The digestive system:

A tissue is a group of cells with a similar structure and function

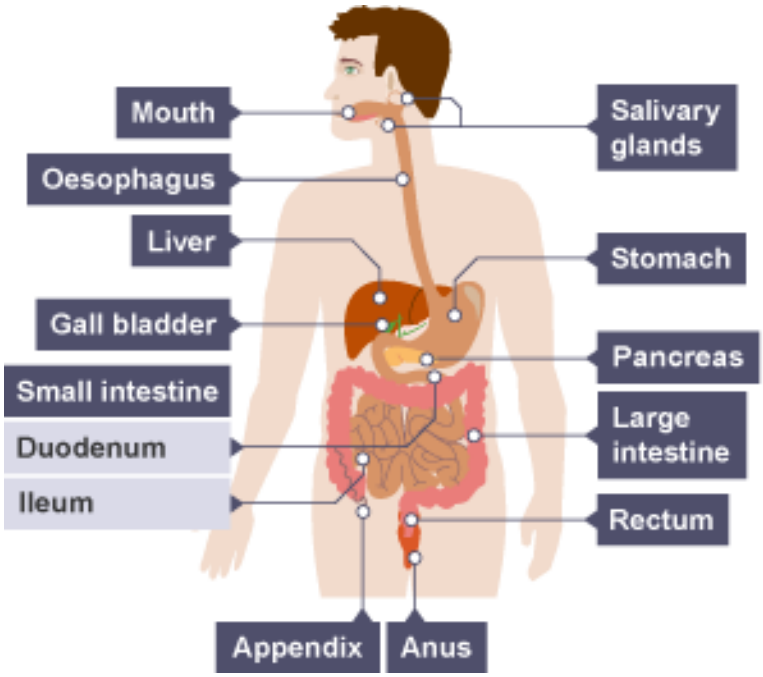
An organ is a group of tissues working together with a specific function

Organs are grouped together into organ systems which then form organisms

Food contains three main nutrients:

- Carbohydrates
- Proteins
- Lipids

During digestion, these food molecules are broken down into smaller food molecules by enzymes



The mouth chews the food and the saliva begin to digest the starch into smaller sugar molecules.

The food passes through the oesophagus and into the stomach, which then enzymes begin to digest proteins.

The food spends hours in the stomach and then the stomach turns the food into fluid (churning) increasing the surface area for enzymes to digest.

The fluid passes into the small intestine. Chemicals are released into the small intestine from the liver and the pancreas.

The pancreas releases enzymes which digest starch and protein and start digestion of lipids.

The liver releases bile which speeds up digestion of lipids and bile also neutralises the acid from the stomach.

The walls of the small intestine release enzymes to digest proteins and lipids.

The food molecules are then absorbed into the bloodstream.

The fluid goes through the large intestine and the water is absorbed into the bloodstream.

The feces is released by the body.

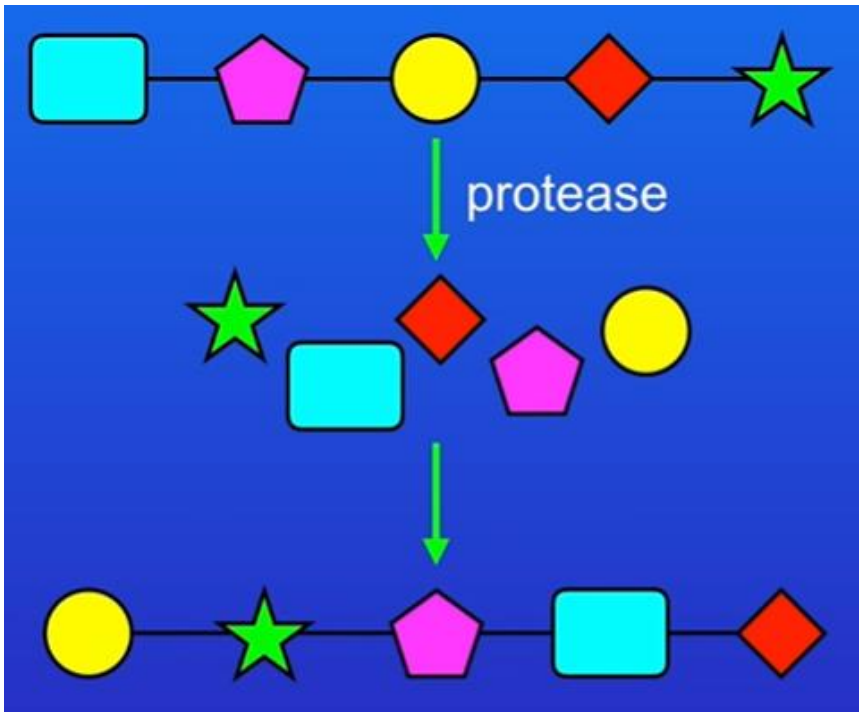
Digestive enzymes:

Enzymes catalyse reactions.

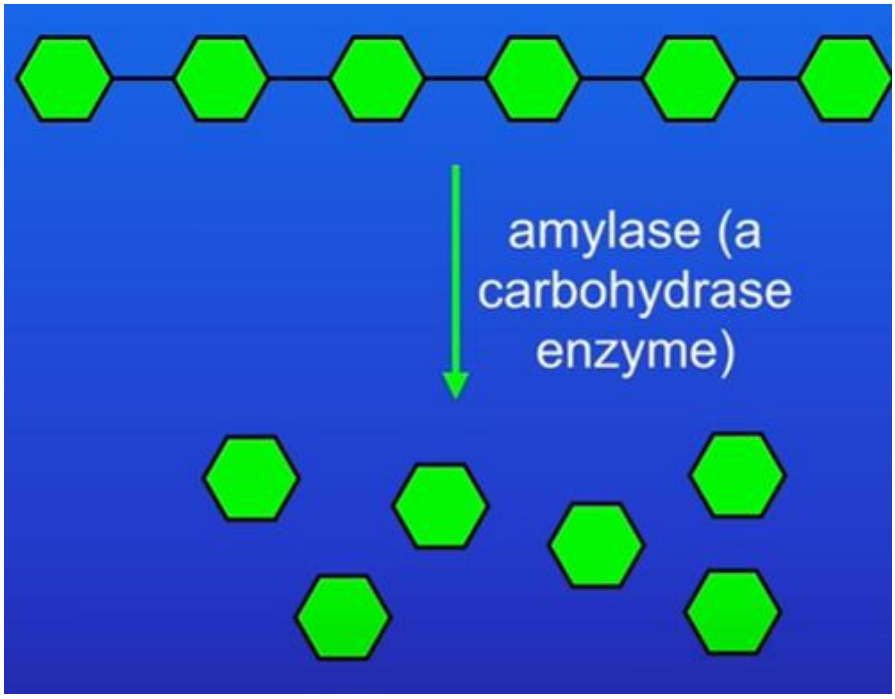
When a reaction happens, the substrate is broken down.

Proteins are broken down by enzymes called proteases.

Proteins are made up by amino acid:

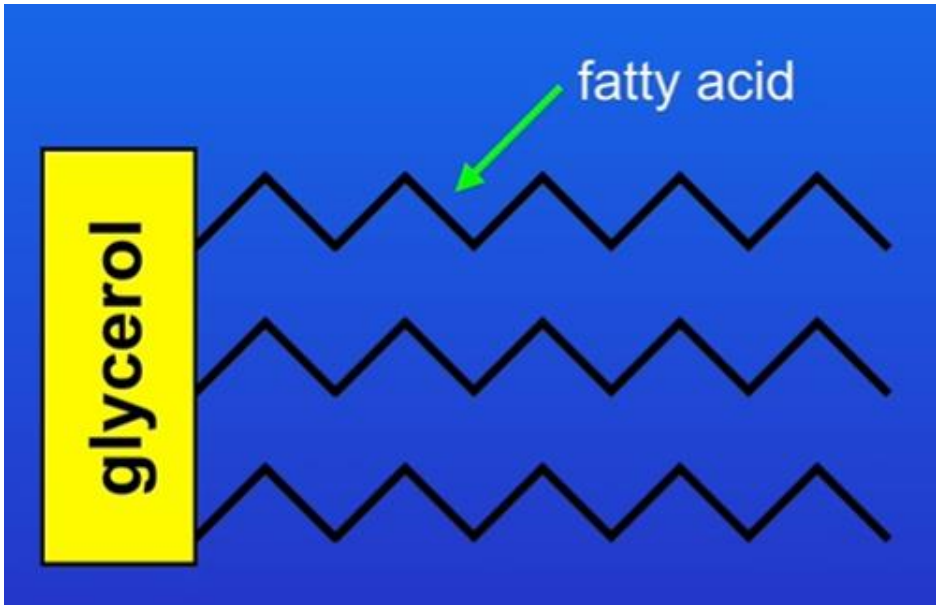


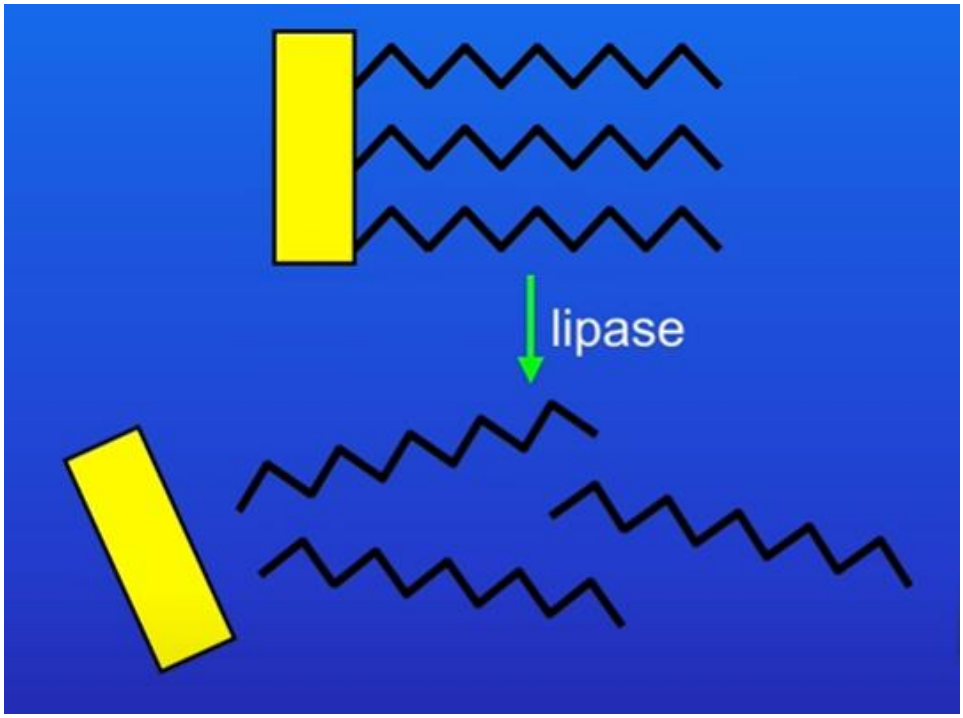
Carbohydrates are broken down by carbohydrases:



Amylase is found in the saliva and the pancreatic fluid.

Lipids are broken down by lipase:



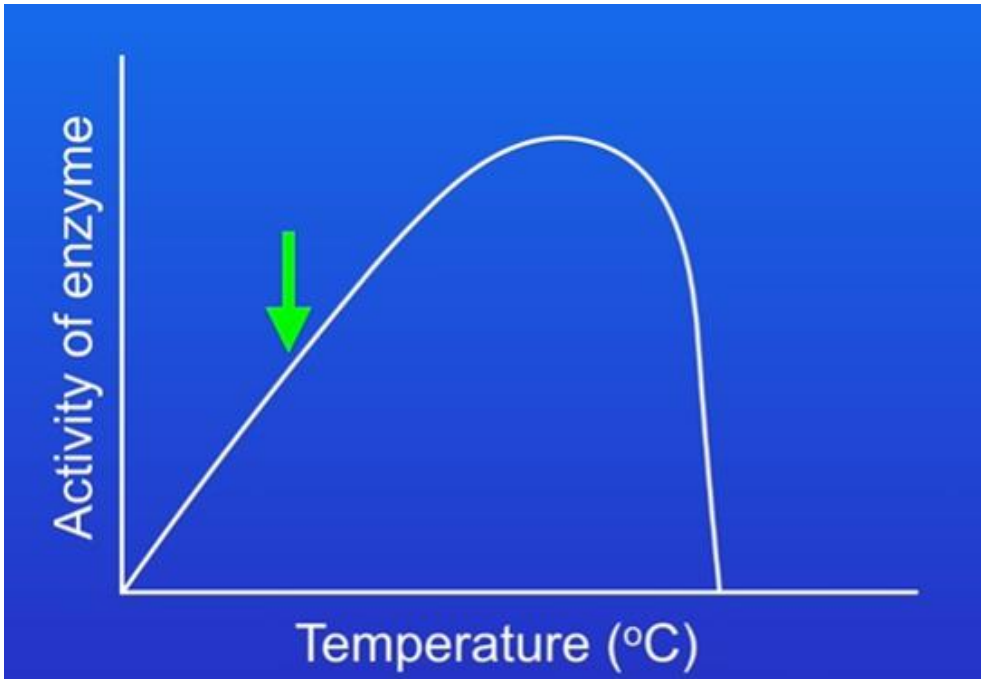


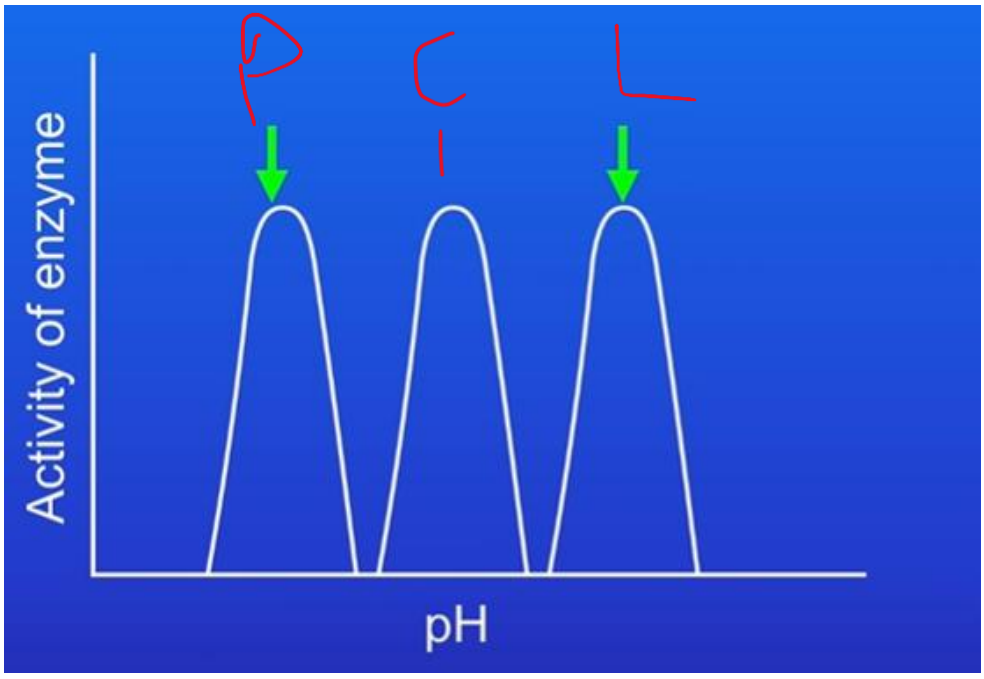
Lipase are found in the pancreatic fluid and the small intestine.

Bile is made in the liver and is stored in the gall bladder and it speeds up digestion.

Bile emulsifies the lipid (breaks down).

The effect of temperature and pH on enzymes:

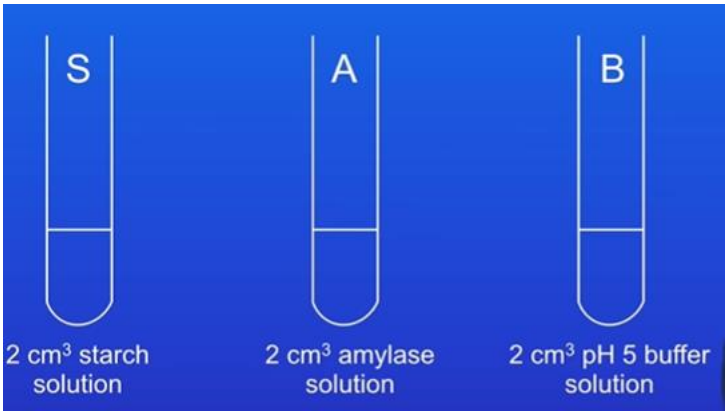




Required practical – Effect of pH on amylase:

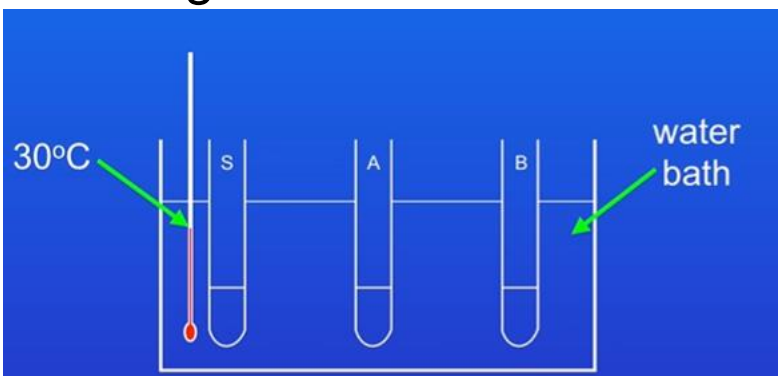
How to perform:

1. Place one drop of iodine into each well in a spotting tile
2. Add the solution



- The buffer solutions control the pH

3. Put three of the beakers into a water bath at 30 degrees and leave for 10 minutes



4. Combine the three solutions into one and stir it and put it back into the water bath and start a stopwatch
5. We use a stirring after every 30s to transfer one drop of solution into the iodine
6. When the iodine turns blue-black, starch is present. We continue this until starch is no longer present (reaction is done)
7. We repeat experiment with different pH buffer solutions (6, 7, 8)

Problems:

- We take samples every thirty seconds, so we only have an approximate time. We can change this by taking it every ten seconds.
- When the iodine doesn't go blue-black, it is not always obvious because the colour change happens gradually. We can ask several people to decide if the reaction has completed.

Required practical – food tests:

How to perform:

1. Take food sample and grind with pestle and mortar
2. Transfer the paste into a beaker and add distilled water and stir so chemicals are dissolved in water
3. Filter the solution to remove suspended food particles
4. Place 2cm^3 of food solution into test tube and add a few drops of iodine. Blue-black if starch
5. Place 2cm^3 of food solution into a test tube and add 10 drops of benedicts solution

6. Place test tube into beaker half filled with hot water
7. Leave for five minutes and if sugars are present, colour will change (green>small amount, yellow>more sugar, red>a lot)
8. To perform for proteins we add $2cm^3$ into test tube
9. Add $2cm^3$ of biuret solution
10. If protein is present, colour will change to purple or lilac
11. To test for lipids, we do the same thing when grinding but don't grind it
12. Add $2cm^3$ of food into tube and add few drops of distilled water and ethanol
13. We gently shake the tube and colour change if present will be cloudy white

Absorption in the small intestine:

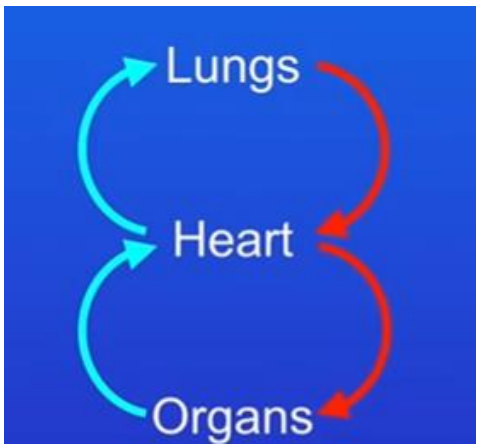
How small intestine is adapted:

- Large surface area for products of digestion
- Interior is covered with villi which increases the surface area
- Surface of villi have microvilli which increases surface area further

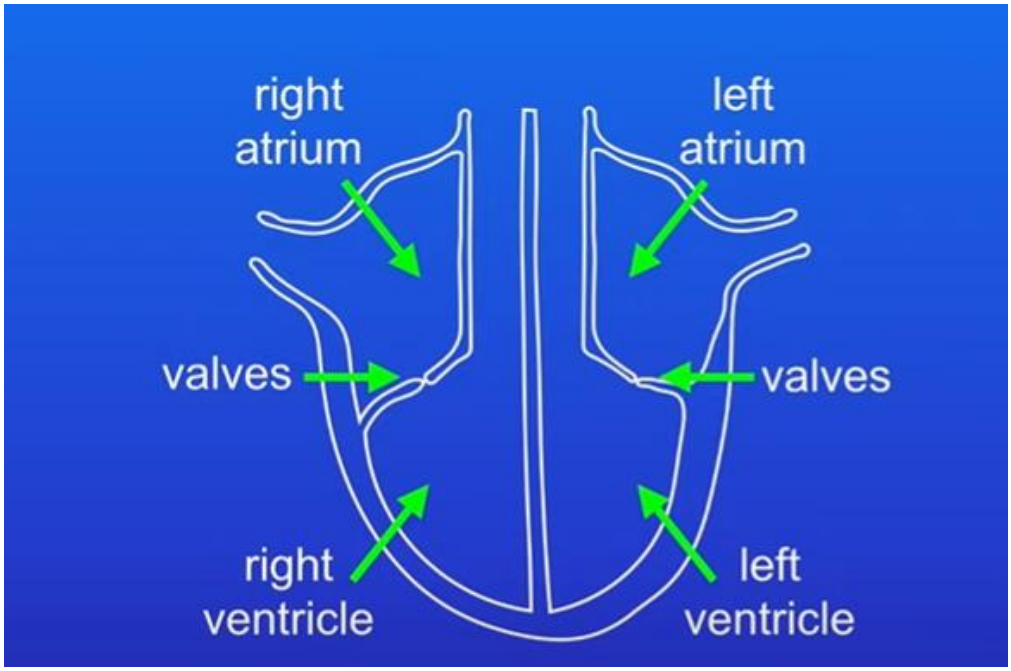
- Villi have good blood supply so products of digestion is removed quickly
- Thin membrane for rapid diffusion

The heart and circulation:

Humans have double circulatory system



Pressure is not lost when blood is transferred to the organs because it goes through the heart twice

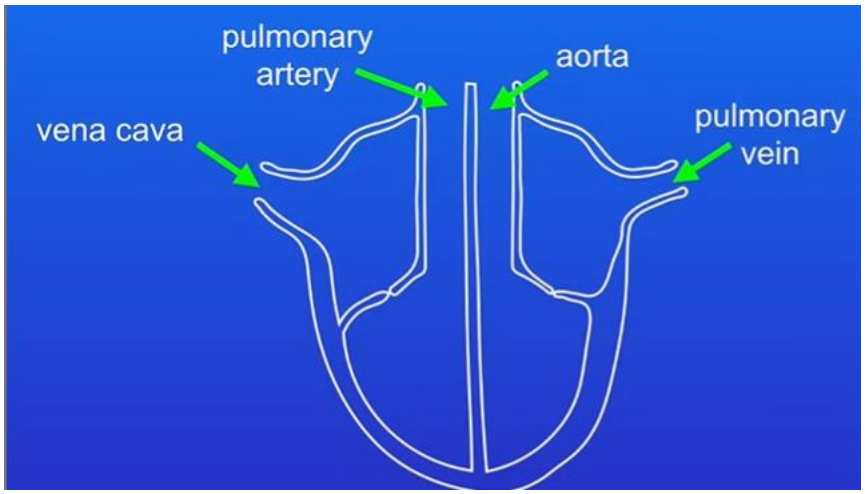


Vena cava brings deoxygenated blood from the body

Blood passes from heart to lungs in pulmonary artery

Oxygenated blood enters into the pulmonary vein

Blood is pumped from heart to body in aorta



Valves in heart stop blood from flowing backwards

Left side is thicker because it has to pump blood to the whole body so it deals with more force

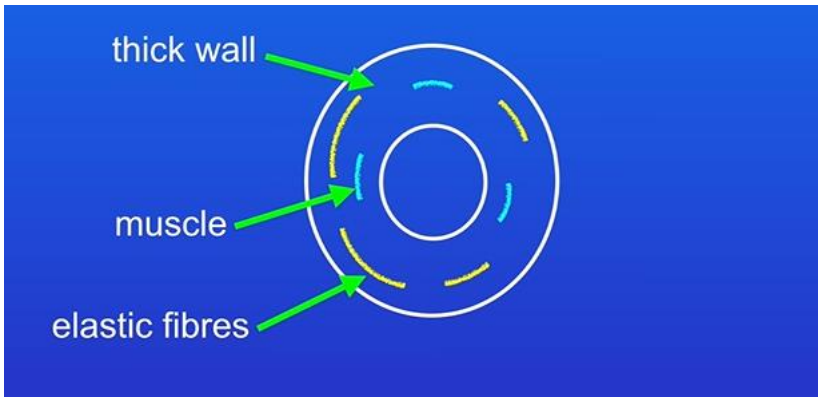
Coronary artery provides oxygen to muscle cells

Resting heart rate is controlled by pacemaker which is found in the right atrium

Arteries, veins and capillaries:

Arteries carry very high pressure blood around the body

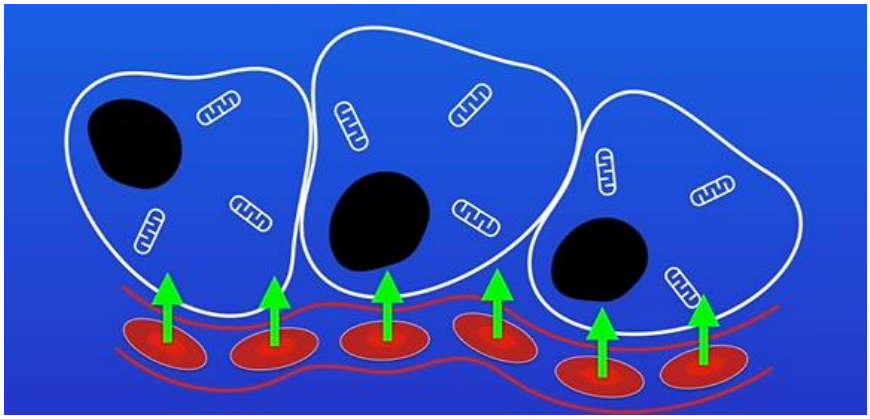
Structure of artery:



Arteries have very thick walls to withstand high pressures.

Elastic fibres stretch when the surge of blood passes through and then recoils in between surges to keep blood moving.

Structure of capillaries:

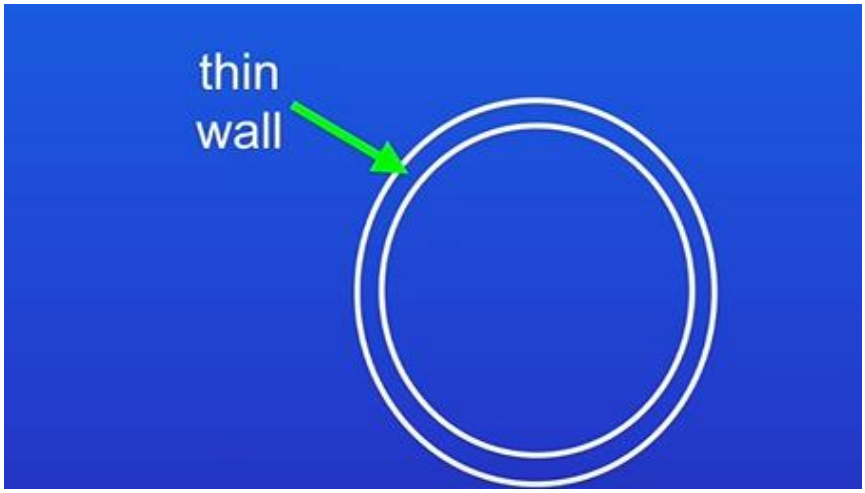


Glucose and oxygen diffuses into the cells.

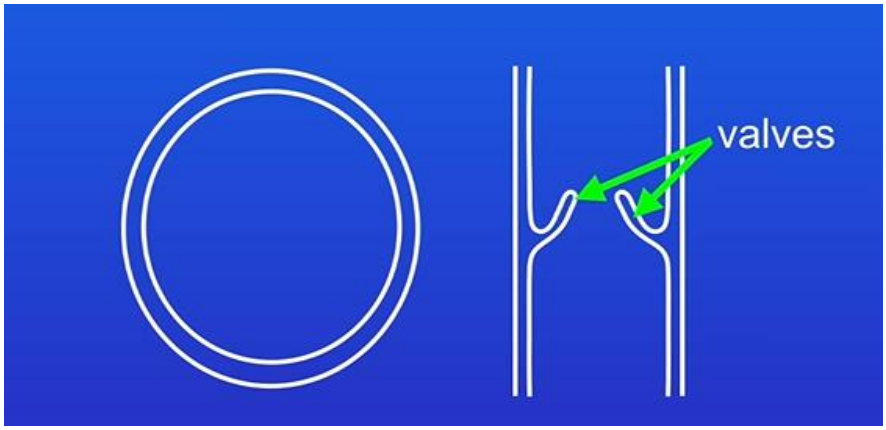
Carbon dioxide diffuses out of the cells.

It has thin walls which means that the path for diffusion is shorter and diffusion is more rapid.

Structure of veins:

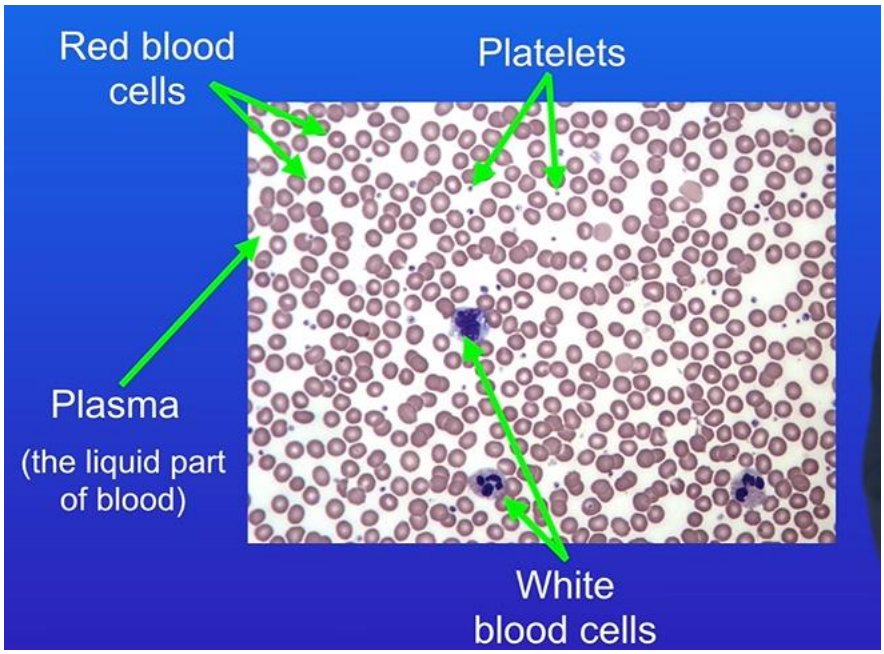


The walls of veins are very thin because the vein doesn't need to withstand high pressures of blood.



There are valves inside veins and they stop blood from flowing backwards and close. When blood is flowing in the right direction, the valves stay open.

<u>The blood:</u>

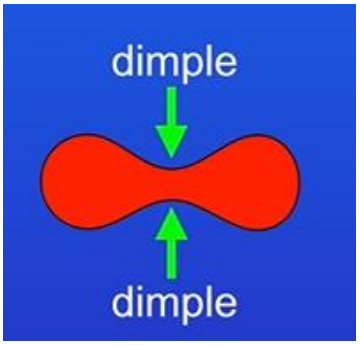


Plasma transports:

- Digestion products
- Carbon dioxide to be breathed out
- Waste product urea to be excreted

Red blood cells transport oxygen, they do this by:

- Having oxygen carrying molecule (haemoglobin) which can bind to oxygen
- Red blood cells have no nucleus which enables them to carry more oxygen
- Red blood cells have a **biconcave disc** shape which increases the surface area and allows them to carry more oxygen



White blood cells are part of the immune system which can help them fight diseases. This is because they have a nucleus which gives them instructions.
Platelets are fragments of cells and it's job is to help blood clot

Donated blood uses:

- Replaces blood during injuries
- Platelets are given to those to help blood clot
- Proteins extracted from blood can be useful

Problems of donated blood:

- In a blood transfusion, blood has to be same type for both otherwise the patients body will reject the blood
- Lots of diseases can be spread but the UK screens it for infections

<u>Cardiovascular diseases:</u>

Cardiovascular diseases are diseases of the heart and the blood vessels

Purpose of coronary arteries is to provide oxygen to the muscle cells of the heart

In a coronary heart disease, layers of fatty material build up in the walls which causes the arteries to narrow which reduces the blood flow. This means that there is less oxygen.

Statins can reduce fatty material building up in the arteries/reduce chloresterol. Statins have unwanted side effects.

Stent is a wired mesh which opens the artery

Sometimes the valves can partially open or it can become leeky so the valves would need to be replaced with a mechanical or animal valve.

Sometimes, a patient’s heart may not be able to pump enough oxygen around the body and therefore needs a donated heart and lungs from someone else.

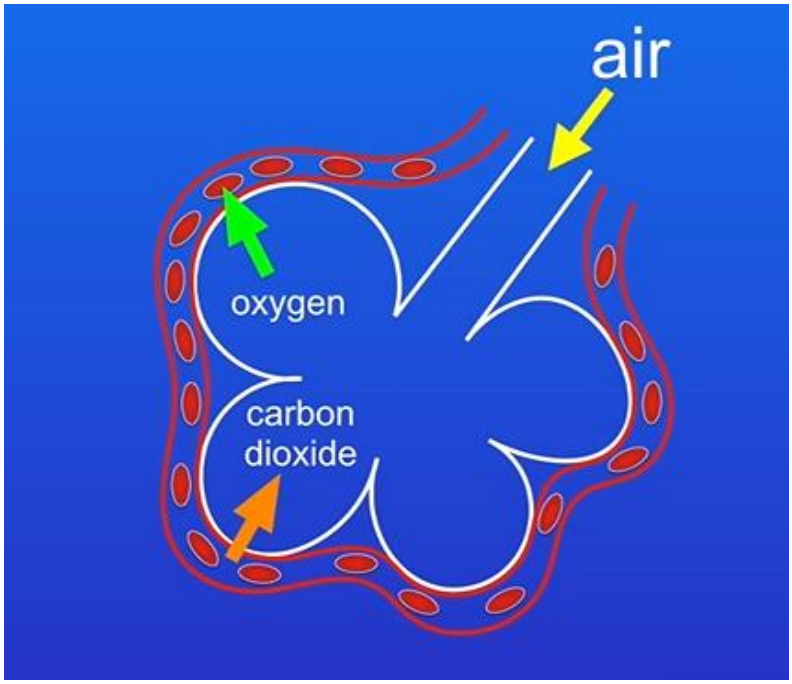
Gas exchange in the lungs:

Air passes into the lungs through the trachea

The trachea has rings of cartilage which prevent the trachea from collapsing.

The air then goes through the bronchi which then goes into smaller tubes called bronchioles and then ends in air sacs called alveoli.

Alveoli is the site of gas exchange



The alveoli makes the lungs have a huge surface area

The alveoli have very thin walls so the diffusion path is very short

The alveoli have a very good blood supply which means that once oxygen has diffused into the blood, it is rapidly removed to make the concentration gradient as steep as possible

Breathing causes the rate of diffusion to increase.

Cancer:

When mitosis happens uncontrollably, cancer is formed.

Benign tumours:

- Found in one area and is enclosed within a membrane
- Does not invade but damages other organs by pushing against them

Malignant tumours:

- Bits of malignant tumours can break off into the bloodstream and can then spread to different parts of the body (metastasis)
- This forms secondary tumours

Cancer can be linked to lifestyle, environment or inheritance.

Correlating risk factors for non-communicable diseases:

Scientists studying peoples lifestyle is called epidemiology.

Smoking can cause lung cancer.

Carcinogens are things which cause cancer

Sampling has to be from random populations and has to be as large as possible

Risk factors:

A diet high in fat and low in vegetables can cause increased cholesterol.

A diet high in salt can cause high blood pressure.

Cardiovascular diseases is caused by smoking.

It can be reduced by exercise.

Alcohol can cause harm to babies

Obese people can obtain type 2 diabetes

Plant tissues:

Epidermis protects the surface of leaf and is transparent which allows light to pass through

Waxy cuticle reduces evaporation of the leaf which helps prevent leaf from drying out

Stomata allow carbon dioxide and oxygen to enter/leave. They also control the amount of water vapour which is in the leaf

Palisade mesophyll is packed full of chlorophyll

Spongy mesophyll is full of air spaces which allows carbon dioxide to diffuse to the palisade cells and also oxygen.

Xylem transports water to the stem and the leaves. Some of the water is used in photosynthesis and the xylem also transport dissolved mineral ions such as magnesium which is used to make chlorophyll.

Phloem tissue transports dissolved sugars produced by photosynthesis.

Movement of sugars through the phloem is called translocation.

Meristem contains stem cells in plants

Meristem tissue is found in shoots and roots

Transpiration:

Water enters the roots through root hair cells

Water is evaporating from the surface of the leaves which is called transpiration.

Transpiration = Process of water movement through the plant and the evaporation of water from the leaf and other parts of the plant

Transpiration starts from inside the leaf and then water diffuses through the air spaces and into the spongy mesophyll and out of the leaf through the stomata

The water passes from the xylem to the leaf to replace lost water

Water is drawn into the xylem through the root hair cells

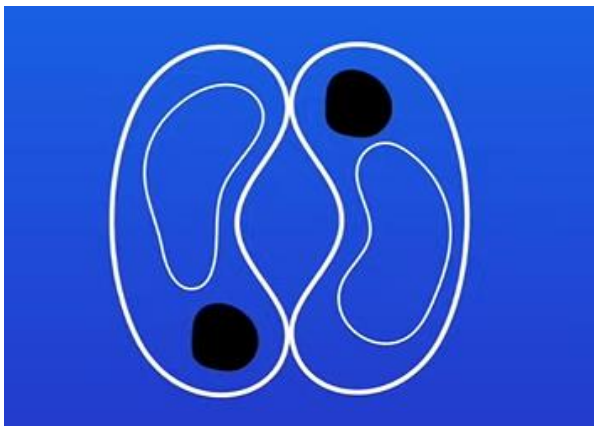
Reasons for transpiration:

- Brings water into the leaf which is required for photosynthesis
- Brings mineral ions such as magnesium
- Evaporation of leaf cools leaf down in warm weather

Rate of transpiration is high at:

- High temperature
- Dry conditions when air is not humid
- When it is windy as it removes any water vapour
- Light intensity increases

Stomata:



The guard cells swell and change the shape which causes stomata to open and allow substances to diffuse

In hot conditions, the plant closes it’s stomata to reduce water loss