

CELL BIOLOGY COMBINED SCIENCE (8464) & BIOLOGY (8461)

Tier 3 vocabulary

Eukaryotes	Plant and animal cells- genetic material enclosed in a nucleus
Prokaryotes	Bacterial cells- genetic material is not enclosed in a nucleus
Cell differentiation and cell specialisation	Cells differentiate to form different types of cells. Cells may be specialised to carry out a particular function.
Stem cells 1. Embryonic and Adult stem cells (animal) 2. Meristem cells (plant)	A stem cell is an undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type
Cell cycle 1. Interphase 2. mitosis 3. Cytokinesis	Cells divide in a series of stages called the cell cycle. During the cell cycle the genetic material is doubled and then divided into two identical cells.
Mitosis	In mitosis one set of chromosomes is pulled to each end of the cell and the nucleus divides producing two daughter cells.
Diffusion Factors which affect the rate of diffusion are: 1. the difference in concentrations (concentration gradient) 2. the temperature 3. the surface area of the membrane	Diffusion is the net movement from an area of higher concentration to an area of lower concentration.
Osmosis E.g. Plants absorb water from the soil by osmosis through their root hair cells.	Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.
Active transport E.g. movement of mineral ions into roots of plants and the movement of glucose into the small intestines.	Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This requires energy from respiration.

Eukaryotes complex organisms

Animal cell

plant cell

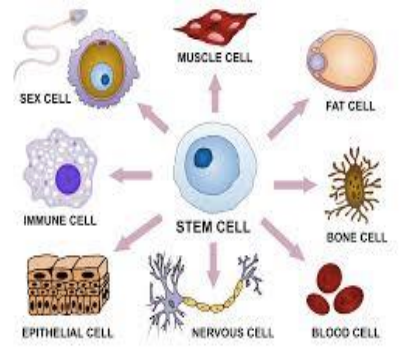
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Required practical activity 1: use a light microscope to observe, draw and label a selection of plant and animal cells. **A magnification scale must be included.**

cytoplasm	<i>site of chemical reactions in the cell</i>
nucleus	<i>contains genetic material</i>
cell membrane	<i>semi permeable- controls the movement of substances in and out of the cell</i>
ribosome	<i>site of protein synthesis</i>
mitochondrion	<i>site of respiration</i>
contains all the parts of animal cells plus extras	
permanent vacuole	<i>contains cell sap- keeps cell turgid, contains sugars and salts in solution</i>
cell wall	<i>made of cellulose supports and strengthens the plant.</i>
chloroplast	<i>Consists of chlorophyll -site of photosynthesis</i>

Specialised animal cells

nerve	carry electrical signals	long branched connections and insulating sheath
sperm	fertilise an egg	streamlined with a long tail acrosome containing enzymes large number of mitochondria
muscle	contract to allow movement	contains a large number of mitochondria long



Specialised plant cells

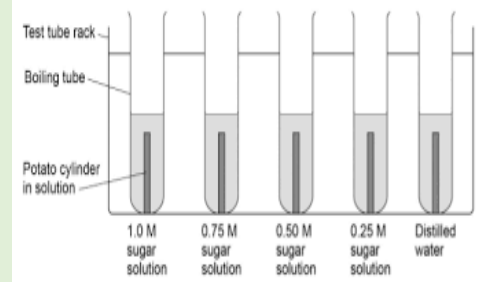
Root hair cell	absorb water and minerals from soil	hair like projections to increase the surface area
xylem	carry water and minerals	TRANSPIRATION - dead cells cell walls toughened by lignin flows in one direction
phloem	carry glucose	TRANSLOCATION - living cells cells have end plates with holes flows in both directions

Prokaryotes simpler organisms

cell membrane	<i>site of chemical reactions in the cell</i>
bacterial DNA	<i>not in nucleus floats in the cytoplasm</i>
cell wall	NOT made of cellulose
plasmid	<i>small rings of DNA</i>
Cell membrane	<i>semi permeable</i>

Treatment with stem cells may be able to help conditions such as **diabetes and paralysis.** Some people object to the use of stem cells on ethical or religious grounds

Required practical activity 2: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. Measure the **mass of the potato cylinders before and after** the experiment. **The more concentrated the solution, more osmosis takes place. Potatoes will lose mass. If the solution is less concentration, less osmosis less lost mass. The distilled water is the control.**



ORGANISATION COMBINED SCIENCE (8464) & BIOLOGY (8461)

Part 1

Tier 3 vocabulary

1. Cells
2. Tissues
3. Organs
4. Organ system

1. The basic building blocks of all living organisms.
2. A group of cells with a similar structure and function.
3. Aggregations (working together) of tissues performing a specific function.
4. Organs working together to form organ systems, which work together to form an organism.

Enzymes

catalyse specific reactions in living organisms due to the shape of their active site. The substrate binds to the active site of an enzyme.

Digestive enzymes

- Carbohydrase and amylase
- Protease
- Lipase

convert insoluble food into small soluble molecules that can be absorbed into the bloodstream.

Bile

Made in the liver and stored in the gallbladder.

It is alkaline to neutralise hydrochloric acid from the stomach. It also emulsifies fat to form small droplets.

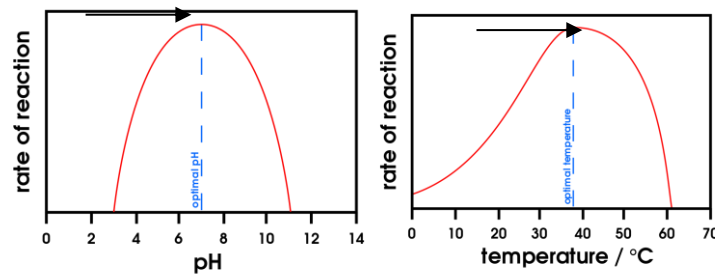
Heart

The heart is an organ that pumps blood around the body in a double circulatory system

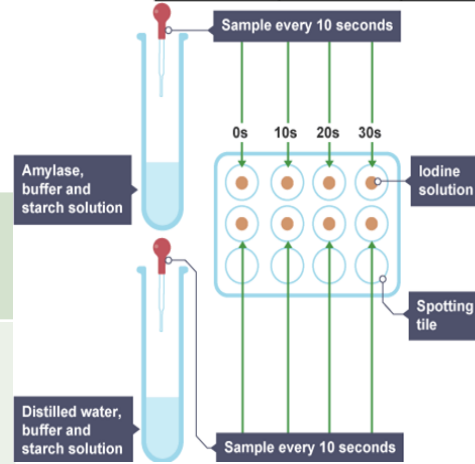
Coronary heart disease

layers of fatty material build up inside the coronary arteries, narrowing them.

Enzymes work best at a **optimum pH** or temperature. This is when the **rate of reaction is maximum**.



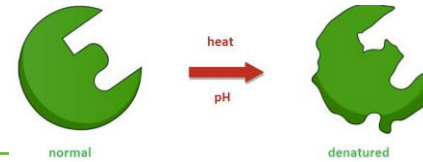
Enzyme	Found in the:				Breaks Down	Into
	Salivary Glands	Stomach	Pancreas	Small Intestine		
Amylase Carbohydrase	✓		✓	✓	Starch	→ Sugar
Lipase		✓	✓	✓	Fats	→ Fatty Acids and Glycerol
Protease e.g. Pepsin		✓	✓	✓	Proteins	→ Amino Acids



Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme.

Method :You will investigate the breakdown of starch by amylase at different pHs.

For each pH investigated, record the time taken for the disappearance of starch, i.e when the iodine solution in the spotting tile remains orange-brown. The inverse of time taken will be the rate of the enzyme reaction.



The 'lock and key theory' is a simplified model to explain enzyme action.

Sugars (glucose)

Benedict's test

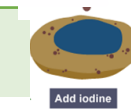
Orange to brick red precipitate

Benedict's solution changes colour when heated

Starch

Iodine test

Brown to blue black



Biuret

Biuret reagent

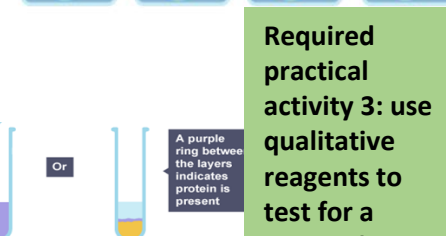
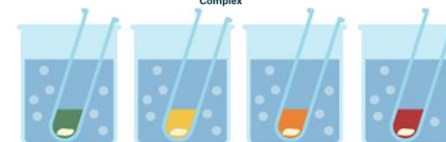
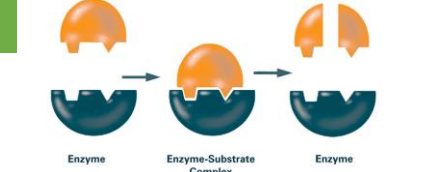
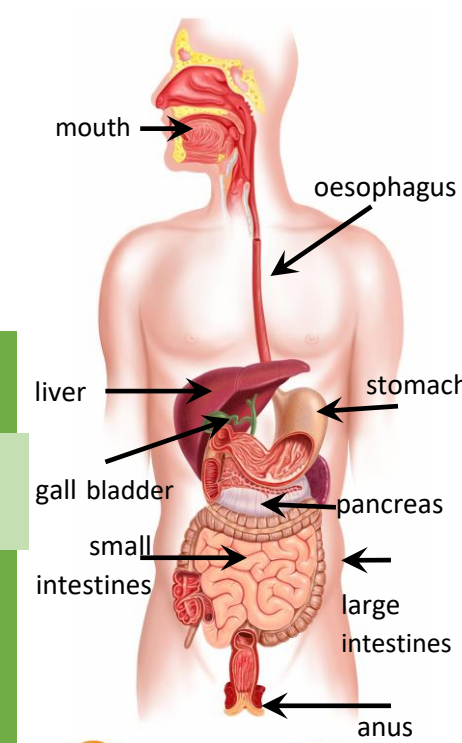
Mauve or purple solution.



Fat test

Sudan test

Red layer forms.
Emulsion test turns cloudy



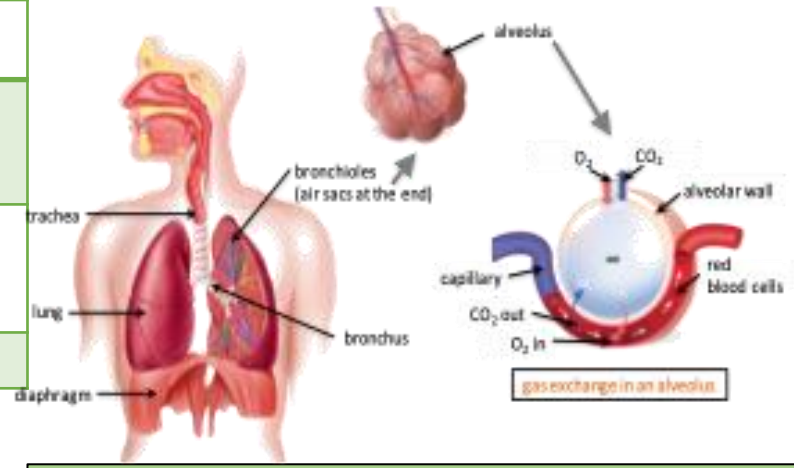
Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.

ORGANISATION COMBINED SCIENCE (8464) & BIOLOGY (8461) Part 2

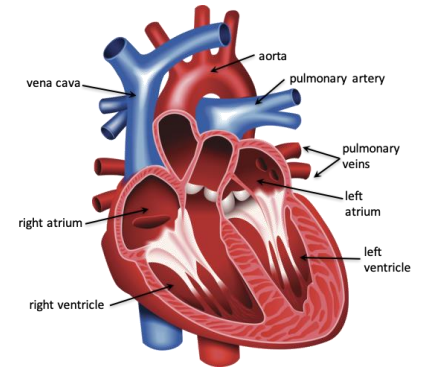
Tier 3 vocabulary

Alveoli	Gas exchange takes place here 1. It is one cell thick – for faster diffusion. 2. Network of blood capillaries - for large surface area. 3. Constant ventilation – maintaining a concentration gradient
Cancer and tumor Carcinogens obesity, smoking, alcohol, lack of exercise	Benign tumours are growths of abnormal cells which are contained in one area, Malignant tumour cells are cancers .
Heart valves	Prevent blood in the heart from flowing in the wrong direction.
Pacemaker	The natural resting heart rate is controlled by a group of cells located in the right atrium that act as a pacemaker.
Transpiration	Loss of water vapor from the plant. e effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration.
Translocation	The movement of food molecules through phloem tissue is called translocation.
Xylem and Phloem	Xylem vessels are hollow tubes strengthened by lignin, Allows transport of water and mineral ions to the leaves. Phloem transports dissolved sugars from the leaves to the rest of the plant.

Plasma (55%)	Transports CO ₂ , hormones and waste.
Red blood cells (45%)	carries oxygen and has a large surface area, no nucleus, full of haemoglobin.
White blood cells (<1%)	Part of the immune system Some produce antibodies, others surround and engulf pathogens.
Platelets (<1%)	Clump together to form blood clots.



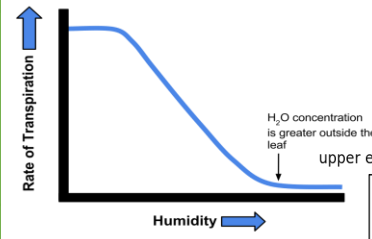
Air moves into the trachea → bronchi → alveoli → capillary network surrounding the alveoli.



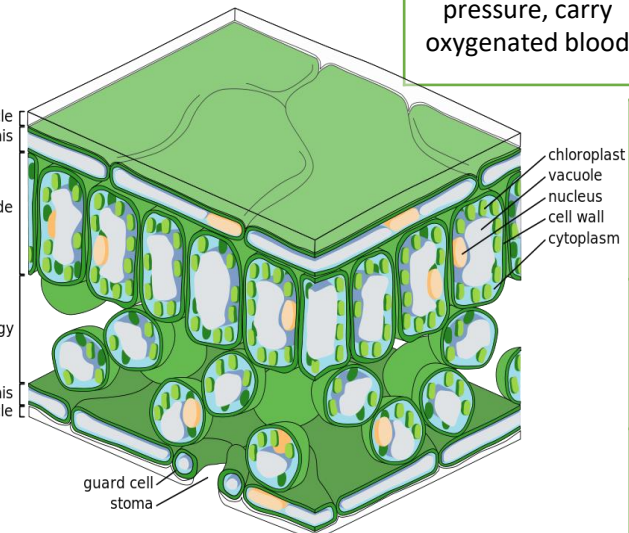
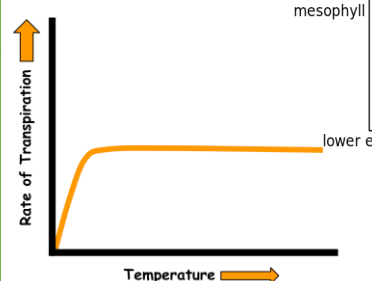
Deoxygenated blood arrives the heart via the vena cava → right atrium → pulmonary artery carries deoxy blood to the lungs → oxygenated → pulmonary vein brings blood back → left atrium → left ventricle → Aorta carries oxygenated blood to the rest of the body

Artery	Vein	Capillary
<i>Carry blood away from the heart</i>	<i>Carry blood to the heart</i>	<i>Connects arteries and veins</i>
Thick muscular walls, small lumen, carry blood under high pressure, carry oxygenated blood	Thin walls, large lumen, carry blood under low pressure, have valves to stop flow in the wrong direction, carry deoxygenated blood	One cell thick to allow diffusion, Carry blood under very low pressure.

Effect of Humidity on Plant Transpiration



Effect of Temperature on Plant Transpiration



Epidermal tissues (Guard cells and stomata)	Guard cells open and close the stomata to control water loss and allow for gas exchange
Palisade mesophyll (Palisade cells)	Packed with chloroplasts – carry out photosynthesis
Spongy mesophyll (Air spaces)	Increased surface area for gas exchange

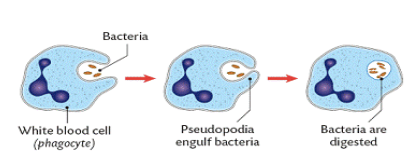
INFECTION AND RESPONSE COMBINED SCIENCE (8464) & BIOLOGY (8461)

Tier 3 vocabulary

Pathogens	Pathogens are microorganisms that cause infectious disease. Pathogens may be viruses, bacteria, protists or fungi .
Communicable diseases	Diseases caused by pathogens are called communicable diseases.
Bacteria	Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.
Virus	Viruses live and reproduce inside cells, causing cell damage.
Protist	The pathogens that cause malaria are protists (Vector).
Primary defense of the body	• skin • nose • trachea and bronchi • stomach.
Vaccination	Vaccination involves dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies .
Antibiotics (eg:penicillin)	Antibiotics are medicines that help to cure bacterial disease.

Traditionally drugs

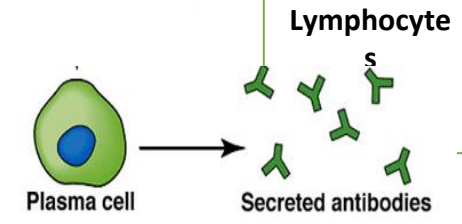
- 1.The heart drug digitalis originates from foxgloves.
2. The painkiller aspirin originates from willow.
3. Penicillin was discovered by Alexander Fleming from the Penicillium mould.



Phagocytes engulf the pathogens and digest them.

Specific antibodies destroy the pathogen. The antibody binds to the **antigen**.

Antitoxin is produced to counteract the **toxins** produced by bacteria.



Bacteria	Salmonella	Fever, cramp, vomiting, diarrhoea.	Food prepared in unhygienic conditions or not cooked properly.	Improve food hygiene, wash hands and vaccinate poultry.
Bacteria	Gonorrhoea	Green discharge from penis or vagina.	Direct sexual contact or exchange of body fluids.	Use condoms. Treatment using antibiotics.
Protists	Malaria	Recurrent fever.	By an animal vector	Prevent breeding of mosquitoes.
Fungus	Rose black spot	Purple black spots on leaves.	Spores carried via wind or water.	Remove infected leaves.
Virus	Measles	Fever, red skin rash.	Droplet infection from sneezes and coughs.	Vaccination as a child.
Virus	HIV	Initially flu like systems, serious damage to immune system.	Sexual contact and exchange of body fluids.	Anti-retroviral drugs and use of condoms.
Virus	Tobacco mosaic virus	Mosaic pattern on leaves.	Enters via wounds in epidermis caused by pests.	Remove infected leaves and control pests.

Clinical trials test for **toxicity, efficacy and dose**

↓

Preclinical testing is done on cells, tissues and live animals.

↓

Clinical trials use healthy volunteers and check for **optimum dosage**.

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In double blind trials, some patients are given a placebo.



Primary response is **slow and produces small amount of antibodies**. However secondary response **produces antibodies quicker due to memory cells**.

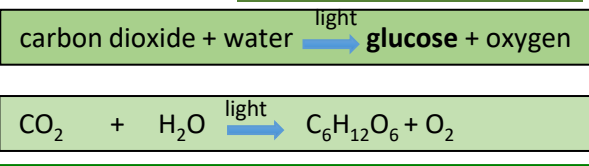
Antibiotics are used to treat bacterial infections and however bacteria mutating causes **antibiotic resistance**.

In a clinical trial **Double blind experiments** are when the patient nor the patients know if they have been given the drug

Tier 3 vocabulary

Photosynthesis	Is an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.
Respiration	Is an exothermic reaction , and produces energy for the cell by breaking down glucose.
Anaerobic respiration	The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt
Oxygen debt	The extra amount of oxygen required to remove all lactic acids from cells is called the oxygen debt
Metabolism	The energy transferred by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism.

Photosynthesis



- Glucose can be stored as
1. **Starch (plants)**
 2. **Glycogen (animals)**
 3. **Proteins**
 4. **Fats**
 5. **Used for respiration**

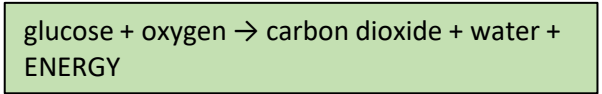
All factors increase the rate till another factor limits photosynthesis

Factor	The rate of photosynthesis is affected
Temperature	As the temperature increases the rate of photosynthesis increases , however high temperature denatures the enzymes and photosynthesis stops.
Light intensity	As light intensity increases so does the rate of photosynthesis (up to a point) as more energy is available for the chemical reaction.
Carbon dioxide concentration	The rate of photosynthesis will increase when a plant is given higher concentrations of carbon dioxide (up to a point).
Amount of chlorophyll	Chlorophyll increased, increases the light absorbed therefore increased photosynthesis.

Respiration



Aerobic



Anaerobic

Glucose → lactic acid + less ENERGY (During exercise)

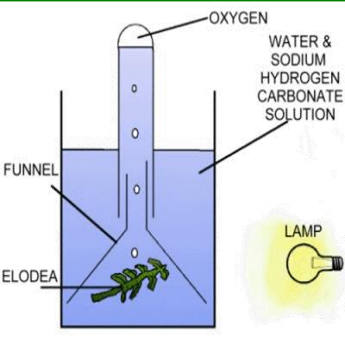
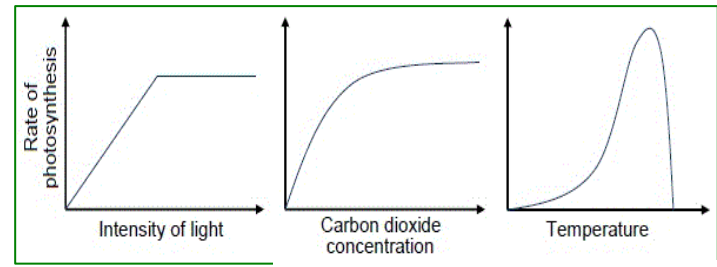
Fermentation

Glucose → ethanol + carbon dioxide

Anaerobic respiration in yeast cells is called fermentation, This process is economically important in the manufacture of alcoholic drinks and bread



During exercise **More oxygen is transported to the cells. More glucose is transported to the cells. More carbon dioxide is transported to the lungs.** Breathing Rate Increases because.....**More oxygen is breathed in. More carbon dioxide is breathed out**

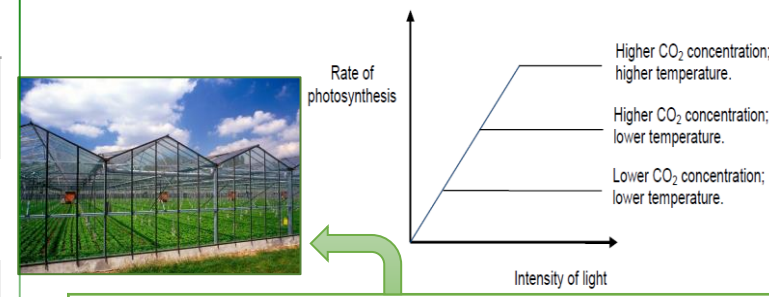


Required practical activity 5: investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed

Light intensity obeys the inverse square law. This means that if you double the distance between the plant and the light source you quarter the light intensity

Metabolism includes

1. **Conversion of glucose to starch, glycogen and cellulose.**
2. The formation of **lipid molecules** from a molecule of glycerol and three molecules of fatty acid.
3. The use of glucose and nitrate ions to form amino acids which in turn are used to **synthesise proteins.**
4. **Respiration**
5. **Breakdown of excess proteins** to form urea for excretion.



Heating Artificial lighting Extra carbon dioxide

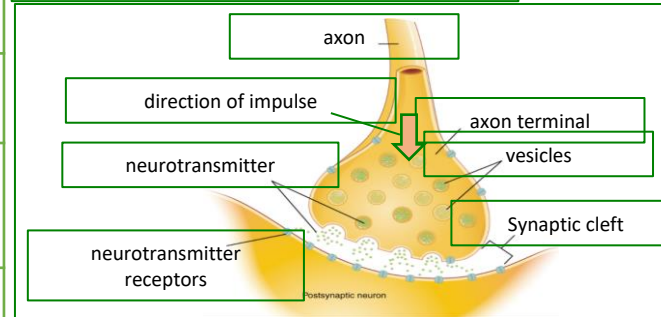
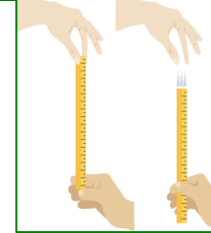
Homeostasis and response – COMBINED SCIENCE (8464) & BIOLOGY (8461) part 1

Tier 3 vocabulary

Homeostasis	maintains optimal conditions for enzyme action and all cell functions.
Stimuli	Changes in the environment.
Central nervous system (Brain and spinal cord)	Information from receptors passes along cells (neurons) as electrical impulses to the central nervous system (CNS)
Synapse	Gap where neurones meet. Chemical message using neurotransmitter.
The endocrine system	composed of glands which secrete chemicals called hormones directly into the bloodstream
Pituitary gland	Is known as the master glands as it secretes several hormones into the blood. Stimulates other glands to produce hormones to bring about effects.
Adrenaline	Produced in adrenal glands, increases breathing/heart rate, blood flow to muscles, conversion glycogen to glucose. Prepares body for 'fight or flight'.

Required practical activity 6: plan and carry out an investigation into the effect of a factor on human reaction time.

Method: in pairs record the distance at which the ruler is caught. Use the conversion table to calculate the reaction time. With practice the reaction time would be less and reflexes would improve



1. Impulse arrives at the synapse.
2. This results in the neurotransmitter release which diffuses into the synaptic cleft and binds to the receptor on the 2nd neuron.
3. This causes an impulse to be stimulated in the neuron.

Cerebral cortex

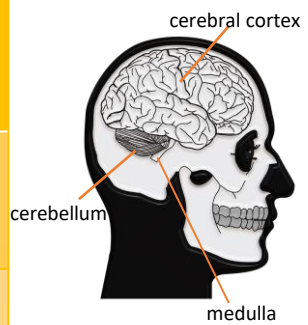
Largest part of the human brain. Higher thinking skills e.g. speech, decision making.

Cerebellum

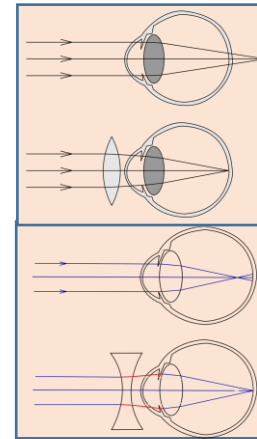
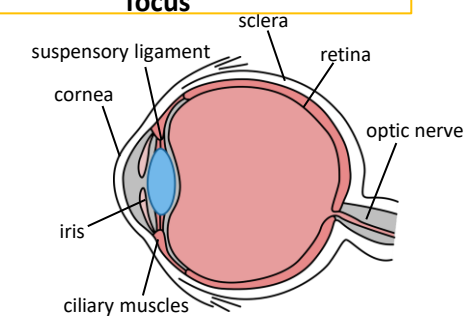
Balance and voluntary muscle function e.g. walking, lifting.

Medulla

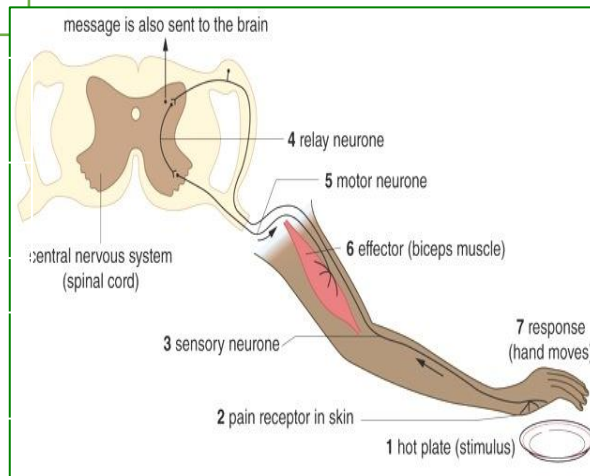
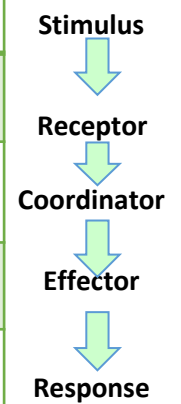
Involuntary (automatic) body functions e.g. breathing, heart rate.



Accommodation is the process of changing the shape of the lens to focus



Sensory neurone	Long axon carries impulse from receptor to spinal cord.
Synapse	Gap where neurons meet. Chemical message using neurotransmitter.
Relay neurone	Allows impulses to travel between sensory and motor neurones.
Motor neurone	Long axon carries impulse from receptor to effector.
Effector	Muscle or gland that carries out response.



Reflex actions are **automatic and rapid**; they do not involve the conscious part of the brain and can protect humans from harm.

Structures of the eye	Retina	Light sensitive cell layer.
	Optic nerve	Carries impulse to brain.
	Sclera	Protects the eye.
	Cornea	Transparent layer that covers the pupil and iris.
	Iris	Pigmented layer, controls size of pupil.
	Ciliary muscles	Controls thickness of lens.
	Suspensory ligaments	Connects lens to ciliary muscles.

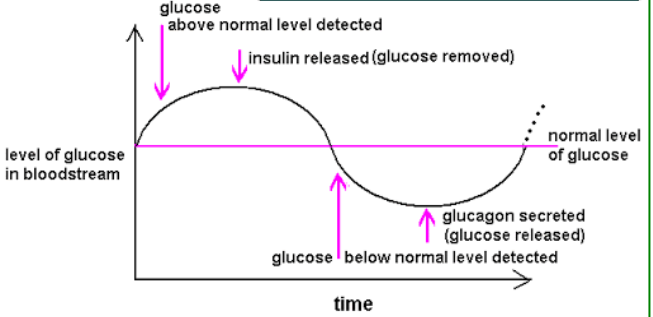
HOMEOSTASIS AND RESPONSE COMBINED SCIENCE (8464) & BIOLOGY (8461) part 2

Tier 3 vocabulary

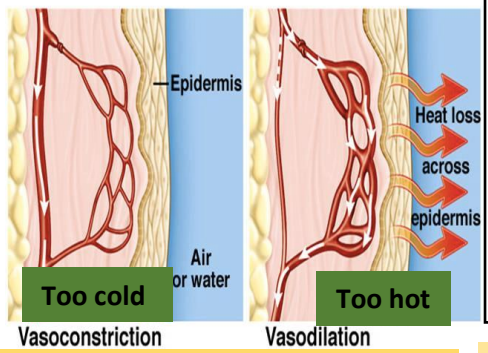
Thermoregulatory centre	Contains receptors sensitive to the temperature of the blood.
Thyroxine	Produced in the thyroid gland, stimulates the basal metabolic rate. Important in growth and development.
In Vitro Fertilisation (IVF) treatment	Involves giving a mother FSH and LH to stimulate the maturation of several eggs
Kidney function	Maintain water balance of the body. Produce urine by filtration of the blood and selective reabsorption of glucose, ions and water.
Diabetes	Type 1- pancreas fails to produce sufficient insulin therefore resulting in increased blood glucose. Type 2- obesity is a risk factor. Body takes longer to respond to insulin. Diet changes and increases can help treat it.
Sex hormones	Oestrogen- female reproductive hormone) and Testosterone male.

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The negative feedback system controlling glucose level using the hormones insulin and glucagon



(HT) Thermal energy loss at the surface of the skin is reduced, respiring muscles cells transfer chemical to thermal energy.

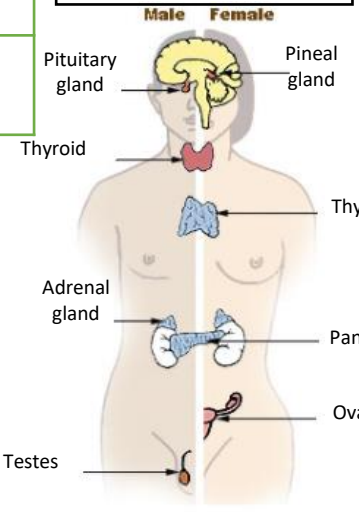


(HT) Thermal energy is lost from blood near the surface of the skin, sweat evaporates transferring thermal energy

Water and nitrogen balance- kidney (Biology only)

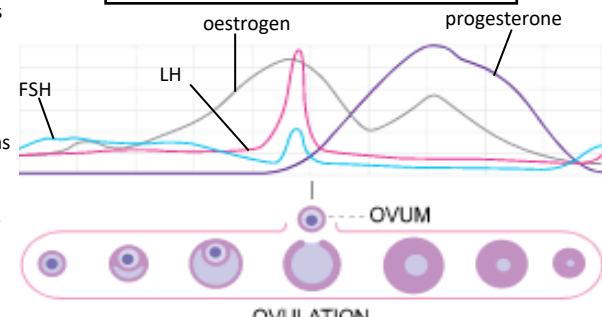
If body cells lose or gain too much water by osmosis they do no function efficiently.	Uncontrolled water/ion/urea loss	Water exhaled in lungs, water, ions and urea in sweat.
	Controlled water/ion/urea loss	via the kidneys in urine.

Kidney failure is treated by organ transplant or dialysis.

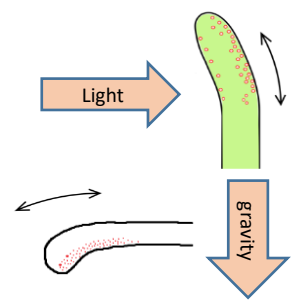


(HT only) ADH Released by **pituitary gland** when blood is too concentrated. Water is reabsorbed back into the blood from the kidney tubules (**NEGATIVE FEEDBACK**).

(HT only) a graph of hormone levels over time



Light (phototropism)- bio only



Gravity (Geotropism)- bio only

Contraception	
Oral contraceptives	Contain hormones to inhibit FSH production so that no eggs mature.
Injection, implant, skin patch	Release of progesterone to inhibit the maturation and release of eggs
Barrier methods	Condoms or diaphragms which prevent sperm reaching the egg.
Intrauterine devices	Prevent implantation of an embryo or release a hormone.
Spermicidal agents	Kill or disable sperm.
Abstaining	Avoiding intercourse when an egg may be in the oviduct.

In Vitro Fertilisation (IVF) treatment.

The **eggs** are collected from the mother and fertilised by **sperm** from the father in a laboratory.
 The fertilised eggs develop into **embryos**.
 At the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb).

Follicle stimulating hormone (FSH)	Causes maturation of an egg in the ovary. stimulates ovaries to produce oestrogen.
Luteinising hormone (LH)	Stimulates release of an egg.
Oestrogen and progesterone	Maintain uterus lining. Oestrogen stops FSH production and stimulates LH production in pituitary gland.

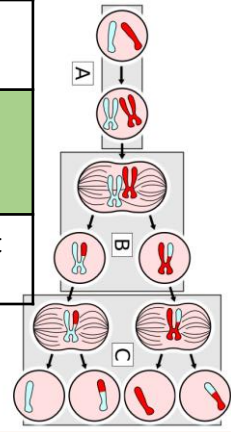
INHERITANCE, VARIATION AND EVOLUTION COMBINED SCIENCE (8464) & BIOLOGY (8461) part 1

Meiosis

Copies of the genetic information are made.

The cell divides twice to form four gametes each with single set of chromosomes.

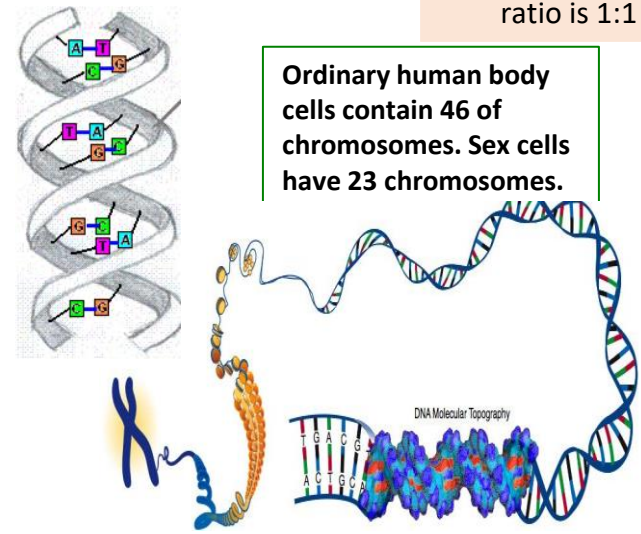
All gametes are genetically different from each other.



Sex determination

Gametes	X	Y
X	XX	XY
X	XX	XY

The punnet square - The probability of a male of female child is 50%. The ratio is 1:1



Ordinary human body cells contain 46 of chromosomes. Sex cells have 23 chromosomes.

DNA is polymer made from four different nucleotides. Each nucleotide consists of a common sugar, phosphate group and one of 4 different bases A, C, G & T.

Mutations - Some change the shape and affect the function of proteins e.g. and enzyme active site will change or a structural protein loses its strength

Sexual reproduction

involves the joining (fusion) of male and female gametes: sperm and egg cells (animals). Egg cells and pollen(plants)

Asexual reproduction and

involves only one parent and no fusion of gametes. There is no mixing of genetic information

Inherited disorders

Polydactyly

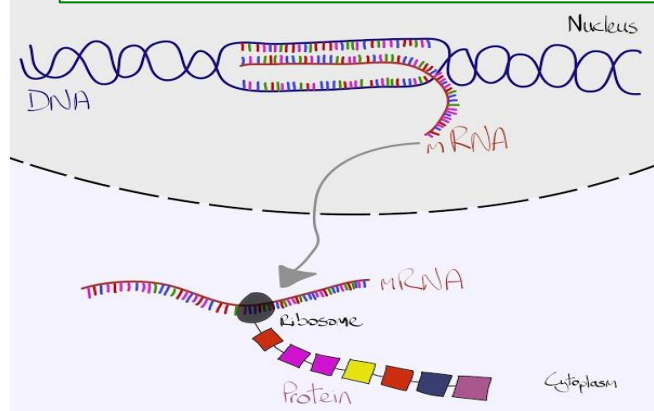
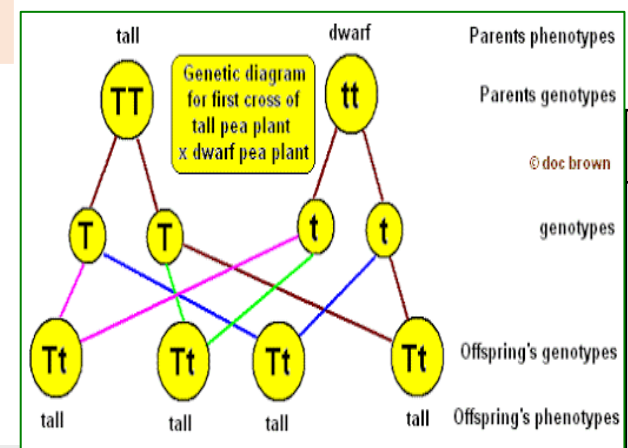
Caused by inheriting a dominant allele.

Causes a person/animal to have extra toes or fingers.

Cystic fibrosis

Caused by inheriting a recessive allele (both parents have to at least carry it).

A disorder of the cell membrane. Patients cannot control the viscosity of their mucus.



Protein synthesis

1. DNA in the nucleus unravels.
2. Enzymes make a copy of the DNA strand called mRNA.
3. mRNA moves from the nucleus to ribosome in the cytoplasm.
4. Ribosomes translate each 3 bases into amino acids according to mRNA template
5. Ribosomes link amino acids brought by carrier proteins.
6. A long chain of amino acids form. Their specific order forms a specific protein.

Tier 3 vocabulary

DNA and gene	Contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a sequence of amino acids to make a specific protein.
Mitosis	Mitosis produces identical daughter cells, mitosis doubles the number of chromosome.
Meiosis	Meiosis leads to non-identical cells. Meiosis halves the number of chromosomes
Gametes	Sex cells produced during meiosis
Allele	Alternate form of a gene. Dominant allele- expressed if only one copy present and when paired with a recessive allele. Recessive allele- only expressed when paired with another recessive allele.
Homozygous	pair of the same alleles, dominant or recessive.
Heterozygous	Two different alleles are present 1 dominant and 1 recessive.
Genotype	Alleles that are present for a particular feature e.g. Bb or bb
Phenotype	Physical expression of an allele combination e.g. black fur, blonde hair, blue eyes.
Variation	Differences in the characteristics of an individual in a population. caused by genes and environment

INHERITANCE, VARIATION AND EVOLUTION COMBINED SCIENCE (8464) & BIOLOGY (8461) part 2

Tier 3 vocabulary

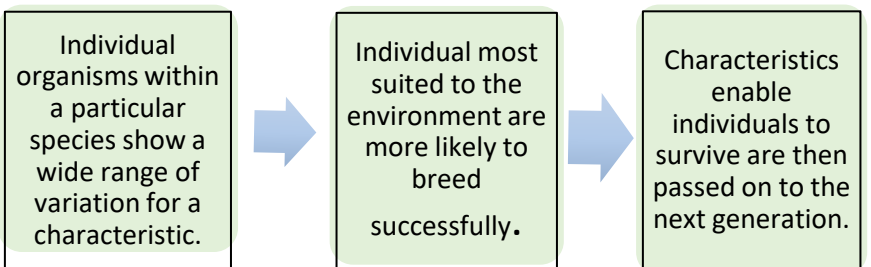
Embryo screening	small piece of developing placenta removed to check for presence of faulty genes
Gene therapy	replacing the faulty allele in somatic cells with a normal allele
Evolution	A change in the inherited characteristics of a population over time through the process of natural selection.
Selective breeding	Choosing parents with the desired characteristics from a mixed population
Genetic engineering	Involves modifying the genome of an organism by introducing a gene from another organism to give a desired Characteristic.

Why selective breeding to ensure:

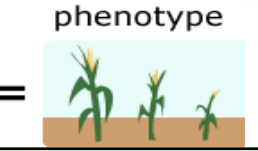
1. Disease resistance in food crops.
2. Animals which produce more meat or milk.
3. Domestic dogs with a gentle nature.
4. Large or unusual flowers.

Selective breeding can lead to **'inbreeding'** where some breeds are particularly prone to disease or inherited defects

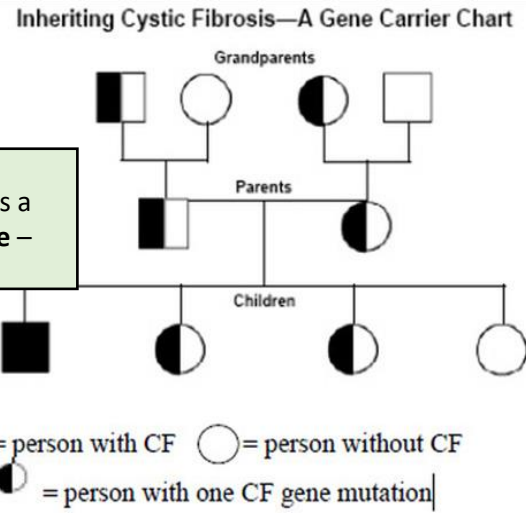
Theory of evolution by natural selection



Genetic variation arises in mutation, most have no effect on phenotype but some do. Variation can be affected by environment e.g. nutrition, sunlight.



Using a family tree: to work out the probability of a disorder. **Cystic Fibrosis** is a disease that occurs due to **recessive allele** – therefore children can be carriers.

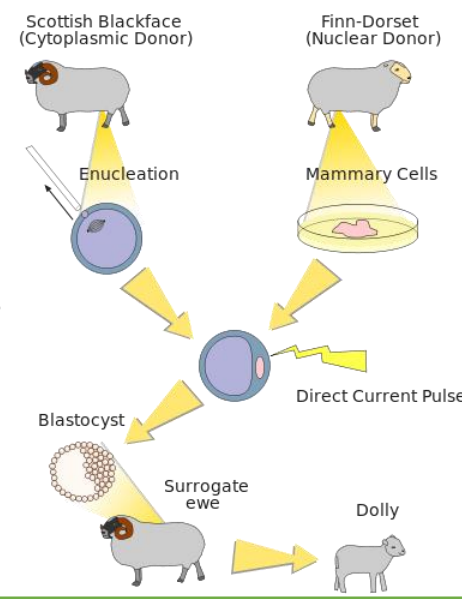


Advantages of Genetic engineering

1. Can be used to make proteins from other organism on a large scale.
2. Can be used to produce medicines
3. Can be used to produce organisms with specific characteristics.

Disadvantages of Genetic engineering

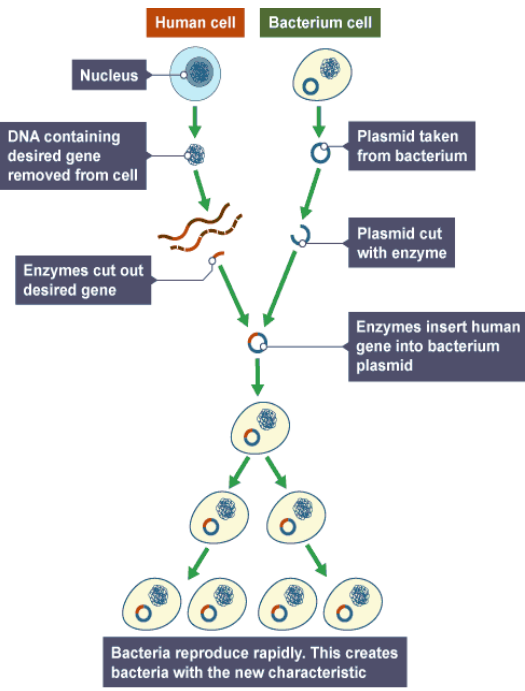
1. Long term side effects
2. Reduced variation in the wild population.
3. Effects on humans not fully explored.



Adult cell cloning – Bio only

1. Nucleus is removed from an unfertilised egg.
2. Nucleus from body cell is inserted into egg cell.
3. An electric shock stimulates the egg to divide into an embryo
4. Embryo cells are genetically identical to adult cells.
5. When embryo has developed into ball of cells it is inserted into host womb.

Genetic engineering



Genetic engineering process (HT only)

1. Enzymes are used to isolate the required gene.
2. Gene is inserted into a vector – bacterial plasmid or virus.
3. Vector inserts genes into the required cells.
4. Genes are transferred to plants/animals/microbes at an early stage of development so they develop the required characteristics.

Cloning techniques in plants/animals- Bio only

Tissue culture	Small groups of cells to grow new plants..
Cuttings	Part of a plant is cut off and grown into full plant.
Embryo transplants	Splitting apart cells from animals embryo before they become specialised. New clone embryos are inserted into womb of adult female.

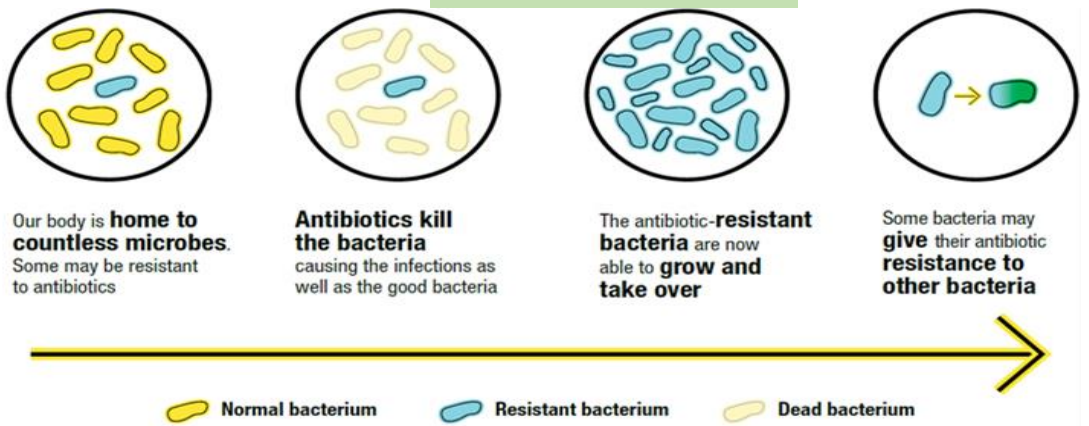
INHERITANCE, VARIATION AND EVOLUTION COMBINED SCIENCE (8464) & BIOLOGY (8461) part 2

Tier 3 vocabulary

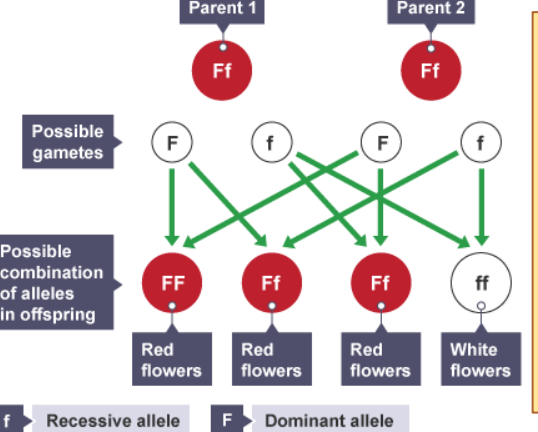
Speciation (Bio only)	Due to isolation of a population of a species e.g. species are split across far apart islands.
Binomial system	Is a system of naming species eg: Humans are <i>Homo sapiens</i>

Evolution is widely accepted. Evidence is now available as it has been shown that characteristics are passed on to offspring in genes.

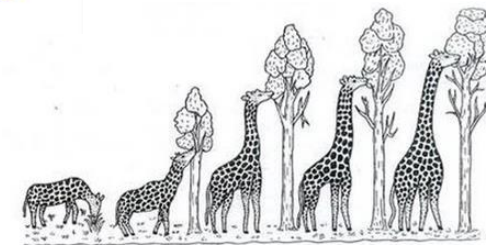
3. Antibiotic resistance



Understanding the role of genetics (Bio only)



Mendel conducted cross tests (as shown in the picture) **Inheritance of each characteristic** is determined by units that are passed on to descendants unchanged—Early 20th century. ‘units’ now called **genes** must be located **on chromosomes**.



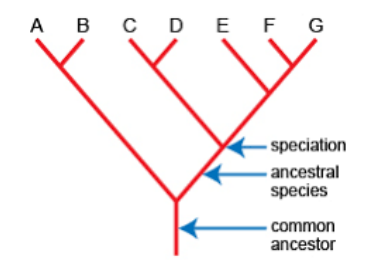
Other theories e.g. Lamarckism are based on the idea that changes occur in an organism during its lifetime which can be inherited. We now know that in the vast majority of cases this cannot occur.

Evidence for the theory of evolution

2. Extinction

When no members of a species survive

Due to extreme geological events, disease, climate change, habitat destruction, hunting by humans.



1. Fossils

1. ‘remains’ of ancient organisms which are found in rocks

2. Parts of organism that have not decayed as necessary conditions are absent.

3. Parts of the organism replaced by minerals as they decay.

4. Preserved traces of organisms such as footprints, burrows and rootlet traces.

Theory of evolution (Biology only) – by Charles Darwin

Supported by Alfred Wallace – working independently

He collected evidence from world wide and proposed the theory of speciation

Classification of living organisms

Carl Woese highlighted the 3 domain based on chemical analysis.

Archaea (primitive bacteria), true **bacteria**, **eukaryota**.

Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Primates
Family	Hominidae
Genus	Homo
Species	sapiens

Speciation – Bio only

Environmental conditions differ for populations e.g. types of food available, habitat.

Individuals in each population most suited to their environments are more likely to breed successfully.

Over long periods of time each population will have greater differences in their genotype.

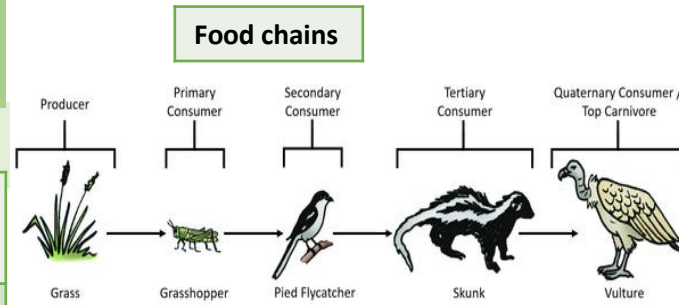
If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.

ECOLOGY COMBINED SCIENCE (8464) & BIOLOGY (8461)

PART 1

Tier 3 vocabulary

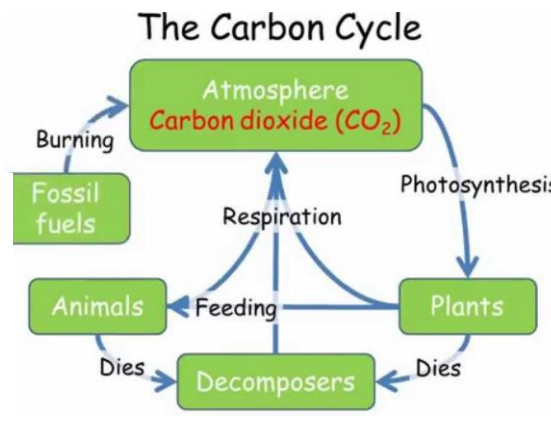
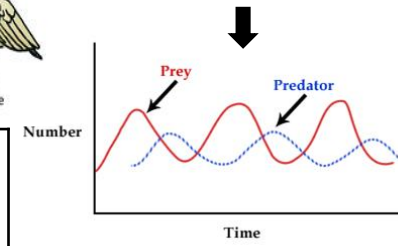
Adaptations	Organisms adaptations enable them to survive in conditions where they normally live.
Environment	The conditions surrounding an organism; abiotic and biotic.
Habitat	Place where organisms live e.g. woodland, lake.
Population	Individuals of a species living in a habitat.
Community	Populations of different species living in a habitat.
Food chains	Feeding relationships in a community
Abiotic factors	Non-living factors that affect a community
Biotic factors	Living factors that affect a community
Competition	Plants in a community or habitat compete with each other for light, space, water and mineral ions.
	Animals compete with each other for food, mates and territory.
Interdependence	Species depend on each other for food, shelter, pollination, seed dispersal etc. Removing a species can affect the whole community



Photosynthetic organisms are the producers of biomass for life on Earth e.g. grass that is usually a green plant or photosynthetic algae.

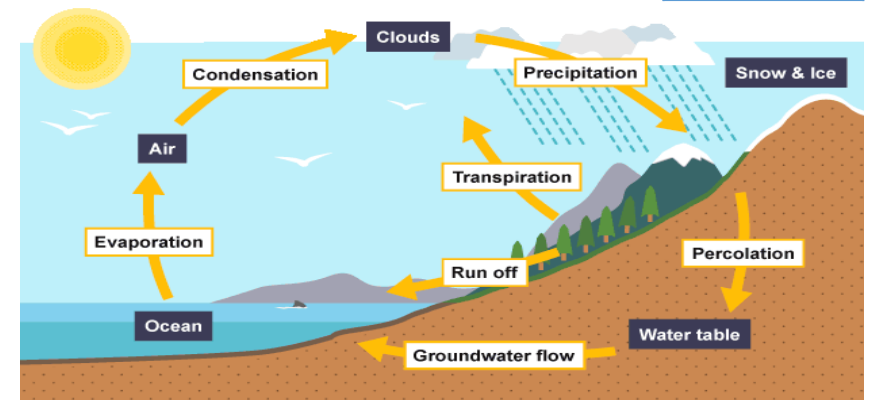
Consumers that kill and eat other animals are predators and those eaten are prey.

In a stable community the numbers of predators and prey rise and fall in cycles.



Dead organisms decayed by bacteria and fungi releasing carbon.

Water cycle






Decomposition and material cycling

Microorganisms can break down dead organisms to produce nutrients in the soil. The decay process is effect by temperature, oxygen and water. Anaerobic decay in biogas generators produces methane gas, used as a fuel

Abiotic	Biotic
Living intensity.	Availability of food.
Temperature.	
Moisture levels.	New predators arriving.
Soil pH, mineral content.	
Wind intensity and direction.	New pathogens.
Carbon dioxide levels for a plant.	
Oxygen levels for aquatic organisms.	One species outcompeting so numbers are no longer sufficient to breed

Adaptations

<p>Plants</p> <p>Cactus in dry, hot desert</p>  <p>No leaves to reduce water loss, wide deep roots for absorbing water.</p>	<p>Animals</p> <p>Polar bear in extreme cold arctic</p>  <p>Hollow hairs to trap layer of heat. Thick layer of fat for insulation.</p>	<p>Extremophiles</p> <p>Deep sea vent bacteria</p>  <p>Populations form in thick layers to protect outer layers from extreme heat of vent.</p>
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ECOLOGY COMBINED SCIENCE (8464) & BIOLOGY (8461) PART 2

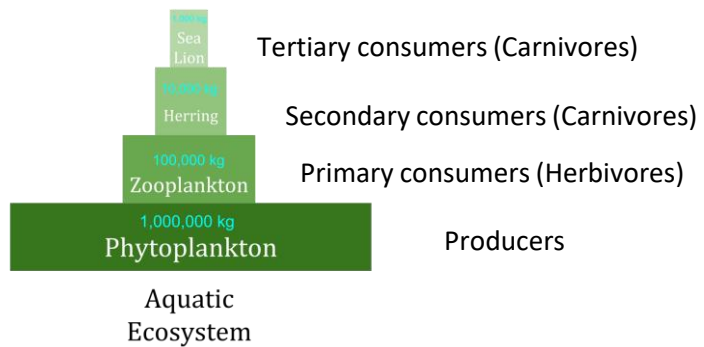
Tier 3 vocabulary

Global warming	<i>Levels of CO₂ and methane in the atmosphere are increasing</i>
Biotechnology	<i>Using bacteria to meet the demands of a growing population.</i> eg : GM bacterium produces insulin to treat diabetes. GM crops to provide more/nutritional food (golden rice).
Farming techniques	<i>Increasing efficiency of food production.</i> Reduce energy waste, limiting movement, control temperature, high protein diet to increase growth
Biodiversity	Biodiversity is the variety of all the different species of organisms on Earth, or within an ecosystem. A high biodiversity ensures the stability of the ecosystem by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment .

Required Practical : Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change (Biology only)
Method : Add 20cm³ milk into three beakers, add universal indicator, cover with cling film and place the beakers at different range of temperature.
Analysis: the experiment measured the rate of decomposition. The higher the temperature, more enzyme activity however at very high temperature the enzyme denatures.

Trophic levels and biomass (biology only)

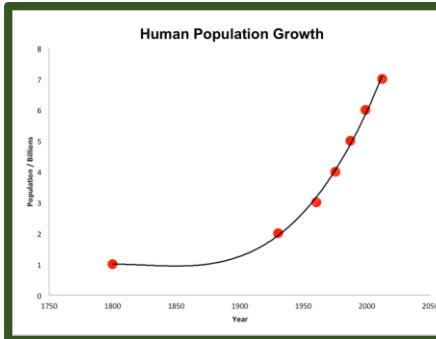
Trophic levels can be represented by numbers and biomass in pyramids.



Efficiency of biomass transfer = $\frac{\text{biomass transferred to the next level}}{\text{biomass available at the previous level}} \times 100$

Biomass is lost between the different trophic levels. Approximately **only 10%** of the **biomass** transferred to the **trophic level** above. Large amounts of glucose is used in respiration, some material egested as faeces or lost as waste e.g. CO₂, water and urea in urine.

Increased human population and has reduced biodiversity



The world population is increasing, where the following activities are having a **negative effect on biodiversity:**

1. How we **manage waste**
2. How we **use land**
3. **Deforestation**
4. **Global warming**

Maintain/grow fish stocks to a sustainable level where breeding continues or certain species may disappear. By controlling net size, fishing quotas.

Sustainable methods must be found to feed all the people on Earth. The **efficiency of food production** can be improved by **restricting wasted energy transfer** from food animals to the environment..

- Factors affecting food security (Biology only)**
Enough food is needed to feed a changing population
1. Increasing birth rate
 2. Changing diets in developing countries
 3. New pests and pathogens affecting farming.
 4. Environmental changes e.g. famine when rains fail.
 5. Cost of agriculture input.
 6. Conflicts (war) affecting water of food availability

Modern **biotechnology** techniques enable large quantities of **microorganisms** to be **cultured for food**.

Genetically modified crops (GM) could be used to provide **more food** or food with an improved **nutritional value**

Maintaining biodiversity

- Put in place programmes to reduce the negative impacts of humans on ecosystems and biodiversity**
- Breeding programmes for endangered species.
- Protection and regeneration of rare habitats.
- Reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop.
- Reduction of deforestation and CO₂ emissions by some governments.
- Recycling resources rather than dumping waste in landfill.

ECOLOGY COMBINED SCIENCE (8464) & BIOLOGY (8461)
PART 3

Tier 3 vocabulary

Quadrats	Organisms are counted within a randomly placed square
Transects	Organisms are counted along a belt (transect) of the ecosystem.
Median	Middle value in a sample.
Mode	Most occurring value in a sample.
Mean	The sum of all the value in a sample divided by the sample number.
Eutrophication	Algae in the water grow rapidly due to the fertiliser. The algae reduce the amount of light available for plants and so they die. The decay process uses up oxygen and so other living organisms such as fish die as well

We can measure population size using:

- Quadrats** are frames usually with an area of 0.25m². They are placed on the ground and the organisms (usually plants) inside the frame are counted. Quadrats are used to calculate population density, population frequency or percentage cover in an area.
- Transects are also use to study population size.



Human activity can have a negative impact on biodiversity

Land use

Humans reduce the amount of land and habitats available for other plants, animals and microorganisms.

Building and quarrying.

Farming for animals and food crops.

Dumping waste.

Destruction of peat bogs to produce cheap compost for gardeners/farmers to increase food production.

Large scale deforestation

In tropical areas (e.g. rain forest) has occurred to:

Provide land for cattle and rice fields, grow crops for biofuels.

Human activity can have a negative impact on biodiversity

Air pollution

Without careful management, air pollution can cause serious harm to humans and other living organisms.

Water pollution

Sewage or **toxic chemicals** may enter lakes, rivers or the sea. Water pollution can cause **eutrophication**.

Waste management

Rapid growth in human population and higher standard of living

More resources used and more waste produced.

Pollution in water; sewage, fertiliser or toxic chemicals.

Pollution in air; smoke or acidic gases.

Pollution on land; landfill and toxic chemicals.

Environmental changes affect the distribution of species

Temperature

Availability of water

Composition of atmospheric gases

These changes might be seasonal, geographic or caused by human interaction.