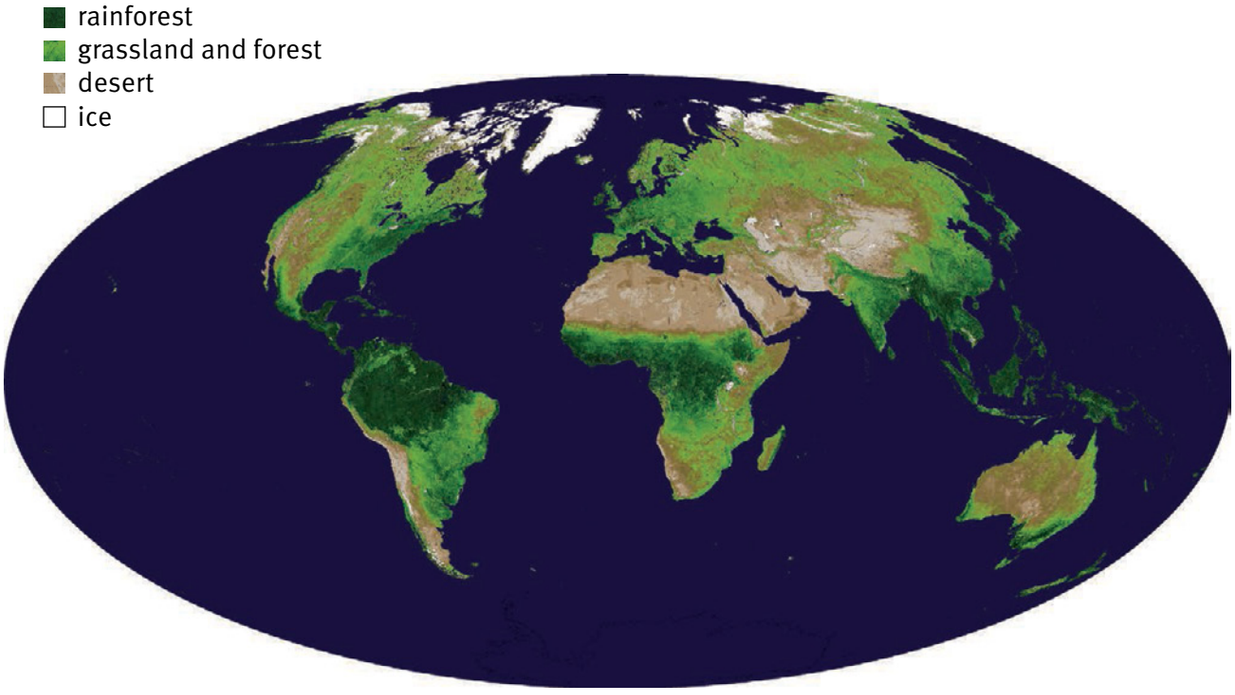
1.1 Plant organs

This map shows where plants cover the surface of the Earth. The map was made using information collected by a space satellite.



Most plants are green. This is because they contain a green pigment (colouring) called **chlorophyll**. Chlorophyll absorbs (takes in) energy from sunlight.

Plants use this energy to make food. All the food that is eaten by animals was originally made by plants.

Plants give out oxygen during the daytime. The oxygen in the air, which almost all living things need to stay alive, was all made by plants.

Questions

1 Look at the map. Explain why some parts of the map are shown in dark green, and some parts are light green.

A+I 2 There are very few plants in the brown parts of the map. Suggest why there are not many plants in these places.

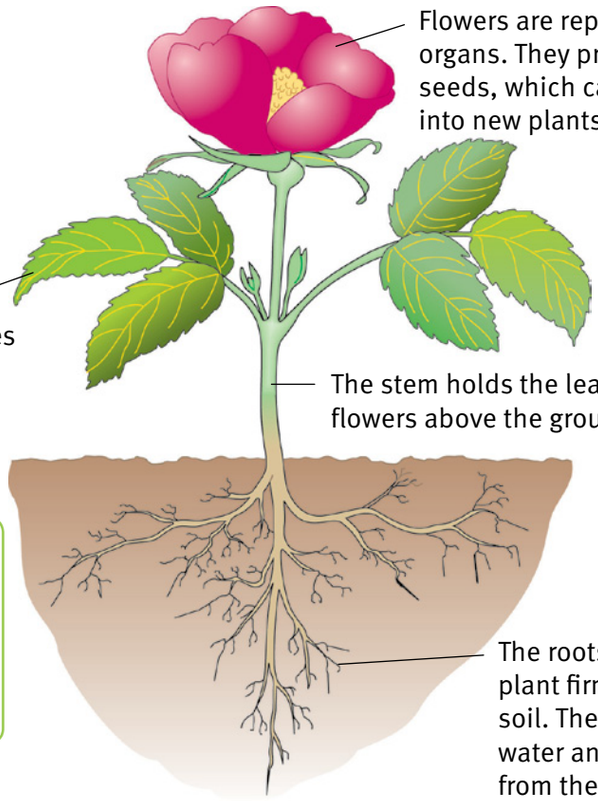
A+I 3 Find the place where you live on the map.
- **a** What does the map tell you about the plants that cover the part of the world where you live?
- **b** Do you agree with the information on the map about your part of the world? Explain your answer.

A+I 4 Animals can only live on Earth because there are plants on Earth. Explain why.

The structure of a plant

A plant is a living thing. Another word for a living thing is an **organism**.

The parts of an organism are called **organs**. The diagram shows some of the organs in a flowering plant.



Questions

A+I **5** Why do you think roots branch out into the soil? You may be able to think of two reasons.

A+I **6** Suggest why many leaves are very broad and thin.

Activity 1.1

Pressing a plant

Your teacher will help you to find a complete, small plant.

1. Wash the roots of your plant carefully. Try to get rid of all the soil, but don't damage the roots.
2. Carefully place the plant on a sheet of newspaper. Spread it out so that all of its parts are as flat as you can make them.
3. Put another sheet of newspaper over the top of your plant. Put a heavy weight on it to press the plant flat.
4. Leave your plant for at least a week to dry out.
5. Put your plant into your notebook and stick it down with some strips of sticky tape. Label the different organs, and write down what each of them does.

Summary

- Roots hold a plant in the ground and absorb water and minerals.
- Leaves absorb sunlight and make food.
- Flowers are reproductive organs.
- The stem holds the leaves and flowers above the ground.

1.2 Human organ systems

We have seen that the different parts of plants are called **organs**. Animals also have organs.

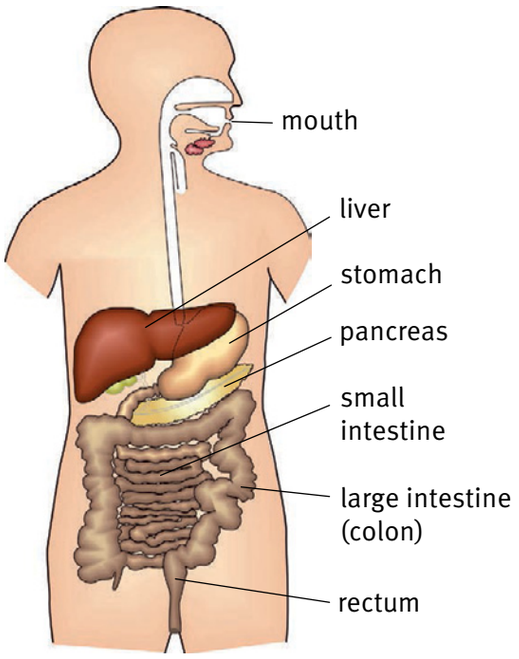
For example, an eye is an organ. The heart is an organ, and so is the brain.

The organs in a human work together in teams. A group of organs that work together is called an **organ system**.

The digestive system

When you eat or drink, food goes into your digestive system. This is a long tube that runs all the way through the body. Food usually takes between one and three days to travel from one end of the tube to the other.

Most of the food is broken down into tiny particles inside the digestive system. The breaking down is called **digestion**. The tiny particles move out of the digestive system, through its walls. They move into the blood. The blood carries them to every part of the body.



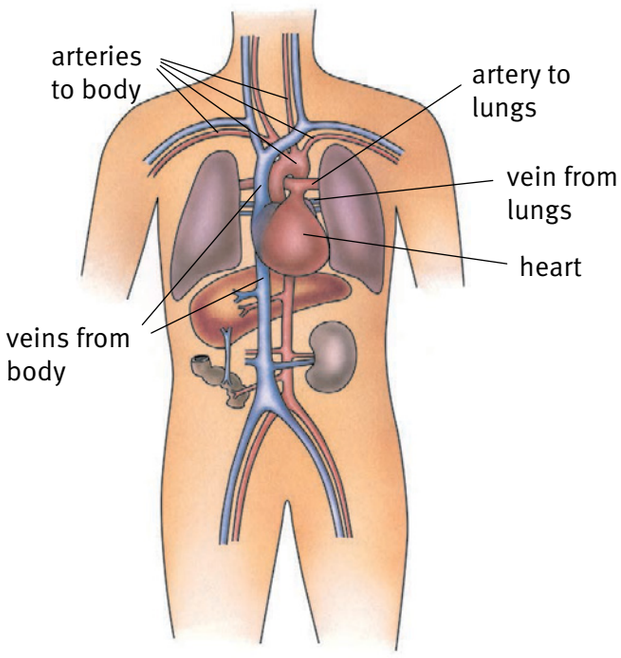
Questions

1. Look at the diagram of the digestive system. Write down, in order, the organs that food passes through as it moves through the digestive system.
2. Some of the food you eat is **not** broken down into tiny particles in the digestive system. Suggest what happens to the food that is not broken down.

A+I

The circulatory system

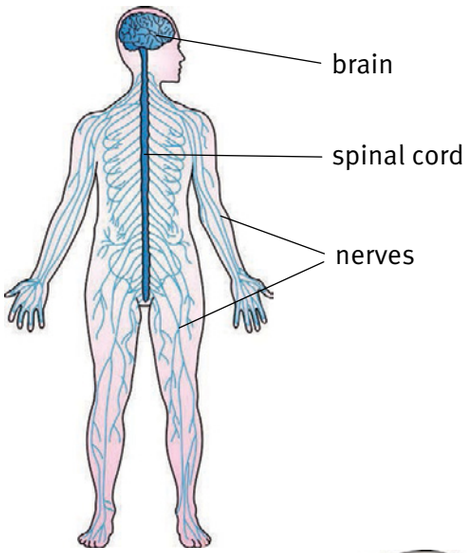
The circulatory system transports substances all over the body. It is made up of tubes called **blood vessels**. These tubes contain blood. The blood is pumped around the circulatory system by the heart.



The nervous system

The nervous system helps different parts of the body to communicate with one another. Signals travel along **nerves** from the brain and spinal cord to all the other body organs.

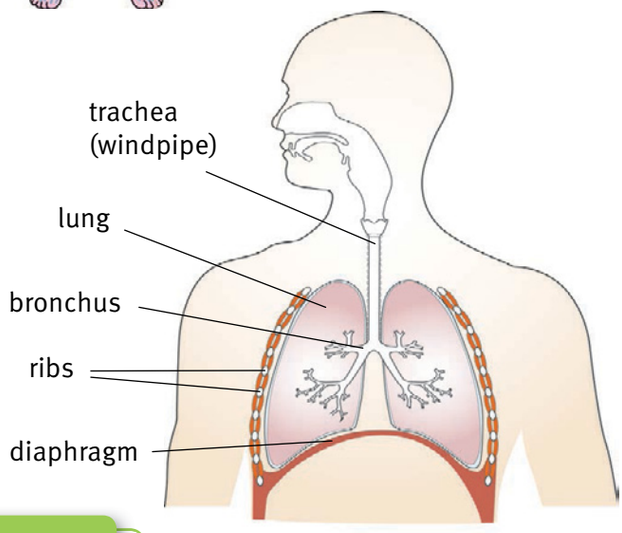
Sense organs are also part of the nervous system. For example, your eyes sense light. Signals travel from your eyes to your brain.



The respiratory system

The respiratory system is where oxygen enters your body and carbon dioxide leaves it. All of your cells need oxygen, so that they can **respire**. This is how they get their energy. When cells respire, they make carbon dioxide, which is a waste product.

Air moves down a series of tubes, until it is deep inside the lungs. This is where oxygen moves into your blood. Carbon dioxide moves out of the blood and into the lungs. The air containing this carbon dioxide moves out of the lungs when you breathe out.



Questions

3 Explain how nerves help the different organs in the body to work together.
4 Why do all cells in the body need oxygen?
5 Describe the function of the lungs.

Summary

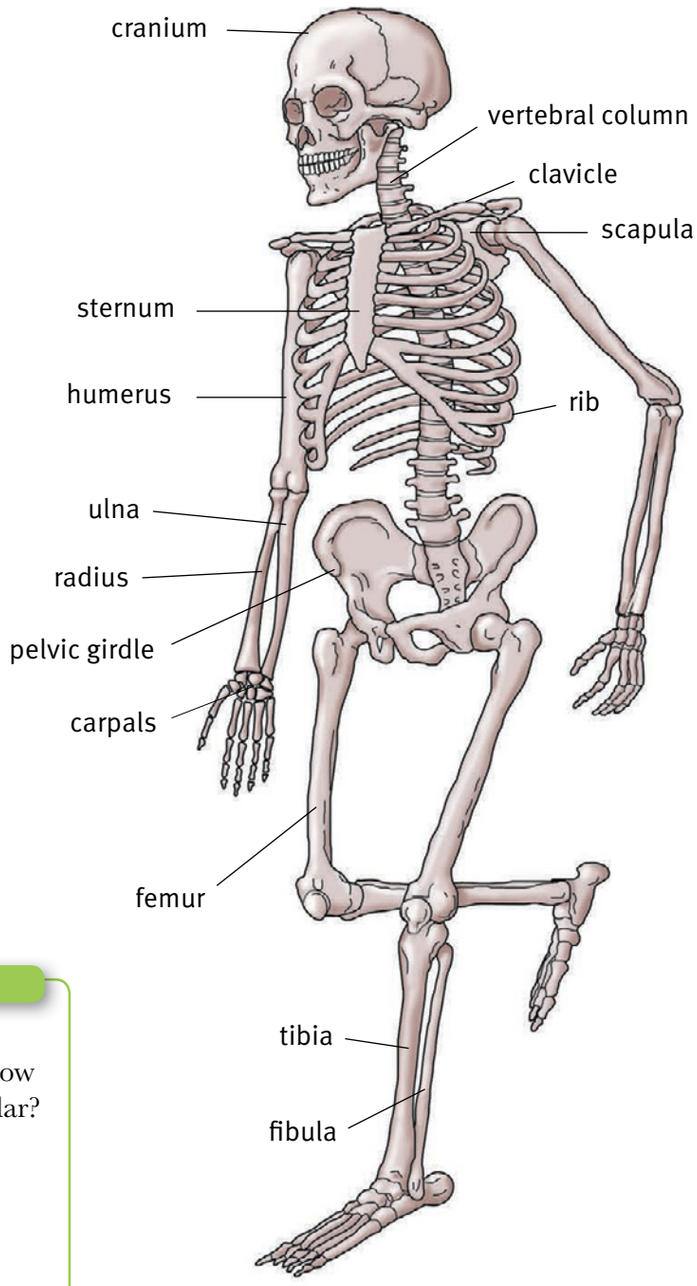
- The digestive system breaks down food so that it can be absorbed into the blood.
- The circulatory system transports substances all over the body.
- The nervous system allows all the parts of the body to communicate.
- The respiratory system helps oxygen to enter the body and carbon dioxide to leave it.

1.3 The human skeleton

Your skeleton supports your body and helps it to move. It also protects some of the soft organs inside you.

The diagram shows the main bones in the skeleton.

This is an X-ray of a mink.



Questions

A+I **1** List **three** functions of the skeleton.

A+I **2** Look at the diagram of the skeleton. How are the bones in the arms and legs similar?

A+I **3** How many ribs does a person have? (Remember that there are the same number on both sides of the body.)

A+I **4** As well as supporting the body, some bones protect other organs. Name the bones that protect: brain, heart and lungs.

A+I **5** Look at the X-ray of a mink. Do you think a mink has the same bones as a human? What evidence do you have for your answer?

Activity 1.3

Do long bones break more easily than short bones?

SE

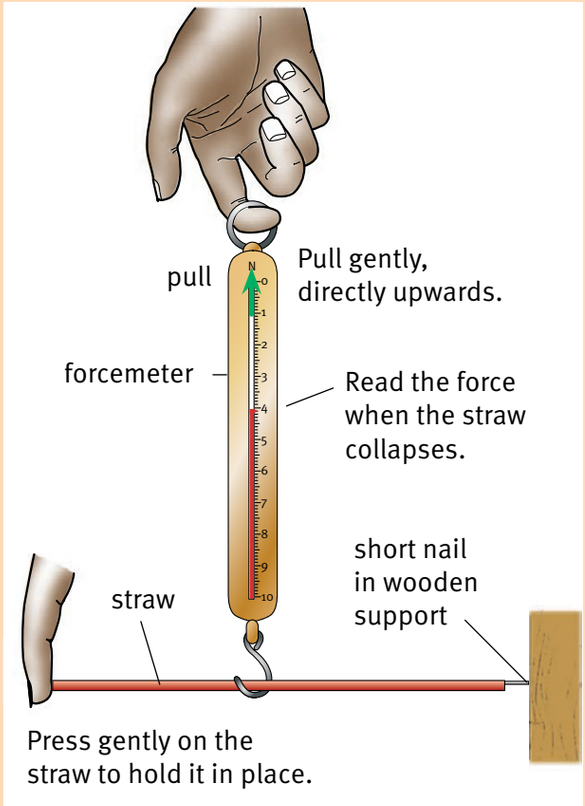
In this experiment, you will use drinking straws instead of real bones.

You will measure the force needed to make the straw bend, rather than break.

The diagram shows how you will find the force needed to bend the straw. You will use a forcemeter. You can find out how to use a forcemeter on page **131**.

It's easiest to do this in pairs. One of you pulls the forcemeter. The other one notes the reading on the forcemeter when the straw collapses.

1. Copy the results table, ready to fill in as you do your experiment.
2. Collect two identical straws. Keep one full length. Cut one in half. Cut one of the halves into half again.
3. Measure the length of a full-length straw, in cm. Fill in your measurement in the first row of your results table.
4. Find the force needed to make a full-length straw bend. Write your result in your results table.
5. Now repeat steps 3 and 4 with the half-length straw and the one-quarter-length straw.



Length of straw / cm	Force needed to bend the straw / N

Questions

A1 To make this experiment a fair test, you kept everything the same except the length of the straws. Write down **three** things that you kept the same.

A2 What conclusion can you make from your results?

Summary

- The skeleton supports the body.
- The cranium protects the brain. The ribs and sternum protect the lungs and heart.

1.4 Joints

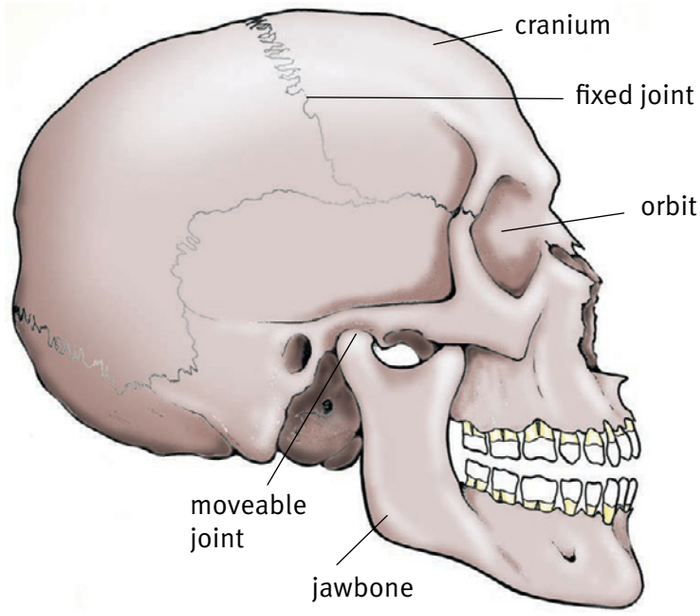
Fixed and moveable joints

A **joint** is a place where two bones meet. We have two main types of joints in our bodies:

- fixed joints
- moveable joints.

The skull has fixed joints in the cranium. The cranium is made up of several bones firmly joined together. This helps the cranium to protect the brain.

The jawbone is joined to the rest of the skull by a moveable joint. This allows the jaw to move up and down and from side to side when you chew, talk or yawn.



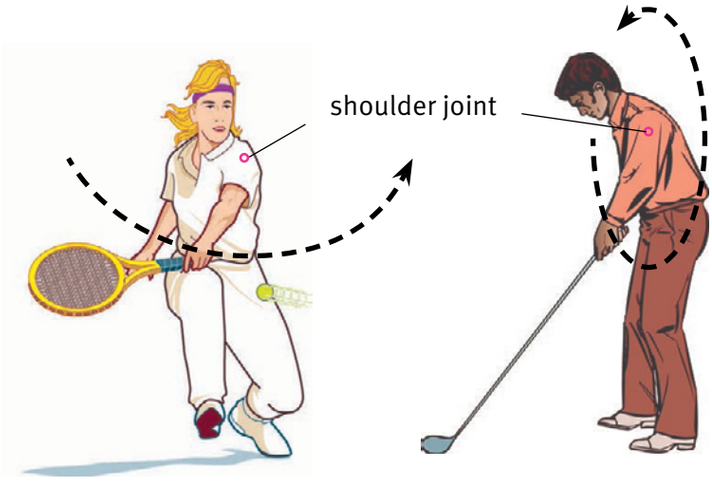
The skull contains both fixed joints and moveable joints.

Hinge joints and ball-and-socket joints

Your shoulder joint can move in almost all directions. You can swing your arm round in a complete circle.

This is because the shoulder joint is a **ball-and-socket joint**. A ball on one bone fits into a socket on the other.

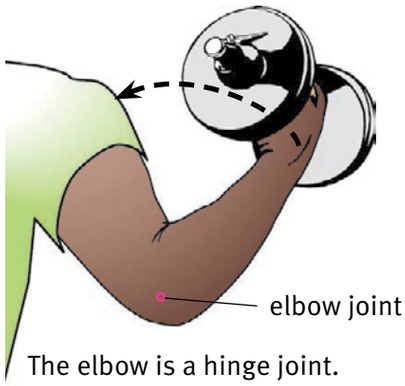
Your elbow joint is a **hinge joint**. It can move in only one direction. It moves like a door on a hinge.



The shoulder is a ball-and-socket joint.

Questions

1. State **one** place in the body where you have a fixed joint. Why is it useful to have a fixed joint in this place?
2. Name the bones that form the ball-and-socket joint in your shoulder.
3. Name the bones that form the hinge joint at your elbow.



The elbow is a hinge joint.

Structure of a moveable joint

The diagram shows what the elbow joint would look like if you could cut through it.

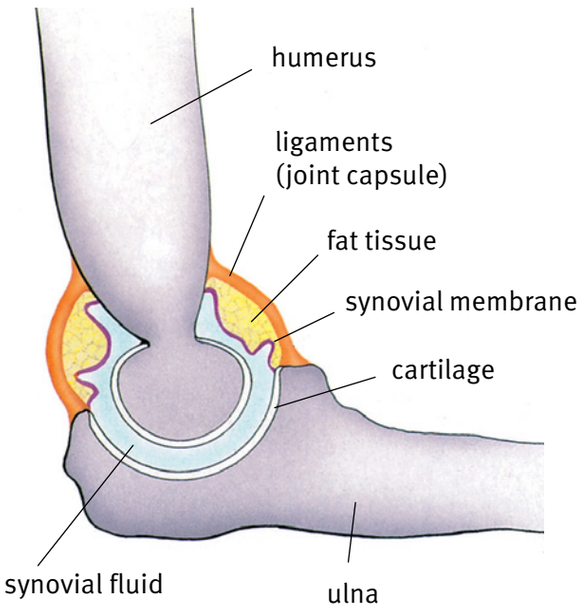
It is important that joints can move easily.

When two surfaces move against each other, a force called **friction** tries to stop them. You can read more about friction on page **136**.

To reduce friction:

- the ends of the bones are covered with a very smooth, slippery material called **cartilage**
- a thick, slippery fluid called **synovial fluid** fills the spaces between the two bones.

The synovial fluid helps to **lubricate** the joint, like oil in the moving parts of an engine or bicycle.



Questions

A+I

4 Suggest why it is important to reduce friction at moveable joints.
5 Describe where cartilage is found at the elbow joint. Why is the cartilage there?
6 What is the function of synovial fluid?

A+I

7 Look at the diagram of the elbow joint. Suggest how the two bones are held together at the elbow joint.

Activity 1.4

Which kind of joint?

SE

Try moving each of these joints in your body, and decide whether each one is:

a fixed joint **a hinge joint** **a ball-and-socket joint**

a a finger joint, **b** the knee joint, **c** a toe joint, **d** the hip joint

Summary

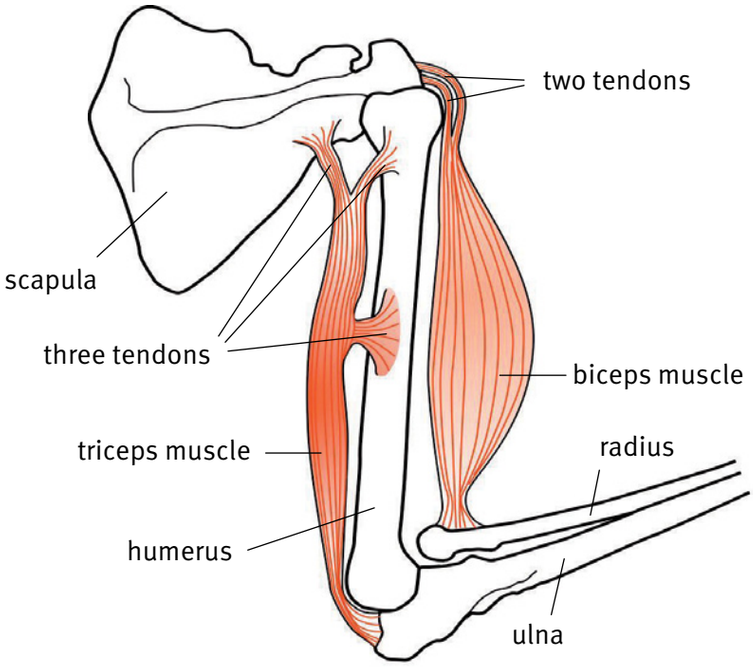
- A joint is a place where two bones meet.
- The bones at a fixed joint cannot move. The bones at a hinge joint or ball-and-socket joint can move.
- Cartilage and synovial fluid reduce friction at moveable joints.

1.5 Muscles

Muscles are organs that help us to move.

The diagram shows the two main muscles in the upper arm.

The muscles are attached to the bones by **tendons**. Tendons are very strong, and they do not stretch.



Questions

A+I

1 Name the bones that the biceps muscle is attached to.
2 Name the bones that the triceps muscle is attached to.
3 'Bi' means 'two'. 'Tri' means three. Look carefully at the diagram, and suggest why the biceps and triceps are given their names.

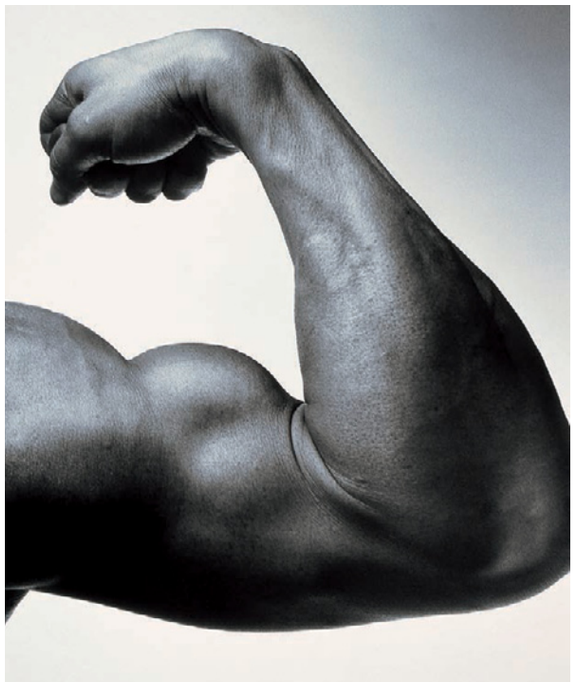
How muscles work

Muscles can get shorter. This is called **contraction**. When muscles contract, they produce a pulling force.

Look at the diagram of the muscles in the arm. When the biceps muscle contracts, it pulls on the radius and scapula.

The pulling force is transmitted to these bones through the strong tendons.

The radius is pulled upwards, towards the scapula. The arm bends.


You can see the biceps muscle bulging when it makes the arm bend.

Questions

A+I

4 Predict what will happen if the biceps stops contracting, and the triceps contracts.

A+I

5 Explain why it is important that tendons do not stretch.

Antagonistic muscles

Muscles can contract and make themselves shorter. However, muscles cannot make themselves get longer.

When a muscle is not contracting, we say that it is **relaxed**.

A relaxed muscle does not do anything by itself. But if a force pulls on it, the force can make the relaxed muscle get longer.

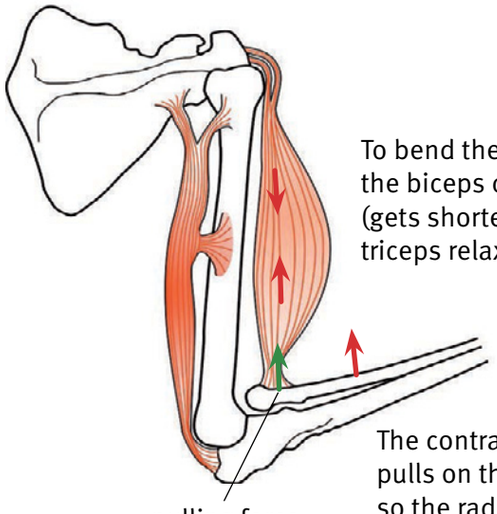
The top diagram shows what happens when the biceps muscle contracts and the triceps muscle relaxes.

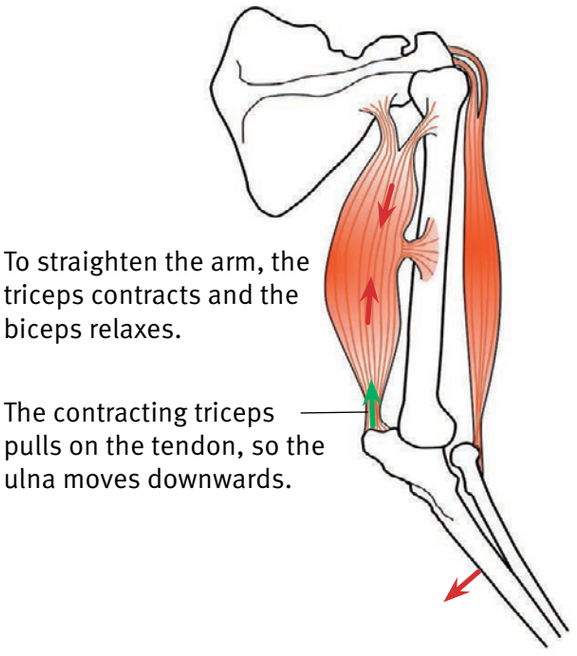
The contracting biceps muscle makes the arm bend at the elbow joint. It also pulls the relaxed triceps muscle and makes it longer.

The next diagram shows how the arm can be made straight again. To do this, the triceps muscle contracts, and the biceps muscle relaxes.

You can see that the biceps and triceps work as a team. When one of them contracts, the other one relaxes. When one of them contracts, it pulls the bones in one direction, and when the other contracts, it pulls the bones in the opposite direction.

A pair of muscles that work together like this are called **antagonistic muscles**.





Question

A+I

6 Explain why the biceps muscle alone cannot make the arm straighten.

Summary

- Muscles produce a pulling force when they contract. They can only pull. They cannot push.
- Muscles are joined to bones by tendons.
- Antagonistic muscles are a pair of muscles working together, pulling in opposite directions.