Biology

Chapter 1-8

23C T.Nemuulen

Contents

Chapter 1-Classification

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1.2 classification

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1.1.Characteristics of living things (Mrs.Gren)

Movement

- an action by an organism or part of an organism causing a change of position or place

Respiration

- the chemical reactions in cells that break down nutrient molecules and release energy for metabolism

Sensitivity

- the ability to detect or sense stimuli in the internal or external environment and to make appropriate responses

Growth

- a permanent increase in size and dry mass by an increase in cell number or cell size or both

Reproduction

- the processes that make more of the same kind of organism

Excretion

- removal from organisms of the waste products of metabolism (chemical reactions in cells including respiration), toxic materials and substances in excess of requirements.

Nutrition

- taking in of materials for energy, growth and development; plants require light, carbon dioxide, water and ions; animals need organic compounds and ions and usually need water

All cells of living things have:

- Cytoplasm
- A cell membrane
- A chemical called DNA(genetic material)
- Ribosomes(used for making proteins)
- Enzymes (helps to carry out anaerobic respiration)

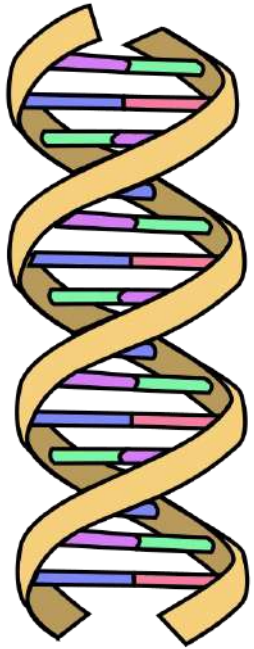
1.2.Classification

Kingdom
|
Phylum
|
Class
|
Order
|
Family
|
Genus
|
Species

The binomial naming system:

genus + species

DNA (Deoxyribonucleic acid)



DNA

=Adenine

= Thymine

= Cytosine

= Guanine

= Phosphate backbone

DNA is the chemical from where our chromosomes are made. It is used to identify relation between organisms.

Adenine=Thymine
Cytosine=Guanine

Adenine/thymine+Cytosine/guanine=50%

The bases on the 2 strands are held together by bonds, forming cross links. The 2 strands then twist together into a kind of spiral into a kind of spiral called helix.

1.3. The kingdom of living organisms

The kingdoms of living organisms

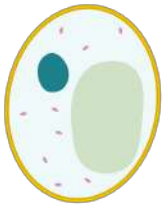
Animals

- Multicellular
- Cells have nucleus, but no chloroplasts or cell walls
- Feed on organic substances made by other living organisms
- Both asexual and sexual

Plants

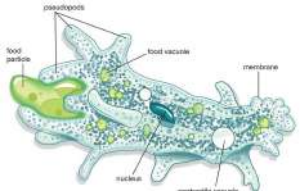
- Multicellular
- Cells have a nucleus, cells have made of cellulose and often contain chloroplasts
- Feed by photosynthesis (autotrophic)
- Asexual and sexual

Fungi



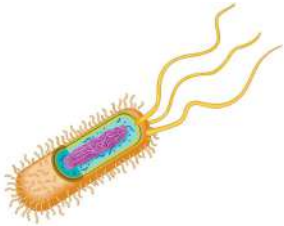
- Usually multicellular
- Have nuclei, have cell walls not made of cellulose
- Do not have chlorophyll
- Feed by saprophytic or parasitic nutrition

Protoctista



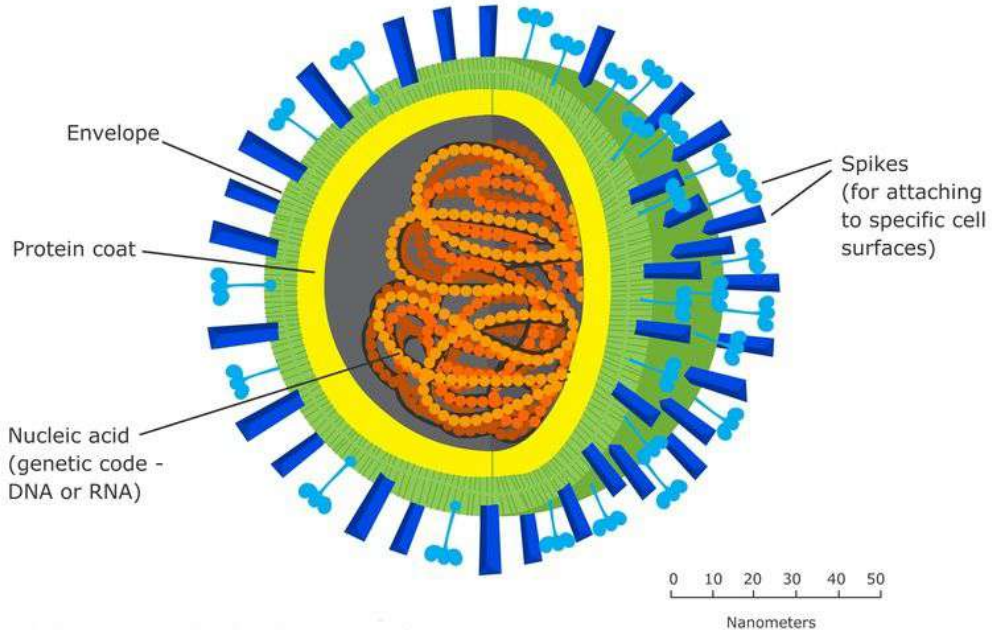
- Multicellular or unicellular
- Cells have a nucleus
- Cells may or may not have a cell wall or chloroplasts
- Some feel by photosynthesis and others feed on organic substances made by other organisms

Prokaryotes(bacteria)



- Often unicellular
- Have no nucleus
- Have cell walls not made of cellulose
- Have no mitochondria
- asexual

1.4. Viruses



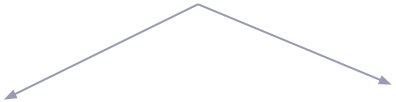
Viruses are not normally considered to be alive, because they cannot do anything other than just exist, until they get inside a living cell.

Magnification:

Size of real object*magnification=size of drawing

1nm(nanometre)=$1* 10^{-9}$mm

1.5.Animal kingdom



Vertebrates (have backbone)

Amphibians:
- Moist, scale skin
- Eggs laid in water
- Larva has gills, adults have lungs
- Heart has 3 chambers

Fish:
- Scaly skin
- Have gills
- Have fins
- Heart has 2 chambers

Reptiles :
- Scaly skin
- Lay eggs with rubbery shells (waterproof)
- Heart has 4 chambers

Birds:
- Feathers
- Forelimbs have become wings
- Lay eggs with hard shells
- Endothermic
- Have a beak
- Heart has 4 chambers

Mammals :
- Hair
- Placenta
- Young feed on milk
- Endothermic
- Have a diaphragm
- Heart has 4 chambers
- Have a different types of teeth

Invertebrate (Have several jointed legs and exoskeleton)

Insects: (шавж)
- 3 pairs of jointed legs
- 2 pairs of wings
- Breathe through trachea
- Body- head, thorax, abdomen

Crustaceans: (хавч хэлбэртэн)
- More than 4 pairs of legs
- Not millipedes or centipedes
- Breathe through gills

Arachnids: (аалз хэлбэртэн)
- 4 pairs of legs
- Breathe through gills called book lungs

Myriapods: (олон хөлт)
- Body consists of many segments
- Each segment has jointed legs

1.6.Classifying plants

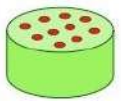
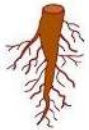
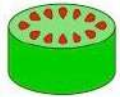
Plant kingdom

Ferns

- Have leaves called fronds
- Plants with roots, stems and leaves
- Do not produce flowers
- Reproduce by spores

Flowering plants

- Plants with roots, stems and leaves
- Reproduce sexually by means of flowers and seeds
- Cells are produced inside the ovary, in the flower

	Seed	Root	Vascular	Leaf	Flower
Monocot					
	One cotyledon	Fibrous roots	Scattered	Parallel veins	Multiples of 3
Dicot					
	Two cotyledon	Tap roots	Ringed	Net-like veins	4 or 5

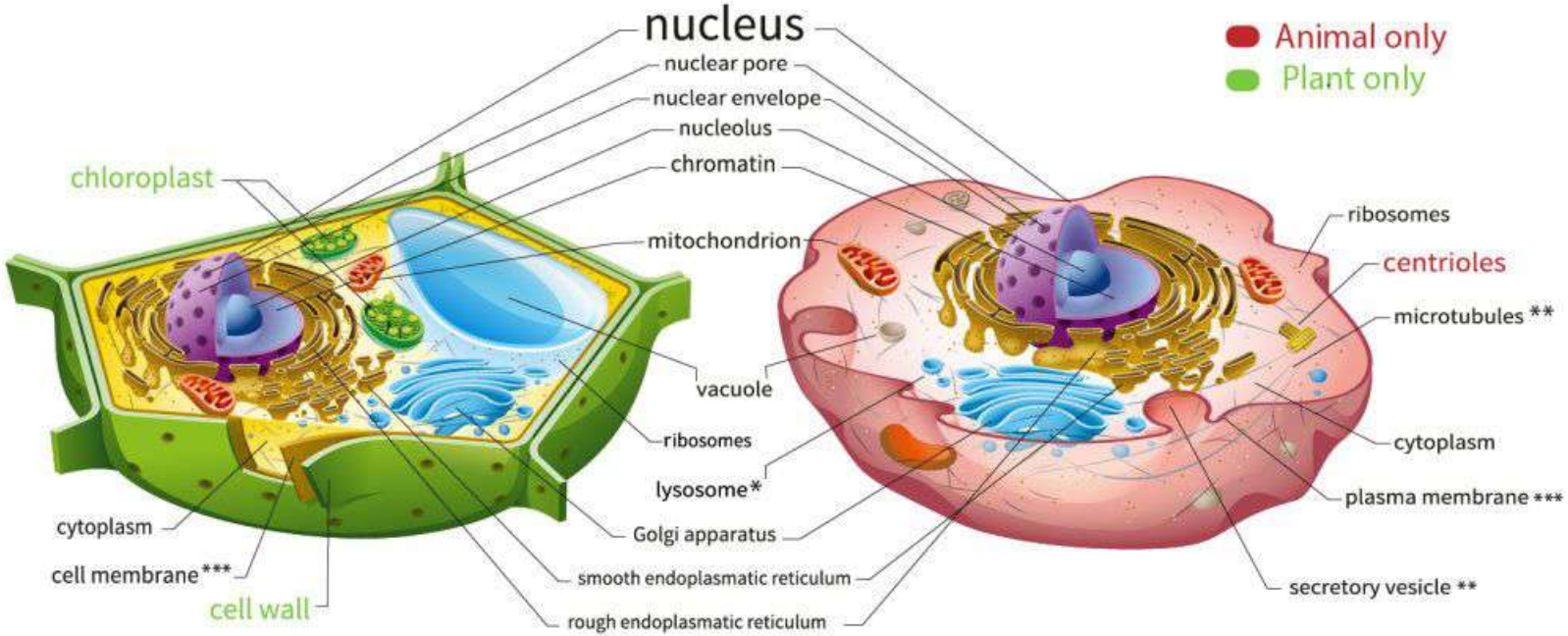
monocot=monocotyledonous
dicot=dicotyledonous

Chapter 2-Cells

2.1
Cell structure

2.2
Cells and organisms

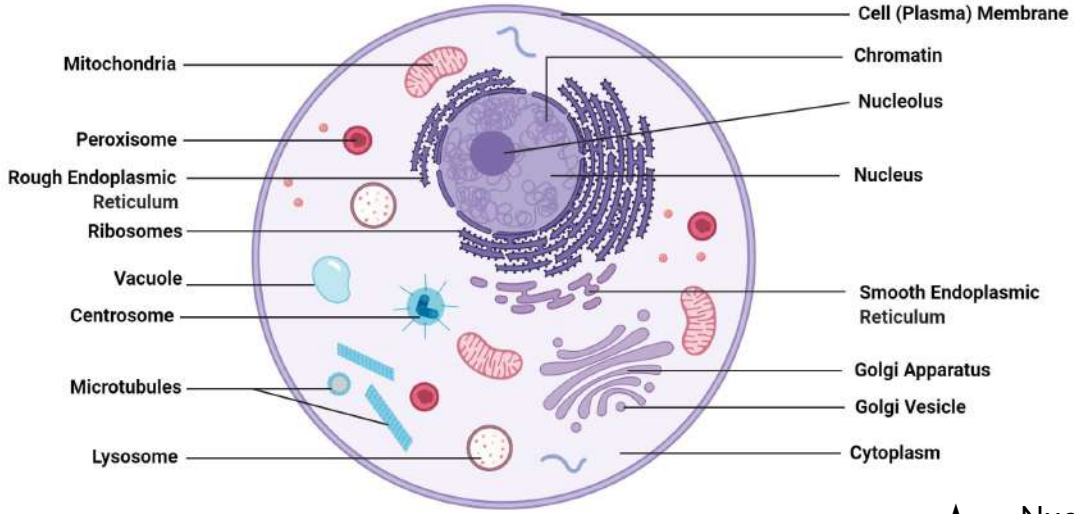
2.1.Cell structure

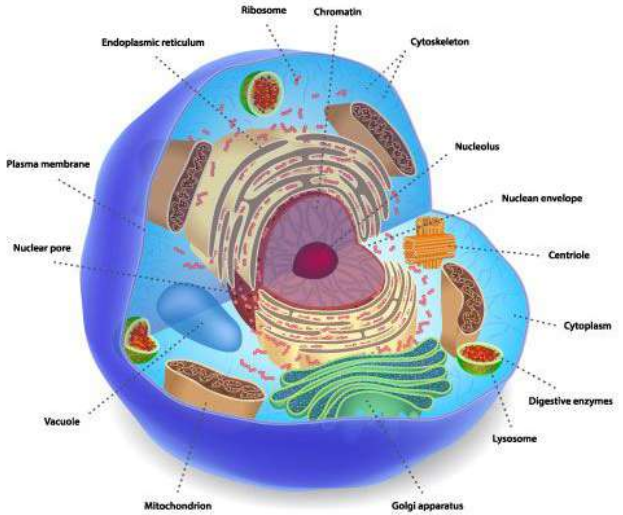


- ❖ Regular in shape
- ❖ Have cell wall
- ❖ Have chloroplast
- ❖ Large vacuole

- ❖ Irregular in shape
- ❖ No cell wall
- ❖ No chloroplast
- ❖ Small vacuole

Animal Cell Structure





- ★ Nuclear pores- act as doorways between nucleus and the cytoplasm
- ★ Cytoplasm- a semi-fluid, gelatin-like substance that surrounds the organelles inside the cell
- ★ Cytoskeleton- gives support and structure to the cell
- ★ Vesicles- store and transport substances within the cell
- ★ Golgi apparatus- modifies proteins and sends them to other parts of the cell
- ★ Centrioles- play a crucial role in cell division (mitosis) and the location of the nucleus

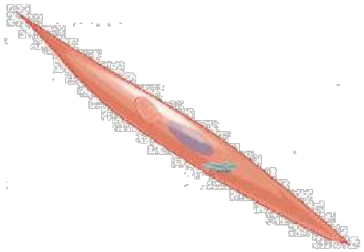
- ★ Nucleous (nucleolus) - the main function is to form ribosomes
- ★ Nucleus- contains the cell's genetic material
- ★ Ribosome- read instructions from messenger RNA to synthesise proteins
- ★ Chromosomes- the bundled form of the DNA strands
- ★ Rough endoplasmic reticulum- manufactures and packages proteins
- ★ Smooth endoplasmic reticulum- synthesizes lipids, phospholipids, and steroids
- ★ Nuclear membrane- separate the nucleus from the rest of the cell

2.1.Cells and organisms

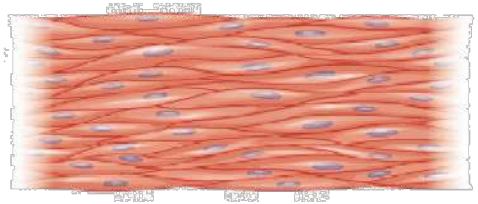
microscope

Light microscope	Electron microscope
x1500	x up to 10 million

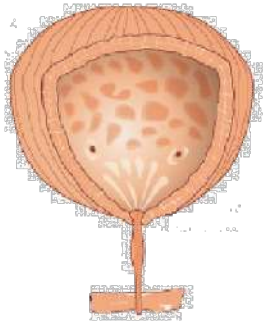
- Tissue- a group of cells with similar structures working together to perform a shared function.
- Organ- a structure made up of a group of tissues working together to perform specific functions.
- Organ system- a group of organs with related functions working together to perform body functions.



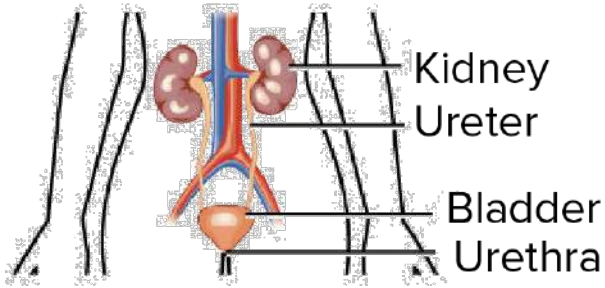
Muscle cell



Muscle tissue



Organ (bladder)



Organ system

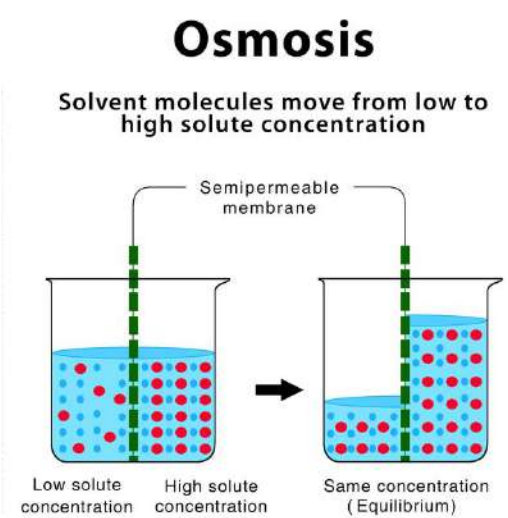
Chapter 3-Movement in and out of cells

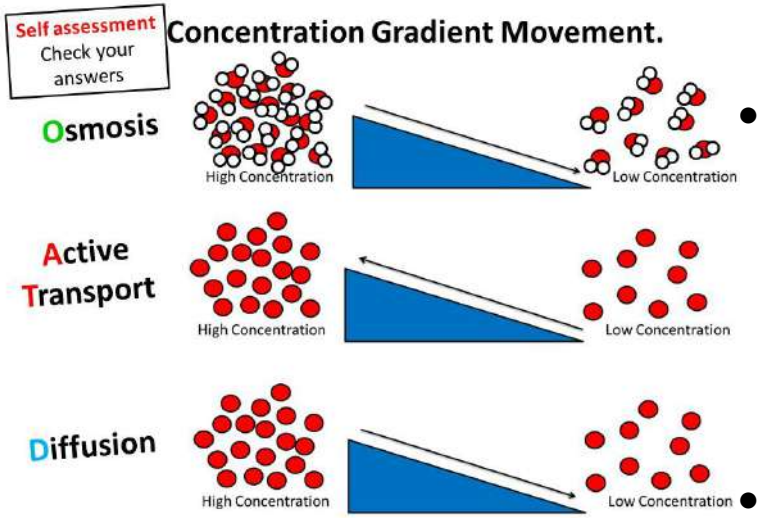
3.1
Diffusion

3.2
osmosis

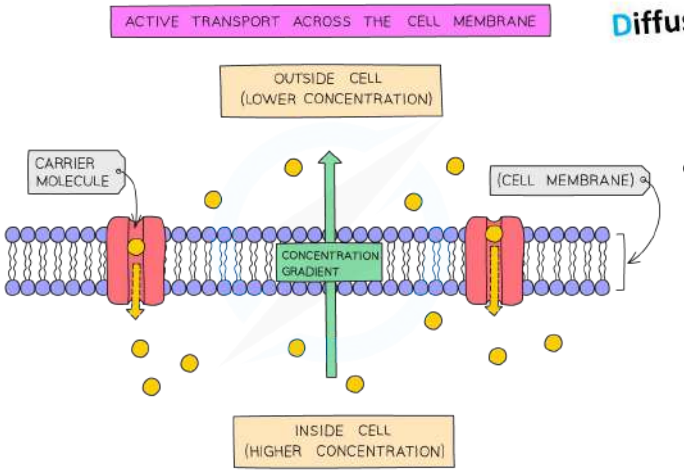
3.3
Active transport

3.1-3 Diffusion, Osmosis, Active transport



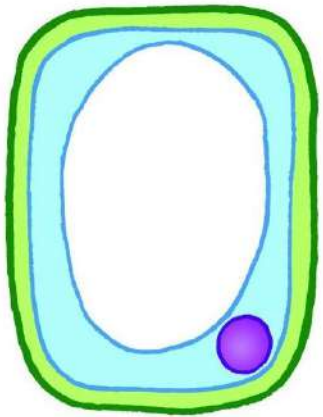


- Diffusion- the net movement of molecules and ions from a region of their higher concentration to a region of their lower concentration down a concentration gradient, as a result of their random movement

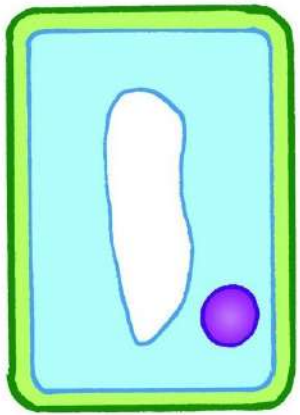


- Active transport- the movement of molecules and ions in or out of a cell membrane against a concentration gradient, using energy from respiration.

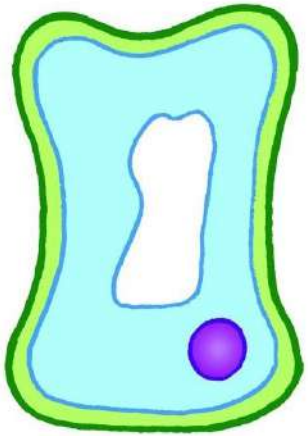
- Osmosis- the diffusion of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane.



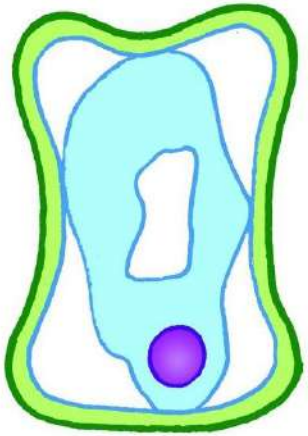
Cell in dilute solution becomes turgid.



Cell in same concentration of solution.



Cell in concentrated solution becomes flaccid.



Plasmolysed cell - cytoplasm is pulled away from the wall.

Chapter 4-The chemicals of life

4.1
What are you made of?

4.2
Carbohydrates

4.3
Fats

4.4
Proteins

4.5
DNA

4.1 What are you made of?

Metabolic reaction- the chemical reactions that can take place inside a living organisms.

Elements in the body:
Carbon,
Oxygen
Hydrogen,
Nitrogen,
Phosphorus
Sulfur

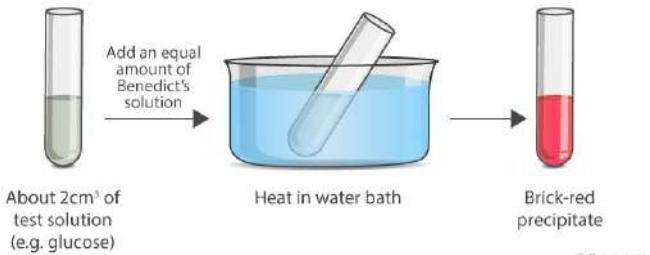
4.2 Carbohydrates

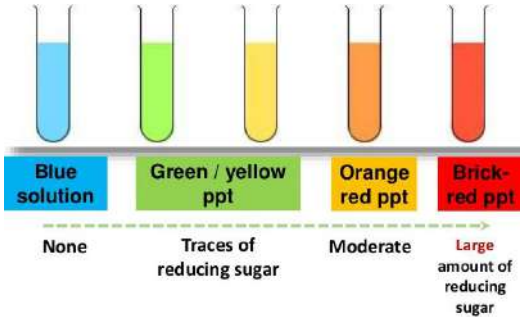
- simple
  - monosaccharide
    - Glucose ($C_6H_{12}O_6$)
    - Fructose
- complex
  - disaccharide
    - Maltose
    - Sucrose
  - polysaccharide
    - Starch
    - Cellulose

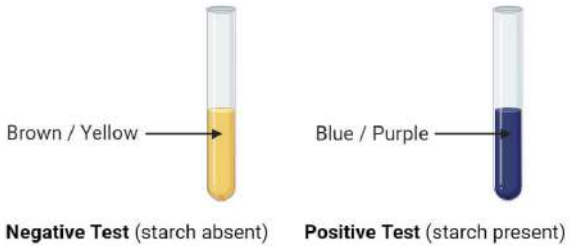
1 gram of carbohydrate = 17 kJ energy

Testing for carbohydrates:

- Benedict's solution (reducing sugar)
- Iodine solution (starch)
- Sugars are soluble, but polysaccharides are not

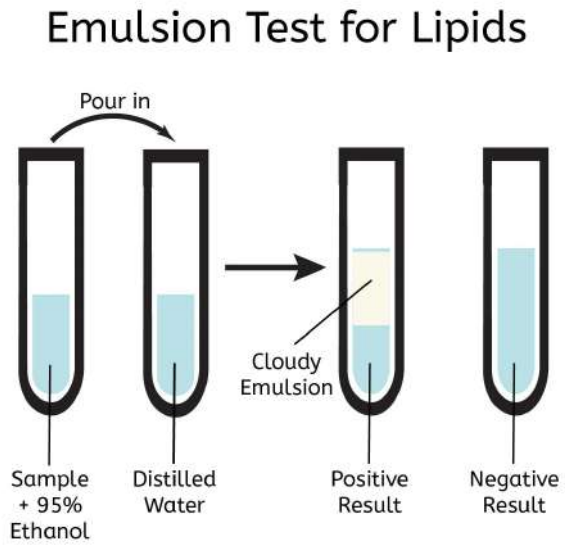


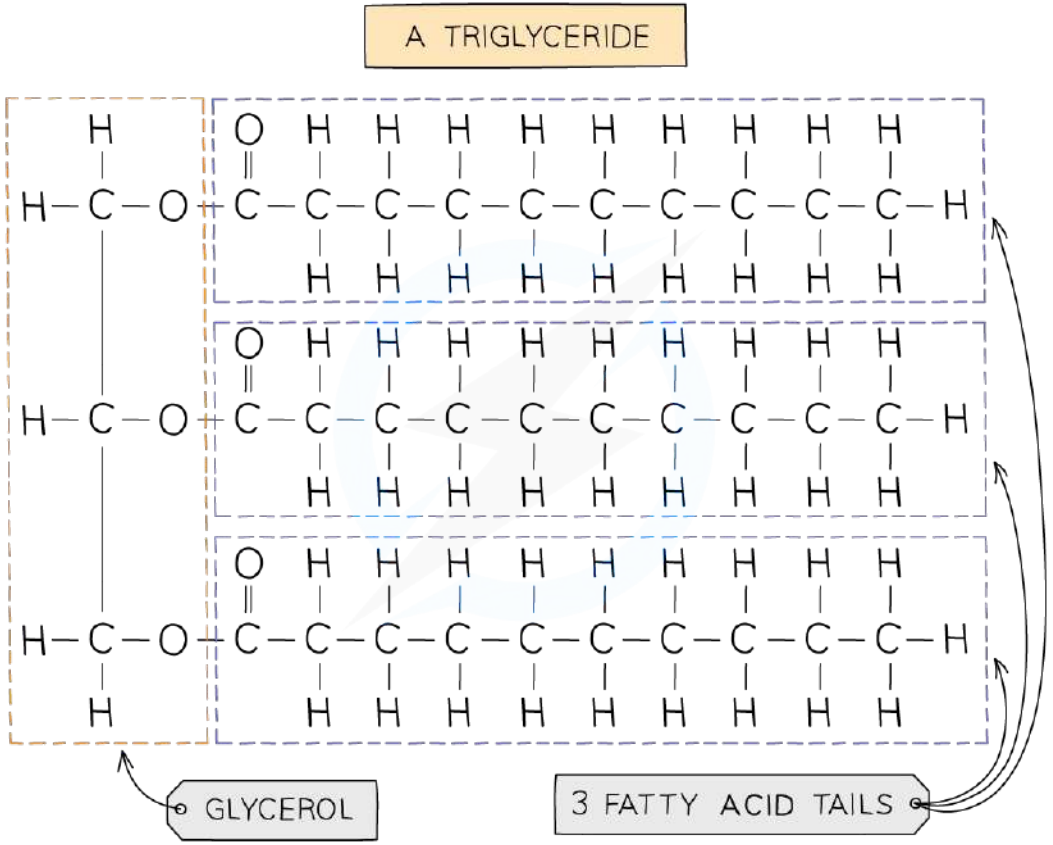




4.3 Fats

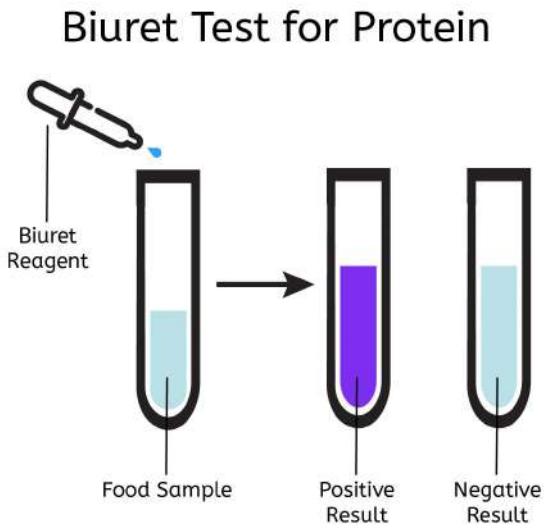
1 gram of fat= 39 kJ energy
Layer of cells that stores energy is called adipose tissue. It heats inside of the body.
Test for fats- emulsion test
Fats are insoluble in water.

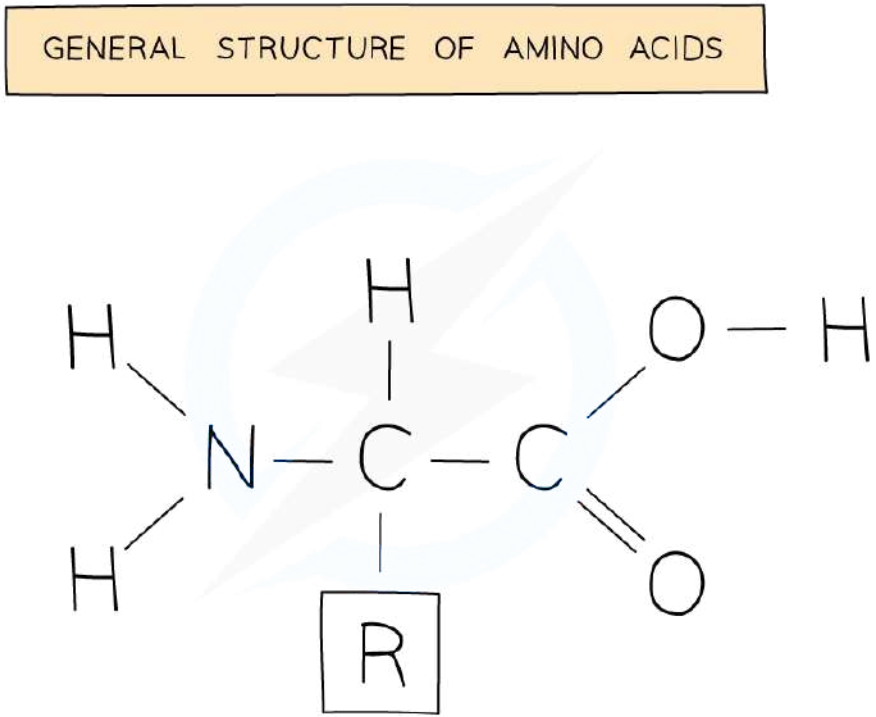




4.4 Proteins

Proteins are made up amino acids.
Living organisms has 20 different amino acids.
Some proteins are soluble but some are not.
Functions- making cells, enzyme, and energy





Chapter 5- Enzymes

5.1

Biological catalysts

5.2

Properties of enzymes

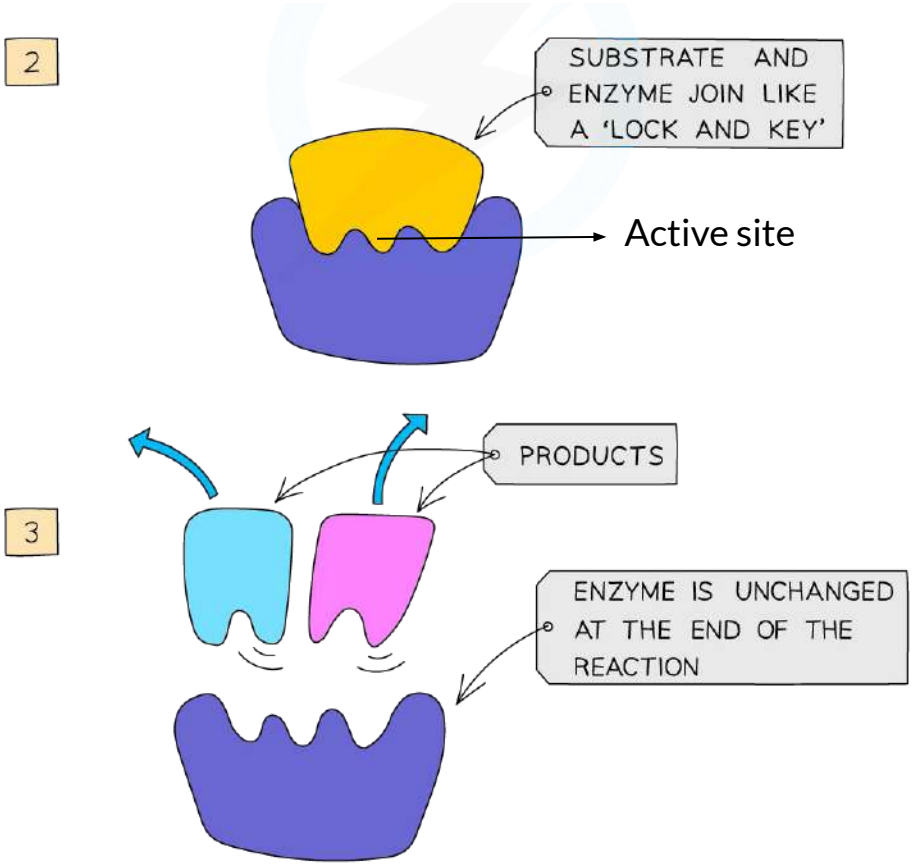
5.1 Biological catalysts

- Catalyst: a substance that speeds up a chemical reaction and is not changed by the reaction
- Enzymes: proteins that function as biological catalysts

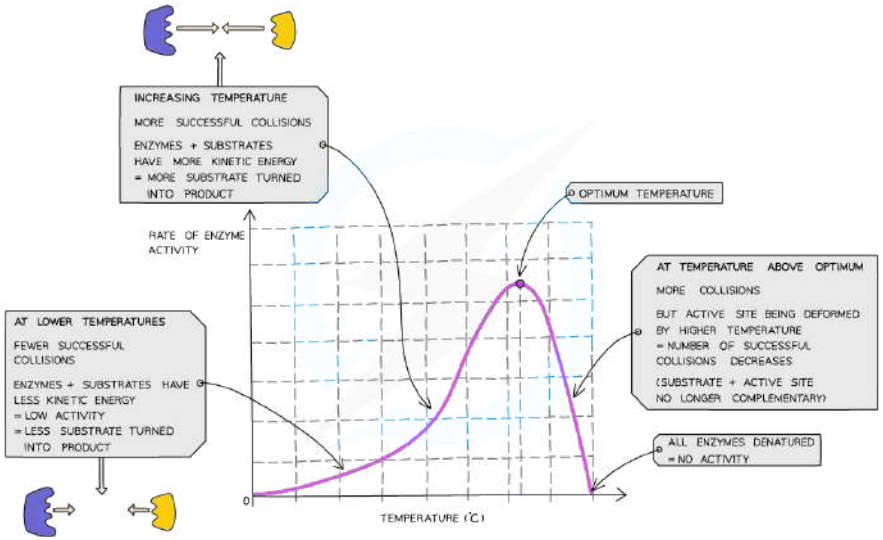
Almost every metabolic reactions are controlled by catalysts called enzymes.

Starch → amylase → sugar maltose
Protein → protease → amino acids
Hydrogen peroxide → catalase → water and glucose
Glucose → phosphorylase → starch
Lipids → lipases
Maltose → maltose
Sucrose → sucrase
All enzymes are proteins.

- Substrate: the molecule(s) before they are made to react
- Product: the molecule(s) that are made in a reaction
- Catabolic reaction: molecules are broken down
- Anabolic reaction: molecules are combined

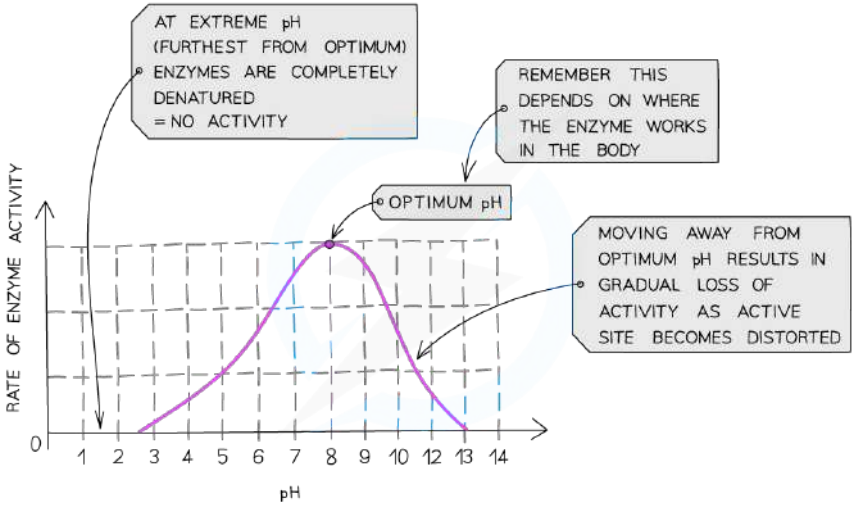


5.2 Properties of enzymes



Enzymes are made inactive by high temperature.
Optimum temperature= 37 degree Celsius

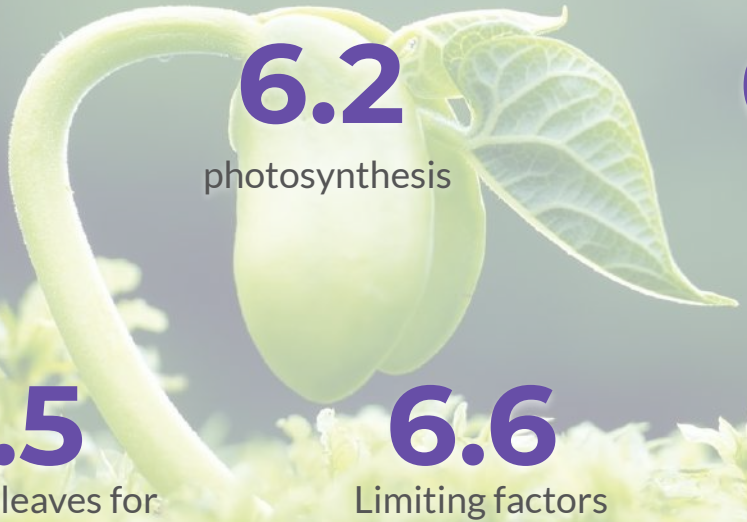
*Enzymes which are damaged by high temperatures are said to denatured.



Enzymes work best at a particular pH.
Optimum pH = 7 pH

But pepsin (protease) works best at 2 pH.

Chapter 6-Plant nutrition



6.1 Types of nutrition

6.2 photosynthesis

6.3 Leaves

6.4 Uses of glucose

6.5 Testing leaves for starch

6.6 Limiting factors

6.7 The importance of photosynthesis

6.1 Types of nutrition

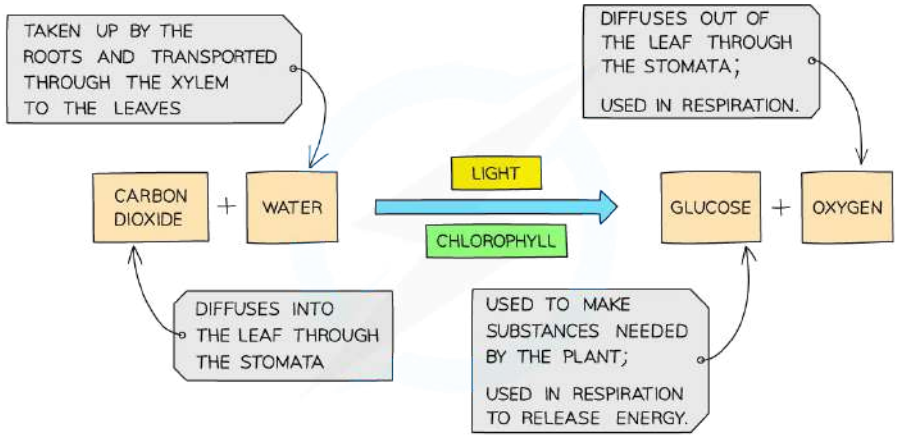
Green plants make their own food. They use simple inorganic substances - carbon dioxide, water and minerals - from the air and soil. Substances made by living things are said to be organic. Plants build these substances into complex materials, making all the carbohydrates, lipids, proteins and vitamins that they needed.

Organic substances have **C**arbon.
(C-C-C-...-C-C)
Inorganic substances - H_2O , CO_2

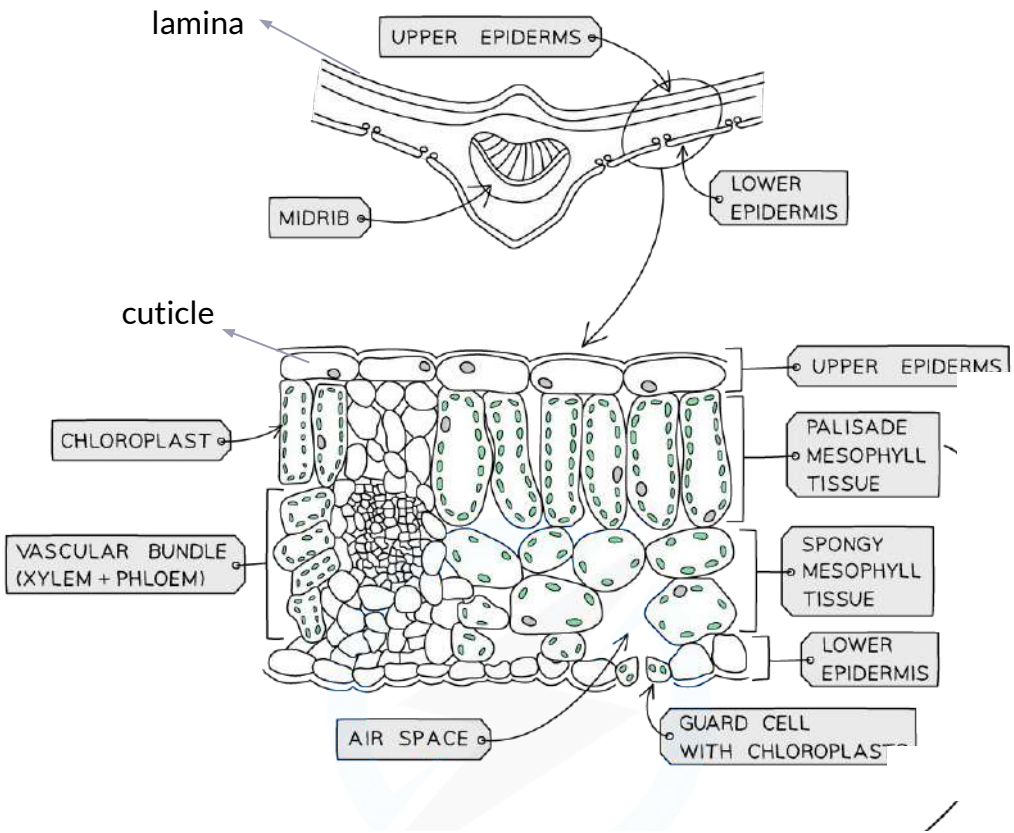
6.2 Photosynthesis

Photosynthesis- the process by which plants manufacture carbohydrates from raw materials using energy from light.
Chlorophyll- a green light absorbing pigment found inside chloroplast in plant cells.
Chloroplast- an organelle found in some plant cells, which contains chlorophyll and where photosynthesis take place.

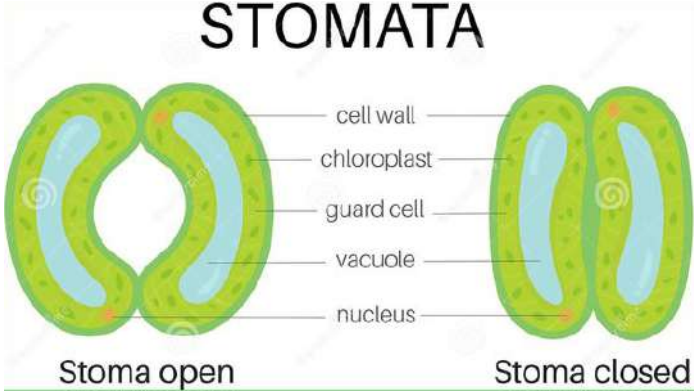
$6H_2O + 6CO_2 \longrightarrow C_6H_{12}O_6 + 6O_2$



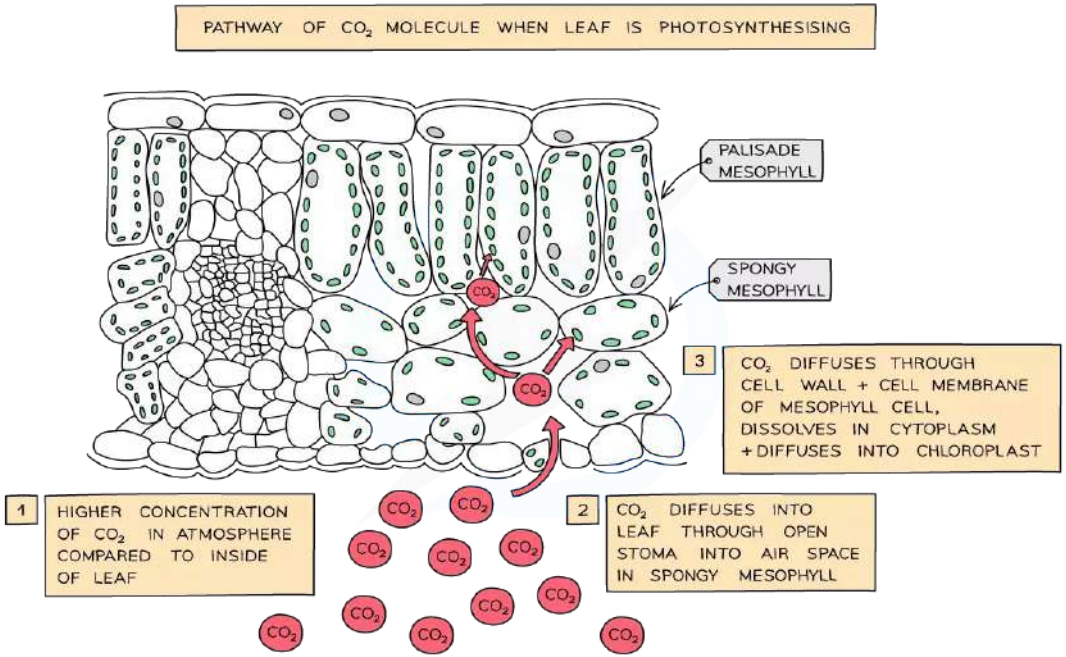
6.3 Leaves



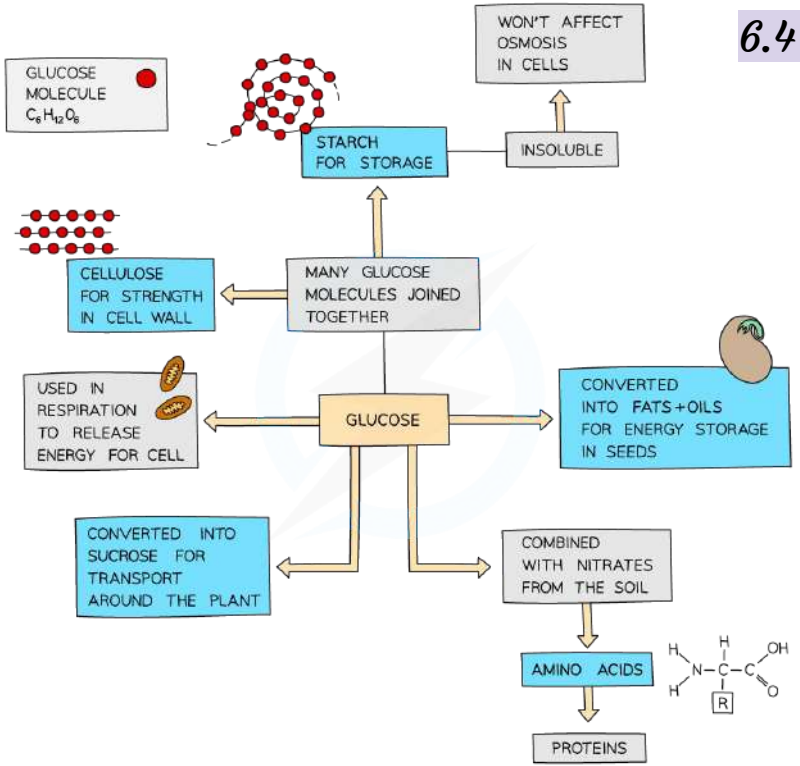
Lamina- the main part of a leaf.
Petiole- a leaf stalk
Vascular bundle- a vein in a plant, containing xylem vessels and phloem tubes.
Epidermis layers protects the inner layers of cells in the leaf. The waxy surface, called cuticle, and it helps to stop water evaporating from the leaf.
Stomata - each stoma is surrounded by a pair of sausage-shaped guard cells which can open or close the hole.



-Leaf adaptations-



FEATURE	ADAPTATION
LARGE SURFACE AREA (LEAF)	INCREASES SURFACE AREA FOR THE DIFFUSION OF CARBON DIOXIDE AND ABSORPTION OF LIGHT FOR PHOTOSYNTHESIS
THIN	ALLOWS CARBON DIOXIDE TO DIFFUSE TO PALISADE MESOPHYLL CELLS QUICKLY
CHLOROPHYLL	ABSORBS LIGHT ENERGY SO THAT PHOTOSYNTHESIS CAN TAKE PLACE
NETWORK OF VEINS	ALLOWS THE TRANSPORT OF WATER TO THE CELLS OF THE LEAF AND CARBOHYDRATES FROM THE LEAF FOR PHOTOSYNTHESIS (WATER FOR PHOTOSYNTHESIS, CARBOHYDRATES AS A PRODUCT OF PHOTOSYNTHESIS)
STOMATA	ALLOWS CARBON DIOXIDE TO DIFFUSE INTO THE LEAF AND OXYGEN TO DIFFUSE OUT
EPIDERMIS IS THIN AND TRANSPARENT	ALLOWS MORE LIGHT TO REACH THE PALISADE CELLS
THIN CUTICLE MADE OF WAX	TO PROTECT THE LEAF WITHOUT BLOCKING SUNLIGHT
PALISADE CELL LAYER AT TOP OF LEAF	MAXIMISES THE ABSORPTION OF LIGHT AS IT WILL HIT CHLOROPLASTS IN THE CELLS DIRECTLY
SPONGY LAYER	AIR SPACES ALLOW CARBON DIOXIDE TO DIFFUSE THROUGH THE LEAF, INCREASING THE SURFACE AREA
VASCULAR BUNDLES	THICK CELL WALLS OF THE TISSUE IN THE BUNDLES HELP TO SUPPORT THE STEM AND LEAF



6.4 Uses of glucose

★ Glucose is used for fruit growth or stored in fruits.
★ Sucrose is use for root growth or stored in roots as starch.
★ Sucrose is used for shoot growth.
★ Sucrose is transported in phloem tubes.

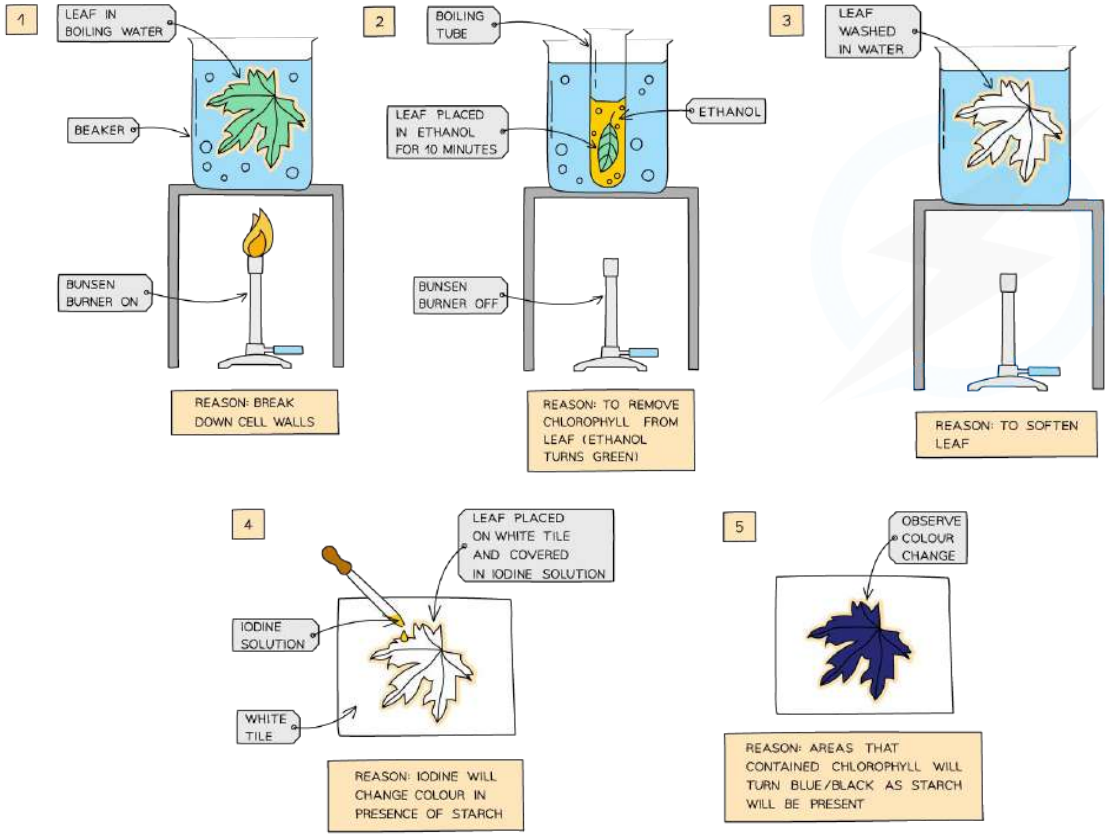
Glucose is:

- Quite reactive and soluble substance
- It might get involved in chemical reactions where it is not wanted.
- It would dissolve in water in and around the plant cells and might be lost from the cell.
- When dissolved, it would increase the concentration of the cell, which would cause damage.
- Changed to sucrose for transport because it is less reactive.

Deficiency of some elements in plants:
Nitrogen (nitrates and ammonium ions) is used to make proteins. As a result of deficiency, the leaves would become yellow and weak growth would occur.

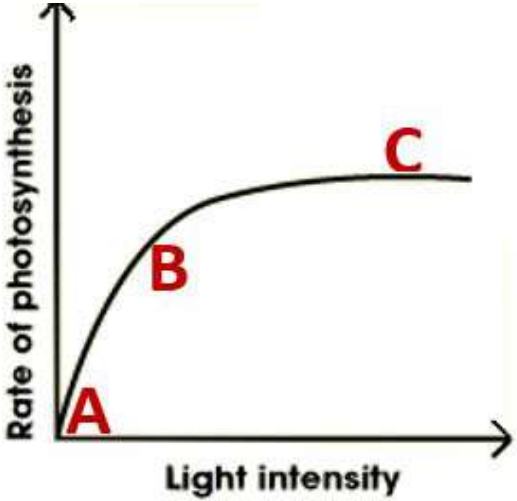
Magnesium (magnesium ions) is used for making chlorophyll. As a result of deficiency, the yellowing between the veins of leaves occur.

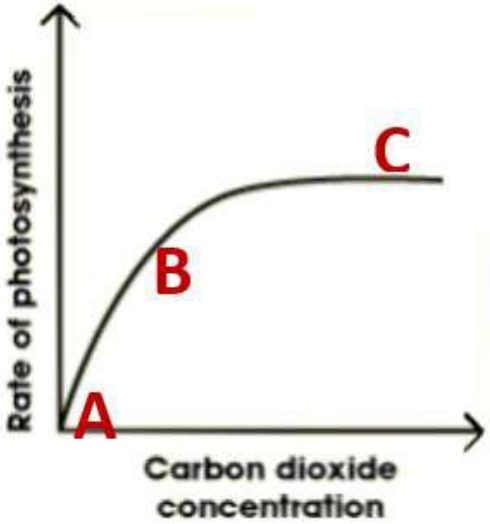
6.5 Testing leaves for starch

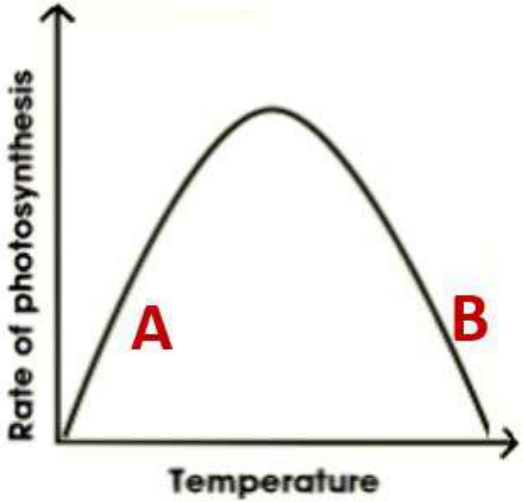


- A leaf is dropped in **boiling water** to **kill and break down the cell walls**
- The leaf is left for 5-10 minutes in hot **ethanol** in a boiling tube. This **removes the chlorophyll** so colour changes from iodine can be seen more clearly
- The leaf is dipped in boiling water to soften it
- The leaf is spread out on a white tile and covered with **iodine solution**
- In a green leaf, the entire leaf will turn **blue-black** as photosynthesis is occuring in all areas of the leaf
- This method can also be used to test whether chlorophyll is needed for photosynthesis by using a **variegated** leaf (one that is partially green and partially white)
- The white areas of the leaf contain no chlorophyll and when the leaf is tested **only the areas that contain chlorophyll stain blue-black**
- The areas that had no chlorophyll remain orange-brown as **no photosynthesis is occurring here and so no starch is stored**

6.6 Limiting factors







Limiting factors- something present in the environment such short supply that in restricts life processes.
In the hot and sunny day, stomata is closed to prevent water from evaporating. So photosynthesis may slow down on a really hot day.

Chapter 7-Animal nutrition

7.1 diet

7.2 digestion

7.3 teeth

7.4 The alimentary canal

7.5 Assimilation

7.1 Diet

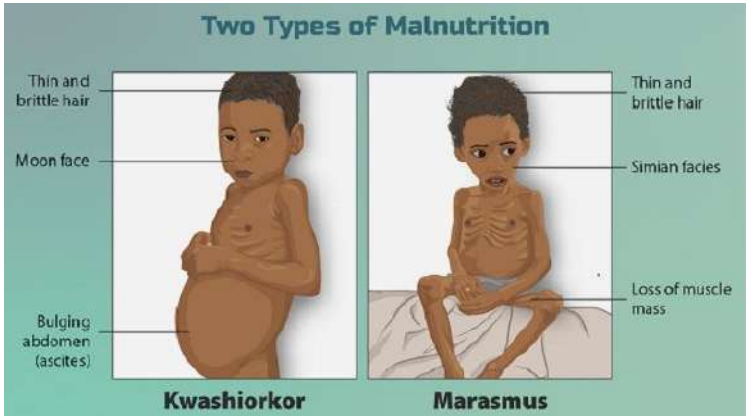
FOOD TYPE	FUNCTION	SOURCES
CARBOHYDRATE	SOURCE OF ENERGY	BREAD, CEREALS, PASTA, RICE, POTATOES
PROTEIN	GROWTH AND REPAIR	MEAT, FISH, EGGS, PULSES, NUTS
LIPID	INSULATION AND ENERGY STORAGE	BUTTER, OIL, NUTS
DIETARY FIBRE	PROVIDES BULK (ROUGHAGE) FOR THE INTESTINE TO PUSH FOOD THROUGH IT	VEGETABLES, WHOLE GRAINS
VITAMINS	NEEDED IN SMALL QUANTITIES TO MAINTAIN HEALTH	FRUITS AND VEGETABLES
MINERALS	NEEDED IN SMALL QUANTITIES TO MAINTAIN HEALTH	FRUITS AND VEGETABLES, MEATS, DAIRY PRODUCTS
WATER	NEEDED FOR CHEMICAL REACTIONS TO TAKE PLACE IN CELLS	WATER, JUICE, MILK, FRUITS AND VEGETABLES

VITAMIN / MINERAL	FUNCTION	SOURCES
VITAMIN C	FORMS AN ESSENTIAL PART OF **COLLAGEN** PROTEIN, WHICH **MAKES UP SKIN, HAIR, GUMS AND BONES** DEFICIENCY CAUSES **SCURVY**	CITRUS FRUIT, STRAWBERRIES, GREEN VEGETABLES
VITAMIN D	HELPS THE BODY TO ABSORB CALCIUM AND SO REQUIRED FOR **STRONG BONES AND TEETH**	OILY FISH, EGGS, LIVER, DAIRY PRODUCTS, ALSO MADE NATURALLY BY THE BODY IN SUNLIGHT
CALCIUM	NEEDED FOR **STRONG TEETH AND BONES** AND INVOLVED IN THE CLOTTING OF BLOOD DEFICIENCY CAN LEAD TO OSTEOPOROSIS LATER IN LIFE	MILK, CHEESE, EGGS
IRON	NEEDED TO MAKE **HAEMOGLOBIN**, THE PIGMENT IN RED BLOOD CELLS THAT TRANSPORTS OXYGEN	RED MEAT, LIVER, LEAFY GREEN VEGETABLES LIKE SPINACH

VITAMIN / MINERAL	FUNCTION	SOURCES	EFFECTS
VITAMIN C	FORMS AN ESSENTIAL PART OF **COLLAGEN** PROTEIN, WHICH **MAKES UP SKIN, HAIR, GUMS AND BONES** DEFICIENCY CAUSES **SCURVY**	CITRUS FRUIT, STRAWBERRIES, GREEN VEGETABLES	Scurvy, which causes pain in joint and muscles, and bleeding from gums and other places.
VITAMIN D	HELPS THE BODY TO ABSORB CALCIUM AND SO REQUIRED FOR **STRONG BONES AND TEETH**	OILY FISH, EGGS, LIVER, DAIRY PRODUCTS, ALSO MADE NATURALLY BY THE BODY IN SUNLIGHT	Rickets, in which the bones become soft and deformed.
CALCIUM	NEEDED FOR **STRONG TEETH AND BONES** AND INVOLVED IN THE CLOTTING OF BLOOD DEFICIENCY CAN LEAD TO OSTEOPOROSIS LATER IN LIFE	MILK, CHEESE, EGGS	CAUSES **RICKETS** – WHERE BONES BECOME SOFT AND DEFORMED (THIS IS BECAUSE VITAMIN D IS NEEDED FOR ABSORPTION OF CALCIUM INTO THE BODY WHICH IS A KEY COMPONENT OF BONES AND TEETH)
IRON	NEEDED TO MAKE **HAEMOGLOBIN**, THE PIGMENT IN RED BLOOD CELLS THAT TRANSPORTS OXYGEN	RED MEAT, LIVER, LEAFY GREEN VEGETABLES LIKE SPINACH	CAUSES **ANAEMIA** – WHERE THERE ARE NOT ENOUGH RED BLOOD CELLS SO TISSUES DO NOT GET ENOUGH OXYGEN DELIVERED TO THEM (THIS IS BECAUSE IRON IS A KEY COMPONENT OF HAEMOGLOBIN)

TYPE	CAUSE	EFFECT
STARVATION	TAKING IN LESS ENERGY THAN IS USED (OVER A LONG PERIOD)	BODY STARTS TO BREAK DOWN ENERGY STORES – FIRST FAT AND THEN MUSCLE TISSUE, LEADING TO SEVERE WEIGHT LOSS AND EVENTUALLY DAMAGE TO HEART AND IMMUNE SYSTEM, INCREASING THE RISK OF MANY DISEASES
CORONARY HEART DISEASE	DIET TOO HIGH IN SATURATED FAT AND CHOLESTEROL	FAT DEPOSITS BUILD UP IN ARTERIES SUPPLYING THE HEART, REDUCING FLOW OF BLOOD TO THE HEART MUSCLE CELLS WHICH DO NOT WORK PROPERLY DUE TO LACK OF OXYGEN. CAN LEAD TO HEART ATTACKS AND DEATH
CONSTIPATION	LACK OF FIBRE IN THE DIET	FOOD LACKS BULK FOR MUSCLES TO PUSH IT THROUGH THE ALIMENTARY CANAL AND SO RISK OF DISEASES SUCH AS BOWEL CANCER ARE INCREASED
OBESITY	TAKING IN MORE ENERGY THAN IS USED	EXTRA ENERGY STORED AS FAT, WEIGHT INCREASES AND CONTRIBUTES TO DEVELOPMENT OF MANY DISEASES SUCH AS HEART DISEASE AND DIABETES

- The two types of malnutrition most common in these situations are termed '**protein energy malnutrition**' (PEM)and they are:
- **Kwashiorkor** – caused by a **lack of protein** in the diet, most common in children under 2. Often caused by poverty as high protein foods tend to be more expensive and scarcer. Children suffering from kwashiorkor are always underweight for their age but they often have a swollen abdomen as their diet may contain a lot of carbohydrate
- **Marasmus** – the most severe form of PEM, where there is a **lack of both protein and energy** in the diet. People suffering from this have a much lower body weight than normal and look emaciated



7.2 Digestion

Chemical

- **Chemical digestion** – the **breakdown of large, insoluble molecules into small, soluble molecules**

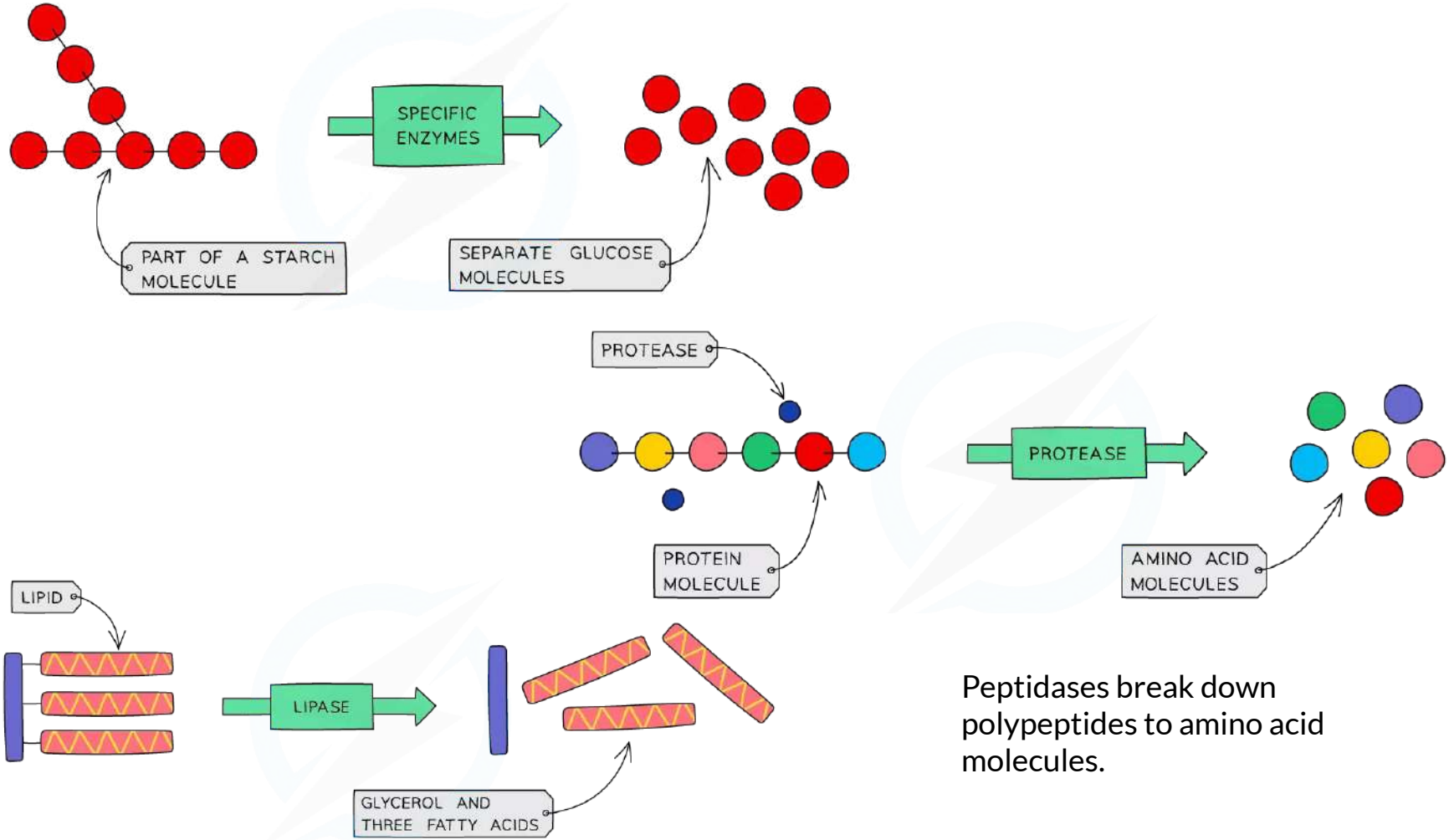
Physical

- **Mechanical digestion** – the **breakdown of food** into smaller pieces **without chemical change** to the food molecules

Food taken into the body goes through **5 different stages** during its passage through the **alimentary canal** (the gut):

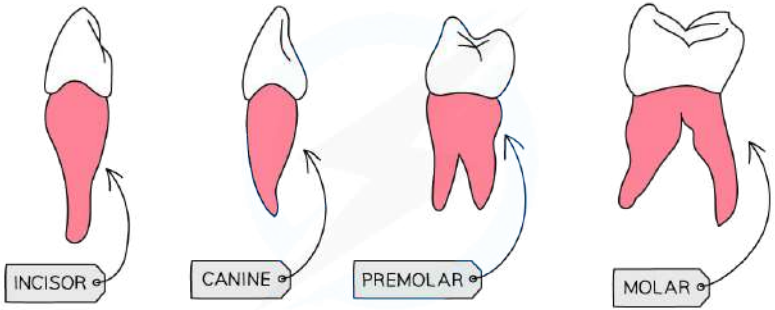
1. Ingestion
2. Digestion
3. Absorption
4. Egestion

- **Ingestion** – **the taking of substances**, e.g. food and drink, **into the body through the mouth**
- **Absorption** – the **movement of small food molecules and ions** through the wall of the intestine **into the blood**
- **Assimilation** – the **movement of digested food molecules into the cells of the body** where they are used, becoming part of the cells
- **Egestion** – the passing out of food that has **not been digested or absorbed, as faeces**, through the anus

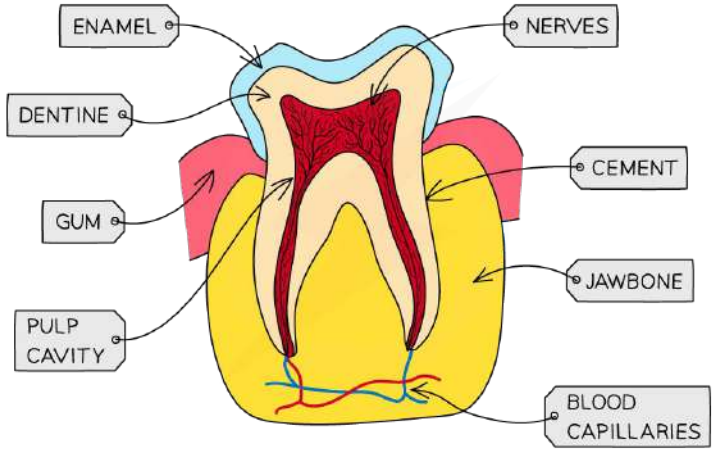


Peptidases break down polypeptides to amino acid molecules.

7.3 Teeth

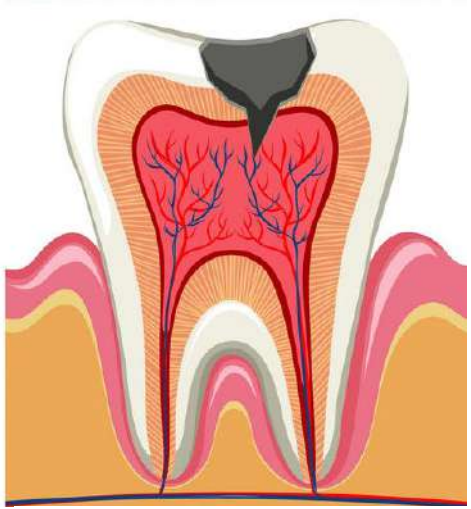


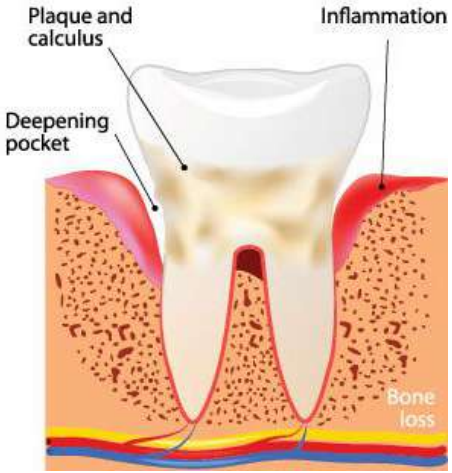
- **Incisors** – chisel-shaped for biting and cutting
- **Canines** – pointed for tearing, holding and biting
- **Premolars and molars** – larger, flat surfaces with ridges at the edges for chewing and grinding up food.



*Only mammals have 4 kinds of teeth and also have 2 sets of teeth.
Sets:

1. Permanent teeth
2. Milk teeth or deciduous teeth





- Tooth decay and gum disease are both caused by **bacteria**
- Many bacteria live in the mouth and most are harmless, however some form a **sticky film** with saliva, called **plaque**, which coats teeth and the areas where they attach to gums
- To begin with, plaque is soft and easy to remove, however if it hardens and forms **tartar**, it cannot be removed by brushing
- Tartar around the edges of teeth and gums can allow bacteria to work their way into roots, causing **gum disease** and loss of teeth
- If **sugar** is left in the mouth after eating, bacteria in plaque will **feed on it**
- They use it in **respiration** and turn it into **acids**
- The acids gradually dissolve the enamel coating of the teeth, working its way into the **dentine**
- Dentine is **softer** than enamel and so **dissolves more easily** and quickly
- This is **tooth decay** and if not dealt with, can cause painful infections and loss of teeth

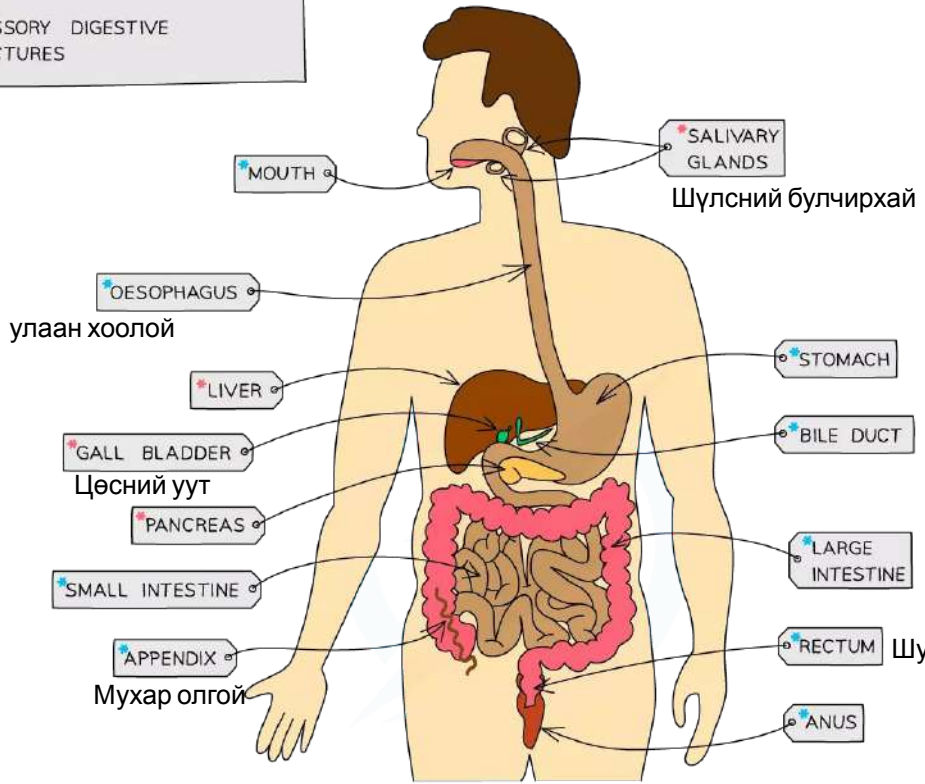
Dental health

- **Reducing the amount of sugar** eaten can prevent tooth decay
- **Brushing teeth regularly** removes the buildup of plaque that can cause gum disease and removes the sugars in the mouth so bacteria cannot turn them into acids and cause tooth decay
- Teeth should be brushed with a **fluoride toothpaste** as this helps to strengthen enamel and reduce damage from acids
- **Regular visits to a dentist** ensures that any signs of gum disease or tooth decay can be dealt with promptly

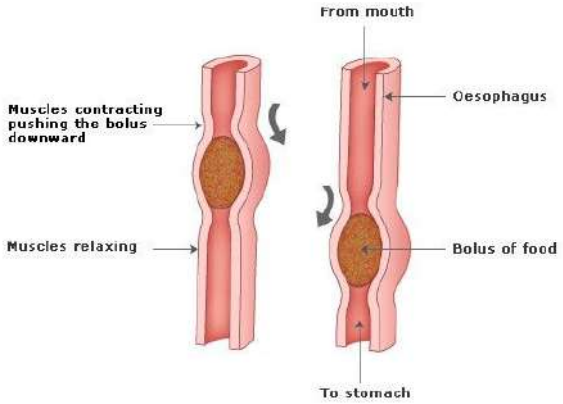
7.4 Alimentary canal

* = PART OF ALIMENTARY CANAL, THE PASSAGE ALONG WHICH FOOD PASSES THROUGH THE BODY

* = ACCESSORY DIGESTIVE STRUCTURES



STRUCTURE	FUNCTION
MOUTH / SALIVARY GLANDS	THE MOUTH IS WHERE **MECHANICAL DIGESTION** TAKES PLACE – **TEETH CHEW FOOD** TO BREAK IT INTO SMALLER PIECES AND INCREASE IT'S SURFACE AREA TO VOLUME RATIO **AMYLASE ENZYMES** IN SALIVA START DIGESTING STARCH INTO MALTOSE THE FOOD IS SHAPED INTO A BOLUS (BALL) BY THE TONGUE AND LUBRICATED IN SALIVA SO IT CAN BE SWALLOWED EASILY
OESOPHAGUS	TUBE THAT **CONNECTS THE MOUTH TO THE STOMACH** WHERE THE FOOD BOLUS GOES AFTER BEING SWALLOWED WAVE – LIKE CONTRACTIONS WILL TAKE PLACE TO PUSH THE FOOD BOLUS DOWN WITHOUT RELYING ON GRAVITY
STOMACH	FOOD IS **MECHANICALLY DIGESTED BY CHURNING** ACTIONS WHILE **PROTEASE ENZYMES** START TO CHEMICALLY DIGEST PROTEINS **HYDROCHLORIC ACID** IS PRESENT TO KILL BACTERIA IN FOOD AND PROVIDE THE OPTIMUM PH FOR PROTEASE ENZYMES TO WORK
SMALL INTESTINE	FIRST SECTION IS CALLED THE **DUODENUM** AND IS WHERE THE FOOD COMING OUT OF THE STOMACH FINISHES BEING DIGESTED BY ENZYMES PRODUCED HERE AND ALSO SECRETED FROM THE PANCREAS PH OF THE SMALL INTESTINE IS **SLIGHTLY ALKALINE** – AROUND PH 8 – 9 SECOND SECTION IS CALLED THE **ILEUM** AND IS WHERE ABSORPTION OF DIGESTED FOOD MOLECULES TAKES PLACE THE ILEUM IS LONG AND LINED WITH VILLI TO INCREASE THE SURFACE AREA OVER WHICH ABSORPTION CAN TAKE PLACE
LARGE INTESTINE	**WATER IS ABSORBED** FROM REMAINING MATERIAL IN THE COLON TO PRODUCE FAECES FAECES IS STORED IN THE **RECTUM** AND REMOVED THROUGH THE **ANUS**
PANCREAS	PRODUCES **ALL THREE TYPES OF DIGESTIVE ENZYME**: AMYLASE, PROTEASE AND LIPASE SECRETES ENZYMES IN AN **ALKALINE FLUID** INTO THE DUODENUM FOR DIGESTION TO RAISE PH OF FLUID COMING OUT OF THE STOMACH
LIVER	PRODUCES **BILE** TO EMULSIFY FATS (BREAK LARGE DROPLETS INTO SMALLER DROPLETS) – AN EXAMPLE OF **MECHANICAL DIGESTION** AMINO ACIDS NOT USED TO MAKE PROTEINS BROKEN DOWN HERE (DEAMINATION) WHICH **PRODUCES UREA**
GALL BLADDER	**STORES BILE** TO RELEASE INTO DUODENUM AS REQUIRED



Peristalsis (гүрвэлзэх хөдөлгөөн) is the rhythmic contractions of muscles that ripple along a tube. There are some special muscles called sphincter muscles. To help food to slide easily through the alimentary canal, it is lubricated with mucus. Mucus is made in goblet cells which occur along the alimentary canal.

★ The mouth

- Mouth: contains teeth used for mechanical digestion, area where food is mixed with salivary amylase & where ingestion takes place

The tongue mixes the food with saliva.
Salivary glands: produce saliva which contains amylase and helps food slide down oesophagus.
Saliva = water + amylase +mucus
Starch -> amylase -> maltose

★ The oesophagus

- Oesophagus: tube-shaped organ which uses peristalsis to transport food from mouth to stomach.

There are 2 tubes leading down from the back of the mouth:

1. Front - trachea - takes air down to the lungs
2. Behind trachea - oesophagus - takes food down to the stomach.

When you swallow a piece of food, cartilage covers the entrance to the trachea. It is called epiglottis. It stops food from going down to the lungs.

★ The stomach

- Stomach: has sphincters to control movement into and also has pepsin (a protease) to break down proteins into peptides, it also kills bacteria with hydrochloric acid. They also have elastic walls.

Chyme = mucus + enzymes

- Have goblet cells
- Secretes hydrochloric acids (acidic environment for pepsin 2 pH; kills bacteria)
- Secretes pepsin - breaks down proteins to polypeptides
- Secretes rennin - it is only produced in the stomach of young mammals.

Roles of stomach:

➔ Store
➔ Mix
➔ Digest

- Pancreas: produces pancreatic juice which contains amylase, trypsin and lipase and hydrogencarbonate.

★ The small intestine

- Small intestine: tube shaped organ composed of two parts:

Duodenum: fats are emulsified by bile, and digested by pancreatic lipase to form fatty acids and glycerol. Pancreatic amylase, lipase and trypsin (a protease) break down starch, fats and peptides into maltose, fatty acids/ glycerol and amino acids

Ileum:

- Sucrase breaks down sucrose into glucose and fructose.
- Maltase breaks down maltose to glucose.
- Lactase breaks down lactose to glucose and galactose.
- Peptidase breaks down polypeptides to amino acids.
- Lipase breaks down fats to fatty acids and glycerol.

  This is where absorption takes place; adapted by having villi and microvilli.

Pancreatic juices contains (hydrogen carbonate) HCO_3^- which partially neutralises acid.

★ The bile

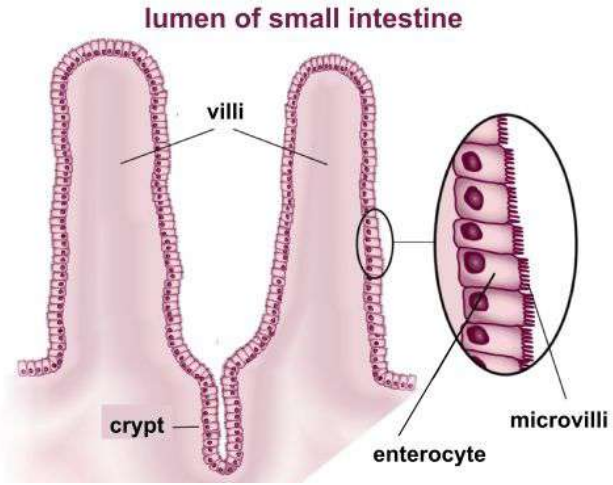
- Gallbladder: stores bile from liver
- Bile: produced by liver and stored in gallbladder, its role is to emulsify (make smaller) fats, to increase surface area for the action of enzymes.

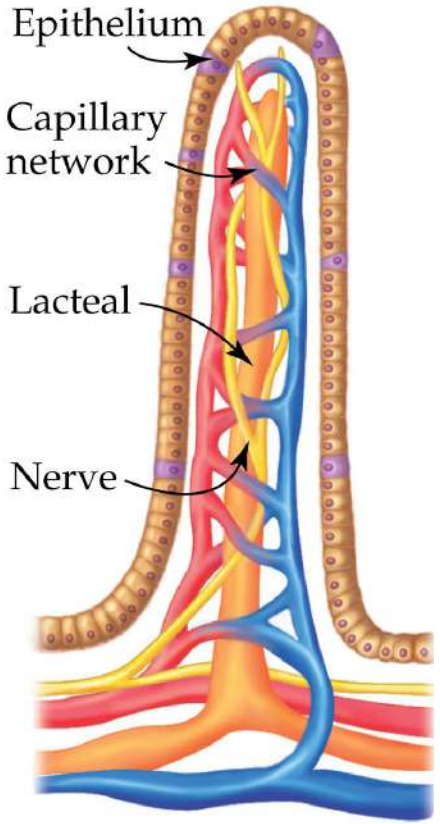
Bile is a yellowish green alkaline,watery liquid which helps to neutralise the acidic mixture from the stomach. Bile doesn't contain any enzymes, but helps to digest fats. Bile also contains yellowish pigments which are made in the liver when it's breaking down old red blood cells. It is made from haemoglobin.

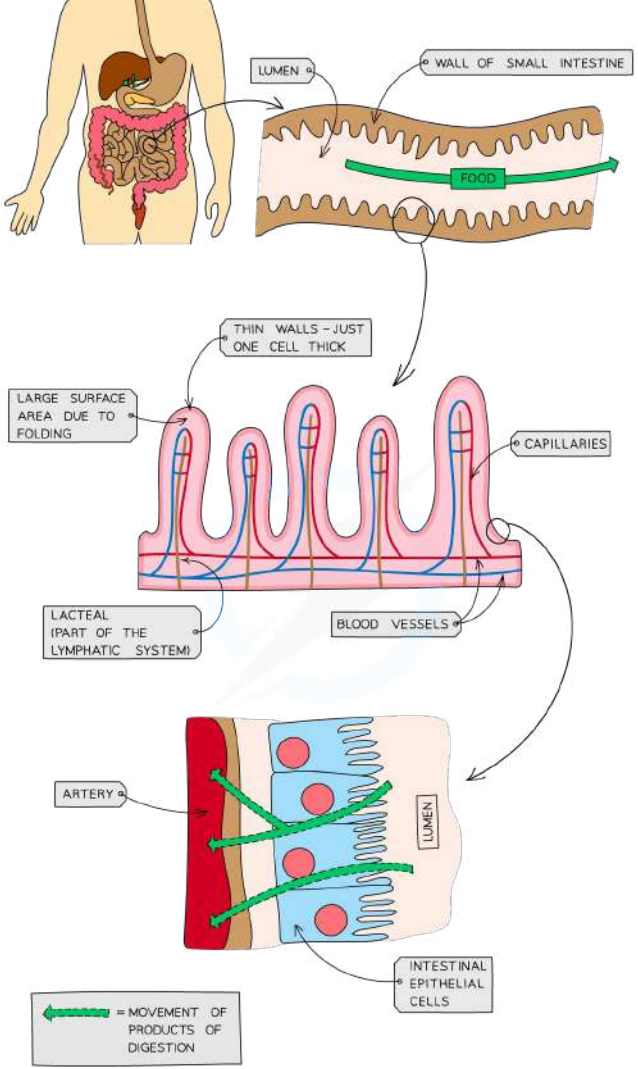
- Liver: produces bile, stores glucose as glycogen, interconverting them to keep glucose concentration constant. Also carries out interconversion of amino acids (transamination), deamination and removal of old red blood cells and storage of their iron. Also, site of breakdown of alcohol and other toxins.

★ The villi

Small intestines have enzymes itself. They are made by cells in the walls, villi.
Lacteal - absorbs digested fats. Blood capillaries absorbs small molecules such as amino acids and sugars.





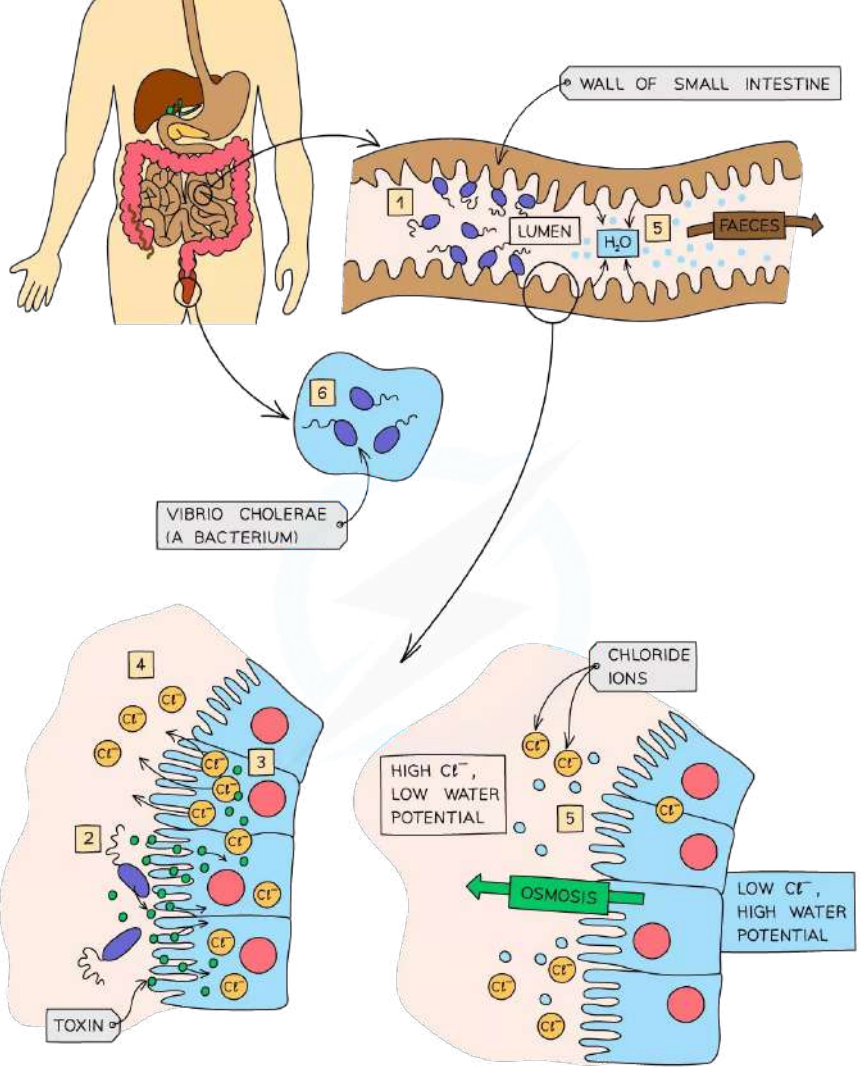


7.5 Assimilation

Assimilation - the movement of digested food molecules into the cell, of the body where they are used, becoming part of the cells. After they absorbed into the blood, the nutrients are taken to the liver, in the hepatic portal vein. If there is more glucose than necessary in the blood, the liver will convert some of it into the polysaccharide glycogen, and store it.
Absorption - the movement of digested food molecules through the wall of the intestine into the blood or lymph.

Long- gives time for digestion
Villi - taken into the body, gives a large surface area

Large intestines:
Colon absorbs salts and a lot of water.
All that remains is indigestible food (fibre or roughage) and some dead cells inside the alimentary canal. The mixture forms the faeces. This process is called egestion.



-Diarrhoea-

- Diarrhoea is the **loss of watery faeces from the anus.** Severe diarrhoea can cause the **loss of significant amounts of water and ions** from the body, causing the tissues and organs to stop working properly.
- It can be effectively treated by **oral rehydration therapy.** This is a **drink with a small amount of salt and sugar** dissolved in it. There are many causes of diarrhoea, one of which is infection with **Vibrio cholerae bacteria**, which causes the disease **cholera.**

1. Bacteria attach to the wall of the **small intestine**
2. They produce a **toxin**
3. The toxin stimulates the cells lining the intestine to **release chloride ions** from inside the cells into the lumen of the intestine
4. The chloride ions accumulate in the lumen of the small intestine and **lower the water potential** there
5. Once the water potential is lower than that of the cells lining the intestine, **water starts to move out of the cells** into the intestine (by **osmosis**)
6. Large quantities of water are lost from the body in **watery faeces**
7. The blood contains **too little chloride ions and water**

Chapter 8-Transport in plants

8.1
Plant transport systems

8.2
Water uptakes

8.3
transpiration

8.4
Transport of manufactured good

8.1,2 Plant transport systems, Water uptake

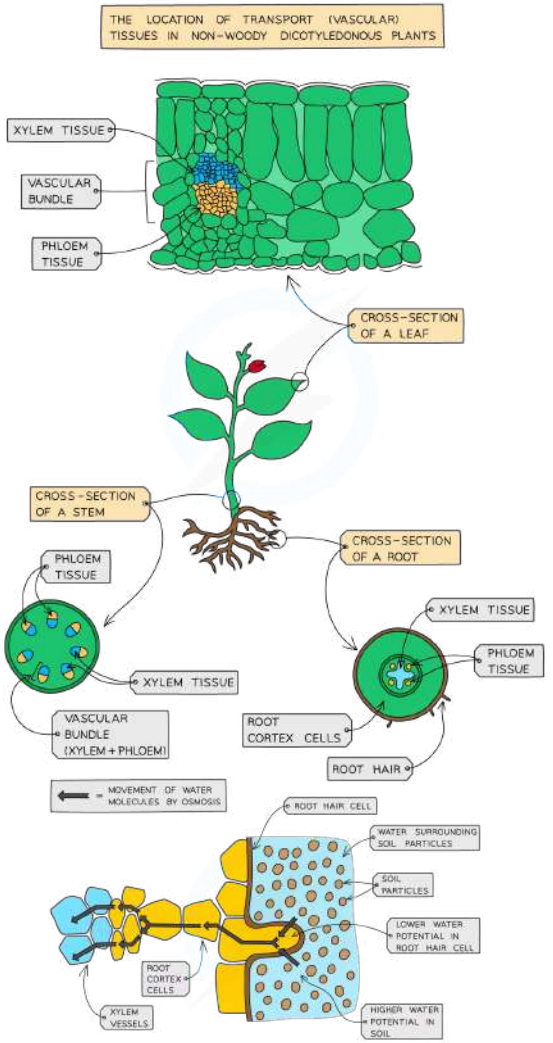
- Plants contain two types of transport vessel:
  - **Xylem vessels** – transport water and minerals (pronounced: zi-lem) from the roots to the stem and leaves
  - **Phloem vessels** – transport food materials (mainly sucrose and amino acids) made by the plant from photosynthesising leaves to non-photosynthesising regions in the roots and stem (pronounced: flow-em)
- These vessels are arranged throughout the root, stem and leaves in groups called **vascular bundles.**

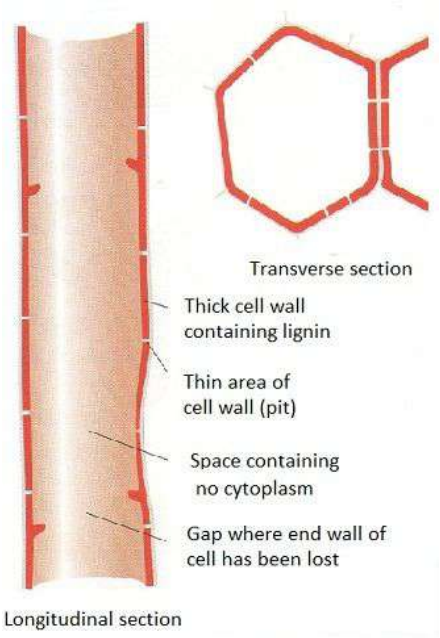
Root hair cells:

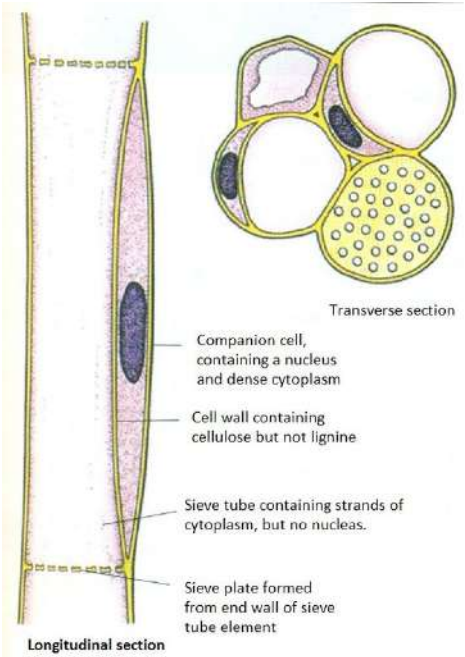
- Root hairs are single-celled extensions of **epidermis cells** in the root
- They grow between soil particles and absorb water and minerals from the soil
- Water enters the root hair cells by **osmosis**
- This happens because soil water has a **higher water potential than the cytoplasm** of the root hair cell

root hair cell → root cortex cells → xylem → leaf mesophyll cells

*just remember that **xylem is always on the inside and phloem is always on the outside.**







- No cytoplasm or nuclei
- Cell walls made up of cellulose and lignin
  Lignin is very strong, so xylem vessels helps pant keep upright
- The end of the cells have disappeared.

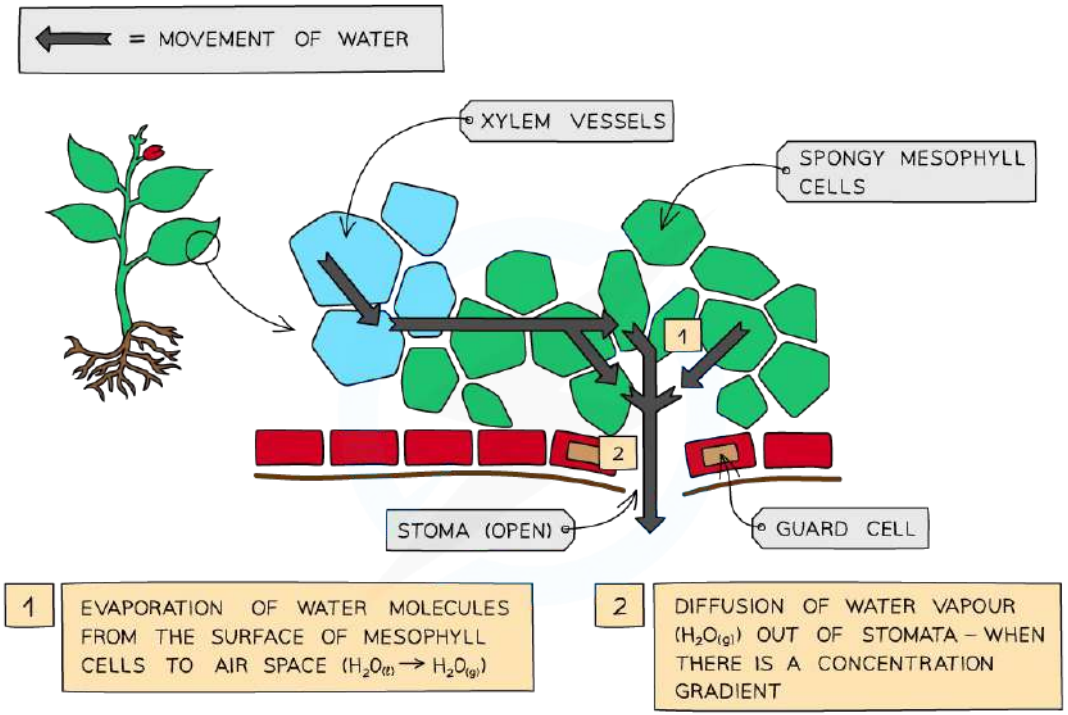
- Form sieve plates:
  Contains cytoplasm
  No nucleus
  No lignin
  Have companion cells (have nucleus and organelles)
- Small holes in them
- Joined end-to-end

Xylem vessels are long hollow tubes made up of dead empty cells with lignified walls, which transport water in plants and help to support them. (mineral in water)

Phloem tubes are long tubes made up of living cells with perforated end walls, which transport sucrose and amino acids.

The pressure at the top of the vessels is lowered, while the pressure at the bottom stays high. Water therefore flows up the xylem vessel. Water molecules are attracted to each other by cohesion - creating a continuous column of water up the plant.

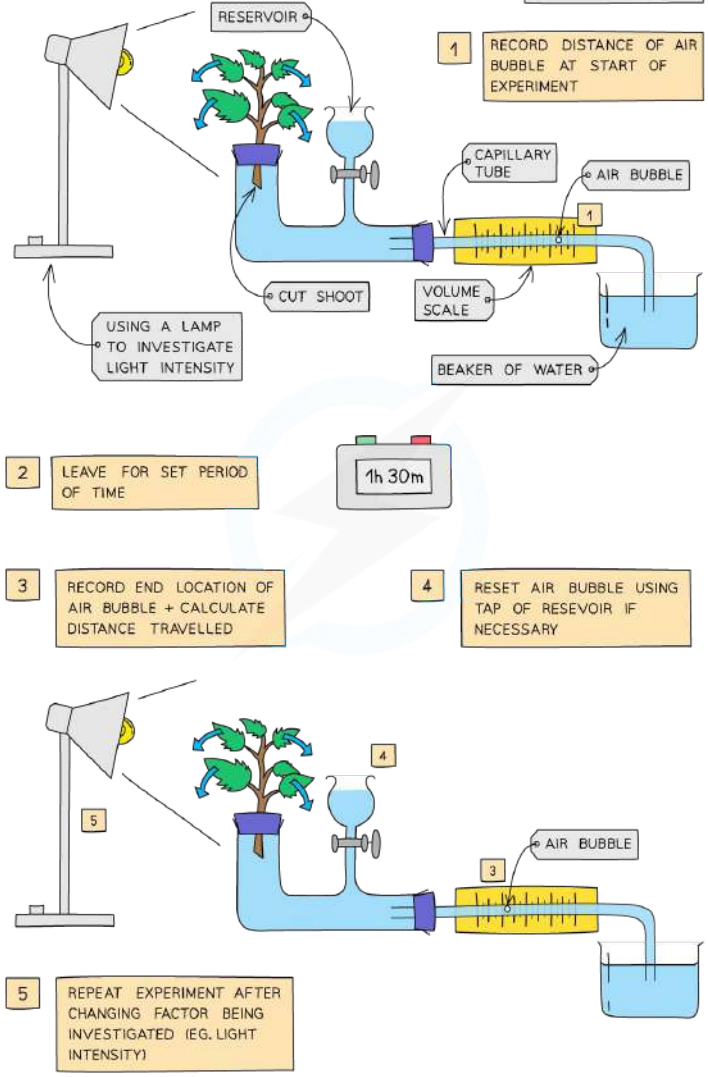
8.3 Transpiration



Transpiration is loss of water from plant leaves by evaporation of water at the surfaces of the mesophyll cells followed by loss of water vapour through stomata.

Transpiration has several functions in plants:

- transporting **mineral ions**
- providing **water to keep cells turgid** in order to support the structure of the plant
- providing **water** to leaf cells for **photosynthesis**
- keeping the **leaves cool** (the conversion of water (liquid) into water vapour (gas) as it leaves the cells and enters the airspace requires heat energy. The using up of heat to convert water into water vapour helps to cool the plant down)



TISSUE	WHAT IS MOVED	PROCESS	DIRECTION OF FLOW	CELLS
XYLEM	WATER AND MINERAL IONS	TRANSPIRATION STREAM	ONE WAY FROM ROOTS TO LEAVES	DEAD
PHLOEM	SUCROSE AND AMINO ACIDS	TRANSLOCATION	IN ALL DIRECTIONS	LIVING

FACTOR	EFFECT ON RATE OF TRANSPIRATION
TEMPERATURE	INCREASES WITH INCREASING TEMPERATURE
HUMIDITY	DECREASES WITH INCREASING HUMIDITY

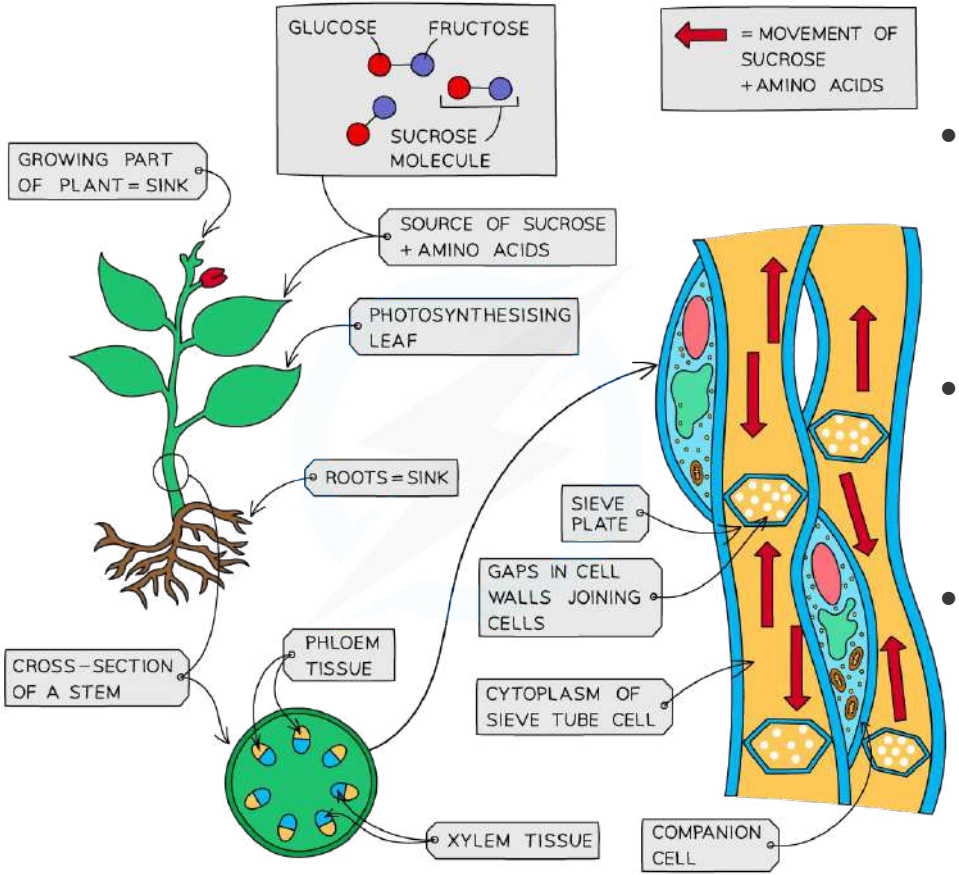
Environmental factors:

- Wind speed
- Light intensity
- Water supply (is there is short supply of water, then transpiration rate will decrease.

Wilting

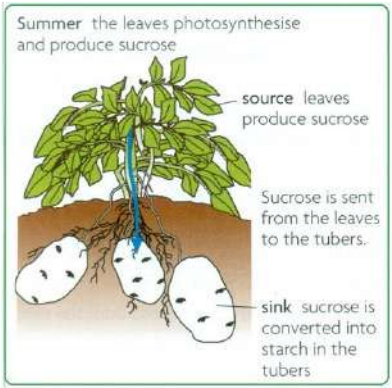
- If more water evaporates from the leaves of a plant than is available in the soil to move into the root by osmosis, then **wilting** will occur
- This is when all the cells of the plant are not full of water, so the strength of the **cell walls cannot support the plant** and it starts to collapse

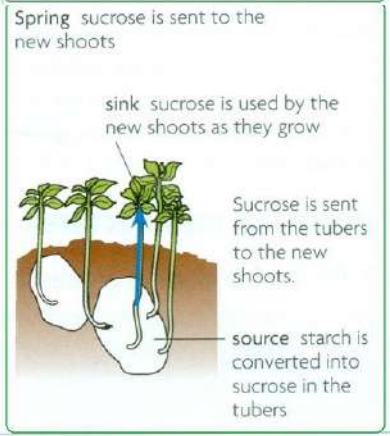
8.3 Translocation



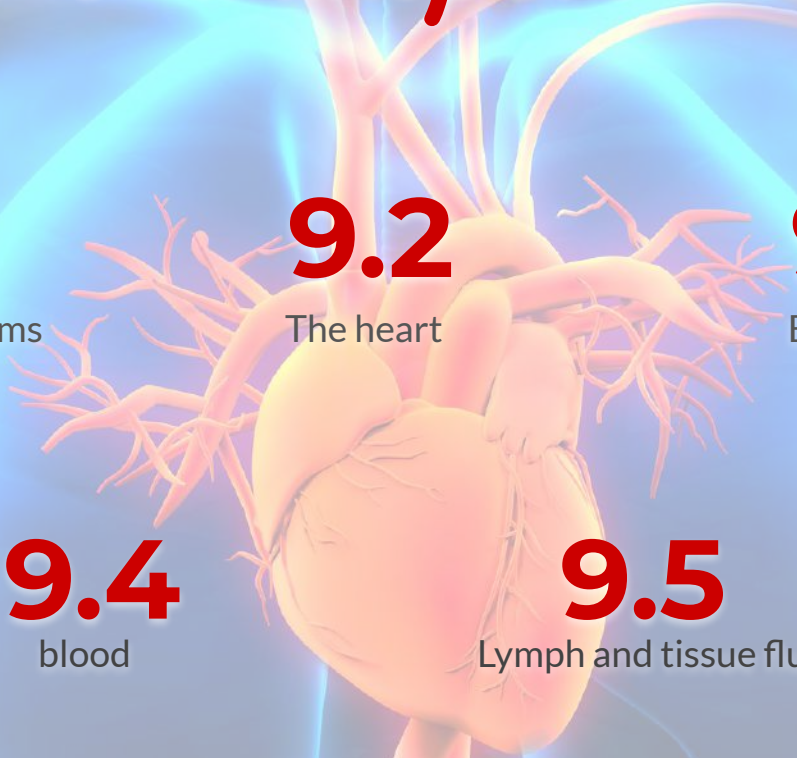
Translocation - The movement of sucrose and amino acids in phloem, from regions of production (source) to the regions of storage , or to utilisation in respiration or growth (sink)

- During **winter**, when many plants have no leaves, the phloem tubes may transport dissolved sucrose and amino acids from the storage organs to other parts of the plant so that respiration can continue
- During a **growth period** (eg during the spring), the storage organs (eg roots) would be the source and the many growing areas of the plant would be the sinks
- **After the plant has grown** (usually during the summer), the leaves are photosynthesizing and producing large quantities of sugars; so they become the source and the roots become the sinks – storing sucrose as starch until it is needed again





Chapter 9-transport in animals



9.1
Circulatory systems

9.2
The heart

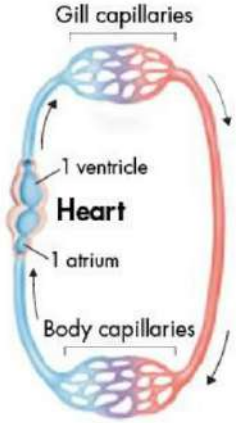
9.3
Blood vessels

9.4
blood

9.5
Lymph and tissue fluid

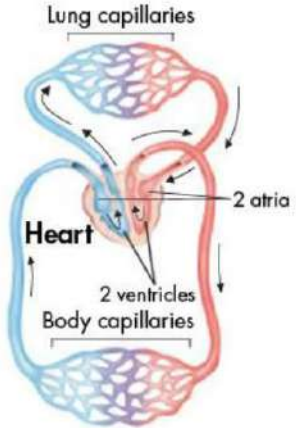
9.1 circulatory systems

Single loop Circulation

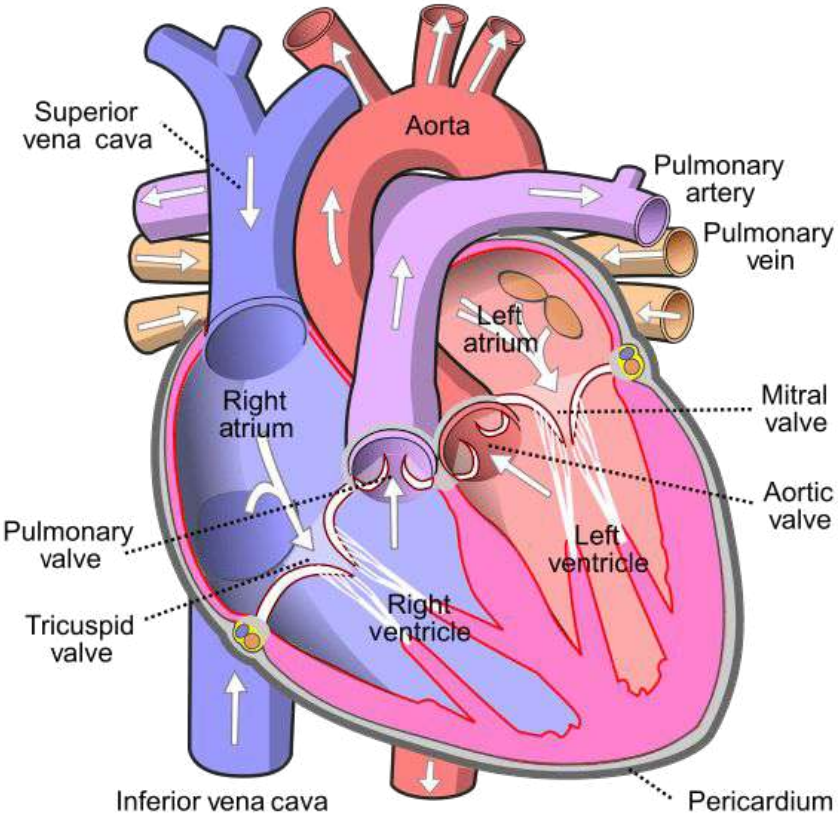


- In mammals, birds, reptiles
- Travels faster
- High pressure
- Passes heart twice

Double loop Circulation



- In fishes
- Travels slower
- Low pressure
- Passes heart once



Lung <-> heart pulmonary system

Heart <->body systemic system

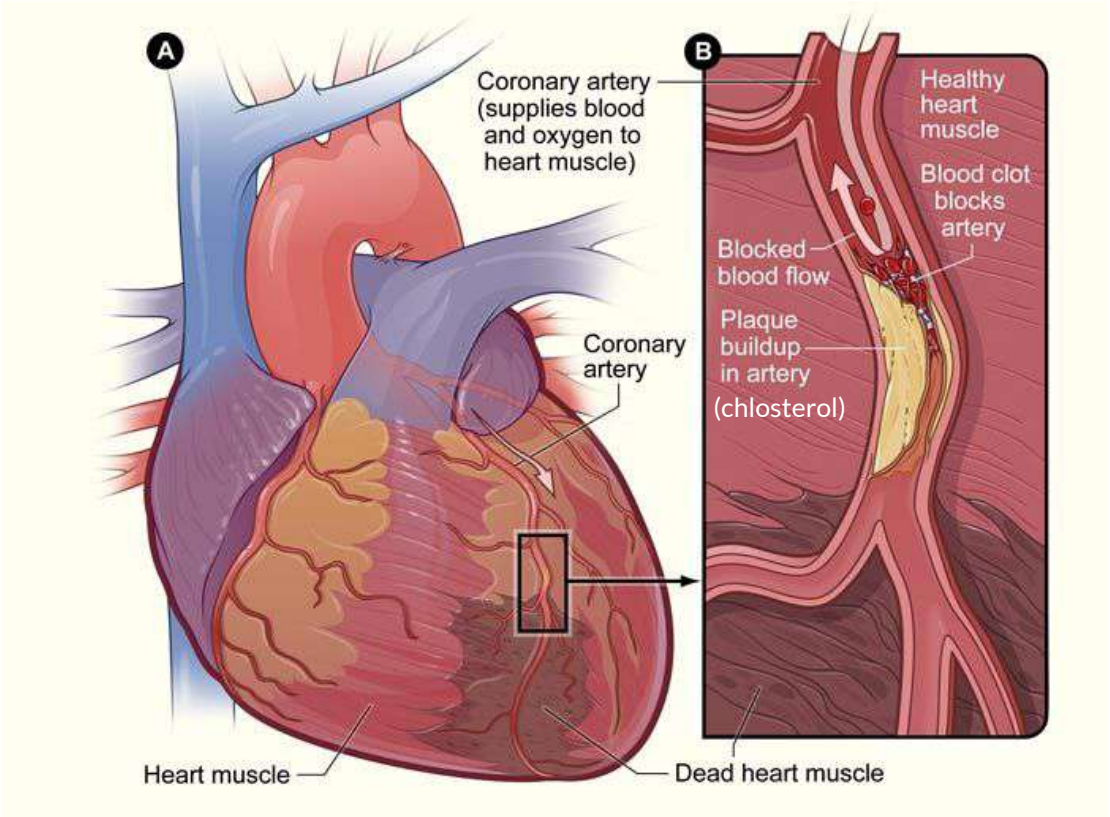
CHD -coronary heart disease

Blockage of coronary arteries are called CHD.

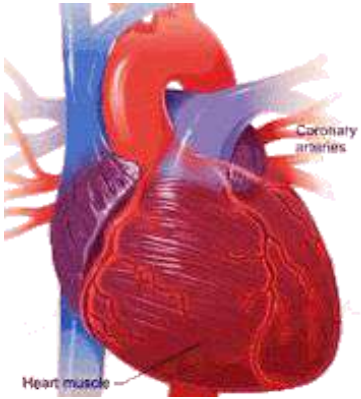
FACTORS AFFECTING:
- Smoking
- Diet
- Obesity
- Stress
- genes

PREVENTING CHD:
- Do not smoke
- Take care on diet
- exercise

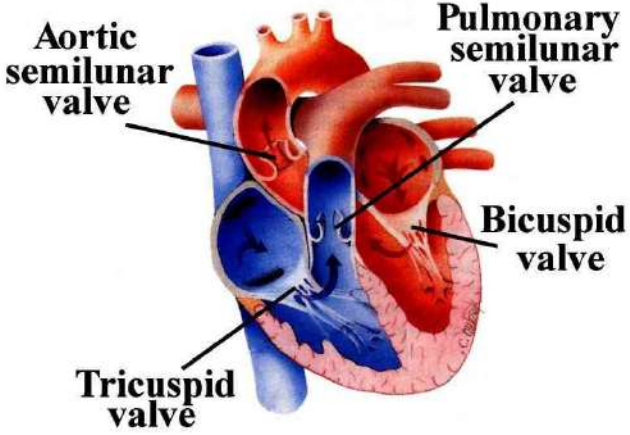
TREATING CHD:
- Drugs containing statin
- Aspirin
- Surgery(coronary bypass operation)
- angioplasty
- stent

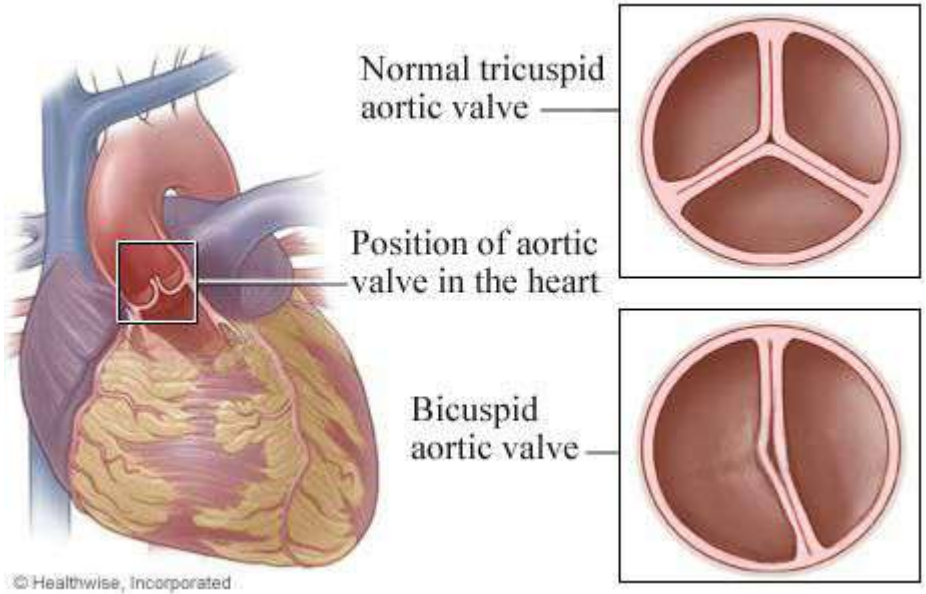


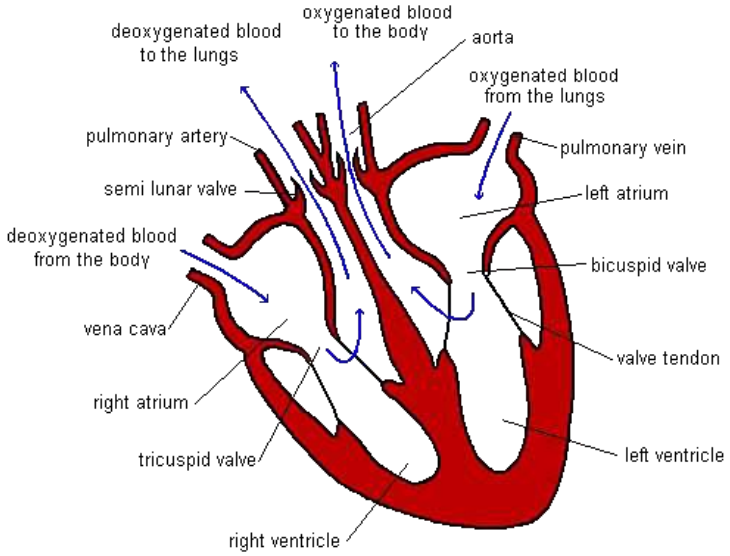
Average human heart beats 60-70 times/min when resting. (Pulse rate=heart rate)
Pulse rate is caused by the expansion and relaxation of an artery. Activity of heart can be recorded as an ECG (electrocardiograph).



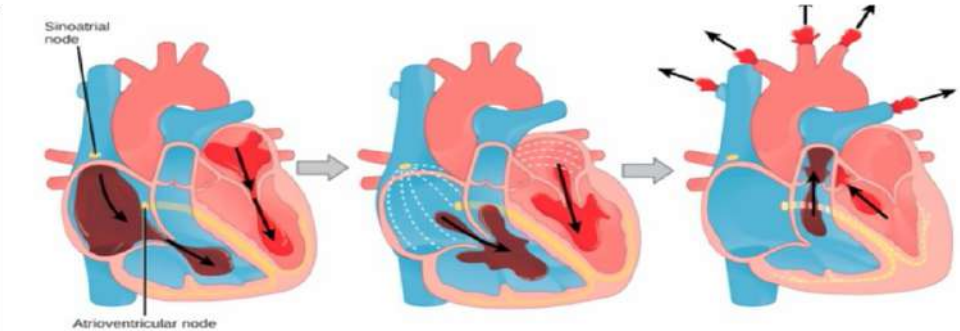
Valves in the heart and blood vessels make sure the blood flows in the right direction.
Left-hand side - bicuspid valve
Right-hand side -tricuspid valve







9.3 blood vessels



a) **Cardiac diastole**; all chambers are relaxed, and blood flows into the heart

Semilunar valves shut

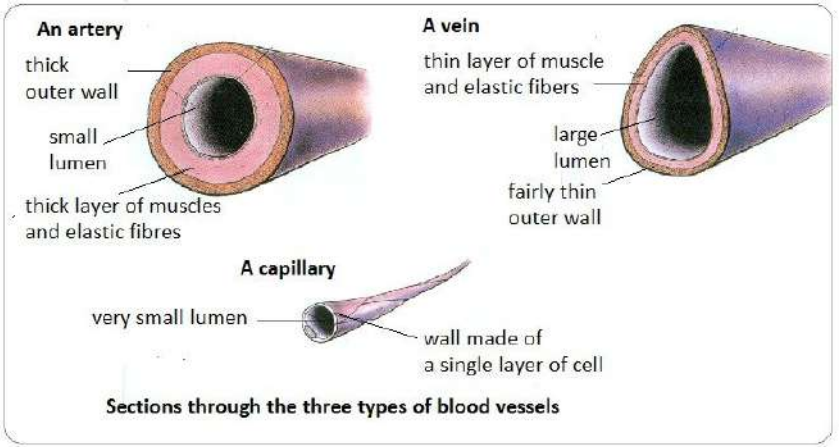
b) **Atrial systole, ventricular diastole**; the atria contracts, pushing the blood into the ventricles

Semilunar valves shut

Valves in the veins shut

c) **Atrial diastole, ventricular systole**; after the atria relax, the ventricles contract, pushing blood out of the heart

Atrioventricular valves shut



artery

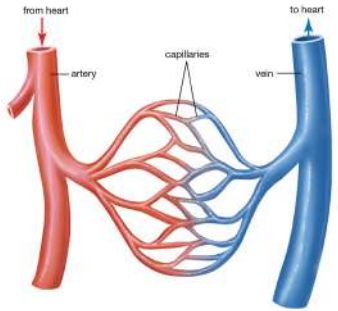
Very high pressure
Have elastic tissue
Blood pressure can be measured by sphygmomanometer

vein

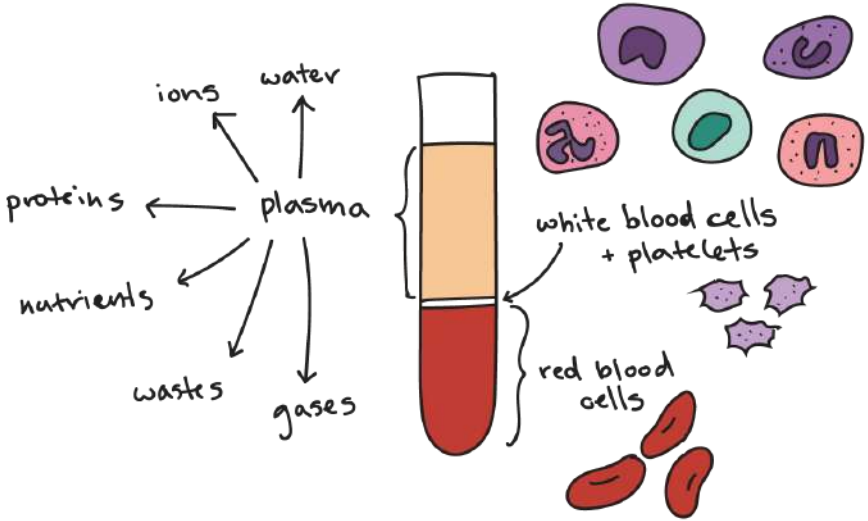
Lower pressure
Have valves
Moves by contraction of muscles
Return blood to the heart

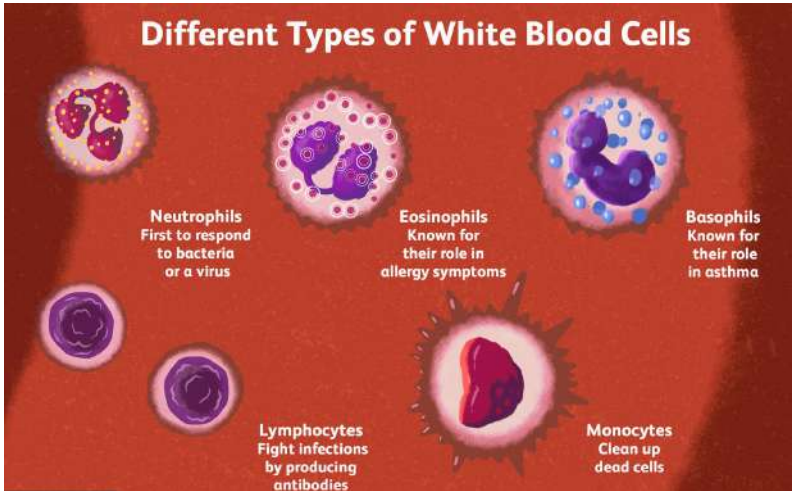
capillary

Takes nutrients and oxygen to cells, take away wastes



9.4 blood





Red blood cells:

- Transport oxygen
- Made in the bone marrow
- Produced very high rate
- Live about 4 months
- Have no nucleus
- High surface area
- Biconcave shape

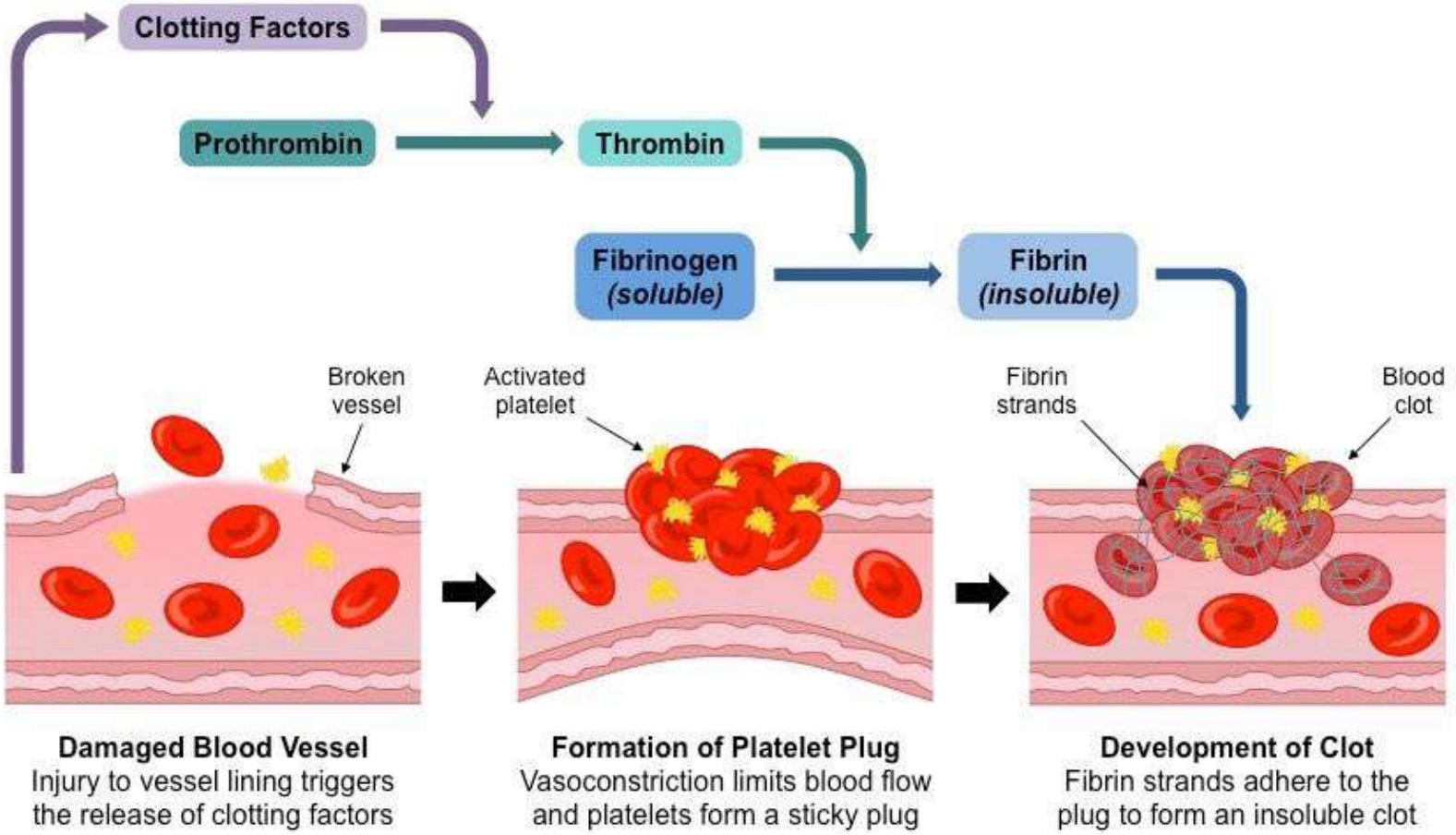
White blood cells:

- Have nucleus (large and lobed)
- Variable shapes
- Engulf and destroys pathogens (phagocyte)
- Makes antibodies (lymphocytes)

Platelets:

- No nucleus
- Made in bone marrow
- Very small
- Helps in blood clotting
- Prevents too much blood loss
- Against bacteria and viruses

Blood clotting



Plasma

components	source	destination	notes
plasma proteins (fibrinogen, antibodies)	Fibrinogen is made in the liver. Antibodies are made in the lymphocytes.	Remain in the blood.	Fibrinogen helps in blood clotting. Antibodies kill invading pathogens.
water	Absorbed in the small intestine and colon.	All cells.	Excess is removed by the kidneys.
lipids	Absorbed in the ileum. Also derived from fat reserves in the body.	To the liver for breakdown. To adipose tissue, for storage. To respiring cells, as energy source.	Breakdown of fat yields energy-heart muscle depends largely on fatty acids for its energy supply.
carbohydrates	Absorbed in the ileum. Also produced by the breakdown of glycogen in the liver.	To all cells, for energy release by respiration.	Excess glucose is in converted to glycogen and stored in the liver.
Excretory substances	Produced by amino acids deamination in the liver.	To kidneys for excretion	
Mineral ions	Absorbed in the ileum and colon	To all cells	Excess ions are excreted by the kidneys.
hormones	Secreted into the blood by endocrine glands.	To all parts of the body.	Hormones only affect their target cells. Hormones are broken down by the liver, and their remains excreted by the kidneys.
Dissolved gases	Carbon dioxide is released by all cells as a waste product of respiration.	To the lungs for excretion	Most CO2 is carried as hydrogen carbonate (HCO3-) in the blood plasma.