IGCSE Biology edexcel

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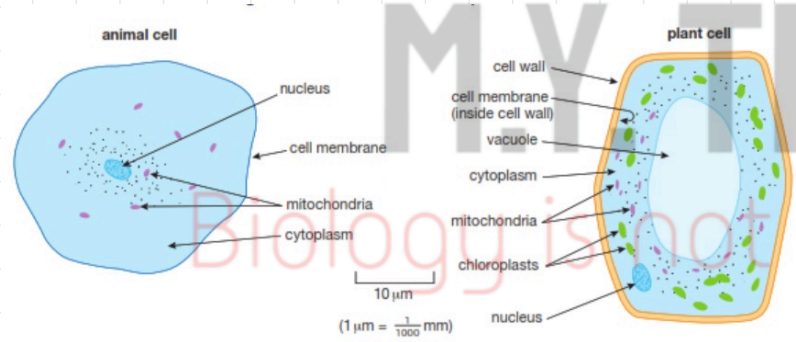
June 2024

Unit 1

Movement —> change in position or posture with time
Respiration —> chemical reaction we break down nutrients to produce ATP / release energy (Within the cell)
Control their internal condition —> Homeostasis
Senetivity ability to detect and provide a proper response to a stimuli
Growth and development —> Permanent increase in Dry mass or no. Of cell (Development increase in complexity)
Reproduction —> making more of the same species
Excretion —> getting rid of 1- metabolic waste products
2- Toxic materials
3- Substance in excess as water and salt
Nutrition —> food and water needed for growth

Cell structure

- label



Nucleus —
Carry the genetic material
Control the cell metabolic activity
Control the cell division
Cytolplasm
Site of chemical reaction
Mitochondria
- site of aerobic repsiration
- Production of ATP

Cell membrane) partially permeable membrane
- controls what goes in and out of the cell
- Hold this organelle and the cytoplasm and prevent their leakage

Plant organelles that are in the plant cell and not in the animal cell
- chloroplast
  - Contains chlorophyll that absorbs sunlight for photosynthesis (convert light energy into chemical energy)
- Cell wall —> Cellulose
  - protects the cell from bursting
  - resist turgidity (support)
  —— provide a definite shape
- Permanent /centeral vacuole
  - storage
  - maintains turgidity
  —- Holds the cell sap

Ribosome (non membranous organelle)
- Site of translation
- Protein synthesis

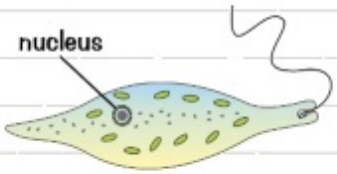
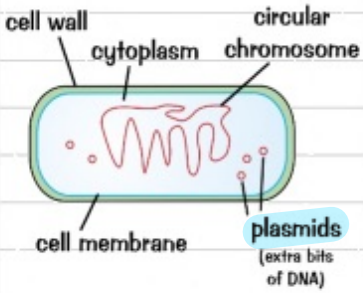
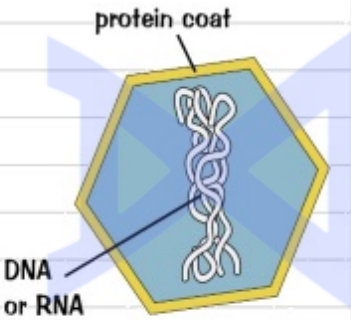
Tissue —> a group of similar cells working together to perform a specific function
Organs —> a group of several tissue working together to perform a specific function

Stem cells
Cells that can
1- Continuously divide by mitosis
2- can differentiate (become specialised)
Into
- Embryonic stem cells ___> differentiated into any type of cell
- Adult stem cells —> differentiated into specific types of cells

Bone morrow —> RBC / WBCS

Medicinal use of stem cell (stem cell therapy)
1- Bone marrow transplant —> to treat those leukemia
—> to replace lost cells during chemotherapy
2- Treating diabetes by replacing damaged pancreatic cells
3- Grafting skin to heal burn
4- treat nerve disorder (Parkinson's disease)

Embryonic stem cells —> unethical / kill embryos

Organism		Description	Examples
Protoctists		1) These are single-celled and microscopic (really tiny). 2) Some have chloroplasts and are similar to plant cells. 3) Others are more like animal cells.	• Chlorella (plant-cell-like) • Amoeba (animal-cell-like) — lives in pond water.
Bacteria		1) These are also single-celled and microscopic. 2) They don't have a nucleus. 3) They have a circular chromosome of DNA. 4) Some can photosynthesise. 5) Most bacteria feed off other organisms — both living and dead.	• Lactobacillus bulgaricus — can be used to make milk go sour and turn into yoghurt. It's rod-shaped. • Pneumococcus — spherical (round) in shape.
Viruses		1) These are particles, rather than cells, and are smaller than bacteria. 2) They can only reproduce inside living cells. A virus is an example of a parasite — it depends on another organism to grow and reproduce. 3) They infect all types of living organisms. 4) They come in loads of different shapes and sizes. 5) They don't have a cellular structure — they have a protein coat around some genetic material (either DNA or RNA).	• Influenza virus • Tobacco mosaic virus — this makes the leaves of tobacco plants discoloured by stopping them from producing chloroplasts. • HIV

How protoctist is resembles both plants and animals
Plant —> some has cell wall and has chloroplast (algae)
Animals —> Can move

Bacteria are classified as prokaryote ?
1- No Nucleus 2- No membranous organelles
Flagellum —> propel and move
Plasmid —> small circular DNA that carry the resistant gene
Circular DNA that's not bounded to histone protein
Capsule —> That protect the bacteria from dehydration
Cell wall —> made of Murien / peptidoglygan
Cytoplasm and a cell membrane

Acelluar structure of the virus
Non living they are only formed
- Protein coat surrounded by a genetic material
- pathogenic

Plants - autotrophic —> can convert simple raw material into compound
Animals heterotrophic —> depend on other living organisms for food
Fungi —> Saprotrophic nutrition —> feed on dead organisms by digesting them

Fungus

1) Some are single-celled.
2) Others have a body called a mycelium, which is made up of hyphae (thread-like structures). The hyphae contain lots of nuclei.
3) They can't photosynthesise.
4) Their cells have cell walls made of chitin.
5) Most feed by saprotrophic nutrition — they secrete extracellular enzymes into the area outside their body to dissolve their food, so they can then absorb the nutrients.
6) They can store carbohydrate as glycogen.

Movement of substance in and out of cell

Diffusion

It the movement of particles or ions from a region of high concentration to a region of low concentration
Till it reach equilibrium

Thickness of wall
Thin —. Provides shorter diffusion distance

Concentration gradient
Higher the gradient —> More collision between particles

Temperature increase
Molecules Gaines kinetic energy and moves faster

Surface area to volume ratio
Smaller organism have a larger surface area to volume ratio so they can rely on diffusion

Size of particles
Smaller the better

Osmosis

Move t of water from an area of high water potential to an area of low water potential through a partially permeable membrane

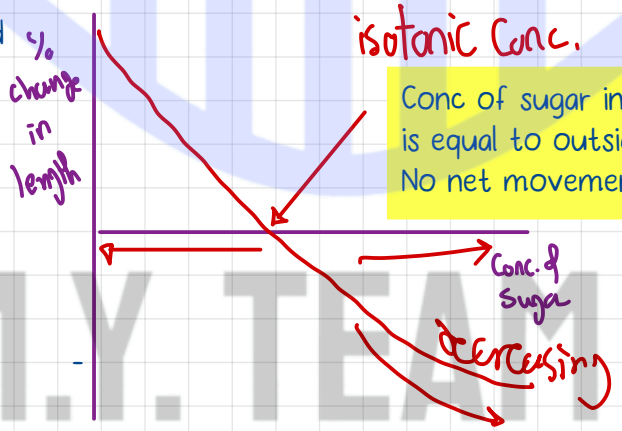
Potato experiment

50 pieces of the same length of potato
Each 10 potato in a different sugar concentration

Observed the percentage change
Final - Initial / initial X 100

Plot a graph

As potato might have a different starting mass



Conc of sugar inside the potato is equal to outside
No net movement of water

Conc of sugar decrease
Higher water potential in the solution
The water moves into the cell by osmosis
Plant cell ___. Turgid and cell wall bends outside
Animal cell ___. Burst as it has no cell wall

As the sugar concentration in solution increases
Water potential of the solution drops
So water moves out of the cell by osmosis
Plant cell ___. Cell membrane will strand to move away from the cell wall and the cell shrinks flaccid
Animal cells —. Plasmolysis

Active transport

Movement of ions against concentration gradient form low concentration to high concentration with the help

1- protein carrier
2- ATP

Biological molecules

	Carbohydrates	Lipids	Proteins
Elements	C,H,O	C,H,O	C,H,O,N
GENERAL FORMULA	CH_2O	— — —	— — —
MONOMERS	Monosaccharide	3 fatty acids + Glycerol	Amino acid

Types

Simple sugar
- Soluble in water
- Sweet taste
- Small Molecular weight

Monosaccharide
- One sugar unit

Disaccharide
- Two sugar units

Complex sugar
- Insoluble
- No sweet
- Large Mwt

- Starch —> plant
- Cellulose —> Cell wall
- Glycogen —> animal

Fats
- Solid at room temperature.

Oils
- liquid at room temperature

- Antibodies
- enzymes
- Hormones

Changed the number or sequence of amino acid it will result in altered protein

Function

- Act as a primary source of energy (Substrate for respiration)
- Stored as starch in plant and as glycogen in animal and fungi
- Form cellulose that forms cell walls in plant

- Act as a 2ry source of energy
- Act as thermal insulator (Adipose tissue)
- Act as a n electric insulator (cover the nerves)
- Formation of cell surface membrane
- Glycerol is used in cosmetics
- Layer surrounding organs for protection

1- Enzymes Act a biological catalyst
2- collagen formation of blood vessels
3- Hemoglobin carry o2 in red blood cells
4- Keratin in nails and skin
5- Antibodies are made of protein
6- important for growth and muscle formation

Food test

Benedict reagent —> reducing sugar
3ml sample + 3 ml Benedict reagent ($CuSO_4$) in NaOH (blue)
Cu^{2+} is reduced To
Heat in boiling water bath
Cu^{+} —-> CuO (Green - yellow -orange - Brick red ppt)

Lipid sample is dissolved in ethanol
Add solution to cold water
White cloudy emulsion

Proteins —> Biuret reagent
$CuSO_4$ in KOH (BLue)
If protein is present
Shake
—> Purple ___>

Iodine solution —> STarch
Food sample, crush and extract then add iodine solution
Starch is present —> Blue black
No starch —> Yellowish brown

Balanced Diet to take in all the correct types of nutrients in the correct proper ion to stay Healthy

Depend on
1- Age (teenager require more protein to build muscle
2- Gender (Males has a higher muscle mass)
3- ACtivity (labor worker require more carbohydrates and proteins)
4- Pregnancy

Vitamins

A —> make chemical in retina and protect the eye surface —> night blindness and damaged cornea

B —> Help in cell respiration —> Beri-beri (poor growth - dry skin — Digestive disorder)

C —> stick the cells together (formation of blood vessels) —> Scurvy (bleeding Gum)

D —> helps in the absorption. Of calcium and phosphate —> rickets

Minerals

Calcium —> essential for formation of bones and teeth and blood clotting —> Rickets , haemophillia

Phosphorus —> Making teeth and bones , role in DNA formation and ATP —> problem in teeth

Magnesium —:> formation of bones —> brittle bones

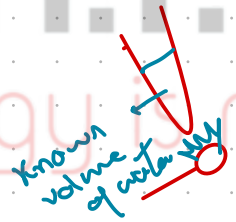
Iron —> essential for Haemoglobine —> anaemia (female require more iron to compensate for blood lost in menstruation

sodium and chloride —> maintain the water potential

Kwashiokor —> due to protein deficiency

- Swollen belly (contain fluid)
- Loss of weight
- Poor muscle growth
- General weakness
- Flaky skin

Caloriemeter



1- Boiling tube and add 20 cm3 of water
2- measure the temp off water using thermometer
3- attach 1g of food to mounting needle and Set it on fire and place it under the boiling tube
4- ensure the food is completely burnet
5- remeasure the temp of water

$$\frac{(\text{final temperature} - \text{Initial temperature}) \times 20 \times 4.2}{\text{mass of food}}$$

mass of fuel
specific heat of water

- Food not completely burnt
- Some heat may be lost to the surrounding

Ingestion taking in food or water through the mouth

Digestion

- Mechanical —> Break down of large food particles into small food particles to increase surface area

1- Teeth

- Cut and tear the food
- Crush and grind the food

2- Peristalsis (rhythmic contraction and relaxation of muscle)

- Circular muscle. _. Contract
- Longitudinal muscle —. Relax

3- Bile (chemical formed in liver and stored in gall bladder)

- Emulsification of lipids (increase the surface area of lipids by breaking large =fat globules into small fat globules)
- Provide alkaline .pH Duodenum

- Chemical —> Breaking down of large insoluble molecules into small soluble molecules by the aid of enzyme

Mouth

Starch — —-Amylase (Salivary gland) —-> Maltose

Stomach

Hcl —> 1- Activate pepsin enzyme. 2- KIll harmful bacteria

Protein —-pepsin —> Polypeptide / peptides

Duodenum

Pancreatic juice (pancreas)

Starch — — Amylase —-> Maltose

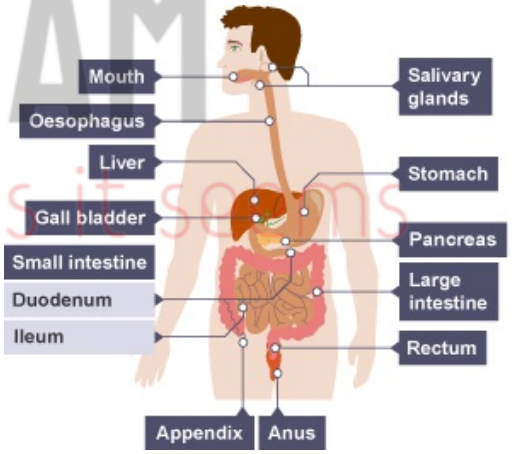
Protein — — Trypsin — —> peptides

Emulsified — Lipase — —-> Fatty acid and glycerol

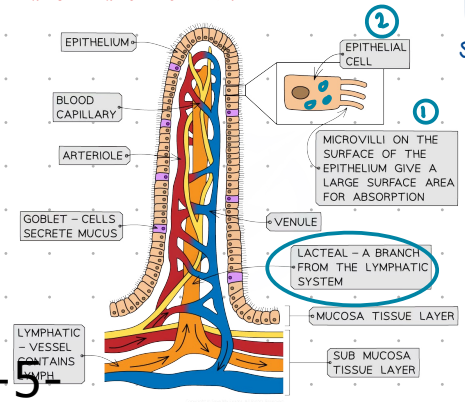
Ileum

Maltose — —-MAltase —-> Glucose

Peptides — — Peptidase — —-> Amino acid



Absorption —> Digested food pass through the wall of the ileum into the blood



Thin wall to provide shorter diffusion distance

3- Packed with mitochondria to provide ATP for active transport

Blood	Lymph
Glucose Amino acids	Fatty acid , glycerol VIt K,D,A

Assimilation —> passage of digested food into the cell to be utilized or stored

Blood — — —- Hepatic Portal Vein —-> Liver

Liver
1- Store glucose as glycogen
2- Demaination of amino acid (remove the nitrogen contains groups and concert it into urea)

Egesetion passage of undigested food out of the body through the anus

Fibers are essential to maintain peristalsis and if it lacks it result in constipation

Enzymes

Enzymes is a protein biological catalyst that speed up the chemical reaction by lowering the activation

- Substarte fit into the complementary active site
- Enzyme substrate complex
- Lower the activation energy
- Form product that's release so enzyme can be reused

Temperature

= Cold —> not enough energy gained by molecules
Less collision
Less Substarte fit into the active site
Less enzyme Substarte complex

As temperature increase
Molecules gain energy
Move faster
More collision
More susbtsrate fir into the active site
More Enzyme substrate complex

As temperature increase past optimum
Actives site shape changes
Less Substarte fit into that active site as it is no longer complementary
Less Enzyme Substarte complex

.PH

.PH 7 is the optimum .pH
As the .pH increase or decrease

Respiration its a chemical reaction where glucose are broken down to produce ATP

Structure Of ATP (Adenosine triphospate)
3 phosphate molecules
Adenosine base
ATP ——release energy——ADP

Uses energy
Ana 3andy active muscle stimulated by nerve
Anabolic. Muscle contraction.
Active transport Nerve stimulation

AEROBIC RESPIRATION
its a chemical reaction where glucose are broken down to produce ATP in presence of oxygen
- large amount of ATP as you can completely breakdown the glucose
- Produce CO2 and H2O

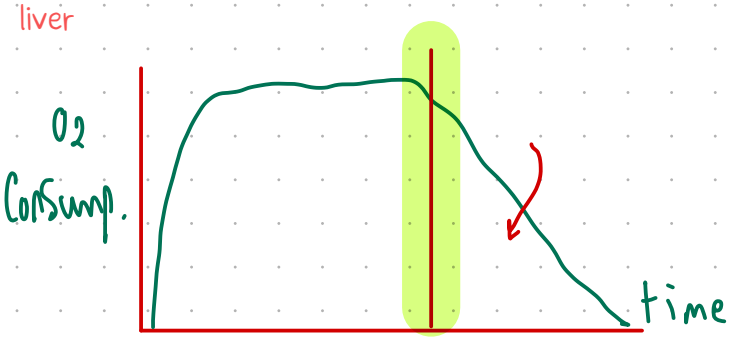
$C_6H_{12}O_6 + 6O_2 \longrightarrow 6\,CO_2 + 6\,H_2O$

ANAEROBIC RESPIRATION
its a chemical reaction where glucose are broken down to produce ATP in in absence of oxygen
- Small amount of ATP as glucose is not completely broken down

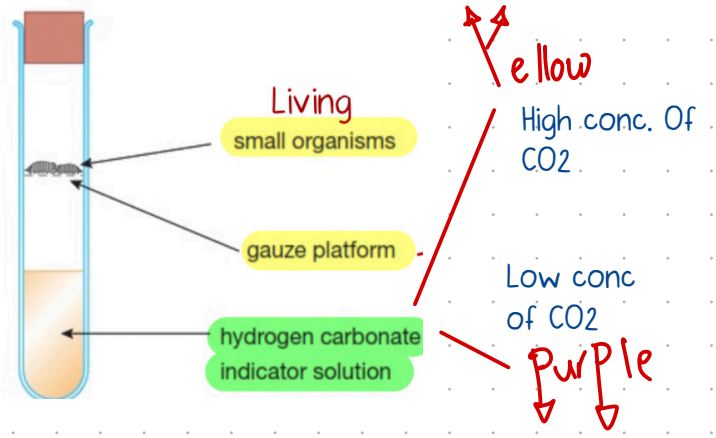
In yeast ($C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$)
Alcohol industry + Biofuel Baking bread

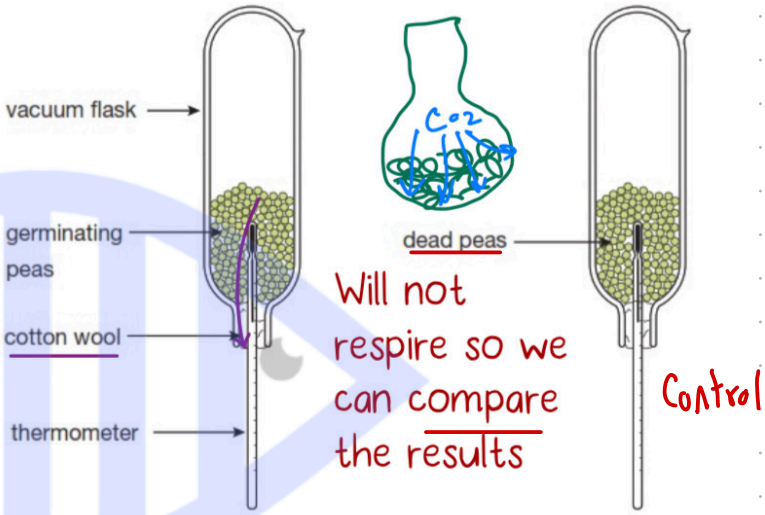
In Muscle ($C_6H_{12}O_6 \longrightarrow 2C_3H_6O_3$ lactic acid)
During vigorous exercise the muscle respire anaerobically as the oxygen delivered doesn't meet the muscle demand so less aerobics respiration and more anaerobic respiration tales place
- less ATP produced
- Accumlation of lactic acid will result in muscle fatigue

After excerise you are going breath heavily at a higher rate and depth in order to pay the oxygen debt by using oxygen to break down lactic acid in liver



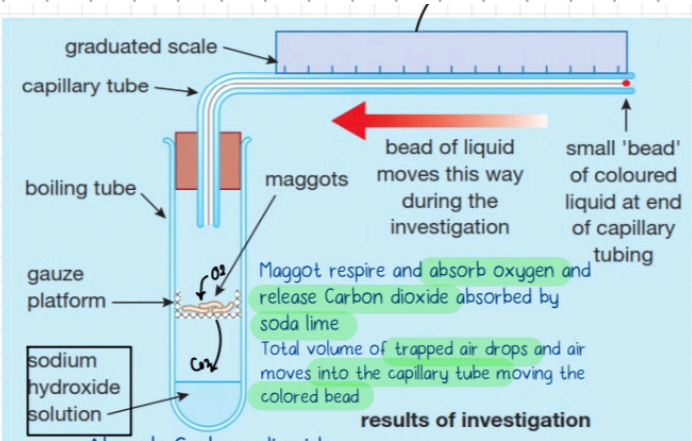
Experiments





Q1- Vacuum flask must be inverted
The seed produces carbon dioxide which is denser than air so the inverted flask and the cotton wool allow it to escape

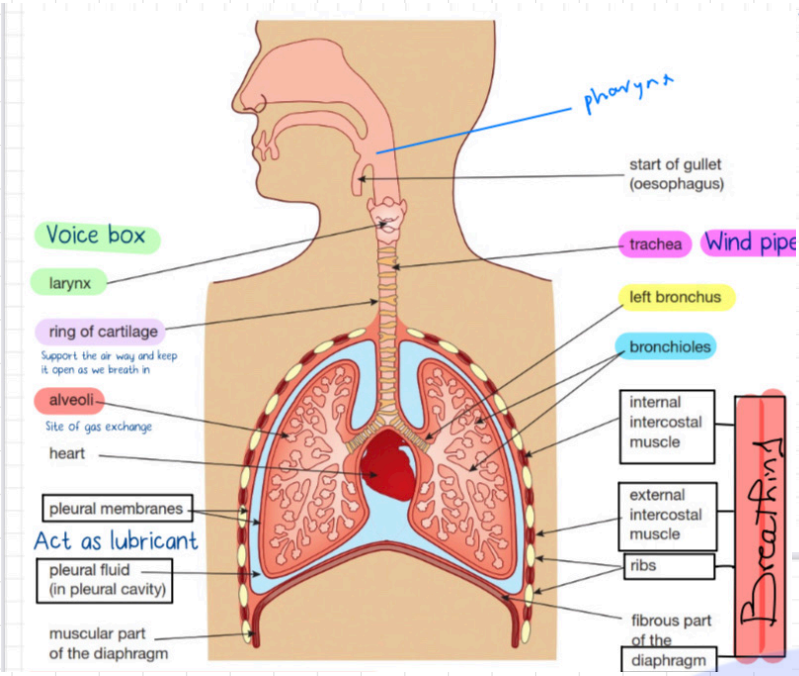
Q2- during the preparation of peas its washed by 1% bleach and then rinsed twice in distilled water ?
Bleach act as a disinfectant that kill any bacteria present on the surface of the peas so it won't respire and compete with peas for oxygen



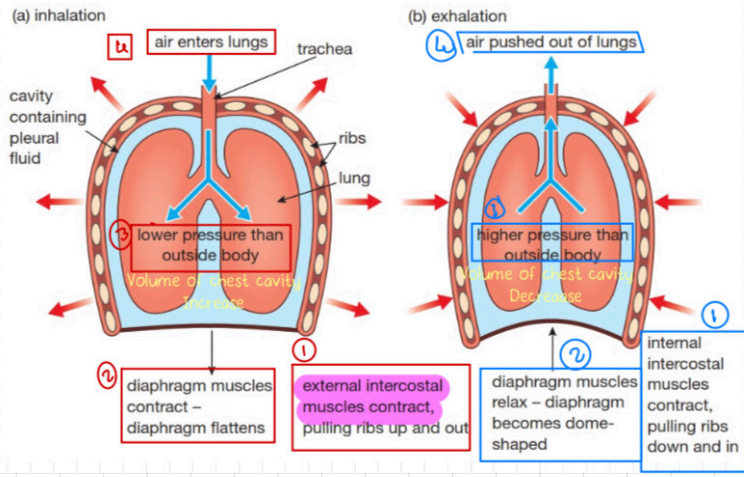
results of investigation

Experiment	Distance moved by bead/mm	
1	20	
2	3	Anomalous result
3	18	

Respiratory system



The mechanism of inhalation and exhalation



Difference in the structure of gases between exhaled and inhaled air

Gas	Atmospheric air/%	Exhaled air/%
nitrogen It's not used by the body	78	~~79~~ 78
oxygen Used in aerobic respiration	21	16
carbon dioxide Product of aerobic respiration	0.04	4
other gases (mainly argon)	1	1

How the trachea is adapted to perform its function

1- C shaped cartilaginous rings is to support the trachea and prevent from collapsing while inhaling

2- Goblet cell that secret sticky mucus to trap dust and bacterium

3- Cilliated epithelial cell that moves Back and forth to push mucus away from lungs

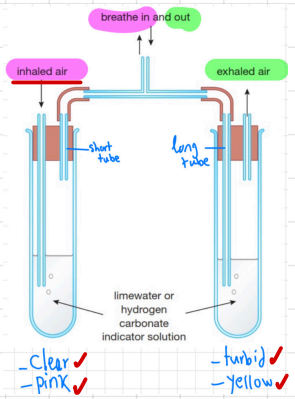
It's not a complete ring so it can withstand the bulge of food going through the oesophagus

What is the effect of exercise on the rate and depth of breathing

They both increase in order to supply more oxygen to the blood and get rid of Co2 accumulated in blood so more O2 is available to muscle to perform aerobic respiration to produce ATP

Rate —> no of breath per minutes

Depth —> volume of air breathed in



How the alveoli is adapted to perform gas exchange

1- Thins wall —> to provide shorter diffusion distance
2- large in no. —> Inc the surface area for diffusion
3- layer of moisture —> helps in dissolving of gases
4- surrounded by large no. Of capillaries to inc the surface area for diffusion
5- Ventilation ————. Maintain diffusion
6- Good blood supply —. Gradient

Smoking

Carbon monoxide

Bind irreversibly to hb
Less oxygen transported to muscle
Increase rate and depth of respiration

Nicotine

Narrow Blood vessels
Increase Blood pressure
Increase heart rate
Damage arteries
Blood clots in arteries Heart attack

Tar

Lung cancer
Mutation in DNA
Results in an uncontrolled division this result in an unspecialized cells

Chronic bronchitis
Inc Mucus secretion
Damages cilliated cell
Mucus accumulates and results in lung infection

Emphysema
Phagocytes enter the lung and breaks down elastic fibers
Alveoli burst so lee area avilable for gas exchange

Transport in man

Why large ' mammals need a transport system

Small surface area to volume ratio → isn't enough surface to supply all that volume → we can't rely on direct diffusion → gas will travel long distance to reach Cell center

Define double circulation
The blood passes through the heart twice in one complete cycle

- Pulmonary circulation (low pressure)
takes place between the heart and the lungs

Heart. ← Deoxygenated Pulmonary artery → Lungs
Heart. ← Oxygenated Pulmonary vein ← Lungs

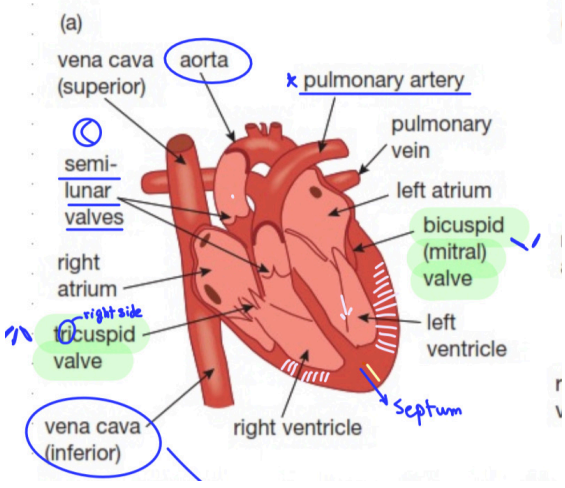
- Systemic circulation (High pressure)
takes place between the heart and body cells

Heart. ← Deoxygenated Vena cava ← Body cells
Heart. → Oxygenated Aorta → Body cells

What's the advantage of double circulation compared to single circulation

The heart pumps the blood twice, so higher pressures can be maintained The blood travels more quickly to organs. In the single circulatory system of a fish, blood loses pressure as it passes through the gills. It then travels more slowly to the other organs.

Labeling the heart



Valve —> It prevents the backflow of blood
Septum —> separates the oxygenated blood form the deoxygenated blood
Left ventricle has the thickest wall ????
Because it pumps the blood with the highest pressure to be able to move for further distance / overcome resistance to reach all body cells

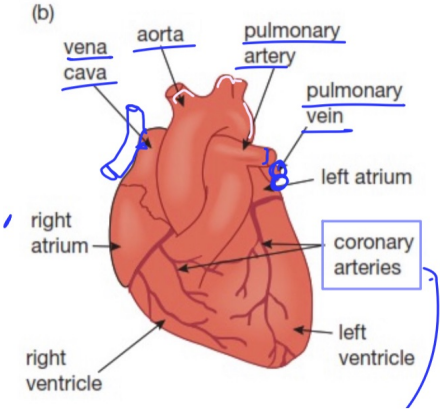
Vena cava deliver deoxygenated blood to right atrium
Right atrium contacts
The tricuspid valve open
Blood flow to right ventricle
Right ventricle contacts
Tricuspid valve closes and semilunar valve open
The blood flows through the pulmonary artery lung
Then oxygenated blood returns to left atrium through the pulmonary vein
The left atrium contacts
Bicuspid valve open
Blood flows to the left ventricle
The left ventricle contacts
The semilunar valve opens and bicuspid valve closes
The blood travel through the aorta

Coronary artery —> delivers blood to the cardiac muscle as it contains glucose and oxygen needed for aerobic respiration to release energy for contraction

Risk factors
heredity - some people inherit a tendency to develop coronary heart disease
high blood pressure - puts more strain on the heart
diet - eating large amounts of saturated fat is likely to raise cholesterol levels
smoking - raises blood pressure and makes blood clots more likely to form stress - raises blood pressure
lack of exercise - regular exercise helps to reduce blood pressure and strengthens the heart.

Coronary artery disease

They are easily blocked by a build-up of fatty substances (including cholesterol) in their walls.
This can cut off the blood supply to an area of cardiac muscle. The affected muscle can no longer receive oxygen and glucose, so it cannot respire and release energy. This means it is unable to contract,



Effect of exercise on the heart muscle

Cardiac output = Stroke volume X Heart rate

C.O. -Volume of blood pumped in one minute
S.V. Volume of blood pumped per beat
H.R. its the number of beats in one minute

As the muscle contracts during exercise it releases large amount of Co2.
Lowering the .pH of blood
The change in ..pH is detected by a receptor in the aorta
Sends a nerve impulse to the cardiac center in the medulla
That sends a wave of excitation to the pacemaker that results in increasing the heart rate

Blood vessels

Artery Away from heart

Thick — to withstand the pressure
Elastic —. Stretch and recoil to maintain the pressure
Muscular wall —> dilate and constrict to control the blood flow
Narrow lumen —> maintain pressure

Vein To the heart

Valve —> prevent the back flow of blood
Embedded in muscle —> the muscle contracts it squeeze the blood in the veins
WIde LumeN ___> to provide less resistance to blood flow

Capillaries site of exchange

Part of the plasma diffuses out of capillary pores under high pressure to form tissue fluid surround the cell and perform exchange of nutrient and gases

Thin wall —> shorter diffusion distance
Large in no —> large surface area for dissuasion
Pores —. that allow only small molecules to diffuse out
Continuous blood flow —. Maintain concentration gradients

Immunity and Blood cells

Pathogen —> A microorganism that causes a disease
Bacteria - Fungus - virus - Potoctista

Defenses
Skin acts as physical barrier
Hcl in stomach to kill bacteria
Mucus that traps dust and bacteria
Cilliated cells that push the mucus

Platelets was responsible for blood clotting
- prevents the blood loss
- Prevents the enterance of pathogen

Fibrinogen (soluble protein) that converted into fibrin that's insoluble and forms a mesh that traps blood cells forming a scab

White blood cells

Lymphocyte
- encounter a non self antigen
- Divide to form Plasma cells and memory cell
- Plasma cells release complementary antibodies to the non self antigen that
  1- immobilize the pathogen
  2- stimulate phagocytosis
- Memory cells upon secondary infection it release large no. Of antibodies in less time

Phagocytes
Phagocytosis
1- Engulf the pathogen
2- release digestive enzymes
3- break down pathogen

Vaccination
— Provide dead or weakend pathogen or toxin
Stimulate lymphocyte to release memory cells upon secondary infection it release large no. Of antibodies in less time
Herd immunity —> to vaccinate large no. Of people so there are less chance of pathogen transmission

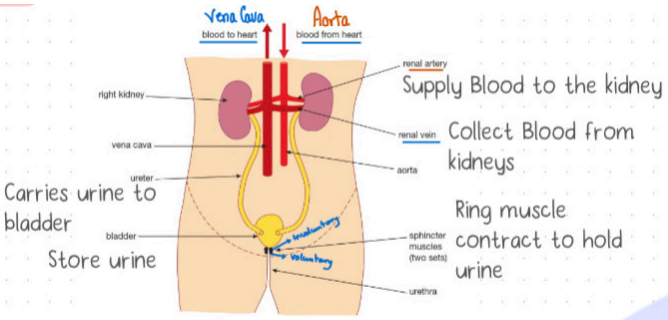
Excretion , coordination and Homeostasis

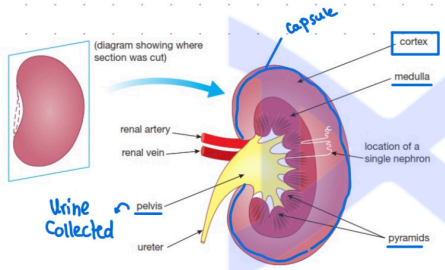
Excretion is getting rid of metabolic waste , substance in excess and toxic substance

- Lung —< excretion Co2
- Liver —> excretion dead RBC —> bile

—> Deamination removal of nitrogen containing group from ammonia and convert it urea

Structure of urinary system

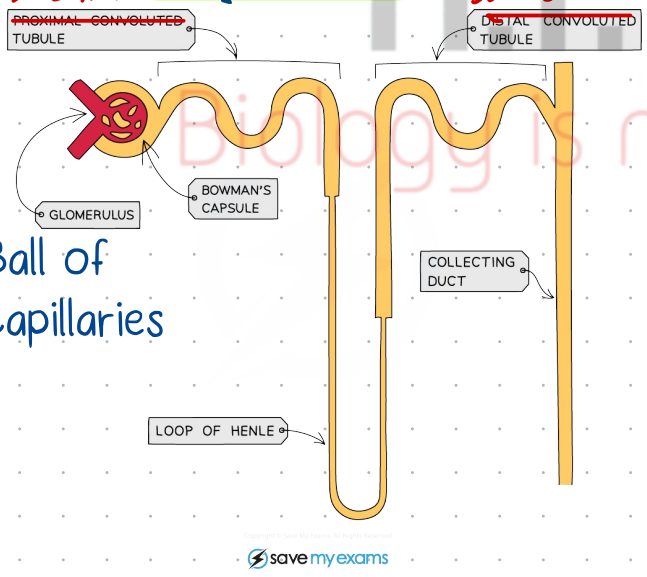




Homeostasis Keep the internal environment constant

Osmoregulation Maintainance of the water and salt concentration of internal environment relatively constant.

First Coiled Nephron Second coiled



Compare urine concentration inn different temperature

Hot day —> Concentrated urine - less water excreted - More sweating

Cold days —> DIluted urine — MOre water excreted —> less sweating

Adaptation of nephron

Ultrafiltration —> passage of the plasma and small molecule (glucose , amino acid , urea , uric acid , water , mineral ions) out of the pores of the glomerulus into the bowman's capusle under high pressure

Blood cells and large proteins can't pass out ?
Too large to pass out rom the capillary pores

Selective reabsorption —> coiled tubule
Reabsorption of all glucose and amino acid by active transport back into the blood
And water is reabsorbed by osmosis back into the blood

Loop of henle —> site of reabsorption of water into the blood
Desert animal has a long loop of henle ?
To ensure maximum reabsorption of water

Collecting duct —> Site of Osmoregulation
ADH (Anti-duretic Hormone)

- Hypothalamus contains osmoreceptors that detect the water potential of the blood
- If the water potential of the blood drops Osmoreceptor shrink stimulate posterior pituitary gland to secrete ADH
- that travel through blood plasma and bind to receptors on the membrane of the collecting
- increasing water reabsorption resulting in concentrated urine

Skin structure

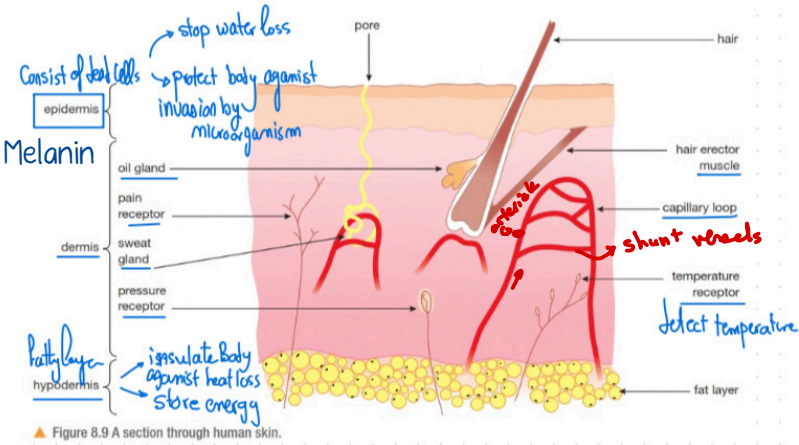


Figure 8.9 A section through human skin.

mammals , birds —> warm blooded / endotherm —> Constant temperature

Amphibians , reptiles , fish —> Cold blooded / ectotherm —> Variable temperatures

What is The function of the skin ? (5)

1- Tough outer layer to resist mechanical damage
2- Act as a barrier for enterance of pathogen
3- Impermeable surface to prevent loss of water
4- Act as a sense organ for touch and Temperature change
5- controlling the loss of heat through body surface

Thermoregulation

Thermoregulatory center in Hypothalamus Detect the change ion temperature and send nerve impulse to

Higher temperature

- Sweat gland to release sweat through the sweat pore that absorb body heat and evaporate providing a cooling sensation
- Vasodilation of arteriole carrying the blood to the skin surface so more heat is lost through convection and radiation
- Hair erector muscle relax so the hair is bent to allow more air to pass near the skin surface resulting in more heat loss

Low temperature

- Shivering the continuous contraction and relaxation of muscles generates heat
- Vasoconstriction of arteriole so less blood comes in contact with skin surface so less heat is lost by convection and radiation
- Hair erector muscle contact to stand the hair erect to trap a layer of air that acts as an insulator

Adrenalin

Hormone -> Chemical secreted by a gland and travel through blood plasma till reach a target organ and alter its activity

- Secreted from the adrenal gland
- In case of fear , fight or flight

Heart —> Increase the heart rate and force of contraction to pump more blood carrying oxygen and glucose to active muscle

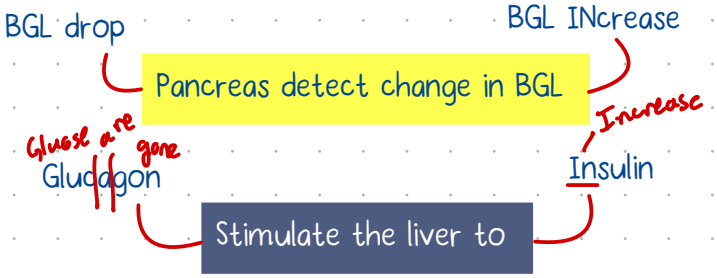
Lungs —> increase in the rate and depth of breath to supply the blood with more Oxygen and remove Co2

Liver —> stimulate liver to break down glycogen into glucose

Iris —> pupil to dilate —> better vision

Muscle —> increase the rate of aerobic respiration to release more energy

Control of blood glucose level



Stimulate break down of glycogen into glucose

Negative Feedback

Stimulate storage of glucose as glycogen
Stimulate break down of glucose in aerobic respiration

Nervous system

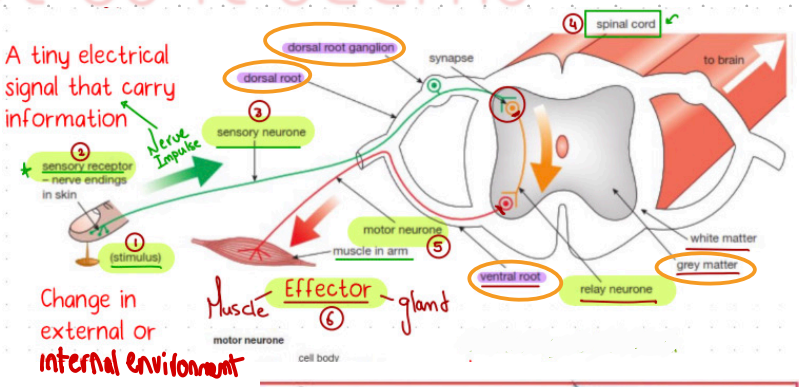
Centeral nervous system

- Brain
- Spinal cord

Peripheral nervous system

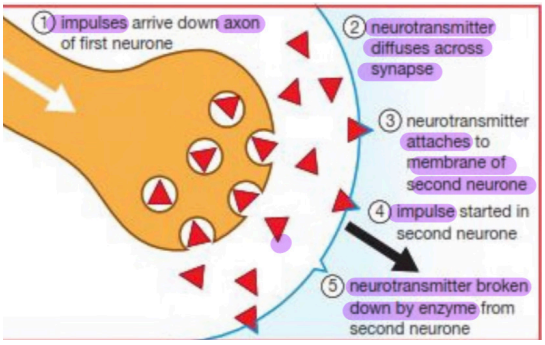
Sensory	relay	Motor
Carry the impulse from the sensory organ till the CNS	COnnect the sensory neuron to motor neurone	Carry the impulse from the CNS to the effector (muscle / gland)
• Long dendron • Cell body at the middle • Short axon		• Short / no dendron • Terminal cell body • Long axon

Reflex action —. Automatic rapid response that protect against tissue damage



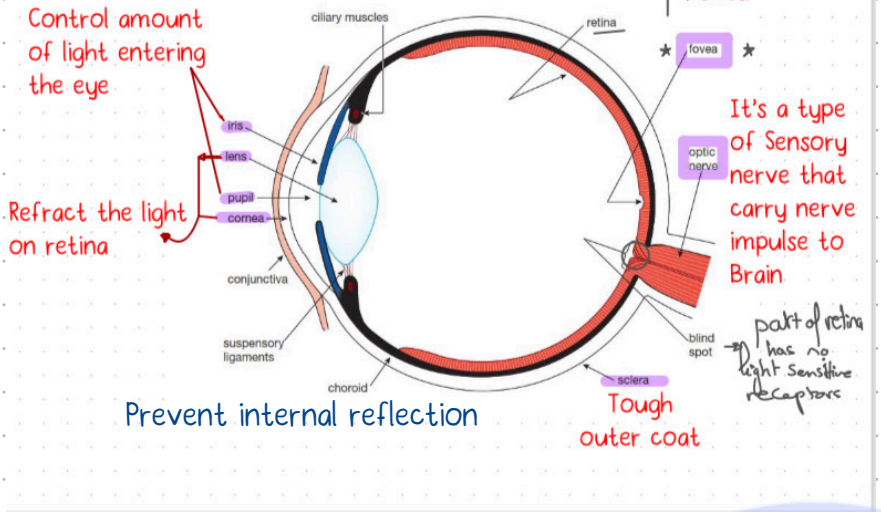
Synapse

Junction between nerve cells
Ensure that nerve impulse travel in single direction



Structure of eye

Rods	Cones
Work in dim light	High light intensity
Can't distinguish color	Red-green-blue
Distributed all over retina	Fovea



Control amount of light entering the eye

Refract the light on retina

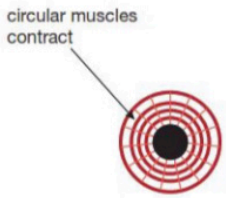
It's a type of Sensory nerve that carry nerve impulse to Brain

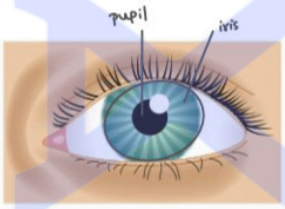
part of retina has no light sensitive receptors

Prevent internal reflection

Tough outer coat

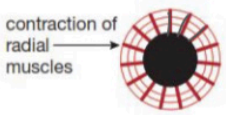
Eye reflex to bright and dark

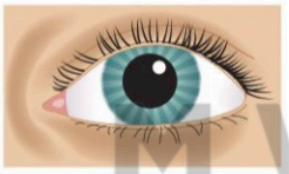




bright light
- circular muscles contract
- radial muscles relax
- pupil constricts

less light passes to retina





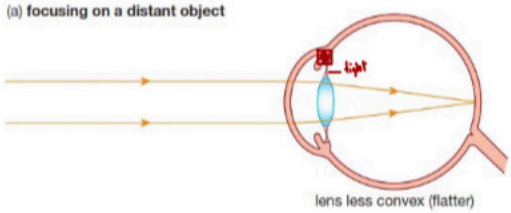
dim light
- circular muscles relax
- radial muscles contract
- pupil dilates

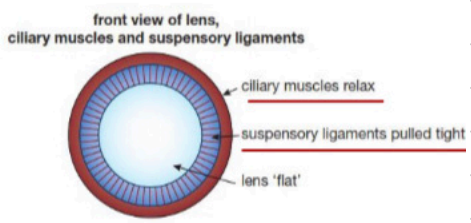
more light passes to retina

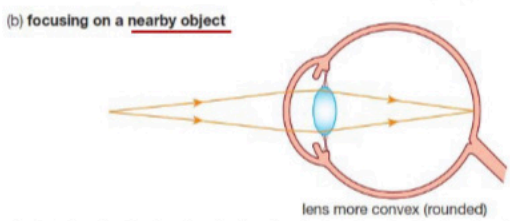
Antagonistic muscle —> muscles that work in opposite direction

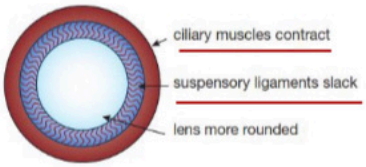
Accommodation of eye to far and near sight

Thin









Thick

Tropism —> its a growth response toward or away from a stimuli

- Phototropism —> its a growth response toward or away from light
- Gravitropism / geotropism —> its a growth response toward or away from gravity

Shoot (positive phototropism)
- shoot bend toward unidirectional light

Shoot (negative geotropism)
- shoot grow upward against gravity

Advantage
Shoot grow upward to collect more light to perform photosynthesis

Root (Positive gravitropism)
- root grow downward with gravity

Advantage
Root grow down to anchor the plant in soil
And be able to absorb water and mineral ions

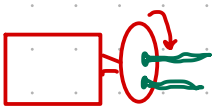
Tropism take place during to presence of plant hormones (Auxins)

Role of auxins in phototropism of shoot
- Auxins are synthesized in shoot tip
- Auxins diffuse from the light side to the dark side
- Unequal distribution of auxin (dark side more auxins)
- Result in stimulation of more cell elongation in the dark side

Role of auxins in the gravitropism of shoot
- Auxins are synthesized in shoot tip
- Auxin diffuse from he upper side to the lower side
- Unequal distribution of auxin (lower side more auxin)
- Result in the stimulation of more cell elongation at the lower side

Role of auxin in the gravitropism of root
- Auxins are synthesized in root tip
- Auxin diffuse from he upper side to the lower side
- Unequal distribution of auxin (lower side more auxin)
- Result in inhibition of cell elongation of the lower side

Clinostat = rotating motors
Seed placed on rotating Motor — shoot / root grow horizontal —> cancel the effect of gravity —> equal distribution of auxins

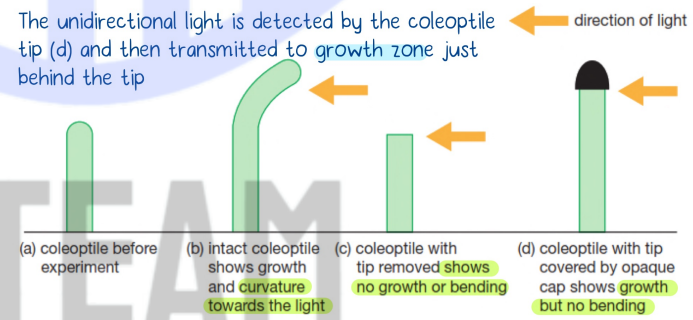


Auxins as weed killers (2,4 -D)
- Spray auxins with large amount
- Weeds has it has a higher surface area of leafs
- Absorb a higher concentrations of auxins
- Higher concentration of Auxins leads to inhibition of root growth
- Not enough food and water reaching the weed so it dies

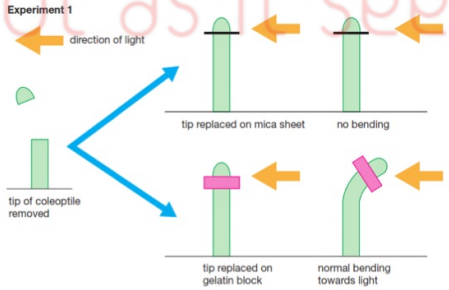
Venus fly trap

Has modified leaves which closes quickly around the prey (insect) trapping it and then it secrets digestive enzymes to digest the insect It benefits from the insect as it gains nutrient especially nitrate

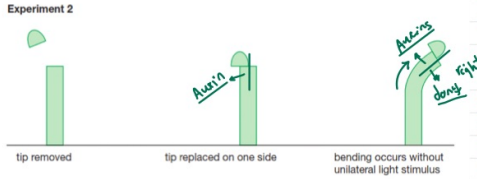
Why did Darwin used coleoptile in his experiment ?
- It has a simple structure
- Easy to grow



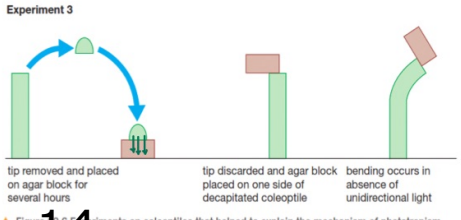
Further experimenting
Mica sheet —> inhibits diffusion of auxins
Gelatin block —> allows the diffusion of auxins



In experiment 1, the stimulus for growth (auxins) was found to pass through materials such as gelatine, which absorbs water-soluble chemicals, but not through materials such as mica (a mineral), which is impermeable to water. This made biologists think that the stimulus was a chemical that was soluble in water.



experiment 2, it was shown that the phototropic response could be brought about, even without unidirectional light, by removing a coleoptile tip ("decapitating' and then placing it in one side Unequal distribution of auxins results in curvature



▲ Figure 2.6 Experiments on coleoptiles that helped to explain the mechanism of phototropism.

In experiment 3, it was found that the hormone could be collected in another water-absorbing material (a block of agar jelly). Placing the agar block on one side of the decapitated coleoptile stalk caused it to bend. Unequal distribution of auxins results in curvature

Nutrition in plant

Photosynthesis —> a process by which plant uses the light energy trapped by chlorophyll to convert simple inorganic molecules as Carbondioxide and water into glucose and oxygen so converting the light energy into chemical energy

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

Uses of glucose

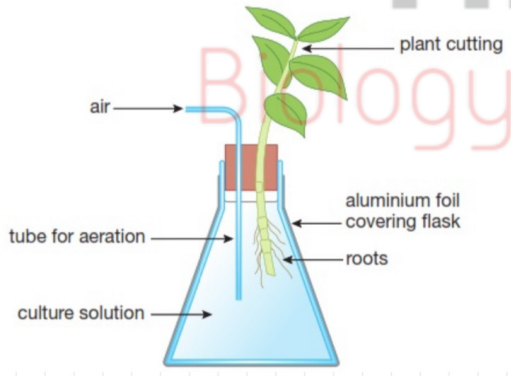
1- Aerobic respiration and produce ATP
2- Stored as starch
3- Formation of cellulose form cell wall
4- Translocated in phloem as sucrose
5- Form sugar in nectar

6 - Glucose + Nitrate —> Amino acid needed for protein formation and growth , and DNA /ATP
—> Stunted Growth - lower / older turn yellow and pale

7- Glucose + Mg + nitrate —> chlorophyll formation
—> Chlorosis leaf turn yellow form bottom up

8- Potassium —> needed for enzymes of respiration and photosynthesis —> turn yellow with dead spots

9- Phosphate —> making DNA and ATP —> resulting in in poor growth and leaves turn purple



0.8 g	calcium nitrate
0.2 g	magnesium sulfate
0.2 g	potassium nitrate
0.2 g	potassium dihydrogenphosphate
(trace)	iron(III) phosphate

Experiment to prove that CO2 , light and chlorophyll are essential for photosynthesis

Destarching (leave the plant in dark room for 24/48 Hours To make sure that all starch is consumed and that any starch found is produced during the experiment

Light —> Cover part of leaf

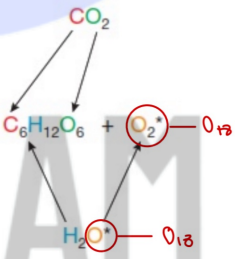
CO_2 —> Soda lime (absorb CO_2)
—> Hydrogen carbonate (release CO_2

Chlrorophyll —> Variegated leaves

Test for starch

1- Boil the leaf —> denature membrane and waxy cuticles
2- Heat with ethanol —> dissolve chlorophyll that mask colour change I2 solution
3- soften the leaf in cold water
4- add I2 solution

- Photosynthesis —> starch —> Blue black
- No photosynthesis —> no starch —> Yellowish brown

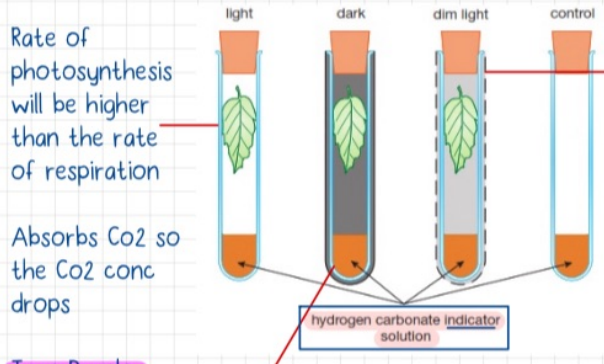


(*oxygen labelled with ^{18}O)

Label the oxygen in water with a radioactive isotope By examining the released oxygen it was radioactive

So water is the source oxygen released

Investigate the effect of light on GAS exchange by leaf



Rate of photosynthesis will be higher than the rate of respiration

Absorbs Co2 so the Co2 conc drops

Turn Purple

Rate of respiration is equal to the rate of photosynthesis So the Co2 conc. Will remain constant

Remain Orange

Rate of respiration will be higher than the rate of photosynthesis so the leaf will release Co2 so the Co2 conc. Increase . Turn Yellow

3 EXp Light intensity , Co2 Concentration Temperature are limiting factors

Limiting factors environmental factors that when found in a short supply restrict a life process
(when increase it I also increase the rate of life process)

Light intensity , Carbon dioxide Concentration and Temperature

Why is counting the no. Of oxygen bubbles inaccurate

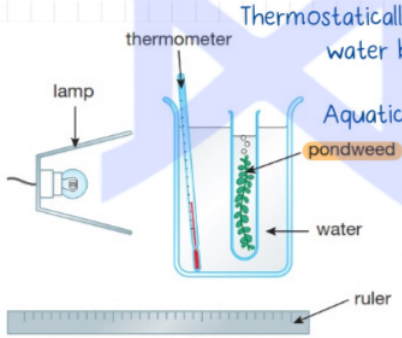
1- miscount
2- Bubbles may not be of the same volume

Gas syringe

Temperature
Thermostatically controlled water bath

Light intensity
Changing / keeping the distance between the light source and the aquatic plant

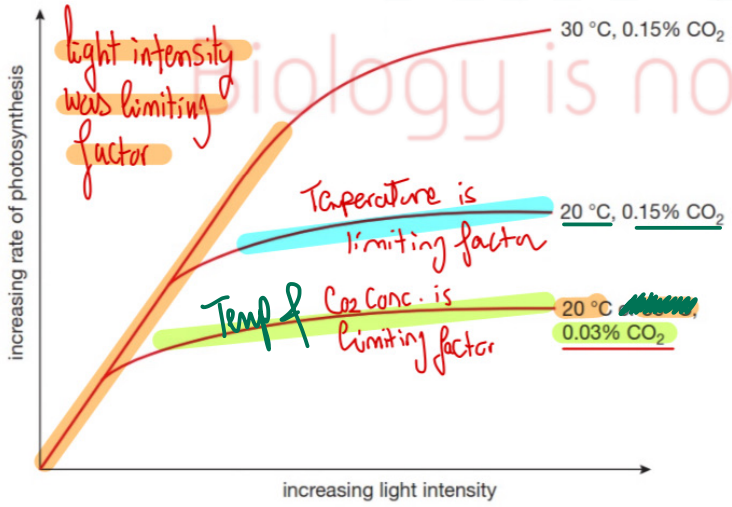
Co2 Concentration
By adding sodium hydrogen carbonate



Light intensity differs according to the distance between the plant and the light source

Dissolved Sodium hydrogen carbonate as a source of Co2

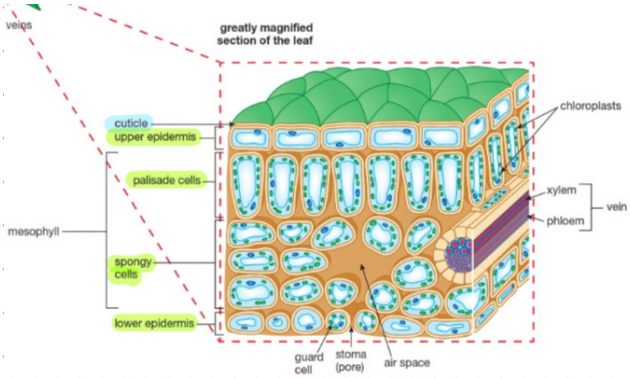
Rate of photosynthesis?? Volume of collected Oxygen (gas syringe) / Time



Rule No —> If the line is increasing then the limiting factor is on the axis

Rule No 2 —> when line level off the limiting factor is what's in short supply

Structure of stem , root and leaves



Upper epidermis
- secrete waxy cuticle —> reduce water loss by evaporation
- Transparent —> to aLLOW passage of light
- One cell thick —> shorter diffusion distance
- Barrier to prevent the enterance of pathogen

Palisade mesophyll
- packed with chloroplast to perform photosynthesis
- Rectangular shape / perpendicular to epidermis (packed under the epidermis)

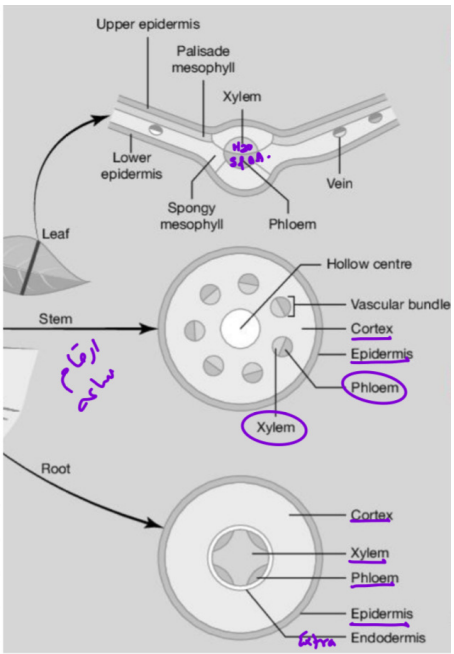
spongy mesophyll
- loosely packed and contain air spaces that allow the diffusion of gases within the leaf
- packed with chloroplast to perform photosynthesis

lower epidermis (same as upper epidermis)

Stomata (pores allow the exchange of gases between the leaf and the environment)

Guard cell (control the opening and closing of stomata)
- Turgid (open). - flaccid (close)

Arrangement of xylem and phloem in leaf stem and root



Adaptation of xylem vessels

Function —> Transport water and mineral ions through the stem

—-> Support the stem

Adapted

- Loss of end walls —> Less resistance
- Loss of protoplasm —> .to water flow
- Deposition of lignin —> prevent xylem from collapsing , strength
- Unlignified pits —> to allow passage of water

Transpiration

Loss of excess water vapor by evaporation from the walls of mesophyll cell and then diffuse out of stomata

Forces that help in ascend of water

Transpiration pull —> was water transpire create a negative pulling force as water potential drops in leaf - water ascend against gravity

Cohesive force - force between water molecule help to keep a continuous water column

Adhesive force —> force between water molecule and xylem wall

Factors affecting the rate of transpiration

* Temperature

As temperature increase molecules Gaines kinetic energy and diffuses faster

* Light intensity

As light intensity increase so more stomata are open so more evaporation

* Wind speed

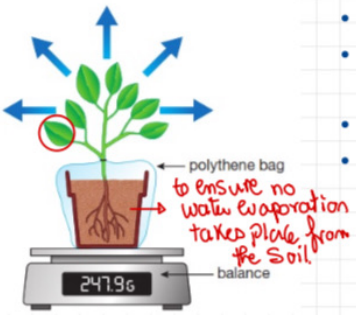
Maintain diffusion gradient as it removes evaporating water

* Humidity

Accumlation of water vapor so less steep diffusion gradient

Measure the rate of transpiration using Potometer

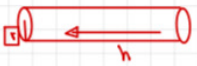
Weight potometer

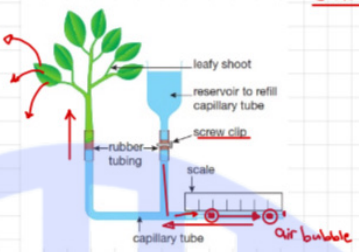


- Weight that plant
- Expose it to the environmental factor that being tested
- Rewight the plant
- Change in plant weight indicates that amount of water lost by evaporation

Volumetric potometer

Rate of transpiration = 98% of water uptaken

$\frac{\text{distance by air bubble}}{\text{time}} \rightarrow$  $= \frac{\pi r^2 h}{\text{time}}$

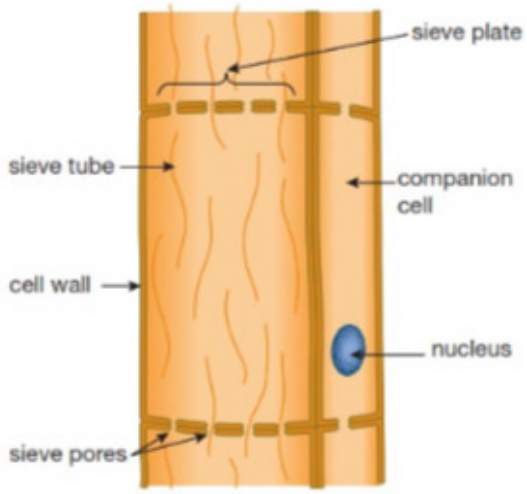


1- assemble under water to prevent enterance of air
2- seal rubber tube to prevent enterance of air
3- keep horizontal
4- reservoir contains water

- prevent air bubble from reaching plant
- Reset meniscus back to staring point

Phloem

1- perforated end walls know as sieve plates
2- Sieve tubes that contains cytoplasm 3- each Sieve tube is connected to companion cells
4- No lignin deposition
5- Phloem translocates sucrose and amino acids in both direction



Reproduction

is the making of new offspring of the same species

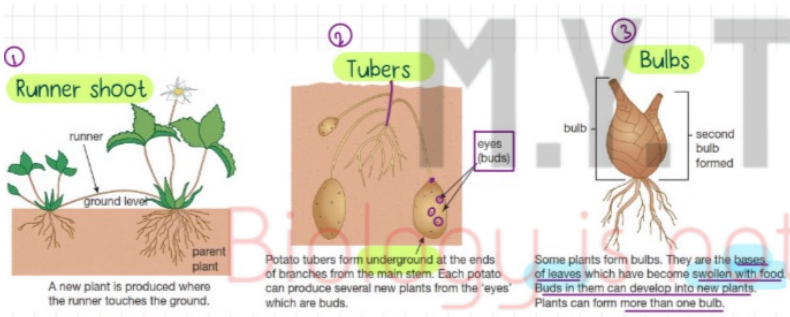
Feature of the process	Sexual reproduction	Asexual reproduction
gametes produced	yes	no
fertilisation takes place	yes	no
genetic variation in offspring	yes	no
has survival value in:	changing environment	stable environment

Advantage of sexual reproduction
S —> higher chance of survival
a. —> higher chance of adaptation
V —> sexual reproduction results in variation
E. —> less risk of extinction

Advantage of asexual reproduction
No need to find mate - only one parent is needed
Less energy consumed - result in more offspring

Fertilisation —> its the fusion of the male gamete haploid (nucleus carry only a single set of chromosome) nucleus with the female gamete haploid nucleus to form a diploid (nucleus carry a full set of chromosomes) zygote

Asexual reproduction in plant



Disadvantages
Lack of dispersal
More competition for nutrients and water in soil
Lack of variation resulting in less adaptation so less survival

4-Cutting
—> artificial way of asexual reproduction —> human intervention
Cut of a healthy plant —> place in soil —> compost (essential minerals and hormones needed for plant growth) —> grow to provide an identical offspring
Disadvantages
Lack of variation resulting in less adaptation so less survival

Sexual reproduction in plant

Pollination its the transfer of pollen from anther to stigma
Self pollination pollen is transferred from the anther to the stigma of the same flower on the same plant

Advantages
-NO pollinator is needed. - Less pollen is lost

Disadvantage
- less Variation - less adaptation

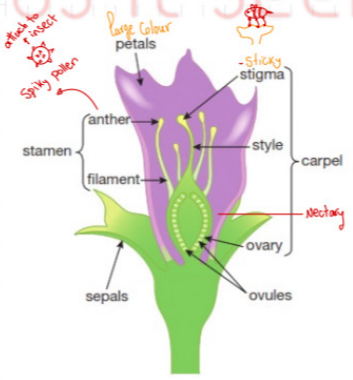
Cross pollination pollen is transfer from the anther to the stigma of a different flower on a different plant

Advantage
- More Variation. - More adaptation

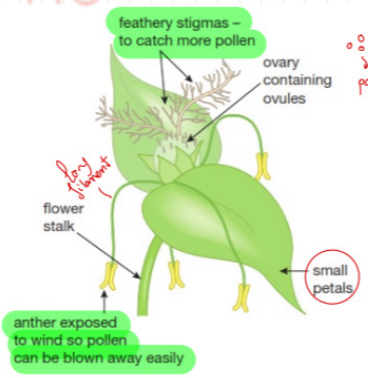
Disadvantages
• pollinator is needed • More pollen is lost

What are the two types of cross pollination (according to the pollinator)

Feature of flower	Type of flower	
	Insect pollinated	Wind pollinated
position of stamens	enclosed within flower so that insect must make contact	exposed so that wind can easily blow pollen away
position of stigma	enclosed within flower so that insect must make contact	exposed to catch pollen blowing in the wind
type of stigma	sticky so pollen grains attach from insects	feathery, to catch pollen grains blowing in the wind
size of petals	large to attract insects	small
colour of petals	brightly coloured to attract insects	not brightly coloured, usually green
nectaries	present – they produce nectar, a sweet liquid containing sugars as a 'reward' for insects	absent
pollen grains	larger, sticky grains or grains with hooks, to stick to insects' bodies	smaller, smooth, inflated grains to carry in the wind



▲ Figure 13.3 The main structures in an insect-pollinated flower.



▲ Figure 13.4 The main structures in an wind-pollinated flower.

Seed germination
W —> warmth to provide optimum .pH for enzyme
O —> oxygen for aerobic respiration
W —> water as a genera solvent and activate enzyme

FERTILISATION

Pollen grain contains two nuclei —>pollen to absorb water and gets activated—>
One nucleus starts to form the pollen tube down the style by releasing digestive enzymes —>till it reach the ovary through an opening called micropyle it enter the ovule and then to the ova cell (egg cell)

The second nucleus starts to descend down the formed pollen tube and fuse with the haploid nucleus of egg cell to from diploid zygote

OVUM / EGG CELLS/ OVULE —> FORMS THE SEED
OVARY —-> FRUIT

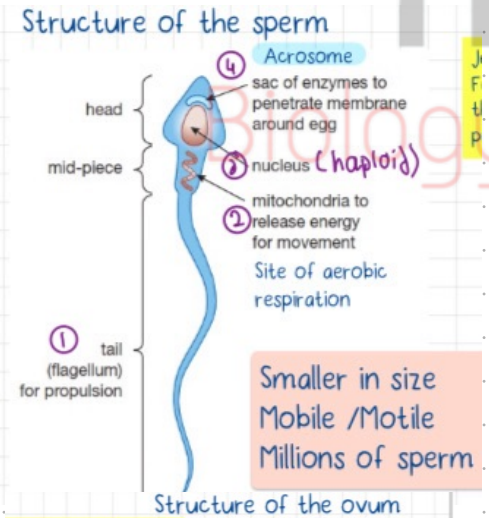
ASEXUAL REPRODUCTION IN ANIMAL/bacteria

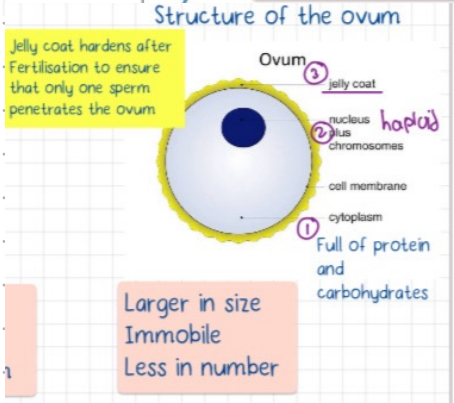
1- Budding —> cells in the body wall divide to form a small version of the adult

2- Binary fission —> Bacteria grows large and split into two identical daughter cells

Sexual reproduction in human

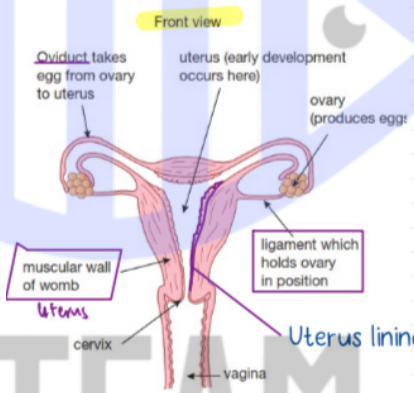
Formation of gamete —> meiosis
Haploid gametes fuse with each other to form zygote
Zygote divide by mitosis to form embryo implantation in uterus

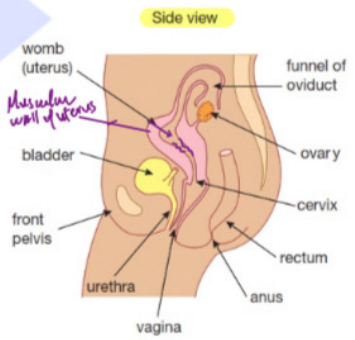




Female reproductive organs

Ovary —> 1- production of female gametes (egg cell or Ovum) (Meiosis) —> 2- release Oestrogen Hormone (2ry sex characteristics)
—> 3- Site of formation of corpus luteum (releases progesterone)
Oviduct (fallopian tube) —> Site of Fertilisation (1st third of the oviduct) —> It has cilliated cells that push the fertilized egg cell to be implanted in the uterus
Uterus lining —> where implantation of fertilized egg cell/ ovum takes place —> placenta depvelopes
Muscular wall —> contracts during delivery to help push the fetus out the uterus
Uterus —> where the embryo develpes
Cervix —> ring of muscles that contract to hold the fetus during pregnancy and relaxes during delivery
Vagina formed of
—> connective / elastic tissue —> to receive the sperm
—> stretches during delivery

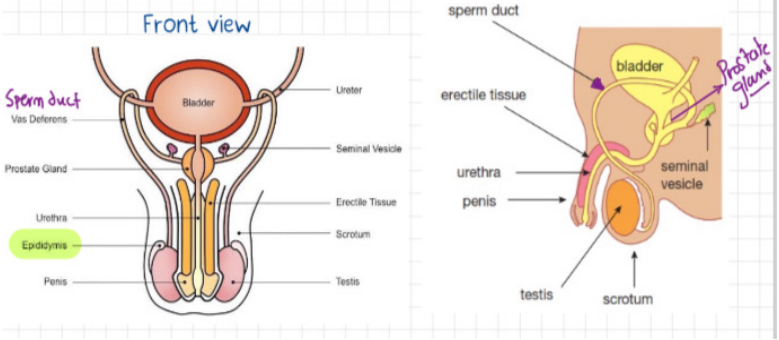




Male reproductive organ

Testis —> site of male gamete formation (sperm) by meiosis division —> site of production of testosterone hormone (2ry sex characters)
Epididymis —> store the sperm
Scrotum sac —> Holds the testes outside the body to provide optimum Tempertaure for sperm production and storage
Sperm duct or vas difference —> carries the sperm to the urethra
Seminal vesicles / Prostate gland —> releases a fluid
It provides a liquid medium for the movement of the sperm
It nourishes the sperm (glucose for aerobic respiration and ATP for swimming)
It neutralizes the .pH of the urethra so its optimum for the sperm
Urethra —> its a common opening for semen and urine
Penis that has erectile tissue to be able to enter the Vagina and ejaculat and release semen in the vagina

Male reproductive organ



Internal Fertilisation

1-Penis is inserted in the vagina during sexual intercourse and ejaculate
2- Release the semen in the vagina
3- Sperm starts to swim till reach the 1st third of the oviduct
4- sperm release digestive enzyme from the acrosome that help penetrate the ovum membrane
5- Fusion between the male gamete haploid nucleus with the female gamete haploid nucleus to form a diploid zygote
6- the jelly coat hardens preventing the enterance of another sperm
7- Zygote starts to divide by mitosis to become a ball of cells
8- the ball of cells gets pushed by the cilia in the oviduct
9- to be implanted in the uterus wall
10- Placenta / umbilical cord and amniotic sac starts to form

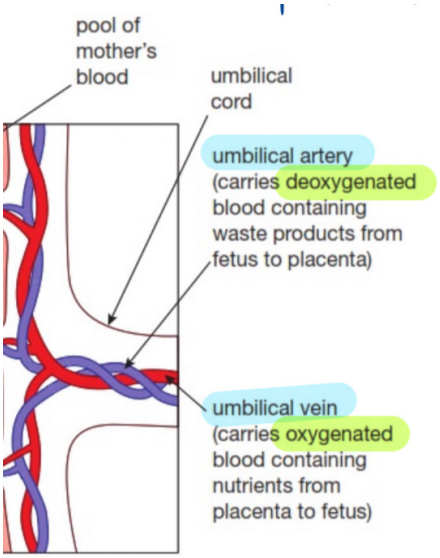
Placenta , umbillical cord , amniotic sac

Placenta

1- Site of exchange of nutrient and gases between the fetal blood and maternal blood by diffusion (fetal gets glucose , oxygen and amino acid and delivers waste as Co2 and urea to maternal blood)
2- No mixing takes place between maternal and fetal blood
A- to protect the fetus against the maternal pressure B- to protect the fetus against the mothers immunity 3- Release progesterone that maintains pregnancy as it maintains uterus lining thickness and vascularity of uterus
4- Site of physical attachement

What's the importance of the presence of microvilli in the placenta ?
Increase the surface area for exchange between maternal and fetal blood

Umbillical cord



Amniotic sac

Secrete Amniotic fluid

1- Protects the baby against mechanical shocks
2- Free movement of fetus
3- Sterile - Optimum Temperature

Delivery

Cervix dilate
Muscular wall of uterus contacts
Amniotic sac rupture
Amniotic fluid is release

Vagina stretch
Baby pass out head first through vaginal

Cut the umbilical cord and tie it
Placenta is expelled through the vagina
Afterbirth

Puberty these changes that are controlled by hormones that indicates sexual maturity

In boys	In girls
sperm production starts	the menstrual cycle begins, and eggs are released by the ovaries every month
growth and development of male sexual organs	growth and development of female sexual organs
growth of armpit and pubic hair, and chest and facial hair (beard)	growth of armpit and pubic hair
increase in body mass; growth of muscles, e.g. chest	increase in body mass; development of 'rounded' shape to hips
voice breaks	voice deepens without sudden 'breaking'
sexual 'drive' develops	sexual 'drive' develops
	breasts develop

Menstrual cycle

Menstruation

Pituitary gland

Brain.

FSH

Follicle stimulating hormone

1

Stimulate The formation and growth of a follicle inside The ovary

└ Ball of cells that Contain egg cell

2 LH

Lutenising hormone

Ovulation → release of mature ovum from the follicle inside the ovary. The follicle becomes corpus luteum

14

Ovary

2 OEstrogen

Increase the vascularity and thickness of uterus lining and it inhibit the release of FSH it stimulate the release of LH

3 Progesterone

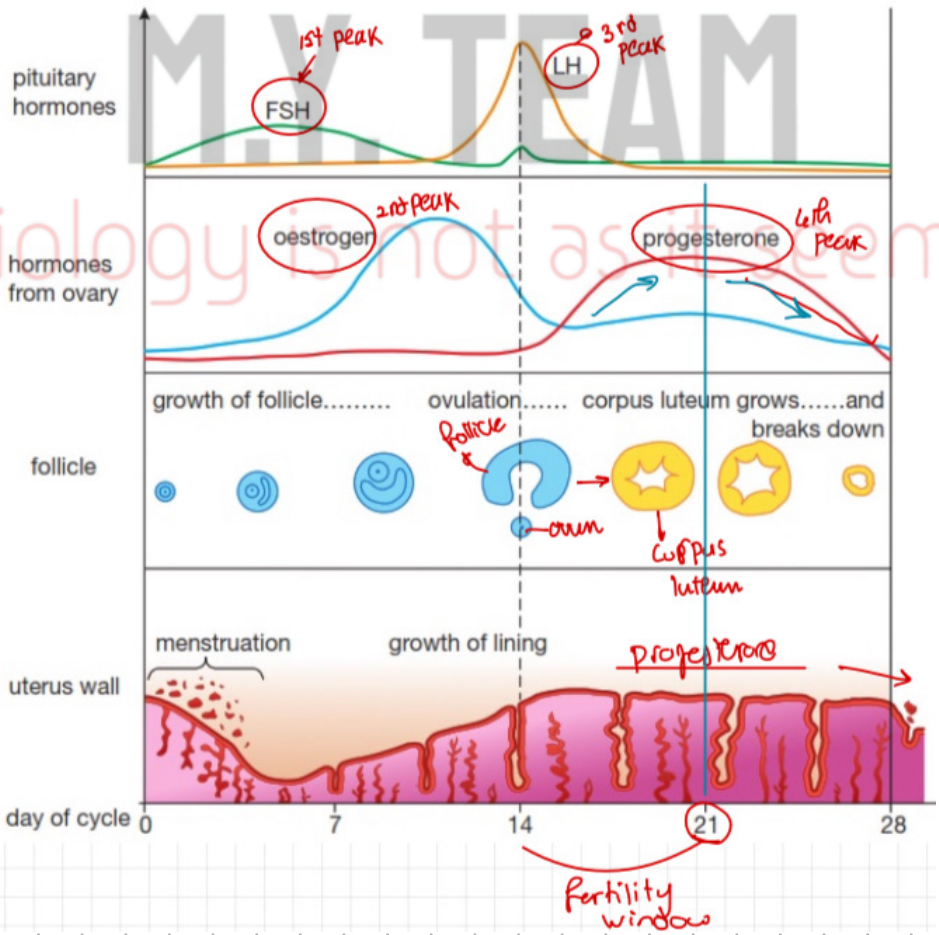
Completes the development of uterus lining and maintain it. Inhibit the release of FSH and LH

21

progesterone level drop

14

28



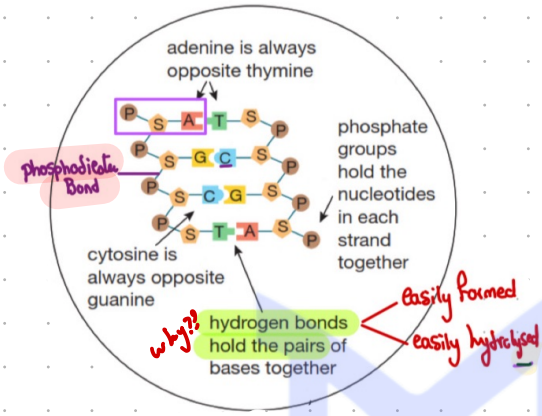
Inheritance

Chromosome —> Threads of DNA coiled around histone
Gene —> length of DNA that code for protein

Structure of DNA
- Nucleotide

Phosphate group attached to Pentose sugar that attached to nitrogenous base

Double stranded helix of repeated nucleotide



4 types of Nitrogenous DNA
Adenine - thymine A - T
Guanine - cytosine C - G

DNA	RNA
Double stranded	Single stranded
Long	Short (uracil)
A,T,C,G	A, U , C , G
Deoxyribose	Ribose

DNA replication

- DNA unwind
- DNA helicase break down bond between complementary bases
- DNA polymerase use each DNA strand as a tempelate
- Start adding complementary neucleotides
- forming a new complementary DNA Strand

Genetic code

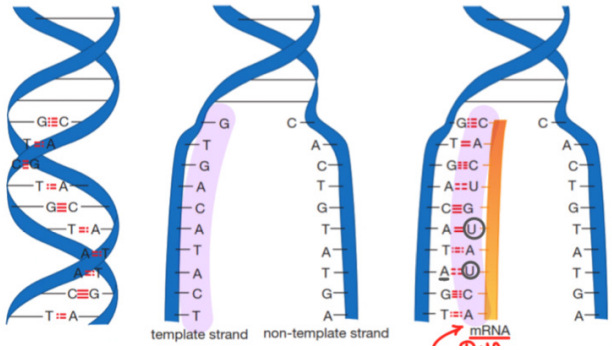
Each 3 bases form a code that codes for a specific amino acid

20 amino acid I need a minimum 20 code

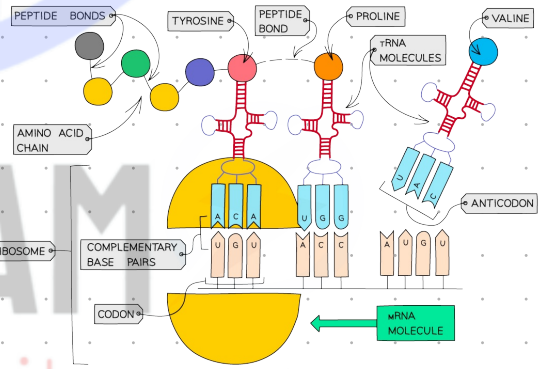
$4^1 = 4$ $4^2 = 16$ $4^3 = 64$

Protein synthesis

- Transcription
- DNA unwind
- RNA polymerase transcribe the template by using RNA polymerase forming mRNA

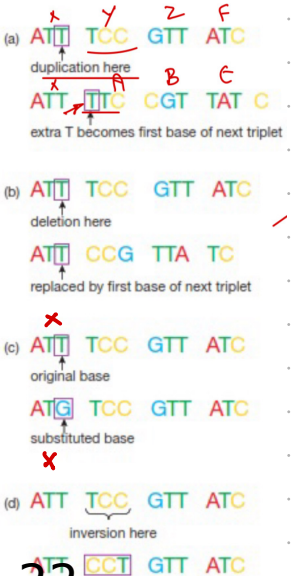


Translation
- mRNA go to the cytoplasm
- Bind to the ribosome
- tRNA fetch amino acid
- ,tRNA anticodon complementary to the codon on mRNA
- This process continuous till it hit a stop codon



Mutagen
- chemicals
- Radiation

Mutation its a random change in the base sequence of DNA resulting in a an altered protein.



Frame shift
All the codes that comes after mutated point will be altered which will result in an altered sequence of amino acids which will result in an altered protein

The effect comes down to only one code

The new code codes for a different amino acid so this will result in an altered protein

The new code codes for the same amino acid so this will result in the same protein
Silent mutation

Inheritance problem

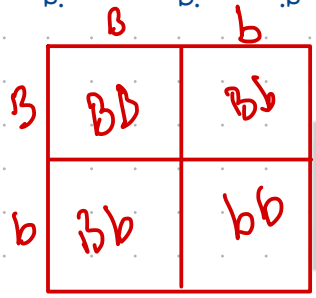
Alleles —> alternative forms of the same gene
Dominant allele —> allele that's always expressed if present
Recessive alleles —> allele that's only expressed in absence of dominant allele
Diploid —> nucleus that carry a full set of chromosomes
Haploid —> nucleus that carry only one set of chromosomes
Phenotype —> expressed characteristic on a living organism
Genotype —> is the genetic make up of the cell
Homozygous —> nucleus is carrying similar alleles of the same gene
Heterozygous —> nucleus is carrying different alleles of the same gene

Idea —> 1

Two black rabbits got a white rabbit

- Both parent rabbits were carriers

Bb. Bb
B. b. B. b



3 black : 1 white

Idea 2

Parents of unknown gentotupe
Offspring

- 3:1 —> Bb X Bb
- 1:1 —> Bb X bb

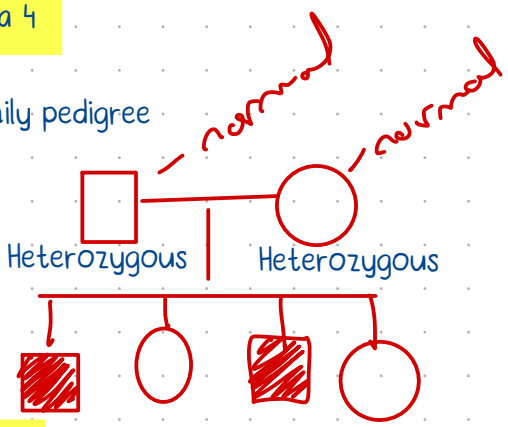
Idea 3

Test cross
Unknown dominant genotype ????

- mating with recessive genotype
- Offspring 100 % dominant —> homozygous BB
- Offspring 50% dominant / 50 % recessive —> Heterzygous Bb

Idea 4

Family pedigree



Idea 5

Male —> XY Female —>XX

Male control gender of the baby has both the X or the Y chromosome

Idea 6

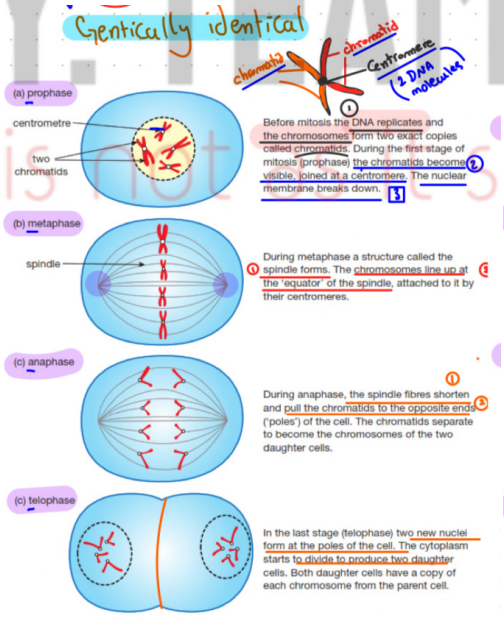
Codominance —> two traits both fail to dominant over each other so both are expressed in phenotype resulting in an intermediate trait

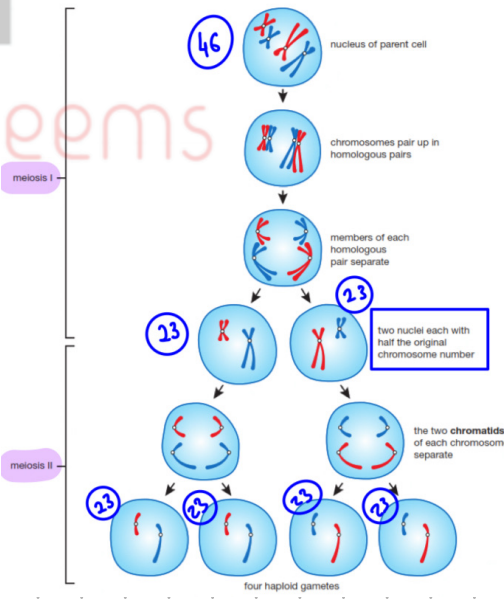
Red flower
RR

White flower
WW

Pink FLower
RW

Mitosis and meiosis





FEATURE OF THE PROCESS	MITOSIS	MEIOSIS
Chromosomes are copied before division begins (DNA Replication)	Yes	Yes
Number of cell divisions	One	Two
Number of daughter cells produced	Two	Four
Daughter cells are haploid or diploid	Diploid	Haploid
Genetic variation in the daughter cells	No	Yes

Variation —> difference found within the Same species

Natural selection

- Mutation leads to variations
- Exposed to selection pressure
- Group have a selective advantage
- They survived and reproduce
- Pass on the advantageous alleles

Artificial selection

- select the living organism with the desired trait
- Allow it to mate
- Select the offspring with the desired trait
- Repeat for several generation

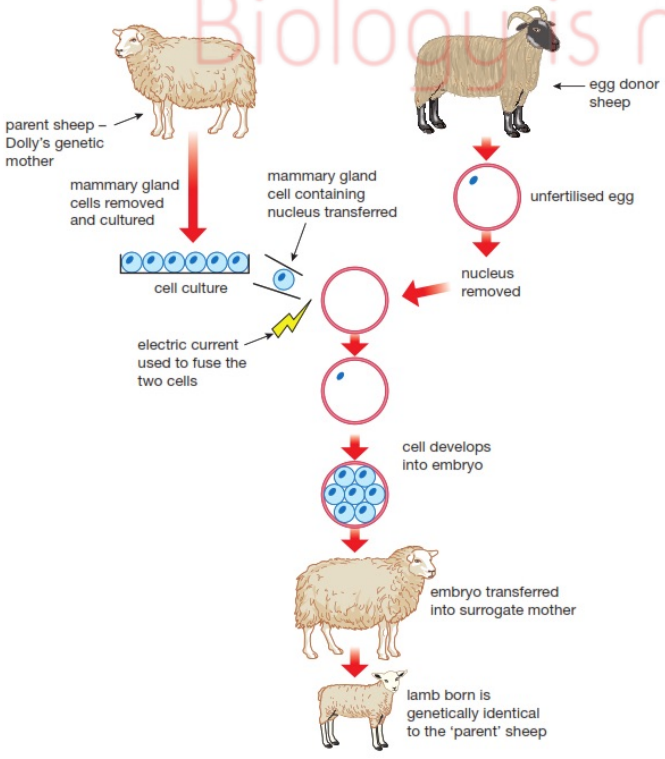
Plant

- give higher yields
- are resistant to certain diseases (the diseases would reduce the yields)
- are resistant to certain insect pest damage (the damage would reduce the yield)
- are hardier (so that they survive in harsher climates or are productive for longer periods of the year)
- have a better balance of nutrients in the crop (for example, plants that contain more of the types of amino acids needed by humans).

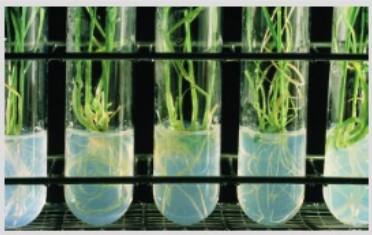
Animal

- produce more meat, milk or eggs
- produce more fur or better quality fur
- produce more offspring
- show increased resistance to diseases and parasites.

Cloning

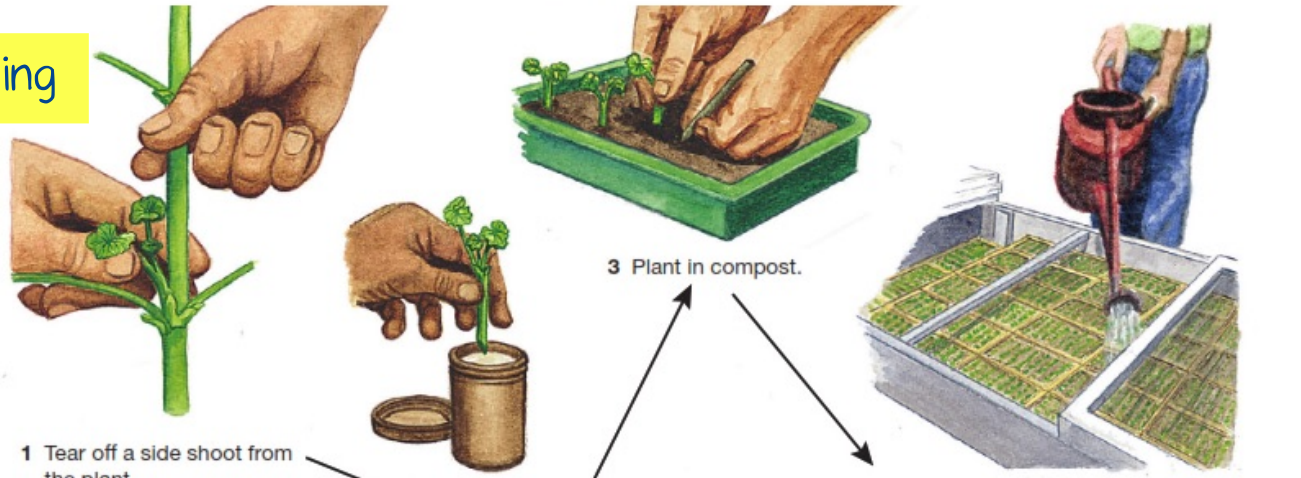


Micropropgation

STAGES	ILLUSTRATIONS
The tips of the stems and side shoots are removed from the plant to be cloned. These parts are called **explants**. The explants are trimmed to a size of about 0.5–1 mm, and surface-sterilised to kill any microorganisms. They are then placed in a sterile agar medium that contains nutrients and plant hormones to encourage growth (Figure 20.6). More explants can be taken from the new shoots that form on the original ones. This can be repeated until there are enough to supply the demand.	 ▲ Figure 20.6 Explants growing in a culture medium.
The explants with shoots are transferred to another culture medium containing a different balance of plant hormones to induce root formation (Figure 20.7).	 ▲ Figure 20.7 Explants forming roots.
When the explants have grown roots, they are transferred to greenhouses and transplanted into compost (Figure 20.8). They are then gradually acclimatised to normal growing conditions. The atmosphere in the greenhouse is kept very moist to reduce water loss from the young plants. Because of the amount of water vapour in the air, they are often called 'fogging greenhouses'.	 ▲ Figure 20.8 Young plants being grown in compost in a greenhouse.

- large numbers of genetically identical plants can be produced rapidly
- species that are difficult to grow from seed or from cuttings can be propagated by this method
- plants can be produced at any time of the year
- large numbers of plants can be stored easily (many can be kept in cold storage at the early stages of production and then developed as required)
- genetic modifications can be introduced into thousands of plants quickly, after modifying only a few plants.

Cutting



Q1- Define

- Ecosystem —> self sustained unit between (all) biotic (Living component) and abiotic (non living component)
- Habitats —> place where an organism live (food . Water . Shelter)
- Population —> Group of a particular species living in the same area at the same time
- Community —> the population of all species found in an ecosystem at a particular time

Q2- Definition of biodiversity THe amount of variation shown by species in an ecosystem

- species richness (number of species in an ecosystem)
- Species abundance (distribution and no. Of organisms in the ecosystem)
- Variation shown by the species

Q3 How to assess the biodiversity

- Divide the land using line transect
- Random number generator to generate random coordinate
- Throw the quadrat
- Identify the no of species (species richness)
- Identify population and distribution of species (species abundance)

Feeding relationship

Q1- Food chain —> its a diagram that represent the flow of energy between different living organism

Q2 - food web —> interacting food chain

Q3- which result in in more accurate representation ?

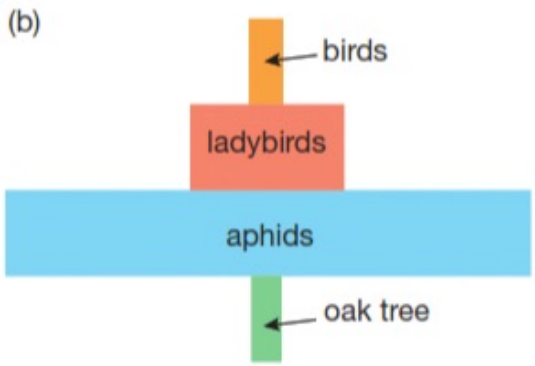
Food web as it shows multiple predators and prey of a single organism

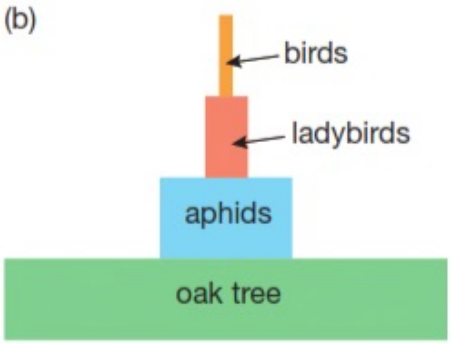
Q4 Define

- Producer —> Synthesis Complex organic material from raw material using light energy
- Consumer —-> Depend on other living organisms for food
- Herbivore —> feed on plants
- Carnivore —> feed on other animals
- Tropic level —> the roles / position of a living organism in a food chain

Q5 Disadvantage of plotting the food chain in a pyramid of no. Rather than in a pyramid of biomass ?

- it doesn't put in consideration the dry mass of an organism
- If the producer is large in dry mass the pyramid is inverted

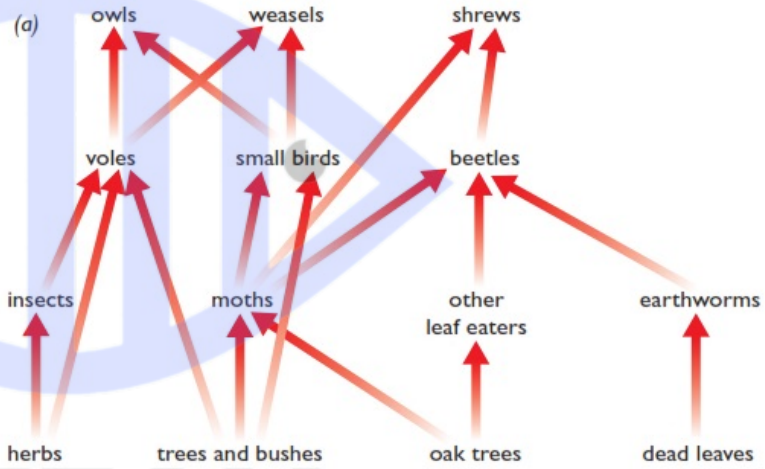




Q6-a- How many food chains in the food web ?

B- living organism with two trophic level? Small birds

C- why energy get lost between different trophic level ?



- between sunlight and producer

1- some of light energy doesn't fall on photosynthesis parts

2- Not all light colour are absorbed

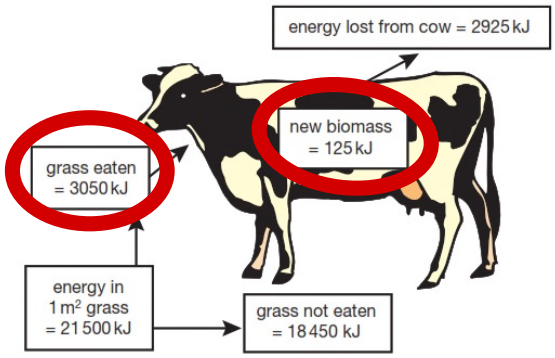
- Between consumer and consumer

1- some energy is lost as heat energy during respiration

2- not all parts are eaten

3- not all eaten parts are digested (some energy lost in excretion)

In a year, 1 m² of grass produces 21 500 kJ of energy. The diagram below shows the fate of the energy transferred to a cow feeding on the grass.



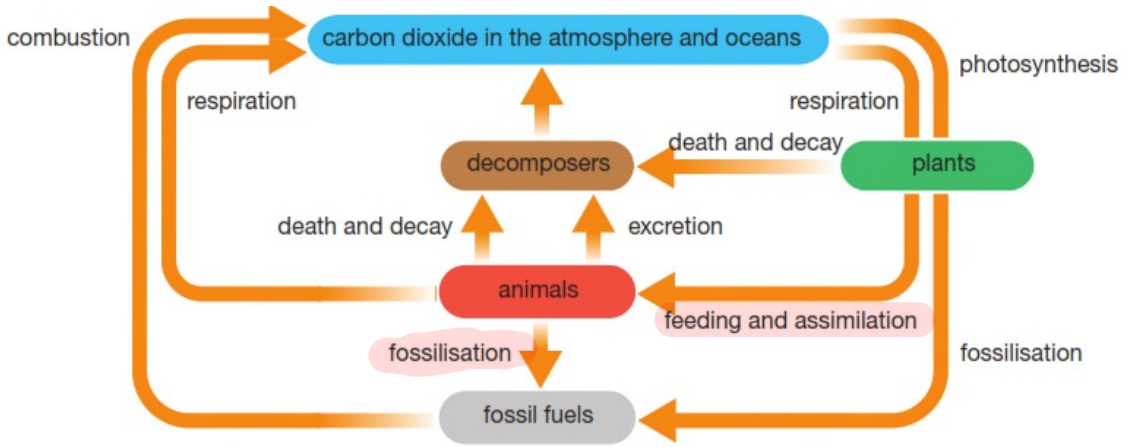
a Calculate the energy efficiency of the cow from the following equation.

$$\text{Energy efficiency} = \frac{\text{energy that ends up as part of cow's biomas}}{\text{energy available}} \times 100$$

125/3050 X 100 = 4.1 %

Cycles —> label

Carbon cycle
Photosynthesis
Decomposition
Respiration
Combustion



Nitrogen Cycle

- Nitrogn fixing bacteria

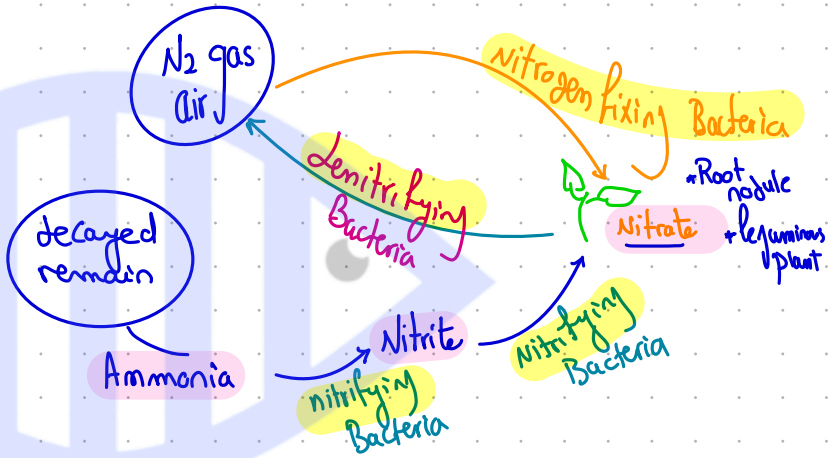
Nitrogen fixation
Take N2 directly from air

- Nitrifying bacteria

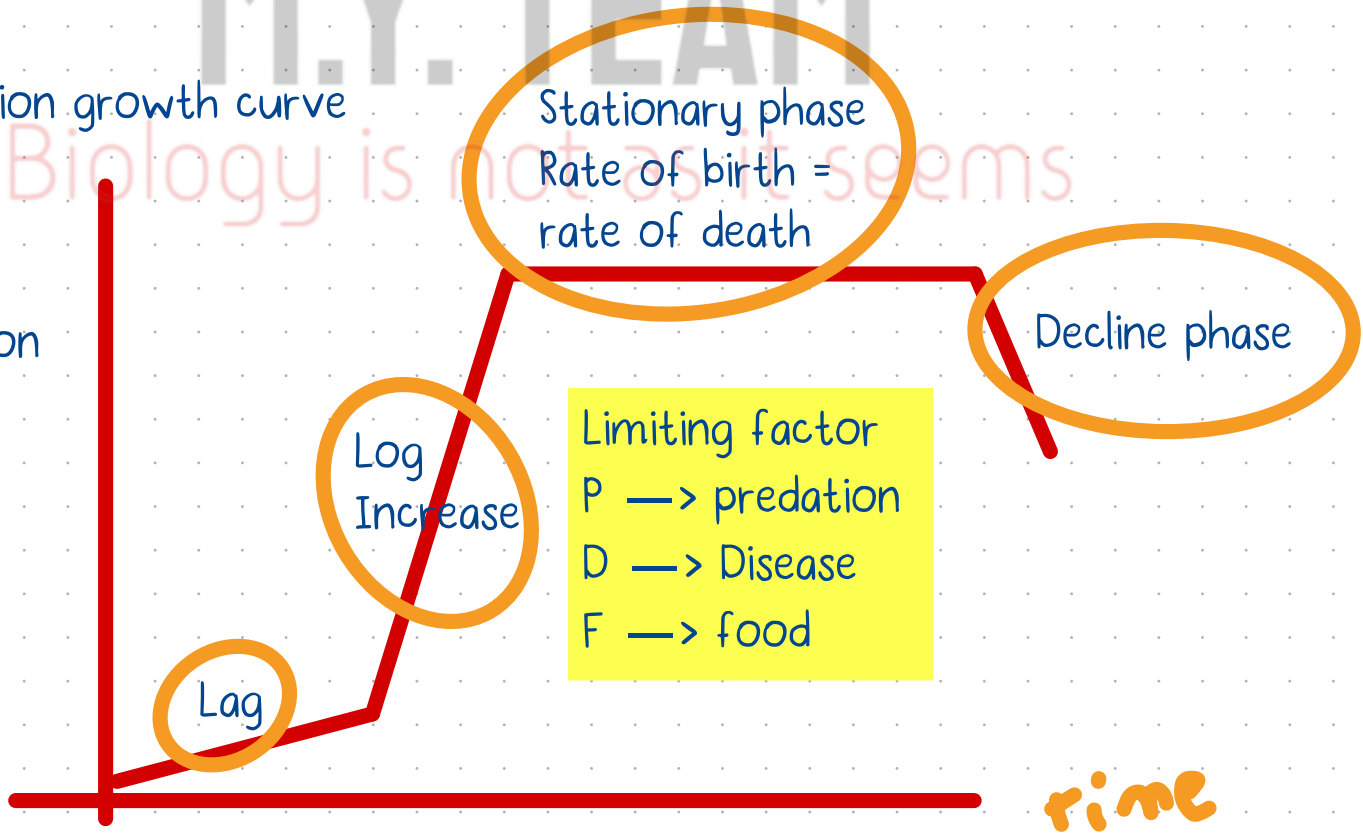
Nitrification
Convert ammonia (soil) to nitrite and then nitrate

- Denitrifying

Denitrification
take nitrogen back to the air



Population growth curve



Modern agriculture

Q1- how glass houses contributed to the increase in modern agriculture ?

Factor controlled	How it is controlled	Reason for controlling the factor
soil ions (e.g. nitrates)	adding fertilisers to the soil or growing in a hydroponic culture (Figure 15.4a)	extra mineral ions can be taken up and used to make proteins and other compounds for growth
soil structure	ploughing fields to break up compacted soil; adding manure to improve drainage and aeration of heavy, clay soils	good aeration and drainage allow better uptake of mineral ions (by active transport) and water
soil pH	adding lime (calcium salts) to acidic soils; few soils are too alkaline to need treatment	soil pH can affect crop growth as an unsuitable pH reduces uptake of mineral ions
carbon dioxide, light and heat	these cannot be controlled for field crops but in a glasshouse or polytunnel all can be altered to maximise yield of crops (Figure 15.4b); burning fuels produces heat and carbon dioxide	all may limit the rate of photosynthesis and the production of the organic substances needed for growth

Q2- Compare Biological control to pesticide (chemical control) of pests

Pests —> organism that reduce the yield of a crop

Biological control of pests —> natural predator of the pest

- natural predator
- Herbivore feed on the weed
- Parasite
- Pathogenic microorganism
- Introduce sterile / infertile male
- Use pheromones to attract pest to trap

Chemical control of pests —> spray pesticides

- Bioaccumlation —. Build up in tissue of an organism
- Biomagnification —> build up become more concentrated along the food chain
- Cause death to harmless insect
- Pests may become resistant to pesticides
- Need to reapply / expensive

Human impact on ecosystem

Q1- causes of deforestation

Removal of trees to build for agriculture or for timber

Q2- negative impact of deforestation

- Destruction of habitat
- Loss of biodiversity
- Some species may go extinct
- Increase in CO2 resulting in global warming
- Reduce in soil fertility / soil erosion(roots of tree is what hold the soil)
- Many species of plant may go extinct result in less use in medicinal drugs
- May result in climate change as it affect the water cycle

Q3- what are the green house gases and what's is their effect on the earth temperature ?

Co2 , methane . CFC —> trap IR radiatioans and prevent their escape result in in the increase in the Earth's atmospheric temperature

Q4- negative impact of global warming

- Polar ice cap melts
- Flooding and drought
- Change in global rainfall pattern
- Loss of habitat
- Migration of animals
- Loss of biodiversity

Source of
Co2 —> combustion of fossil fuel
Methane
- landfill
- Fermentation in cattle stomach
- fermentation of bacteria in rice field

Q5- Effect of acid rain on ecosystem

Acid is formed due to combination of NO2 and SO2 with rain water

- Soil slightly acidic
- Leaching os some ions into lacks resulting in eutrophication
- Kill microorganisms in soil
- Root hair lose it ability to absorb mineral ions
- Kill aquatic organism
- Destroy lime stone building

Q6 - Negative impact of Eutrophication on aquatic life

- Mineral ions / fertilizer leach into the river
- Algal Bloom
- And started screening sunlight from smaller algae
- Small algae die
- Decomposers start decomposing the algae and consuming O2 for respiration
- Fish suffocate

Q7 - Negative impact of dumping sewage in rivers

- sewage contains microorganisms
- Microorganisms consume oxygen
- Fish suffocate

Fish farming

Q1- How to sustain the population fish / fish farming ?

- Fish are kept in dense stack of net enclose in a river or lack
- diet of fish is monitored
- Oxygen for aerobic respiration
- Suitable temperature
- From predation
- Selective breeding programs
- Sort the fish by size and species

Q2- Disadvantage of fish farming

1- risk the spread of disease

2- pollution problem due to the waste produced

Negative impact on the wild fish stock

Biotechnology use of any organism to make useful products for humans

Use of yeast in alcohol formation

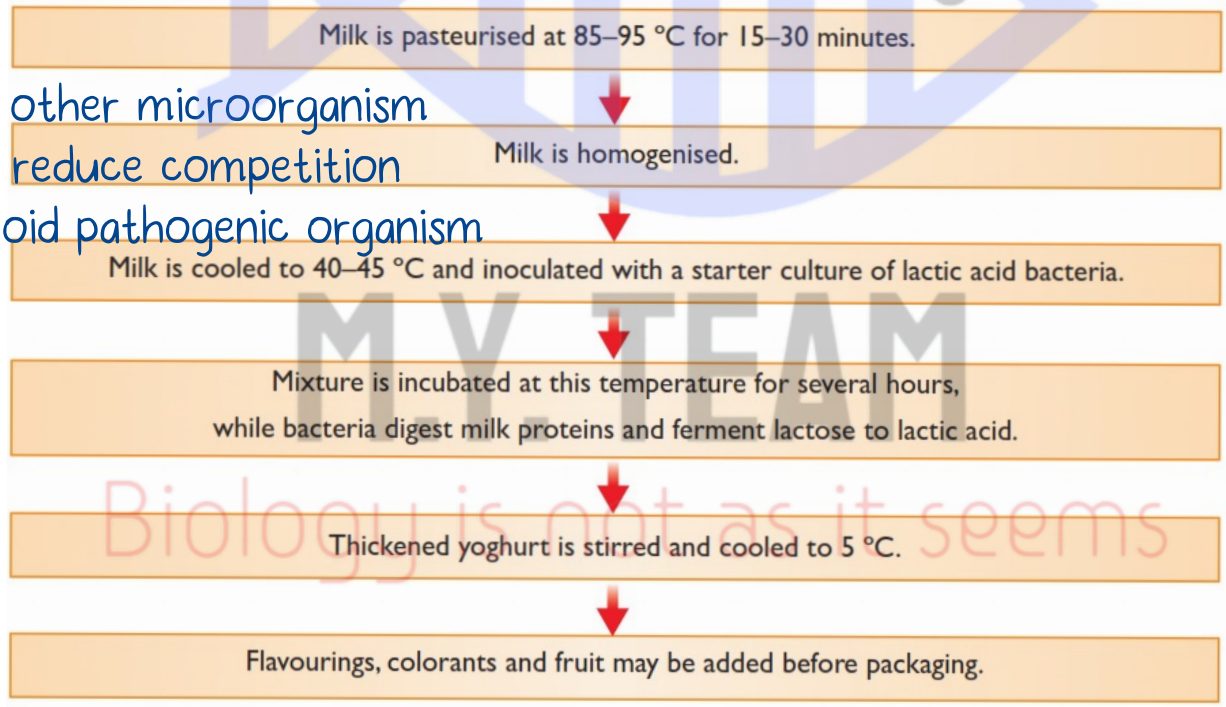
- Yeast added to grape juice
- Add boiled and cooled water and provide optimum temperature
- Set an air lock (force anaerobic respiration)
- Alcohol is produced that accurate and kill yeast

Use of yeast in bread making

- Yeast added to flour
- Add boiled and cooled water and provide optimum temperature
- Set an air lock (force anaerobic respiration)
- Co2 is produced make the dough rise
- Put in the oven (Kill the yeast - evaporate alcohol - expand Co2)

Use of lactobacillus and streptococcus in yoghurt formation

Kill other microorganism
To reduce competition
Avoid pathogenic organism



Fermenter Conditions

G —> GLucose for aerobic respiration
A —> Air / O2 for aerobic respiration
A —> Ammonia —> as a source of nitrogen for protein formation
S —> Suitable temperature —> water jacket —> enzyme don't denature
S —> suitable .pH —> buffer —> enzymes don't denature
S —> stirring —> distribute heat - Mix organism with food and air

Genetic engineering —>insert or alter a gene of microorganism so they code for a new product

Transfere of a desired gene to a bacteria

Extract a plasmid from the bacteria
Cut the plasmid and the desired gene with the same restriction enzyme to create complementary sticky end
Gene is inserted into the plasmid with Ligase enzyme to form recombinant DNA
That's inserted in transgenic (organism acquired a gene from a different species) bacteria

Uses

1- bacteria to synthesis Human insulin
2- Bacteria to synthesis Human Growth Hormone
3- Bacteria to produce hepatitis B virus antigen used in vaccination
4- Bacteria synthesis BOvine somatotropin

- Adv —> Increase milk yield and muscle mass in cows
- Disadv —> COw needs more food / increase cost

Transfere of desired gene to plant

- The same as above
- Bacteria (Agrobacterium tumefaciens) is allowed to infect leaf discs
- Leaf discs is left to grow in agar and nutrient develop into a whole plant carrying the gene

Gene Gun fire golden bullet coated with DNA that's insterted into nucleus

Uses

- Herbicide resistant
- Pest resistant
- Anti freeze
- B coratene vit A (rice) Golden rice
- Plant produce antibodies

Transfere a desired gene to animal

Extract Desired DNA
Inject it in the fertilized egg nucleus
Insert fertilized egg (embryo) into a surrogate mother
Result in offspring carrying desired gene

Uses

- Manufacturing of human protein
- Increase the production of a particular product
- Increae resistant to a disease
- Produce an organ for transplantation

Other uses of enzyme

- enzyme in washing powder
- Isomer are convert glucose into fructose (sweeter)