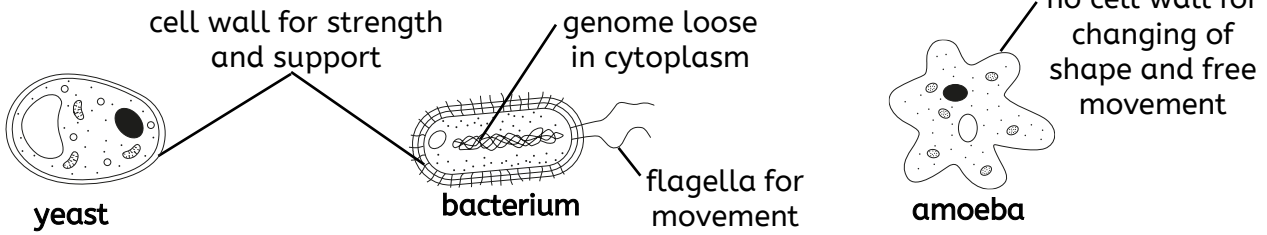
Organ systems

Unicellular organisms are made of only one cell (e.g. bacteria, amoeba and yeast).

- They can carry out the 7 life processes of living organisms, all in one cell.
- Unicellular organisms share common organelles, but they also have adaptations.
- Unicellular organisms can be helpful or harmful.
- Unicellular organisms use diffusion to exchange substances.



- Used in baking
- Used to make alcoholic drinks

- Supports digestion
- Used to make cheese and yoghurt

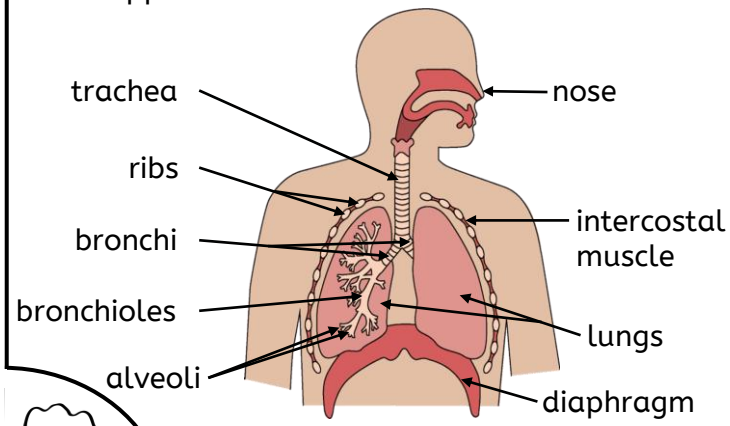
Multicellular organisms are made of many cells (e.g. plants and humans).

- They are larger and more complex than unicellular organisms.
- They cannot rely on diffusion alone for exchanging substances.
- Multicellular organisms depend on tissues, organs, and organ systems working together to exchange and transport substances to cells of the body, to keep cells alive.
- Organ systems in humans include the **gas exchange system**, **digestive system**, **circulatory system**, **skeletal system** and **muscular system**.

Gas exchange system

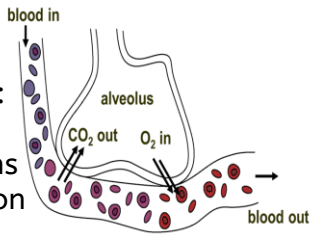
Air is a mixture of gases, including oxygen and carbon dioxide.

The human gas exchange system allows for the exchange of oxygen and carbon dioxide between an organism and its environment. Inhaled air contains more oxygen than exhaled air. Exhaled air contains more carbon dioxide than inhaled air. Oxygen moves from the alveoli into cells and then into the blood vessels (capillaries), while carbon dioxide moves in the opposite direction via diffusion.



Alveoli are adapted for efficient diffusion:

- **good blood supply** maintains the concentration difference
- **large surface area** for faster rate of diffusion
- **thin walls** (one cell thick) to provide a shorter diffusion pathway



Breathing involves changes in pressure and volume inside the chest, helped by the movement of intercostal muscles and diaphragm, which causes the movement of the ribcage.

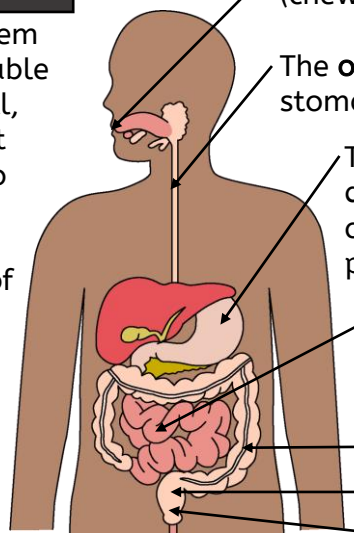
Vital capacity is the maximum volume of air exhaled after inhaling fully and can be used to estimate lung volume.

	Inhalation	Exhalation
Intercostal muscles	contract	relax
Ribcage	pulled up and out	released down and in
Diaphragm	contracts and moves downwards	relaxes and moves upwards
Volume in the chest	increases	decreases
Pressure in the chest	decreases	increases
Movement of air	into the lungs	out of the lungs

Organ systems

Digestive system

- The human digestive system breaks down large, insoluble food molecules into small, soluble molecules so that they can be absorbed into the blood.
- **Mechanical digestion:** the physical breakdown of food into smaller pieces.
- **Chemical digestion:** the use of chemical substances to break food down into smaller molecules.



The **mouth** performs both mechanical digestion (chewing) and chemical digestion (saliva).

The **oesophagus** connects the mouth to the stomach and uses peristalsis to push food down.

The **stomach** performs both mechanical digestion (muscular tissue contracts) and chemical digestion (glandular tissue producing chemical substances).

The **small intestine** breaks down food chemically. Absorption of digested nutrients also happens here.

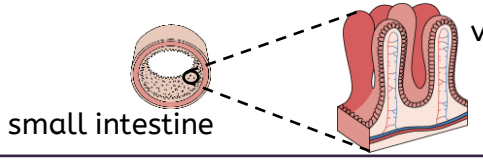
The **large intestine** reabsorbs water from undigested food back into the blood.

Faeces (poo) are stored in the **rectum**.

Faeces and waste gases are egested from the **anus**.

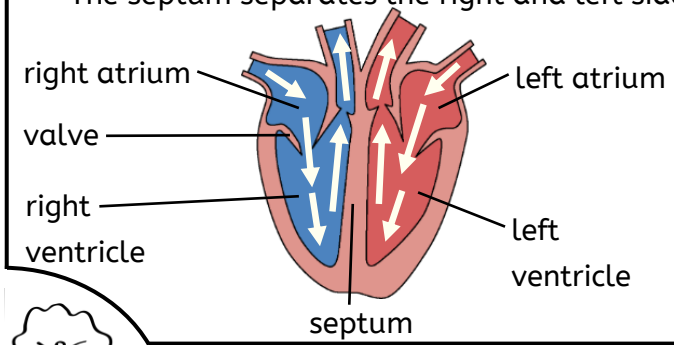
Adaptations:
The small intestine is covered in many villi for efficient absorption by diffusion:

- villi provide a **large surface area** for faster rate of diffusion
- villi have **good blood supply** to maintain the concentration difference
- villi have **thin walls** (one cell thick) to provide a shorter diffusion pathway

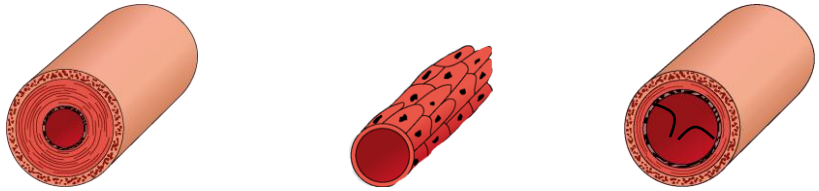


Circulatory system

- The circulatory system transports useful molecules and waste around the body. The human circulatory system consists of the heart, blood and blood vessels.
- The heart has four chambers: two atria and two ventricles.
- Valves ensure blood flows in the right direction.
- The septum separates the right and left sides of the heart.



The heart pumps oxygenated blood from the lungs to the body and deoxygenated blood from the body to the lungs (double circulatory system).

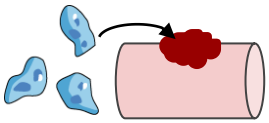


Arteries	Capillaries	Veins
• Blood taken away from heart • High pressure blood • Thick muscular and elastic walls • Small lumen	• Exchange substances between blood and cells • Very low pressure blood • Very thin walls (one cell thick) • Very small lumen	• Blood brought back to heart • Low pressure blood • Thin walls • Large lumen • Valves prevent back flow

Organ systems

Circulatory system (continued)

Blood is a fluid that transports substances, useful molecules and waste around the body. Blood helps the body to defend against diseases and to form scabs to heal cuts.



Platelets help with blood clotting for wound healing.

Plasma carries the other blood parts, nutrients, waste and carbon dioxide. It is yellow coloured and mostly water.

Red blood cells carry oxygen to all the cells of the body.

White blood cells help defend against disease.

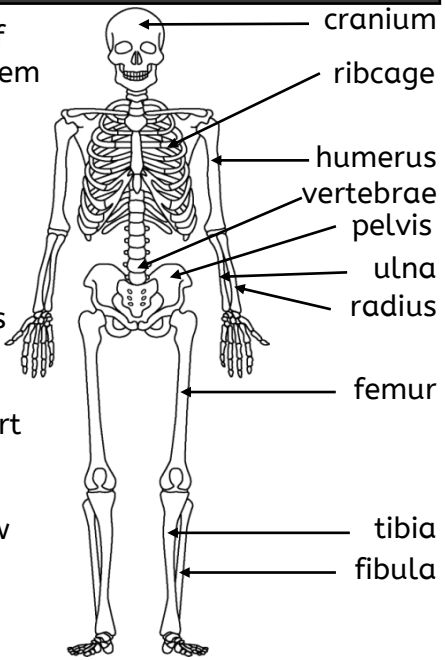
Adaptations of the red blood cells:

- biconcave shape →large surface area for faster oxygen diffusion
- contains haemoglobin → carry oxygen
- no nucleus → space for more haemoglobin → more oxygen

Red blood cells, white blood cells and platelets are made in the **bone marrow** - soft tissue inside large bones protected by the hard part of the bone around it.

Skeletal system

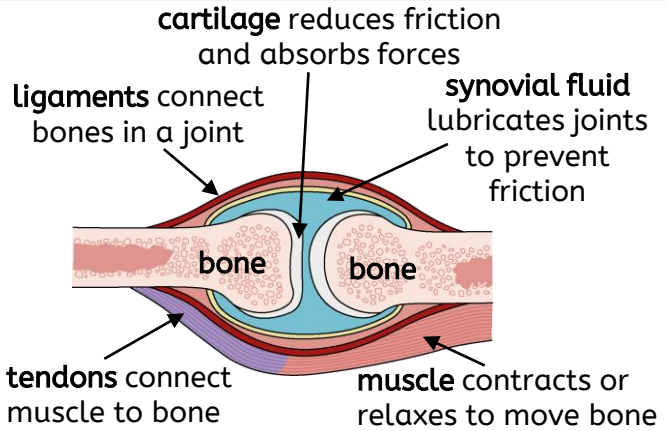
Four functions of the skeletal system are **support**, **movement**, **making new blood cells** and **protection** of organs (e.g. the cranium protects the brain and the ribcage protects the heart and lungs). **Bones** are living tissues that grow and change.



Joints, muscles and movement

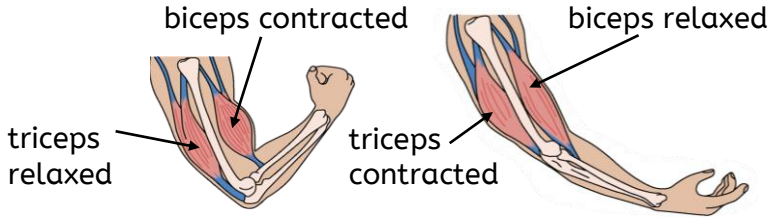
A joint is the point where two or more bones meet in the body. Joints connect bones and allow the body to move and bend. Different joint types allow various movements:

- **hinge** joint: movement backwards and forwards e.g. the knees and elbows
- **ball-and-socket** joint: movement in many directions e.g. the hips and shoulders
- **pivot** joint: twisting movement around a fixed point e.g. the neck
- **fixed** joint: does not allow for any movement e.g. in the cranium



Ageing can lead to joint wear, inflammation and arthritis. Arthritis causes joint pain and affects synovial fluid and cartilage.

- Muscles can **only** pull, they **cannot push**;
- Muscles work in **antagonistic muscle** pairs. When one muscle contracts to pull the bone in one direction, the other muscle relaxes to allow movement.



- The way in which muscles and bones work together to exert forces is called **biomechanics**.
- **Muscle strength** varies based on muscle size, age, sex, training, nutrition and injury.