

NELSON



**PHYSICAL
EDUCATION**
VCE UNITS 1&2



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EDITION 2

Nelson Physical Education VCE Units 1 & 2

2nd Edition

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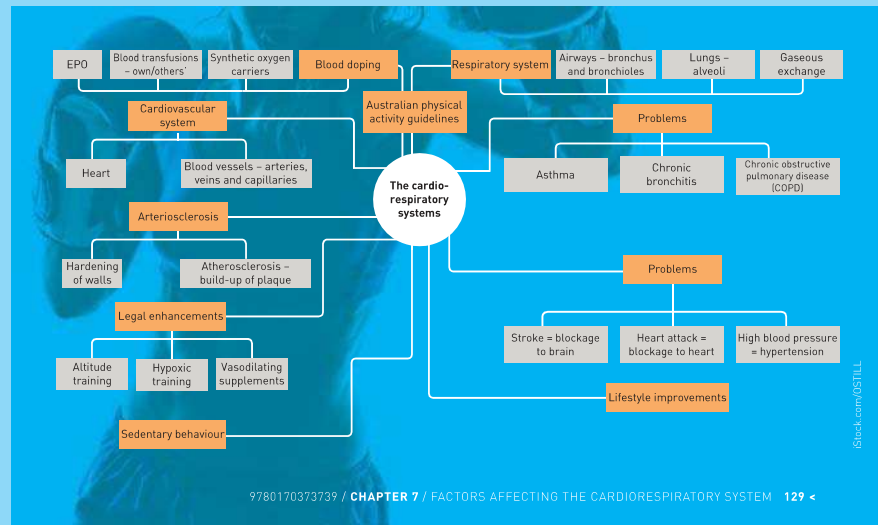
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ABOUT THIS BOOK

This book has been completely rewritten to match the new study design, so we have taken the opportunity to include new research in the relevant areas. We have revised the content and features to provide a better, clearer, more user-friendly book.

Area of study pages list chapters. All VCAA key knowledge and key skills are explicitly covered within them. Each chapter opens with a flow chart providing an at-a-glance preview of what the chapter will cover.



IN EACH CHAPTER

Real world applications include articles and interviews throughout the chapters. Some of the print interviews are also longer video clips (watch for the video icon).

• Sitting at work
 • Sitting or lying down for other social or leisure activities.
 At the time the AHS was collected, the adult physical activity guidelines specified 150 minutes of physical activity over five or more sessions per week. There were no sedentary behaviour guidelines at that time.

REAL WORLD APPLICATION

We're still a nation of Norms

Australian Bureau of Statistics media release, 23 November 2013

It's been 25 years since Norm, the beer-swilling couch potato, climbed off his couch and declared 'Life, lie in it!', but the majority of adult Australians still do not meet the recommended levels of physical activity according to the Australian Bureau of Statistics (ABS).

National activity guidelines recommend adult Australians undertake at least 150 minutes of physical activity per week over five or more separate sessions.

The 2014 National Nutrition and Physical Activity Survey found that only 43 per cent of adult Australians met these guidelines. A higher proportion of males (45 per cent) met the guidelines compared with females (41 per cent).

The Australian Capital Territory had the highest proportion of its population (almost 50 per cent) meeting the national guidelines. The Northern Territory recorded the lowest proportion (37 per cent).

ABS Director Andrew Middleton said that, along with poor nutrition, sedentary behaviour and lack of physical activity are key factors associated with obesity and being overweight.

State/Territory	%
Australian Capital Territory	49.5
New South Wales	44.9
Western Australia	44.6
Victoria	43.4
Queensland	40.5
South Australia	38.8
Northern Territory	37.2

Questions

- Which state or territory has the highest proportion of adults meeting the physical activity guidelines in Australia?
- Which state or territory has the lowest proportion of adults meeting the physical activity guidelines in Australia?
- What age group is the most active population subgroup?

FIY

Resistance training strengthens both the axial (head, neck and trunk) and appendicular (upper and lower limbs) musculoskeletal systems. This improves biomechanics by making your musculoskeletal system more efficient at various movements, while also improving posture by strengthening core and back muscles.

Increased range of motion is an additional benefit of resistance training. By taking your muscles and joints through a greater range of motion, resistance training can improve your mobility, promote healthy joints and decrease your risk of injury.

Resistance training can directly enhance your performance in your chosen sport or activity too. For example, it could enable a soccer player to kick the ball further, and a boxer to throw a punch with greater force.

CHAPTER CHECK-UP

- Define resistance training.
- Define hypertrophy, giving an example in your response.
- Explain the difference between a resistance training program that focuses on strength training and one that focuses on endurance training.

PRACTICAL ACTIVITY

MY RESISTANCE TRAINING PROGRAM

A resistance training program should be designed with your specific fitness goals in mind. Find a sport or activity of your choice and design a resistance training program, addressing the following key elements:

- warm-up
- pre-exercise stretching
- specificity of exercises
- order of exercises, start with large or multiple muscle groups, followed by small muscle groups
- number of repetitions and sets to be completed
- weight to be lifted, the correct weight should produce fatigue by the last repetition in each set
- post-exercise stretching
- frequency

Flexibility

Flexibility is the capacity of a joint or muscle to move through its full range of motion. It also refers to the mobility of the muscles and connective tissues, such as ligaments and tendons, which allows for more movement around the joints. This means the joints can move freely, reducing the risk of injury and falls, which is vitally important in everyday fitness.

Flexibility is required in all our activities of daily living, from getting out of bed to walking, bending down to pick something up, or lifting objects. Flexibility is specific to a particular segment or joint; the degree of flexibility can vary around the body. Being flexible helps produce muscle awareness and can improve posture. It allows muscles to remain mobile, enabling pain-free exercise. Tight muscles or a lack of flexibility can contribute to pain or difficulty in performing the activities of daily living.

As people age, their lean muscle mass decreases. The muscle naturally lose strength and size, and can become less supple. This can affect the range of movement around joints.

FIY snippets are sprinkled through the book to keep you awake! They are not, however, part of the study design key knowledge.

Rollover definitions work with the NelsonNetBook. Otherwise, go to the Glossary pages at the end of the printed book (pp. 356–359).

There are several types of activities within the chapters: Chapter check-up, Laboratory, QuickVid, Data/Text analysis, Investigation and Practical activity. These activities help you develop key skills, think about the content topics, or summarise and consolidate the material you have just completed. They are supplemented by the *Nelson Physical Education VCE Units 1&2 Peak Performance* workbook activities.

QUICKVID

Take a couple of minutes to watch this video that summarises inspiration and expiration and associated pressure changes.

DATA/TEXT ANALYSIS

- Describe any trends that are evident when comparing oxygen consumption, arteriovenous oxygen difference and blood flow.
 - Why does the $a-vO_2$ diff plateau towards the end of the test but blood flow still increases linearly?
 - Why does the $a-vO_2$ diff plateau towards the end of the test but blood flow still increases linearly?
- Why does the $a-vO_2$ diff plateau towards the end of the test but blood flow still increases linearly?
- If the $a-vO_2$ diff graph represents the response of an untrained 20-year-old male who can get to level 5 on the Beep Test, draw a new set of axes to show this, as well as the response of a trained 10-year-old who can get to level 15 on the Beep Test. Assume both are running at the same incremental pace throughout the test.
- As $a-vO_2$ diff increases throughout the test, what must be happening to gas exchange between the alveoli and capillaries at the lungs as well as the muscle cells and surrounding capillaries? Describe why you believe this to be different from resting conditions.

INVESTIGATION

- Briefly discuss how the diaphragm and intercostal muscles work together to bring about inspiration and expiration.
 - Briefly discuss how the diaphragm and intercostal muscles work together to bring about inspiration and expiration.
 - Briefly discuss how the diaphragm and intercostal muscles work together to bring about inspiration and expiration.
- Explain how being 'winded' affects the mechanics of breathing.
- Most athletes perform a warm-up prior to competing. Briefly discuss how this improves oxygen uptake when they start their activity and how this decreases oxygen deficits.

PRACTICAL ACTIVITY

- Briefly discuss how the diaphragm and intercostal muscles work together to bring about inspiration and expiration.
 - Briefly discuss how the diaphragm and intercostal muscles work together to bring about inspiration and expiration.
 - Briefly discuss how the diaphragm and intercostal muscles work together to bring about inspiration and expiration.

CHAPTER CHECK-UP

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- Are these statements true or false?
 - Tendons attach one bone to another.
 - Multipennate muscle fibres produce greater forces than unipennate muscle fibres.
 - Nerve cells come into direct contact with muscle fibres.
 - Acetylcholine activates the release of calcium ions, which stimulate cross-bridges on myosin to reach out and attach to actin filaments.
- Draw a sarcomere (all that is contained between Z-lines) and clearly label the following:
 - Z-lines
 - I-band
 - actin filaments
 - A-band
 - myosin filaments
 - H-zone
- Describe how the sliding filament theory explains muscle movement. Include a brief explanation of how a message sent from the brain very quickly becomes a muscular movement.
- How are athletes able to control the amount of force that a particular muscle group exerts? For example, in one instance a performer may use her arm muscles to pick up a drink bottle and in another the same muscles may be responsible for hurling the discus over 60 metres.
- What does the all or nothing principle convey in terms of muscular contractions?

LABORATORY

ACUTE RESPONSES TO EXERCISE AT THE CARDIOVASCULAR AND RESPIRATORY LEVELS

AIM
To investigate any relationship between exercise intensity and both heart and respiratory rates.

EQUIPMENT
Bench, metronome, heart rate monitor

METHOD

- Form groups of three students. One student will perform bench steps while the other members of their group record heart rates and respiratory rates (rise and fall of chest or number of breaths per minute). The roles should be swapped to allow everyone to experience first hand what occurs during varied exercise intensities.
- Students should keep up with the metronome for each of the four different rates:
 - Rate 1 - 30 beats/min
 - Rate 2 - 45 beats/min
 - Rate 3 - 60 beats/min
 - Rate 4 - 90 beats/min
 The student performing the task should step up on one beat of the metronome and step down on the next beat.
 - One partner records the heart rate and another records the respiratory rate for the last 10 seconds of each minute.
- Use a table similar to the following to record your results.

	Rest/rate	Heart rate	Respiratory rate
Rest			
30 beats/min			
45 beats/min			
60 beats/min			
90 beats/min			

DISCUSSION

- What is the relationship between exercise intensity and heart rate and respiratory rate?
- Is there a relationship between respiratory rate and arteriovenous oxygen difference?
- Account for any differences in the results obtained from different class members (think about gender, training, etc.).

There are no direct weblinks printed in the book, as URLs change often. Instead, there is a single weblink (<http://vcepe12.nelsonnet.com.au>) to a free-access website that will give you direct access to all the weblinks. A web icon will alert you to web-based activities and video clips.



Weblink

CHAPTER SUMMARY

- Endurance athletes such as marathon runners, triathletes and road cyclists use altitude training to improve their body's aerobic capacity.
- Some coaches and athletes use hypoxic training at sea-level based on artificial hypoxic chambers, hooded or even home-based hypoxic tents to trick the brain into thinking it is at altitude.
- Athletes who seek to blood dope are attempting to increase their oxygen-carrying capacity via illegal:
 - blood transfusions
 - injections of erythropoietin (EPO)
 - injections of synthetic oxygen carriers.
- Beta blockers play an important role in cardiovascular medicine and rehabilitation, but an abuse takes by athletes using steady hands, incoordination and a relaxed state of mind. Some abuse use of beta blockers can lead to dangerously low blood pressure, respiratory and cardiac arrest, and altered blood glucose levels, which might cause problems for diabetes.
- Ethical behaviour is generally considered to be behaviour that complies with legal and socially accepted standards, using an ethical method or substance to improve performance assess moral and ethical questions for all of us, and goes beyond the sporting field sport.

CHAPTER REVIEW

Multiple-choice questions

- Blood doping occurs when:
 - athletes remove their own blood, store it and then have it re-injected weeks later
 - EPO is injected by endurance athletes, causing more red blood cells to be produced
 - endurance athletes take plasma expanders
 - all of the above occur
- Low high, train low training involves:
 - athletes living and training at high altitude
 - athletes living and training at sea level
 - athletes living at high altitude and training at sea level
 - athletes living at sea level and training at high altitude.

Short-answer questions

- Typically, which of the following athletes do not use beta blockers?
 - A 200m runner
 - An archer
 - A golfer
 - A soccer goalkeeper.
- What is the primary purpose of altitude training? How can athletes use it to improve endurance efforts?
- Research and then discuss one of the alternative methods to physically training at altitude. Suggest one advantage of your chosen method.
- WADA is well aware that scientists are trying to cheat with genes responsible for improved oxygen-carrying capacity and receptors. What measures has it had in place to counter these 'DNA-dope' cheats?

Each chapter concludes with a dot-point summary of the relevant key knowledge covered.

Chapter revision questions are exam-style, with multiple-choice, short-answer and investigation questions. Answers are in the back of this book, where relevant.

ON THE NELSONNET WEBSITE

The NelsonNet student website has:

- short video clips of interviews
- some templates (scaffolds) of forms, tables and questionnaires for you to complete online or print out
- a few skillsheets and fact sheets



Video



Fact sheet



Skillsheet



Scaffold

Complex concepts are explained by the authors in short video clips, also located on your student website.

Visit <http://nelsonnet.com.au> and enter your login code from the back of this book to access the website.

We hope you have fun using and learning from this book!

ABOUT THE AUTHORS

Dr Amanda Telford (PhD) is an Associate Professor in teacher education. She coordinates a Health and Physical Education degree course in Melbourne and lectures in pedagogy, curriculum design and physical activity behaviour. Amanda was involved in the development of the physical activity and sedentary behaviour guidelines for young people nationally.

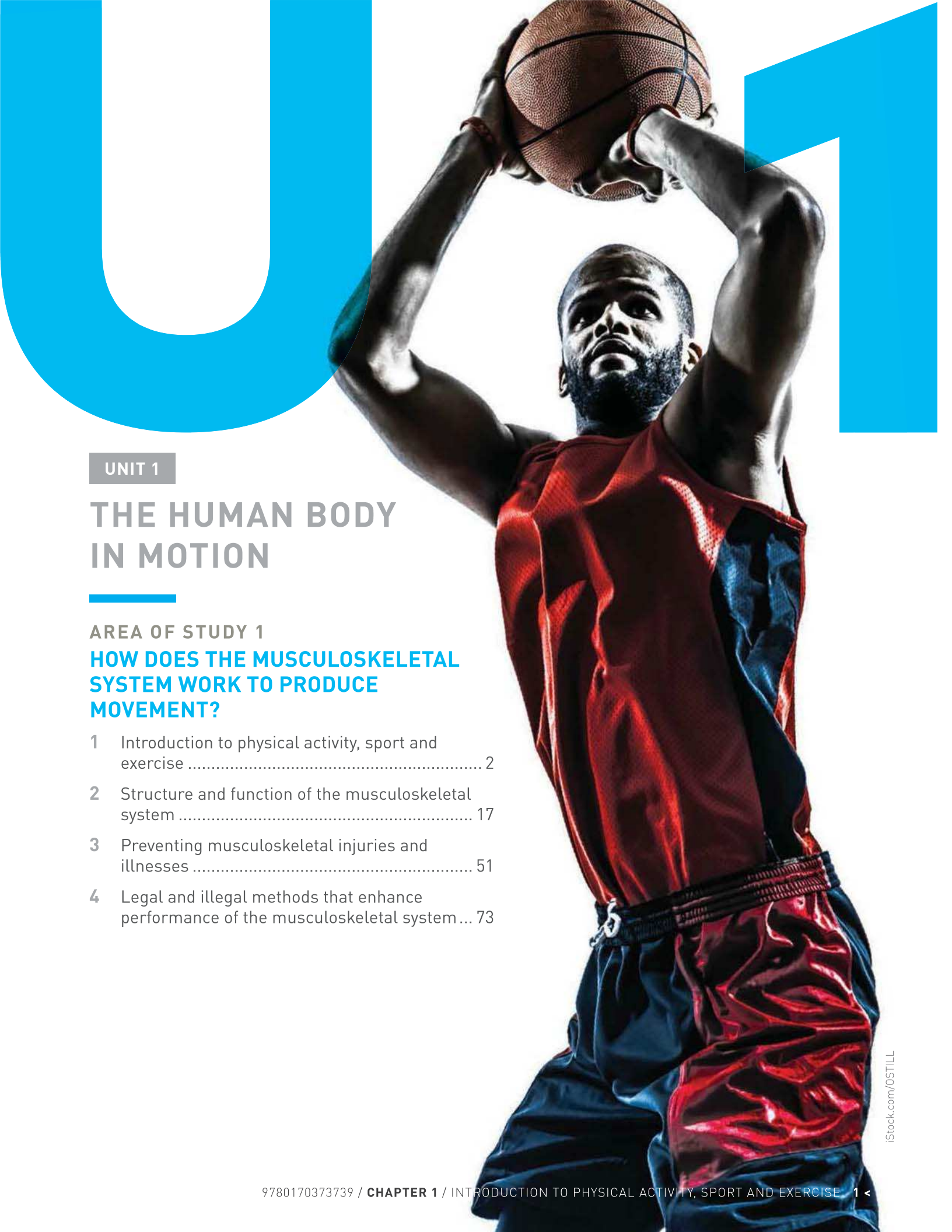
Robert Malpeli teaches at the Knox School, Victoria. He has been a leading light in senior physical education for more than 25 years. With Amanda Telford, he runs a physical education teacher network in Victoria that supports both teachers and students at professional development sessions and seminars.

Rachael Whittle is an experienced senior-secondary physical education teacher. She has worked extensively with the Victorian Curriculum and Assessment Authority (VCAA) on the development of senior-secondary physical education curriculum and assessment. Rachael has delivered dynamic professional learning to teachers nationally and internationally and teaches Physical Education undergraduate degree students at RMIT University. She is currently undertaking her doctoral studies at RMIT University.

Paul Seery is currently VCE and Special Programs manager at Bendigo Senior Secondary College. He is a presenter for the Australian Council for Health, Physical Education and Recreation (ACHPER) and has been involved with VCAA. He has also worked in the sports fitness industry, designing and implementing elite sports programs.

Mark Corrie has taught VCE Physical Education for the past 17 years. He also runs one of the largest physical education teacher networks in Victoria, aimed at sharing resources with teachers across the state. He has been a VCAA Physical Education exam assessor for the past 16 years. Mark is a respected presenter at numerous conferences for both teachers and students throughout the state.





UNIT 1

THE HUMAN BODY IN MOTION

AREA OF STUDY 1

HOW DOES THE MUSCULOSKELETAL SYSTEM WORK TO PRODUCE MOVEMENT?

- 1 Introduction to physical activity, sport and exercise 2
- 2 Structure and function of the musculoskeletal system 17
- 3 Preventing musculoskeletal injuries and illnesses 51
- 4 Legal and illegal methods that enhance performance of the musculoskeletal system... 73

INTRODUCTION TO PHYSICAL ACTIVITY, SPORT AND EXERCISE

Key knowledge

- » the concepts of physical activity, sport and exercise
- » social, cultural and environmental enablers and barriers to movement such as family, peers, socioeconomic status, level of education, cultural values, geographic location and access to facilities

Key skills

- » define and participate in a range of physical activities, sports and exercise
- » describe the social, cultural and environmental influences on physical movement

Source: Extracts from VCE Physical Education Study Design (2017–2021), reproduced by permission, © VCAA.

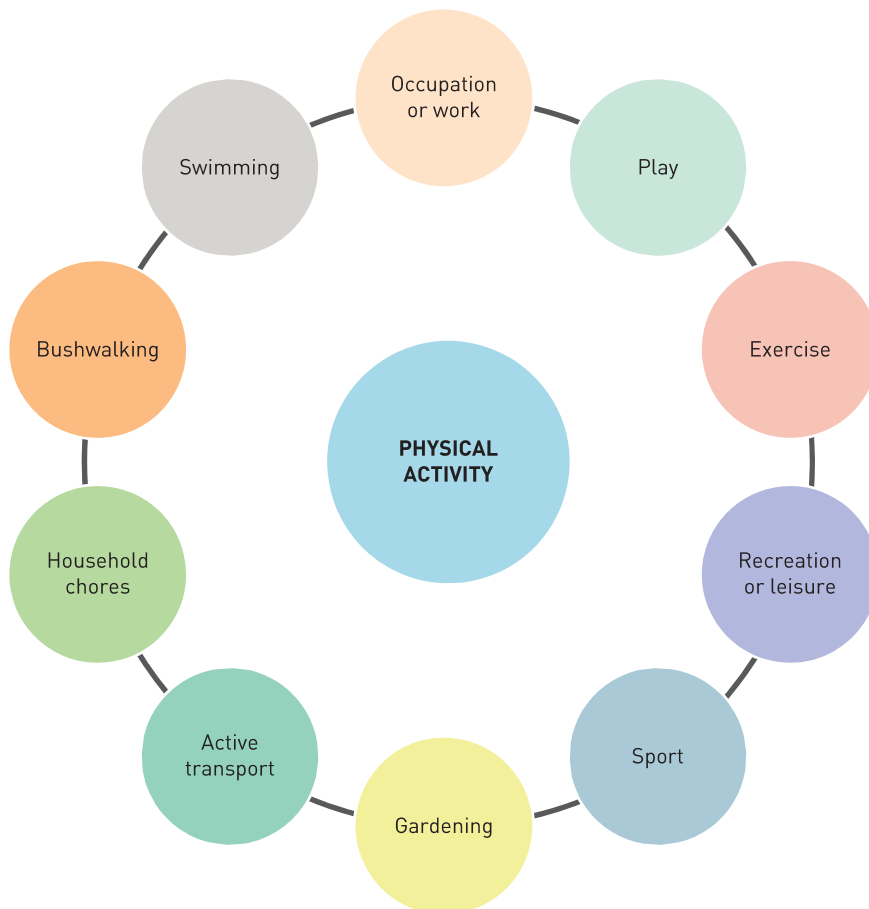


The study of VCE physical education enables students to integrate a contemporary understanding of the theoretical underpinnings of influences on performance and participation in physical activity with practical application. Through engagement in physical activities, VCE physical education will allow students to develop the knowledge and skills required to critically evaluate influences that affect their own and others' performance and participation in physical activity. This study equips students with the appropriate knowledge and skills required to plan, develop and maintain their involvement in physical activity, sport and exercise across their lifespan and to understand the physical, social, emotional and cognitive health benefits associated with being active. The study also prepares students for employment and/or further study at the tertiary level or in vocational education and training settings in fields such as exercise and sport science, health science, education, recreation, sport development and coaching, health promotion and related careers.

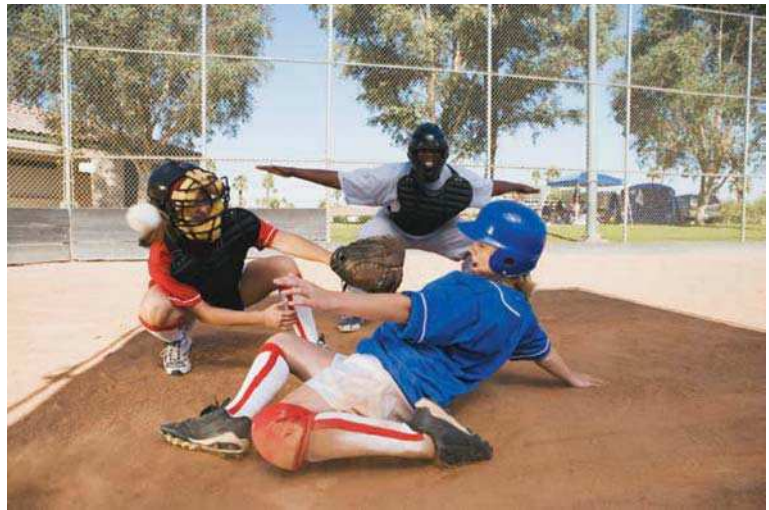
Source: VCAA VCE Physical Education Study Design 2017–2021

While undertaking VCE physical education, you will be looking at physical activity and its various components or parts. Units 1 and 2 introduce a number of different concepts, such as the musculoskeletal and cardiorespiratory systems, as well as participation in physical activity, all within the context of physical activity, sport and exercise.

The terms 'physical activity', 'exercise' and 'sport' are often used interchangeably. They all refer to bodily movement that expends energy, but exercise and sport are components of physical activity, just as aerobic capacity, agility, speed, flexibility and a whole host of other components make up a person's physical fitness.



The relationship between physical activity, sport and exercise



Physical activity can occur in a number of ways – scooting to the shops, playing competitive softball on the weekend or playing beach cricket with family and friends.

Physical activity is commonly described according to the following four dimensions:

- 1 **frequency** – the number of events of physical activity during a specific time period
- 2 **intensity** – physiological effort associated with participating in a special type of physical activity
- 3 **duration** – time of participation in a single bout of physical activity
- 4 **type** – the sort of physical activity that is being done.

These are sometimes referred to by the acronym FITT, which stands for frequency, intensity, time (duration) and type. Three of the dimensions of physical activity (intensity, frequency and duration) are fundamental because their assessments make it possible to calculate the energy expenditure associated with physical activity.

Students undertaking physical education studies will engage in exercise and sport – two common sub-components of physical activity that are both structured and planned. However, some physical activity is unstructured and unplanned. This type of activity is commonly referred to as incidental physical activity.

CHAPTER CHECK-UP

- 1 How could you encourage more students to use active transport as a means of getting to school two days per week?
- 2 List three different ways you could assess the intensity of movement when someone is
 - a bushwalking
 - b playing netball
 - c doing a gym workout.
- 3
 - a What are the differences between sport, exercise and play?
 - b What do sport, exercise and play all have in common?

In 2012 the Australian Bureau of Statistics found that physical activity levels of adults (aged 15+) were related to a number of environmental and socioeconomic conditions.

- » Men had higher participation rates for sport and physical recreation than women.
- » Adults living in the lowest income households were more likely to be sedentary or to exercise at low levels.
- » Employed adults were more active than unemployed adults.
- » People living in cities were likely to be more physically active than those living in rural areas.
- » Almost half of employed adults worked in a job environment with low levels of physical activity or incidental physical activity.
- » Women spent more hours per day sitting at work than men.
- » People with dependent children were less likely to meet the recommended physical activity guidelines than those without children.
- » Being physically inactive can lead to becoming overweight and obese, which can increase the risk of developing a number of chronic health conditions. People who were sedentary or exercised at low levels were more likely to have heart disease, stroke and vascular disease, hypertension, type 2 diabetes and arthritis than those who exercised at moderate or high levels.

iStock.com / Halfpoint



Having dependent children doesn't necessarily mean physical activity levels need to decrease. Being active with others, as well as providing social benefits, is more likely to result in regular physical activity.

ENABLERS AND BARRIERS TO MOVEMENT AND PHYSICAL ACTIVITY

If you take a quick survey of your classmates regarding the physical activities they participate in, their preferences and the reasons for these would probably differ from those of their parents. There is a range of factors that influence people to participate in physical activities – these are known as **enablers**. Conversely, the factors that stop or inhibit people's participation in activities are known as **barriers**. These will be investigated in greater detail in chapter 12.

The two factors that have the greatest influence on physical activity, sports and exercise participation are access to supportive facilities, and time. These factors can be both enablers and barriers. The following factors also influence people's decisions to take up, and continue, physical activity.

Family and peers

Socialising agents such as family, peers, coaches and teachers can all greatly influence participation in physical activities.

Parents and carers can help their children be physically active in numerous ways. They can set a positive example by being regularly physically active themselves, and also by involving the whole family in physical activities. This can happen by playing sport together, or by engaging in recreational and play-based activities, depending on the age of their children. Once children become young adults, this support can also come in the form of driving them to games and cheering for them on the sidelines.

Parents and carers can also encourage students of an appropriate age to consider active transport to school, such as walking, scooting or cycling. Setting time limits on sedentary activities such as playing computer games, spending time on social media and watching



Positive peer interactions promote physical activity.

Shutterstock.com / wavebreakmedia

television can also help encourage physical activity and adherence to the Australian physical activity and sedentary behaviour guidelines (see chapter 10).

Family members can become actively involved in other ways, too. Many parents encourage participation in sport by organising and supporting training schedules, converting part of their home into a training space, or by providing financial assistance when required.

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Peer role modelling of sedentary behaviour can lead to decreased participation in physical activity.

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Alamy Stock Photo / Derek Trask

It is vital that students receive equal opportunities and encouragement to pursue sports that they enjoy, regardless of their gender.

CHAPTER CHECK-UP

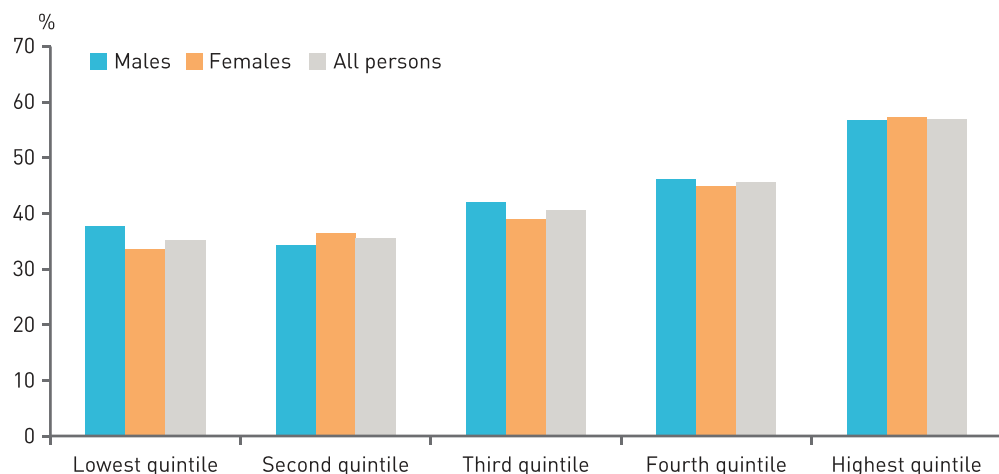
- 1 Discuss how having dependent children might contribute to lowered levels of physical activity.
- 2 Some family settings do not encourage participation in physical activity, and some may even provide significant barriers to it. Provide two examples of barriers to physical activity that may be present in a family setting.
- 3 Discuss two ways a peer group can positively influence participation in physical activity.
- 4 How can physical education teachers contribute to barriers to physical activity?
- 5 Not having enough time is often cited as a reason for not being physically active. Imagine that you know a 15-year-old who plays two musical instruments, is SRC middle-school rep and has just been awarded the leading role in the school's drama production. She is concerned that she is 'too busy' to exercise. Suggest two ways she could create time for exercise.

As children become young adults and move from primary to secondary school, their peers will increasingly influence whether they are physically active or inactive. Research indicates that some parents believe that sports are more suited to boys than girls, and encourage stereotypical participation in sport and physical activity according to gender. For example, some parents may encourage their daughters to take up gymnastics and dance but their sons to take up football and karate.

Teachers, and PE teachers in particular, can counter these skewed perceptions by providing equal opportunities and encouragement to both males and females. Although this is slowly changing, some activities still offer one gender more opportunities than the other. A boy who loves netball may struggle to find a team to train and play with, while a girl trying to play rugby may encounter similar difficulties, particularly in their mid to late teens.

Socioeconomic status

People living in lower income households are less likely to meet the national physical activity guidelines. In 2011–12, just 35 per cent of Australians in the lowest income households were sufficiently active for health. The proportion of fit adult Australians generally increased with



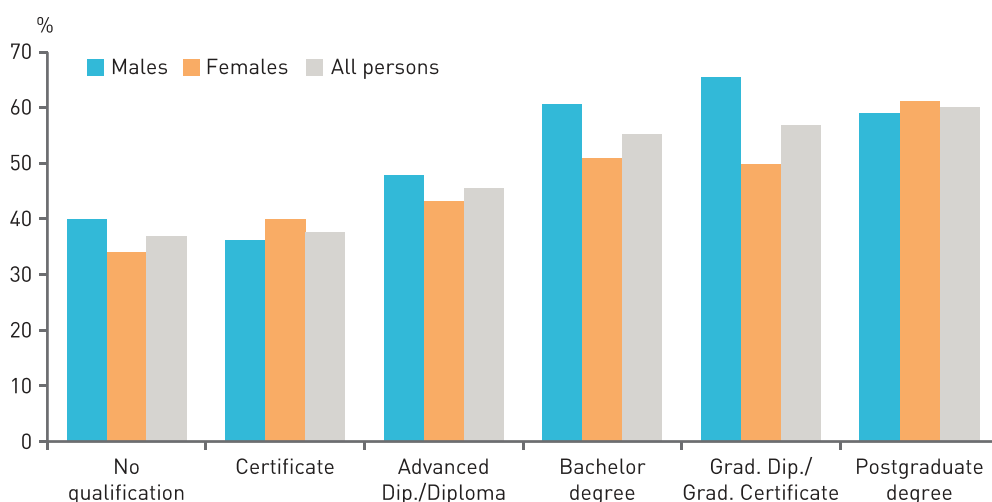
Proportion of adult Australians classed as sufficiently active, by household income, 2011–12

Source: Australian Bureau of Statistics, 2013, *Perspectives on Sport*, cat. No. 4156.0.55.001, viewed 6 June 2016

income, with 57 per cent of people in the highest income households sufficiently active for health. The low rates of activity in lower income households may be due, in part, to limited financial resources, greater child-minding responsibilities, higher levels of disability, higher levels of psychological distress, or long hours in manual work, all of which affect people's capacity for participation.

Level of education

The most recent Australian survey has found that higher education levels are associated with increased physical activity. Adults with a tertiary qualification were more likely to meet the physical activity guidelines than those with no post-school qualifications (46 per cent compared with 34 per cent), and were less likely to be sedentary or to exercise at low levels.



Proportion of Australian adults classed as sufficiently active, by highest non-school qualification, 2011–12

Source: Australian Bureau of Statistics, 2013, *Perspectives on Sport*, cat. No. 4156.0.55.001, viewed 6 June 2016

People with higher levels of education may be more informed about the health consequences of certain lifestyle behaviours, leading them to exercise more often and more intensely.

As well as leading to a greater awareness of the health benefits associated with regular physical activity, a higher level of education is closely linked to higher income, earning capacity and socioeconomic status.

Age and sex

Age also affects the likelihood of a person being sufficiently active for health. In 2011–12, Australians aged 18 to 24 years were more likely to meet the national guidelines than any other age group (53 per cent). The proportion of the active population declined with age, with only about 25 per cent of Australians aged 75+ years being sufficiently active. In the 18 to 24 age group, 59 per cent of males and 48 per cent of females were sufficiently active, reflecting a trend that can be seen across all age groups.

Cultural values

Research suggests that a person's culture shapes their attitudes towards and involvement in physical activity. For example, some cultures value physical activity and movement obtained via sport, leisure and play, whereas others regard physical labour and household chores as a better way to engage in physical activity.

In some cultures, family and community responsibilities take precedence over recreational activity. Taking time to exercise can be seen as selfish. In others, clothing requirements, such as women being required to wear skirts or a hijab, or men to wear a turban, might restrict movement, and thus limit involvement in physical activity.

Religious beliefs and holidays can affect an individual's ability to participate in scheduled sporting programs and competitions. For example, many Muslim men and women pray at regular times throughout the day. A scheduled physical activity program may not be able to accommodate this requirement (Caperchione et al., 2009).

People who are new to Australia may not speak English, and so may struggle to understand programs and activity guides, or follow exercise instruction. Not all cultural groups are aware of the benefits of physical activity, so a lack of translated material and multimedia campaigns aimed at these groups can be a barrier. Additionally, the steps required in order to join physical activity pursuits, such as joining clubs, completing registration forms and providing personal information, might be particularly problematic for people from a non-English speaking background (NESB).

Some people feel more comfortable interacting with individuals of a similar background and identity. This can either be a motivator or a barrier to physical activity, depending on the facility and the organisation. Individuals may be afraid of encountering prejudice and discrimination due to ethnicity, race or cultural heritage. For example, there have been instances of racist abuse against black players in some sports, most notably in football.

Geographic location and environmental factors

People living in rural areas are often perceived as being more active than those in metropolitan areas, due to the physical nature of work commonly done in rural areas, such as agriculture, forestry and fishing. However, reduced access to and availability of sporting and public transport facilities in rural areas may create barriers to participating in recreational physical activity. The active nature of a person's job may also have an effect on how much physical activity they do outside of work.

After adjusting for age, a higher proportion of men living in inner regional (41 per cent) or outer regional and remote areas of Australia (47 per cent) did no exercise in the week prior to interview, compared with those living in major cities (36 per cent). Men in outer regional and remote areas of



Newspix / Norm Oortloff

Australia were also more likely to be sedentary or to exercise at low levels than those in major cities (72 per cent compared with 68 per cent). (Australian Institute of Health and Welfare, 2014) This may be influenced by the amount of physical activity they do at work. The exercise levels of women living both within and outside major cities were similar.

Being outside can provide opportunities for enjoyable physical activity. However, the natural environment can also be a barrier to physical activity, with factors such as weather and air quality sometimes creating unsafe conditions.

Activities such as camping and hiking are popular ways to exercise outdoors. Some people enjoy walking in natural settings as the sunlight and fresh air can improve their physical and mental states. However, the natural environment can also be uncomfortable and sometimes unsafe for people to be active in. For example, extreme heat or cold may lead to hyperthermia or hypothermia, respectively, and air or water quality can be too poor or polluted to be active in. These factors can provide significant barriers to being physically active.

CHAPTER CHECK-UP

- 1 Belonging to a cultural group can either be an enabler or a barrier to physical activity. Copy and complete the following table to provide two examples of each that are different from the reasons given on pages 9 and 10.

Cultural enablers	Cultural barriers

- 2 Rural areas in Australia have a reputation for

having great 'sporting communities', despite researchers having found that people living in rural areas have lower levels of physical activity participation. Discuss why this might be the case.

- 3 Provide two examples of how the natural environment might not be suitable for physical activity at a particular time.
- 4 In Singapore, most new schools have air-conditioned gymnasiums. Why would schools go to this great expense?

Alamy Stock Photo / Martyn Goddard



Natural settings where local councils install community facilities attract people and encourage them to be physically active.

The built environment refers to things that have been built by people, as opposed to occurring naturally – for example, paths, roads, schools and recreation facilities (pools, playing fields, gymnasiums), as well as town planning and neighbourhood design. Traffic calming measures such as roundabouts, speed humps or other means of slowing traffic make it safer for people to use active transportation such as walking, cycling and skating. Well-lit, well-maintained footpaths and separate bike lanes also encourage active transportation.

Safety

Unsafe neighbourhoods provide barriers to physical activity for both males and females. People who feel that their neighbourhood is unsafe are less willing to walk outside, especially at night. Neighbourhood safety can be challenged by the presence of drugs, crime and violence. Neighbourhoods can also be unsafe due to poor lighting, pollution or poor design. Community leaders and representatives need to be aware of these issues in order to combat them and provide safe places for people to be physically active outdoors in their local area.

Social support

Social support has long been considered a key determinant in reinforcing physical activity. Sources of this type of support can be in the form of someone with whom to exercise, or someone who provides encouragement and praise for being active. People who feel socially isolated may be less confident about participating in physical activity and less aware of the programs that are available. When family or friends do not support an individual's attempts to become physically active, it is harder to stay involved, and participants are more likely to drop out. When an individual's social connections change (for example, kids grow up, friends move away, careers change direction), this transition can affect social connections and lead to decreased levels of physical activity.

REAL WORLD APPLICATION

Physical activity: getting children involved

Getting children involved in lots of fun physical activity keeps them active and healthy. It's easy when you help them find activities that they enjoy – and that you can do as part of everyday family life.

How to get children involved in physical activity

Helping children find activities that they like is one of the keys to keeping them active.

Dancing, skipping, running, playing with a ball or flying a kite – it doesn't matter what the activity is as long as they like it.

Physical activity: variety and fun

You can help your child explore lots of different activities to find something they enjoy.

For example, children who like balancing might enjoy climbing, cycling, playgrounds, dance or gymnastics. Others who like hand–eye coordination tasks might enjoy ball games in the park, tenpin bowling, Frisbee or sports such as cricket or tennis.

Plenty of variety in your child's mix of sports, games and activities will also keep him or her excited about moving. And when your child tries out different activities, they can pick up new skills, stay interested and challenged, and get enough physical activity in their days.

It is also good for your child's health and development to do physical activity that varies in intensity, including moderate and vigorous activity.

Tips for encouraging active children

- Be active yourself and your child is more likely to follow your lead.
- Give your child praise and encouragement if an activity is proving hard for them.
- Try to make some time to have fun playing actively with your child. It's great to find something you both enjoy doing.
- Encourage your child to play outside.





- Go with your child when they try an organised sport or group lesson – for example, swimming or dancing.
- Get the family going – organise family activities like camping, bushwalking and outdoor games.
- Involve your child in daily chores around the house such as gardening, washing the car and cleaning.
- Keep an activities box at home and in the car with balls, bats, kite, beach bucket and spade so that you're always prepared.
- Balls, bikes and scooters make great gifts, and encourage physical activity and opportunities to play outdoors.

Young children are rarely intensely active for long periods, but will often have bursts of activity for a few minutes or less. This is healthy, and your children will be more likely to keep doing it if you encourage them.

Source: Raising Children Network

Activity

The advice above from the Raising Children Network on encouraging children to be active provides us with insights into social, cultural and environmental considerations around the promotion of movement and physical activity, as well as the barriers that need to be overcome.

Draw a grid similar to the one below. Decide whether each recommendation/bullet point in the article above is an enabler or barrier linked to family, peers, access to facilities, access to equipment, geographic location, socioeconomic status etc., and list it in the table below.

Some enablers and barriers have already been inserted to start you off.

	Family	Peers	Access to facilities	Access to equipment	Geographic location	Socioeconomic status
Enablers	» Having active parents as role models		» Having playing fields, playgrounds, basketball/netball courts at school		» Living close to the beach, park, playing field	
Barriers	» Parents who don't like walking and drive their children to school			» Not having frisbees, kites, balls etc.	» Not living close to bike paths	» Not being able to afford dance/swimming lessons

Walking

One of the easiest ways to incorporate activity into your child's routine is to take regular walks together.

You can walk to school, child care or kindergarten. Look for parks along the way. Active transport, such as walking, cycling or using a scooter, encourages children to get around on their own safely in your neighbourhood. You can even start when your child is a baby. Young babies can go on outings in a sling, carrier or pram.

Walking to school every day has many benefits for you, your children and your community. These benefits include:

- » keeping you and your children feeling happy and well
- » giving your children opportunities to learn and practise road rules and road safety
- » making your children aware of their neighbourhood
- » giving you and your children the chance to talk and spend time together
- » meeting neighbours along the route, and chatting with other parents at the school gate
- » helping children feel good about where they live.

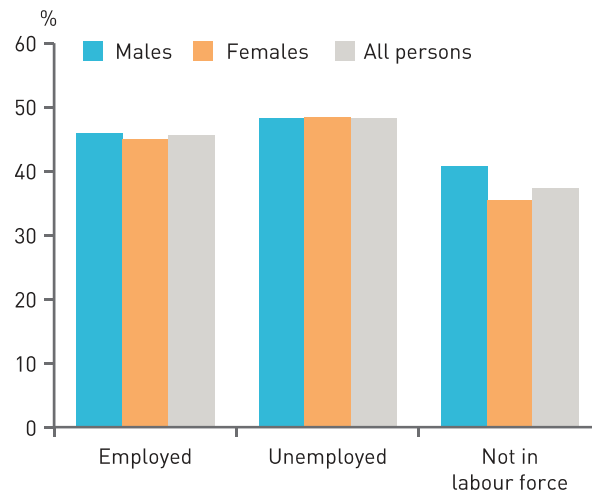
You can increase the range of your walks by following nature trails in parks, and by taking trips to interesting locations.

FYI

Dogs are considered a form of social support because they can increase a person's confidence and decrease their fear of walking alone. People who own a dog walk an average of 15 minutes a week more than non-dog owners.

Employment status

There is no statistical evidence to suggest that employed people are more likely to meet the Australian physical activity guidelines than unemployed Australians. In 2011–12 a similar proportion of employed Australians (45 per cent) and unemployed Australians (48 per cent) were classed as being sufficiently active. However, both employed and unemployed people were more likely to meet the guidelines than those not in the labour force (retirees and those who no longer work, do not intend to work in the future, are permanently unable to work or have never worked). Adults who were employed were less likely to be sedentary or exercise at low levels (54.6 per cent) than those who were not in the labour force (62.7 per cent). Around 37 per cent of Australians not in the labour force were classed as sufficiently active for health. Of those not in the labour force, a higher proportion of males (41 per cent) than females (35 per cent) were classed as sufficiently active for health (Australian Bureau of Statistics).



Proportion of adult Australians classed as sufficiently active, by work status

Source: ABS, 2013, *Perspectives on Sport*, cat. No. 4156.0.55.001

Mass media promoting physical activity

Mass media also plays a key role in the promotion of physical activity. It does this in a number of ways, such as:

- » increasing awareness of how people can become involved in physical activity
- » increasing awareness of physical activity as a public health issue
- » providing information about the health and non-health benefits associated with regular physical activity
- » providing information about the consequences of inactivity
- » increasing interest in physical activity participation and raising awareness of community-based programs
- » motivating individuals to take action towards increasing their physical activity.

CHAPTER SUMMARY

- Exercise and sport are components of physical activity, which involves bodily movement resulting in energy expenditure.
- Participation in physical activity is influenced by many factors. Some of these are known as 'enablers' – things that promote and encourage participation in movement/physical activity. Others are known as 'barriers', because they block or impede participation in physical activity.
- FITT is an acronym describing the four dimensions commonly monitored when considering physical activity. FITT stands for frequency, intensity, time and type of activity.
- Incidental physical activity can occur during work, play and walking to and from work/school. Structured activities include dancing, organised/competitive sport and bushwalking.
- Socialising agents such as family, peers, coaches and teachers greatly influence participation in movement-based and physical activities.
- There is a relationship between lower socioeconomic status and reduced participation in physical activity.
- Recent Australian research has found that higher education levels are associated with increased physical activity. People with higher levels of education may be more informed of the health consequences of certain lifestyle behaviours, leading them to exercise more often.
- Some cultures value physical activity and movement obtained via sport, leisure and play whereas others regard physical labour and household chores as a better way to engage in physical activity.
- People living in rural areas are often perceived as being more active than those living in metropolitan areas, due to the physical nature of work commonly done in rural areas, such as agriculture, forestry and fishing. However, reduced access to and availability of sporting and public transport facilities in rural areas may create barriers to people participating in recreational physical activity.
- Unsafe neighbourhoods provide barriers to physical activity. People who feel their neighbourhoods are unsafe are less willing to walk outside, especially at night.
- People who feel socially isolated may feel less confident about participating in physical activity and may not be aware of the programs that are available.

CHAPTER REVIEW

Multiple-choice questions

- 1 The natural environment can be a nice place to be active, unless it is:
 - A overcrowded
 - B far away
 - C polluted
 - D of historical significance.
- 2 Some immigrants may display low levels of physical activity because they might not:
 - A like the activities available to them in Australia
 - B have a driver's licence, and so might have restricted access to facilities
 - C be aware of opportunities to be physically active, due to language barriers
 - D want to change their existing patterns of exercise and physical activity participation.
- 3 Factors that influence the ability to participate in physical activity outdoors include:
 - A natural environments
 - B built environments
 - C the weather
 - D all of the above.

Short-answer questions

- 4 Rather than rewarding their children with electronic games, parents today are being encouraged to consider providing

- sporting goods (balls, racquets, bikes) as rewards. Discuss why this practice doesn't guarantee an increase in children's physical activity levels.
- 5 Mass media campaigns, such as TV commercials, seek to increase levels of physical activity among the population, targeting thousands of people. List two advantages these campaigns have over information brochures, which might be mailed to 5000 households. How might the brochures actually have a greater influence in getting more people physically active than mass media campaigns?
- 6 People with higher levels of education tend to be more physically active than those with lower levels. Discuss two reasons why this might be the case.
- 7 Just as racism, sexism and classism are all forms of prejudice, disability can also be met with negative attitudes and false stereotypes. People with impairments often have lower levels of participation in physical activity than non-impaired people. Suggest three reasons why this might be the case.
- 8 Schools are great settings in which to encourage participation in physical activity. Discuss three reasons why schools are able to do this more effectively than the workplace or the general community.

2

STRUCTURE AND FUNCTION OF THE MUSCULOSKELETAL SYSTEM

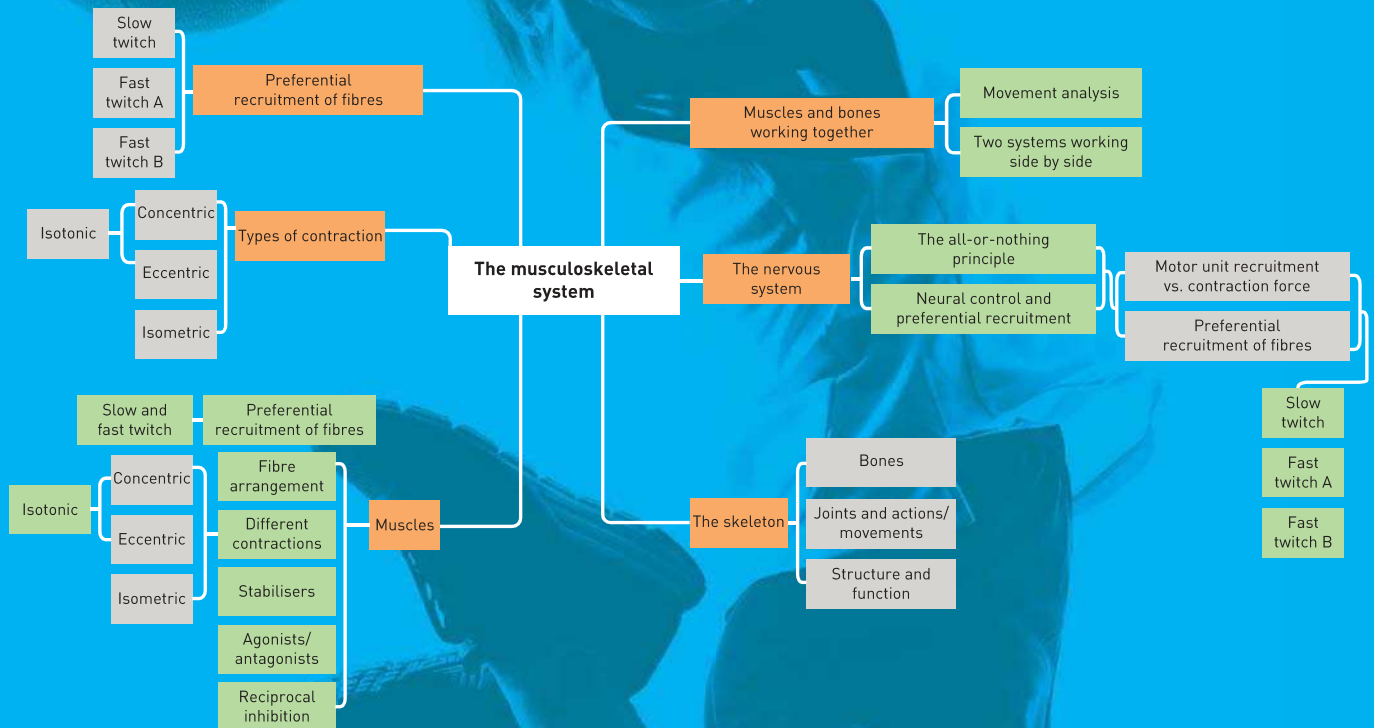
Key knowledge

- » the structure and function of the skeletal system including bones of the human body, classification of joints and joint actions
- » the major muscles of the human body
- » characteristics and functions of muscle fibres, including fibre arrangement and type (fast twitch and slow twitch)
- » types of muscular actions (isoinertial, isometric and isokinetic)
- » agonists, antagonists and stabilisers, and the concept of reciprocal inhibition
- » control of muscles, including the recruitment (size principle) and activation (all or nothing principle) of motor units in relation to force production
- » interactions of muscles and bones to produce movement in physical activity, sport and exercise

Key skills

- » use and apply correct terminology to the working of the musculoskeletal system in producing human movement
- » perform, observe and analyse a variety of movements used in physical activity, sport and exercise to explain the interaction between bones, muscles, joints and joint actions responsible for movement
- » describe the role of agonists, antagonists and stabilisers in movement
- » describe the relationship between motor unit recruitment, activation and force production

Source: Extracts from VCE Physical Education Study Design (2017–2021), reproduced by permission, © VCAA.



When studying physical education, a basic understanding of anatomy and physiology is vital. This chapter considers anatomical concepts relating to the body's basic structure. It then looks at physiological concepts, which focus on how the human body works and functions, and how its many systems are interrelated.

The musculoskeletal system consists of the skeletal system, which is made up of the bones and joints, and the skeletal (voluntary) muscle system. The bones provide the levers for the muscles to act upon. As well as the bones and skeletal muscles, the musculoskeletal system includes:

- » ligaments, which connect bones to other bones
- » cartilage, which provides a protective 'shock-absorbing' gel between joints
- » tendons, which connect muscles to bones.

These three tissues work together with the skeleton, which performs the following important functions:

- » protection of vital internal organs such as the brain (skull), spinal cord (vertebral column) and lungs (ribs)
- » support, allowing upright posture to be attained and maintained, as well as suitable attachment sites for muscles
- » storage of fuels, fats and minerals
- » leverage, allowing movements to occur
- » mineral balance/homeostasis
- » blood cell production (haematopoiesis).

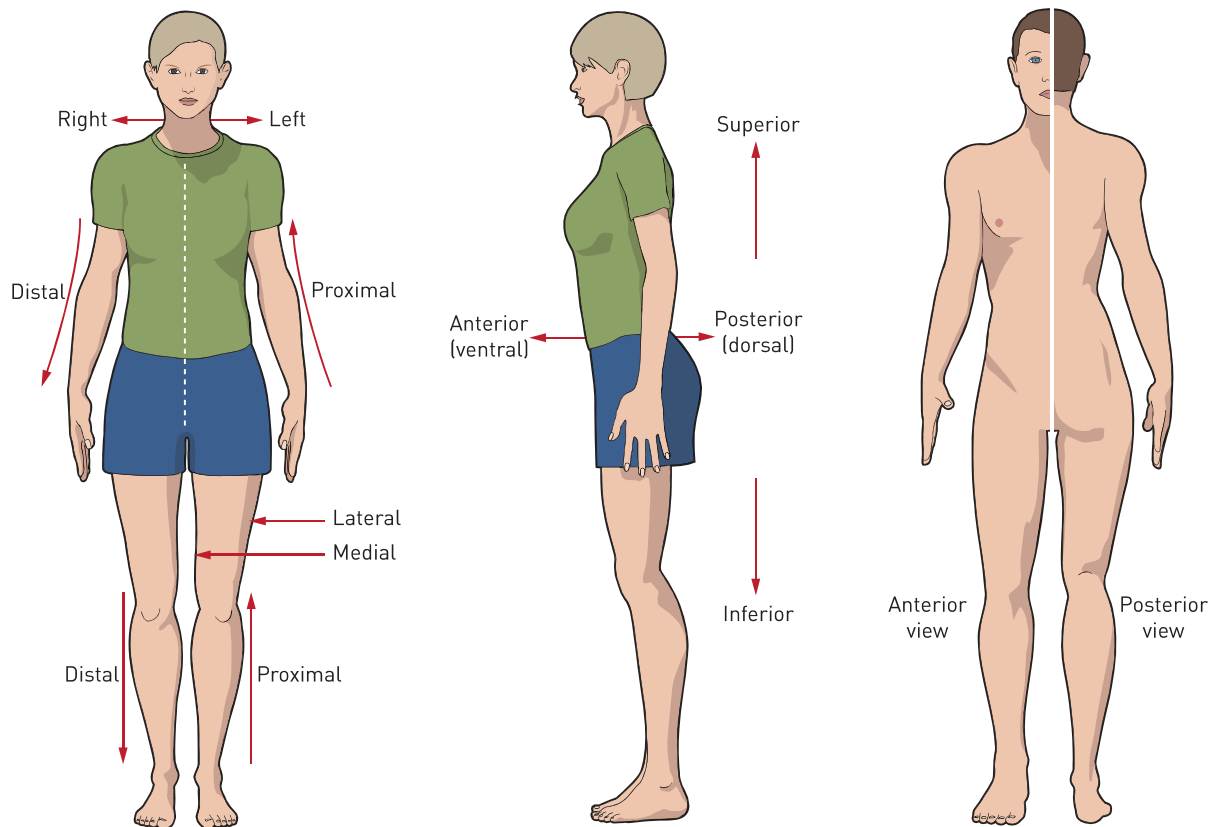
ANATOMICAL TERMS

To understand how the parts of the musculoskeletal system work together, it is important to become familiar with terms of direction and body planes. Anatomical terms are used to explain the location of body parts, usually in relation to others. For example, the shoulder is superior to the hip and the knee is inferior to the hip. Table 2.1 summarises some of the most commonly used anatomical terms.

TABLE 2.1 Definitions of commonly used anatomical terms

Anatomical term	Definition	Example
Superior	Closer to the head than another part	The shoulder joint is superior to the elbow joint.
Inferior	Closer to the feet than another part	The knee joint is inferior to the hip joint.
Anterior/ventral	Towards the front of the body	The pectorals are anterior to the latissimus dorsi.
Posterior/dorsal	Towards the back of the body	The hamstrings are posterior to the quadriceps.
Medial	Towards the imaginary midline of the body	The nose is medial to the ears.
Lateral	Away from the imaginary midline of the body	The ears are lateral to the eyes.
Proximal	A body part closer to its attachment point	The elbow is proximal to the wrist because it is closer to the shoulder joint – the attachment point.

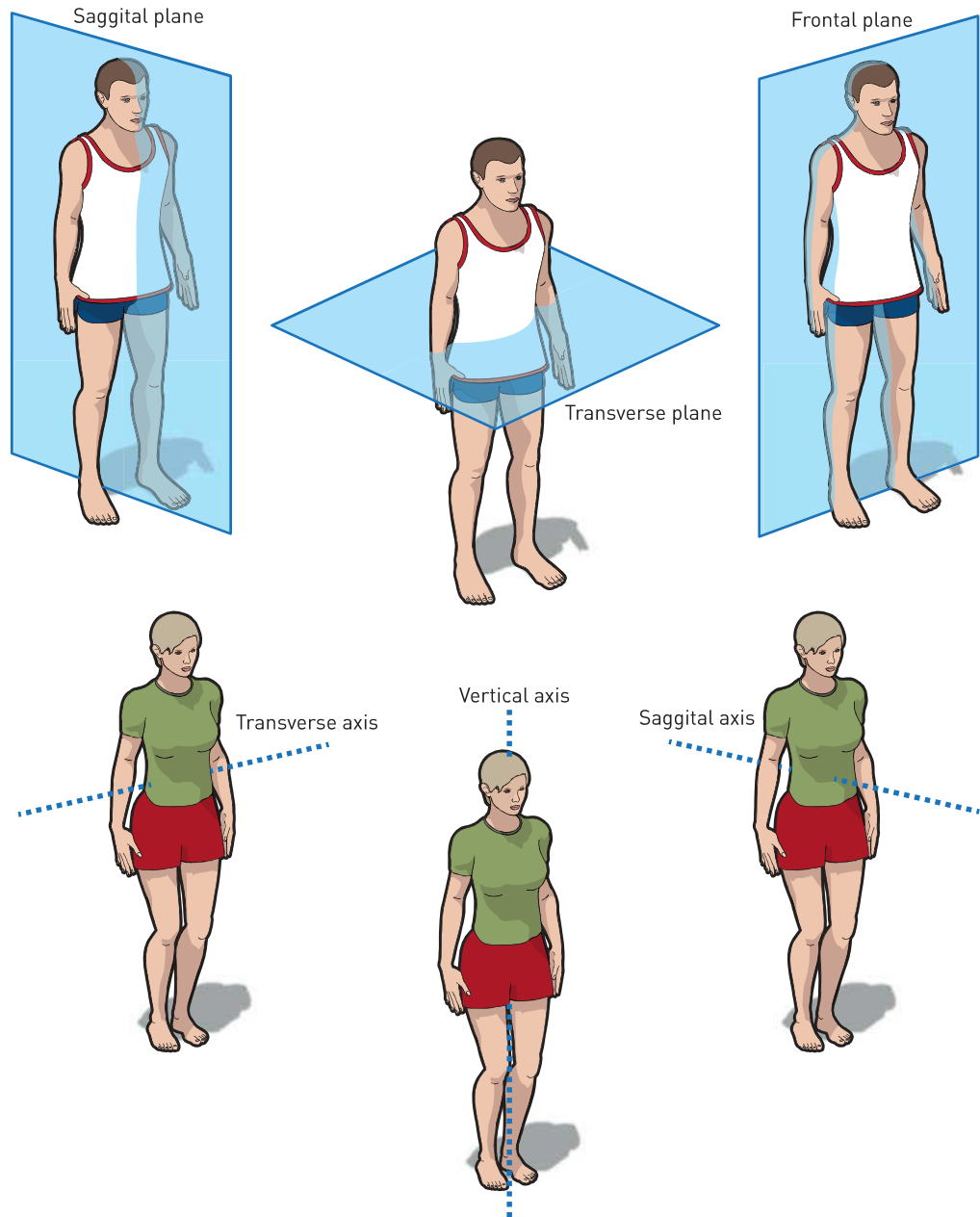
Anatomical term	Definition	Example
Distal	A body part further away from the point of attachment than another	The wrist is distal to the forearm flexors.
Left	Towards the left side of the body	Your right if looking at the anterior view.
Right	Towards the right side of the body	Your left if looking at the anterior view.
Superficial	A body part closer to the surface of the body than another	When you sweat, your veins dilate and become more superficial.
Deep	A body part that is internal or further from the surface of the body than another	Hypothermia leads to vasoconstriction and the veins become more deeply positioned.
Palmar	The palm side of the hand	When the radius and the ulna of the forearm are crossed, the palmar part of the hand faces downwards.
Plantar	The sole side of the foot	When the heel strikes the ground and you push off your toes as you walk or run, you are using the plantar side of your feet.



Basic anatomical positions

When the skeletal and muscular systems work together, our bodies are capable of moving in many different ways. It is useful to imagine the body and its segments having flat surfaces or planes running through them. These surfaces are known as **planes of movement**, and they divide the body up in three ways.

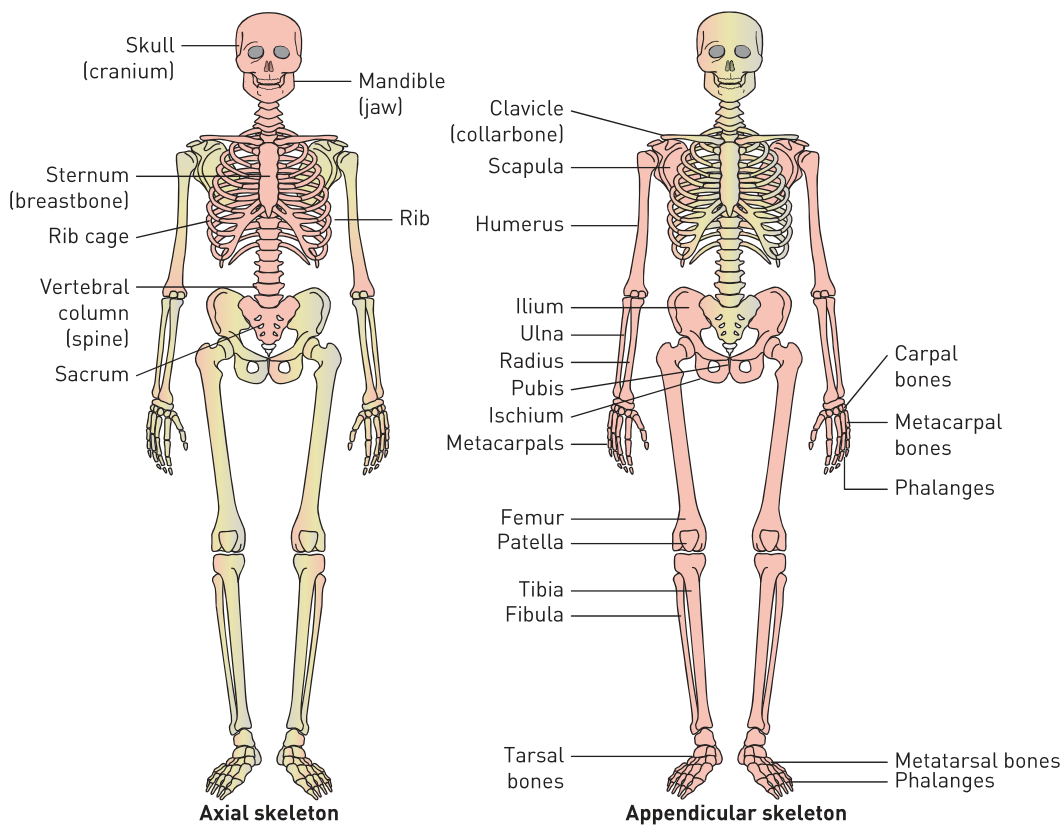
- » **Median/sagittal plane** – divides the body into left and right sections.
- » **Horizontal/transverse plane** – divides the body into superior and inferior sections.
- » **Frontal/coronal plane** – divides the body into anterior and posterior sections.



Body planes

BONES OF THE HUMAN BODY

The skeleton is made up of 206 bones and can be divided into two distinct sections – the axial and appendicular skeletons. The diagram on page 21 shows the differences between these two sections, and reveals the major bones responsible for movement (it's unlikely you will need to familiarise yourself with every bone in the body!). The axial section provides the main support for the body and includes the skull, vertebral column and rib cage. The appendicular section is made up of the limb bones and their 'girdles', which connect onto the axial skeleton.



FYI
 The appendicular skeleton has 126 bones; the axial skeleton has 80 bones.

The axial and appendicular sections of the skeleton (shown in pink)

The vertebral column

The vertebral column is involved in more than 95 per cent of the movements you make. It comprises 33 bones – 24 are unfused or separate and nine are fused together to make up the sacrum and coccyx. The five main sections of the vertebral column are summarised below.

The cervical vertebrae

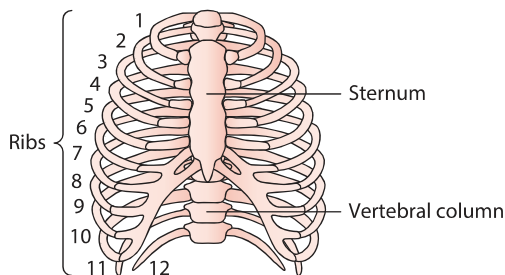
These seven unfused bones essentially make up the neck and are responsible for supporting the head. The top two bones – the atlas and axis – allow your head to move up and down and side to side, so that you can nod yes or shake no.

The thoracic vertebrae

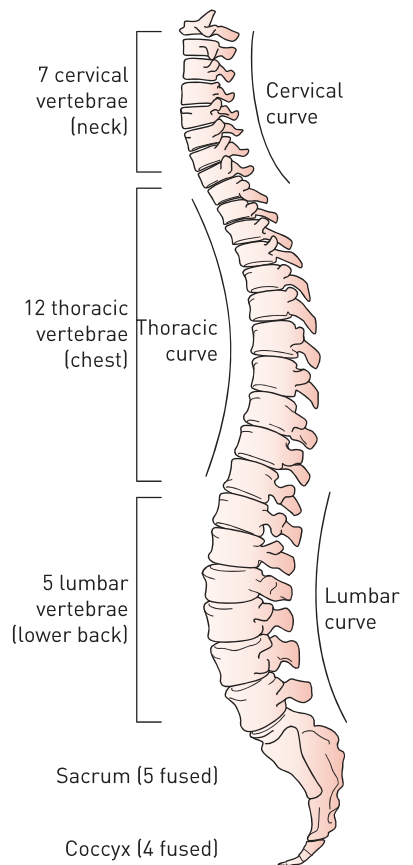
These 12 unfused bones connect the rib cage to the spinal column and form a protective shield for the heart and lungs. The first seven pairs of ribs attach directly to the sternum to reinforce this shield, and each rib is attached to the others via intercostal muscles, which assist the body to breathe in and out.

The lumbar vertebrae

These five unfused bones are the largest of the vertebrae and have a high weight-carrying capacity. They also provide a large attachment site for powerful muscles to pull on.



The ribs and attachment to the vertebral column (posterior) and sternum (anterior)



The five sections of the vertebral column

The sacrum

The five fused sacral vertebrae are connected to form the sacrum, which fuses to the pelvis. Together they distribute the weight of the upper body.

The coccyx

The coccyx is sometimes referred to as the 'tail bone', and comprises four fused bones that form the base of the vertebral column. Its main function is to provide a site for muscle attachment to allow a multitude of movements to occur.



Weblink

QUICKVID

Take two minutes to view this great clip, which provides a simple overview of skeletal structure and function. You can link to it directly via <http://vcepe12.nelsonnet.com.au>.

JOINTS

Muscles are attached to bones; when the muscles contract, they pull on the bones and movement occurs. Where two or more bones meet, they form a joint. This can remain quite rigid and immovable, as in the skull, but most joints are free-moving to allow a wide range of movement and actions. Joints are classified into three main categories according to the amount of movement they allow (see Table 2.2).

TABLE 2.2 Joints and their movement

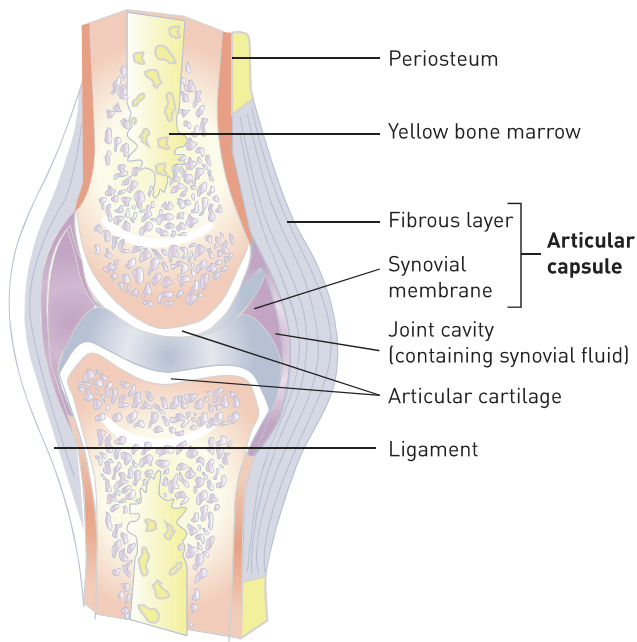
Type of joint	Amount of movement	Examples
Fixed or fibrous	None	Skull, pelvis, radioulnar and tibiofibular joints
Cartilaginous	Slight	Ribs attaching to sternum, lumbar vertebrae
Synovial	Free	Hip and knee joints, cervical and thoracic vertebrae

Synovial joints

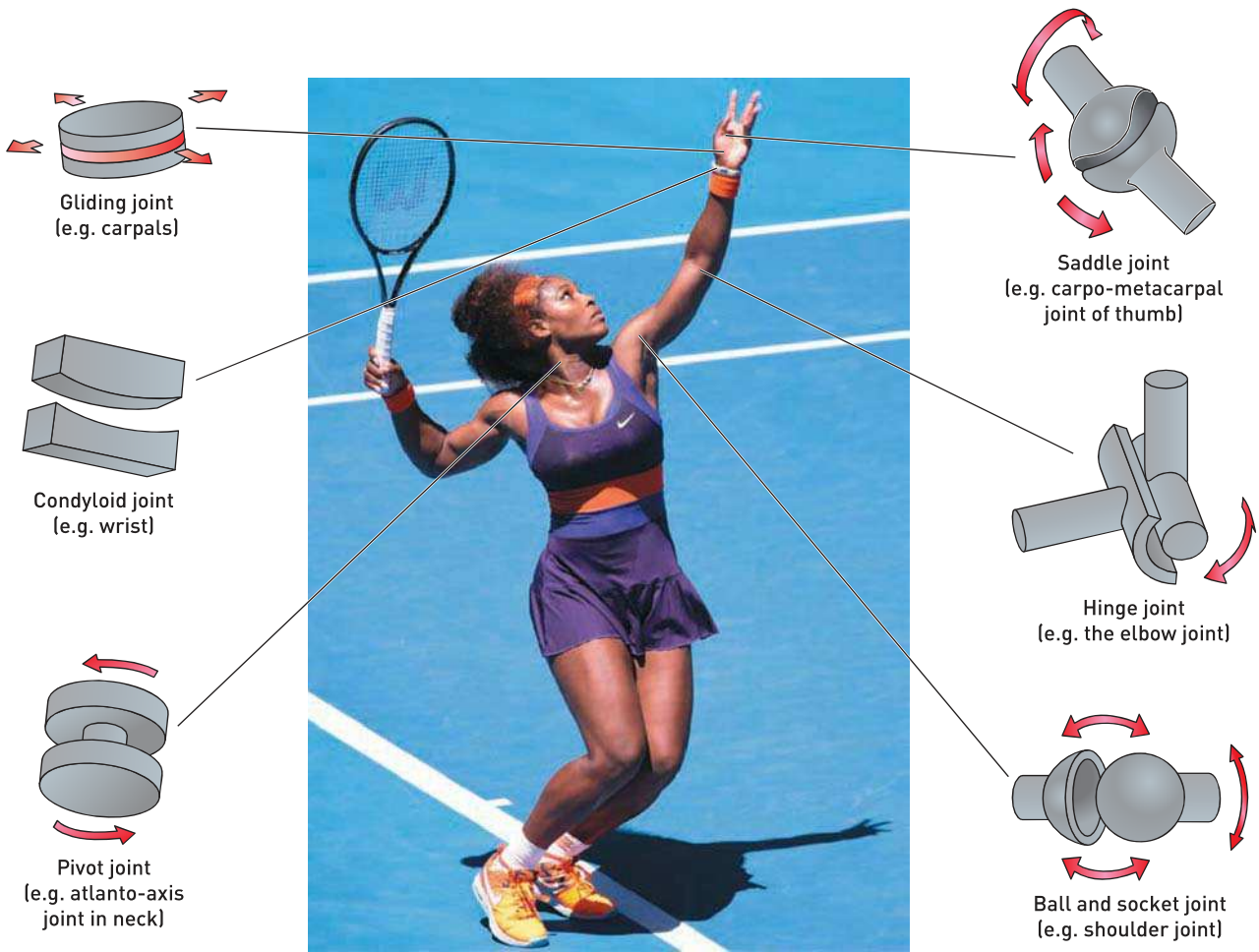
There are more synovial joints in the body than any other kind of joint. They allow the greatest amount of movement. All synovial joints have a synovial capsule, made up of collagenous material, surrounding the entire joint. A synovial membrane on the inner layer of the capsule secretes a lubricating fluid known as synovial fluid, and the hyaline cartilage completes the joint and provides padding at the ends of the **articulating** bones (see next page).

Types of synovial joints

There are six types of synovial joints, which are classified according to their shape and the type of movement they allow. They are summarised in the diagram on the next page and in Table 2.3.



A typical synovial joint



Shutterstock.com / Neale Cousland

Examples of the six synovial joints

TABLE 2.3 The six synovial joints: basic structure and examples of the movement they allow

Type of joint	Basic structure	Movement at joint	Examples
Pivot	A uniaxial joint that only allows rotation	Rotation of one bone around another	Atlas and axis (top vertebrae)
Gliding	Occurs where flat bones glide past each other, usually in a biaxial manner	Gliding movements	Carpals/tarsals
Ball and socket	Occurs where a rounded bone head articulates with a cup-shaped cavity	Flexion, extension, adduction, abduction, internal and external rotation	Shoulder, hip
Hinge	A uniaxial joint	Flexion, extension	Knee, elbow
Saddle	Occurs where concave and convex bone surfaces align; generally biaxial	Flexion, extension, adduction, abduction, circumduction	Carpo-metacarpal joint of thumb
Condyloid	Very similar to a hinge joint but also allows slight rotation; hence, is biaxial	Flexion, extension, adduction, abduction, circumduction	Wrist



Weblink

QUICKVID

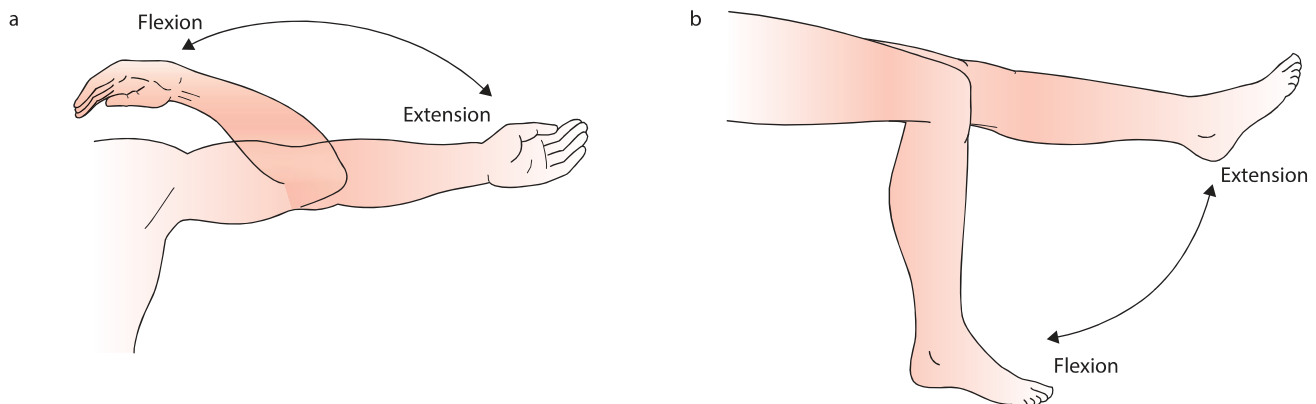
This two-minute clip reinforces the six different types of synovial joints and their associated movements. Link to it directly via <http://vcepe12.nelsonnet.com.au>.

Types of joint movements

When muscles receive messages from the brain, they contract to pull on bones, which act as levers, and movement occurs. The role muscles and nerves play will be discussed later in this chapter. First, consider the types of movements that are possible at the various synovial joints.

Flexion

The angle between articulating bones is decreased and flexion occurs in the median plane about a horizontal axis. Muscles responsible for flexion are called flexors.



Flexion and extension at the elbow and knee joints