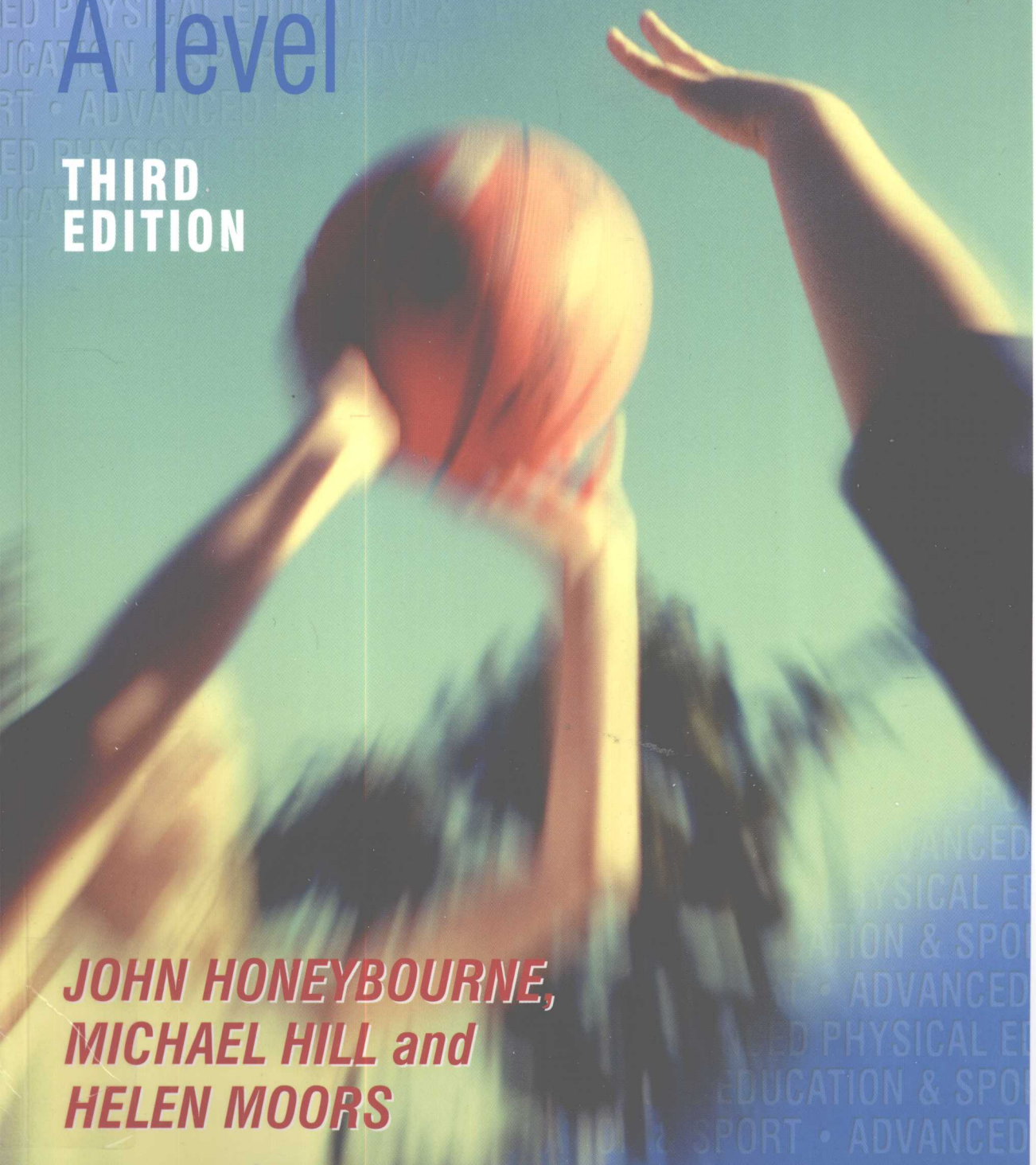
Advanced PE & Sport

A level

THIRD EDITION



JOHN HONEYBOURNE,
MICHAEL HILL and
HELEN MOORS

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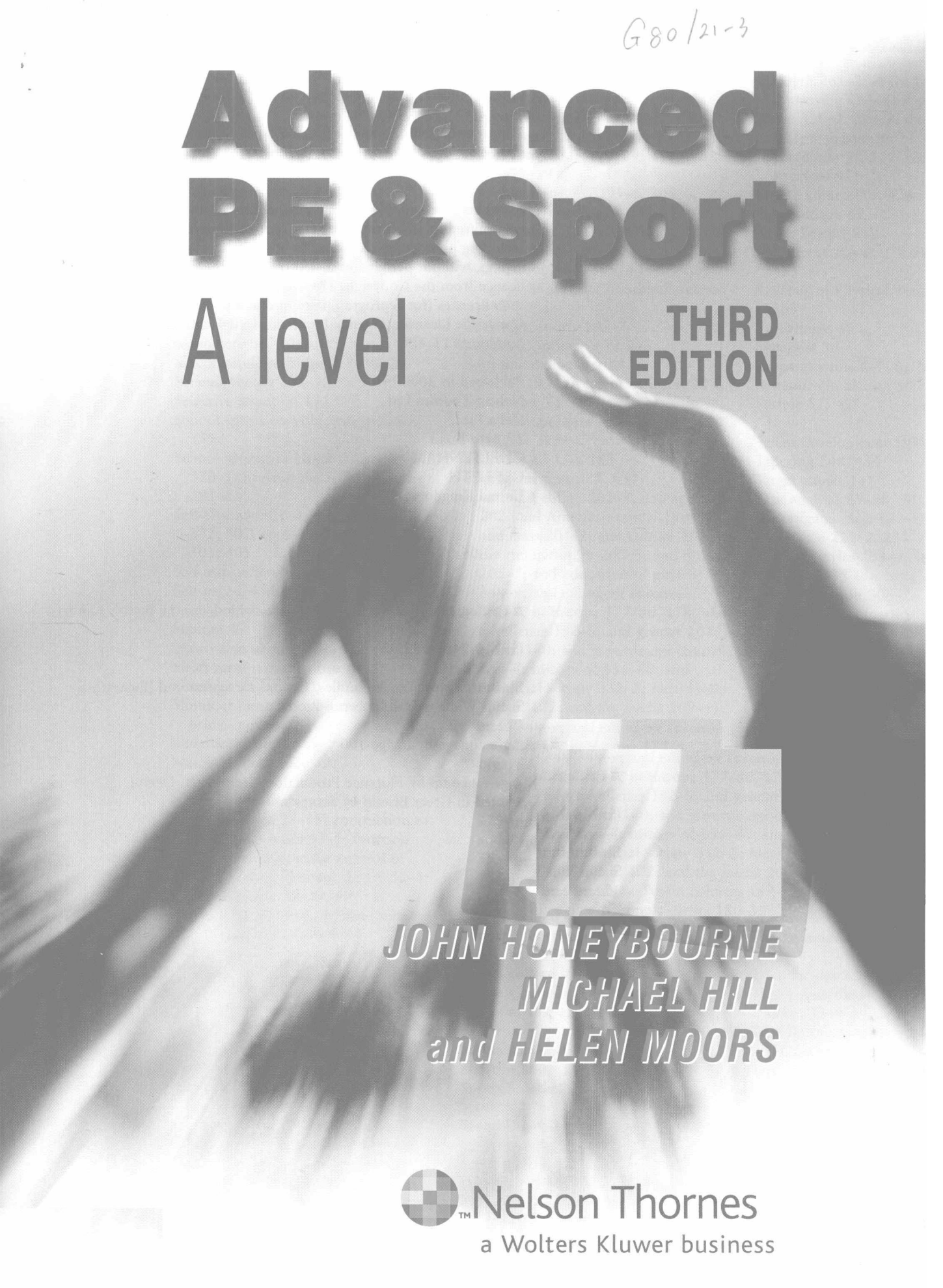

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Introduction

Physical Education continues to be one of the largest growth subjects at AS and A2 level. Examination board specifications have recently been revised and this edition includes any additional material necessary to fulfil the specifications' requirements. You can be confident in the knowledge that this text covers the content of all the AS and the A2 specifications, including OCR, EDEXCEL, AQA and WJEC. The third edition of this popular and market-leading textbook now has full-colour features making it an even more accessible and attractive must-have resource for students and their teachers.

We have written this book for students to use as a no-nonsense resource. We have all had considerable experience in teaching AS and A level Physical Education, Sports Studies, GCSE Physical Education, BTEC National Sport, GNVQ/AVCE Leisure and Tourism and GNVQ/AVCE Health and Social Care. We have all been senior examiners at A level for three of the four examination boards.

Students and teachers who use this book will realise that the aim is to give only information that is relevant and clearly expressed. This book will give students enough information to pass the AS level examination and the full A level, or to build a portfolio for GNVQ/AVCE work, or to give some of the necessary background for writing assignments for the BTEC Sport qualifications.

The book is clearly set out in Parts and Chapters. Each Part covers the main areas of the subject at AS level and A level and represents the content of all syllabuses in this area at the time of writing. There are seven parts to the book. The first three parts deal with the material relevant to the AS level and the remaining four parts deal with the content of the A2 aspect of the full A level. Part 1 deals with anatomy and physiology. Part 2 covers skill acquisition. Part 3 deals with the social issues in physical education and sport. Part 4 covers exercise physiology. Part 5 covers sports psychology. Part 6 covers the historical development of physical education and sport. Part 7 deals with comparative studies of physical education and sport. There is also an important section in the appendices that deals with the writing of research projects, which some specifications allow.

At the beginning of each chapter, *Learning objectives* clearly state what is to be covered. There are *Activity* boxes, which include ideas to reinforce learning, and *In practice* boxes, which look at the application of theory to practical situations. All of the AS level and A2 examinations and the work required for GNVQ/AVCE and the BTEC National qualifications demand that the student can apply theory to practice. To help understanding we have also included *Definition* boxes, which expand on some key words and phrases. At the end of each chapter there is a list of *Key terms* that need to be learned and understood by the student, along with *Revision* boxes, which will focus students' attention on the key concepts that are important for passing the examination. We have also included a *Revision guide* for each section and *Examination-style questions* that will help to prepare students for the written examinations. There is a *Glossary* of the main key terms at the back of the book, which can again be used for revision purposes.

This is a fascinating and rewarding subject area and should be studied with a view to applying theoretical principles to practical situations. We hope that students and teachers will get maximum benefit from this third edition of the textbook and share our enjoyment of studying and teaching Physical Education and Sport.

This is a book that will not go out of date and will give students the background that is vital for examination success.

About the authors

John Honeybourne is a freelance Educational Consultant, an OFSTED Additional Inspector and Associate Inspector for the Adult Learning Inspectorate specialising in sport and leisure. An Advanced Skills Teacher Assessor, freelance lecturer and Principal Examiner for a major awarding body, he also runs INSET courses for A Level and AS Level PE and Sport.

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Contents

ANATOMY, BIOMECHANICS AND PHYSIOLOGY

This part of the book contains:

The following chapters provide an introduction to anatomy, physiology and, in particular, to the systems that play a significant role in the production of skilled human movement – the skeletal, muscular, cardiovascular and respiratory systems. It is important to know both the structure of these systems and how they function, including basic biomechanics, in order to develop a better understanding of how the body works and to appreciate the body's capabilities and limitations in performance of sport.

CHAPTER 1

Introduction to the skeletal system

Learning objectives

- To have a general understanding of the structure of the skeletal system.
- To be aware of the main functions of the skeletal system.
- To know the structure and type of the major joints of the body.
- To know the types of movement that can be produced around each joint.

The skeletal system needs to be studied and understood by any person interested in human movement. The skeletal system provides the system of leverage required for human movement. Each joint is structured in a way that best suits its function, for example the structure of the knee joint allows movement in one plane only. This is because although free movement of the knee is desirable, stability is also needed. The skeletal system provides the basis of attachment for most muscles, enabling them to work together in order to produce efficient and coordinated movement. It helps to provide the strength and stability that is needed in order to stay balanced and upright, and provides protection for many vital organs.

1.1 The skeletal system

The skeletal system is made up of two kinds of tissue: *bone* and *cartilage*.

1.1.1 Bone

There are five different types of bone, which are classified by their shape rather than their size.

1 *Long bones*, such as the femur
2 *Short bones*, for example the metatarsals
3 *Irregular bones*, the vertebrae are examples of these
4 *Flat bones*, for example the scapula
5 *Sesamoid bones*, such as the patella.

Examples of each type of bone are shown in Figure 1.1.

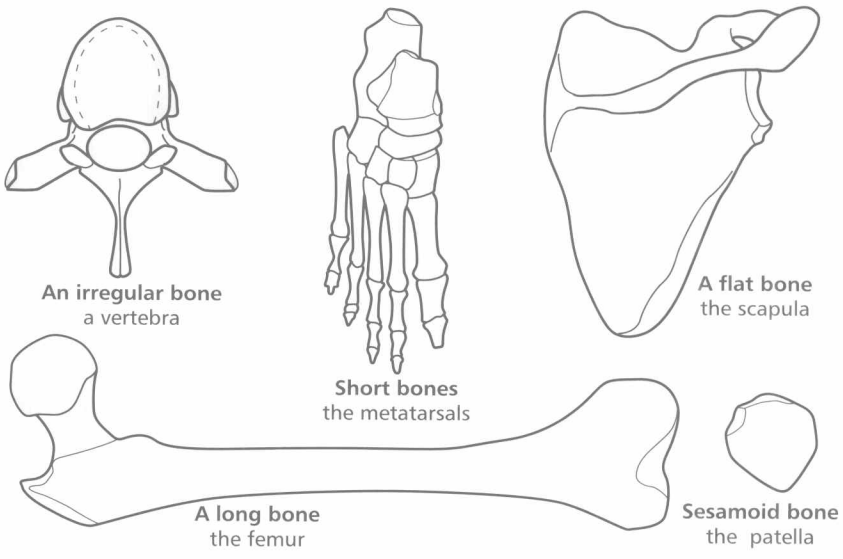
Bone is the hardest connective tissue in the body, mainly because it contains deposits of calcium phosphate and calcium carbonate. Bone acts as a store for calcium, and as a result of regular exercise more calcium is deposited, increasing bone density. The bone matrix also contains *collagen*. Collagen gives bone tissue a flexible strength, allowing it to cope with a certain amount of impact. As you get older the bone contains less collagen and the bone is less dense, resulting in brittle bones that are damaged quite easily. *Hard*, or *compact*, bone makes up the outer layer of all bones, giving them strength. *Cancellous*, or *spongy*, bone is typically found at the ends of the long bones. Cancellous bone is not as dense as hard bone because it contains cavities filled with bone marrow.

OSSIFICATION
Ossification is the process of bone formation.

1.1.2 Ossification

The process of bone formation is known as *ossification*. The skeletal frame is initially made out of cartilage, which is gradually replaced by bone. An outline of the structure of a typical long bone can be seen in Figure 1.2. The ossification process begins in the *diaphysis* (the primary ossification centre) and then occurs in the *epiphyses* (the secondary sites of ossification). A plate of cartilage is left between the diaphysis and each epiphysis; this

Figure 1.1
Classification of bones



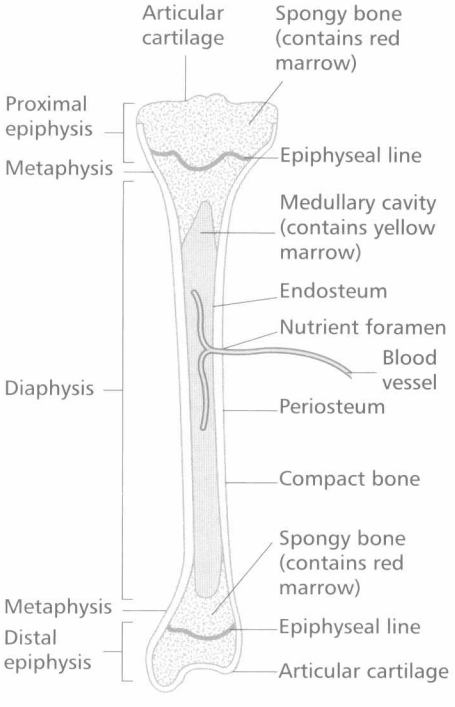


Figure 1.2 *Structure of a typical long bone*

is where bones grow in length until maturation takes place (endochondral ossification). The plate is known as the *epiphyseal plate* and when growth stops this plate fuses and becomes bone. A long bone also has to increase in diameter; this is achieved by depositing a new layer of bone on the surface. This process is known as *appositional growth*.

As bones do not fully mature until ossification is complete, young athletes can run the risk of damaging the epiphysis and/or the epiphyseal plate. If the epiphyseal plate slips this can result in the hip giving way under the stress of movement and eventually can lead to one leg being shorter than the other. Activities such as swimming (swimmer's shoulder) and tennis (tennis elbow) can put strain on young bones and joints. For this reason plyometric training (see page 266) is not recommended for young athletes.

ARTICULATION

The place where two or more bones meet to form a joint. The articulating surface is the point of contact between the bones.

1.1.3 Cartilage

There are three types of cartilage:

1 *Elastic cartilage*, which is soft and slightly elastic. Examples may be found in the ear lobe and epiglottis.
2 *Fibrocartilage*, which is tough and slightly flexible. This cartilage acts as a shock absorber, helping to prevent damage to the bone. The cartilage between the vertebrae is white fibrocartilage.
3 *Hyaline* or *articular cartilage*, which is solid and smooth. Hyaline cartilage protects the bone from the constant wear and tear of moving and can be found on the articulating surface of bones.

in training

Exercise has a positive effect on bone tissue. It varies the line of stress and stimulates an increase in the amount of calcium salts deposited in the bone, making it stronger.

1.2 The skeleton

The skeleton is made up of 206 bones (Figure 1.3). It comprises the axial skeleton and the appendicular skeleton.

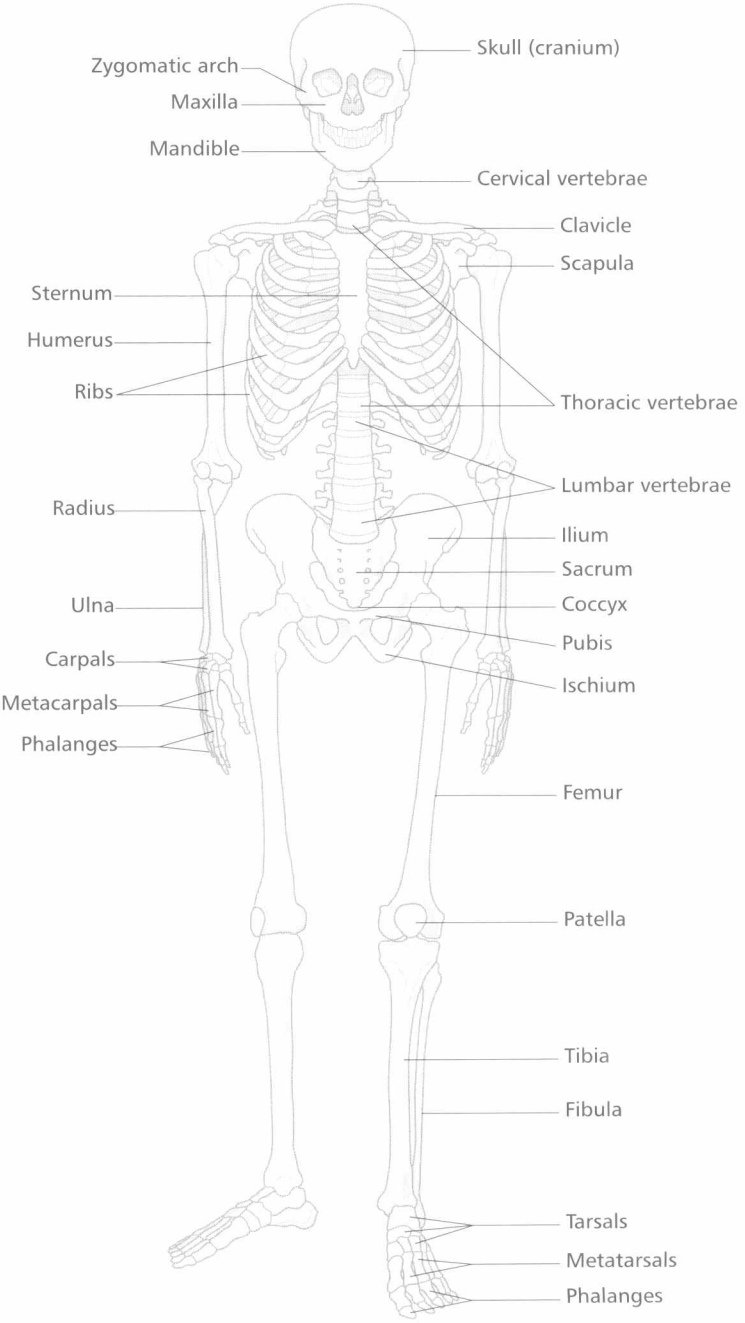


Figure 1.3
The bones making up the human skeleton

activity

Examine the bones of a skeleton and see if you can classify the following bones: the parietal bone (part of the skull), the ilium (part of the pelvis), phalanges, the sternum, the ulna and the metatarsals.

1.2.1 The axial skeleton

This is made up of the skull, the vertebral column, the sternum and the ribs.

1.2.2 The appendicular skeleton

The appendicular skeleton is composed of the shoulder girdle, the hip girdle, the bones of the arms and hands and the bones of the legs and feet.

Although for your courses you do not need to know about the individual bones which make up the head and face or the hands and feet, a more detailed knowledge of the spine is useful. This is outlined in Figure 1.4.

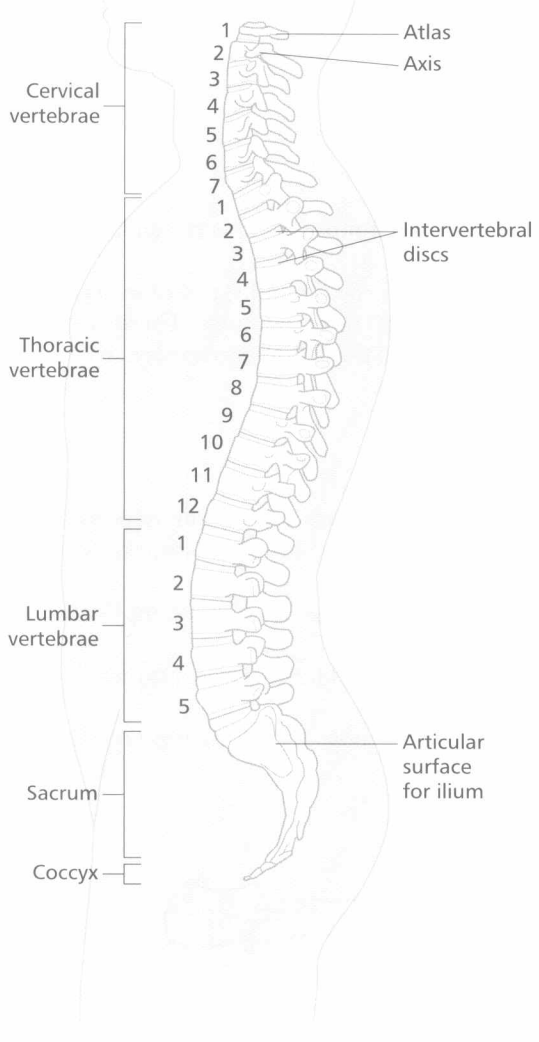


Figure 1.4 *Lateral view of the spinal column*

in training

The size of an athlete's skeletal frame is largely genetically determined, but exercise and a well-balanced diet can help to ensure proper bone growth.

1.2.3 Function of the skeletal system

The skeletal system has four main functions:

- to provide support for the body;
- to provide protection for vital organs;
- to produce blood corpuscles (cells);
- to provide attachment for muscles.

For sport enthusiasts it is the last of these functions which is the most interesting. In order for us to perform the sophisticated movements demanded by many sports, we need a sophisticated system of joints and levers capable of producing a wide range of movements. As you will see, we have been very well designed to do this.

1.3 Joints

Joints can be classified in two ways: by considering their structure, or by considering how much movement they allow.

1.3.1 Classification by structure

The following classification of joint by structure should be used.

Fibrous

These joints have no joint cavity and the bones are held together by fibrous connective tissue. Examples are the sutures of the skull bones.

Cartilaginous

Cartilaginous joints also have no joint cavity. There is cartilage between the bones of the joint. Cartilaginous joints may be found between the vertebrae of the spine.

Synovial

A synovial joint has a fluid-filled cavity surrounded by an articular capsule. The articulating surfaces of the bones are covered in hyaline cartilage. The hinge joint of the knee is a synovial joint.

1.3.2 Classification by movement allowed

When it comes to classifying joints by the movement they allow, the following terms are applied.

Fibrous joint or synarthrosis

This type of joint does not allow any movement. When you consider where these joints occur this makes sense as some parts of the body, such as the brain, need protection. A moveable joint could not provide this protection.

Cartilaginous joint or amphiarthrosis

This joint allows limited movement.

Synovial joint or diarthrosis

A synovial joint allows free movement, or certainly as much movement as the shape of the articulating surfaces permits.

As you may have gathered by now, there always seem to be several types of everything you come across in anatomy and physiology. Joints are no exception. There are six different types of synovial joint – and as these are the joints that allow movement, we need to know more about them.

1.4 Synovial joints

The synovial joints allow movement to take place. How much movement is permitted depends on the shape of the articulating surfaces. Six different joint constructions have been identified. Figure 1.5 illustrates each joint type.

1 *Ball and socket*: a ball-like head fits into a cup-shaped depression – an example of this is the shoulder joint.
2 *Hinge*: a convex surface articulates with a concave surface. The elbow is a typical hinge joint.
3 *Pivot*: part of a bone fits into a ring-like structure. The most well-known pivot joint is the atlas and axis (cervical 1 and 2: see Figure 1.5).

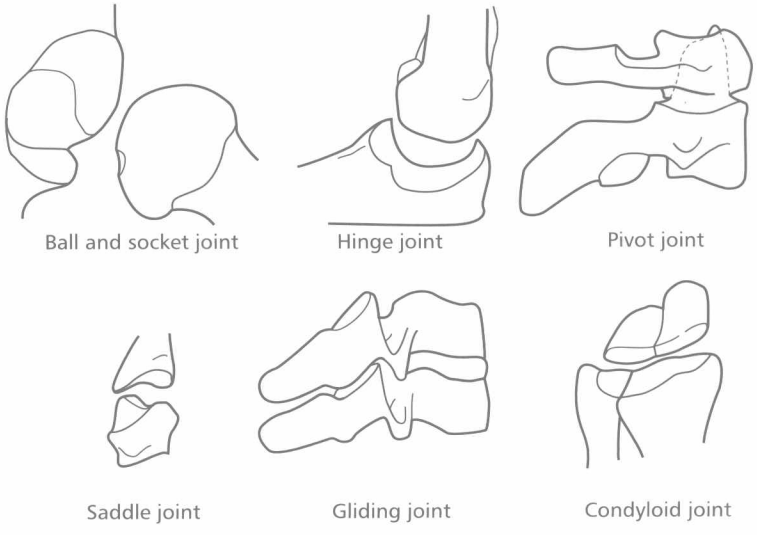


Figure 1.5 *The six types of synovial joint*

4 *Saddle*: a bone fits into a saddle-shaped surface on another bone – the thumb is a good example.
5 *Gliding*: two relatively flat surfaces slide over one another – this may be seen at the articular processes of the vertebrae.
6 *Condyloid*: a convex surface fits into an elliptical cavity – the wrist joint is a condyloid joint.

The six types of synovial joint differ in the amount of movement they allow, but are very similar in structure and share common features. Figure 1.6 highlights the common features of a synovial joint, using the hinge joint of the knee as an illustration.

- The *articular/joint capsule* is a fibrous tissue encasing the joint, forming a capsule.
- The *synovial membrane* acts as a lining to the joint capsule and secretes synovial fluid.
- *Articular/hyaline cartilage* covers the ends of the articulating bones.
- *Synovial fluid* fills the joint capsule and nourishes and lubricates the articular cartilage.
- *Ligaments* are white fibrous connective tissues joining bone to bone, making the joint more stable.
- *Bursa* is found where tendons are in contact with bone. The bursa forms a fluid-filled sac between the tendon and the bone and helps to reduce friction.
- *Articular discs* of cartilage act as shock absorbers.
- *Pads of fat* act as buffers to protect the bones from wear and tear.

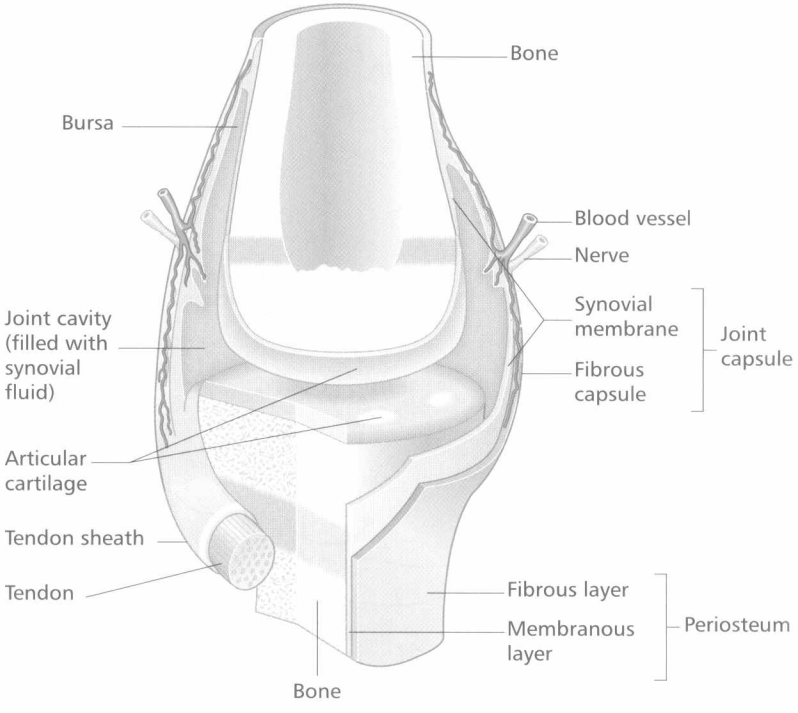


Figure 1.6 *Structure of a synovial joint*

activity

Try to construct a joint by taking the appropriate bones and fastening them together. For example, you could use tape to represent the ligaments and felt or moulding clay for the articular cartilage. If you don't have any bones, improvise!

in training

When organising young children into teams, it is important to match players by size as well as ability, to avoid potential damage to joints due to contact/impact injuries.

1.5 Movement terminology

1.5.1 Movement terms

Later in Part 1 we will look at the structure of some joints in more detail, but here we will consider the range of movement that the body can perform. There are a lot of terms that you need to be familiar with, and you will remember the terms much more easily if you put them into practice.

The terms that you are most likely to use are given below, and are illustrated in Figure 1.7.

- *Flexion*: a decrease in the angle around the joint.
- *Extension*: an increase in the angle around the joint.
- *Abduction*: movement away from the midline of the body.

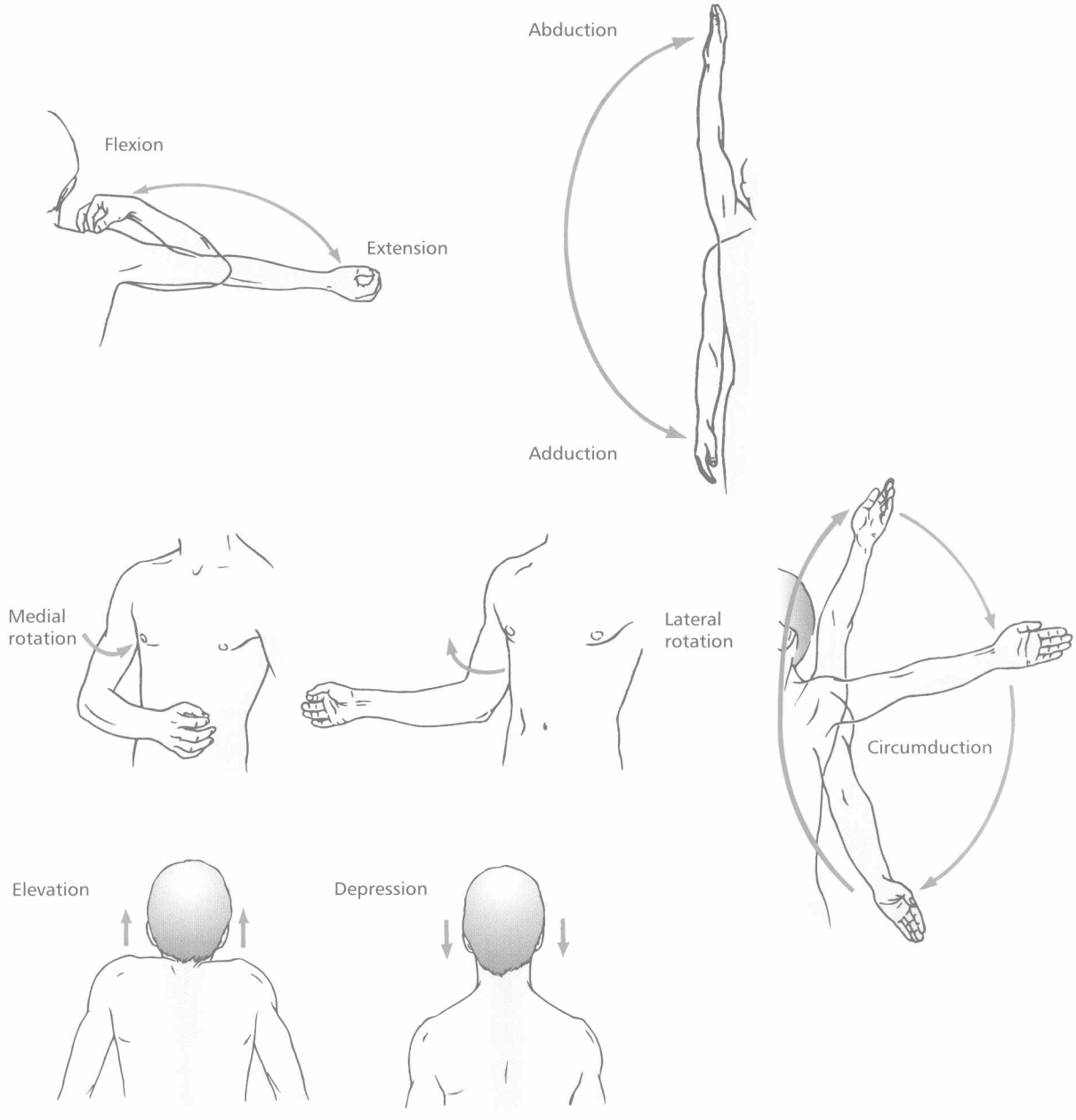


Figure 1.7 *Movement terminology*

- *Adduction*: movement towards the midline of the body.
- *Rotation*: movement of a bone around its longitudinal axis. Rotation can be inward (medial) or outward (lateral).
- *Circumduction*: the lower end of the bone moves in a circle. It is a combination of flexion, extension, adduction and abduction.
- *Lateral flexion*: bending the head or trunk sideways.
- *Elevation*: moving the shoulders upwards.
- *Depression*: moving the shoulders downwards.
- *Plantarflexion*: bending the foot downwards, away from the tibia.
- *Dorsiflexion*: bending the foot upwards, towards the tibia.
- *Pronation*: facing the palm of the hand downwards.
- *Supination*: facing the palm of the hand upwards.

More simply, *flexion* occurs when you bend a limb and *extension* occurs when you straighten it. For example, the movement at the elbow joint when you do press-ups involves both flexion and extension. When performing star jumps, as you move your arms outwards you are *abducting* the shoulder joint and as you bring your arms back to the side of your body you are *adducting* the shoulder joint. As a ballet dancer moves into first position he or she must *rotate* their hip joints laterally. When bowling, a cricketer moves the arm in a full circle – this is *circumduction* of the shoulder joint. Remember: movement occurs around a joint and not a body part, so it is incorrect to say (for example) 'flexion of the leg'. You must refer to the actual joint involved, as in flexion of the hip, knee or ankle joint. Be precise.

When you take part in your next practical session, break down the skills you attempt into simple phases and try to identify the specific movements. It is quite difficult to begin with, but with practice becomes very straightforward. If the joints have a similar structure, then their pattern of movement will be the same: for example, flexion of the hip is the same as flexion of the shoulder joint.

Look back to the list of synovial joints. Working with a partner, locate each of the joints given as examples and determine the types of movement that can take place at each. For example, the elbow joint can flex and extend.

1.5.2 The planes of the body

There are three planes, which relate to the three dimensions of space through which the body or body part can move. Each plane must pass through the centre of gravity. The sagittal or median plane divides the body into left and right halves. The frontal or lateral plane divides the body into front and back, and the transverse or horizontal plane divides the body into upper and lower halves. For example, when you abduct your shoulder joint you are moving through the frontal or lateral plane.

For each of the practical examples given to illustrate the three different axes (right), identify the plane that the body moves through.

When a body part moves, it moves in a plane and around an axis. The frontal horizontal axis passes horizontally from side to side, e.g. a forward roll. The sagittal horizontal axis passes horizontally from front to back, e.g. a cartwheel. The vertical axis passes vertically from head to toe, e.g. a 180 degree turn. The axis is always at right angles to the plane in which it occurs. In most movement analyses it is easier to work out the axis first and then determine the movement plane.