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BIOLOGY NOTES FOR IGCSE

By Sarah Jamil

Topic 1

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Classification

Classification is putting organisms into groups based on genus and species

M- movement
R- reproduction
S- sesitivity
G- growth
R- repiration
E- excretion
N- nutrition

Excretion- removal from organisms of toxic materials, waste products of metabolism, and substances in excess.

Nutrition- the taking in of nutrients which are organic substances and mineral ions, containing raw materials for growth and repair of tissues, absorbing, and assimilating them.

Magnification= size of drawing/ size of real obj

Topic 2

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Cells

Plant Cell	Animal Cell
Cell wall	No cell wall
Chloroplasts	No chloroplasts
Large vacuoles	Small vacuole
Starch grains	Glycogen granules
Regular shape	Irregular shape

Organelle- a structure within a cell
Tissue- Group of cells with similar structures
Organ- Structure made of a group of tissues
Organ system- Group of organs working together

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Movement in and out of cells

Diffusion- net movement of molecules 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.

Osmosis- the diffusion of water molecules from a region of their higher concentration to a region of their lower concentration, through a partially permeable membrane.

Active transport- the movement of ions in our out of a cell through the cell membrane from a region of their lower concentration to a region of their higher concentration, against a concentration gradient, using energy released from respiration.

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The chemicals of life

Carbs	Fats	Proteins
C,H,O	C,H,O	C,H,O,N
Made of monosaccharide's	Made of fatty acids and glycerol	Made of amino acids
Easily available (17kj/g)	Storage of energy (39kj/g)	Making cells, antibodies, enzymes, haemoglobin, etc
Sugars are soluble	Insoluble	Some are soluble, and some aren't

Test for reducing sugar

Cut food into very small pieces and add to a test tube with water.
Add benedict's solution, which is blue.
Heat the tube. A positive result will give a brick red colour.

Test for starch

Take a piece of food.
Add a few drops of iodine solution to it, which is brown.
A positive result will give a blue-black colour.

Test for fats

Chop some food and place in a dry test tube.
Add pure ethanol.
Add distilled water to another tube.
Add the fat solution to the distilled water.
A positive result will give a milky white solution

Test for protein

Put chopped food into a test tube, and add a little water.
Add some biuret reagent.
Shake the tube gently.
A positive result will give a purple colour.

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Enzymes

Enzyme- a biological catalyst

Properties of enzymes

1. Proteins
2. Made inactive by high temp
3. Work best at a particular temp
4. Work best at a particular pH
5. Catalysts
6. Specific

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Plant Nutrition

Nutrition- the taking in of nutrients which are organic substances and mineral ions, containing raw materials for growth and repair of tissues, absorbing, and assimilating them.

Photosynthesis- the process by which plants make carbs from raw materials and energy from light

Nitrogen	**Magnesium**
Nitrates or ammonium ions	Magnesium ions
Making proteins	**Making chlorophyll**
Weak growth, yellow leaves	**Yellow leaves**

Limiting Factors- sth present in such short supply it restricts life processes

1. Sunlight
2. CO_2
3. Temp
4. Stomata

Test for STARCH

Boil a leaf for 30 s
Drop it in a tube of alcohol till all the chlorophyll is removed
Dip it in hot water to soften it
Spread it out and put iodine on it, it will turn blue

Seeing if chlorophyll is needed for photosynthesis

Destarch a plant
Leave it in a warm sunny spot for a few days
Test one leaf for starch

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Animal Nutrition

Animals need

Carbs
Proteins
Fats
Vitamins
Minerals
Water
Fibre

Vitamin	Foods that contain it	Why it's needed	Deficiency Disease
C	Citrus fruits, raw vegetables	To make collagen, and keep tissues in good repair	Scurvy (muscle and joint pain and bleeding gums)
D	Butter, egg yolk, also made by skin	To help absorb calcium and make bones and teeth	Rickets (softening and deformation of bones)

Mineral	Foods that contain it	Why it's needed	Deficiency Disease
Calcium	Dairy products, bread	For bones, teeth, and blood clotting	Brittle bones and teeth, poor blood clotting
Iron	Liver, red meat, egg yolk, dark green vegetables	Making haemoglobin	Anaemia

Features of Small Intestine

feature	How it helps absorption rate
Long	More time for digestion to be completed
Has villi covered in microvilli	Large SA, more absorption
Villi have certain blood capillaries	Monosaccharide's, a.a, water, minerals, some fats, and vitamins pass into blood to be taken to liver and then to other places in the body
Villi contain lacteals	To absorb fats
Villi wall only 1 cell thick	Easier absorption

List of juices secreted in the alimentary canal

Mouth- Saliva, containing amylase
Stomach- Gastric juice, containing protease
Pancreas- Pancreatic juice, containing lipase, protease, and amylase
Duodenum- Bile, containing bile salts and pigments to emulsify fats

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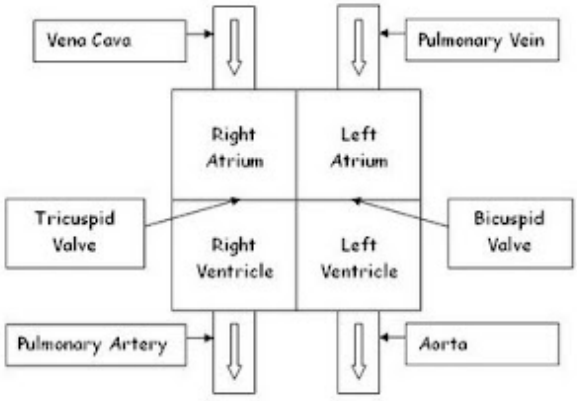
Transport in Animals

Double Circulatory System means that blood passes through the heart twice for every time it goes around the body.



Factors leading to heart disease

- Smoking
- Diet
- Obesity
- Stress

Cardiac Cycle

- Both atria CONTRACT(so aortic and semilunar valve CLOSE, and bicuspid and tricuspid valve OPEN) and pump blood into the respective ventricles, which RELAX
- Both atria RELAX(so aortic and semilunar valve OPEN and bicuspid and tricuspid CLOSE) to receive blood and the respective ventricles CONTRACT to pump it out
- RELAXING of a chamber is called SYSTOLE
- CONTRACTING of a chamber is called DIASTOLE
- After ventricles undergo SYSTOLE there is a short period where all chambers are in DIASTOLE

Structure	Wall	Width of lumen	Function	How structure fits function
artery	Thick and strong, containing muscles and elastic tissue	Narrow (varies with heartbeat)	Carry blood away from heart	Strength needed to withstand pulsing of blood as it's pumped through the body
capillary	One cell thick	Very narrow	Supply all cells with their req, and take away waste products	No need for strong walls as v little bp. Narrow lumen bring blood i2 close contact with cells
vein	Thin, containing far less muscle and elastic tissue than arteries	Wide, contains valves	Return blood to heart	No need for strong walls as v little bp. Wide lumen offers less resistance to

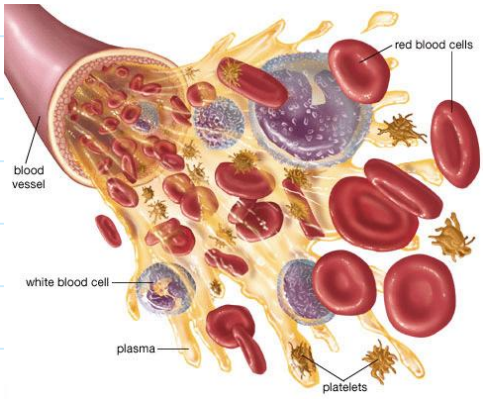
				blood flow, and valves prevent backflow.

Components of blood

Component	Structure	Functions
Plasma	Water, containing many substances in solution	• Transports CO2 • Transports nutrients • Transports urea • Transports hormones • Transports heat • Transports antibodies
RBC's	Biconcave discs with no nucleus, containing haemoglobin	• Transports oxygen • Transports a small amt of CO2
WBC's	Variable shapes, with nucleus	• Engulf and destroy pathogens • Make antibodies
Platelets	Small cell fragments with no nucleus	• Help in blood clotting

Components of blood plasma

- Water
- Plasma proteins
- Lipids
- Carbs
- Urea
- Mineral ions
- Hormones
- Dissolved gases



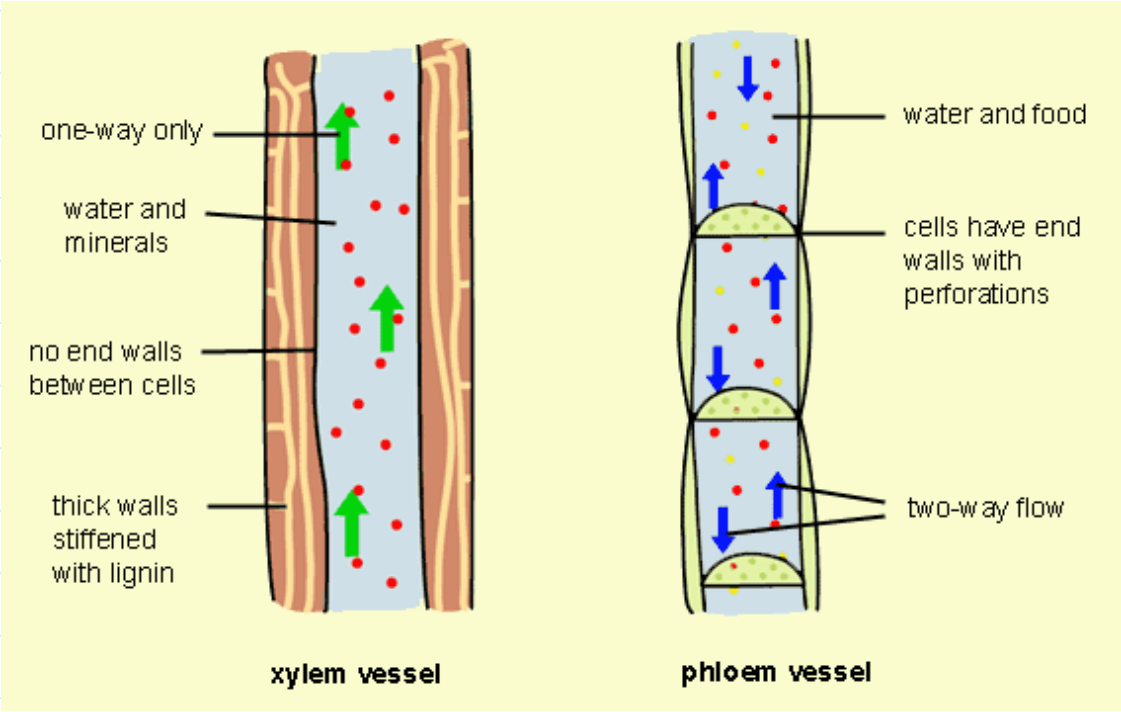
Transport in Plants

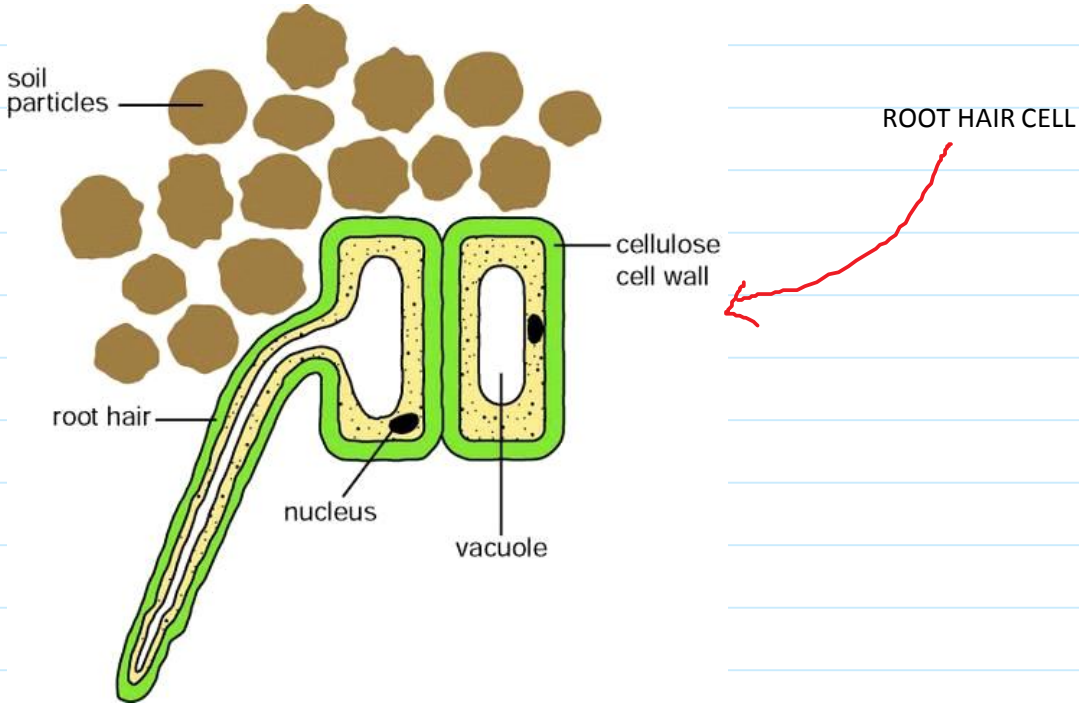
Properties of Xylem Vessel

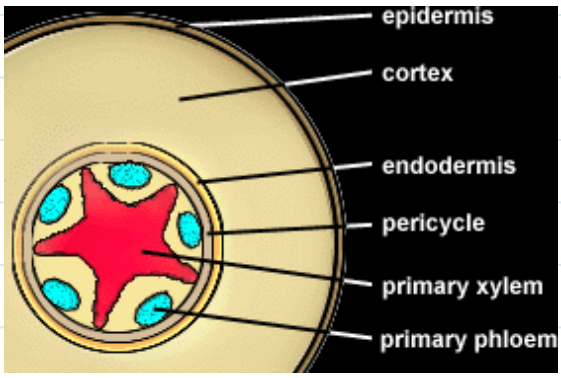
- Thick wall containing lignin
- No cytoplasm
- No end walls of cells
- Carry water and minerals
- No companion cell
- One way flow

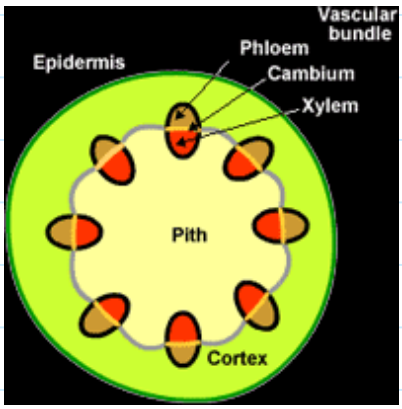
Properties of phloem tubes

- Wall containing cellulose but not lignin
- Strands of cytoplasm in sieve tube
- Sieve plate forms end wall of sieve tube
- Carry organic nutrients
- Companion cell containing nucleus and dense cytoplasm
- Two way flow


one-way only
water and minerals
no end walls between cells
thick walls stiffened with lignin
xylem vessel
water and food
cells have end walls with perforations
two-way flow
phloem vessel


soil particles
ROOT HAIR CELL
cellulose cell wall
root hair
nucleus
vacuole





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

Factors affecting transpiration rate

- Temperature- The higher the temperature the faster the transpiration.
- Humidity- The higher the humidity the slower the transpiration.
- Wind speed-The higher the wind speed the higher the higher the transpiration
- Light intensity- The higher the light intensity the higher the transpiration.
- Water supply- The more the water supply the more the transpiration.

Adaptation of desert plants to environment

- Closing stomata
- Waxy cuticle
- Hairy leaves
- Rolled leaves
- Pitted stomata
- Stomata on underside of leaf
- Less SA of leaf

Translocation- the movement of sucrose and a.a in phloem , from regions of production to regions of storage, or utilisation in respiration or growth.

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Respiration

The chemical reactions that break down nutrient molecules in living cells to release energy

Aerobic respiration- the release of a relatively large amount of energy in cells by the breakdown of food substances in the presence of oxygen.

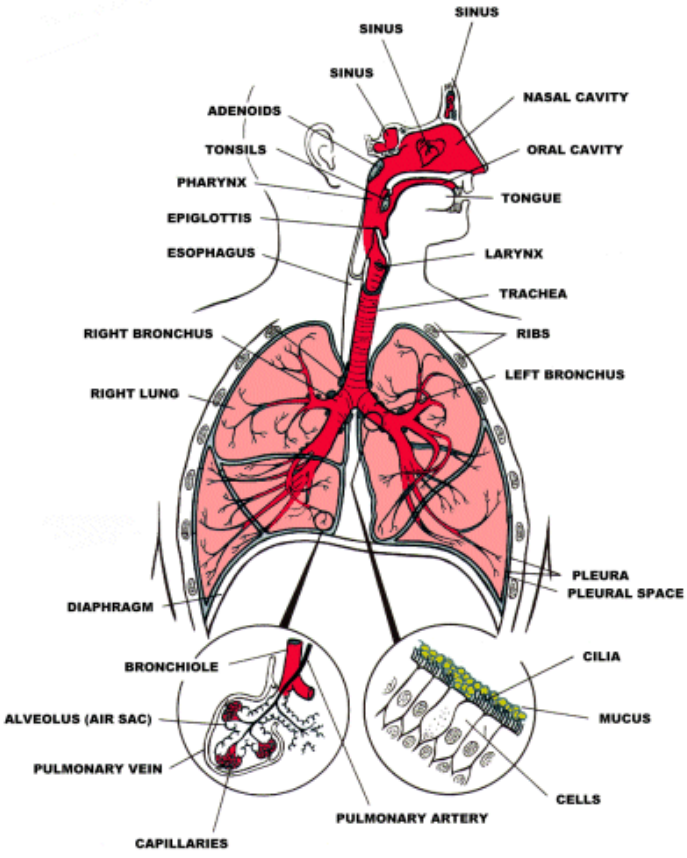
Glucose + Oxygen → Carbon Dioxide + Water

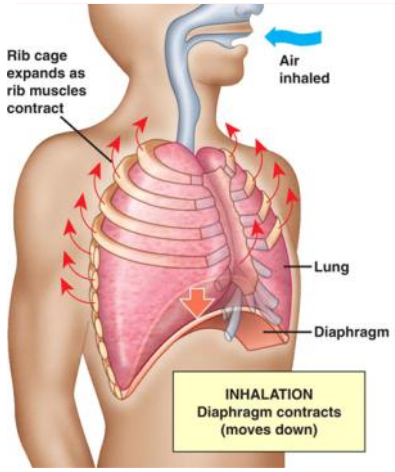
Anaerobic respiration- the release of a relatively small amount of energy by the breakdown of food substances in the absence of oxygen.

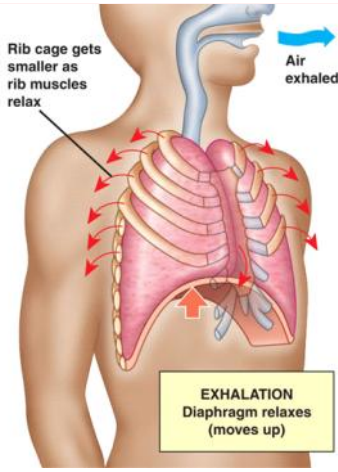
Glucose → Lactic Acid

Aerobic Respiration	**Anaerobic Respiration**
Uses oxygen	Doesn't use oxygen
No alcohol or lactic acid made	Alcohol(in yeast and plants) and lactic acid made
Large amount of energy released	Less amount of energy released
Carbon dioxide made	Carbon dioxide made by yeast and plants but not by animals

THE RESPIRATORY SYSTEM







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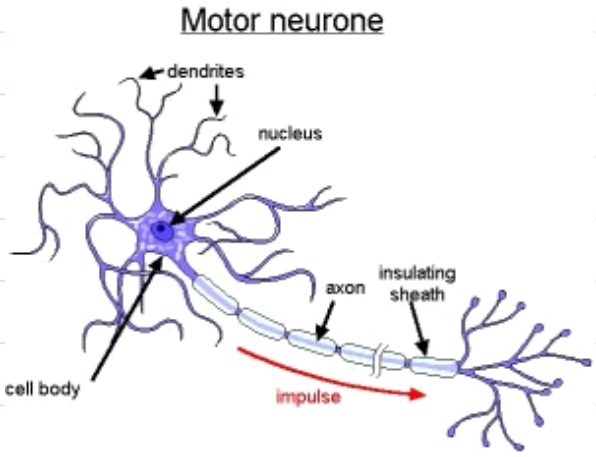
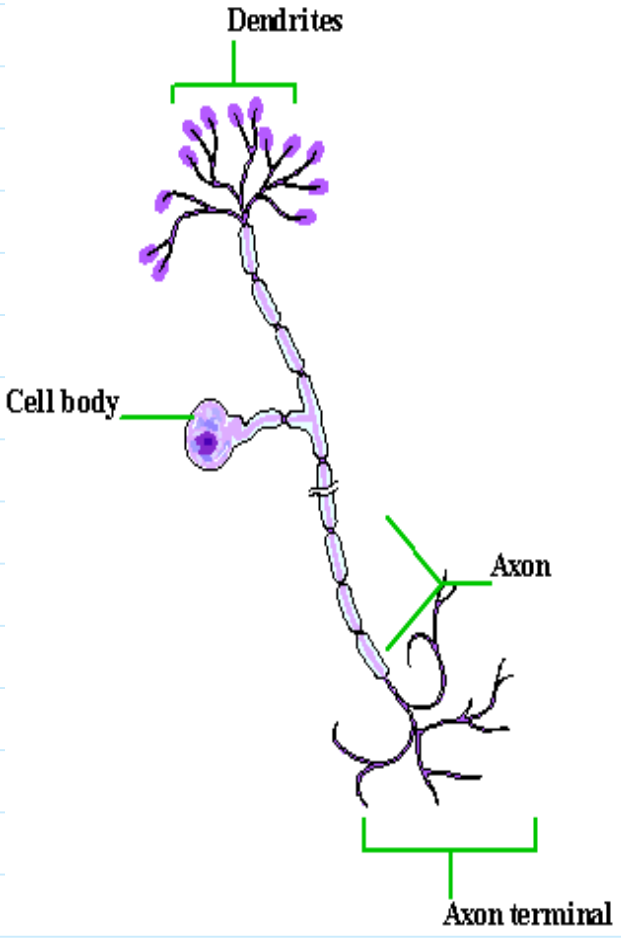
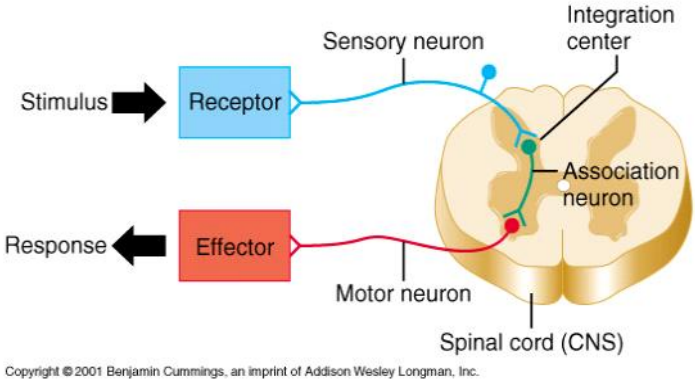
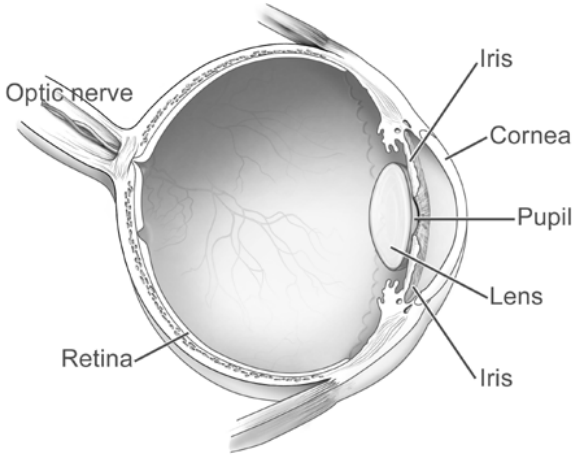
Coordination and response









Sense Organs- groups of receptor cells responding to specific stimuli.

Accomodation- Adjustment of the eye to vision at different distances, carried out by the lens

In bright light the circular muscles of the iris contract, widening the iris and narrowing the pupil.

In dim light the radial muscles of the iris contract, narrowing the iris and widening the pupil.

When viewing a DISTANT object, the ciliary muscle

relaxes, so the suspensory ligaments are pulled taut and the lens is pulled thin.

Cones respond to **C**olour
Rods respond to dim light

When viewing a NEARBY object, the ciliary muscle contracts, so the suspensory ligaments slacken, and the lens is fattened.

Antagonistic muscles- muscles that work against each other. E.g. When the triceps contracts the biceps relaxes.

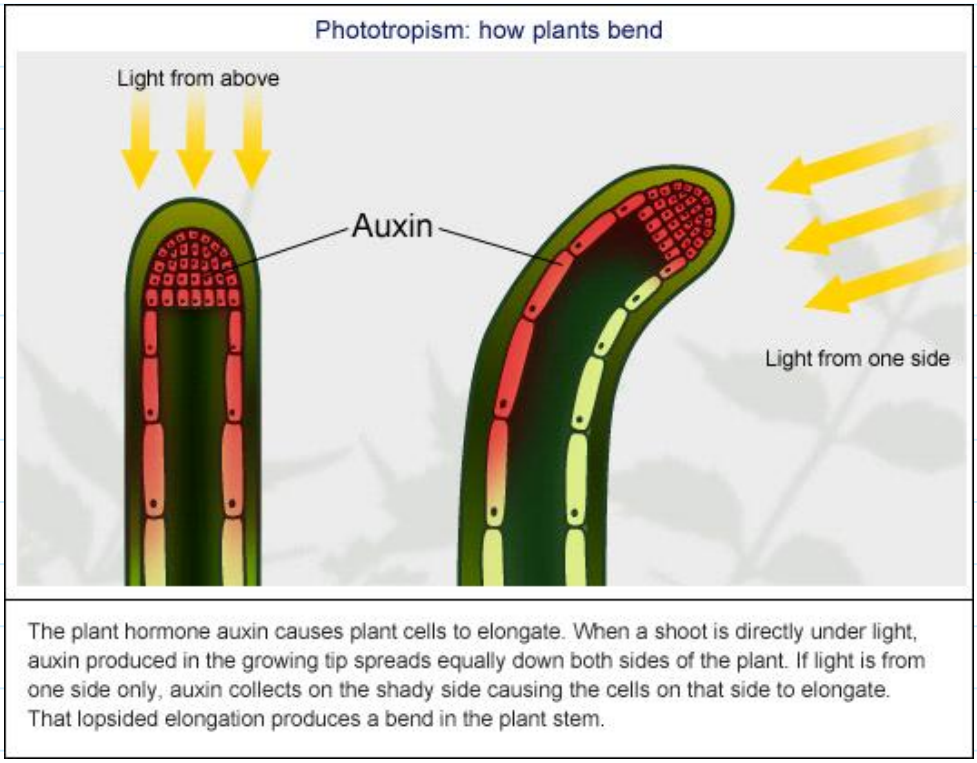
Hormone- A substance produced by an endocrine gland that affects one or more target organs and is carried by the blood, and then destroyed by the liver.

Features of Hormones

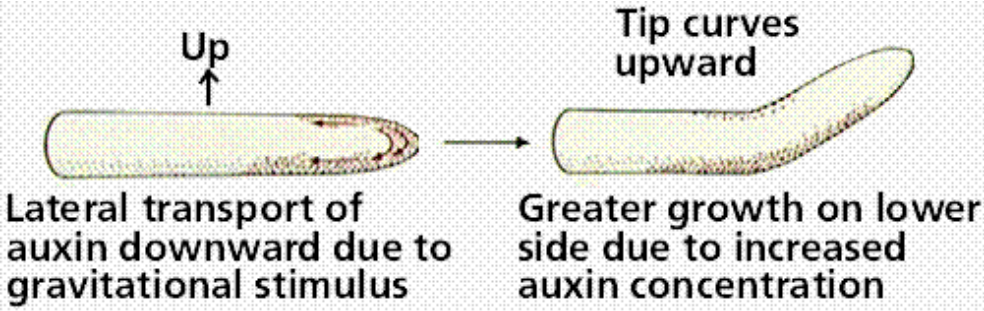
- Soluble
- Organic molecules
- Carried dissolved in plasma
- Affect target organs
- Destroyed by liver

Geotropism- a response in which a plant grows towards or away from gravity.

Phototropism- a response in which a plant grows towards or away from the direction light is coming.

- 

The plant hormone auxin causes plant cells to elongate. When a shoot is directly under light, auxin produced in the growing tip spreads equally down both sides of the plant. If light is from one side only, auxin collects on the shady side causing the cells on that side to elongate. That lopsided elongation produces a bend in the plant stem.


Up
Tip curves upward
Lateral transport of auxin downward due to gravitational stimulus
Greater growth on lower side due to increased auxin concentration

Topic 11

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Homeostasis and excretion

Homeostasis- maintenance of a constant internal environment

When the body is cold

Muscles work
Respiration increases
Hair stands up
Vasoconstriction occurs

When the body is hot

Hair lies flat
Vasodilation occurs
Sweat

Negative feedback is where, when the hypothalamus has made your skin take action to increase heat loss, info about this is fed back as the drop in blood temperature is sensed, so the hypothalamus stops the skin taking action to lose heat.

When you eat a meal **high** in sugar, the pancreas secretes the hormone insulin, which passes to the liver in the blood stream and causes it to use some of the glucose in respiration and store some as glycogen, thus regulating blood glucose.

When you eat a meal **low** in sugar the pancreas secretes glucagon, which passes to the liver in the blood stream and causes it convert the stored glycogen to glucose, thus regulating blood glucose.

How urine is made- in the nephrons

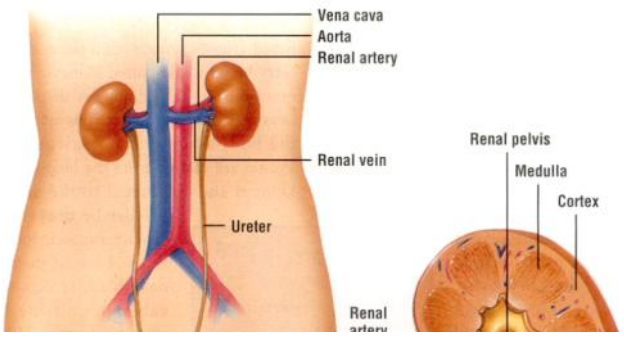
Filtration-Small molecules like water, glucose, salts, and urea are squeezed out of the blood -in the glomerulus- into the renal capsule.

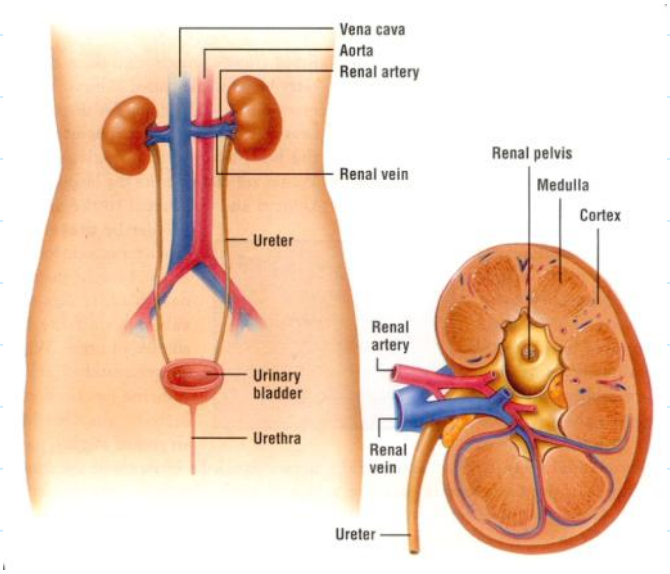
Reabsorption- Any useful substances like water and glucose are reabsorbed in the kidney tubules and taken back to the blood. The rest passes to the collecting duct and into the ureter to the bladder to be excreted, now called urine.

Functions of the liver

- Does deamination
- Controls blood glucose
- Stores glycogen
- Makes bile
- Breaks down old RBC's
- Stores vitamins A,B,D,E, & K
- Stores potassium
- Makes cholesterol

Excretion- removal from organisms of toxic materials, waste products of metabolism, and substances in excess of requirements




Vena cava
Aorta
Renal artery
Renal vein
Ureter
Urinary bladder
Urethra
Renal pelvis
Medulla
Cortex
Renal artery
Renal vein
Ureter

Topic 12

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Drugs

Narcotic(depressant)- a drug that reduces sensibility and pain and slows down hypothalamus. Produces a feeling of euphoria. E.g. Heroin, Alcohol

Stimulant- a drug that causes a person to become more alert

Features of alcohol

Depressant
Lengthens reaction time
Increases aggression
Kills
Causes liver cirrhosis
Causes stomach ulcers
Causes brain damage
Causes addiction

Features of nicotine

Stimulant
Causes blood vessels to narrow
Increases blood pressure

Features of tar

Causes cancer
Damages airway(cilia)

Features of carbon monoxide

Combines with haemoglobin in the RBC, forming carboxyhaemoglobin and prevents oxygen from combining with haemoglobin so less is carried to cells

Features of smoke particles

Cause emphysema

Topic 13

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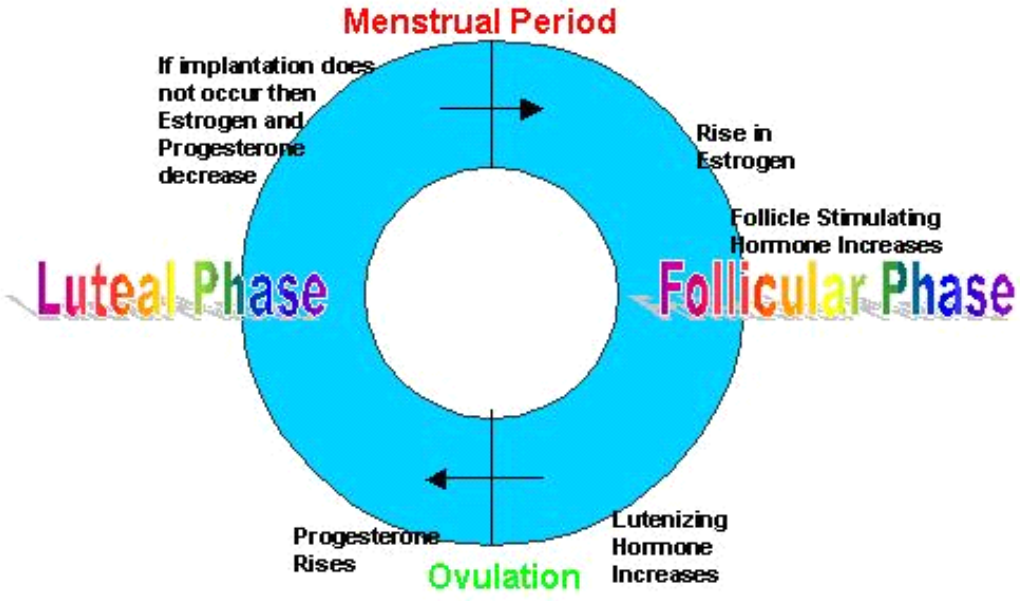
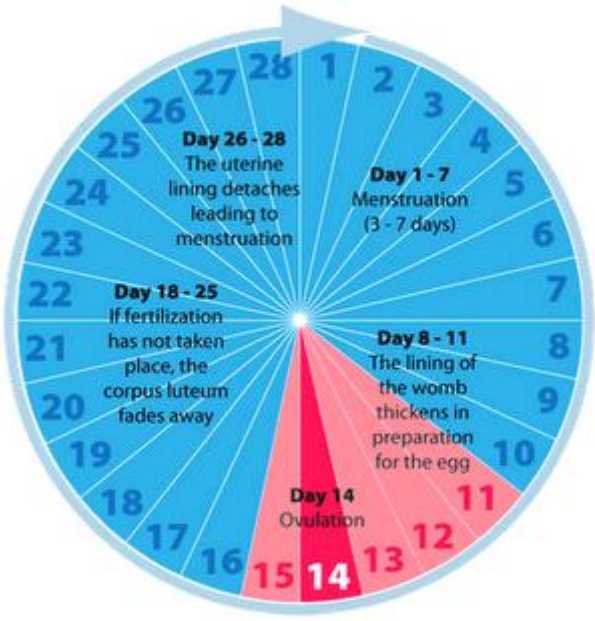
Human Reproduction

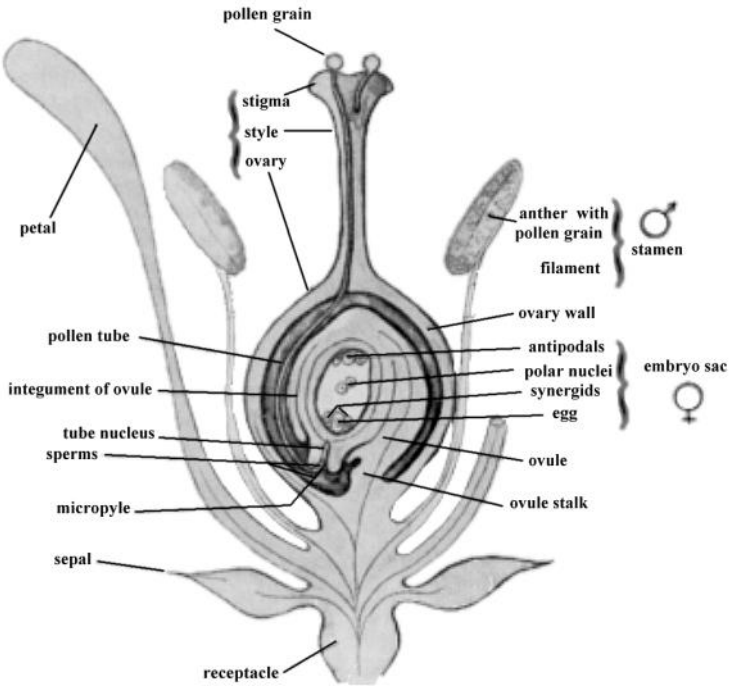
Asexual reproduction- the process resulting in the production of genetically identical offspring from one parent

Menstrual cycle





Plant Reproduction



Topic 14

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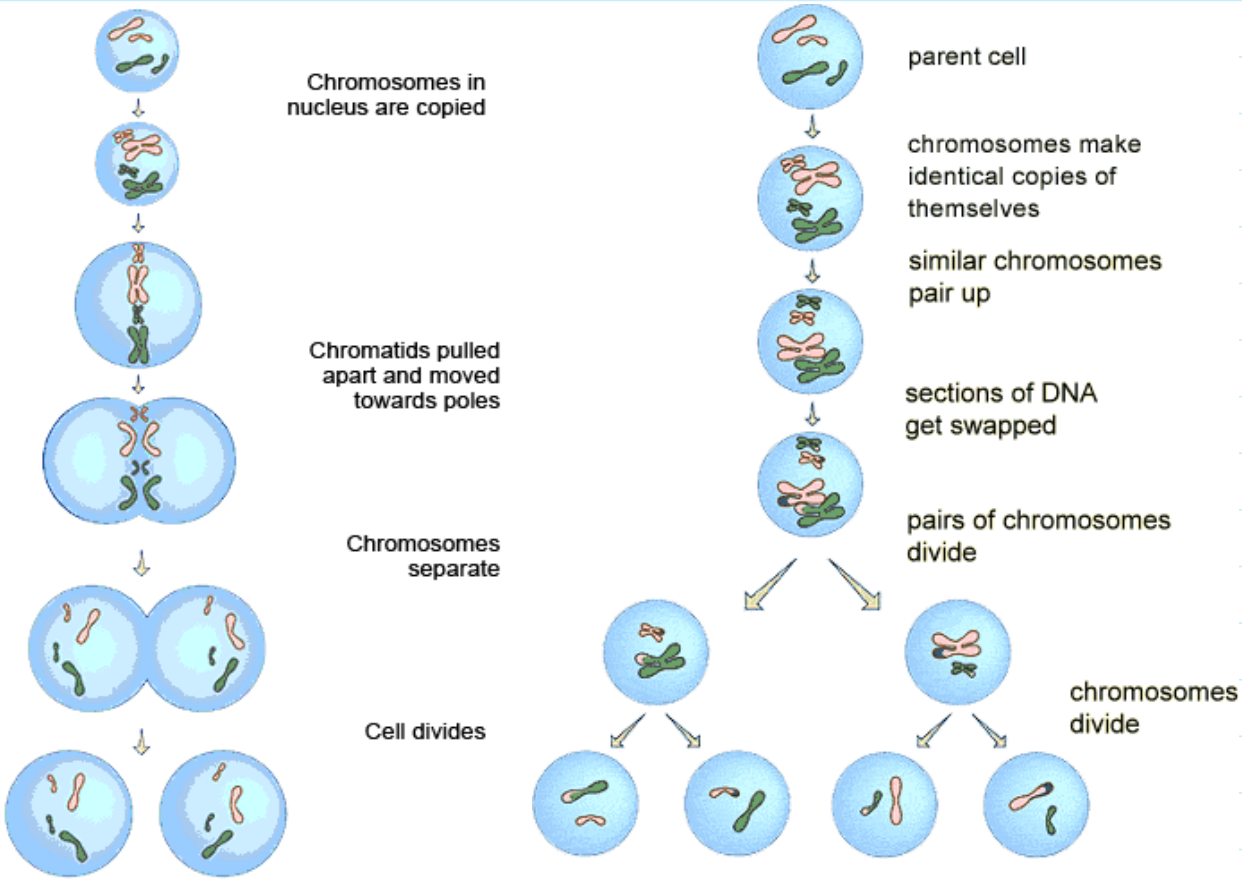
Inheritance and Evolution

Haploid- a nucleus containing a single set of unpaired chromosomes
Diploid- a nucleus containing two sets of chromosomes
Mitosis- nuclear division giving rise to genetically identical cells in which the chromosome number is maintained by the duplication of chromosomes.
Meiosis- reduction division in which the chromosome number is halved from diploid to haploid.
Homozygous- having two identical alleles for a particular gene
Heterozygous- having two different alleles for a particular gene
Genotype- genetic makeup of an organism in terms of alleles present
Phenotype- physical or other feature of an organism due to genotype and environment



Continuous Variation- changes all the time in different individuals e.g. height.
Discontinuous Variation- there are no in between categories e.g. blood type
Genetic Variation(discontinuous)- when a persons genotype is different, it can be passed on
Environmental Variation(continuous)- when an organisms environment is different there will be variation

Causes of Natural Selection (the greater chance of passing on genes by the best adapted organisms)

- Variation

Genetic Engineering

- DNA containing gene that codes for insulin is extracted from a human cell

Causes of Natural Selection (the greater chance of passing on genes by the best adapted organisms)

- Variation
- Over- production
- Survival of the fittest
- Struggle for existence
- Advantageous characteristics passed to offspring
- Gradual Change

Genetic Engineering

- DNA containing gene that codes for insulin is extracted from a human cell
- DNA from the plasmid of a bacterium is cut out using enzymes
- Gene coding for insulin is inserted into plasmid using enzymes
- Mass production of these bacterium in a fermenter produce large amounts of insulin

Topic 15

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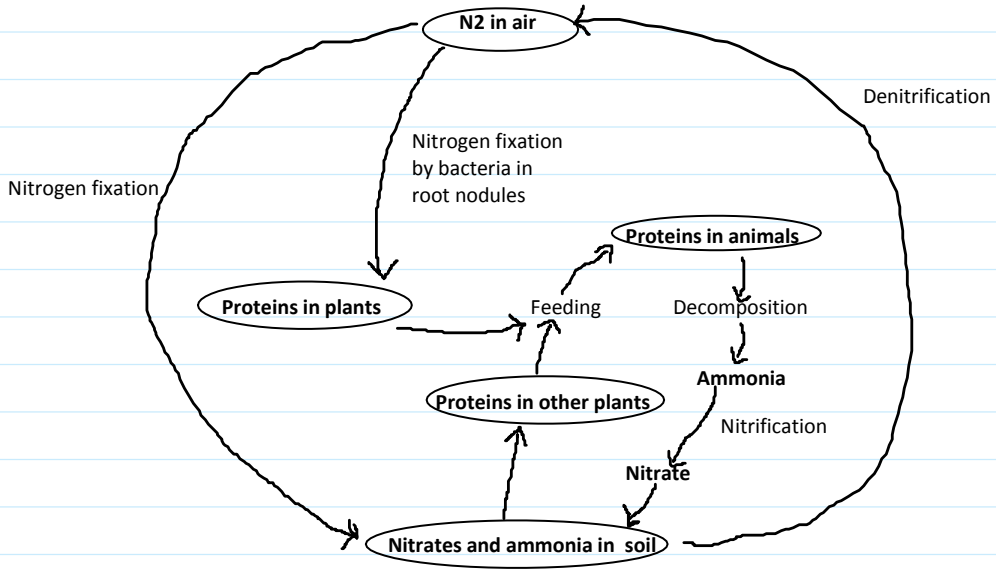
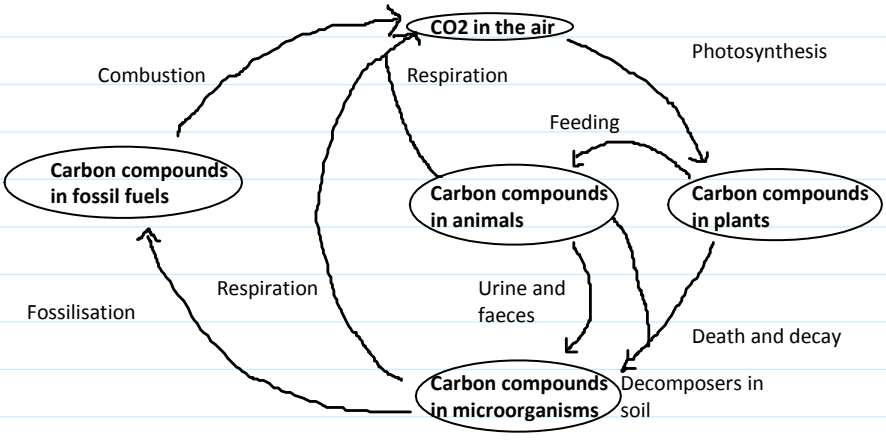
Living organisms in their environment

Ecosystem- a unit containing all the organisms and their environment, interacting together in a given area
Food Chain- a chart showing the energy flow from one organism to the next
Food Web- a group of linked food chains showing the energy flow from one part of the ecosystem
Trophic Level- the position of an organism in a food chain, food web, pyramid of numbers, or pyramid of biomass.

Nitrogen Cycle



Carbon Cycle



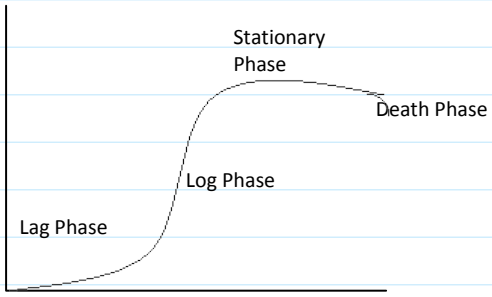
Nitrogen fixation- changing nitrogen into a more reactive form- occurs due to:

Lightning
Artificial fertilisers
Nitrogen fixing bacteria

Nitrifying bacteria- turn ammonia into nitrates
Denitrifying bacteria- turn nitrates and ammonia into nitrogen

Stationary Phase

Artificial fertilisers
Nitrogen fixing bacteria



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Humans and the environment

When fertilizers containing nitrates and phosphates are washed into lakes when it rains, it is called leaching. This may lead to eutrophication which is when algae in lakes grow faster and cover the surface of the lake blocking out light for plants ,so they cant photosynthesize, so they die. This is a good source of food for bacteria which use up all the oxygen in the water so that organisms living in the water, like fish, cant survive.

Sewage Treatment