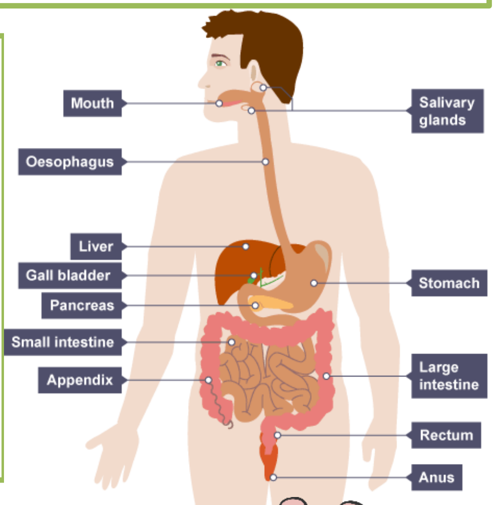
# Biology Knowledge Organiser
# Organisation

## The human digestive system

The digestive system breaks down and absorbs food molecules into molecules our cells can actually use. The products of digestion are used to make new molecules we need, and the glucose is used in respiration. It is an organ system; the organs of the digestive system are shown on the diagram.

Mechanical digestion occurs in the mouth and stomach especially, where food is physically broken up into smaller pieces. This does not, however, break down the large molecules that our food is made from (carbohydrates, lipids and proteins). That is the role of chemical digestion, which is what enzymes do.

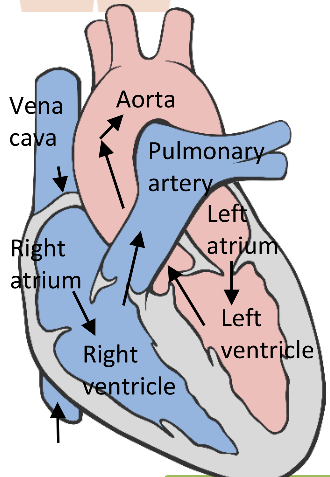



## The heart

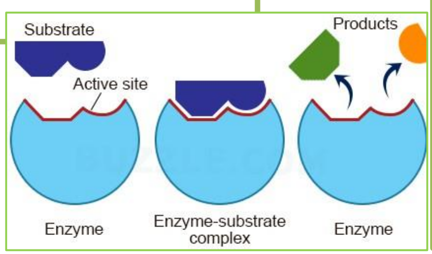
The heart is an organ whose role is to pump blood around the body. In humans and other mammals, the heart is part of a **double circulatory system**. This means the blood goes through the heart twice on its route around the body. It goes: heart → lungs → heart → body (and back to the heart again).

Learn the labelled parts of the heart. The arrows show the direction of blood flow. The heart walls are made mainly of muscle – when the heart 'beats', the muscle contracts to pump the blood.

The natural resting heart rate is controlled by a group of cells in the right atrium that act as a **pacemaker**. These cells set off the impulses that make the heart muscle contract. If there is a fault in the heart and the heart rate is irregular, an **artificial pacemaker** can be fitted to correct these irregularities.




| Key Terms | Definitions |
|---|---|
| Enzyme | A biological catalyst that speeds up chemical reactions in living organisms. Enzymes are large proteins. |
| Digestive enzyme | Enzyme that works in the digestive system, breaking down large food molecules into simpler, smaller molecules for absorption into the blood. |
| Active site | The part of an enzyme where the reaction takes place. They are very specific in shape, so that a specific substrate fits into the active site. |
| Denature | To disrupt the shape of the active site of an enzyme. Denaturation happens when the enzyme is at too high a temperature or at the wrong pH. |
| Substrate | The molecule that fits into an enzyme's active site and reacts to make a product or products. |
| Carbohydrate | A type of molecule found in all living things. Made of carbon, hydrogen and oxygen. Simple sugars like glucose are carbohydrates, and so are complex sugars like starch – in fact, starch is made of many glucose molecules joined up. |
| Lipid | Scientific name for fat. Lipids are made up of **glycerol** and **fatty acids**. Made mainly of carbon and hydrogen. |
| Protein | Type of molecule made from **amino acids**. Proteins in the body can be **structural** (e.g. muscle is made mainly of proteins) or **metabolic** (control chemical reactions – e.g. enzymes). Made mainly of carbon, hydrogen, oxygen and nitrogen. |
| Optimum | The ideal temperature or pH for enzymes to work. |

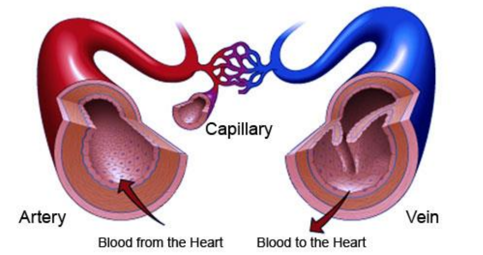


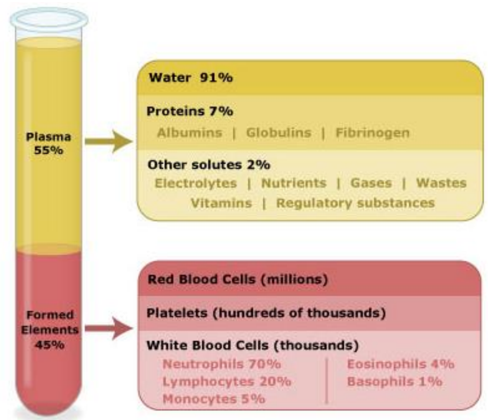

## Enzymes and digestion

Enzymes are large proteins; there are many different types. All organisms use enzymes to control chemical reactions (**metabolism**). Enzymes are **catalysts**, so they speed up chemical reactions. They work by having an **active site** with a specific shape. A specific molecule slots into the active site (like a key into a lock) and the reaction takes place. So, the shape of the active site is vitally important, and only one sort of enzyme will work on each substrate. The diagram shows this 'lock and key' model of enzyme action.

## Blood vessels

Blood is restricted to blood vessels in the body (unless you cut yourself!). There are three types: arteries, capillaries and veins. Blood being pumped by the heart always travels in the order arteries → capillaries → veins and veins return the blood to the heart. Arteries carry the blood at <u>high pressure</u>, so they have **thick, elastic** walls. Capillaries are where **exchange** takes place, so their walls are **only one cell thick** (for a *short diffusion pathway*). Veins carry the blood back to the heart at <u>low pressure</u>, so their walls are thinner than arteries (much thicker than capillaries though). However, to prevent blood flowing back the wrong way, veins have **valves** in them.




## The blood

Blood is a <u>tissue</u>. When separated into the component parts as a the diagram shows, we find that just over half of it is made up of <u>plasma</u>. The cells components (mostly red blood cells) are **suspended** in the plasma – meaning they are normally mixed evenly throughout the plasma. The majority of the cell parts is made up of red blood cells, which transport oxygen. The other components are white blood cells and platelets.

## The food tests.

Different foodstuffs contain different parts of a healthy diet. To test foodstuffs for each part of a healthy diet you can apply a different test.

**Carbohydrates – Iodine**
**Fats – Ethanol**
**Sugars - Benedict's solution**
**Proteins – Biurets solution**

| Key Terms | Definitions |
|---|---|
| Ventricles | The larger chambers in the heart. The right ventricle pumps blood to the lungs; the left ventricle pumps blood around the whole body. |
| Atria | Smaller chambers of the heart. These fill with blood from the vena cava and pulmonary vein, then pump the blood into the ventricles. |
| Aorta | The artery leaving the left ventricle. It branches off to supply, in the end, every cell of the body with blood. |
| Vena cava | The major vein transporting blood from the whole body back to the heart (to the right atrium) |
| Pulmonary artery | The blood vessel leaving the right ventricle, carrying blood to the lungs. |
| Pulmonary vein | Vein leading from the lungs back to the heart (to the left atrium). |
| Artery | Blood vessel that carries blood away from the heart, at relatively high pressure. |
| Capillary | Very small, thin-walled blood vessel where exchange of substances between the blood and body cells takes place. |
| Vein | Blood vessels that return blood to the heart at relatively low pressure. Only these vessels have **valves** in them. |
| Coronary blood vessel | The heart muscle needs its own blood supply. This comes from branches from the aorta as soon as it leaves the heart called **coronary** arteries. |
| Plasma | The liquid part of the blood, mostly made of water, but with substances like glucose, proteins, ions and carbon dioxide dissolved in it. |
| Red blood cells | Disc-shaped cells that contain **haemoglobin**, which can bind to oxygen, so it can be transported from the lungs to tissues. |
| White blood cells | Cells in the blood that fight infection caused by pathogens. |
| Platelets | Fragments of cells that cause clotting of blood at a wound, to reduce blood loss. |
| Clot | A solid clump of blood formed when there is an injury. |

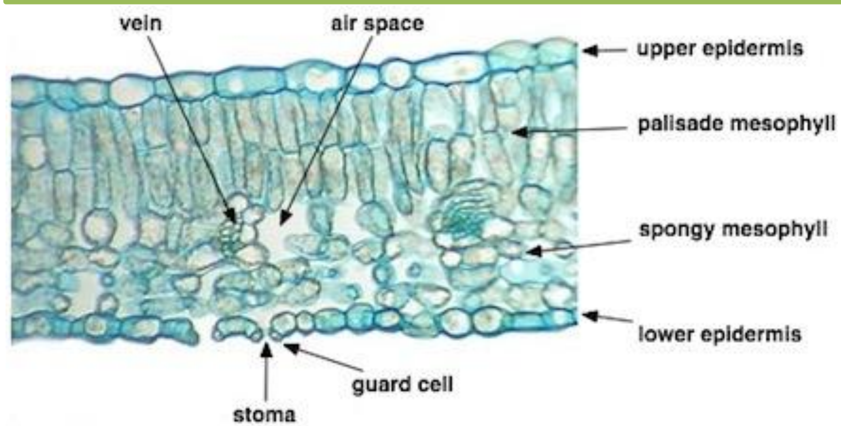
| Key Terms | Definitions |
|---|---|
| Epidermal | Type of plant tissue that covers the surface of a plant |
| Palisade mesophyll | Tissue in the leaf where photosynthesis takes place |
| Spongy mesophyll | Tissue in the leaf with air spaces between cells – specialised for gas exchange |
| Xylem | Narrow tubes in the roots, stem and leaves, which transport water and mineral ions |
| Phloem | Other tubes that run alongside xylem, but transport sugars dissolved in water instead – a process called **translocation** |
| Meristem | Type of tissue found at growing tips of roots and shoots, containing stem cells so they can differentiate into different sorts of plant cell |
| Guard cell | In pairs, guard cells form the stomata on leaves – the holes through which gases are exchanged. They can open and close the stomata as required by the plant. |
| Transpiration | The process by which plants lose water, as vapour, from their leaves through the stomata. |

## Plant tissues in the leaf and transpiration

Look at the key terms and definitions for the key types of plant tissue. Leaves are **organs** in plants that contain many of those types of tissue. Together with the stem and roots, they form an **organ system** for transport of substances around the plant. The photograph shows the **transverse section** of a leaf – a thin slice through the leaf, looking edge-on.

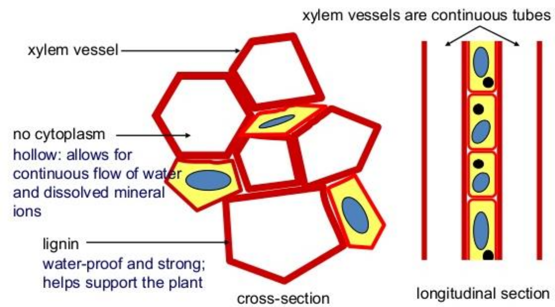
The **vein** contains the xylem and phloem vessels. The **stomata** (singular: stoma) are the holes through which gases are exchanged. This includes water vapour. Plants absorb all their water in the roots (you've already looked at root hair cells), and keep water moving constantly through by losing water as vapour from the leaves. The constant flow of water up the plant is called the transpiration stream. This loss of water vapour from the leaves is called **transpiration**. Transpiration is sped up by:

- a *higher temperature*, since water molecules have more kinetic energy so diffusion is faster
- *Lower humidity* (drier air), since there is a steeper concentration gradient if the air outside the plant is relatively drier than the air in the air spaces
- *Higher air flow* (being windier!), since this refreshes the concentration gradient all the time, as water vapour is blown away from the leaves
- *Higher light intensity*: this increases the rate of photosynthesis, which uses water, so water flows more rapidly up through the plant.




## Stomata, guard cells and transpiration

Stomata must be open at least some of the time, to allow carbon dioxide to enter the leaf for photosynthesis. However, guard cells can control how many stomata are open, and how wide open they are. This is useful in dry conditions, because the plant can conserve water instead of losing lots of it through transpiration.





## Xylem and Phloem

Xylem tissue is made of hollow tubes, formed from the cell walls of dead cells, and strengthened by a substance called **lignin**. The diagram shows their adaptations to the function of transporting water and minerals.

Phloem, on the other hand, is a tissue made of living cells. They are elongated and stacked to form tubes. Phloem tubes transport food – dissolved sugars – made in the leaves to other parts of the plant, for use in respiration or for storage. The sugary substance they transport is called cell sap, and its transport is called **translocation**. Cell sap flows from one phloem cell to the next through **pores** (holes) in the ends of the cells.