without sleep, we are at more risk of accidents. The effects of partial sleep deprivation impede driving ability in many ways. An investigation into Australian train drivers found that fatigue interfered with their ability to plan ahead, causing them to use the brakes more heavily, use less throttle and use up to nine per cent more fuel (Dorrian *et al.*, 2007). They were also more likely to exceed speed limits.

FIGURE 15.10 Driving while sleep deprived is extremely dangerous.

DAYLIGHT SAVING AND CAR ACCIDENTS

A Canadian study investigated the effects of changing times due to daylight saving on the incidence of car accidents. The number of car accidents on the Monday following the change into and out of daylight saving was monitored over two years. It was found that there were about seven per cent more accidents on the Monday following the start of daylight saving. It appears that more drivers are suffering from partial sleep deprivation after losing an extra hour of sleep.

On the other hand, car accidents decreased by about seven per cent on the Monday following the end of daylight saving. The extra hour of sleep appears to help drivers to overcome partial sleep deprivation.

These findings support the Transport Accident Commission (TAC) message that we should not drive when we are tired (slogans such as 'Sleepy drivers die' and 'A powernap could save your life') and should be seriously considered by drivers.

Did you know?

If you are driving at 100 kph and fall into a microsleep for 10 seconds, the car will cover 278 metres in the time that you are asleep!

MICROSLEEPS

As the amount of sleep deprivation (sleep loss) increases, we can experience **microsleeps**. A microsleep is a brief, involuntary period of sleep in the midst of a wakeful activity in which we tend to drift off and stop concentrating on what we are doing. Microsleeps assist us in overcoming or preventing sleep deprivation and usually last 3–15 seconds, though they may be longer – even up to a minute or more. We are usually unaware of a microsleep. If we are performing a dangerous activity, the consequences of a microsleep can be tragic, such as in the case of a driver falling asleep at the wheel. Avoiding sleep deprivation and having short sleeps, often called 'powernaps', can help prevent microsleeps.

FIGURE 15.11 Microsleeps can lead to serious accidents.

Sleep deprivation compared with blood-alcohol concentration

Driving while sleep deprived is extremely dangerous and has led to many tragic outcomes. The same is equally and harrowingly true for driving while under the influence of alcohol. While police report that most drivers (over 99 per cent) breath-tested on our roads do not exceed the legal blood-alcohol concentration (BAC) limit, almost one in four drivers that are killed on our roads exceed this legal BAC limit. This statistic is not including the number of drivers injured, plus other passengers and pedestrians killed or injured as a result of drink-driving.

Adelaide sleep researchers found that a driver who has been awake for 17 hours has the same risk of having a car accident as someone with a BAC of 0.05 and is twice as likely to have a car accident as a driver with a BAC of 0.00 (Dawson & Reid, 1997). Twenty-four hours without sleep is equivalent to a BAC of 0.1, making these sleep-deprived drivers seven times more likely to have a crash. These levels are outlined in Table 15.2.

TABLE 15.2 Comparing risks of accident when driving while sleep deprived with blood-alcohol concentration (BAC)

TIME WITHOUT SLEEP (HOURS)	RISK OF ACCIDENT EQUIVALENT TO BAC OF:
17	0.05
24	0.1

As described earlier in this chapter, not only can sleep deprivation for a full night impact our cognitive abilities, being deprived of REM sleep for a full night can also lead to mood disturbances such as grumpiness, irritability and sadness due to interruptions in the release of neurotransmitters.

Alcohol is a psychoactive drug that slows down the nervous system. In doing so, it decreases alertness, reflexes and decision-making ability. Look back at Chapter 13 and the effects of BAC on driving outlined in Table 13.5. Most of the impairments listed start while a fully licensed driver is under the BAC limit of 0.05.

As the risks of driving while sleep deprived are similar to those of being under the influence of alcohol, both types of drivers are a significant danger on our roads.

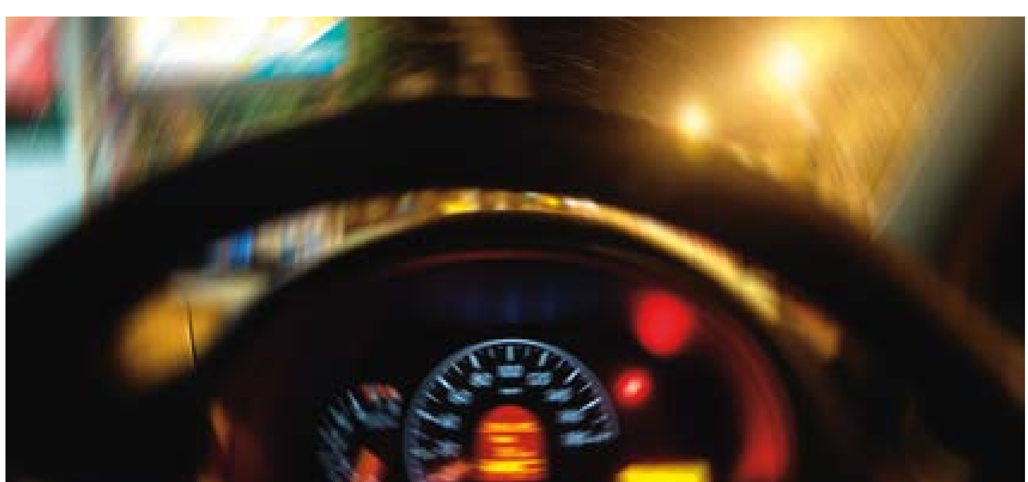


FIGURE 15.12 Sleepiness has a comparable effect to driving under the influence of alcohol.

Table 15.3 gives an indication of when impairment of different characteristics of consciousness occurs due to BAC level. Read the table carefully and complete the right-hand column describing how each impairment may affect driving. For more information, search 'effects of alcohol' on the TAC website.

15.4 INVESTIGATE

TABLE 15.3 Effect of BAC on consciousness and driving ability

AREA OF CONSCIOUSNESS IMPAIRED	BAC IMPAIRMENT LEVEL	IMPACT ON DRIVING
Tracking (Difficulty controlling and staying in same position relative to the environment)	0.0018 to 0.005	Unable to stay in the lane while going around a bend in the road
Perception (Difficulty processing and making sense of sensory stimuli)	0.03	Failure to recognise potential traffic hazard, such as a car broken down in the lane
Divided attention (Unable to concentrate on two or more tasks at once, and make decisions about them)	0.005	
Drowsiness (Difficulty staying awake)	0.01	
Vigilance (Unable to maintain vigilance [alertness])	0.03	
Psychomotor skills (Difficulty maintaining balance and coordination)	0.04 (balance) 0.05 (coordination)	
Reaction time (Unable to respond quickly to an event)	0.02 to 0.06	

Source: www.tac.vic.gov.au/road-safety/statistics/summaries/drink-driving-statistics/effects-of-alcohol

CAMPAIGNS FOR SAFE DRIVING

While learners and probationary drivers are not permitted to drive with alcohol in their bodies, the legal limit for drivers with full licences is BAC 0.05. Some debate exists at the moment as to whether this should be lowered to BAC 0.03 or even BAC 0.00. What do you think?

15.5 INVESTIGATE

15.3 REVIEW

1 What are microsleeps? When are they likely to occur? What can we do to prevent them?
2 What is the likely impact on concentration, mood and cognition after the loss of one full night's sleep? In what ways might this impair a person's ability to drive?
3 Very small amounts of alcohol impede driving ability.
   a What are some of the effects on consciousness when BAC is under 0.05?
   b In what ways does this impair a person's ability to drive?
   c How do these effects on consciousness compare with sleep deprivation?
4 What message do studies on sleep deprivation and BAC carry about safe driving?

CHAPTER SUMMARY 15

- Sleep needs vary between individuals and depend on factors such as age, lifestyle and genetics.
- Partial sleep deprivation (having some sleep in a 24-hour period but not getting enough to meet your needs) and total sleep deprivation (going without sleep for an entire 24-hour period) may occur for one night or for several nights.
- Partial sleep deprivation can lead to psychological (affective, cognitive and behavioural) effects and physiological effects.
- Chronic sleep deprivation (not having enough sleep over an extended period of time) is linked with several serious conditions such as cardiovascular disease, mood disorders and immune deficiencies including cancer.
- Sleep deprivation, partial or full, has a serious impact on our consciousness. Our ability to drive is seriously affected and can be comparable to the risks of driving under the influence of alcohol, even at very low BAC levels (legal limits for fully licensed drivers). Both can be deadly when driving on our roads.
- REM sleep deprivation has been linked with memory and learning problems and mood disturbances such as grumpiness, irritability and sadness.
- Sleep deprivation can usually be addressed by having a little more sleep than is usually needed over the subsequent nights. We are likely to fully recover from most sleep-deprivation effects without sustaining any long-term psychological or physiological problems.
- A microsleep is a brief period of sleep that occurs without conscious control during a period of wakefulness. Microsleeps prevent or help us to recover from sleep deprivation, but are obviously very dangerous if we are driving a car or operating machinery.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- blood-alcohol concentration (BAC)
- chronic sleep deprivation
- microsleep
- partial sleep deprivation
- REM rebound
- sleep debt
- sleep deprivation
- total sleep deprivation.

KEY IDEAS

For the exam, you must know:

- that sleep needs vary between individuals and give examples of how sleep needs can depend on factors such as
  - age
  - lifestyle
  - genetics
- the effects of partial sleep deprivation
  - psychological effects (affective, cognitive and behavioural) and physiological effects
  - chronic sleep deprivation effects
  - microsleeps
- sleep deprivation effects compared with blood-alcohol concentration (BAC) on driving ability
  - impact of alcohol at legal BAC limits.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study
- understand ethical considerations relating to studying sleep deprivation.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 On average, a teenager needs ________________ of sleep per night.
- a 7–8 hours
- b 8–9 hours
- c 9–10 hours
- d 10–11 hours

2 Good sleepers are more likely to have a ________________ than poorer sleepers.
- a regular bedtime and rise time
- b varying bedtime and rise time
- c regular bedtime but varying rise time
- d varying bedtime but regular rise time

3 Having some but not enough sleep in a 24-hour period is called ________________ sleep deprivation and going without sleep for an entire 24-hour period is called ________________ sleep deprivation.
- a partial; total
- b total; partial
- c partial; partial
- d total; total

4 When you are sleep deprived, you are more likely to:
- a think you performed better on a task than you actually did
- b think you performed worse on a task than you actually did
- c find it easier to stay awake after a few days
- d find it harder to fall asleep after a few days.

5 Performance on ________________ and ________________ tasks tends not to be greatly affected by sleep deprivation.
- a short; complex
- b lengthy; complex
- c simple; monotonous
- d short; simple

6 *REM rebound* is where a lack of time spent in REM sleep results in:
- a more frequent episodes of REM sleep over the subsequent night or nights
- b less frequent episodes of REM sleep over the subsequent night or nights
- c more frequent and longer episodes of REM sleep over the subsequent night or nights
- d shorter episodes of REM sleep over the subsequent night or nights.

7 The amount of sleep a person needs:
- a remains stable throughout life
- b varies depending on age, lifestyle and genetics
- c is greatest during late adulthood
- d increases with an inactive lifestyle.

QUESTIONS 8–10 RELATE TO THE FOLLOWING STATEMENT:

Sasha has not been sleeping well for the past week. As a result, she is sleep deprived and experiencing a number of psychological and physiological effects.

8 A cognitive effect that Sasha is likely to be experiencing is:
- a irritability
- b droopy eyelids
- c increased creativity
- d poor decision-making.

9 An affective effect that Sasha is likely to be experiencing is:
- a clumsiness
- b memory problems
- c feelings of alertness
- d that previously enjoyed activities seem dull and boring.

10 A behavioural effect that Sasha is likely to be experiencing is:
- a feelings of fatigue
- b lack of motivation
- c problems performing simple monotonous tasks
- d problems performing short complex tasks.

SHORT ANSWER

11 Name and discuss three factors that influence the amount of sleep that an individual needs.

6 marks

12 Outline the link between sleep loss and immunity.

3 marks

13 Sleep deprivation can affect our performance at school. In terms of schoolwork, outline:

a two likely cognitive effects due to sleep deprivation

2 marks

b two likely affective effects due to sleep deprivation

2 marks

c two likely behavioural effects due to sleep deprivation

2 marks

d two likely physiological effects due to sleep deprivation.

2 marks

14 Why is it an overgeneralisation to state that REM sleep is just for psychological wellbeing and NREM sleep is only for physiological wellbeing?

2 marks

15 Discuss the ethical issues associated with research investigating the effects of sleep deprivation (partial and total).

3 marks

16 Complete the following:

a Outline a TAC advertisement that looks at how to overcome sleep deprivation effects while driving a car.

2 marks

b How can sleep deprivation interfere with driving a vehicle? Outline two psychological effects and two physiological effects.

3 marks

17 The effects of sleep deprivation on driving ability have been compared with the effects of blood-alcohol concentration (BAC) on driving ability. In what ways does BAC impair consciousness and at what levels are these impairments noticeable?

a In what ways would one night without sleep impair a person's cognition and mood?

3 marks

b How do the effects on consciousness of one night of total sleep deprivation compare with the effects of legal BACs for a fully licensed driver?

4 marks

c Why do you think there are tighter restrictions on legal BACs for learner and probationary drivers?

4 marks

18 What is sleep debt and how can it be overcome?

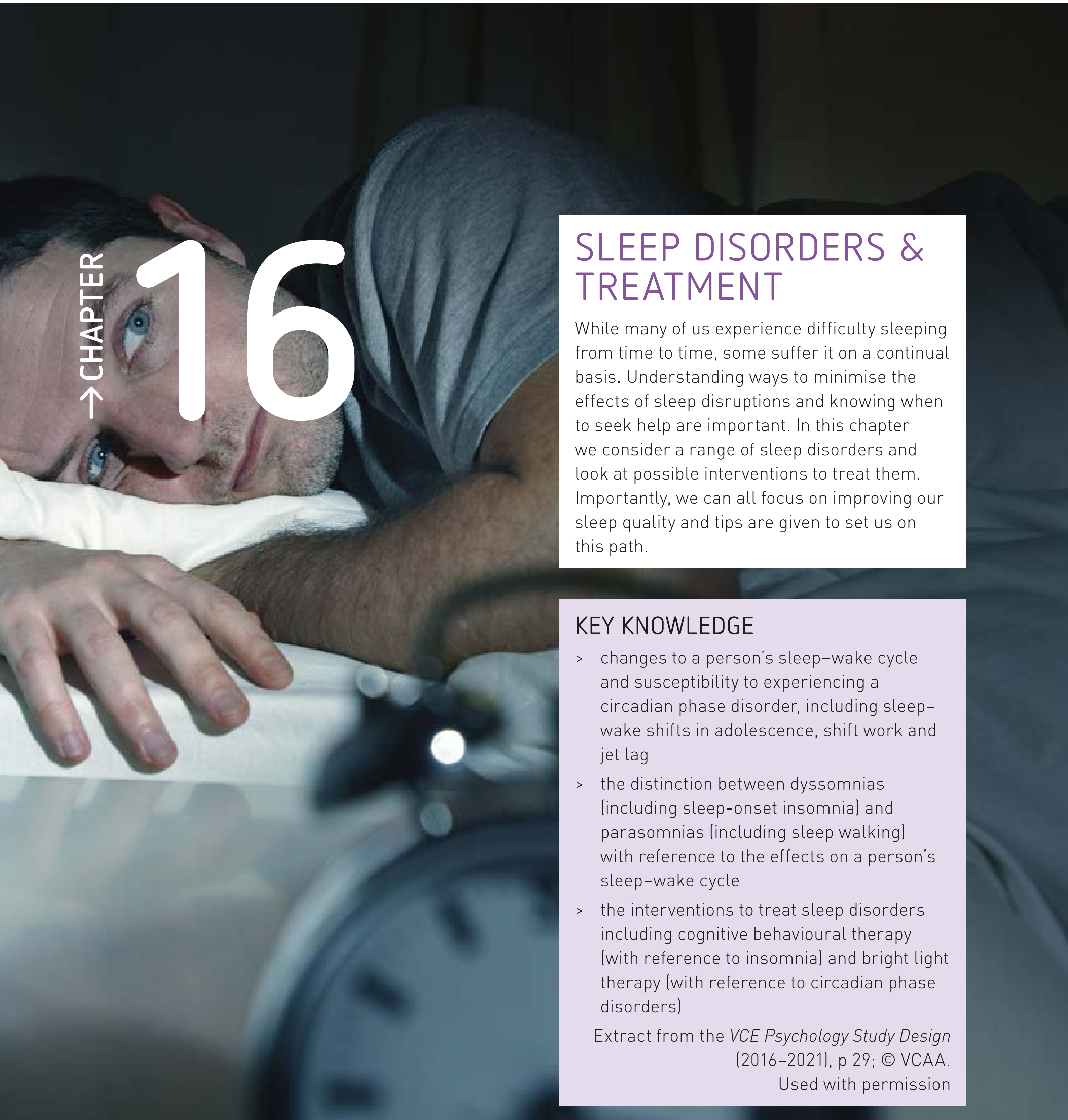
2 marks

19 Explain how partial sleep deprivation can impact our cognitive, affective (emotional) and behavioural functioning. Give an example of each.

6 marks

20 Harry has been up all night studying for a big exam in the morning. He used the extra time to learn a whole new section of the study design, but now finds he is so tired he is having trouble recalling everything he just crammed. Why might the lack of REM and NREM sleep be a bad idea for Harry's learning and ability to function in the exam?

4 marks



→ CHAPTER 16

SLEEP DISORDERS & TREATMENT

While many of us experience difficulty sleeping from time to time, some suffer it on a continual basis. Understanding ways to minimise the effects of sleep disruptions and knowing when to seek help are important. In this chapter we consider a range of sleep disorders and look at possible interventions to treat them. Importantly, we can all focus on improving our sleep quality and tips are given to set us on this path.

KEY KNOWLEDGE

> changes to a person's sleep–wake cycle and susceptibility to experiencing a circadian phase disorder, including sleep–wake shifts in adolescence, shift work and jet lag

> the distinction between dyssomnias (including sleep-onset insomnia) and parasomnias (including sleep walking) with reference to the effects on a person's sleep–wake cycle

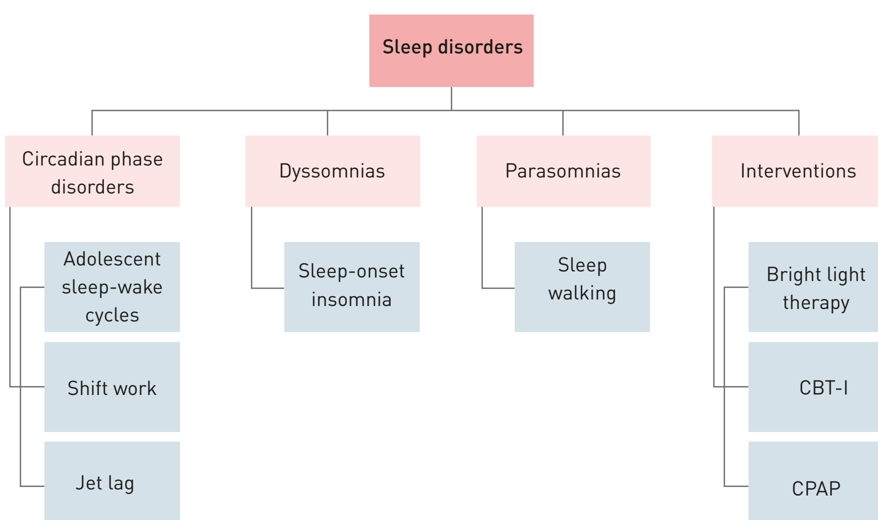
> the interventions to treat sleep disorders including cognitive behavioural therapy (with reference to insomnia) and bright light therapy (with reference to circadian phase disorders)

Extract from the *VCE Psychology Study Design* (2016–2021), p 29; © VCAA. Used with permission

CHAPTER OVERVIEW

Circadian phase disorders	Adolescent sleep–wake cycles Shift work Jet lag
Dyssomnias and parasomnias	Dyssomnias Parasomnias Comparing dyssomnias with parasomnias
Interventions for sleep disorders	Cognitive behavioural therapy to treat sleep-onset insomnia Bright light therapy to treat circadian phase disorders Tips for a better night's sleep

CONTENT MAP



Did you know?

While *delayed sleep-wake phase disorder* is usually seen in adolescents and young adults, *advanced sleep-wake phase disorder* is most common in the elderly. People with advanced sleep-wake phase disorder experience sleepiness in the late afternoon or early evening, resulting in an early bedtime (6.00 p.m. to 9.00 p.m.). They usually wake early (2.00 a.m. to 5.00 a.m.), and find it difficult to go back to sleep.

Circadian phase disorders

'How did you sleep?' This common question indicates that most people understand the importance of good sleep and that poor sleep can lead to problems. There are more than 80 different types of sleep disorders, some quite widespread and others rare. It is not uncommon for a person to suffer from more than one sleep problem.

What happens when our sleep–wake cycles goes 'out of whack' – when we find ourselves having to be awake at night and asleep during the day? In this section we discuss **circadian phase disorders**, sleep disorders in which a person's circadian rhythms (internal sleep–wake clock) are disrupted. Circadian phase disorders result in disturbed sleep and consequential daytime sleepiness and, therefore, negatively affect a range of personal, work, school, social and safety aspects of life. To understand how a shift in the body's internal sleep–wake cycle can cause such disruption, we first need to understand how the body normally regulates this circadian rhythm.

Alterations in circadian rhythms can have profound effects on our health and wellbeing. Three factors that can disrupt our circadian rhythms and lead to a circadian phase disorder are adolescent sleep–wake cycles (delayed phase shifts), shift work and jet lag.

Adolescent sleep–wake cycles

It is not unusual for a teenager to want to go to bed later and sleep in longer in the mornings. While an adult might fall asleep at 10.00 p.m., a teenager may find themselves lying awake, staring at the ceiling, until midnight. It takes longer for a teenager to 'wind down' at the end of the day. Teenagers are not turning into lazy people who want to sleep all morning by choice – there are valid biological reasons for the desire to stay awake late and sleep in the next day! This phenomenon can be categorised as **delayed sleep-wake phase disorder**, a circadian rhythm sleep disorder. Try Investigate 16.1 and find out if more members of your class are owls rather than larks.

SUPPORTING UNDERSTANDING

Open the curtains: Melatonin's involvement

Melatonin is a hormone that causes sleepiness in humans. It is secreted when it is dark by the pineal gland, a small structure in the brain. Thus, we naturally feel sleepy at night. This fact cannot be ignored by shift workers; it is not uncommon for them to experience difficulties working in the early hours of the morning and to have difficulties sleeping well in daylight hours.

Light stops melatonin secretion and, therefore, helps prevent sleepiness or can assist in helping us to feel awake if needed.

> If you can't wake up in the morning, open the curtains and turn on the light. Give it at least 10 minutes – this way you can wake up naturally.

> Replace your alarm clock with a light clock – one that turns on when it is time to get up!

> If you are feeling a bit down, maybe due to a gloomy winter, or feeling sleepy during the day, try being near natural light settings and bright lights. A long walk, a cold environment and being around attention-grabbing stimuli also helps!

FIGURE 16.1 Teenagers have valid biological reasons for sleeping longer in the mornings.

FIGURE 16.2 Some Year 12 students can suffer from inadequate sleep leading up to exams.

The adolescent sleep–wake cycle occurs only during the teenage years. The sleep patterns tend to shift back to an adult pattern around 19.5 years for females and 21 years for males. Most adults need about 8 hours' sleep per night.

Teenagers need 9–10 hours of sleep per night. Not surprisingly, most don't get this much. A hectic schedule of school, homework, part-time jobs, social activities and family commitments leaves many teenagers with too little time to sleep. In addition, myriad electronic devices, social networking sites, television and playing sport late at night keep our brains stimulated and prevent sleep.

In teenagers, the release of sleep–wake hormones such as melatonin at night (inducing sleepiness) and cortisol in the day (encouraging alertness) is often delayed for up to 2 hours. This means that the average bedtime of 9.30–10.30 p.m. is pushed back later and most teens report not being tired at this time. This leads to a behaviour that is seen as typical of teenagers; that is, that they prefer to go to bed late (on average around 11.00 p.m.) and, therefore, wake up later. A sleep time of 11.00 p.m. and a wake time of 7.00 a.m. – perhaps typical of the school week – will leave a teenager at least one hour short of the optimal amount of sleep. Over the period of one week, this adds up to a *sleep debt* of at least 5 hours. If this happens, teenagers can become chronically sleep deprived.

Some schools, especially those in the United States that traditionally have a very early start time, are taking this sleep research seriously and are starting school later. Studies are demonstrating that students with a later start time, getting almost one hour more sleep, are less sleepy during the day and are showing improved grades. In addition, there are fewer school absences (Carskadon *et al.*, 1998; Wahlstrom, 2002; Wolfson *et al.*, 2007). These improvements were found to be almost immediate, highlighting the dramatic effect that good sleep can have on a teenager's life.

Being a night owl is less than ideal in our school environment. Further research has found that night owls (those who go to bed late and are late to rise) tend to experience more emotional stress than early birds (Ong *et al.,* 2007). In this study, night owls held more negative and rigid beliefs about the need for sleep and what their sleep should be like. They felt less in control of their sleep and did not go to bed or wake up at regular times. Consequently, they felt sleepier during the day and were more at risk of depression and insomnia.

INVESTIGATE 16.1

RESEARCH INVESTIGATION: ARE YOU AN OWL OR A LARK?

Are you a lark – more energetic early in the day? Are you an owl – more energetic late in the day? Or are you somewhere in between? To find out, answer the following questions.

1 Assuming you were free to choose any time you wished, when would you prefer to wake up in the morning?
   - **a** before 6.30 a.m.
   - **b** 6.30–7.30 a.m.
   - **c** 7.30–8.30 a.m.
   - **d** 8.30 a.m. or later

2 When do you prefer to go to bed?
   - **a** before 9.00 p.m.
   - **b** 9.00–10.00 p.m.
   - **c** 10.00–11.00 p.m.
   - **d** 11.00 p.m. or later

3 If you always had to go to bed at midnight, would it be easy or difficult to fall asleep?
   - **a** very easy; I'd fall asleep almost at once
   - **b** easy; I'd lie awake for some time
   - **c** difficult; I'd lie awake for quite a while
   - **d** very difficult; I'd lie awake for a long while

4 If you always had to awake at 6.00 a.m., what would it be like?
   - **a** easy; it would be no problem at all
   - **b** slightly unpleasant
   - **c** rather difficult and unpleasant
   - **d** very difficult and unpleasant

5 How long does it usually take you to feel completely awake in the morning?
   - **a** 0–10 minutes
   - **b** 11–20 minutes
   - **c** 21–30 minutes
   - **d** 31–40 minutes

Score each answer as follows: a = 1, b = 2, c = 3, d = 4. Add the score for each answer to calculate your total score.

The higher the score, the more you are a night owl. You are more likely to be alert and less fatigued later in the day. You are likely to have higher adrenalin levels later in the day, which means that your blood pressure, heart rate and arousal are likely to be higher later in the day.

The lower the score, the more you are a lark. You are more likely to be alert and less fatigued earlier in the day. You are likely to have higher adrenalin levels earlier in the day, meaning that your blood pressure, heart rate and arousal are likely to be higher earlier in the day.

Adapted from Torsvall & Akerstedt, 1980

16.2 INVESTIGATE

DEBATE: SHOULD SCHOOL START LATER?

The question 'Should school start later?' is a politically charged and extremely complex one. Many aspects of school, family, student and teacher requirements need to be considered before making your decision. Schools across the world have battled with this question. Take a moment to think about the issue before making your own decision.

1 Where do you fit on this line?

Definitely yes — Unsure — Definitely no

2 Write a few sentences to support your point of view.
3 Recreate this continuum in the classroom. Nominate one side of the room for 'Definitely yes' and the other for 'Definitely no'. Nominate the middle of the room for 'Unsure'. Members of the class should move to the relevant spot.
4 Your teacher will then ask different members of the class their opinion.
5 Take note of the arguments raised for and against changing the school start time. Has the class discussion changed your point of view?

FIGURE 16.3 Research has shown that later start times in schools can influence student performance.

Shift work

In our 24/7 society, working night shifts is increasingly common and plays an important role in certain occupations and industries. Shift work refers to only working night shift; only working early morning shifts; or working rotating shifts, for example, rotating through morning shift, afternoon shift and night shift – typically in a forward 'staying awake later' direction. Most people who do shift work experience sleep deprivation effects. For some shift workers, these effects are an ongoing problem that interferes with work, family and/or other aspects of life.

Shift work disorders are probably the most problematic in terms of circadian phase disorders. While the disruption to adolescent sleep patterns is largely due to internal (biological, endogenous) factors, night shift disruptions are mainly caused by external (environmental, zeitgeber) factors. Working at night conflicts with our natural body clock, forcing people to be awake when they should be sleeping.

If the shift worker's body clock cannot adjust sufficiently, sleep is interrupted, which can result in *chronic sleep deprivation*, leading to excessive sleepiness, insomnia, or a host of other serious issues (see Chapter 15). This can become very dangerous, not only for the individual but for the community, especially where shift workers are in demanding roles that require quick and important decisions such as transport, medical and emergency responses.

For those who do shift work, keeping their bedroom dark and quiet to help daytime sleep (for example, using daylight-blocking blinds, wearing a blackout mask, turning the phone off and wearing earplugs) and maintaining a sleep schedule of daytime sleep, even during their days off, may help. On days off, if they undertake standard daytime activities, they may need to wear dark sunglasses.

Findings to date highlight the need to monitor shift workers' health and wellbeing on a regular basis, especially if they have been doing it for a number of years. Rotating shift work has particular challenges. Studies on the best way to rotate shift work are inconclusive. Current research is investigating the role of the duration and length of rotating shifts, the interplay between shift work and individual characteristics, and recovery patterns once shift work has ceased. The effects on psychological (cognition, affective and behavioural) and physiological aspects continue to be explored as well as other possible risk factor variables, such as vitamin D deficiency.

FIGURE 16.4 Shift workers, such as doctors, can experience the effects of sleep deprivation.

Jet lag

Travel is increasingly common in our society. People travel great distances for holidays, business, sport and other activities. This travel can include crossing one or several different time zones.

We can experience **jet lag** when travelling across time zones. Our sleep–wake cycle is disrupted and we can find it difficult to adjust and function at our best in the new time zone. This is particularly true when we travel in an easterly direction. With a natural body clock of just over 24 hours, we find it easier to stay up (delay sleep) than to sleep earlier (advance sleep).

For example, if we hop on a plane in Melbourne at 4.00 p.m. (1.00 p.m. Perth time), we should arrive in Perth around 5.05 p.m. (8.05 p.m. Melbourne time). While the trip takes approximately 4 hours and 5 minutes, it looks shorter because of the different time zones. We are likely to adjust to this new time zone quickly, as staying awake for longer is easier than going to bed earlier. In other words, this change is more compatible with our natural circadian rhythm.

Going home is a different story! Leaving Perth at 4.00 p.m. (6.00 p.m. Melbourne non-daylight savings time) lands you in Melbourne around 9.35 p.m. (7.35 p.m. Perth time). While the flight is quicker at 3 hours 35 mins – due to favourable wind (jet-stream) currents – the likelihood of being able to fall asleep quickly is reduced. We may experience some jet lag and take a bit longer to adjust.

Perth to Melbourne is a reasonably short flight compared to many international flights from Melbourne. Flying further, across many time zones, creates a bigger circadian rhythm disruption and more pronounced jet lag.

It can take days for our body clocks to align (resynchronise) to the new day/night time zone, especially after longer international flights. Jet lag causes fatigue and grumpiness, difficulty sleeping, being awake and being tired at the wrong times, and many other sleep deprivation effects (as discussed in the previous chapter). Someone experiencing jet lag is therefore prone to more accidents, making it something pilots must work hard to avoid!

To attempt to minimise jet lag you can:

- try to schedule your arrival in the late afternoon and stay up until 10.00 p.m.
- start adjusting to the new time zone before you leave, try waking and sleeping closer to the times of your destination
- avoid stimulants such as coffee
- resist the desire to sleep during the day; if you must take a nap, make it a short one and set an alarm or get someone to wake you
- create a dark and quiet sleep zone, bring a sleep mask and earphones
- go outside and/or sit under bright light to help your body detect the light and wake
- when you go to bed, set an alarm to wake you up in the morning. This may help you to stay calm and not worry that you will oversleep.

If jet lag persists, seek professional help. Medications, such as melatonin, are now available and are particularly effective in treating jet lag.

INVESTIGATE 16.3

PLAN A HOLIDAY

Imagine you are planning a holiday that requires travelling on a plane across several time zones. Pick a place to visit, and work out the time differences. Check the flight departure and arrival times.

1. Will travelling to or travelling from the destination (or both) be more disruptive to your body's natural circadian rhythm?
2. Select a flight to depart and another to return that may help minimise the effects of jet lag.
3. What else can you do to help minimise the effects of jet lag – before, during and after the flight?

FIGURE 16.5 We experience jet lag when travelling across time zones.

REVIEW 16.1

1. The sleep–wake cycle is often delayed during adolescence.
   - a. What does this mean in terms of when a teenager is more likely to want to go to bed at night?
   - b. How does the length of sleep required change during adolescence?
   - c. When is the delay in the sleep–wake cycle likely to shift back to an adult sleep–wake cycle?
2. Shift work can cause a host of problems for some individuals.
   - a. What are the different types of shift work?
   - b. What are some of the chronic sleep deprivation effects that may result?
   - c. What can a shift worker do to try to minimise the effects of sleep deprivation?
3. Jet lag can have a profound effect on your sleep and alertness.
   - a. What is jet lag?
   - b. When travelling to a new time zone, why do some advocate that 'travelling west is best'?
   - c. What are some steps a person can take to minimise the effects of jet lag?

Dyssomnias and parasomnias

Sleep disorders, such as circadian phase disorders, relate to shifts in our sleep–wake cycles. Other sleep disorders relate to issues around falling asleep and staying asleep and abnormal behaviours during sleep. Many sleep disorders can be *co-morbid*, meaning that it can occur with another psychological condition.

Dyssomnias

Dyssomnias are sleep disorders characterised by difficulty in falling asleep or staying asleep. There are several types of dyssomnia, including insomnia and hypersomnia. Dyssomnias affect the sleep–wake cycle as sufferers are unable to regulate the typical cycle of Stage 1, 2, 3, 4 and REM sleep.

People who have a dyssomnia may experience the following:

> difficulty falling asleep
> difficulty staying asleep
> excessive daytime sleepiness
> other effects of sleep deprivation, which may lead to school, work, personal or social problems, as well as health and safety issues.

Dyssomnias are known to have a genetic factor, but can also be triggered by intense emotional events or by some medications or illnesses. The following can be useful in the treatment of dyssomnias:

> behavioural changes
> cognitive approaches (including coping strategies)
> sleep environment changes
> medication
> improved sleep habits and a healthier lifestyle.

CASE STUDY

STRESS AND SLEEP

In the month leading up to his mid-year exams, Jack was studying until 10 pm every night. He would then go to bed thinking about the exams and the marks he needed to get into his preferred university course. He would spend hours thinking about his notes, becoming more and more stressed about the exams. Often, Jack would be thinking about the exams until 1 am. At 1 am, Jack would start to worry that he would not get enough sleep before his alarm went off at 6 am. He would then begin to calculate how much sleep he could get before the alarm was due to go off. This would further worry him as it was often less than four hours.

Each day at school, Jack would be tired during class and struggle to concentrate. As a result, he would try to do extra work at home at night to cover what he had missed, staying up late and again becoming stressed about exams and sleep.

Jack sought help from a sleep psychologist about why he was struggling to fall asleep. The psychologist suggested that he keep a sleep diary. He completed the diary, which showed the pattern that was occurring each night. This helped the psychologist establish that Jack was experiencing a stressful period because of his exams. Jack was provided with relaxation techniques so that he could go to bed less stressed, which helped him to get more sleep.

SLEEP-ONSET INSOMNIA

Insomnia does not relate to the occasional sleeping problems that we may all experience from time to time. It refers to persistent trouble with sleep. People with insomnia can have trouble falling asleep or maintaining sleep even when they have the opportunity to do so. When they sleep, they often feel dissatisfied with the experience. They are likely to suffer sleep deprivation effects such as fatigue, low energy, moodiness and trouble concentrating. Insomnia can negatively affect school and work and other activities.

There are different types of insomnia that people may experience including:

> **sleep-onset insomnia**: trouble falling asleep at the beginning of the night
> **sleep-maintaining insomnia**: difficulty maintaining sleep
> **early morning awakening insomnia**: trouble with waking up too early and not being able to go back to sleep.

In the context of studying for the VCE Psychology exam, we will focus on sleep-onset insomnia.

We can have *acute* episodes of insomnia, which may coincide with a stressful or emotional period, such as exam time or being told some bad news. However, insomnia can also be a *chronic* condition, meaning periods of sleeping difficulty occur at least three times a week over three months or longer. Chronic insomnia can arise for a number of reasons, including persistent stress, pain, shift work, or changes in habits, medications or the sleep environment. Often insomnia, including sleep-onset insomnia, is co-morbid (exists alongside) other physiological and/or psychological conditions.

Insomnia is the most common sleep disorder, with 10 to 40 per cent of the population suffering at any one time. While both males and females can suffer from insomnia, there is an increased risk for females, the elderly, and new parents. Adolescents and young adults are more likely to experience sleep-onset insomnia, while sleep maintenance and early morning awakening insomnia are more common in the elderly.

Diagnosis of insomnia usually involves use of a sleep diary, a sleep inventory (questionnaire about sleep), blood tests and perhaps a sleep laboratory study. Chronic sleep-onset insomnia may be diagnosed as a delayed circadian phase disorder if the person also has great difficulty waking up in the morning.

There can be multiple approaches to the treatment of insomnia, including sleep-onset insomnia, and we will discuss **cognitive behavioural therapy (CBT)** in relation to this, later in this chapter. Some treatments are behavioural, such as improving sleep routine and environment and learning **relaxation** techniques and other ways to cope with stress. Cognitive strategies can include learning to deal with negative thoughts and feelings towards sleeping. Medical intervention can be used, although only for a short time due to the need to limit and monitor the use of such drugs.

Did you know?

While insomnia relates to difficulty sleeping, **hypersomnia** relates to sleeping too much. People with hypersomnia experience excessive sleepiness no matter how much they sleep. Therefore it has similar effects to insomnia and is also classed as a dyssomnia.

FIGURE 16.6 Sleep-onset insomnia can cause significant stress and impairment.

16.4 INVESTIGATE

SLEEP INTERVIEW

Imagine that you are about to visit a sleep psychologist and prepare answers for the following questions.

1 Describe your sleep issues. What sleep difficulties are you experiencing (for example, difficulty falling asleep, staying asleep, waking too early)?
2 How often are you experiencing these sleep difficulties? How many times per week and for how many weeks?
3 Describe your sleep routine. What time do you go to bed? What time do you wake? Do you have naps during the day?
4 Does your sleep routine alter at weekends and/or other times of the week? In what ways? Why?
5 What do you do in the evenings, including the last hour before going to sleep (for example, eat dinner, exercise, read a book, watch TV, play computer games)?
6 What do you *do* when you cannot sleep (for example, keep trying to sleep, get up, listen to the radio, check your mobile phone)? Does this help you to go back to sleep?
7 What do you *think* when you cannot sleep (for example, create a list of things to do the next day, go over events that occurred during the day)?
8 What do you *feel* when you cannot sleep (for example, very anxious, worried you won't cope the next day, worried about all sorts of things in your life, elated after winning the grand final or the lottery)?
9 What is your bedroom/sleep environment like (for example, dark and quiet, noisy, comfortable bed)?
10 Has there been a major event or change in your life recently? (for example, moving schools, taken VCE exams, broken up with girlfriend/boyfriend)
11 What is your diet and exercise regime? Do you think it is healthy?
12 Do you have any illnesses or conditions that may affect your sleep? Have you taken any drugs or medicines recently?
13 Is there anything else that you can think of that may be affecting the way you sleep?

Did you know?

Another type of parasomnia is night terrors. Night terrors are not the same as nightmares, as they have a physical response and in the morning the person is unlikely to remember it.

Parasomnias

Parasomnias are sleep disorders characterised by unusual or abnormal behaviours during sleep. There are many different types of parasomnias, some still being classified, including nightmares, sleep walking, sleep aggressions and sleep-related eating disorders. Parasomnias involve movements, emotions, behaviours, perceptions and dreams and they happen during all of the stages of sleep. Some parasomnias occur during REM sleep, others in NREM and others are in the sleep–wake transitions. Parasomnias, as you would expect, disrupt the quality of sleep and can have negative daytime effects, including sleepiness. Different parasomnias can be more common among different genders and age groups. Parasomnias often need the assistance of a parent or partner to help with diagnosis, as the person with the parasomnia may, upon waking, be unaware of their psychological or physiological change. Parasomnias can be treated with behavioural and sleep environment changes, cognitive approaches and medication.

SLEEP WALKING

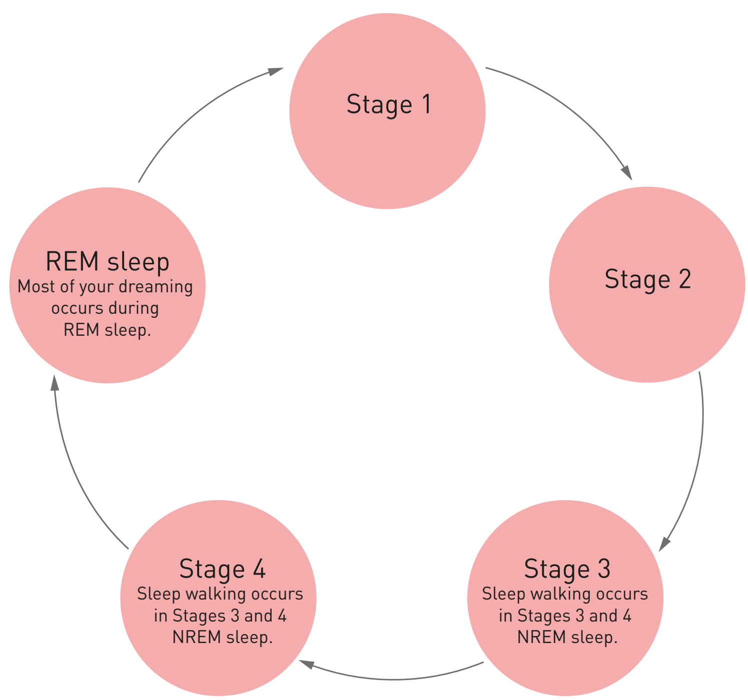


FIGURE 16.7 This diagram shows the stages of sleep in which sleep walking occurs.

Sleep walking, or somnambulism, is a parasomnia that seems to captivate the interest of a lot of people. Sleep walking occurs during stages 3 and 4 NREM sleep. About seven per cent of children sleep walk and two per cent of adults (Neveus *et al*., 2001; Ohaon *et al*., 1999), showing that most 'grow out' of sleep walking. Sleep walking can run in families, suggesting a genetic link.

Most sleep walkers follow routine activities that are automatic and require very little conscious awareness, such as walking down a corridor, brushing their teeth or going to the toilet. Most often stare blankly as they sleep walk and do not respond to other people. Contrary to popular belief, sleep walkers are not acting out their dreams as there is very little, if any, dreaming during these stages of sleep. Sometimes during a sleep walking episode people may behave in ways that could be considered unacceptable. More commonly, this can include children going to the toilet in a cupboard, and less commonly, it can include people driving while sleep walking.

It is a common misconception that it is dangerous to wake sleep walkers. However, it can actually be dangerous not to wake a sleep walker as they may harm themselves while walking. They are likely to be startled and disoriented if woken because they are in stages 3 and 4 NREM sleep. Typically, a sleep walker will return to bed after their episode and will be unlikely to remember their sleep walking activities when they wake.

A sleep walking episode is sometimes tied to a strong emotional event, illness, stress, alcohol or medication. There is not a lot that can be done to prevent sleep walking. A review of medications, diet and lifestyle, and counselling to address any stressful events or circumstances may help reduce triggers. The most important thing is to keep the sleep environment safe. Parents of children who sleep walk and people who sleep walk should ensure that they put any dangerous kitchen items away, and lock all doors and windows before sleep so that they are unlikely to leave their home if they sleep walk.

FIGURE 16.8 Sleep walking usually involves routine activities, such as going to the toilet or walking to the fridge.

SLEEP WALKER, AGE 15, FOUND CURLED UP ON CRANE

Olinka Koster and Tahira Yaqoob

She was more of a steep walker than a sleep walker

A passer-by could barely believe his eyes when he saw a body curled up on the counterweight of a 130-foot crane at 2.00 a.m.

The rescue operation his 999 call set in play revealed that the body belonged to a 15-year-old girl ... who was fast asleep and blissfully unaware of her perilous predicament.

A fireman scaled the structure, on a building site in South-East London, and sat with the snoozing teenager while he anxiously discussed with colleagues below what to do next.

Fearful of waking her in case she should panic and fall, he attempted to secure her in position and conducted a cursory body search, finding a mobile phone. It is understood he found a number for her parents in the phone's memory. They were told the astonishing story, and then rang her on the mobile themselves to wake her.

A specialist fire rescue team, based at Battersea, arrived at the site and used a hydraulic ladder to carry the girl down. She was delivered safely to the ground and her parents came to collect her.

Unusual case

No one knows how she managed to climb up the crane. But Dr Irshaad Ebrahim, of the London Sleep Centre, said he was not surprised. Anything you can do while awake, you can do while sleep walking, he said. And, of course, without the fear factor. 'I treat people who have driven cars, ridden horses and even attempted to fly a helicopter while asleep,' he said.

'However, this is one of the more unusual cases I've come across.

'Up to 10 per cent of adolescents sleep walk, so her age is a common factor. Sleep walking is nothing to do with dreaming because it occurs in a non-dreaming sleep state.'

Dr Ebrahim was recently an expert witness in a court case in Manchester where Jules Lowe was acquitted of murdering his father Eddie after he convinced the jury he had been sleep walking.

The girl apparently walked unnoticed out of her home in Dulwich to the building site nearby. The crane was switched off and in a stationary position.

A security guard was on duty but did not see the girl.

After reaching the top she somehow crawled around 40 feet horizontally to the end of the counterweight section of the crane.

Responding to the emergency call, police initially thought she might be attempting suicide. But when the fireman reached her the innocent, but terrifying, truth became clear.

A source, who was involved in the rescue operation, said: 'The fireman had to be very careful because he realised the girl was asleep and he knew it might cause a serious problem if he woke her suddenly.

'He gently tried to wake the girl while talking to her and reassuring her that she was safe and well.

'Police then took the decision to scroll through her mobile phone electronic contacts book to find a number for her mum or dad and they contacted them to explain what was going on. Whoever the police called, they explained to the officers that the girl was a frequent sleep walker.

'They came down to the building site straight away to take her home.'

'It was tense'

A London Fire Brigade spokesman, who attended the incident, said: 'It was tense for a while.

'One of our guys had to wait up there with her, making sure she was all right and couldn't fall.

'She was fast asleep until we got one of her relatives to phone her. That woke her.'

The girl did not need medical treatment and her name has not been released by emergency services.

The incident happened in the early hours of Saturday, June 25.

The medical term for sleep walking is *somnambulism*. Experts say it is common for sleep walkers to go outside or up stairs.

But it is a myth that waking a sleep walker will seriously harm them, they say, though they might become confused or hysterical.

Dr Neil Stanley, of Surrey University's psychopharmacology research unit, said: 'It is certainly feasible for the girl to climb up a crane.

'People do all manner of odd things when they are sleep walking, including driving 20 kilometres and killing their parents.

'Anything short of that I'm prepared to believe.'

Daily Mail, Wednesday, 6 July 2005

SLEEP WALKER REPORT

16.5 INVESTIGATE

In small groups, discuss the story of the 15-year-old sleep walker. Think about what you would do if you were the passer-by, the rescuer, her parents or the girl. Link your understanding of sleep walking to this case.

1 When is sleep walking likely to occur (age, emotional state, stage of sleep)?
2 How common is it for sleep walkers to do such bizarre and dangerous things?
3 Is it safe to wake a sleep walker? How did they handle waking the sleep walker in this story?
4 How do you think the girl felt after waking and realising what had happened?
5 What could she and her family do in the future to keep her safe?
6 What type of support is the girl likely to need in the future?

Comparing dyssomnias with parasomnias

Sleep disorders have a range of fascinating signs and symptoms and present complex challenges for the sufferer. There is a broad range of dyssomnias and parasomnias, each affecting the person in different ways and requiring their own treatments. Table 16.1 summarises the comparisons between dyssomnias and parasomnias.

TABLE 16.1 Comparing dyssomnias with parasomnias

	DYSSOMNIAS	PARASOMNIAS
Definition	> Disorders of sleep or wakefulness > Inability to regulate sleep–wake cycles	> Disorders of sleep–wake transition and behaviours
Examples	> Insomnia > Hypersomnia	> Nightmares > Night terrors > Sleep walking
Description	> Difficulty getting to sleep, staying asleep, excessive daytime sleepiness (even after a good night sleep)	> Undertaking behaviours in a state of unconsciousness > Abnormal sleep behaviour disorders > Occurs while falling asleep or anytime during sleep cycles
Daytime experiences (and other effects)	> Sleepiness during the daytime > Other sleep deprivation effects, which may lead to personal, school/work and social problems, chronic health issues and safety risks	> Sleepiness during the daytime > Other sleep deprivation effects, which may lead to personal, school/work and social problems, chronic health issues and safety risks
Cause	> Multiple factors > Can run in families (genetic factor) > May be triggered by highly emotional events > May be triggered by various medications, illnesses, physical/ physiological factors	> Multiple factors > Can run in families (genetic factor) > May be triggered by highly emotional events > May be triggered by various medications, illnesses, physical/ physiological factors
Treatment	> Behavioural changes > Cognitive approaches (including coping strategies) > Sleep environment changes > Medication > Improve sleep habits and aim for a healthy lifestyle	> Behavioural changes > Cognitive approaches (including coping strategies) > Sleep environment changes > Medication > Improve sleep habits and aim for a healthy lifestyle

More detailed comparisons are possible if you drill down to comparing different dyssomnias (such as sleep-onset insomnia with hypersomnia), different parasomnias (such as sleep walking with nightmares) and, even further, different dyssomnias with different parasomnias (sleep-onset insomnia with sleep walking or sleep-onset insomnia with nightmares).

For example, when comparing sleep-onset insomnia with sleep walking, both can involve sleepiness during the daytime. Both of these sleep disorders can run in families, and can be triggered by stressful life events. Sleep-onset insomnia is more common in females, and sleep walking is more common among children with 7% having had a sleep walking episode.

16.2 REVIEW

1 Fill in the following table:

	DESCRIPTION	POSSIBLE CAUSES	POSSIBLE TREATMENTS
Sleep-onset insomnia			
Sleep walking			

2 What are two similarities and two differences between a dyssomnia and a parasomnia?

3 Outline at least one similarity and one difference between sleep-onset insomnia and sleep walking.

FIGURE 16.9 Dyssomnias and parasomnias can be due to genetic disposition.

Interventions for sleep disorders

There are a number of interventions that can be attempted to manage sleep disorders, and a sleep psychologist and other health professionals are likely to take a multi-pronged approach. In this section we will focus on cognitive behavioural therapy to treat insomnia, bright light therapy to treat circadian phase disorders and tips we can all follow to improve our sleep.

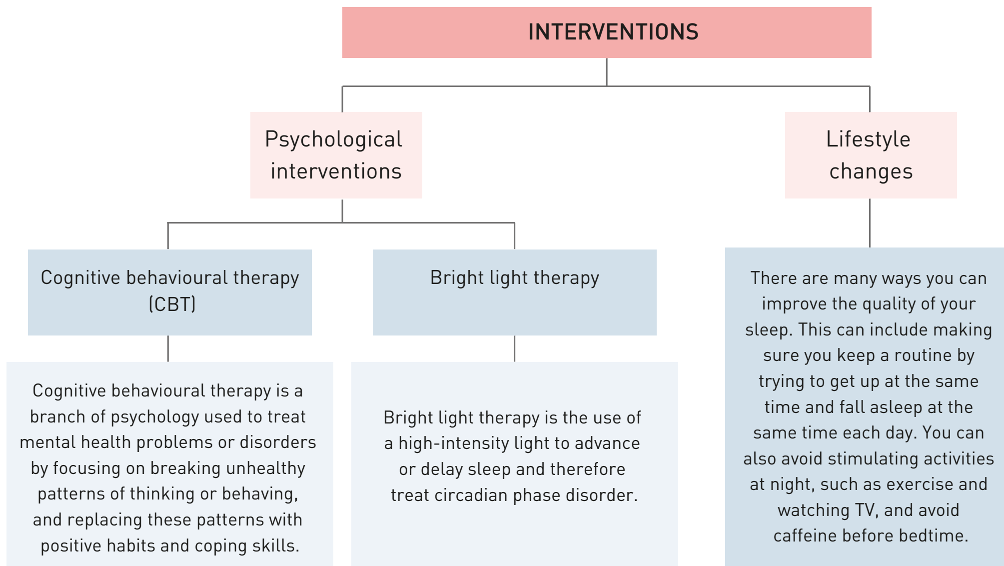


FIGURE 16.10 This diagram shows some of the interventions that can help people get a good night's sleep.

Cognitive behavioural therapy to treat sleep-onset insomnia

Wendy is a secondary school teacher. Ever since she had a bad dose of glandular fever and was bed-ridden for three months, she has not slept well. In fact, her ability to sleep has spiralled out of control and, five years later, she dreads the nightly battle to get to sleep. Each night she would fight against the clock, lying awake and worrying about how tired she would feel the next day.

A friend suggested she see a sleep psychologist who uses cognitive behavioural therapy to treat insomnia. Over a period of six weeks, Wendy worked with the psychologist to address her problematic thoughts, emotions and behaviours bound up with sleep. She also modified her sleep environment (bedroom), and changed some of her habits such as reading her iPad before going to sleep and drinking coffee after midday. Her sleep has improved dramatically.

CBT-I, shorthand for cognitive behavioural therapy to treat insomnia, assumes that our behaviours and cognitions (thoughts and feelings) with regard to sleep influence each other strongly. It recognises, for example, that we can get into a nasty cycle where our poor sleep behaviours lead to negative thoughts and emotions about sleep, which then influence the poor sleep behaviours further. CBT-I seeks to establish an alternative *healthy* sleep cycle so that sleep can become automatic, natural and restful.

A sleep psychologist is likely to ask their client to complete a sleep questionnaire to assess their sleep and lifestyle habits, along with their attitudes (thoughts and feelings) towards sleep. They will then devise an individualised program to change these habits and attitudes for the better. The client may also be asked to keep a sleep diary to record their behaviours and cognitions about sleep. In their sessions with the psychologist, clients may also be taught specific behaviours to facilitate good sleep, such as maintaining regular sleep–wake times, avoiding long naps in the day, following a healthy diet and exercise program, and avoiding stimulating activities such as exercise, coffee and electronic screens in the couple of hours before going to bed. The psychologist might also recommend that the insomnia sufferer ensure that their bedroom environment is conducive to good sleep, such as having window dressings that block out the light and a good pillow. The sleep psychologist is also likely to want to monitor and reassess the effectiveness of the CBT-I program on a regular basis.

It usually takes six to eight weekly sessions of CBT-I for the client to learn new cognitions and behaviours to support their sleep in the long term. The effectiveness of the program lies in the psychologist's ability to target the problematic behaviours and cognitions and the client's commitment to change. The results of CBT-I to date have been very positive and it is typically the preferred option for treating insomnia.

Did you know?

Ever felt gloomy during the winter months? **Seasonal affective disorder** (SAD) is a debilitating disorder where sufferers experience severe depression during winter. It is more prevalent in places that experience very short daylight hours in the winter months, especially Scandinavia. Bright light therapy is commonly used as part of the treatment for severe cases of SAD.

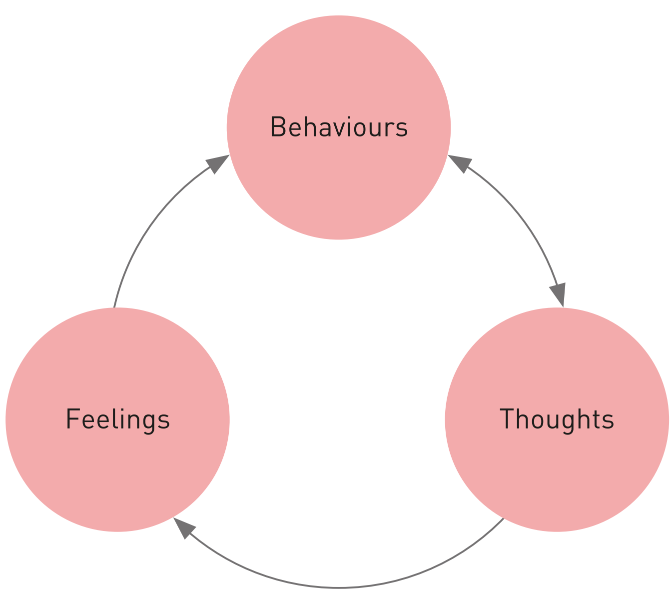


FIGURE 16.11 Cognitions influence behaviours, which in turn influence cognitions.

Bright light therapy to treat circadian phase disorders

Louis is 18 years old and studying VCE. He has developed a chronic case of circadian phase disorder in which his circadian rhythm has become delayed. His natural sleep time overlapped with school time and consequently interfered with his ability to do school work and enjoy his time at school and with friends.

Under the guidance of a sleep psychologist, Louis changed some of his sleep behaviours and now uses bright light therapy to set his circadian sleep–wake clock. This involves sitting in front of a high-intensity light box for 20 minutes each morning. Louis still likes to sleep in, but it is not an overwhelming desire that interferes with his ability to stay awake and alert during the day.

Bright light therapy is used to treat people suffering from circadian phase disorders. In other words, it is used to advance or delay sleep depending on the type of circadian phase disorder. Louis was diagnosed with delayed sleep-wake phase disorder. The light therapy was administered to him in the morning, at the time when his body really wanted him to sleep. People experiencing advanced sleep-wake phase disorder are likely to have bright light therapy in the *evening*, in an attempt to delay sleep. The bright light therapy signals to the brain's *suprachiasmatic nucleus* that it is daylight, effectively acting as a *zeitgeber*. In turn, the suprachiasmatic nucleus can adjust the body clock, including ceasing the release of melatonin from the pineal gland.

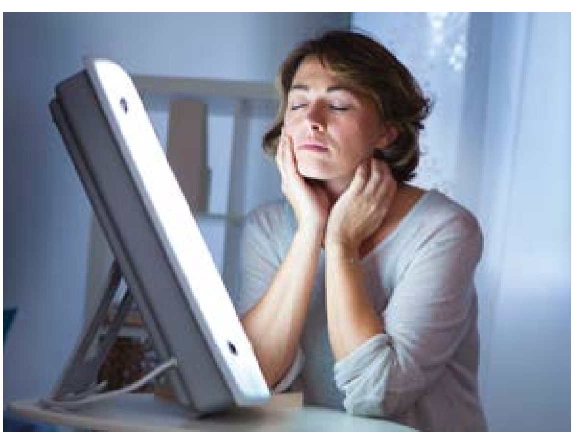


FIGURE 16.12 Bright light therapy is used to treat circadian phase disorders.

People with jet lag may benefit from bright light therapy in the *morning* when they travel west to east, or in the *evening* when they travel from east to west.

Shift workers often need to sleep during daylight hours. It can be very hard to correct the body's response to a shift-work schedule, especially if it changes regularly or the worker wants to revert to standard daytime activities on their days off. However, bright light therapy may help to keep them awake during their night shift if they use it in the evenings as they go off to work.

Although the side effects of bright light therapy are minimal, a specialist is required to ensure that the exposure is safe and consistent. It is not uncommon for the person to sustain eye irritations, dry skin, headaches and nausea, especially at the start of treatment. There should be limits to the intensity of and time in front of the bright light. The therapy should begin slowly, with exposure gradually increasing as the body gets used to it.

Bright light therapy requires a high-intensity light (approximately 10 000 lux). There are different types of lights that can be used. Light boxes are the most common. The light box contains many light tubes and sits on a table that plugs into the wall. A person just needs to be near the box. They don't need to look at it, and they can often complete everyday activities at the same time. Other types of high-intensity lights include desk lamps that look like a typical lamp or light visors that can be worn like a normal visor and shine light on the person's forehead. Dawn simulators may also be used. These lights gradually increase the light within a room, in an attempt to mimic sunrise, or gradually decrease it to mimic sunset.

Tips for a better night's sleep

Sleep is important and, whether or not we have a sleep disorder, all of us can take steps to improve its quality. Understanding sleep–wake cycle shifts and the need for adequate sleep can help teenagers avoid sleep deprivation. Just an extra 30 minutes' sleep each night can make a significant difference. You need to be patient and persistent because it takes about four weeks to set up an earlier sleep time, but the potential benefits are worth it. Read the tips for a better night's sleep below and start improving the quality of your sleep today!

FIGURE 16.13 If you have persistent trouble sleeping, see a health specialist.

> Follow a regular routine. Go to bed at the same time and get up at the same time each day.
> Have a relaxing bedtime routine such as a bath followed by a warm milk drink.
> Avoid staying up too late on weekends.
> Try to limit your weekend sleep-ins to Saturday morning only. Staying up late and sleeping in too much is likely to shift your sleep–wake cycle. You will go to bed later on Sunday and find it hard to get up on Monday morning.
> It is best to go to bed early on Sunday night to avoid being sleep deprived at the start of the school week. Avoid 'Monday morningitis'!
> Avoid stimulating activities just before bedtime, such as computer games, arguments, physical exercise, loud music, homework and television. Turn off all screens well before bedtime!
> Avoid caffeinated products, especially after 3.00 p.m. (Skip that can of Coke, hot chocolate or late-night coffee.)
> Don't worry if you can't sleep straight away. It is normal to take 15 minutes or more to fall asleep at night. Also remember that sleeping poorly one night is not the end of the world – you will probably find you sleep better the following night.
> Keep your room dark at night and brighten it when you want to wake up in the morning, for example, by opening curtains or turning on lights.

It is important to take sleep as seriously as the other aspects of your health and wellbeing. If you are having persistent trouble sleeping then it is time to seek professional help. Your family doctor, psychologist or school counsellor is a good starting point.

16.3 REVIEW

1 CBT-I works on both cognitions and behaviours to stop the negative cycle that influences poor sleep.
   a What does CBT-I stand for?
   b Use an example to show how thoughts can influence and be influenced by feelings and behaviours and therefore affect sleep quality and quantity.
   c Is CBT-I a quick fix to overcome insomnia? Explain your answer.
2 Bright light therapy can be used as part of a treatment plan for circadian phase disorders. Why is it believed to be effective?

CHAPTER SUMMARY 16

- Circadian phase disorders are sleep disorders in which a person's circadian sleep–wake rhythm is disrupted. Examples include delayed (often seen in adolescence) and advanced sleep-wake disorders, shift work and jet lag.
- During their teenage years, most people experience a delayed onset of sleep (going to sleep later) and the need for more sleep (9–10 hours per night). An increased need for sleep during these years tends to be found in all cultures, suggesting that it is biological and a normal part of life.
- People who perform shift work, particularly at night or on a rotating basis, may also experience a circadian phase disorder.
- Travelling to a distant location, across time zones, can produce 'jet lag', one of the most common sleep disorders.
- A dyssomnia is a type of sleep disorder that relates to issues around falling and staying asleep. A parasomnia refers to abnormal behaviours during sleep. Both types of disorder result in sleep deprivation effects, sometimes chronic, which can negatively affect the person's personal, social, work and school lives.
- Sleep-onset insomnia is a dyssomnia in which the person has trouble falling asleep at the beginning of the night.
- Sleep walking is a parasomnia in which the person sleep walks or carries out other automatic activities during stages 3 and 4 NREM sleep.
- Cognitive behavioural therapy is commonly and effectively used to treat insomnia. Therapy sessions usually occur on a weekly basis for six to eight sessions, in which the person learns strategies and is given homework to improve their thoughts, feelings and behaviours surrounding sleep.
- Bright light therapy can be used to treat circadian phase disorders.
- Adequate, high-quality sleep is important for everybody. There is a number of strategies that can be adopted to ensure this such as keeping a regular sleep–wake time, avoiding sleeping in and avoiding stimulating activities before bed.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- adolescent sleep–wake cycles
- bright light therapy
- cataplexy
- CBT-I
- circadian phase disorders
- dyssomnia
- insomnia
- jet lag
- parasomnia
- shift work
- sleep debt
- sleep-onset insomnia
- sleep paralysis
- sleep walking
- somnambulism.

KEY IDEAS

For the exam, you must know:

- sleep–wake cycles
  - link to circadian rhythms
  - natural sleep–wake cycle, and endogenous and zeitgeber cues
  - role of melatonin and link to dark and light environments
- circadian phase disorders
- adolescent sleep–wake cycles
  - a delayed onset of sleep (going to sleep later)
  - the need for more sleep (between 9 and 10 hours per night)
  - the difference between adolescent sleep–wake cycles and child and adult sleep–wake cycles
- how jet lag and shift work are linked to circadian rhythms and sleep deprivation
  - ways to minimise the effects of jet lag and shift work
- dyssomnias and parasomnias
  - understand nature of dyssomnias, including sleep-onset insomnia
  - understand nature of parasomnias, including sleep walking
  - compare the similarities and differences between dyssomnias and parasomnias
- sleep disorder interventions, including:
  - cognitive behavioural therapy for insomnia (CBT-I)
  - bright light therapy for circadian phase disorders
- tips for a better night's sleep.

RESEARCH METHODS

For the exam, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study
- be aware of ethical considerations relating to studying sleep deprivation.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Which of the following is not linked to a circadian phase disorder?
  a adolescent sleep–wake cycles
  b sleep walking
  c shift work
  d jet lag

2 When compared to sleep needs in late childhood, an adolescent tends to need ________________ sleep and sleep time tends to be ________________.
  a less; delayed
  b less; earlier
  c more; delayed
  d more; earlier

3 The release of sleep–wake hormones, such as ________________, which induces sleepiness, and ________________, which encourages alertness, tend to be delayed for up to ________________ during adolescence.
  a melatonin; cortisol; 2 hours
  b cortisol; melatonin; 2 hours
  c melatonin; cortisol; 4 hours
  d cortisol; melatonin; 4 hours

4 Which of the following is classified as a dyssomnia?
  a chronic sleep deprivation
  b delayed sleep-wake phase disorder
  c sleep walking
  d sleep-onset insomnia

5 Jim sometimes gets out of bed during the night and walks through the house. He appears to be asleep and does not respond when his sister speaks to him. Jim is experiencing a type of ________________, which usually occurs during ________________ sleep.
  a dyssomnia; REM
  b dyssomnia; stages 3 and 4 NREM
  c parasomnia; REM
  d parasomnia; stages 3 and 4 NREM

6 Renata finds it very difficult to fall asleep at the beginning of the night. She sees a sleep psychologist, who determines that she is suffering from ________________ and suggests she starts a ________________ treatment program.
  a hypersomnia; bright light therapy
  b hypersomnia; cognitive behavioural therapy
  c sleep-onset insomnia; bright light therapy
  d sleep-onset insomnia; cognitive behavioural therapy

7 Which of the following brain structures is primarily responsible for controlling our internal body clock?
  a the frontal lobe
  b the pineal gland
  c the hippocampus
  d the suprachiasmatic nucleus

8 Early morning awakening insomnia can be defined as:
  a trouble falling asleep at the beginning of the night
  b difficulty maintaining sleep
  c sleeping a lot and still experiencing sleepiness
  d trouble with waking up too early and not being able to go back to sleep.

9 A person diagnosed with sleep-onset insomnia is likely to:
  a go straight to sleep upon going to bed
  b take at least 30 minutes to fall asleep
  c function normally on very few hours of sleep
  d suddenly collapse into REM sleep in the middle of the day.

10 Which is the most common of the sleep disorders?
  a sleep walking
  b hypersomnia
  c insomnia
  d night terrors

SHORT ANSWER

11 Discuss the influence light has on our sleep–wake cycle, including the role of the suprachiasmatic nucleus and melatonin.

4 marks

12 a How much sleep does a teenager need?

2 marks

b Why do you think teenagers rarely get the amount of sleep that they need?

2 marks

c Outline how adolescent sleep–wake cycles differ from child and adult sleep–wake cycles.

2 marks

d If a teenager's sleep is severely affected, bright light therapy may be used as part of the treatment plan. What is bright light therapy and how is it likely to help this circadian sleep phase disorder?

2 marks

13 Distinguish between dyssomnias and parasomnias.

2 marks

14 Alejandro is a nine-year-old boy. In the middle of the night, Alejandro's mother has seen him going to the fridge, and also brushing his teeth. Alejandro always appears to be asleep while completing these actions. His mother is concerned about him moving around without being awake.

a What is Alejandro likely to be experiencing?

2 marks

b What stage of sleep does this typically occur in?

2 marks

c What can Alejandro and his mother do to ensure that he sleeps safely?

2 marks

15 Tina, a 25-year-old female, suffers from a sleep disorder. The disorder makes it difficult for Tina to fall asleep at night. She is often tired the next day, and can spend hours at night lying in bed staring at her ceiling.

a Name the sleep disorder that Tina is likely to be suffering from.

1 mark

b During what stage of sleep is Tina likely to experience this?

1 mark

c What symptoms is Tina likely to display?

1 mark

d Outline some ways that may help Tina fall asleep more easily.

3 marks

16 Cognitive behavioural therapy is often successfully used to treat insomnia.

a What is cognitive behavioural therapy?

2 marks

b How long is cognitive behavioural therapy likely to last?

2 marks

17 Why is bright light therapy used to treat circadian phase disorders? Refer to the sleep–wake cycle in your answer.

2 marks

18 How is bright light therapy usually administered? Relate the timing of the bright light therapy to delayed circadian phase disorder, advanced circadian phase disorder, shift work and jet lag.

4 marks

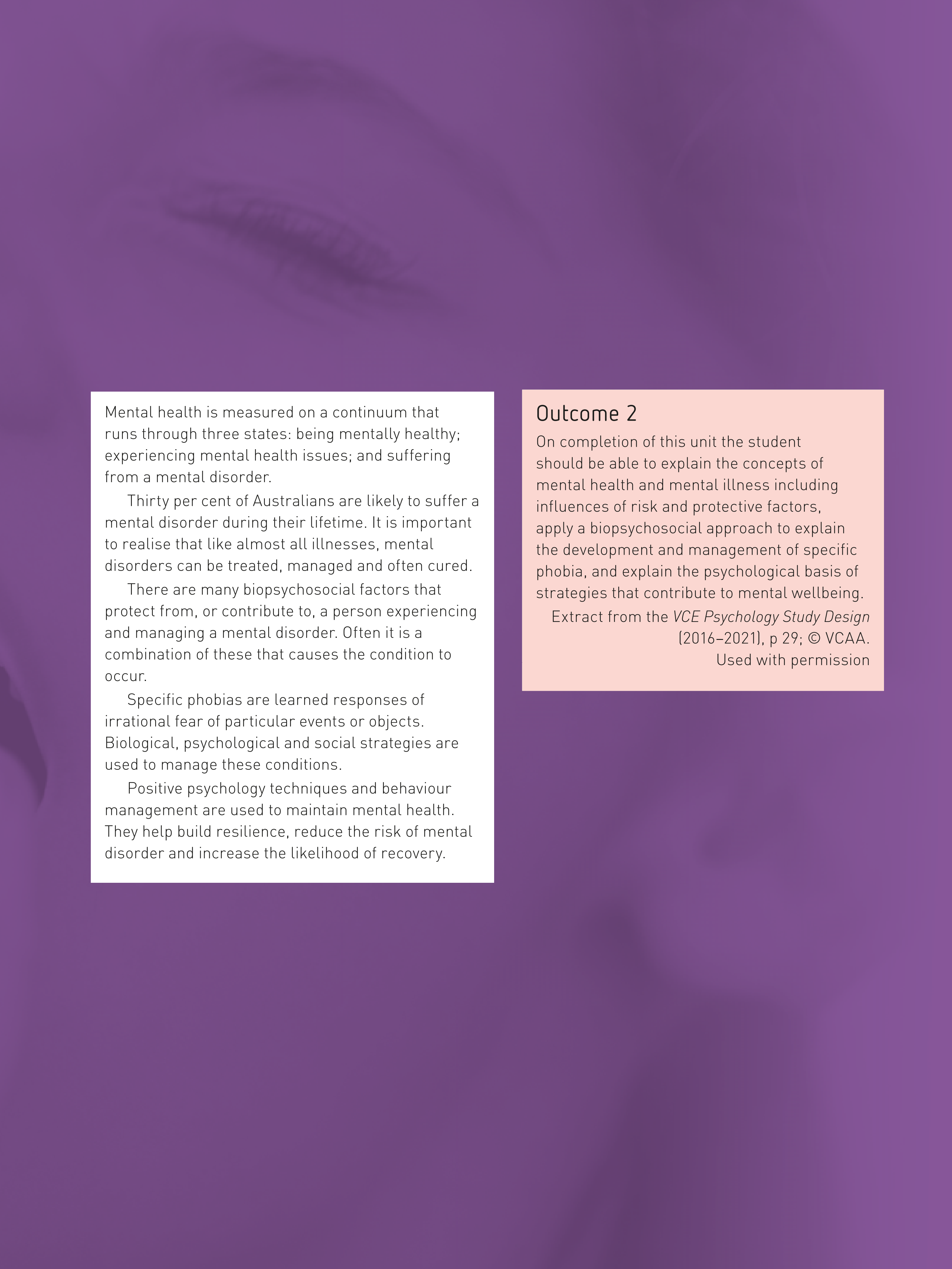
19 Bright light therapy is likely to be only one part of the treatment plan for circadian shift disorders. What other areas may be considered as part of this treatment plan?

2 marks

20 You have now learnt about the importance of sleep. How do you think our way of life is affecting our sleeping habits? Do you expect a higher incidence of sleep problems to be diagnosed in the future? Give reasons for your answer.

4 marks

AOS 2
WHAT INFLUENCES MENTAL WELLBEING?



Mental health is measured on a continuum that runs through three states: being mentally healthy; experiencing mental health issues; and suffering from a mental disorder.

Thirty per cent of Australians are likely to suffer a mental disorder during their lifetime. It is important to realise that like almost all illnesses, mental disorders can be treated, managed and often cured.

There are many biopsychosocial factors that protect from, or contribute to, a person experiencing and managing a mental disorder. Often it is a combination of these that causes the condition to occur.

Specific phobias are learned responses of irrational fear of particular events or objects. Biological, psychological and social strategies are used to manage these conditions.

Positive psychology techniques and behaviour management are used to maintain mental health. They help build resilience, reduce the risk of mental disorder and increase the likelihood of recovery.

Outcome 2

On completion of this unit the student should be able to explain the concepts of mental health and mental illness including influences of risk and protective factors, apply a biopsychosocial approach to explain the development and management of specific phobia, and explain the psychological basis of strategies that contribute to mental wellbeing.

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→ CHAPTER 17

DEFINING MENTAL HEALTH

Mental disorders affect 20 per cent of the people in the world at any given time, and it is expected that 30 per cent of all people will experience a diagnosed mental disorder at some stage of their lives.

Mental disorders are influenced by internal and external factors that may vary over time for the individual. It is important that mental health practitioners have a common understanding of how to define mental health and disorder and the particular characteristics of a given mental disorder.

KEY KNOWLEDGE

> mental health as a continuum (mentally healthy, mental health problems, mental disorders) influenced by internal and external factors that can fluctuate over time

> the typical characteristics of a mentally healthy person, including high levels of functioning, social and emotional wellbeing and resilience to life stressors

> ethical implications in the study of, and research into, mental health, including informed consent and use of placebo treatments

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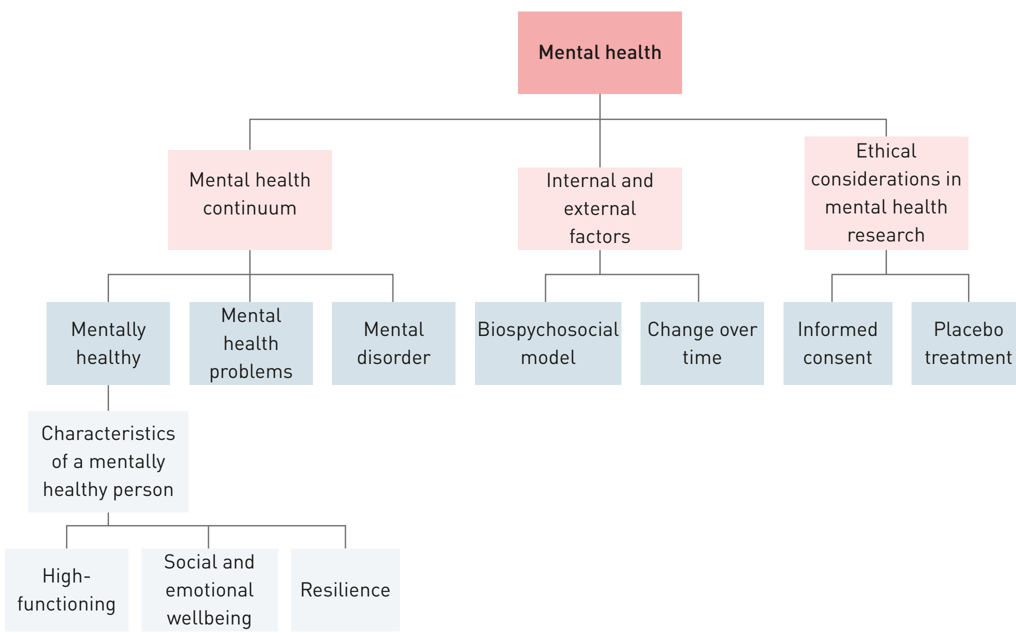
CHAPTER OVERVIEW

Defining mental health and disorder	Mental health continuum Internal and external factors influencing mental health Diagnosis of mental disorder
Characteristics of a mentally healthy person	Positive psychology
Ethical considerations in mental health research	Informed consent Placebo treatments

CONTENT MAP



Defining mental health and disorder

It is important that mental health professionals have a clear and common understanding of the characteristics of particular **mental disorders**. For example, if someone is diagnosed as having 'social phobia', it is important that all psychologists, psychiatrists or other mental health workers have the same picture of what this diagnosis means. Properly naming a mental disorder allows better communication between psychologists, psychiatrists, other healthcare workers and educators.

Systems to help diagnose mental disorders have been developed over the past 60 years and the International Classification of Diseases **(ICD)** and the Diagnostic and Statistical Manual of Mental Disorders (DSM) are widely used and well understood. These systems are not perfect but are evolving through constant review and redevelopment as our knowledge and understanding increase. As with all areas of psychology, ethical research into mental health and disorders is essential so that our knowledge and understanding continue to develop.

In 1952, the American Psychiatric Association introduced the term 'mental disorder' to its DSM.

> A mental disorder is a clinically significant behavioural or psychological syndrome or pattern that occurs in an individual and that is associated with present distress (e.g. a painful symptom) or disability (i.e. impairment in one or more aspects of functioning) or with a significantly increased risk of suffering, death, pain, disability or an important loss of freedom.
>
> American Psychiatric Association, 2000

The term 'mental disorder' is sometimes wrongly used synonymously with disease or syndrome, but the three terms have important differences in meaning (see Table 17.1).

Did you know?

Medical students disease' is a recognised syndrome where people studying medicine have a tendency to identify, within themselves, all the symptoms they read about, and begin to believe that they have all kinds of rare, exotic and dangerous diseases. The same is true of psychology students!

TABLE 17.1 Differences between disorder, syndrome and disease

TERM	MEANING	EXAMPLE
Disorder	> A set of symptoms that interfere with daily functioning > Symptoms are reasonably consistent between patients but origins/causes may differ	> Post-traumatic stress disorder > Major depression
Syndrome	> A particular profile of symptoms > The origins and clinical severity may vary	> Dyslexia
Disease	> A condition with a known cause, predictable course and standard protocols for treatment	> Malaria > Alzheimer's disease > Dementia

Mental health continuum

The **mental health continuum** recognises the stages of being mentally healthy, having **mental health problems** and having a mental disorder.

FIGURE 17.1 It is important to recognise that a person may have completely recovered from a mental disorder.

MENTALLY HEALTHY

According to the World Health Organization (1998), mental health is a state of emotional and social wellbeing in which individuals realise their own abilities, can cope with the normal stresses of life, work productively and contribute to their community.

MENTAL HEALTH PROBLEMS

Most of the time people with mental health problems are mentally healthy – but the normal stresses and strains of life can lead to temporary and minor setbacks. This may be related to the strain of a change in family situation, relationship breakdown or impending examinations. Such situations may cause difficulty with the person's thought processes, emotional stability, concentration, behaviour and perceptions.

These issues may interfere with normal daily functioning, but generally for a limited time. Most mental health problems are simply exaggerated forms of normal thoughts, feelings and behaviours. We can all feel happier or more miserable from one day to the next and normally we are **resilient** enough to bounce back.

MENTAL DISORDERS

Mental disorders are more serious, often longer lasting conditions than mental health problems. The term implies a clinically recognisable set of symptoms and behaviours that usually need treatment to be alleviated (WHO, 1992).

About 20–30 per cent of people in Australia will experience a mental disorder at some stage in their lives. Some mental disorders are more likely to occur early in life, others much later and a few may occur either early or later in life.

The nature and course of a mental disorder may vary from person to person. Many people have only one, short-lived episode and fully recover. Others battle their whole life with a mental disorder. With psychological and often medical support, the vast majority of people living with mental disorder can lead full, active and successful lives.

Beware of self-diagnosis!

If you feel that you have symptoms of a mental health problem or disorder, please seek professional assistance – a school counsellor or welfare coordinator, or your GP can refer you to a psychologist. There are also organisations to help such as Kids Helpline (1800 551 800) and beyondblue (1300 22 46 36).

Internal and external factors influencing mental health

Today, the central tool for mental health practitioners is the 'biopsychosocial model' (Engel, 1977). According to this model, mental health is influenced by the interaction of internal (biological and psychological) and external (sociocultural) factors. Table 17.2 outlines four groups of factors affecting mental health, which are further explored in the next chapter.

Factors that influence mental health and our ability to respond to our environment may include:

> current life stressors such as problems at work, at school or with relationships
> drug and/or alcohol abuse
> dramatic changes in hormone levels – such as during pregnancy or adolescence
> trauma/loss
> social isolation.

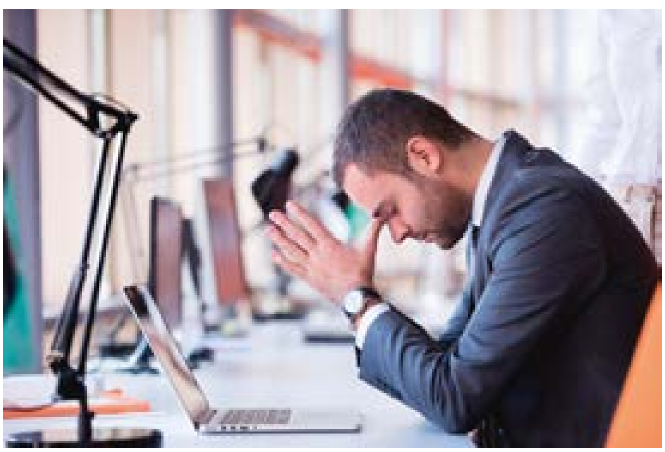


FIGURE 17.2 A common external factor that can affect our mental health is difficulty at work.

The effects of these internal and external factors can fluctuate over the lifespan as a result of hereditary, social or environmental factors. The types of stressors we come across as well as the way we respond to them will change. For instance, a person may have good mental health in childhood and adolescence, but then experience the onset of a mental disorder as they encounter new pressures at work or in relationships. Our mental health may improve with age as environmental stressors diminish or as we develop coping mechanisms. Mental disorders may also develop in old age, with one in five dementia sufferers also experiencing depression. The elderly are often forgotten in conversations about mental health, but emotional wellbeing is just as important in old age as it is when we are young.

TABLE 17.2 Groups of internal and external factors affecting mental health

	INTERNAL	EXTERNAL
Predisposing factors	> Genetics > Personality	> Nutrition
Precipitating factors	> Developmental stage – hormone balance	> Life events - Stressors - Infections - Injury
Perpetuating factors	> Immune system > Biochemical processes	> Stressors > Social situation/isolation
Protective factors	> Genetics > Immune system > Personality	> Social support > Treatment

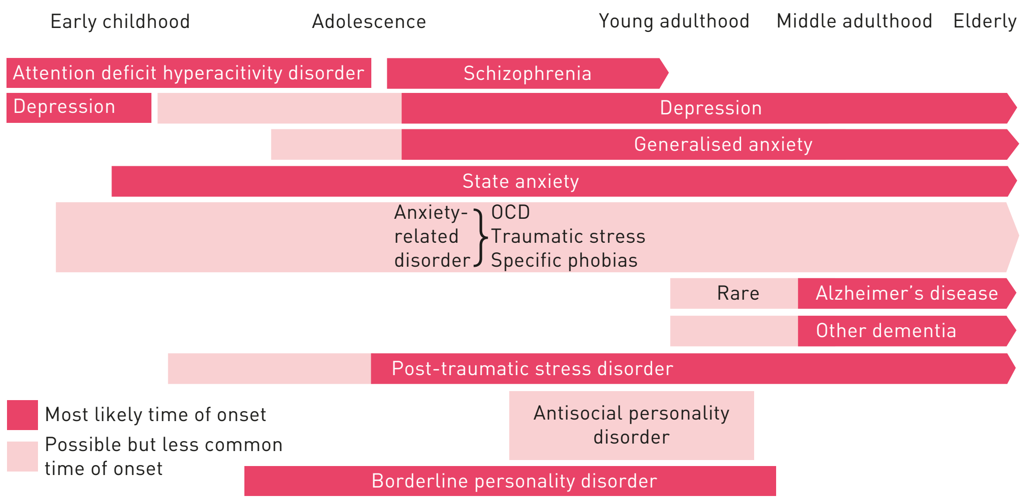


FIGURE 17.3 Typical age of onset of certain mental disorders

Diagnosis of mental disorder

A correct diagnosis of a mental disorder is extremely important as it determines the course of treatment. One of the roles of a psychologist is to diagnose mental disorder. A classification system is used to identify symptoms and make a diagnosis and manage the mental disorder, while also helping to clarify and define variables in research in the area.

As we have seen, the two main systems of classifying and diagnosing mental health disorders are the DSM and the ICD. The DSM is the most widely used diagnostic manual in Australia. Diagnosis is based on a number of factors, including the person's medical condition, psychosocial stressors and the extent to which their mental state is interfering with everyday life. The DSM is descriptive and covers the onset, course and persistence of symptoms. It does not specify the causes of the mental disorder, nor does it direct the treatment. There has been a series of revisions made to the DSM since it was first published in 1952, with 106 disorders identified in 1952 and 380-plus in the latest edition (DSM-5, 2013).

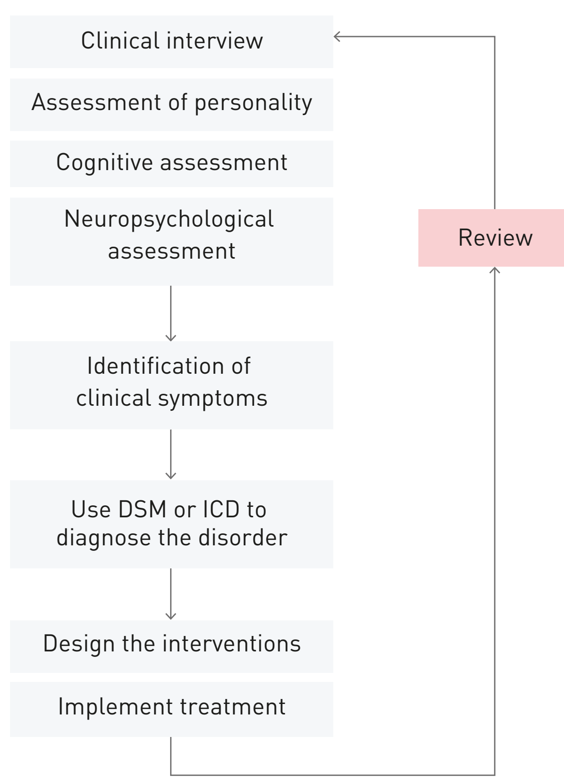


FIGURE 17.4 The steps in intervention when a person presents to a psychologist with a mental health problem, showing the role of the DSM or ICD in this process

VALIDITY OF THE DIAGNOSES

The goal of these classification systems has been to enable and increase the consistency of diagnosis, but it can be argued that this means that the validity of the diagnostic categories may be overlooked. It is possible that a very precise and specific description may not truly reflect a disorder. For example, on 15 December 1973, homosexuality was removed from being classified as a mental disorder. On that day, millions of gay people across the world were 'cured'!

FIGURE 17.5 Homosexuality was considered a mental disorder prior to 15 December 1973.

INVESTIGATE 17.1

GENDER DYSPHORIA

Gender dysphoria, formerly known as gender identity disorder, is a condition in which a person identifies with the opposite sex and desires to live as a member of that sex. Gender dysphoria is classified as a mental disorder in the DSM-5.

Do you think gender dysphoria should be classified as a mental disorder? Give reasons for your answer. You may wish to undertake your own research.

INVESTIGATE 17.2

MYTHS, MISUNDERSTANDING AND FACTS ABOUT MENTAL DISORDERS

There are many myths and misunderstandings about mental disorders. Education plays a key role in overcoming negative stereotypes and helping to support people suffering with one. Using the internet, research the following questions:

1 Are mental disorders a form of intellectual disability or brain damage?
2 Are mental disorders curable?
3 Are people born with a mental disorder?
4 Can anyone develop a mental disorder?
5 Are people with a mental disorder usually dangerous?
6 Should people with a mental disorder be isolated from the community?

SUPPORTING UNDERSTANDING

Categories or dimensions?

If you go to your doctor with a cough and high temperature, they will probably take a blood test to determine exactly what the illness is so that appropriate treatment decisions can be made.

Mental disorders do not always fit into such neat categories and very often a person with one diagnosed disorder will have symptoms of one or more others (Kessler *et al.*, 2005). These are referred to as 'co-morbidities'. If the categories really are separate and discrete disorders, then there should be no greater percentage of people who have generalised anxiety disorder (GAD) being diagnosed as depressed than the percentage in the general population; however, this is simply not the case. People diagnosed with GAD are many times more likely to be depressed than people with no other mental disorder, and the most common presentation of mood disorder is actually the co-morbid conditions of mixed anxiety and depression.

The DSM has moved towards a less categorical structure by introducing dimensional classifications, especially of personality disorders. This would mean that mental health professionals would rate an individual on the extent to which they show personality characteristics such as the following:

> *neuroticism* (with emotional stability as its opposite), which means a person is anxious, stressed, depressed and self-conscious

> *agreeableness* (with self-interest and suspicion as its opposite), which means a person is compassionate and trusting

> *conscientiousness* (laziness and carelessness as its opposite), which means that a person is self-disciplined and reliable.

FIGURE 17.6 The DSM-5 was released in May 2013, after a 14-year revision process.

Other possible dimensions would be *compulsiveness*, *antisocial responses* and *social withdrawal*.

17.1 REVIEW

1. Define *mental disorder* using your own words.
2. Why is it important for psychologists and other mental health professionals to diagnose and identify different mental disorders?
3. How should you proceed if you or a friend shows symptoms that you think might reflect a mental health problem or a mental disorder?
4. Name two internal and two external factors that may influence mental health.
5. Describe how internal and external factors influencing mental health may fluctuate over time.

Characteristics of a mentally healthy person

In the same way that physical health is not just the absence of disease, mental health is a state of wellbeing. Good mental health allows us to experience life fully and appreciate our environment and relationships. A person who is mentally healthy experiences high levels of functioning and normal mood fluctuations. They are able to go through day-to-day life without any of the sometimes debilitating symptoms of mental disorder.

FIGURE 17.7 Mentally healthy people function better than those with mental health problems.

A mentally healthy person might display the following characteristics of emotional and social wellbeing:

> normal mood fluctuations
> calm state of mind/takes things in their stride
> good sense of humour
> performs well at school and work
> good cognitive functioning
> good level of concentration
> normal sleep patterns
> few sleep difficulties
> physically well
> good level of energy
> physically and socially active
> maintains positive relationships with family and others.

Such a person will also show resilience, appearing to take setbacks in their stride and pushing ahead, being productive for themselves and for society. Resilience is the ability to adapt to adversity or stress. For people who are experiencing mental health problems, it can be difficult to show resilience when they are already vulnerable to environmental or social stressors. Remember A-B-C: Act–Belong–Commit. Being active, having a sense of belonging and having a purpose in life all contribute to happiness and good mental health.

Positive psychology

In 1998, Martin Seligman, then president of the American Psychological Society, indicated that psychology should turn away from its preoccupation with mental disorders (psychopathologies) and make a positive effort to understand and harness human strengths in order to deal with everyday life. He recommended the development of resilience through **positive psychology**.

Positive psychology represents a commitment to the sources of psychological wellness, such as positive emotions, positive experiences, positive environments, and human strengths and virtues (Lyubomirsky, 2007).

The four major principles of positive psychology are:

1 Rise to life's challenges; make the most of setbacks and adversity.
2 Engage and relate to other people.
3 Find fulfilment in creativity and productivity.
4 Look beyond oneself and help others to find lasting meaning, satisfaction, and wisdom (Keyes & Haidt, 2004).

Did you know?

Seligman proposed five key elements of good mental health (PERMA):

- P – Positive emotions
- E – Engagement
- R – Relationships
- M – Meaning and purpose
- A – Accomplishments

FIGURE 17.8 According to the principles of positive psychology, helping others is one way to achieve lasting satisfaction in life.

17.2 REVIEW

1 How is a mentally healthy person different from a person experiencing mental health problems?
2 Identify three characteristics of a mentally healthy person.
3 What is resilience and why is it important to mental health?
4 How does positive psychology differ in its approach from traditional psychology?

Ethical considerations in mental health research

Throughout this section, you should refer back to Chapter 1 to make sure that you are understanding and using the research-related terms appropriately.

Mental health research is vital, but there are many ethical considerations that contribute to the difficulty of performing rigorous, placebo-controlled experiments with human participants. Two of the vital ethical considerations are informed consent and appropriate safeguards when using **placebos**.

Informed consent

Imagine you are a researcher and you wish to examine the effectiveness of a new therapy that you have designed to treat social anxiety disorder. You have randomly selected 100 volunteer adult participants, all diagnosed with social anxiety disorder. You have randomly allocated 50 into the experimental group (E-Group) and 50 into the control group (C-Group).

The independent variable is simply going to be whether participants receive the therapy (E-Group); or a counselling treatment (a placebo), which will not harm them at all, but is known to have no positive effects in the treatment of social anxiety disorder (C-Group).

Informed consent requires that participants are aware of the purpose of the research and know what will be expected of them as they participate. This means that the researchers must either tell participants whether they are in E-Group or C-group, or deceive them into believing that they are all receiving the therapy!

Obviously, you would have to put your proposal in detail up before the ethics committee of the institution that was overseeing your research. If they felt that the research was of potentially great value, then you may receive permission to make such deception, provided you perform thorough debriefing and inform participants of how they can obtain counselling if required.

This dilemma is extremely common in research into mental health.

FIGURE 17.9 The ethical consideration of informed consent requires that the researcher explain to the research participants the purpose of the research and what is expected of them.

1 What is the dependent variable (DV) in the research described above?
2 Write an appropriate research hypothesis for this research.
3 Outline another study in mental health where use of a placebo (for C-Group) and informed consent may appear to be incompatible. What measures might you take to overcome this problem?

17.3 INVESTIGATE

Placebo treatments

The use of placebo treatments in mental health research is also cause for ethical debate, even though they are common in many research designs.

While placebos can make people feel better, the effect can be small or temporary when compared with a legitimate treatment. An important part of research that involves participants is informed consent, and this cannot really be obtained when there is the deception involved in a placebo-controlled research design.

FIGURE 17.10 The use of placebos is a contentious topic in mental health research.

Another problem with placebo treatments in research is that it can sometimes require a participant to go without treatment. Imagine you have a mental disorder such as an anxiety disorder. You volunteer for a trial to test a new medication that is supposed to reduce your symptoms. You later find out that the medication you have been taking is a placebo. How do you feel about this?

In cases where a sound treatment for a mental disorder already exists, the use of a placebo treatment to trial a new treatment can be seen as unethical. This is because medical health professionals are required to provide patients with the best proven treatment available (Rothman & Michels, 1994). However, there are arguments in favour of using placebo treatments in trials, such as that the placebo effect can still improve patient symptoms and the outcome of the trials can often improve treatment methods overall.

1 What is *informed consent* and why is it so important?
2 Why might the use of placebo treatments in research be unethical?
3 What might be a justification for using placebo treatments in research?

17.3 REVIEW

CHAPTER SUMMARY 17

- Mental health is represented on a continuum ranging from mentally healthy, through to mental health problems and mental disorders.
- The term *mental disorder* was brought into favour by the American Psychiatric Association, authors of the Diagnostic and Statistical Manual of Mental Disorders (DSM).
- Naming a mental disorder improves communication between psychologists and other mental health professionals. It also helps clarify and define variables for future research. The two principal tools for naming a mental disorder are the International Classification of Diseases (ICD) and the DSM.
- The number of disorders has increased as the different revisions of the DSM have been published and now stands at 380-plus.
- A correct diagnosis is extremely important as it can assist with the course of treatment and the control of the disorder and symptoms.
- Internal (biological and psychological) and external (sociocultural) factors influence mental health and these can vary over time and over the lifespan.
- Mental disorders do not fit into neat categories as most medical conditions do, and very often people with one diagnosed disorder have symptoms of one or more other disorders.
- A mentally healthy person functions well in society, is productive and experiences psychological and social wellbeing.
- In 1998, Martin Seligman advocated that psychology should shift its focus from mental disorders to trying to better understand and harness human strengths. He developed positive psychology, which advocates resilience, engaging with other people, finding fulfilment in creativity, and helping others.
- A problem with research into mental health conditions with human subjects is that *informed consent* and *placebo-controlled trials* are almost mutually exclusive.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- biopsychosocial approach
- diagnosis
- disease
- disorder
- external factors
- informed consent
- internal factors
- mental disorder
- mental health
- placebo
- resilience
- syndrome.

KEY IDEAS

For the exam, you must know:

- the continuum of mental health
- internal and external factors influencing mental health and variations over time and the lifespan
- characteristics of a person with good mental health: functioning positively, emotional wellbeing, social wellbeing
- resilience
- research into mental health – the dilemma of informed consent in placebo-controlled designs.

RESEARCH METHODS

The diagnosis of mental disorder is an in-depth investigation of an individual. Each is therefore a case study. You should be familiar with the strengths and weaknesses of this form of research.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Which of the following terms does not exist on the mental health continuum?
- a mentally healthy
- b resilient
- c mental health problem
- d mental disorder

2 In 1973, which 'mental disorder' was declared not to be a disorder at all?
- a megalomania
- b schizophrenia
- c bipolar disorder
- d homosexuality

3 A person suffering a mental disorder:
- a cannot expect to recover
- b is likely to recover fully with therapy, perhaps medication and social support
- c is likely to experience one type of mental disorder after another
- d needs medication or surgery to recover.

4 In diagnosing and treating mental health problems and disorders, most mental health professionals adopt the:
- a positive psychology approach
- b cognitive behavioural approach
- c biopsychosocial approach
- d clinical approach.

5 Which of the following is not one of the groups of factors affecting mental health?
- a precipitating factors
- b predisposing factors
- c protective factors
- d power factors

6 Resilience refers to:
- a the ability to 'bounce back' after a setback
- b a long slow decline into mental decay
- c suffering mental health problems
- d experiencing negative psychology.

7 Which of the following is not covered by the DSM?
- a recommended treatment
- b characteristics of the onset of the disorder
- c description of the course the disorder may take
- d outline of how the disorder may persist over time

8 A person enjoying good mental health:
- a will never have to deal with a stressor in life
- b may have a life stressor but will deal with it and move on
- c is likely to have mental health problems and disorders as they get older
- d will have suffered mental health problems, but overcome them.

9 When a person is given a treatment that they think will cure their mental health problem, and it works although it has otherwise been shown to be ineffective, they are experiencing the:
- a experimenter effect
- b Hawthorne effect
- c placebo effect
- d Doppler effect.

10 It may be acceptable for a researcher to breach the principle of informed consent, in which of the following circumstances?
- a Performing the study will increase the researcher's chances of receiving a research grant.
- b The participants are fully debriefed and given the opportunity for counselling.
- c Deceiving the participants is approved by the ethics committee.
- d The people in the control group have more resilient personalities than those in the experimental group.

SHORT ANSWER

11 Distinguish *disease* and *disorder* and give one example of each.

4 marks

12 How does a 'mental health problem' differ from a 'mental disorder'? Give an example of each.

4 marks

13 Why is it important to receive an accurate diagnosis of a mental disorder?

4 marks

14 Name one mental disorder that is likely to arise from early teenage years until about age 30 and one that may arise at virtually any time after early childhood.

2 marks

15 According to the biopsychosocial model, what are the four factors affecting mental health?

4 marks

16 When diagnosing a mental disorder, what are the steps in involved?

2 marks

17 a What does *DSM* stand for?

1 mark

b What does it cover?

2 marks

18 Explain what *positive psychology* is and its four major principles.

5 marks

→ CHAPTER 18

MENTAL DISORDERS: DEVELOPMENT & PROGRESSION FACTORS

As you are aware by now, mental disorder is a major concern in today's society. One in five people experience at least one mental disorder in their lifetime. Mental health disorders can affect all areas of a person's life from employment, to relationships, to everyday functioning. The more accurate the information we have, the better equipped we are to deal with it in our lives.

KEY KNOWLEDGE

> the distinction between predisposing risk factors (increase susceptibility), precipitating risk factors (increase susceptibility and contribute to occurrence), perpetuating risk factors (inhibit recovery) and protective factors (prevent occurrence or reoccurrence)

> the influence of biological risk factors including genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance abuse

> the influence of psychological risk factors including rumination, impaired reasoning and memory, stress and poor self-efficacy

> the influence of social risk factors including disorganised attachment, loss of a significant relationship and the role of stigma as a barrier to accessing treatment

> the concept of cumulative risk

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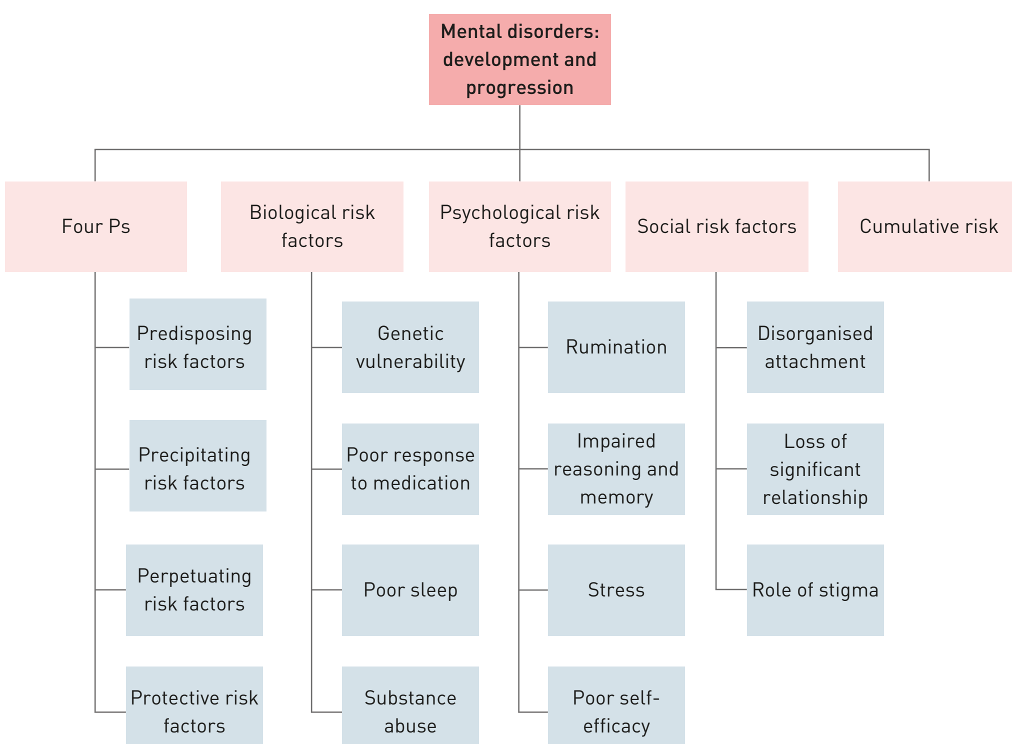
CHAPTER OVERVIEW

Development of mental disorders	Risk factors and protective factors The Four P's
Influence of biological, psychological and social factors	Biological risk factors Psychological risk factors Social risk factors
Risk factors together and cumulative risk	Cumulative risk

CONTENT MAP



Development of mental disorders

There are many different risk factors associated with developing a mental health disorder, including biological, psychological, sociocultural and environmental ones. It is important that the causes of a particular patient's mental disorder are identified because this can enable their treating practitioner to better assist in managing their condition and also reduce the chance of it reoccurring.

Risk factors and protective factors

Risk factors are those that contribute to the likelihood of a person either suffering from a mental disorder or experiencing a relapse. In contrast, **protective factors** guard against onset or relapse by supporting a person's general wellbeing. Unlike risk factors, addressing protective factors gives people resilience in the face of adversity and softens the effects of stress.

It is important to acknowledge the limitations of our current understanding of the risk factors for mental disorders and the significance of any single risk factor. Not everyone who is exposed to a risk factor will necessarily develop a mental disorder. The *multidimensional model*, followed by many practitioners, recognises that risk factors interact, and that multiple and persistent risk factors are more likely to cause a mental disorder than any single risk factor. Table 18.1 sets out risk factors and protective factors that may affect mental health according to the World Health Organization.

TABLE 18.1 Factors affecting mental health

(World Health Organization, http://www.who.int/mental_health/mhgap/risks_to_mental_health_EN_27_08_12.pdf, (2012)

LEVEL	RISK FACTORS	PROTECTIVE FACTORS
Individual attributes	> Low self-esteem > Cognitive/emotional immaturity > Difficulties in communicating > Medical illness, substance use	> Self-esteem, confidence > Ability to solve problems and manage stress or adversity > Communication skills > Physical health, fitness
Social circumstances	> Loneliness, bereavement > Neglect, family conflict > Exposure to violence/abuse > Low income and poverty > Difficulties or failure at school > Work stress, unemployment	> Social support of family and friends > Good parenting/family interaction > Physical security and safety > Economic security > Scholastic achievement > Satisfaction and success at work
Environmental factors	> Poor access to basic services > Injustice and discrimination > Social and gender inequalities > Exposure to war or disaster	> Equality of access to basic services > Social justice, tolerance, integration > Social and gender equality > Physical security and safety

INVESTIGATE 18.1

Go to the beyondblue website and navigate to the 'Who does it affect?' page to look at the list of risk factors for different groups in the population; for example, women, young people, elderly, low socio-economic groups.

Make a list of the risk factors for two groups of your choice. Can you think of anything else that might be a risk factor for those groups?

The Four P's

When treating patients with a mental disorder, practitioners often try to identify factors that might cause or perpetuate the mental disorder and also what are the protective factors that might prevent the disorder from reoccurring.

Together these four might be conveniently referred to as *the Four P's*:

> Predisposing risk factors → increase susceptibility.
> Precipitating risk factors → increase susceptibility and contribute to reoccurrence.
> Perpetuating risk factors → increase duration and inhibit recovery.
> Protective risk factors → protect from initial onset and prevent reoccurrence.

PREDISPOSING RISK FACTORS

This refers to factors that increase vulnerability to mental disorders and takes into account that we might be born with.

These factors may include:

> *inherited traits* such as certain genes that may increase the chances of a mental disorder developing – having a biological member of your family such as a parent or a sibling with a mental disorder
> *environmental exposures before birth* such as to toxins, alcohol or drugs
> *chronic social stressors* such as difficult circumstances during childhood, bullying, parental neglect
> *brain chemistry*; for example, some neural networks may be impaired and the malfunctioning leads to nervous system changes and possibly mental disorders
> *ongoing chronic medical condition*; for example, diabetes, cystic fibrosis, cancer.

FIGURE 18.1 Predisposing risk factors include things we might inherit, or encounter in the early stages of development.

PRECIPITATING RISK FACTORS

These factors help the practitioner to understand the patient's current symptoms and might include:

> stressful life situations; for example, legal and/or financial problems, death of a loved one, divorce, witnessing parental violence
> being the victim of parental emotional, physical or sexual abuse, or neglect
> belonging to an ethnic minority
> traumatic experiences; for example, being assaulted, being affected by war or terrorism, military combat
> long-term use of some medications.

PERPETUATING RISK FACTORS

These factors inhibit recovery, in other words, make the mental disorder last longer than it otherwise would, and include:

> problems with alcohol, tobacco and drugs

FIGURE 18.2
Homelessness is considered a perpetuating risk factor.

- social isolation; for example, having few friends or extended family, or few healthy relationships in general
- relationship difficulties
- family conflicts
- poverty and/or homelessness
- medical conditions such as heart disease
- weakened immune system
- poor parental attachment
- previous mental illness
- missing school or work
- harm to self and/or others.

PROTECTIVE FACTORS

The following protective factors prevent the occurrence or reoccurrence of a mental disorder and include a person's strengths, resilience and supports:

- good diet
- maintaining fitness and good physical health
- maintaining good sleep patterns
- ability to recognise early warning signs of relapse of the disorder
- awareness of potential risks for developing or experiencing the relapse of a disorder
- maintaining appropriate medication when relevant
- staying connected with family and friends
- awareness, acceptance and recognition of the mental disorder
- joining a support group
- learning about mental disorders
- anticipating and planning appropriately for potential scenarios and relapses
- avoiding harmful use of alcohol and drugs
- being involved in education, art or other activity
- economic wellbeing and having a reliable job or means of income
- having a home.

INVESTIGATE 18.2

Go to the KidsMatter website, or find the link in your obook. Use the information to list the risk and protective factors for children who might develop a mental disorder.

REVIEW 18.1

1 What is the difference between risk factors and protective factors in terms of mental disorders?
2 List the Four P's and explain the role they play in terms of mental health.
3 Give two examples of each of the Four P's.

Influence of biological, psychological and social factors

Different mental health problems and illnesses have different risk factors, which can be grouped into biological, psychological and environmental/social ones.

Biological risk factors

Biological risk factors include genetic predisposition, physiological structures of the body and the biochemical processes of the brain and nervous system. These factors are examined in more detail below in the context of genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and long-term or sporadic substance abuse.

GENETIC VULNERABILITY TO SPECIFIC DISORDERS

Twin studies, family studies, and adoption studies have suggested that people can be more at risk of developing a mental disorder if it runs in the family. Our genes, passed on to us by our parents, instruct our body on how it will make the proteins that make up our cells, including those in our brain. A genetic mutation can cause proteins to be created that will function differently from how they should. Some people are genetically predisposed to producing low or high levels of particular neurotransmitters that render them at greater risk of a mental disorder.

It is important to note, however, that being vulnerable to specific disorders does not mean a person will definitely develop one. It simply means they are more susceptible to its onset.

FIGURE 18.3 People can inherit genetic vulnerability for a mental disorder from their parents.

POOR RESPONSE TO MEDICATION DUE TO GENETIC FACTORS

Some individuals respond better than others to medication, depending in part on their genetic make-up and metabolism. Abnormal levels of neurotransmitters are thought to be involved in mental disorders. For example, some patients respond well to antidepressants and others less so.

Did you know?

Rumination in Latin means 'chewing the cud' – a process where cows grind up food, swallow it, regurgitate it and then chew it over again. Humans who ruminate go over and over and over the same issue without seeming to resolve it.

POOR SLEEP

Chronic sleep problems are associated with mental health issues and each can perpetuate the other. Sleep problems are particularly common in patients with anxiety, depression, bipolar disorder and attention deficit hyperactivity disorder.

LONG-TERM SUBSTANCE ABUSE

Long-term substance abuse has been linked with a number of mental disorders. There is an association between alcoholism and depression, cannabis and depression, and amphetamines and paranoia and anxiety. Addictive substances such as nicotine or alcohol change the way the brain works by interfering with chemical neurotransmission. Some substances affect the amount of neurotransmitters released and others affect how neuronal messages are getting through. Prolonged use of these substances can have devastating long-term effects on the way our brain functions.

It is not clear whether having a mental disorder can make a person more likely to abuse drugs to relieve their symptoms in the short term, but drug use can also make an existing mental disorder worse. Some drugs can also trigger the first symptoms of a mental disorder such as schizophrenia, for those people who are predisposed to it.

Psychological risk factors

Psychological risk factors include a person's personality, thoughts, feelings and behaviours. Such factors are explored below with particular reference to rumination, impaired reasoning and memory, stress and poor self-efficacy.

RUMINATION

Rumination refers to obsessive thinking and worrying about the negative aspects of a past, present or future situation. It has the potential to adversely affect mental health if a person is unable to break the cycle of ruminating about the negative aspects of life without developing any strategies to address their perceived problems. Rumination is associated with anxiety and, if untreated, can lead to depression.

IMPAIRED REASONING AND MEMORY

Impaired reasoning and memory are often associated with dementia, depression, schizophrenia and bipolar disorder. Causes vary and depend on the type of mental disorder and the particular part of the brain that has been impaired.

FIGURE 18.4 Stress can have a negative impact on mental health.

STRESS

Stress can negatively affect mental health if it is not checked or managed. Stress causes our bodies to release hormones such as adrenalin and cortisol as part of the fight-flight-freeze response. If too much cortisol is released over long periods, the risk of a person developing a mental disorder such as depression is increased.

POOR SELF-EFFICACY

Self-efficacy refers to a person's general coping strategies and their perception of their ability to control the events that happen in their lives. People with poor self-efficacy can sometimes develop symptoms of anxiety and/or depression.

Social risk factors

The culture and/or values of a particular community or sector of society can place expectations on people that are associated with the onset of mental disorders. For example, pressure on women to be thin can lead to depression and/or other disorders such as anorexia and bulimia. Social and economic factors, such as divorce or unemployment, can place some people at risk. Social isolation is another significant contributor to developing a mental disorder. The following social factors are explored below: disorganised attachment, loss of a significant relationship, and stigma as a barrier to accessing treatment

DISORGANISED ATTACHMENT

A contributing factor to social isolation is the phenomenon of **disorganised attachment**, which affects individuals in society who find it difficult to share their feelings or to relate to others.

LOSS OF A SIGNIFICANT RELATIONSHIP

Loss of a significant relationship might be due to separation from a partner, the breakdown of a relationship with another family member or the death of someone close to you. All these circumstances can contribute to an individual experiencing anxiety and/or depression. For some people, the death of a loved one can cause acute grief that worsens over time rather than getting better. This debilitating mental health condition is known as *complicated bereavement disorder*.

STIGMA AS A BARRIER TO ACCESSING TREATMENT

Stereotyping of people with a mental disorder, such as beliefs that they are dangerous or unpredictable, can lead sufferers and their families to avoid seeking treatment for fear of being associated with that stereotype. A person may also avoid seeking treatment because they do not want to seem weak to their families and friends when, in actual fact, suffering with a mental disorder can have nothing to do with personal strength at all.

SANE

Visit the SANE website, either directly or by following the link in your obook, to investigate how they try to reduce social stigmas about mental health.

18.3 INVESTIGATE

1 Identify four biological risk factors for mental health.
2 What role does genetics play in mental health?
3 Define *rumination* and explain how it is a psychological risk factor.
4 Describe the role that stigma can play in preventing people from accessing treatment for their mental disorder.

18.2 REVIEW

Risk factors together and cumulative risk

The first three of the Four P's and the biological, psychological and social factors for developing a mental disorder can be put together into a workable table (such as Table 18.2), which practitioners can use to formulate a diagnosis and management plan for their patients or clients.

TABLE 18.2 Three of the Four P's and biological, psychological and social risk factors

	PREDISPOSING FACTORS	PRECIPITATING FACTORS	PERPETUATING FACTORS
Biological	> Genetic background > Physical illness	> Substance abuse	> Medication metabolism > Physical illness > Substance abuse
Psychological	> Developmental experiences > Early life experiences – trauma > Personality style > Learnt behaviours	> Stressful life events	> Dysfunctional relationships > Social isolation
Social	> Culture > Ethnicity > Occupation > Social support	> Unemployment > Migration > Financial difficulties	> Unemployment > Stigma > Lack of support

INVESTIGATE 18.4

1 Categorise the risks shown in Figure 18.5 into biological, social and psychological.

2 You might wish to investigate these risk factors further by looking at the mental health section of the World Health Organization website.

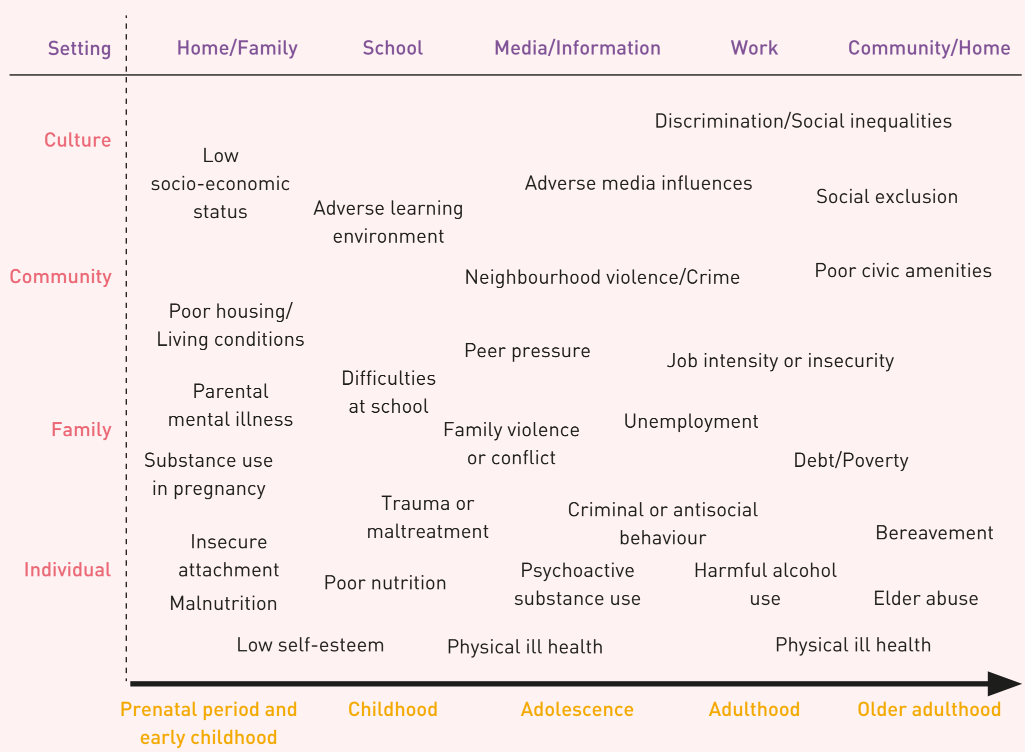


FIGURE 18.5 Overview of risks to mental health over the lifespan by the World Health Organization (2012)

18.5 INVESTIGATE

1 Using the following case studies and your knowledge of factors that contribute to mental disorders, complete the first three columns of the table below.

2 Add some suggestions for protective factors in the final column. This may involve the need for your own research.

ANNE

Anne was 27 years of age when she experienced severe abdominal pain one Sunday afternoon. She called an ambulance and had to crawl to the front door to let the ambulance officers in. She was diagnosed with a twisted bowel – a painful condition that required an operation and several weeks of recovery. Anne's parents were divorced and lived in different states. When informed of the seriousness of her condition, she contacted her mother for assistance. Unfortunately, her mother declined to help her as she was 'too busy'. Anne was devastated by this and found that her time in hospital was more difficult than she expected. When she was finally allowed to go home, her recovery was further complicated by depression. She spent her days crying and lost interest in everything around her. This despair was further intensified by a lack of contact with other people. Neither of her parents visited her that year.

YANNI

Yanni is a Year 12 student, born into a family who immigrated from Greece 20 years ago. He is under intense pressure from his parents to maintain an 'A' grade average and he is constantly fighting with them. In addition, he has just broken up with his Japanese girlfriend, Mitsuko, primarily because of parental interference and cultural expectations and demands from both sides.

Even though Yanni is upset about everything going on in his life, he agrees to go with a mate to a party. While there, he is offered a marijuana 'joint'. Contrary to his values and beliefs, and due to all the pressure he's under, Yanni smokes the entire thing. However, Yanni is unaware that he has a strong family history of schizophrenia. This single exposure to the drug results in him hearing voices (auditory hallucination) and feeling as if someone or something is watching him. As Yanni's behaviour becomes increasingly more bizarre, his friend calls for an ambulance. Yani is one of the unlucky ones. Not only is he feeling sad, anxious and stressed from a range of personal issues, he has now experienced the first of many psychotic episodes characteristic of schizophrenia.

	PREDISPOSING RISK FACTORS (INCREASE SUSCEPTIBILITY)	PRECIPITATING RISK FACTORS (INCREASE SUSCEPTIBILITY AND CONTRIBUTE TO REOCCURRENCE)	PERPETUATING RISK FACTORS (INCREASE DURATION AND INHIBIT RECOVERY)	PROTECTIVE RISK FACTORS (PREVENT INITIAL ONSET AND REOCCURRENCE)
Biological				
Psychological				
Social				

Cumulative risk

All of the factors discussed in the chapter so far might interact with each other to precipitate a mental disorder: this would be referred to as **cumulative risk**.

Individuals often encounter some kind of risk factors across their lifespan. Unfortunately, events such as loss or bereavement are a part of life. People with mental disorders, however, have often encountered multiple risk factors throughout their lives. Researchers have found that the accumulation of risk factors increases the chances of a person developing a mental disorder.

For example, a person might have a neurotransmitter imbalance because of a genetic predisposition, and then they experience a significant life event such as divorce or the death of a loved one. This combination of factors may precipitate a mental disorder.

INVESTIGATE 18.6

RESEARCH A WEBSITE

In pairs or small groups, investigate one of the following organisations' websites and answer the questions below:

- Youthbeyondblue
- headspace
- Black Dog Institute
- SANE
- ReachOut.

(Youthbeyondblue)

Questions

1. Who could use this website?
2. What sort of information does this website provide?
3. Which mental disorder does this organisation work with?
4. Does it organise events? Explain.
5. Where is the organisation located? Can it be contacted?
6. What is some other relevant information about the organisation?

INVESTIGATE 18.7

Read the following case study and list the information a treating mental health professional would need to find out in order to make a diagnosis and form a treatment and management plan to try to reduce the chance of him suffering a relapse once he is well.

THE CASE OF MIKE

Mike is a 37-year-old divorced male with one child. His GP has referred him to a psychologist but Mike refuses to go. He has never seen a psychologist before. Mike believes that someone has removed his brain and replaced it with someone else's. He thinks that this new brain is controlling him and that he is not responsible for his actions. Mike has a degree in finance and has been in his current job for 15 years. He says he has a lot of friends but sometimes he thinks it's one of them who did this to him.

REVIEW 18.3

1 Give an example of biological, psychological and social risk factors in terms of the following:
   - **a** predisposing risk factors
   - **b** precipitating risk factors
   - **c** perpetuating risk factors.

2 What is cumulative risk and what relationship does it have with the onset of a mental disorder?

CHAPTER SUMMARY 18

- The view that a mental disorder is caused by a number of factors is referred to as a *multidimensional model*.
- Risk factors contribute to the likelihood of a person suffering from a mental disorder, or a person who has previously suffered a mental disorder experiencing a relapse.
- Protective factors guard against relapse by helping a person's wellbeing or giving them resilience in the face of adversity.
- Psychologists refer to the Four P's to describe factors influencing mental health:
  - predisposing risk factors increase susceptibility
  - precipitating risk factors increase susceptibility and contribute to reoccurrence
  - perpetuating risk factors increase duration and inhibit recovery
  - protective factors protect from initial onset and prevent reoccurrence.
- Biological, psychological and social risk factors may contribute to the onset of a mental disorder.
- Biological risk factors include genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance abuse.
- Psychological risk factors include rumination, impaired reasoning and memory, stress and poor self-efficacy.
- Social risk factors include disorganised attachment, loss of a significant relationship and the role of stigma as a barrier to accessing treatment.
- Cumulative risk involves the accumulation of risks, including biological, psychological and social ones. The more risks accumulated, the higher the cumulative risk and, therefore, the higher the risk of developing a mental disorder.

ESSENTIAL KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- biological risk factors
- cumulative risk
- disorganised attachment
- genetic vulnerability
- perpetuating risk factors
- precipitating risk factors
- predisposing risk factors
- protective factors
- psychological risk factors
- risk factors
- rumination
- self-efficacy
- social risk factors
- stigma
- substance abuse.

KEY KNOWLEDGE

For assessment, you must be able to show your understanding and apply your knowledge of:

- predisposing risk factors, precipitating risk factors, perpetuating risk factors, and protective factors
- biological risk factors including genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and substance abuse
- psychological risk factors including rumination, impaired reasoning and memory, stress and poor self-efficacy
- social risk factors including disorganised attachment, loss of a significant relationship and the role of stigma as a barrier to accessing treatment
- cumulative risk.

RESEARCH METHODS

- Apply knowledge of research methods to evaluate study of risk factors for mental health disorder according to the multidimensional model.
- Understand how family studies and adoption studies assist to identify risk and development of mental disorder.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 The cause of a mental disorder is attributed to:
  a a single factor
  b poor diet
  c several factors
  d the interaction of several factors.

2 Risk factors for mental disorders include:
  a predisposing, precipitating and perpetuating factors
  b precipitating, perpetuating and protective factors
  c predisposing, precipitating and protective factors
  d predisposing, perpetuating and protective factors.

3 Biological risk factors for mental disorders include:
  a genetic predisposition
  b poor sleep
  c substance abuse
  d all of these answers are correct.

4 Psychological risk factors for mental disorders include:
  a rumination and poor sleep
  b poor sleep and substance abuse
  c impaired reason and memory and poor self-efficacy
  d rumination, poor sleep and substance abuse.

5 Protective risk factors against a mental health disorder include:
  a exercise and diet, good sleep patterns, staying connected with family and friends
  b staying connected with family and friends, good sleep patterns, weakened immune system
  c good fitness, poor parental attachment, having a home
  d having a home, missing school or work, economic wellbeing.

6 Perpetuating risk factors:
  a prevent the occurrence or reoccurrence of a mental disorder
  b inhibit recovery from a mental disorder
  c trigger a mental disorder
  d are triggered by trauma.

7 Stigma can be a barrier to accessing treatment for a mental disorder because:
  a sufferers are always dangerous
  b sufferers fear being stereotyped negatively
  c family and friends fear becoming negatively stereotyped
  d all of these answers are correct.

8 Social risk factors for a mental disorder include:
  a the culture and values of the person's community
  b the level of support available for the sufferer in their local community
  c community expectations of individuals
  d all of these answers are correct.

9 Which hormones are associated with stress?
  a cortisol
  b oxytocin
  c adrenalin
  d cortisol and adrenalin.

10 Self-efficacy is:
  a a biological risk factor for a mental disorder
  b a mood disorder
  c obsessive worrying about oneself
  d a person's general coping ability.

SHORT ANSWER

11 Provide an example of a predisposing risk factor for a mental disorder and explain why it is a risk factor.

2 marks

12 Provide an example of a precipitating risk factor for a mental disorder and explain why it is a risk factor.

2 marks

13 Provide an example of a perpetuating risk factor for a mental disorder and explain why it is a risk factor.

2 marks

14 Provide three examples of protective risk factors for a mental disorder and explain how these would assist in preventing the onset or reoccurrence of a mental disorder.

2 marks

15 Write a sentence or a short paragraph that shows the distinction between psychological, biological and social risk factors for developing a mental disorder.

2 marks

16 Deanne's grandmother, father and sister all have problems with an addiction to alcohol. Deanne believes alcoholism runs in her family and refuses to drink as a result of this. Categorise the kind of risk Deanne has identified and explain why it may or may not be a problem for her.

3 marks

17 a What is *cumulative risk*?

2 marks

b Provide two examples of cumulative risk.

2 marks

CHAPTER 19

SPECIFIC PHOBIA

This chapter explores the phenomenon of specific phobia and its relationship with stress and anxiety. It also examines the biological, psychological and social factors that interact and contribute to the development and maintenance of a specific phobia and its successful treatment. Evidence-based treatments are considered, including cognitive behavioural therapy, systematic desensitisation and psychoeducation.

KEY KNOWLEDGE

> the distinctions between stress, phobia and anxiety; variation for individuals with stress, phobia and anxiety on a mental health continuum

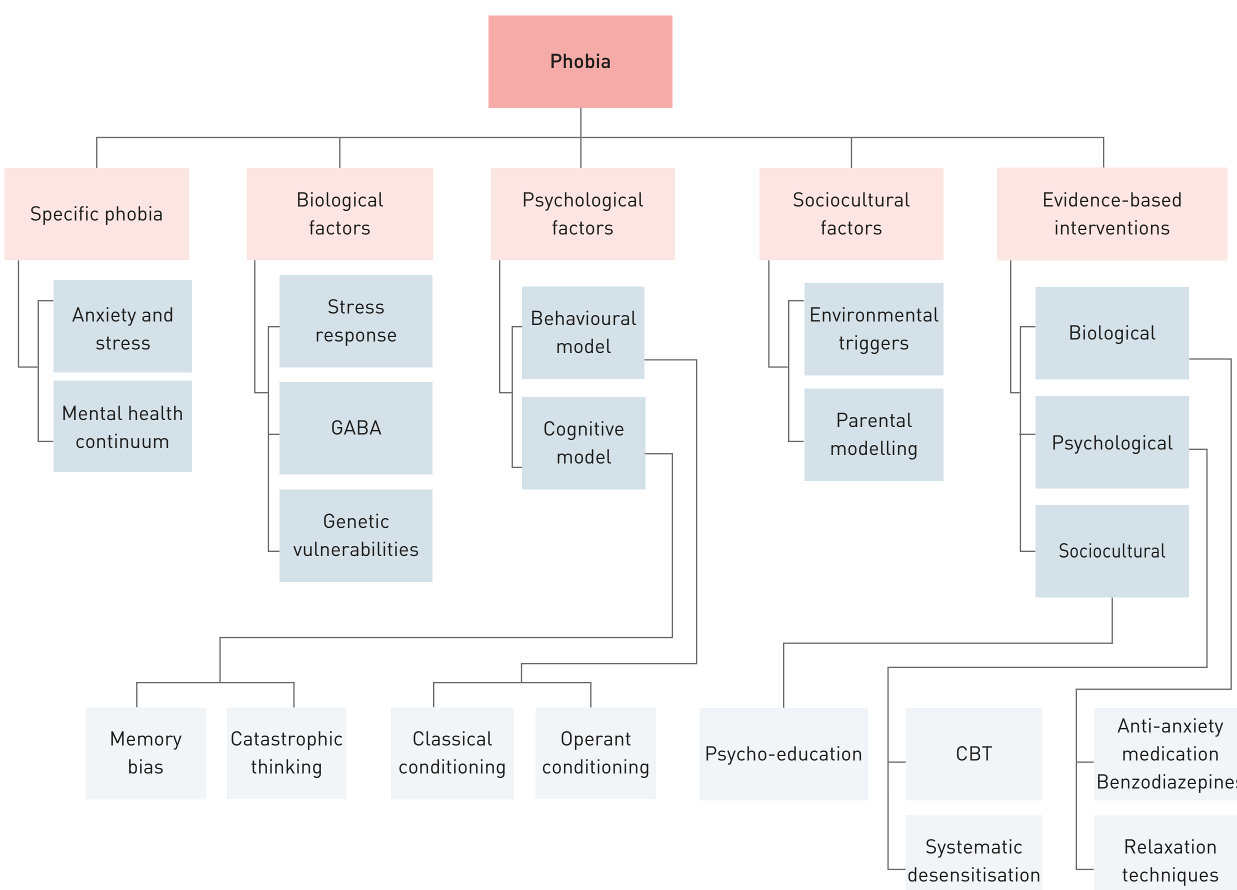
> the relative influences of contributing factors to the development of specific phobia with reference to: gamma-amino butyric acid (GABA) dysfunction, the role of stress response and long-term potentiation (biological); behavioural models involving precipitation by classical conditioning and perpetuation by operant conditioning, cognitive bias including memory bias and catastrophic thinking (psychological); 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 (gamma-amino butyric acid [GABA] agonists) in the management of phobic anxiety and relaxation techniques including breathing retraining and exercise (biological); the use of cognitive behavioural therapy (CBT) and systematic desensitisation as psychotherapeutic treatments of phobia (psychological); psychoeducation for families/supporters with reference to challenging unrealistic or anxious thoughts and not encouraging avoidance behaviours (social)

CHAPTER OVERVIEW

Specific phobia as an anxiety disorder	Stress, anxiety and specific phobia Stress, anxiety and specific phobia on the mental health continuum Age of onset
The biopsychosocial approach to specific phobia	Contributing biological factors Contributing psychological factors Contributing social factors
Evidence-based interventions	Anti-anxiety medication Breathing retraining and exercise Cognitive behavioural therapy Systematic desensitisation Psychoeducation

CONTENT MAP



Specific phobia as an anxiety disorder

Do you know anyone who is terrified of spiders or snakes? Have you ever jumped onto a chair and started screaming at the sight of a mouse? How is the stress response related to specific phobias?

Stress, anxiety and specific phobia

Before discussing specific phobia in detail, it is important to understand its links to stress and anxiety and to independently define these terms. Stress is defined as the psychological and physical response to internal or external sources of tension (stressors). Anxiety is characterised by feelings of persistent and extreme apprehension, fear and unease, when stressors are not necessarily present. Symptoms of anxiety include heart palpitations, muscle tension, feeling shaky/hand tremors, choking sensation, dry mouth and an upset stomach. Does this sound like the fight-flight-freeze response? It is!

Have you ever felt anxious, perhaps just before sitting an exam or playing in a grand final? This is a normal part of human existence. For some, however, it can become a major problem with disturbing consequences. It may also be an indicator that an anxiety disorder is present.

FIGURE 19.1 Twin studies have shown that there are strong genetic links to the development of specific phobias.

Studies have found that anxiety disorders occur in approximately 18 per cent of the population (Drew, Bromet & Switzer 2000), and many people suffer from more than one of these disorders at a time. Women, especially between 45 and 54 years of age, are also more vulnerable to anxiety disorders (Australian Bureau of Statistics, 1998). Biopsychosocial factors play a role in most anxiety disorders. Twin studies have revealed that anxiety disorders such as panic disorder and specific phobia are particularly heritable, occurring in 85 per cent of identical twins with a family history of these disorders (Nestadt *et al*., 2000).

A specific phobia is a persistent, irrational and intense fear of a particular object or event. As with anxiety, exhibiting the fear response is normal, as long as it is a rational response to an actual situation that is occurring. Many people are frightened of spiders or snakes and experience a fear response if one crosses their path. This fear response makes sense from an evolutionary perspective because humans are genetically wired to fear things that pose a threat to their survival. However, if that fear starts to interfere with a person's social functioning – where they deliberately avoid the distress-causing object, activity or situation to the point where it affects their day-to-day life – it then becomes a *specific phobia*. If the individual is faced with the feared object or event, they may experience acute physiological arousal – the fight-flight-freeze response – as in the case of anxiety disorders. In extreme cases, just thinking about the phobic object can cause intense fear and anxiety.

There are four main types of specific phobia:

> animal phobias (for example, fear of snakes, spiders, rats or dogs)
> natural environmental phobias (for example, fear of heights, storms, water or darkness)
> situation phobias (for example, fear of enclosed spaces, elevators, flying, dentists, driving, tunnels or bridges)
> blood-injection-injury phobia (for example, fear of medical procedures or of the sight of blood).

FIGURE 19.2 Fear of toads is known as *bufonophobia*.

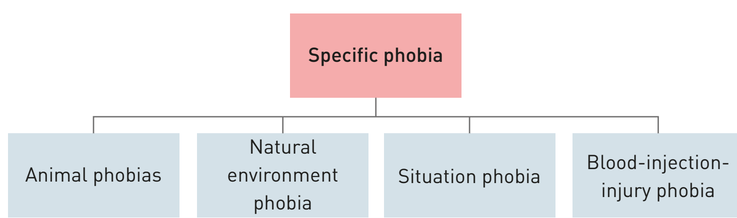


FIGURE 19.3 Specific phobia and sub categories

The connection between anxiety disorders and specific phobias is no coincidence as in fact, specific phobia is a type of anxiety disorder, together with the following conditions, also listed in the DSM-5:

> panic disorder
> agoraphobia
> selective mutism
> separation anxiety disorder
> social anxiety disorder (social phobia)
> generalised anxiety disorder
> substance/medication-induced anxiety disorder
> anxiety disorder due to another medical condition
> unspecific anxiety disorder.

Adapted from www.adaa.org

The connections between stress, anxiety and specific phobia are intricate. The physiological activation that occurs when we feel stressed is also accompanied by feelings of anxiety. Not only are stress and anxiety symptoms of specific phobia, they can also act as triggers for the condition.

Did you know?

Research has found that approximately five per cent of the population experiences at least one phobia at any given time and about 10 per cent of the population will have a phobia at some stage during their lifetime (Graske & Waters, 2005). Twice as many women as men experience a phobia!

Stress, anxiety and specific phobia on the mental health continuum

Like all physical and mental health conditions, we can think about the relative severity of stress, anxiety and specific phobia in terms of their position along a continuum. One model breaks this continuum up into four broad categories: healthy, reacting, injured and disorder (see Table 19.1).

To use the spider example, in the case of a specific phobia, a 'healthy' person may be frightened of them, but their fear is considered to be within a normal range. If they see a spider, they may simply squash it or ask a friend to catch it and release it into the garden. A 'reacting' individual will do just that: physically and psychologically 'react' to the spider by screaming, or running away each time they see one. They may also experience difficulty sleeping if they think that there might be a spider in their bedroom and misinterpret bits of black thread or fluff in their environment as spiders. If they are at the 'injured' level along the continuum, their phobic symptoms are significantly impacting their functioning. Once they reach the 'disorder' end of the spectrum, their specific phobia has affected their functioning to the point where they have a mental disorder that requires significant intervention. On a positive note, as mental health is determined along a continuum, a specific phobia can improve with treatment so that, over time, the person could go from being 'disordered' to 'healthy'.

INVESTIGATE 19.1

A SPECIFIC PHOBIA

Watch a YouTube video that explains the symptoms experienced by someone suffering from a specific phobia.

TABLE 19.1 Mental health continuum for specific phobia

Healthy Normal healthy functioning	**Reacting** Common and reversible distress	**Injured** Significant functional impairment	**Disorder** Significant mental disorder. Severe and functional impairment
> Normal fluctuations in mood, fear and anxiety > Normal levels of stress > Normal sleeping patterns > Physically well, full of energy > Socially active > Attends school and/or work	> Nervous, irritable, anxious > Moderate levels of stress > Trouble sleeping > Tired, low energy, muscle tension, headaches > Procrastination > Decreased social activity > Attends school/work	> Anxiety, pervasive and irrational fear > High levels of stress > Hypervigilance to threat information > Memory bias > Avoidance behaviours > Decreased performance > Social avoidance or withdrawal > High levels of absenteeism from school/work	> Excessive anxiety and fear, easily frightened, agitated > Extremely high levels of stress > Unable to fall or stay asleep > Exhaustion, physical illness > Unable to perform duties, absenteeism from school/work > Isolation, avoiding social events > Significant avoidance behaviours
> No treatment required	> Some professional psychotherapy	> Professional psychotherapy	> Professional psychotherapy and possible medication

Adapted from http://staffmentalhealth.providencehealthcare.org/staff/self-assessment

Age of onset

For specific phobias, the age of onset depends on the phobia (see Table 19.2). Most specific phobias develop during childhood and eventually disappear. Those that persist into adulthood rarely go away without treatment.

TABLE 19.2 Mean age of onset for selected phobias

PHOBIA	YEARS OF AGE
Animal	7
Blood	9
Dental	12
Claustrophobia	20

FIGURE 19.4 Dental phobia often occurs at around 12 years of age.

MIX AND MATCH!

INVESTIGATE 19.2

Using the internet and other sources, match the phobia to its correct definition.

Agoraphobia	Fear of drafts, air swallowing or airborne substances
Acarophobia	Fear of being alone or of oneself
Anemophobia	Fear of neglecting duty or responsibility
Acrophobia	Fear of open spaces or of being in public places
Claustrophobia	Fear of work or functioning; surgeon's fear of operating
Agliophobia	Fear of crowds or mobs
Aichmophobia	Fear of the sea
Autophobia	Fear of heights
Brontophobi	Fear of being seen or stared at
Ergasiophobia	Fear of insects
Gephyrophobia	Fear of pain
Ochlophobia	Fear of needles or pointed objects
Paralipophobia	Fear of crossing bridges
Scopophobia	Fear of confined spaces, such as lifts
Thalassophobia	Fear of thunder and lightning

REVIEW 19.1

1 Define the term *specific phobia*.
2 What is the difference between stress, anxiety and specific phobia?
3 List four phobic responses a person who suffers from a phobia of spiders may experience.
4 What are the four subcategories of specific phobia?

The biopsychosocial approach to specific phobia

After many years of extensive research into the origins of specific phobias, the scientific community came to an important conclusion: there is no simple explanation! Rather, there appear to be several complex mechanisms that contribute to the development of a specific phobia, and that are also relevant to its maintenance and treatment. Thus, phobias are now frequently examined using the **biopsychosocial approach**.

Contributing biological factors

There are three important biological factors that contribute to the development and maintenance of a specific phobia. These are:

> the fight–flight–freeze response
> GABA and glutamate
> genetic predisposition and inherited vulnerabilities.

THE FIGHT–FLIGHT–FREEZE RESPONSE

As discussed previously, our fight–flight–freeze response is important to our survival. It provides us with an instant burst of energy to deal with danger in our environment and is controlled by the sympathetic branch of the autonomic nervous system. Once activated, stress hormones such as adrenalin and noradrenalin are released into the bloodstream to increase our heart rate and respiration rate, circulate more glucose through our body for energy, improve focus and temporarily boost our stamina to either fight the impending danger or flee to a safe place. A person with a specific phobia of spiders will experience an intense fight–flight–freeze response when they see a spider or a milder response by simply looking at a picture of one!

These symptoms can include:

> elevated blood pressure
> tremor (shaking in the hands)
> palpitations (abnormally fast heartbeat that the person is aware of)
> diarrhoea
> sweating
> shortness of breath
> skin sensation of prickling, burning or itching without identifiable physical cause
> dizziness.

The role of the amygdala and hippocampus

As we learnt in Chapter 9, the amygdala and hippocampus are located in the medial temporal lobes of the brain and are part of the limbic system. The amygdala is vital in initiating and processing emotional responses such as fear and in forming emotional memories. As such, it plays a critical role in anxiety disorders such as specific phobias. The hippocampus is involved in the formation of declarative memories such as information about the world, facts and knowledge, and episodic (autobiographical) memories.

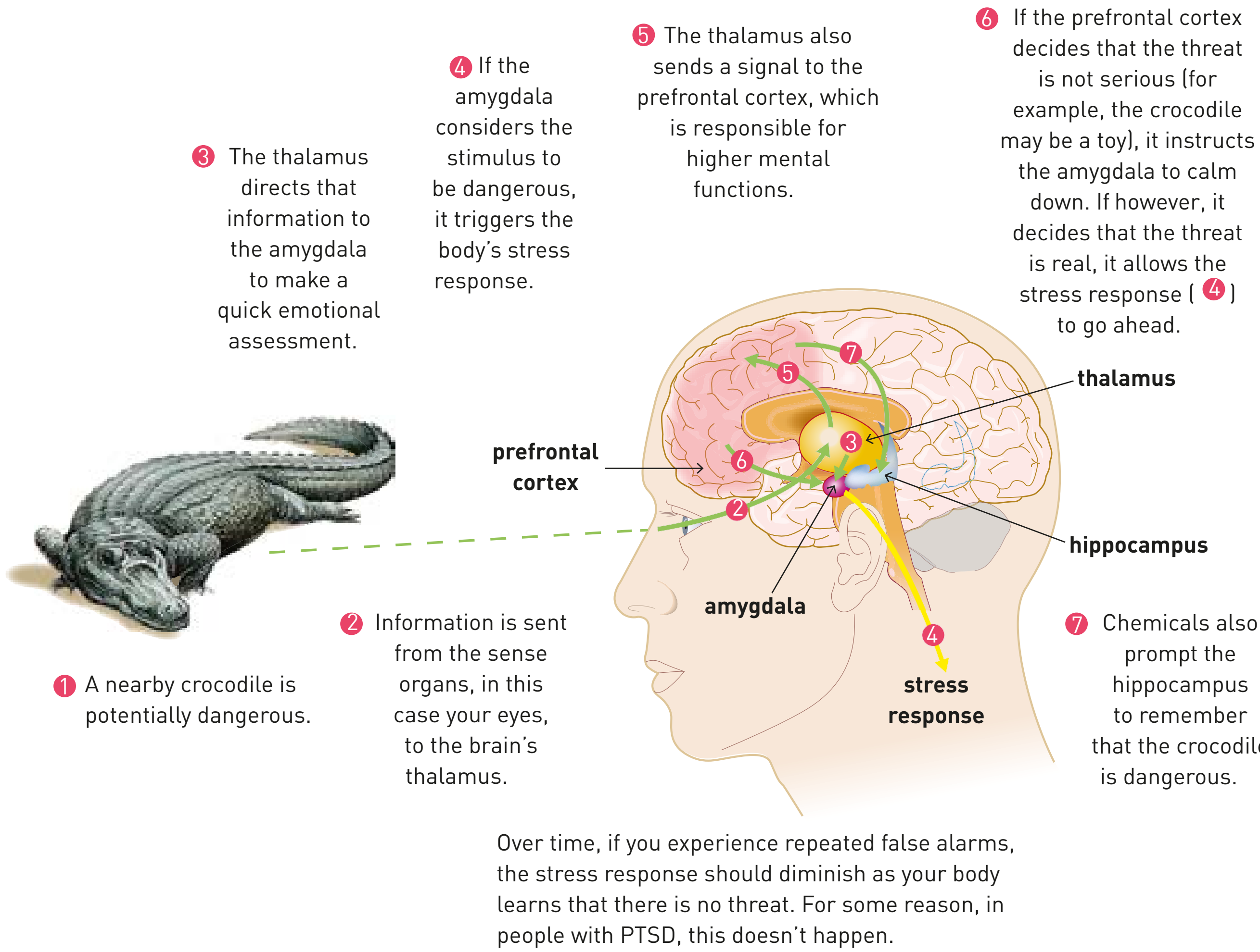


FIGURE 19.5 Biological processes involved in activating the fight-flight-freeze response when a person sees a phobic object

So, when a person experiences a frightening event, information from all the senses is processed by the amygdala to become an emotion linked to the memory. The memory of the frightening episode itself is consolidated by the hippocampus, to form a conscious recollection – the more frightening the event, the stronger the memory. Importantly, the amygdala is responsible for the formation and storage of classically conditioned fear. So, when the person is exposed to a similar stimulus, the amygdala triggers the 'emotion' of fear and the fight-flight-freeze response is initiated (Hold, 2008).

Long-term potentiation

Long-term potentiation is an 'experience-dependent' type of brain plasticity where physical changes occur as a result of the repeated stimulation of a neural pathway during learning. What is the relevance of long-term potentiation to specific phobia? Researchers have discovered that there is a link between long-term potentiation and memory. A person knows if they have a phobia of spiders because every time they see one, they experience psychological distress and the fight–flight–freeze response. The memory of this fear, 'Spiders are eight-legged, scary and harmful', has been consolidated by the hippocampus. The intense physiological arousal (fight–flight–freeze response) that accompanies that thought each time they see or think they see a spider, is stored by the amygdala.

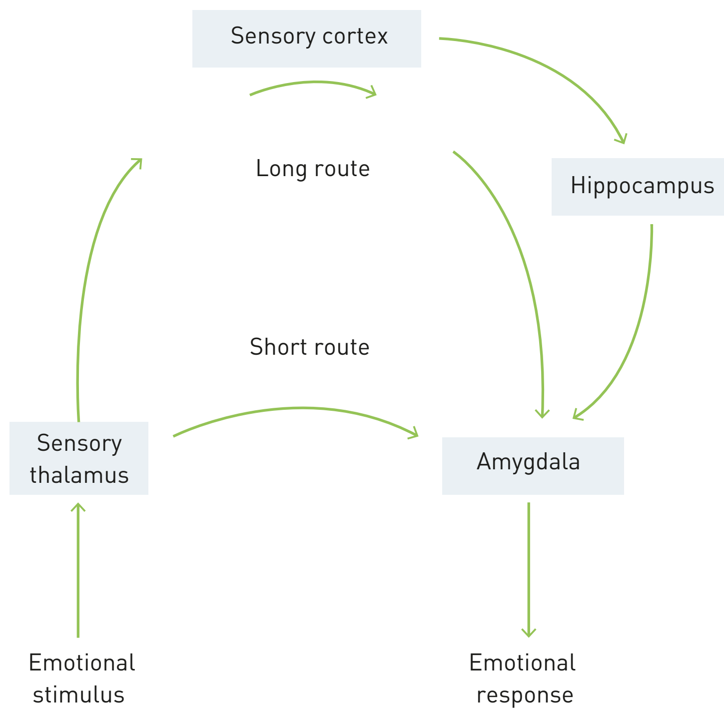


FIGURE 19.6 For a person with a phobia of spiders, a spider-like object (emotional stimulus) is detected by the sensory thalamus. This message of potential danger takes the short route to the amygdala that initiates the emotional response (fight-flight-freeze response). After the emotional response has occurred, the threat information is finally received (via the long route) in the sensory cortex and then the hippocampus for processing. By the time the person has realised that the object is not a spider, they are already experiencing the fight-flight-freeze response.

Rogan, Stäubli and Le-Doux (1996) explored the relationship between long-term potentiation and the role of the amygdala in memory and fear conditioning in rats. They used classical conditioning techniques where a tone (neutral stimulus) was relayed directly into the brain of a rat via an electrode. The rats were then placed into a specifically designed chamber that could deliver an electric shock under their feet (unconditioned stimulus). The tone was activated immediately before the shock was applied. The rats were classically conditioned to fear (conditioned response) 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 were demonstrating behaviours and physiological responses consistent with a phobia. The researchers concluded that long-term potentiation (changes to the brain's structure during memory formation of the fear) had occurred in the rat's amygdala.

GABA AND GLUTAMATE

The neurotransmitters GABA (gamma-amino butyric acid) and glutamate play an important role in maintaining the right balance in our nervous system so that our levels of anxiety (physiological arousal) remain at an optimal level. GABA has an inhibitory role on the fight-flight-freeze response and glutamate has an excitatory role, and the two transmitters work together. When a person has low levels of GABA, the increased presence of glutamate increases agitation and anxiety and can contribute to their developing a specific phobia.

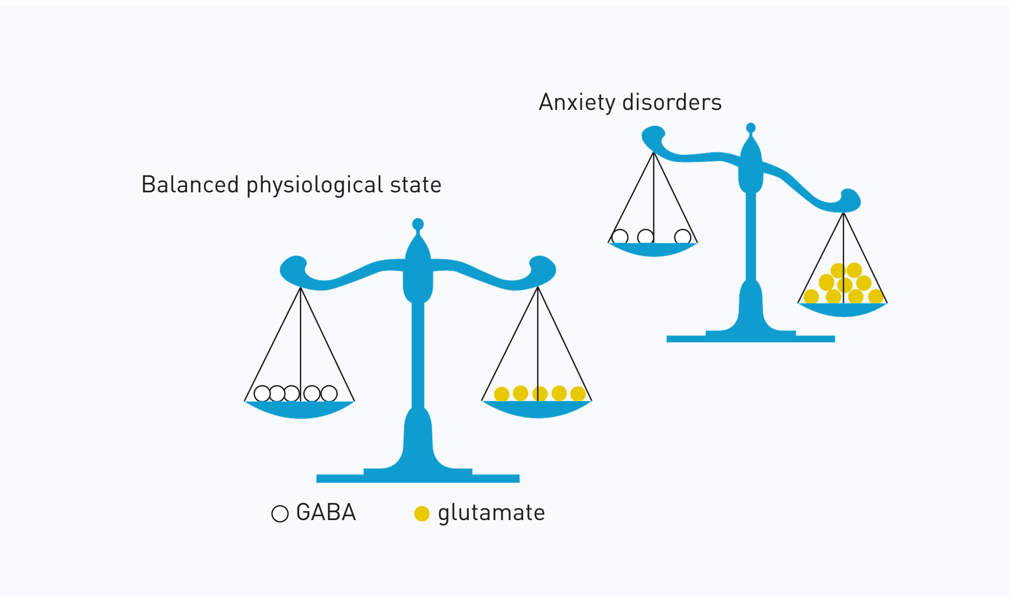


FIGURE 19.7 We need just the right amount of GABA and glutamate to maintain appropriate levels of anxiety.

GENETIC PREDISPOSITION AND INHERITED VULNERABILITIES

Can a specific phobia be inherited? In a way, it can. It is not the phobia itself, however, that is inherited, but the person's biological make up that can lead to a genetic vulnerability – such as being born with low levels of GABA. This vulnerability is also expressed in personality: individuals who are apprehensive about environmental objects and events are more likely to develop anxiety disorders and specific phobias. Although a person may have the genetic predisposition to develop a specific phobia, they will not necessarily develop one. Certain psychological, social and environmental influences will increase this likelihood.

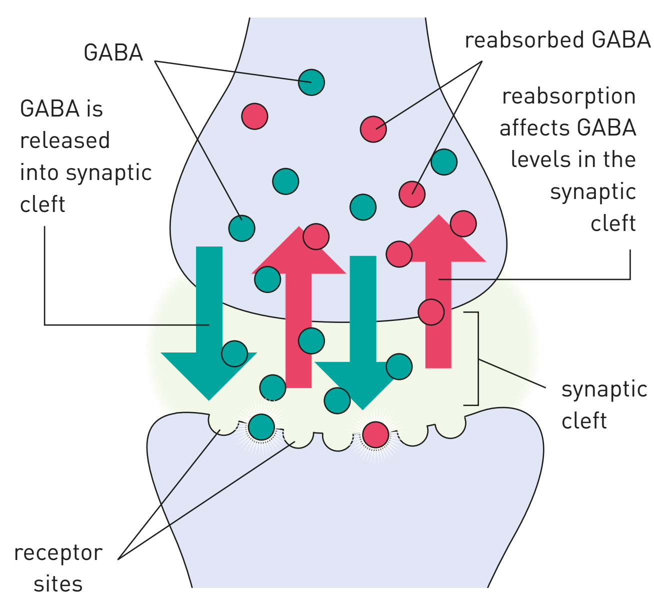


FIGURE 19.8 GABA at a synapse

Contributing psychological factors

How do the different psychological approaches explain the development, reinforcement and management of specific phobias?

The psychological factors involved in developing a specific phobia refer to 'our thoughts, beliefs and perception about ourselves, our experiences and our environment' (Jacofsky *et al*., 2010). Essentially, we are the sum of our experiences and, depending on genetics and personality, we will interpret environmental events in our own unique way. This allows people to develop mental shortcuts (heuristics) that enable them to function at work, with family and friends, and within the community at large. Those who are more sensitive and anxious and feel less in control are more likely to notice events in their environment and to view them as potentially threatening, even though they may not be. These thoughts and perceptions play a key role in developing a specific phobia.

How do different theoretical approaches explain the specific phobia? In the next section, we will examine the behavioural and cognitive models to see how they differ.

THE BEHAVIOURAL MODEL

Precipitation of specific phobia through classical conditioning

The behavioural approach examines how an organism's behaviours are influenced by **environmental factors** and downplays the importance of thinking processes (cognition). According to the behavioural model, specific phobias are learnt through classical conditioning and maintained through operant conditioning.

FIGURE 19.9 People who suffer from a specific phobia have shown a tendency to perceive events as more threatening than those who do not.

Watson's controversial experiment involving 'Little Albert' (see Chapter 6) demonstrated that an intense fear response can be classically conditioned at the sight of a rat and generalised to other stimuli. Essentially, Watson and Rainer enabled the scientific community to find a behavioural explanation for the development of a specific phobia.

As we learnt in Chapter 6, a neutral stimulus paired with an unconditioned stimulus elicits an unconditioned response. However, this can develop into a conditioned response if the stimulus is appropriately conditioned. In other words, we can develop a phobia of a neutral stimulus because we have been conditioned to associate it with fear. Through this process people can develop phobias of such things as clowns or birds. While some people may view these things as harmless, others have been conditioned to be afraid of them.

Perpetuation of specific phobia through operant conditioning

Having a specific phobia is not just as simple as learning through association. The process of a child actively avoiding a visit to the dentist or having a tantrum that makes a session impossible has more to do with operant conditioning.

In the case of the dentist phobia, the avoidance of an unpleasant injection acts as a negative reinforcer that strengthens the likelihood of that behaviour being repeated.

You could also say that the 'good' feeling of relief (at being able to avoid the injection) presents a positive reinforcement of the behaviour.

While classical and operant conditioning provide convincing behavioural explanations for the acquisition of a specific phobia, they do not fully explain situations where people are phobic about objects or events that they have never experienced.

THE COGNITIVE MODEL

Unlike the behavioural model, the cognitive model emphasises the influence of thought processes on how we feel and behave. In treating specific phobia, psychologists use this model to examine and challenge the distorted thinking processes involved in the development and maintenance of the condition. The cognitive approach also reflects the notion that anxious individuals are likely to interpret situations, objects or activities as more dangerous than the average individual (Beck & Emery, 1985).

Our thoughts can be very powerful in influencing our behaviours and emotional responses. Studies have found that people who suffer from a specific phobia commonly report 'anxious beliefs, experience unrealistic expectations and make improbable predictions about the potential danger in a situation. In essence, they are reflecting 'cognitive bias', (Hood & Antony, 2012).

Cognitive bias refers to a 'systematic error in thinking that affects the decisions and judgements that people make'. This can also involve **memory bias** where a memory has been encoded inaccurately and influenced by the person's distorted thinking. Consequently, each time the person remembers the situation, object or event, it is usually more catastrophic or threatening than it really is.

Cognitive bias can involve **catastrophic thinking**, in which a person ruminates or obsessively thinks about a perceived threat. As the person overestimates the threat in a way that is often irrational, thoughts of worst-case scenarios lead them to an increased state of anxiety about the (often imagined) potential dangers of their specific phobia.

This situation can be worsened when the person shows an **attentional bias**, or preference for noticing threat-relevant information as they remain more alert to their environment. For example, a person who suffers from arachnophobia will remain on high alert at all times in case there is a spider nearby. This can lead to

BEFORE CONDITIONING

Neutral stimulus (NS) → No response

Unconditioned stimulus (UCS) *pain from injection* → Unconditioned response (UCR) *fear: due to pain from injection*

DURING CONDITIONING

NS *dentist* + UCS *pain* → UCR *fear: due to pain from injection*

AFTER CONDITIONING

conditioned stimulus (CS) *visit to the dentist* → conditioned response (CR) *fear: due to visit to dentist*

FIGURE 19.10 Acquisition of a dentist phobia through classical conditioning

FIGURE 19.11 Exposure to a parent's specific phobia can teach a child to fear the same stimulus.

the misreading of ambiguous stimuli – such as a small piece of fuzzy black fabric – as a spider and can lead the person to believe that the probability of being harmed by a spider is greater than it actually is. A study conducted by Jones and Menzies (2000) found that individuals with a spider phobia had a tendency to 'overestimate the probability and consequences of being bitten' and tended to demonstrate avoidance behaviours.

Once a specific phobia has been established, according to both behavioural and cognitive and approaches, avoidance behaviour is key to maintaining the anxiety around it. For a person with arachnophobia, this behaviour may include wearing gloves and protective clothing, placing clothes in sealed plastic containers or simply not going into areas where they fear a spider might lurk. These avoidant coping strategies are considered maladaptive. They alleviate the immediate feelings of anxiety in the short term. However, they do not help the person to change their persistent unrealistic beliefs.

Contributing social factors

Social and cultural factors can contribute to the type and incidence of specific phobia. Research has found that a child whose parent suffers from a phobia of moths, for example, is more likely to develop the same phobia as a result of simply observing their parent's fear response and making the cognitive connection that 'moths are dangerous'.

Sometimes, a parent, partner or friend may help to maintain the avoidance behaviour by trying to be helpful. For example, consider the person with arachnophobia. Spiders can be found in the garden, in cupboards and under beds. In fact, they live both inside and outside the home. A well-meaning parent may think that they are assisting their child by using insect repellents and not asking their child to help in the garden or take the clothes off the line. They are in fact encouraging avoidant behaviours and unwittingly helping the child to maintain the phobia.

ENVIRONMENTAL TRIGGERS

In many instances, specific environmental triggers can lead to the development of a specific phobia. There are three possible environmental paths:

1. direct exposure to a distressing or traumatic event, such as being attacked by a dog
2. witnessing other people experiencing a traumatic event, such as seeing another person being attacked by a dog
3. reading or hearing about dangerous situations or events, for example, developing a fear of dogs after hearing stories about children, adults or family pets being attacked by a dog.

PARENTAL MODELLING

Albert Bandura combined behavioural and cognitive approaches to develop social learning theory. According to this theory (discussed in Chapter 8), a great deal of our behaviour is learnt through imitating or modelling other people's behaviours. According to this theory, specific phobias can be learnt by observing other people's phobic reactions. Consider this scenario: a child is raised in a household where a parent is terrified of moths. Each time the parent sees one, they exhibit their fear by screaming and running out of the house. This increases the child's anxiety and leads them to believe that moths are dangerous and should be avoided at all costs. Thus, children whose parents show phobic responses are more likely to develop comparable fears of similar stimuli. Parental modelling can lead to the transmission of threat information, which is incorporated into the child's long-term memory.

TRANSMISSION OF THREAT INFORMATION

The transmission of information that a person perceives as threatening is not limited to the parent and child relationship. Information can be received from a range of different sources including the media, internet, friends and school. A student, who is interested in travelling, might develop a fear of flying if each time they Google 'travel or flying' they get plane crash websites with graphic pictures or video clips. If their fear prevents them from being able to board a plane, then threat information delivered by the internet has led to a specific phobia.

STIGMA AROUND SEEKING TREATMENT

As with a number of different mental health conditions, there is often a stigma attached to a person seeking treatment. Stigma refers to a 'mark of disgrace' that labels a person as different and separates them from others. A person suffering from a specific phobia may experience embarrassment, shame, distress, helplessness, sadness or anxiety as a result of their illness.

Consequently, individuals are less likely to seek or accept help and often go untreated for years. This not only affects the person suffering with the mental disorder, but also their family and friendship group. Imagine how difficult it would be if a family member had a phobia about flying? How would you be able to go on a holiday overseas together? Alternatively, if a friend of yours had a phobia of insects, going on a camping trip with them would be impossible.

INVESTIGATE 19.3

RESEARCH A WEBSITE

In pairs or small groups, investigate an online organisation that offers support for individuals suffering from a specific phobia and answer the questions below.

Who could use this website?

1 What sort of information does this website provide?
2 Which mental disorders does this organisation work with?
3 Where is the organisation located? Can it be contacted?
4 What is some other relevant information about the organisation?

REVIEW 19.2

1 Can specific phobia be inherited? Explain.
2 Give an example of a psychological factor in specific phobia.
3 Explain the behavioural model of specific phobia using the appropriate terms.
4 How can psychologists use the cognitive model to understand specific phobia?
5 How might parents impact their children's development of a specific phobia?

Evidence-based interventions

The good news for the many people who suffer the anxiety and stress associated with a specific phobia is that treatment is available. The treatment options explored here are anti-anxiety medication, relaxation techniques and exercise, cognitive behavioural therapy, systematic desensitisation and psychoeducation.

Anti-anxiety medication

Earlier in the chapter we discovered that low levels of GABA contributes to the development of an anxiety disorder such as a specific phobia. Research has found that anti-anxiety drugs that mimic GABA's inhibitory effects have been a successful form of treatment. These include benzodiazepines such as Lorazepam (Ativan), Clonazepam (Klonopin) and Diazepam (Diastat, Diazemuls and Valium). However, medication alone is not usually sufficient and many health professional also use other evidence-based treatments.

Breathing retraining and exercise

As a specific phobia is an anxiety disorder, the person experiences significant physiological symptoms that can be quite frightening. Breathing retraining and exercise are two biologically based interventions that can help to alleviate these uncomfortable physical responses:

1 Stop what you are doing and sit down or lean against something.
2 Hold your breath and count to 10 (don't take a deep breath).
3 When you get to 10, breathe out and say the word 'relax' to yourself in a calm, soothing manner. Remember to breathe through your nose.
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 overbreathing have gone.
7 If this is done at the first signs of overbreathing, the symptoms will subside within a minute or two and an anxiety attack will not follow.

Adapted from Andrews *et al.*, 1996

BREATHING RETRAINING

Breathing retraining is based on the notion that when a person is stressed, they tend to 'overbreathe' or breathe too quickly (hyperventilation). This can cause dizziness, palpitations, tingling in the fingers or body and pressure or tightness in the chest. Hyperventilation is not dangerous, however, it can be frightening as it is part of a typical fight-flight-freeze response.

With breathing retraining, individuals are taught to use a slow-breathing technique to manage the effects of hyperventilation and this is recommended as soon as the person begins to feel anxious. This technique can also be used to help lower a person's overall levels of anxiety.

EXERCISE

When we suffer from a specific phobia and are faced with the threat object, our HPA axis triggers a predictable sequence of biological processes to help mobilise our physical resources to deal it. Once hormones such as adrenalin, noradrenalin and cortisol are released into the bloodstream, we experience the usual arousal symptoms and glucose is released to give us that extra energy boost needed to deal with the phobic stimulus. If we are not physically active during one of these physiologically arousing events, we find ourselves feeling agitated and anxious and will most likely experience hand tremors and sweaty palms. Vigorous exercise is a great way to work off this anxiety. As discussed in Chapter 4, beta-endorphins are also produced during physical exercise and, along with serotonin and dopamine, help improve our mood and even give us a sense of euphoria.

Cognitive behavioural therapy

Cognitive behavioural therapy (CBT), often combined with relaxation, has been successfully used to treat a wide range of specific phobias. CBT uses a combination of verbal and behavioural modification techniques to help change irrational patterns of thinking that create and maintain a specific phobia. CBT focuses on helping the person change negative, dysfunctional thoughts and replace them with more positive, realistic ones. According to this model, there is a cycle that occurs. When a person is exposed to the object or situation (stimulus), negative thoughts lead to an emotional (distress) and a biological (fight-flight-freeze) response. The person then alters their behaviour (actively avoids the object or situation).

In CBT, the person is encouraged to recognise that the incidence of exposure to the threat object or environment is seldom and their catastrophic thoughts are not based on reality. The person is taught to monitor and document the occurrence of these negative thoughts in an 'automatic thought diary'. As the person becomes more aware of their frightening/anxious thoughts, they begin to understand that they are based on incorrect assumptions and, with the help of the therapist, learn to change them to more realistic and positive ones such as: 'Flies are not dangerous,' and 'If a fly lands on me, I won't die.' The therapist gives homework to assist the client to change their thoughts and behaviour until eventually they can deal with the feared stimulus without experiencing the phobic response.

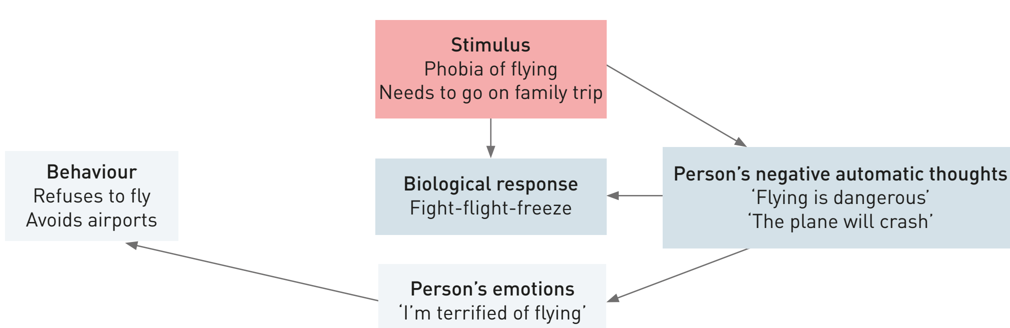


FIGURE 19.12 When a person with a fear of flying is told they need to go on a family trip, they experience negative automatic thoughts that elicit feelings of fear and terror. This situation activates the fight-flight-freeze response and the person refuses to fly so as to avoid their fear.

Systematic desensitisation

In 1958, Joseph Wolpe developed graduated exposure, which involves teaching relaxation and **systematic desensitisation**. It is based on the assumption that most anxiety responses are initially acquired through classical conditioning and that, therefore, eliminating a specific phobia can be achieved through *counter-conditioning* or weakening the association between the conditioned stimulus (for example, rat, needle, flying) and the conditioned response of fear or anxiety. This is done in three steps:

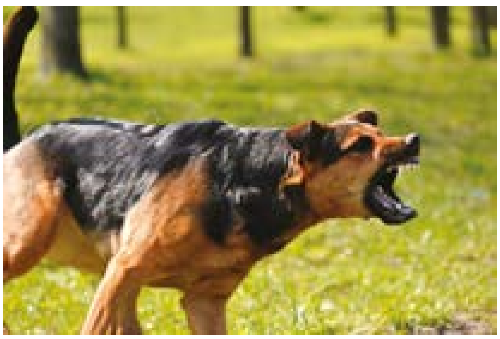


FIGURE 19.13 *Cynophobia* is a fear of dogs.

1. The therapist trains the client in deep muscle relaxation.
2. The therapist helps the client build an anxiety/fear hierarchy. The client makes a list of anxiety-causing stimuli that are linked to their specific phobia, from least anxiety/fear-inducing to most anxiety/fear-inducing.
3. The client tries to work through the hierarchy, learning to remain relaxed while imagining each stimulus on their hierarchy. This is repeated until the person can imagine each situation or object with little or no anxiety/fear.

Initially, treatment is done within a therapeutic environment and, when or if appropriate, desensitisation is achieved through gradual exposure to the fear object in a safe and controlled manner. For example, if you have a fear of dogs, exposure can take the following path with the accompanying relaxation techniques at each step.

1. Teach patient relaxation techniques.
2. Develop a hierarchy of fear with the person from what causes them the least to the most fear.
3. Work through the hierarchy.
4. Draw a dog on a piece of paper.
5. Read about dogs.
6. Look at photos of dogs.
7. Look at videos of dogs.
8. Look at dogs through a closed window.
9. Look at dogs through a partly opened window.
10. Look at dogs from a doorway.
11. Move further out from the doorway.
12. Have a dog on a leash brought into the room.
13. Have a dog on a leash sit beside you.
14. Pat the dog's head while it is on a leash.

Although systematic desensitisation has been useful in treating specific phobia, the following points should be considered:

> Systematic desensitisation is less effective in treating performance fears such as exam anxiety if the person doesn't study. In this instance, the anxiety is based on lack of preparation rather than a phobia of exams.

> It may not be effective in treating specific phobias that have an underlying evolutionary survival element, such as fear of spiders, fear of the dark, or fear of other dangerous animals or situations.

Psychoeducation

Psychoeducation involves educating the sufferer of the mental disorder and their family to better understand the condition and treatment options. The information helps to dispel any myths surrounding the disorder and the individual is more likely to feel empowered as they are helped to develop more adaptive coping strategies.

From the family's point of view, psychoeducation provides much-needed support and an opportunity to discover effective ways of helping their relative.

A person suffering from a specific phobia needs the support of their family and friends to help manage their condition. They often experience fear on a daily basis – yet, they may only see their mental health professional once a week or even once a fortnight. How can family and friends help in between? As part of the psychoeducation strategy, some of the following recommendations may be made:

> Challenge unrealistic or anxious thoughts and help the sufferer to replace these with more realistic ones.
> Do not encourage avoidance behaviours.
> Provide evidence to help with catastrophic thinking.
> Challenge cognitive and memory bias.
> Underplay threat information.
> Encourage positive thinking.
> Go for a walk together – as this is a great stress release.
> If the sufferer experiences a panic attack/stress response, help support them with controlled breathing exercises.

RESEARCH INVESTIGATION

19.4 INVESTIGATE

Read the following account of an experiment and answer the questions below.

Participants were randomly selected to participate in a study that involved observing a person sitting in a chair, attached to a complex range of electrical apparatus. A buzzer sounded intermittently and the person, in what appeared to be great pain, would stand quickly and remove their hand from the arm of the chair. While the participants observed the individual in the chair, their physiological responses were monitored. What the participants did not know was that the person in the chair was not actually experiencing any pain or discomfort – they were pretending! Having observed the 'stooge's' pain reaction, the participants learnt to react emotionally to the sound of the buzzer, demonstrating that vicarious learning had taken place.

1 Write a possible aim for this experiment.
2 Write a hypothesis.
3 Discuss two ethical considerations for this experiment.

19.3 REVIEW

1 Use your textbook and the internet to complete the following table:

TREATMENT TYPE	ADVANTAGES	LIMITATIONS
CBT		
Systematic desensitisation		

2 Little Albert had a phobia of rats. Outline how a therapist could use CBT to cure Little Albert of his phobia. Use a step-by-step process to illustrate your understanding.
3 List some of the ways relatives might assist the specific phobia sufferer according to the psychoeducation strategy.

CHAPTER SUMMARY 19

- Specific phobia is a form of anxiety disorder that is defined as a persistent, irrational and intense fear of a particular thing, animal, situation, activity or person that interferes with a person's day-to-day functioning.
- Individuals with specific phobia experience both psychological and physiological symptoms. The fight-flight-freeze response is elicited when the person is faced with the object, situation or activity that they fear.
- The severity of a specific phobia can be rated along a mental health continuum. One model characterises the relationship with a potentially phobic object as *healthy*, *reacting*, *injured* and *disorder*.
- The biopsychosocial approach to understanding and managing specific phobia takes into account genetic vulnerability, levels of the neurotransmitter GABA, physiological processes, psychological determinants, sociocultural factors, family history of anxiety/specific phobia and environmental influences.
- The amygdala is pivotal in initiating and processing emotional responses such as fear and anxiety. It works together with the hippocampus where the formation and storage of classically conditioned fear is stored.
- In explaining the development of a specific phobia, the behavioural model focuses on the importance of behaviours and downplays the importance of thinking, while the cognitive model does the opposite.
- Social and cultural factors can contribute to the type and incidence of specific phobia. Environmental triggers can include direct exposure, witnessing other people experiencing a traumatic event or reading or hearing about a traumatic event. Other factors include parental modelling.
- There is often stigma attached to people seeking treatment. A person suffering from a specific phobia may feel different and embarrassed by their illness. People with a mental disorder are often unfairly grouped together or stereotyped.
- Biological methods used to treat specific phobia include the use of anti-anxiety drugs that mimic GABA's inhibitory effects; breathing retraining, which helps lower a person's overall levels of anxiety and exercise, which is a useful method of using up stress hormones such as adrenalin, noradrenalin and cortisol and releasing beta-endorphins.
- Cognitive and behavioural methods used to treat specific phobia include cognitive behavioural therapy (CBT) that assists people to alter their negative automatic thoughts and systematic desensitisation, where the person is gradually exposed to the source of their fear while using relaxation techniques.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following terms and concepts and be able to relate them to an example where appropriate:

- amygdala
- anxiety disorders
- behavioural model
- breathing retraining
- cognitive behavioural therapy (CBT)
- cognitive model
- environmental triggers
- fight-flight-freeze response
- GABA (gamma-amino butyric acid)
- hippocampus
- long-term potentiation
- mental health continuum
- modelling
- neurotransmitter
- sociocultural factors
- specific phobia
- systematic desensitisation.

KEY KNOWLEDGE

For assessment, you must be able to show your understanding and apply your knowledge of:

- biological contributing factors in a specific phobia
- specific phobia as an anxiety disorder on the mental health continuum
- the difference between stress, anxiety and specific phobia
- role of the fight-flight-freeze response
- neurotransmitters gamma-amino butyric acid (GABA) and glutamate
- psychological contributing factors in specific phobia
- behavioural explanation of specific phobia: classical conditioning and operant conditioning
- cognitive explanation of specific phobia
- cognitive and memory bias and catastrophic thinking
- treatment methods – cognitive behavioural therapy and systematic desensitisation
- sociocultural contributing factors in specific phobia – specific environmental triggers and parental modelling
- stigma around seeking treatment
- biopsychosocial approach to understanding and management of specific phobia
- sociocultural contributing factors.

RESEARCH METHODS

For the exam, you must be able to discuss behavioural models and demonstrate their link to understanding specific phobia.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 How many subcategories of specific phobia exist?
  a four
  b two
  c three
  d five

2 Which of the following is not a subcategory of specific phobia?
  a natural environmental phobia (for example, fear of the dark)
  b animal phobia (for example, fear of rats)
  c social phobia (for example, fear of interacting with others)
  d situation phobia (for example, fear of flying)

3 When do most specific phobias first appear?
  a after developing social phobia
  b during childhood
  c at any time, but particularly in early adulthood
  d at any time, but particularly during adolescence

4 Which of the following terms is not reflected in the mental health continuum as it relates to specific phobia?
  a healthy
  b injured
  c disorder
  d developing

5 Young Roger is terrified of dogs, particularly big black-and-white ones. What does he experience whenever he sees a dog?
  a the fight-flight-freeze response
  b the amygdala reaction
  c the run-or-hide response
  d the hippocampus reaction

6 What type of role does the neurotransmitter GABA play in regulating anxiety?
  a excitatory
  b inhibitory
  c agonistic
  d synaptic

7 Which of the following brain structures are involved in initiating and processing the fear response?
  a amygdala; hippocampus
  b hippocampus; pons
  c amygdala; pons
  d hippocampus; adrenal gland

8 Which of the following is not considered a biologically based treatment for a specific phobia?
  a anti-anxiety medication
  b cognitive behavioural therapy
  c exercise
  d breathing exercises

9 Unlike the behavioural model, the cognitive model emphasises the importance of:
  a thought processes
  b personality predispositions
  c psychodynamic factors
  d cultural and environmental elements.

10 Which of the following is not involved in the process of systematic desensitisation?
  a training the client in relaxation techniques
  b confronting the phobic object to purposely trigger the fight-flight-freeze response
  c developing a hierarchy in relation to aspects of the phobic object or environment
  d gradually exposing the client to aspects of the phobic object or environment

SHORT ANSWER

11 At what point is a rational fear considered to have become a specific phobia?

2 marks

12 Explain the relationship between anxiety disorders and specific phobia.

3 marks

13 Outline one biological factor that can contribute to the development of a specific phobia.

1 mark

14 Explain the role of classical and operant conditioning in specific phobia.

2 marks

15 'Today, therapists take a biopsychosocial approach to the treatment and management of specific phobia.' Explain what this statement means.

3 marks

16 Amanda has a fear of birds. When she is outside, she actively avoids walking near them and at school she sits away from the courtyard where flocks of pigeons tend to gather. Images or videos of birds make her uncomfortable and bird sounds make her nervous.

a What type of specific phobia is Amanda suffering from?

1 mark

b Would you categorise Amanda's specific phobia as healthy, reacting, injured or disorder on the mental health continuum? Explain why.

1 mark

c What reactions would she need to show to downgrade her phobia to the category below what she is currently experiencing?

2 marks

d What reactions would she need to show to elevate her to the next category?

2 marks

17 Create a situation for a person suffering from a specific phobia.

a Using Figure 19.12 as a guide, explain the person's reactions using the cognitive behavioural therapy model.

4 marks

b Now describe how you would treat the person using cognitive behavioural therapy.

4 marks

18 In terms of the cognitive model, explain the difference between cognitive, memory and attentional bias.

5 marks

CHAPTER 20

MAINTENANCE OF MENTAL HEALTH

Do you deal with change well? What about stress? How do you cope when you have several SACs due in one week? As well as understanding the problems that can arise with mental health, it is important to recognise the need to maintain good mental health in order to function day by day and perhaps prevent mental health issues from occurring in the first place. In this chapter we will discuss protective factors for maintaining mental health as well as examining a model of how positive behavioural change can occur.

KEY KNOWLEDGE

> resilience as a positive adaptation to adversity including the relative influence of protective factors with reference to: adequate diet and sleep (biological); cognitive behavioural strategies (psychological); support from family, friends and community (social)

> models of behaviour change with reference to the transtheoretical model including the stages of pre-contemplation, contemplation, preparation, action and maintenance/relapse

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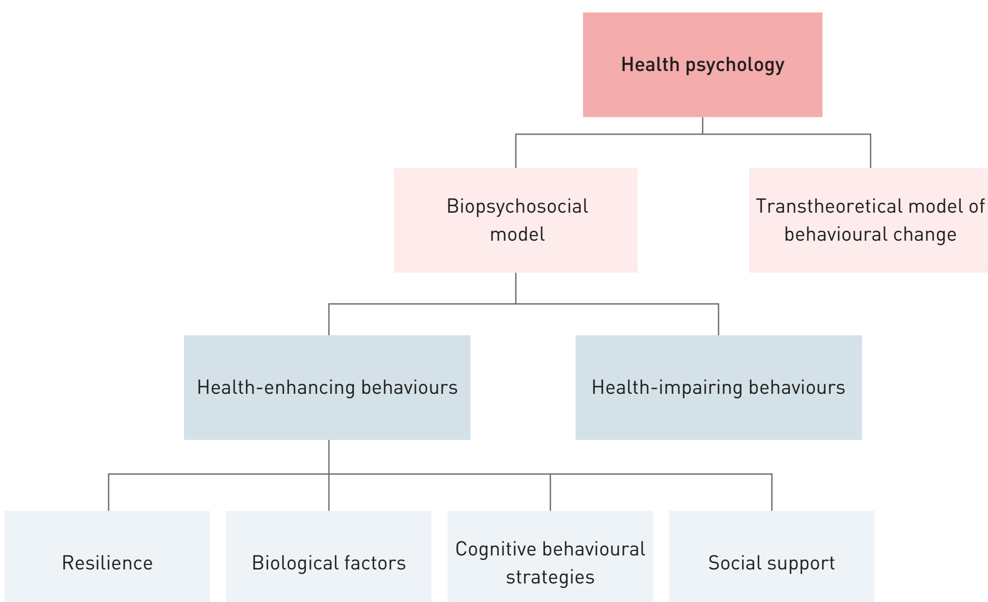
CHAPTER OVERVIEW

Health psychology	The biopsychosocial model of health > biological factors > psychological factors - resilience > social support factors
The transtheoretical model of behaviour change	Pre-contemplation Contemplation Preparation Action Maintenance Termination

CONCEPT MAP



Health psychology

What does it mean to be healthy? What affects our health? In the past, people considered it in terms of biological and medical aspects, but today we must also consider the psychological ones. The branch of psychology known as **health psychology** combines research on physical health and psychology to better understand how this relationship contributes to overall wellbeing and to develop holistic strategies to promote it.

For health psychologists an individual's behaviours, together with their thoughts and feelings, are central to understanding and improving their health. Hence, they attempt to promote *health-enhancing behaviours*, as opposed to *health-impairing behaviours*. An example of a health-enhancing behaviour is resilience. This is the ability of an individual to demonstrate positive adjustments to negative life events. Resilience is important as it helps to protect us against mental health problems and maintain our wellbeing.

FIGURE 20.1 In the biopsychosocial model of health, health and illness are interrelated through biological, psychological and social factors.

The biopsychosocial model of health

Health psychology follows the biopsychosocial model of health, where health and illness are interrelated through biological (for example, genetics), psychological (for example, stress and beliefs about health) and social (for example, culture, gender, family and relationships) protective factors.

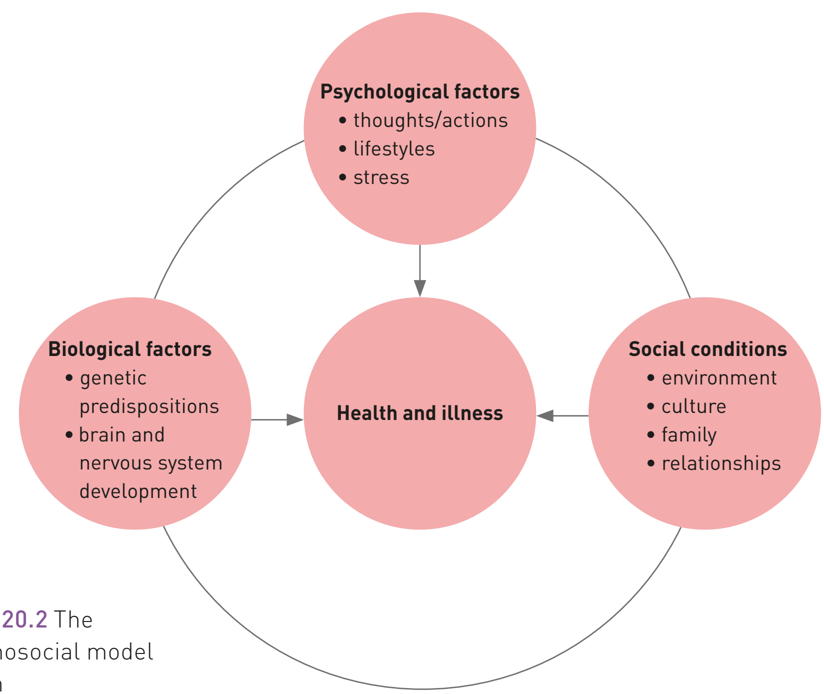


FIGURE 20.2 The biopsychosocial model of health

BIOLOGICAL FACTORS

Biological factors such as sleep, diet and exercise can all affect mental health, and it was not until the 1970s that research highlighted the effects of lifestyle on mortality. The research used 7000 adult participants and studied the relationship of seven good health practices to life expectancy (see Figure 20.3). These good health practices were:

> sleeping 7–8 hours per day
> eating breakfast
> not smoking
> not eating between meals
> being at or near the prescribed body weight
> taking regular exercise
> consuming moderate amounts of alcohol.

It was found that those good health practices predicted a longer life, compared to those participants with poor health practices (Belloc, 1973).

Sleep

In Chapters 14, 15 and 16 you read about the need to sleep and the theories as to why we sleep. It is important to remember that sleep is also necessary to maintain mental health and to be aware of the recommended amount of sleep for your age. Resilience improves when an individual has enough sleep, because they are able to deal with adversity and challenges better. Chronic sleep deprivation can create negative thinking and emotional vulnerability. A link has also been demonstrated between poor sleep and mental health problems such as anxiety and depression. Also, worrying about your poor sleep can create a vicious cycle, because the more you worry you can't sleep, the more you won't be able to.

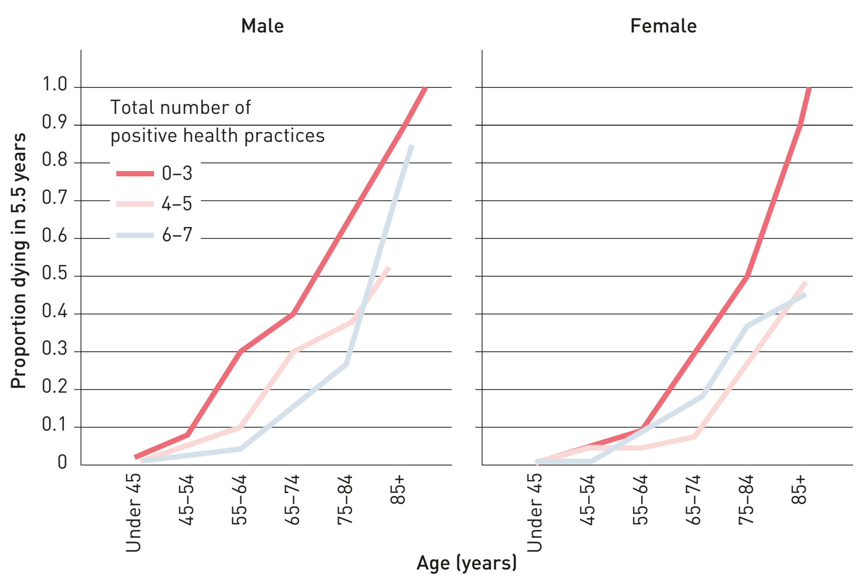


FIGURE 20.3 This data set shows the link between positive health practices and longevity in men and women. Those who adhered to few of the health practices experienced earlier mortality, with the pattern appearing earlier in men than in women.

INVESTIGATE 20.1

In the 1970s, the Australian Government launched the 'Life. Be in it.' campaign. Research the campaign on the internet and answer the following questions.

1 What was the aim of the 'Life. Be in it.' campaign?
2 What year was the campaign introduced?
3 Why was the campaign introduced?
4 Who was the character 'Norm' portraying?
5 How successful was this campaign?
6 What is the relevance of the campaign for today?

Diet

An overall healthy diet is one that includes lots of fresh, unprocessed and nutrient-dense foods, including an adequate amount of complex carbohydrates, essential fats, amino acids, vitamins and minerals, and water.

A good diet is essential as it not only provides us with the energy to sustain an active lifestyle and promote healthy growth and development, but it is great for our brains as well. When people lead a healthy lifestyle, they feel better and fitter and are more able to cope with challenges.

There is also growing evidence to suggest that a healthy diet may contribute to the management and prevention of specific mental health problems such as depression, schizophrenia, ADHD and Alzheimer's disease. Some research has indicated that diet quality is also associated with improved mental health in adolescents, but it is unclear whether their food choices affect their mental health or their mental health affects their food choices (Jacka *et al.*, 2011).

INVESTIGATE 20.2

Research the effects of a healthy diet on mental health and create a poster of your findings that targets adolescents.

PSYCHOLOGICAL FACTORS

Cognitive behavioural therapy (CBT) involves cognitive behavioural strategies that are psychological techniques used to help maintain or improve mental health. The aim of these strategies is to change unhelpful beliefs and thought patterns that affect a person's mood and behaviours. In turn, it is thought that the changes in mood and behaviour will affect negative beliefs and thought patterns. In Chapter 19, you will have read about the use of CBT to deal with specific phobias. Another type of CBT involves mindfulness-based therapies; this is known as Mindfulness-integrated cognitive behavioural therapy (MiCBT). Mindfulness-based therapies teach people to observe and change their connection to maladaptive thoughts and emotions. This approach requires them to deliberately focus their attention on the present experience in a non-judgemental manner through meditation and other **mindfulness** practices.

Our beliefs play an important role in how we deal with challenges or stressors. Research has indicated that optimistic people are at lower risk for anxiety and depression when they confront stressful events. Chang (1998) found that people with optimistic beliefs felt less helpless when facing stress and adjusted better to negative life events than pessimists.

The ability to demonstrate positive adjustments to negative life events is known as resilience, and is another important psychological contributor to mental health. Your levels of resilience can change over the course of your life. Masten and Coatsworth (1998) found that children possess certain characteristics that can contribute to positive outcomes when faced with challenges (see Table 20.1). Some of these charateristics are adequate intellectual functioning, social skills and environmental factors.

TABLE 20.1 Personal and environmental factors that contribute to stress resilience in children

SOURCE	CHARACTERISTIC
Individual	> Good intellectual functioning > Appealing, sociable, easygoing disposition > Self-efficacy, self-confidence, high self-esteem > Talents > Faith
Family	> Close relationship to caring parent figure > Authoritative parenting: warmth, structure, high expectations > Socio-economic advantages > Connections to extended supportive family networks
Extrafamilial context	> Bonds to pro-social adults outside the family > Connections to pro-social organisations > Attending effective schools

Source: Masten & Coatsworth, 1998

While some people may believe that they have a charmed stress free life, they will one day experience adversity, and resilience is needed to deal with it.

Mark Seery and colleagues (2010) conducted longitudinal research on resilience, more specifically, the relationship between wellbeing and exposure to negative life events (see Figure 20.4). They found that people who experienced moderate levels of cumulative adversity (the total amount of negative events experienced over a lifetime) were more likely to develop resilience. In other words, they were able to cope with stress and adversity, as well as adapt to negative circumstances and 'bounce back'. The researchers also found that those who experienced a high level of adversity had poor health outcomes and those who were never exposed to stressful situations did not develop the ability to cope with adversity.

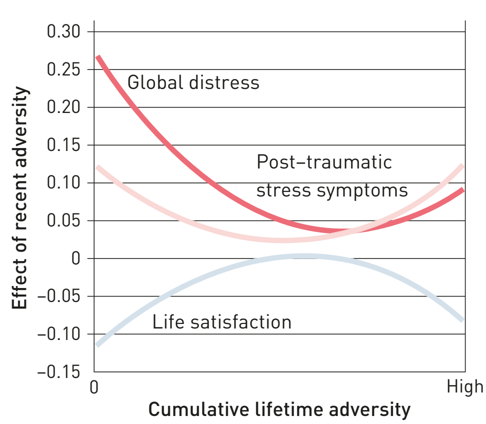


FIGURE 20.4 Mark Seery *et al.* (2010) found that people who experienced some adversity in their life could cope with stressors better than people who experienced high levels of adversity or none at all.

INVESTIGATE 20.3

Go online and search for an article or study on the positive effects of mindfulness-based therapies, then answer the following questions:

1 Write a hypothesis for this study.
2 Who were the participants for this study?
3 What type of research design was used in this study? Provide evidence.
4 What were the findings?
5 How is the biopsychosocial model of health illustrated in this article?

FIGURE 20.5 Social support can come from our family, friends, co-workers and classmates in times of need.

SOCIAL SUPPORT FACTORS

Can good friends help reduce stress? The answer is yes. There has been mounting evidence to support the idea of the important moderating effects of social relationships (Weiten 2009).

Social support is also important for maintaining physical and mental health. Social support refers to the resources other people provide, such as the message that one is loved, cared for and connected to other people. Social support can come from family members, friends, co-workers and neighbours. It is not only emotional, but tangible. For example, it may be financial, or in the form of transportation or housing. Social support may also include informational support such as advice, information and feedback.

Studies have shown that social support decreases psychological distress in people who are dealing with stressful life events (Pakenham *et al.*, 2007). Strong social support with the opportunity for emotional disclosure has been found to decrease a person's vulnerability to stress and increase their ability to cope. A solitary person waiting to undergo invasive surgery is likely to experience greater levels of stress and anxiety than another individual who is undergoing the same operation but is surrounded by friends and family. Situations like these are not uncommon and illustrate the importance of social support as a buffer to stress.

In addition, people who know they have social support experience a greater sense of identity and meaning in their lives resulting in greater psychological wellbeing (Cohen, 1988). Social support and networks can reduce loneliness and increase a person's sense of control over stressors. Further, social networks can help by preventing people from dealing with stressors in maladaptive ways such as with alcohol or drugs.

REVIEW 20.1

1 What is the biopsychosocial model of health?
2 What are some of the effects of poor sleep on mental health?
3 What are the elements of a healthy diet?
4 What is the aim of cognitive behavioural therapies?
5 How can the presence of social support factors contribute to an individual's level of resilience?

The transtheoretical model of behaviour change

So far in this chapter we have discussed numerous behaviours that promote and maintain mental health. Psychologists have devoted much time and effort to try to understand the processes that motivate people to adopt such behaviours. This has led to numerous health behaviour theories and models, such as *stage theories*, which are helpful in designing behaviour change interventions. Psychologists James Prochaska and Carlo DiClemente studied the process that occurs when people change their thoughts, feelings and behaviours in a positive way. From their research they developed a widely used stage theory called the **transtheoretical model** (see Figure 20.6).

Stage 1 Pre-contemplation
The person may deny that they have a health-related problem that may endanger their wellbeing or they may feel helpless to change.

Stage 2 Contemplation
The person understands there is a problem or wants to change their behaviours, but has not yet decided to take action.

Stage 3 Preparation
The person has decided to change their behaviours and is making plans to do so; they may also be taking the initial steps to change.

Stage 4 Action
The person begins behavioural changes, and requires behaviour-control skills to fulfil their plan of action through commitment of effort and energy.

Stage 5 Maintenance
The person has successfully avoided relapse and controlled the target behaviour for at least six months. Some people may still relapse into former behaviours at various times, but they restore their change efforts.

Stage 6 Termination
The change in the behaviour is entrenched such that the problem behaviour will not return. The new behaviour has become an automatic habit.

FIGURE 20.6 The transtheoretical model of behaviour change

The transtheoretical model allows psychologists to understand how people change and to develop different intervention strategies at various stages of the model. Psychologists will determine the stage a person is in and will apply *stage-matched interventions* that allow the person to move towards the action, maintenance and termination stages.

For instance, those people stuck in the pre-contemplation stage may require information that convinces them that there is a problem, as well as social support, to change. Those people in the contemplation stage may require an emotional experience that increases their motivation to change or re-evaluate their behaviours. During the preparation stage a person needs to develop a plan of action as well as have the skills to carry it out. When the person is ready for the action stage, their behavioural changes should have the intended effect.

However, it is important to note that people may not go through all the stages in a smooth or continuous sequence. For example, it may take them several attempts to fulfil the action stage before behavioural changes occur.

20.2 REVIEW

1. What is the transtheoretical model of behaviour change?
2. Outline the process a person may go through when trying to quit smoking according to the transtheoretical model of behaviour change.
3. List some of the matched interventions that may be used at the various stages outlined in the transtheoretical model of behaviour change for a person who suffers anxiety.
4. Does the transtheoretical model of change suggest that behaviour change is a continuous process? Explain.

CHAPTER SUMMARY 20

- Health psychology combines research on health and psychology to better understand the relationship between thoughts, actions and physical and mental health.
- Health psychology follows the biopsychosocial model of health, which involves looking at the relationship between biological, psychological and social support factors.
- Health psychologists promote *health-enhancing behaviours*, which aim to maintain or increase health, as opposed to *health-impairing behaviours*, which promote the development of illness.
- Resilience is the ability of an individual to demonstrate positive adjustments to negative life events. It is a health-enhancing behaviour that is important in protecting us against mental health problems and maintaining our wellbeing.
- Biological, psychological and social protective factors help people adopt a healthier lifestyle and maintain mental health.
- Biological factors such as sleep, diet and exercise can all affect mental health.
- Sleep is necessary to maintain mental health. Resilience improves when an individual has enough sleep, because they deal with adversity and challenges better.
- The evidence suggests that a healthy diet may contribute to the development, management and prevention of specific mental health problems such as depression, schizophrenia, ADHD and Alzheimer's disease.
- One psychological factor that contributes greatly to mental health is resilience. This is the ability of an individual to demonstrate positive adjustments to negative life events.
- Cognitive behavioural strategies are psychological techniques that are used to help maintain or enhance mental health. The aim of these strategies is to change unhelpful beliefs and thought patterns that affect a person's mood and behaviours.
- Social support is important for maintaining physical and mental health. Social support refers to the resources other people provide, including emotional, tangible and informational.
- There are numerous health behaviour theories and models, such as stage theories, which are helpful in designing behaviour change interventions. One such model is the transtheoretical model of behaviour change, which encompasses the stages of pre-contemplation, contemplation, preparation, action, maintenance and termination.
- Psychologists develop and apply stage-matched interventions to assist the individual to move from the pre-contemplation stage of the transtheoretical model of behaviour change to the action, maintenance and termination stages.

ESSENTIAL EXAM KNOWLEDGE

KEY TERMS

For the exam, you must know definitions for the following key terms and concepts and be able to relate them to an example where appropriate:

- action
- biological factors
- biopsychosocial model
- cognitive behavioural strategies
- contemplation
- health psychology
- maintenance
- pre-contemplation
- preparation
- resilience
- social support
- termination
- transtheoretical model of behaviour change.

KEY KNOWLEDGE

For the examination you must know about:

- the biopsychosocial model of health
- resilience as a health-enhancing behaviour
- protective biological factors such as sleep and diet
- the protective cognitive factors of cognitive behavioural therapy
- protective social factors such as social support
- the transtheoretical model of behaviour change.

RESEARCH METHODS

For the examination, you must be able to:

- use your knowledge of research methods to evaluate a research study
- apply your knowledge and understanding from this chapter to a related research study
- understand and identify any ethical considerations in relation to researching health-enhancing behaviours.

TEST YOUR UNDERSTANDING

MULTIPLE CHOICE

1 Health psychology combines research on:
- a health and physiology to understand physical and mental health
- b health and psychology to understand the relationship between thoughts, actions and physical and mental health
- c health and biological factors to understand the relationship between anatomy and the mind.
- d all of these answers are correct.

2 Health psychology follows the:
- a biomedical model of health
- b psychosocial model of health
- c biopsychosocial model of health
- d transtheoretical model of health.

3 Joel always ensures that he eats healthily. This is an example of a:
- a health-enhancing behaviour
- b cognitive behavioural strategy
- c health-impairing behaviour
- d stage in the transtheoretical model of behaviour change.

QUESTIONS 4–5 REFER TO THE FOLLOWING INFORMATION:

Susie and Sarah have been great school friends for a number of years. Recently they had an argument and no longer want to spend time together. Sarah is struggling to come to terms with this breakdown in her friendship, but she is determined to go to school and try to make new friends.

4 By doing this Sarah will help to build:
- a mental toughness
- b resourcefulness
- c leadership skills
- d resilience.

5 Susie decides to see the school psychologist for help. He suggests that she try to be more optimistic and attempts to change Susie's negative thought patterns. This is an example of:
- a a biological factor
- b social help
- c resilience
- d a cognitive behavioural strategy.

6 Jamie has recently failed a Science test. His mother advises him to approach his teacher about resitting the test. Jamie's mother is providing him with:
- a a health-impairing behaviour
- b social support
- c a cognitive behavioural strategy
- d biopsychosocial assistance.

7 A type of cognitive behavioural therapy is mindfulness, which aims to change the:
- a context in which a person's thoughts are understood
- b person's behaviour only
- c person's meditative state
- d person's awareness of others.

8 The transtheoretical model of behaviour change was created by:
- a Freud
- b Watson and Bandura
- c Prochaska and DiClemente
- d Atkinson and Shiffrin.

9 The termination phase of the transtheoretical model of behaviour change is:
- a where the change in the behaviour is under control such that it will not return
- b where the person begins behavioural changes, and requires behaviour-control skills to fulfil their plan of action
- c where the person has decided to change their behaviours and is making plans to do so
- d all of these answers are correct.

10 Mary has decided to quit smoking, but she has already tried several times before. It is likely that Mary is stuck in the ________________ stage of the transtheoretical model of behaviour change.

a pre-contemplation
b maintenance
c termination
d action

SHORT ANSWER

11 How does the biopsychosocial model of health relate to health psychology?

2 marks

12 Why is it beneficial to mental health that people deal with some challenges in life?

2 marks

13 School psychologist Nicole often uses mindfulness with her students. What are the benefits of this technique?

1 mark

14 What kinds of behaviours do health psychologists promote? Why?

2 marks

15 Using an example, explain the importance of resilience in mental health.

2 marks

16 Suggest why a good diet can help us to cope better with stress.

2 marks

17 Angus is not coping at school. He can't afford to go out on the weekends with his friends, so he is feeling left out. He is also stressed by VCE and is failing a subject that he needs to get into his university course next year. Explain how social support could improve Angus's ability to cope with the distress he is experiencing.

3 marks

18 Name and describe each of the six stages of the transtheoretical model of behaviour change.

6 marks

19 How do psychologists use the transtheoretical model of behaviour change?

2 marks

20 Describe how psychologists might use stage-matched interventions to help a person suffering from stress.

3 marks

AOS 3
STUDENT-DIRECTED PRACTICAL INVESTIGATION

In this Area of Study, students design and conduct a practical investigation related to mental processes and psychological functioning. This can be undertaken in *either* Unit 3 or 4.

The investigation relates to knowledge and skills developed across both Units 3 and 4, and is undertaken by the student using an appropriate experimental research design involving independent groups, matched participants, repeated measures or a cross-sectional study. It requires the student to identify an aim, develop a question, formulate a research hypothesis (including operationalised variables) and plan a course of action to answer the question. It must also consider safety and ethical guidelines.

Students then undertake an experiment that involves:

- collecting primary qualitative and/or quantitative data
- analysing and evaluating the data
- identifying the limitations of the data and research methods
- linking experimental results to scientific ideas
- reaching a conclusion in response to the question
- suggesting further investigations to undertake.

Results are communicated in a scientific poster.

Note: A practical work folio must be maintained by the student for purposes of record-keeping, authentication and assessment.

Outcome 3

On completion of this unit the student should be able to design and undertake a practical investigation related to mental processes and psychological functioning, and present methodologies, findings and conclusions in a scientific poster.

Students communicate findings for the investigation in Outcome 3 of this study in the form of a scientific poster. The poster may be produced electronically or in hard copy format and should not exceed 1000 words. Students must select information carefully so that they meet the word limit. The production quality of the poster will not form part of the assessment.

SUGGESTED TOPICS:

Unit 3

- Does physical exercise reduce levels of stress?
- Are VCE Year 12 students more anxious than Year 10 students?
- Can the eye-blink or the salivation response be classically conditioned in an individual?
- How can you modify a person's behaviour with operant conditioning?
- What steps are involved in a person learning a new skill through observational learning?
- Which is a more effective method of measuring memory: recall or recognition?
- How does the serial position effect affect recall?
- Does mood affect the recall of information (state-dependent cue)?
- Can environmental stimuli influence memory recall (context-dependent cue)?
- How reliable are eyewitness testimonies (Loftus)?

Unit 4

- How can consciousness be measured (meditation using heart rate)?
- Does technology impact sleep?
- How can sleep diaries/mobile phone applications/exercise devices be used to measure the quality of sleep?
- Can meditation alter perception of time?
- How do sleep cycles change over a lifespan?
- Does diet impact mental health?
- Does sleep deprivation affect mental health?
- Is there a relationship between the number of Facebook friends a person has and mental health?
- What does the community consider to be protective or risk factors in mental health?
- How are individuals with an anxiety disorder (or other mental health issue) perceived by the community?

Tips for approaching your practical investigation

Developing a topic for research can be hard when you are required to conduct the practical research that will accompany it.

- Consider the size and scope of the task. Think ahead about how you will investigate your question and what research you will need to conduct in order to assess the question properly. Make sure research can be completed within the timeframe allocated and using the resources you have. Think about your potential hypothesis and whether or not it can be tested easily, or if it will require a lot of effort and people power, and adjust your plans accordingly.
- Keep proper research methods in mind. Revisit Chapter 1: Research toolkit to revise correct procedures; for instance, how to form a hypothesis. It's a particularly good idea to think about how you can apply the scientific method as you approach your research.
- Develop a firm hypothesis to test. Keep variables in mind and don't worry about rejecting your hypothesis at the end of the investigation. It does not matter if you guessed right or wrong at the beginning of the process, rather you should be able to analyse the information you collect to draw an appropriate conclusion.
- Be ethical. A crucial part of any scientific or psychological research is that it is conducted in an ethical manner. As we have learnt throughout VCE Psychology, the most important consideration of any research that involves humans is that no physical or psychological harm can come to participants. If you plan to use people in your research, discuss this with your teacher first and make sure you are appropriately following ethical guidelines. Remember to be professional, respect the rights of the participants and have their informed consent at all times. If your research involves the observation of behaviour and requires deception in research, you must ensure that the participants are in no way distressed or negatively impacted by your research and that

they are fully debriefed once your observation is complete. Again, it would be a good idea here to consult Chapter 1: Research toolkit and revise the ethical considerations involved in designing an experiment.

- Use the poster template. A poster template developed by VCAA has been provided for you as a guide. While a poster is a visual medium, it is also a scientific presentation of the results from your investigation and requires thought and depth. You will need to follow correct report-writing procedures when you record your findings. Remember to define the terms and scope of your investigation in your introduction and properly explain your method before you discuss your results and their implications. You might also like to refer to the useful guide at the end of Chapter 1, 'Report writing for VCE', when planning and developing your poster.

The following template is to be used by students in the development of the scientific poster for the investigation undertaken.

SECTION	CONTENT AND ACTIVITIES
Title	Question under investigation is the title
Introduction	Explanation or reason for undertaking the investigation, including a clear aim, a hypothesis and/or prediction and relevant background of psychological concepts
Methodology	Summary that outlines the methodology used in the investigation, authenticated by logbook entries
	Identification and management of relevant risks, including the relevant health, safety and ethical guidelines followed in the investigation
Results	Presentation of collected data/evidence in appropriate format to illustrate trends, patterns and/or relationships
Discussion	Analysis and evaluation of primary data
	Identification of outliers and their subsequent treatment
	Identification of limitations in data and methods, and suggested improvements
	Linking of results to relevant psychological concepts
Conclusion	Conclusion that provides a response to the question
References and acknowledgments	Referencing and acknowledgment of all quotations and sourced content as they appear in the poster

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ASSESSMENT RUBRIC

CRITERION	0–1 MARK	2–3 MARKS
Title	Question under investigation is in the title. Question incorporates IV and DV.	
Introduction	Explanation for undertaking the investigation is absent. Aim not included or does not follow structural conventions. Few, if any, psychological concepts are defined.	Little explanation for undertaking the investigation. Aim is vague. Psychological concepts are not well explained or linked to the investigation. Sequence of the introduction does not follow structural conventions.
Introduction	Variables not accurately identified. Hypothesis accurately identifies only one of IV, DV and population, and predicts outcome.	Variables are accurately identified and operationalised. Hypothesis accurately identifies two of IV, DV and population and predicts directional outcome.
Methodology	Method demonstrates little understanding of what is required to address the research question or how to operationalise the hypothesis/variables. Participants, materials and procedure are absent or only partially completed. Few, if any, aspects can be authenticated by logbook entries.	Method partially addresses aspects of the research question. Operationalisation of hypothesis/variables is evident. Includes most necessary information in participants, materials and procedures sections. Some aspects can be authenticated by logbook entries.
Methodology	Potential/relevant health and safety risks not identified. Few, if any, ethical guidelines followed in the investigation.	Identification of most potential/relevant health and safety risks. Most ethical guidelines followed in the investigation.
Results	Results reflect errors in calculation. Presentation of collected data/evidence is not appropriately formatted so that trends, patterns and/or relationships are difficult to identify. Mean or median or mode not included.	Results reflect some errors in calculation. Presentation of collected data/evidence is not appropriately formatted so that trends, patterns and/or relationships are difficult to identify. Mean or median or mode not included.
Discussion	Analysis and evaluation of primary data (results) is incorrect. Hypothesis is misinterpreted. Understanding of descriptive and inferential statistics not evident.	Analysis and evaluation of primary data (results) is mostly accurate. Hypothesis is correctly accepted or rejected. Little interpretation/understanding of descriptive and inferential statistics.
Discussion	Identification of outliers (data that skews interpretation) included.	Identification of outliers (data that skews interpretation) is discussed and noted as excluded/included with appropriate justification for treatment.
Discussion	Few, if any, limitations identified in data and method. Few, if any, improvements suggested to address the flaws in the investigation.	Identification of limitations in data and method are evident and suggested improvements appropriately address most of the flaws identified in the investigation.
Discussion	Evidence that some attempt to link results with relevant psychological concepts has been made.	Results are linked with relevant psychological concepts. Although the relationship between psychological concepts and results are not clear.
Conclusion	Conclusion does not link with the question. Interpretation of the data and hypothesis is incorrect.	Conclusion reflects a basic response to the question. Interpretation of the data and hypothesis is mostly correct.
References Acknowledgments	Some referencing and acknowledgment of quotations and sourced content as they appear in the poster/document included.	Referencing and acknowledgment of all quotations and sourced content as they appear in the poster/document included and correctly formatted.

4–5 MARKS	6–7 MARKS
Clear explanation for undertaking the investigation. Aim incorporates IV and DV. Most relevant background psychological concepts are defined and integrated into the introduction and follow structural conventions.	Detailed/succinct explanation for undertaking the investigation. Clear aim that incorporates IV and DV. Relevant background of psychological concepts outlined, defined and effectively integrated into the introduction in a logical manner. Introduction follows structural conventions.
Variables are accurately identified and operationalised. Hypothesis accurately identifies IV, DV and population and clearly predicts a directional outcome.	
Method is appropriately designed and addresses the research question. Effectively operationalises the hypothesis/variables. Includes all necessary information in participants, materials, and procedure sections. Summary is detailed and follows appropriate sequence. All aspects can be authenticated by logbook entries.	
Effective identification and management of all potential/relevant health and safety risks. All ethical guidelines followed in the investigation.	
Results are clear and accurate. Presentation of collected data/evidence is appropriately formatted to illustrate trends, patterns and/or relationships. All tables and graphs are correctly labelled. Mean, median and mode included.	
Analysis and evaluation of primary data (results) is accurate. Hypothesis is correctly accepted or rejected. Interpretation of descriptive and inferential statistics is detailed.	Analysis and evaluation of primary data (results) is accurate. Hypothesis is correctly accepted or rejected with an in-depth/comprehensive interpretation of descriptive and inferential statistics.
Identification of outliers (data that skews interpretation) is discussed in depth and noted as excluded/included with appropriate justification for treatment.	
Identification of limitations in data and method are comprehensive and suggested improvements appropriately address each of the flaws identified in the investigation.	
Results are effectively and succinctly linked with relevant psychological concepts.	
Conclusion reflects an appropriate response to the question and shows evidence of correct interpretation of the data and hypothesis.	Conclusion reflects an appropriate response to the question and shows evidence of correct interpretation of the data and hypothesis. Suggests possible implications/applications of the findings.

A-B-C of operant conditioning
Antecedent condition – Behaviour – Consequence

abnormal
used to describe data that lie outside the normal range for the population; statistically the two per cent at the extreme top and extreme bottom of the distribution

acculturative stress
stress arising from the need to adapt to a different culture, customs and laws, often experienced when migrating to a new country

action potential
a momentary change in the electrical potential of a cell, which allows a nerve cell to transmit a signal or impulse towards another nerve cell

adaptive plasticity
the ability of the brain to change, adapt and grow throughout life (but does diminish with age)

adolescence
a lifespan stage, between childhood and adulthood (approximately 12–20 years of age) including the teenage years

adrenalin
a type of neurotransmitter

affector neuron
see sensory neuron

age-related memory decline
memory loss associated with getting older but with no health issues or brain damage

alarm
the first stage of Selye's General Adaptation Syndrome (GAS) where the fight-flight-freeze response is activated to prepare the person to deal with the challenge or stressor; this stage has two components: shock followed by countershock

alcohol
a psychoactive drug of tolerance; it is a depressant – it slows down the nervous system and causes an altered state of consciousness

allostasis
'where the body maintains stability or homeostasis through change' (Sterling & Eyer, 1988); when a person interprets an event as being stressful several internal physiological and behavioural processes are activated so that adaptation to the stressor, or allostasis can be achieved

allostatic load
refers to the cumulative effects of our body trying to re-establish allostasis in response to frequent and intense stressors

allostatic overload
when the demands of the stressor exceed the body's ability to repeatedly adapt, the person is no longer able to meet the demands

alpha waves
the typical brainwave pattern (reasonably high frequency, but not as high as beta waves, and low amplitude, but slightly higher than beta waves) that occurs when awake but very relaxed

altered states of consciousness
any state of consciousness that deviates from normal waking consciousness, in terms of marked differences in level of awareness, perceptions, memories, thinking, emotions, behaviours and one's sense of time, place and self-control; it can be deliberately induced or occur naturally

Alzheimer's disease
a disease that progressively destroys neurons in the brain, causing memory loss

amnesia
memory loss

amplitude
in terms of brainwaves, the height of the peaks and troughs of the curved graph that represents brain wave activity

amygdala
an almond-shaped structure, located in the medial temporal lobe of the brain that is central in emotion, aggression and implicit learning.

anterograde amnesia
inability to encode and store new memories

anxiety disorder
dysfunctional feelings of extreme apprehension, fear, stress and uneasiness; characterised by feelings of extreme apprehension, fear, stress and uneasiness – there are five main types of anxiety disorders: generalised anxiety disorder, phobic disorder, panic disorder, obsessive-compulsive disorder and post-traumatic stress disorder

association
a learned connection between two (or more) objects or events – especially significant in classical conditioning

association areas
regions of the cerebral lobes that are not part of the sensory (visual, auditory, somatosensory) or motor cortices; the association areas make up 75 per cent of the cortex and integrate the information between the motor and sensory areas and higher order mental processing

Atkinson and Shiffrin's multi-store model of memory
a model of memory that suggests that memory is comprised of three memory stores: a sensory store, a short-term memory store and a long-term memory store

attentional bias
an individual's preference for noticing threat-relevant information
utomatic processes
processes that require little attention and little thought, and can allow you to do two things at once

autonomic processes
processes that require little attention and thought, and can allow you to do two things at once

autonomic arousal
the response of the autonomic nervous system generally operating below the level of conscious awareness, and responsible for the fight-flight-freeze response

autonomic nervous system
consisting of the parasympathetic and sympathetic branches and responsible for the communication between the body's non-skeletal (visceral) muscles and the internal organs and the glands that carry out bodily functions

aversion therapy
a form of treatment using classical conditioning to cause an undesired behaviour to create an unwanted response, thereby reducing the incidence of the behaviour

awareness
how conscious (aware) you are of internal and/or external event(s); your level of awareness can vary in normal waking consciousness

axon
the part of a neuron along which the electrochemical nerve impulse is transmitted

axon terminal
located at the end of the axon, it transmits messages to the next neuron by secreting neurotransmitters

basal ganglia
located in the frontal lobes, they are involved in motor activity by integrating and smoothing movements using information from primary and secondary motor areas and the somatosensory cortex; also involved in learning skills.

behaviour modification
an application of operant conditioning to change a person's behaviour

beta waves
typical brainwave pattern – high frequency (fast) and low amplitude (small) – during normal waking consciousness, associated with being alert, active, anxious and paying (selective) attention

bimodal distribution
a distribution where two distinct populations are plotted on the same curve

biological approach
an approach in psychology that explains a person's functioning in term of bodily structures, biochemical processes and genetics; also known as biopsychology

biological rhythms
the cyclical pattern of the body's physiological measurements over time

biopsychosocial approach
taking a holistic approach to treating simple phobias including biological, psychological and sociocultural factors that contribute to causes and treatment of psychological disorders

blood-alcohol concentration (BAC)
a measure of the amount of alcohol absorbed by the body into the bloodstream

Bobo doll
a large inflatable plastic doll named 'Bobo', approximately 1.5 metres, designed to spring back upright when knocked over, used by Albert Bandura in his research on social learning

body
the physical being, including the brain; these entities (parts) can be physically measured in terms of size, weight, shape and density, and occupy space and exist in time

brain
organ of the body that controls thoughts, emotions and motivations, and also motor responses

brain stem
part of the brain that connects the brain to the spinal cord

brain trauma
any form of organic (physical or chemical) damage to the brain

brainwave activity
the electrical activity of the brain as detected, amplified and recorded by a electroencephalograph (EEG)

bright light therapy
the use of a high-intensity light to advance or delay sleep and therefore treat circadian phase disorder

case study
also known as 'single subject' research; an in-depth investigation of a single participant

cataplexy
when a person remains conscious but is physically paralysed; also known as muscle atonia

catastrophic thinking
thinking that is obsessive and irrationally overestimates a threat; often involves thinking in terms of worst-case scenarios

central nervous system (CNS)
comprises the brain and the brain and spinal cord, the CNS controls the body by processing and responding to sensory input from the peripheral nervous system

cerebral hemispheres
large, wrinkled structures of the brain that are covered by the cerebral cortex

challenge
an assessment that there is opportunity for personal growth or something might have a positive outcome

childhood
a lifespan stage, between infancy and adolescence (approximately 2 to 12 years of age)

chronic sleep deprivation
not getting enough sleep over an extended period of time, long-term sleep deprivation

circadian phase disorder
a sleep disorder that affects a person's internal sleep-wake clock, resulting in disturbed sleep

circadian rhythm
biological rhythms that occur approximately once every 24 hours, for example, the sleep-wake cycle and body temperature

classical conditioning
whereby an animal or other organism can passively learn to show a naturally occurring reflex action, such as salivation, in response to any stimulus – learning through association; also known as Pavlovian conditioning

cognition
a broad term that relates to mental activities such as thinking, problem solving language and reasoning. It entails our knowledge, beliefs, thoughts and ideas that we have about ourselves and our environment

cognitive appraisal
the process through which people evaluate the meaning of a specific event with regards to its personal significance

cognitive behavioural therapy (CBT)
a branch of psychology used to treat mental health problems or disorders by focusing on breaking unhealthy patterns of thinking or behaving and replacing these patterns with positive habits and coping skills

cognitive bias
error in thinking that affects decisions and judgement based on that error

cognitive processes
the mental processes involved in acquiring, retaining and using knowledge; a major aspect of our cognitions involves attention, perception, memory, language and learning, which is linked with our conscious experience

conclusion
in research, refers to a statement of acceptance or rejection of the hypothesis tested

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
a variable other than the independent variable that has a systematic effect on the value of the dependent variable (it acts like a second, unwanted, independent variable)

consciousness
our awareness of our own thoughts, feelings and perceptions (internal events) and our surroundings (external stimuli) at any given moment

consolidation
process in which the brain forms a permanent representation of memory

construct validity
a form of internal validity that involves deciding whether the test can be used to support the theory that is being tested

content validity
a form of internal validity that involves examining the instrument to decide whether the item appears to be measuring what it is supposed to measure; also known as face validity

context-dependent cue
a clue to assist retrieval from long-term memory, due to the external environment in which learning took place

continuous positive airway pressure (CPAP)
a breathing mask, fitted over a person's face during sleep, to provide a constant flow of air and treat obstructive sleep apnoea

continuum of awareness
the levels of awareness that can be experienced, from deep unconsciousness to heightened awareness, on a continuous scale including normal waking states and altered states of consciousness

control group (C-group)
the group in research that is not presented with the independent variable. The control group is used as a basis for comparison with the experimental group

controlled processes
processes that require mental effort to focus attention on the required task; you are unable to complete another controlled process at the same time as they both require your full attention and therefore will interfere with each other

controlled variable
a variable that has had the potential effects of an extraneous variable removed from the experiment (usually by the experimental design)

correlation
a statistical measure of how much two variables are related; a correlation does not show a cause-and-effect relationship

cortisol
hormone released by the adrenal glands

counterbalancing
the process in a repeated measures design to eliminate order effects; conditions A, B and C would be presented in a different sequence to different groups of participants

cross-sectional studies
a form of independent groups design, where data is collected at one time from participants of all ages and different age-groups and compared

cued recall
recall assisted by clues, not involving the original items to be retrieved, for example, being given an individual's initials to assist recall of their name

cumulative risk
refers to the combined risks or factors that may interact with each other to cause a mental disorder

daydreams
our private thoughts, feelings and imagined scenarios that occur when we shift our attention internally while ignoring the external world. Daydreams tend to be visualised thoughts that are usually positive and pleasurable; they occur naturally and often and are mostly considered an altered state of consciousness

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

declarative memory
a long-term memory store of personal experiences (episodic) and facts (semantic)

deep sleep
collectively stage 3 and stage 4 of NREM sleep

delayed sleep-wake phase disorder
a circadian phase disorder that delays sleep patterns, often seen in adolescence

delta waves
the typical brainwave pattern – a steady pattern of low frequency (slow) and high amplitude (large) – associated with NREM deep sleep

dementia
a progressive and largely incurable disorder that impairs memory and other cognitive functions; about 40 per cent of dementias are due to Alzheimer's disease

dendrite
a component of a nerve cell that receives information from other nerve cells and transports them to the cell body

dependent variable (DV)
the variable that is measured by the researcher to discover the effects of the independent variable

developmental plasticity
the development and consolidation of neural pathways in babies, children and adolescents

discriminative stimulus
in operant conditioning, Skinner's term for the pre-condition that indicates that a behaviour will be reinforced

disorder
a set of symptoms that interfere with daily functioning; symptoms are reasonably consistent among patients but origins/causes may differ

disorganised attachment
experienced by individuals who find it difficult to share their feelings or empathise with others

distress
refers to a negative psychological response to a perceived stressor

divided attention
refers to our capacity to perform two or more activities at the same time; this is generally only possible if the tasks can be performed with very little mental effort

dopamine
a neurotransmitter in the brain involved with emotional arousal and voluntary movement

double-blind procedure
an experimental design that ensures that neither researcher nor participants are aware of which participants are in the control group and which are in the experimental group; this eliminates both experimenter and participant expectations as possible confounding variables

DSM-5
The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, published by the American Psychiatric Association in May 2013; formerly known as DSM-V

dyssomnias
sleep disorders that relate to falling asleep and staying asleep

early morning awakening insomnia
a form of insomnia characterised by problems with waking up too early and not being able to go back to sleep

echoic memory
auditory memory in the sensory memory register

effective punishment
punishment administered in such a way as to reduce the likelihood of the behaviour recurring

effector neuron
see motor neuron

elaborative rehearsal
a method of encoding memories by making meaningful associations between new information and old or familiar information

electroencephalograph (EEG)
a device that detects, amplifies and records electrical activity in the brain in the form of brainwaves

electromyograph (EMG)
a device that detects, amplifies and records the electrical activity of heart muscles

electro-oculograph (EOG)
a device that detects, amplifies and records electrical activity in the muscles that allow the eye to move

emotion-focused coping
involves trying to reduce the negative emotional responses associated with stress such as embarrassment, fear, anxiety, depression, excitement and frustration by using strategies such as meditation, relaxation, talking to a friend/family, ignoring the problem and distraction

emotional forecasting
in the primary appraisal phase, the person experiences an emotional response to the given situation. In the secondary appraisal phase, the person considers how they will feel when considering each different option

encoding
the process of putting information into a form which will allow it to fit in with your personal storage system

encoding specificity principle
associations are formed at the time of forming new memories and these will be the most effective retrieval cues

endogenous
based on internal factors

environmental factors
physical, biological and social experiences and events that a person is exposed to during life

episodic buffer
a theoretical component of working memory that acts as both a bridge and a filter (for auditory and visual information) between long-term memory and the central executive and storage components in working memory

episodic memory
memory of personal experiences

episodic memories
long-term memories of episodes or experiences in your life

ethical principles
the code of ethics designed to protect participants from psychological and physiological harm including confidentiality, debriefing deception in research, informed consent, voluntary participation and withdrawal rights

eustress
refers to a positive psychological response to a perceived stressor

evolutionary (circadian) theory of sleep
a theory stating that sleep serves as a means to increase an animal or human's chance of survival in its environment; it allows us to adapt to our environment and the amount needed depends on how much food we need, how available it is (we may need to conserve energy) and how safe it is when we sleep; these sleep requirements have evolved over time in order for the species to hunt food, hide and conserve energy

exhaustion
the third stage of General Adaptation Syndrome (fight-flight-freeze response) where the body cannot continue to cope with the stressor and its resistance begins to drop; the body's resources are depleted and very tired which can lead to life-threatening illness and death if the stress continues

experiment
research that aims to find cause-and-effect relationships among variables

experimental design
the system of research being used: independent groups, matched participants and repeated measures

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

experimenter effect
the outcome of an experiment being unintentionally (or even intentionally) influenced by the experimenter

explicit memory
memories of facts, names, images, and events; also called declarative memories

external validity
criterion-related validity that refers to the extent to which results from this measure are comparable with other, established, measures of the variable

extinction
when a response no longer occurs; in classical conditioning, extinction occurs when the conditioned stimulus is presented several times after the unconditioned stimulus (which acts as a reinforcer) has been withdrawn. In operant conditioning, the response will be extinguished after being shown several times without reinforcement

extraneous variable
any variable other than the IV or DV – these may be confounding, controlled or neutral variables

eyewitness testimony
evidence given by a person who saw a crime committed

fight-flight-freeze response
a physiological response to stress that causes an organism to react in a combative manner (fight), by removing themselves from the situation (flight), or by not reacting at all (freeze)

forebrain
part of the brain responsible for higher order thinking processes; includes cerebral hemispheres

forgetting
the inability to retrieve information; may refer to short-term or long-term memory

free recall
recalling as much information as possible in any order, without cues

frequency
the number of brainwaves per second

frontal lobe
the largest lobe of the brain; it has several functions, including initiating movement of the body, language, planning, judgement, problem solving, aspects of personality and emotions. It is extremely well developed in higher order mammals

GABA (gamma-amino butyric acid)
an inhibitory neurotransmitter imbalance of GABA is implicated in severe anxiety disorders; also involved in arousal and sleep

General Adaptation Syndrome (GAS)
a model developed by Selye to explain the biological processes involved in chronic stress; he suggested there were three stages: alarm, resistance and exhaustion. GAS is the body's way of adapting and dealing with a perceived stressor or stressors

generalisation
a judgment about the extent to which the research findings can be applied to the population represented by the sample

genetics
the study of heredity and the role of genes throughout an individual's life

glutamate
an excitatory neurotransmitter in the brain involved in learning

hallucinations
experiences of perceptions, such as sight or sound, which are not present in reality, they can occur in each sense: auditory, tactile, visual, gustatory and olfactory

health psychology
the study of the role of biological, psychological and social factors and their influence on physical health

hindbrain
the primitive parts of the brain, comprising the cerebellum, pons and medulla, adjacent to the spinal cord

hippocampus
finger-sized curved structure that lies in the medial temporal lobes; responsible for consolidation of explicit (declarative) memories and acts to transfer these to other parts of the brain for storage as long-term memory

histogram
graphical representation of how often each score appears in a visual form to help gain a clearer picture of the data

homeostasis
the state of balance in the body's metabolism

HPA axis
refers to the hypothalamus, pituitary gland and adrenal gland which are part of the neuroendocrine system; these structures interact through a feedback system to regulate a number of functions such as a person's digestion, immune system, mood, emotions and their response to stress

hypersomnia
a sleep disorder that results in sleeping too much

hypnogogic (hypnic) jerks
involuntary muscle twitches that cause us to jolt are common; usually experienced in stage 1 NREM sleep (part of hypnogogic state)

hypnogogic state
the relaxed state that occurs during the transition from being awake to being asleep, often considered to be part of stage 1 NREM sleep

hypnogram
a graph that plots the proportion of REM and NREM sleep in a sleep cycle

hypothalamus
structure in the forebrain that plays a major role in controlling emotion and motivated behaviours such as eating, drinking and sexual activity

hypothesis
a prediction of the outcome of research, stated in terms of the influence of changes in the value of the independent variable on the value of the dependent variable

ICD
International Classification of Diseases, published by the World Health Organisation; current edition is the ICD-10

iconic memory
a sensory register for the fleeting storage of visual information, it lasts about 0.3 seconds and explains why we can see a moving picture from a series of still photos

implicit memory
memories of skills, emotions, preferences and dispositions; also called procedural or non-declarative memories; processed in the amygdala and possibly the cerebellum

independent groups design
allocates participants to E-group or C-group at random; also known as between participants design

independent variable (IV)
the variable that is manipulated by the experimenter who then measures resulting changes in the dependent variable

infancy
a lifespan stage, between birth and childhood (approximately 0 to 2 years of age)

infer
to assume conclusions from the information provided in the data used to investigate a psychological (hypothetical) construct

inferential statistics
statistical techniques used to determine causative relationships and to make generalisations from samples to populations

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, and participates on a voluntary basis

internal reliability
the extent to which all the items in a research instrument contribute equally to the final score

internal validity
the extent to which the results gained from a measure are truly due to the variable that it is thought to be measuring

interneurons
neurons that connect affector and effector neurons in a reflex arc

inter-rater reliability
the extent to which the same result is obtained by anyone administering the test

interval data
data is measured on a scale where each step is the same value, but zero does not mean that the property does not exist, for example, shoe size or temperature in degrees Celcius

jet lag
the disruption of the sleep-wake cycle when travelling across time zones

K-complexes
brainwave patterns that consist of a sharp rise and fall in amplitude, lasting for about 2 seconds on the EEG; indicative of stage 2 NREM sleep, occurring about once a minute although can be triggered by external stimuli (such as a loud noise)

Lazarus and Folkman's Transactional Model of Stress and Coping
a cognitive model focused on the transaction between an individual's perception of a stressor and the stressor itself. A person goes through primary appraisal of the situation and then secondary appraisal. Then either/both emotion-focused coping or problem-focused coping strategies are used to deal with the stressor

learning
a relatively permanent change in behaviour due to experience

levels of encoding and processing (Craik & Lockhart)
a model of memory storage and suggests that memory does not comprise any specific number of separate memory stores but instead comprises a continuous dimension in which memory is encoded, related to the ease with which it can be retrieved: the deeper the processing of information, the greater the chance of it being retrieved

longitudinal study
a form of repeated measures design, where the same participants are investigated over a period of time

long-term depression
the weakening of an existing synapse over time when the frequency of electrical stimulation is reduced

long-term memory
like the hard drive in your computer, the information is encoded and stored, and as long as you know enough about the information (like the name of a document or a folder) then it can be retrieved

long-term potentiation
the strengthening of synapses after they have been electrically stimulated at a particularly frequency, strengthening continues when the same electrical frequency is fired over time

maintenance rehearsal
a strategy for keeping information in short-term memory or for moving it into long-term memory by simply repeating it over and over, but not trying to form meaningful connections between the new information and other information which is already in memory

matched participants design
a subject selection procedure that attempts to eliminate confounding variables by 'matching', on key characteristics, each individual in the experimental group with an individual in the control group

mean
calculated by adding up all the scores and dividing that total by the number of scores

measures of central tendency
measures (mean, median and mode) that tell us how the data are clustered near the central point of the dataset

measures of variability
measures that tell us about how scores are spread out (standard deviation and range)

median
the score that occurs exactly halfway between the lowest and the highest score

medical students' disease
the tendency for medical students to see, in themselves, some of the symptoms or characteristics of the disease they are studying

meditation
a deliberately induced altered state of consciousness in which a person uses mental exercises to become highly focused on a single thought, to the exclusion of others

melatonin
a sleep hormone that causes sleepiness and is released when it is dark; it is secreted from a small structure in the brain called the pineal gland

memory
the mental capacity for retaining an image, concept or knowledge when the stimuli that created it no longer exist in consciousness, memory may also refer to the storage system that retains such images

memory bias
when a memory has been encoded incorrectly, it results in thought based on this memory that is also incorrect

mental disorders
exaggerated forms of thoughts, feelings and behaviours, implying the existence of a clinically recognisable set of symptoms and behaviours that usually need treatment to be alleviated; can interfere with a person's thoughts, emotions, perceptions and behaviours

mental health
a state of emotional and social well-being in which individuals realise their own abilities, can cope with the normal stresses of life, can work productively and can contribute to their community

mental health problems
problems that cause emotional, cognitive and behavioural difficulties that affect relationships and functioning in everyday life

mental representation
a cognitive process where information is stored in memory for later retrieval and use

microsleep
a brief involuntary period of sleep that occurs in the midst of a wakeful activity – we tend to drift off and stop concentrating on what we are doing

midbrain
connects the hindbrain with the forebrain and controls arousal levels, attention and consciousness; essentially comprises the reticular activating system (RAS)

mindfulness
a state of pure being in which a person deliberately pays attention to each thought and feeling, from moment to moment and without imposing judgment; associated with some forms of meditation

misinformation effect
questions asked in such a way as to provide information in the asking of the question, for example, 'Did you see the broken headlight?'

mode
the most commonly occurring score in the dataset

modelling
tendency for a person to copy the behaviour or attitude that is demonstrated by another person (also known as observational learning)

monosynaptic reflex arc
a reflex arc made up of only two neurons (one sensory and one motor)

mood
an emotional state that can affect our perceptions, thoughts and behaviours

motor neurons (nerves)
neurons that communicate messages from the central nervous system to the particular muscles that an organism intends to move at any particular moment. Also referred to as efferent neurons

muscle atonia
the total relaxation of muscles to the point of paralysis when in REM sleep; also known as cataplexy

myelin
a white, fatty, waxy substance that coats some axons and insulates them, protecting them from electrical interference from other neurons; this increases the efficiency of transmission of nerve impulses

myelination
a process in the brain whereby the axons of the neurons in a child's brain become covered in myelin, a white, fatty covering that insulates a neuron's axon and speeds transmission; this process continues until a person's early 20s

natural environment
a setting that is familiar and where an experience normally occurs

negative correlation
a correlation in which the two variables change in the opposite direction

negative emotions
for example, anger, anxiety, disgust, envy, fright, guilt, jealousy, sadness and shame

negative reinforcer (negative reinforcement)
(in operant conditioning) the removal, reduction or prevention of an unpleasant stimulus in response to a behaviour, increasing the likelihood that a behaviour will be repeated

nerve
bundle of axons running together in the peripheral nervous system

neural connections
the connections formed between the brain's neurons

neural pathway
bundles of neurons that provide connections between one part of the nervous system and another

neural plasticity
the ability of the brain's synapses to be modified

neurofibrillary tangles
an abnormal build-up of protein inside neurons, associated with the death of brain cells in patients with Alzheimer's disease

neurohormone
a hormone that is produced by the nervous system, not endocrine glands, and that acts as a chemical messenger, for example, noradrenalin

neurons
nerve cells, responsible for communication within the body

neurotransmitters
chemicals that help the communication across nerve synapses

neutral stimulus (NS)
(in classical conditioning) the name given to the conditioned stimulus before it becomes conditioned

nominal data
data that has qualitative value rather than quantitative value, where there is no ranking or ordering of the values implied

non-rapid eye movement (NREM) sleep
one of two phases of sleep, characterised by little or no rapid eye movement, and often divided into four stages of NREM sleep that are determined mainly by predominant brainwave patterns

normal waking consciousness
the states of consciousness we experience when we are awake and aware of our thoughts, feelings, and perceptions from internal events and the surrounding environment; we experience a real sense of time and place and create our reality and a baseline to judge all other states of consciousness

objective data
data that are measured according to identifiable external criteria

objective measurement
physical measurement that is free of bias, such as height

observational learning
where a person learns by watching the behaviour demonstrated by another; originally called social learning theory

occipital lobe
the cerebral cortex at the rear of the brain; it is the location of the primary visual cortex and association areas involved with integration of visual stimuli

old age
a lifespan stage, after middle adulthood (approximately 65+ years of age)

operant conditioning
a type of learning in which behaviour becomes controlled by its consequences

operational definition
a variable defined in a way that describes how it can be quantified

operationalisation
quantification of a variable

order effects
changes in results caused by the sequence of performing tasks in a test; often ascribed to practice- or boredom effects

ordinal data
data that has a definite sequence, but the gap between one level and the next is not constant, for example, the ages of persons in a room

organic amnesia
memory loss caused by biological, physical or chemical damage

parallel form reliability
used to assess the consistency of the results of two tests constructed in the same way from the same content domain; the property is measured before the treatment with the independent variable (pre-test) and again, with a parallel form, after the treatment (post-test)

parasomnias
sleep disorders that involve an unusual form of behaviour during sleep, such as sleep walking

parasympathetic nervous system
a branch of the autonomic nervous system, responsible for maintaining our day-to-day functioning and for most of the automatic functions of the body such as digestion, heart rate, breathing and some glandular functions

parietal lobes
the location of the primary somatosensory cortex in the brain; enable a person to perceive their own body and to perceive where things are located in their immediate environment

Parkinson's disease
a progressive neurological condition, known to affect the control of movement

partial sleep deprivation
having some sleep in a 24-hour period but not getting enough to meet your needs; may occur for just one night or for several nights and can have serious consequences

participants' rights
ethical considerations including the right to informed consent, debriefing and withdrawal rights

peripheral nervous system (PNS)
communicates information from the body to the central nervous system (for example, aches and pains) and to the body's organs, glands and muscles

photographic memory
the ability to recall sharp, detailed images of a picture or notes from a page after viewing them for a short period of time; this is a very rare phenomenon

physical exercise
refers to an activity that requires exertion with the purpose of improving fitness or health

physiological measurement
the observation of a measurable bodily (physical or physiological) response (such as heart rate, brainwave activity and galvanic skin response)

placebo
a variable other than the independent variable that causes a change in the value of the dependent variable due to the participant's belief that it will have an effect

placebo effect
refers to the participants' behaviour being influenced by their expectations of how they should behave, caused by the belief that they have received some treatment

polysomnogram
a continuously moving chart that displays data collected simultaneously from EEG, EOG, EMG and any other devices

polysynaptic reflex arc
a reflex arc made up of multiple neurons, with one or more interneurons connecting the sensory and motor neurons

population
the group of people about whom we wish to draw conclusions

positive correlation
a correlation in which the two variables increase or decrease in parallel with each other

positive emotions
for example, pride, love, relief

positive psychology
a branch of psychology that focuses on the promotion of wellbeing, fulfilment, and positive experiences and emotions

positive reinforcer (positive reinforcement)
a consequence that strengthens a behavioural response by providing a pleasant or satisfying outcome

post synaptic neuron
a neuron that receives information from another neuron

post-traumatic stress disorder (PTSD)
a condition where victims of trauma suffer symptoms such as sleep disturbances and flashbacks

presynaptic neuron
a neuron transmits information to another neuron

primacy effect
the tendency for superior recall of words that occur at the start of a list

primary appraisal
the initial evaluation process where the person determines whether the event (stressor) is a threat or a challenge

primary auditory cortex
located in the upper part of the temporal lobe; receives sounds from the ears

primary motor cortex
located at the rear of each frontal lobe; responsible for movement of the skeletal muscles of the body

primary somatosensory cortex
located at the front of each parietal lobe; processes sensations such as touch, pressure, temperature and pain from the body

primary visual cortex
located in the occipital lobes; processes information from the eyes

probability (*p*-value)
the likelihood that a result would be achieved by chance alone; considered significant if $p \leqslant .05$

problem-focused coping
involves trying to address the negative situation by using practical ways to deal with it such as seeking information, and evaluating the pros and cons

procedural memory
one aspect of implicit memory; memory for how to perform particular tasks, skills or actions

protective factors
factors that guard against the onset or relapse of a mental disorder

psychoactive drugs
chemical substances that affect the nervous system and brain activity. As a result, they impact on our consciousness by altering thoughts, feelings, perceptions and behaviours

psychological construct
a hypothetical concept; it is created to explain phenomena that are believed to exist or occur, but cannot be directly observed or measured. Consciousness is a psychological construct – it is believed to exist and descriptions are 'constructed' to explain it

punch-drunk
the ongoing effect of severe hits to the head which leads to brain impairments such as poor memory, permanently slurred speech and other cognitive deficits

punisher (punishment)
(in operant conditioning) any event that reduces the likelihood of a particular response occurring over time

qualitative data
descriptions of the characteristics of what is being studied

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

questionnaire
a form of self-report survey

random allocation
a subject selection procedure where all participants who have been selected for an experiment have an equal chance of being in the E-group or C-group

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

range
the difference between the highest score and the lowest score in the dataset

rapid eye movement sleep (REM) sleep
one of two phases (REM and NREM) of sleep, characterised by rapid eye movement

ratio data
measurements that represent quantities in terms of equal intervals and an absolute zero point of origin

recall
retrieval of stored information using minimal cues

recency effect
the tendency for superior recall of words that occur at the end of a list due to them still being in short-term memory

recognition
a process of retrieval that requires identification of a correct response from a set of alternatives

reconstruction
the process of remembering what we remembered previously and believing that this is the memory of the original event, even if the previous memory has been changed or recalled inaccurately

reflexes
simple, automatic response to a sensory stimulus

reinforcer (reinforcement)
any event that strengthens the likelihood of a particular response occurring over time

relaxation
calming of the body and mind, reflected in changes in brainwave activity, heartrate, respiration rate, blood pressure and temperature; this is often done through breathing exercises and systematic muscle relaxation techniques, but distinct from meditation which is focused

relearning
learning again something that has already been committed to memory; also the most sensitive measure of retention

reliability
the extent to which a measure could be expected to produce the same result with the same subject(s) under the same conditions on other occasions

REM rebound
the significantly larger amount of time spent in REM sleep than usual that follows a period of being deprived of REM sleep

remember
the general and popular term covering all forms of retrieval from memory

reorganisation
a reordering of neural connections so that an existing part of the brain adopts a new function

repeated measures design
a subject selection procedure where each participant is part of both the E-group and C-group; also known as within participants design

resilience
the ability to cope with stress

resistance
the second stage of Selye's General Adaptation Syndrome (GAS); it is considered the adaptive stage because even though heart rate and respiration rate return to almost normal, blood-glucose levels and stress-related hormones such as adrenalin and cortisol continue to circulate through the body keeping it ready for action

response cost
a form of punishment that occurs when something desirable is removed (for example, removing a mobile phone if misused)

restorative (restore and recovery) theories of sleep
sleep allows us to recharge our bodies, recover from the physical and psychological work during the day and allow our body's growth processes to occur

retention
learning stored in memory

retrieval
the process of getting information back from long-term memory to be used in working memory

retrieval cues
mental reminders or prompts that we create to assist our recollection later on

retrograde amnesia
inability to recall previously stored memories; a problem with retrieval

reward
a consequence that causes a behaviour to be repeated

risk factors
factors that contribute to the likelihood of a person developing (or relapsing into) a mental disorder

rumination
obsessive thinking or worrying

sample
the members of the population that have been chosen to take part in the research in order to represent the population

sawtooth waves
associated with REM sleep; a special type of theta-like brainwave pattern that resembles the blade of a saw that may be found among the random and fast beta-like waves, especially when there is a burst of rapid eye movement

scatter diagram (scatter plot)
a diagram that shows the values of the two variables for each participant in the sample by representing the intersection of those two values with a dot on a graph

scientific method
the logical problem-solving process that is used in all psychological research

seasonal affective disorder (SAD)
a mental disorder in which sufferers experience severe depression during winter

secondary appraisal
the second stage where the person considers what options are available to them and how they will respond to the event (stressor); this appraisal is made at a more conscious level

selective attention
refers to the limitations placed on how much we can focus on at any given moment; it is usually difficult to attend to more than one event at the same time, especially if this requires a great deal of mental effort

selective inattention
refers to the way we attend to (or do not attend to) information that may be relevant but emotionally upsetting

self-control
the ability to monitor and direct personal behaviours and responses

self-efficacy
an individual's sense of ability to control and succeed in their life; a person's sense of self-efficacy can impact how they perceive or approach challenges or sources of stress

self-report
statements and answers to questions made by the participants concerning their thoughts and feelings

semantic memory
long-term storage of facts that are not characterised by any particular personal context in which the individual acquired the facts; general knowledge – for example knowing that Canberra is the capital of Australia

semantic networks
the idea that items in long-term memory are stored in a hierarchical pattern of nodes (concepts) with links between related nodes

sensory memory
according to the multi-store model of memory, the sensory memory is the store for incoming, fleeting sensory information

sensory neurons
a neuron that carries information from the body and from the outside world into the central nervous system; also known as effector neuron

serial position effect
in immediate free recall, items at the beginning or end of a list are remembered better than those in the middle; comprises the primacy effect and the recency effect

serial recall
recalling information in the order in which it was presented

serotonin
neurotransmitter

shaping
a procedure in which a reinforcer is given for each response that is closer and closer and eventually leads to the desired response; also called 'the method of successive approximations'

short-term memory
according to the multi-store model of memory, the short-term memory is a store which receives information from the long-term and sensory stores; it has a limited capacity of 7+2 pieces of information, and a duration of approximately 12-20 seconds

single-blind procedure
an experimental design in which either the participants or the researcher does not know which participants are in the experimental group

Skinner box
an enclosed chamber with a device to deliver reinforcers (food etc.) and a mechanism which an animal can manipulate in order to escape

sleep
a dynamic process of different stages of consciousness from 'feeling drowsy' through to 'sound asleep' and not being aware of anything

sleep debt
the difference between the amount of sleep you should be getting and the amount you actually get

sleep deprivation
not getting the amount of sleep needed; may involve partial or total loss of sleep

sleep diary
a log used to record sleep patterns

sleep laboratory
a place used for scientific research on sleep that usually resembles a bedroom

sleep-maintaining insomnia
a form of insomnia characterised by difficulty staying asleep throughout the night

sleep-onset insomnia
a form of insomnia characterised by difficulty falling asleep at the beginning of the night

sleep spindles
brainwave patterns that consist of rapid bursts of high frequency, often associated with stage 2 NREM sleep but can be found in stage 3 and 4 NREM sleep

sleep–wake cycle
the biological process of alternating between sleep and wakefulness

social learning theory
describes the way in which people acquire certain behaviours by watching and learning from their role models; the initial focus of observational learning

social support
refers to the network of family, friends, neighbours and community members that are available during difficult times to provide emotional, physical and financial assistance

soma
largest part of the neuron

somatic nervous system
the division of the peripheral nervous system that carries sensory information into the central nervous system and motor commands from the central nervous system to the skeletal muscles

somnambulism
sleep walking, which occurs in stage 3 and stage 4 NREM sleep

somnambulists
sleep walkers, occurs in stage 3 & 4 NREM sleep and usually perform routine tasks

specific phobia
fear of specific objects or situations, illness, injury, disease or death

spinal cord
the bundle of nerve fibres connecting the brain with the peripheral nervous system

spinal reflex
an action controlled by the spinal cord, not the brain

split-half reliability
compares examinee's scores on two halves of a test

spontaneous recovery
the reappearance of an extinguished response after a rest period

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

state-dependent cue
a clue to assist retrieval from long-term memory, due to the internal environment (mood, state or physical condition) in which learning took place

states of consciousness
an individual's level of awareness of internal events (thoughts, feelings and perceptions) and external surroundings; an individual experiences a range of different states of consciousness throughout the day

statistical significance
a result is called statistically significant when the likelihood of a finding occurring by chance is less than 5 in 100 (probability less than 5 per cent; $p < 0.05$)

stimulus discrimination
when an organism responds to the conditioned stimulus but not to any stimulus that is similar to the conditioned stimulus

stimulus generalisation
when an organism responds to a stimulus that is similar to the conditioned stimulus

storage
maintaining encoded information in a memory store

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

streams of consciousness
an analogy, termed by James, that explained consciousness as an ever-changing stream of thoughts that can shift smoothly and effortlessly from one moment to the next, just like water flowing in a stream

strength of correlation
the strength of the relationship between two variables

stress
a psychological and physical response to internal or external sources of tension (stressors) that challenge a person's ability to cope; these can be real or perceived

stressor
a source of tension that challenges a person's ability to cope

subjective data
information about the variables being studied based on opinion, with no external yardstick by which they are measured

subjective reporting
a personal evaluation that could be biased or difficult to compare with other measurements, such as reporting feelings

suprachiasmatic nucleus
located in the hypothalamus where the left and right optic nerves cross paths, it controls circadian rhythms in response to external stimulus

sympathetic nervous system
a branch of the autonomic nervous system that activates the fight-flight-freeze response

synapse
the connection between two neurons

synaptic cleft
the microscopic gap between neurons across which synaptic transmission occurs

synaptic transmission
refers to the process of neurons sending information to each other via neurotransmitters

synaptogenesis
the process of moulding or forming new synapses

systematic desensitation
a process of treating a phobia by introducing stimuli that are more and more fear-provoking while simultaneously invoking relaxation

temporal lobe
the part of the forebrain beneath the temporal plate of the skull, at the side of the head above the ears; contains Wernicke's area and the primary auditory cortex

test–retest reliability
the extent to which a test produces the same result if re-administered to the same person under the same conditions at a different time

theta waves
the typical brainwave pattern (medium frequency and mixed amplitude (some high, some low)) during the early stages of sleep

threat
an assessment that there may be a future harm or a loss

three-phase model
in operant conditioning, the D-B-C (A-B-C) model

tip-of-the-tongue phenomenon
the feeling that something we know is just not available to be recalled from memory. An indication that some forgetting is due to retrieval failure

total sleep deprivation
going without sleep for an entire 24 hour period; may occur for just during one night or for several nights and can lead to serious consequences

transtheoretical model of behaviour change
allows psychologists to understand how people change and to develop different intervention strategies at various stages

treatment
the treatment is the variable that the experimental group participants receive and members of the control group do not (another term for IV)

ultradian rhythm
a biological rhythm that is shorter than 24 hours, such as the NREM/REM sleep cycle

unconditioned response (UCR) (in classical conditioning)
the response that occurs automatically when the unconditioned stimulus is presented; a reflexive or involuntary response as it is predictably caused by an unconditioned stimulus

unconditioned stimulus (UCS) (in classical conditioning)
any stimulus which consistently produces a particular naturally occurring automatic response (for example, the food in Pavlov's experiments)

validity
the extent to which an instrument measures what it is supposed to measure

variables
describable or quantifiable properties measured in research, they may be independent, dependent, confounding, controlled or extraneous

variance
a measure of how much, on average, scores in a dataset differ from the mean

video monitoring
now a common method used in sleep laboratories and in the person's own home to observe sleep; it uses infrared cameras (or cameras in a room lit with infrared light) that operate silently to allow footage to be seen and taped in the dark without disturbing the sleeping participant

voluntary behaviour
actions that are controlled by the person or animal performing them

withdrawal rights
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

zeitgebers
external or environmental cues that affect the sleep–wake cycle, such as the level of light in a room

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