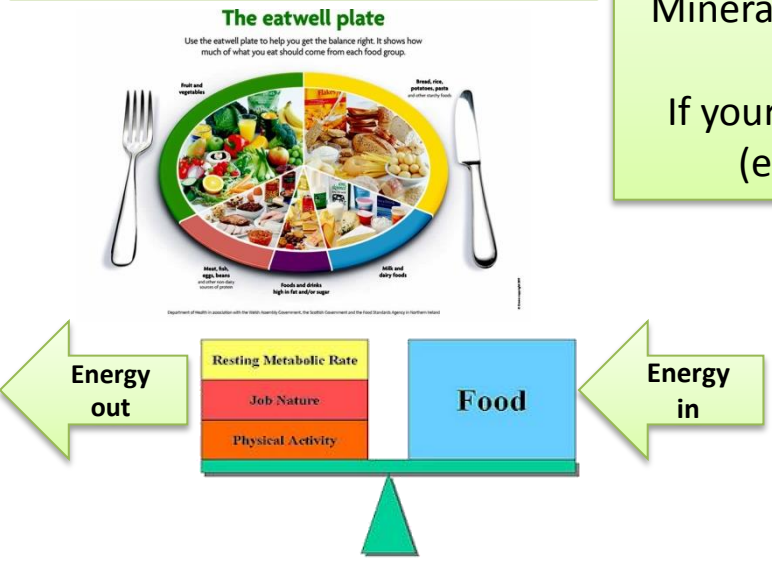
AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.1 Keeping healthy

A combination of a balanced diet and regular exercise is needed to help keep the body healthy. Our bodies provide an excellent environment for many microbes which can make us ill once they are inside us. Our bodies need to stop most microbes getting in and deal with any microbes which do get in. Vaccination can be used to prevent infection.

- **B1.1.1 Diet and exercise –** no Higher Tier content.

- **B1.1.2 How our bodies defend themselves against infectious diseases -** Higher Tier candidates should understand that:
  - antibiotics kill individual pathogens of the non-resistant strain
  - individual resistant pathogens survive and reproduce, so the population of the resistant strain increases
  - now, antibiotics are no longer used to treat non-serious infections, such as mild throat infections, so that the rate of development of resistant strains is slowed down.

B1.1.1 Diet and exercise



A healthy BALANCED diet contains the right balance of the different nutrients from foods you need and the right amount of energy.
Mineral ions (e.g. iron, calcium) and vitamins (e.g. A, C, D) are needed in small amounts for healthy functioning of the body.
If your diet is not **BALANCED** a person can become **MALNOURISHED** (e.g. over/underweight or suffer from a deficiency disease).

Nutrient group	Needed for
Carbohydrates	energy for life processes
Fats	energy for life processes: fats to make cell membranes: insulate bodies
Proteins	growth and repair - building cells: energy for life processes

Metabolic Rate = Rate that chemical reactions occur in cells – affected by age, gender and level of activity.
By exercising regularly a person can increase their metabolic rate, reduce their weight and reduce bad cholesterol levels.

The amount of energy that a person takes in (gets from their food) needs to be the same as the **energy they use** or they can become **UNHEALTHY.**
If there is **LESS energy** in a person becomes **underweight**.
If there **MORE energy** in than out a person becomes **OVERWEIGHT** or **OBESE**. Obesity can lead to Type 2 diabetes and other health problems e.g. heart disease.

Cholesterol levels in the blood can affect health.
Cholesterol is **made in the liver and is needed for healthy cell membranes**.
Two types:

- **Bad Cholesterol** (Low density lipoproteins -LDL) Carry cholesterol to cells, high levels of LDLs cause fat to build up in the artery.
- **Good Cholesterol** (High density lipoproteins -HDL) Carry cholesterol back to liver, helps prevent cholesterol building up.

B1.1.2 How our bodies defend themselves against infectious diseases – Pathogens and defence

- **Pathogens**: Microorganisms that cause disease.
- **Bacteria** - Reproduce rapidly, make toxins, smaller than plant or animal cells e.g. Typhoid, cholera
- **Viruses** – Need to reproduce inside other cells, always damage cells and are much smaller than bacteria e.g. colds, measles.
- **Infectious**: pathogen can be passed on by: Droplet infection in the air, direct contact, a break in skin, contaminated food or drink

Ignaz Semmelweis 1850's

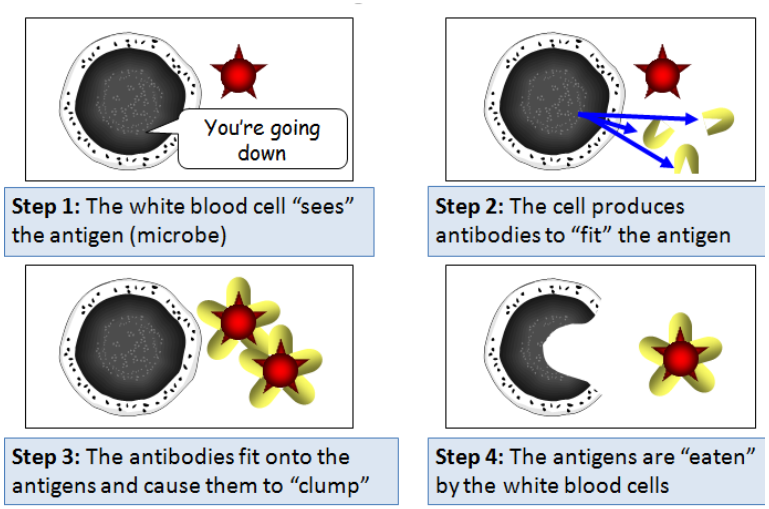
He was a doctor who noticed many women used to die after **childbirth** 'childbed fever'. There were **two wards** one with **midwives** one with **doctors**. **More** women **died** when the **doctors** treated them. He realised that doctors **did not wash their hands** after they had been working on **dead bodies** and went to examine the pregnant women. **He made** the **doctors wash their hands in chlorine** water. There was a **huge decrease** in the **number of deaths**. He knew that they were carrying something (**pathogens**) on their hands. He was mocked by other doctors for what he thought we now know that he was right.

Defence against infection

1. **Physical barriers** – prevent pathogens getting in
2. **Chemical defences** – kill pathogens before they harm us

White blood cells:

- **Ingest pathogens** and destroy them.
- Produce **antibodies** to destroy particular pathogens.
- Produce **antitoxins** that counteract the toxins released by pathogens.



B1.1.2 How our bodies defend themselves against infectious diseases – Drugs and immunity

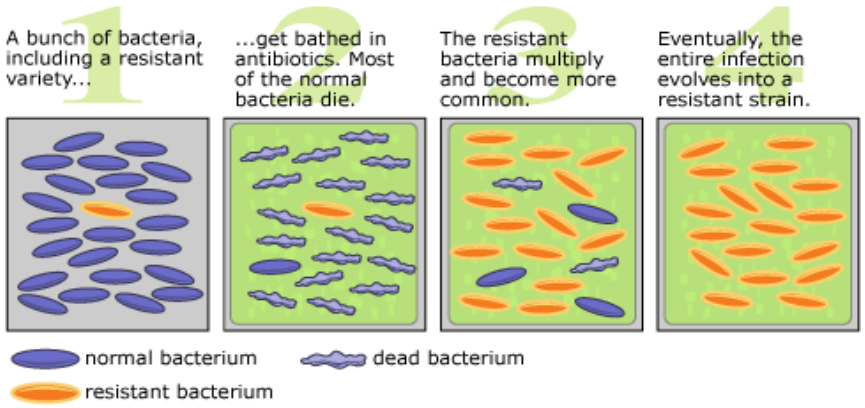
Antibiotics work **inside the body** to **kill bacteria** that cause diseases by damaging the bacterial cells – they **don't work on viruses** as viruses live inside body cells

Painkillers relieve symptoms but **do not kill** the pathogen

Resistance ***Some bacteria develop natural resistance to antibiotics (higher tier only).***

During antibiotic treatment

1. **Less** resistant bacteria **killed first**
2. **More** resistant bacteria **remain** and **will re-infect if full** course of antibiotics not taken. ***Overuse of antibiotics can cause more resistance to develop antibiotics not used to treat non serious infections anymore.*** MRSA – **multi resistant** to many antibiotics therefore very difficult to treat



Immunity

- ***Antigens*** – unique proteins on a pathogen cell surface
- White blood cells produce ***antibodies*** to join up with antigens on a pathogen
- White blood memory cells – ***immunity***

Vaccinations

- Given a **weak/dead** form of the **pathogen**.
- **White blood cells** (WBC's) produce **antibodies**. **Pathogen** is **destroyed.**
- If come across **real pathogen** WBC's can produce **antibodies quickly**

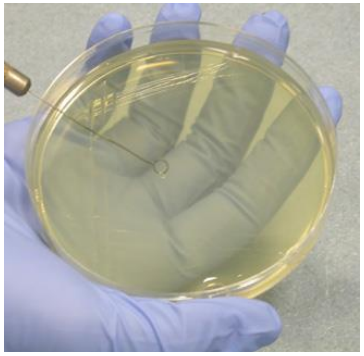
MMR vaccine is used to protect children against measles, mumps and rubella.

Some viruses mutate often and the immune system (WBC's) doesn't recognise them so new vaccines have to be made for them e.g. flu

B1.1.2 How our bodies defend themselves against infectious diseases – Growing bacteria.

Microorganisms can be grown in the lab

- A ***culture medium (agar)*** used containing an *energy* source (carbohydrate) and minerals.
- Petri dishes and agar must be **sterilised before use to kill microorganisms.**
- **Inoculating loops** used to transfer microorganisms.
- Lid of the Petri dish should be **sealed** with **tape to stop microorganisms** getting in (must **not be fully sealed so oxygen** can get in) .
- In school petri dishes **incubated at 25°C reduces risk** of growth of **pathogens** that might be **harmful to humans.**

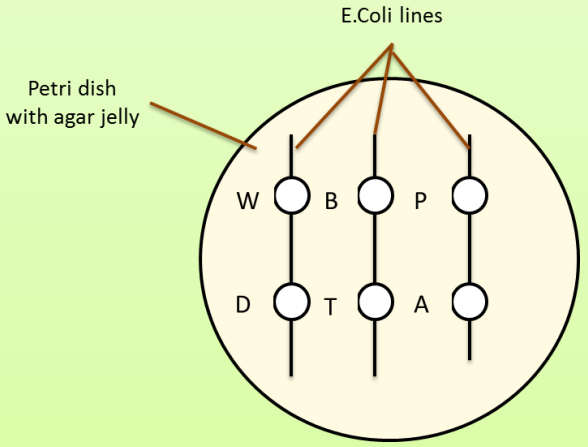


Effectiveness of disinfectants and antibiotics on bacteria experiment

- Agar inoculated with **BACTERIA**.
- **Paper discs** containing **antiseptics** and **antibiotics** placed on **bacteria** and **left to grow.**

Water DISK used as a CONTROL.

- If **bacteria don't grow** around the disk the it is **effective** at killing bacteria.
- **Area** where **bacteria don't grow** is called **ZONE OF EXLUSION**.



AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.2 Nerves and hormones

The nervous system and hormones enable us to respond to external changes. They also help us to control conditions inside our bodies. Hormones are used in some forms of contraception and in fertility treatments. Plants also produce hormones and respond to external stimuli.

- **B1.2.1 The nervous system**
- **B1.2.2 Control in the human body**
- **B1.2.3 Control in plants**

No Higher Tier content

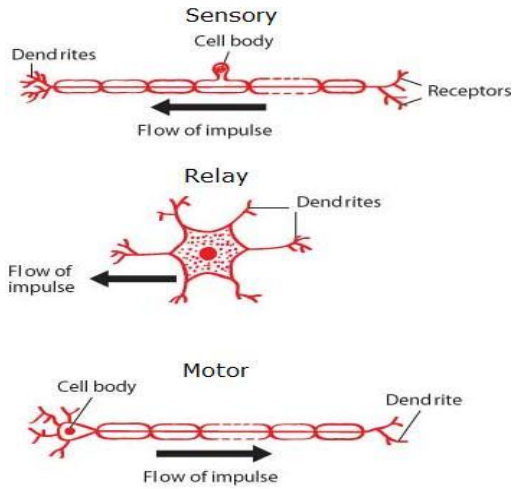
B1.2.1 The nervous system

Types of Neurone :

Sensory neurones send impulses from **receptors** in the sense organs to the CNS.

Motor neurones send impulses from the CNS to muscles and glands.

Relay neurones found in the spinal cord/brain. The link sensory and motor neurones.



Light receptor cells, like most animal cells, have a nucleus, cytoplasm and cell membrane.

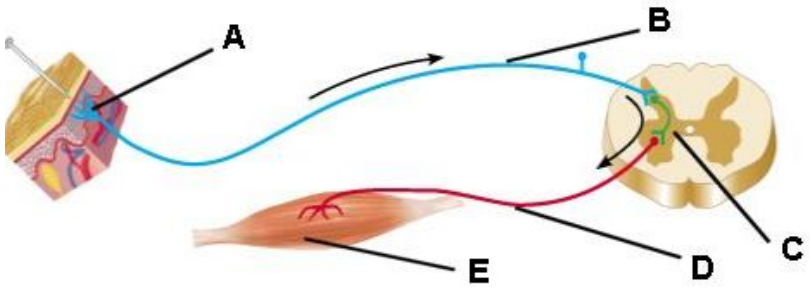
The nervous system uses electrical impulses to send messages along neurons. These are VERY fast and allow you to respond quickly to changes in the environment.

Neurone – a cell that transmits electrical impulses in the nervous system. **Central Nervous system (CNS)** – Brain and Spinal cord. **Peripheral Nervous system (PNS)** - nerves connecting the sense organs and effectors to the CNS

Sense organs – detect changes both in and outside your body. They contain receptor cells **Eye; Ear; Skin; Mouth; Nose**

Stimulus – Anything your body is sensitive to e.g. noise, heat, light. **Impulses** – Electrical signals in the nervous system that travel through neurones.

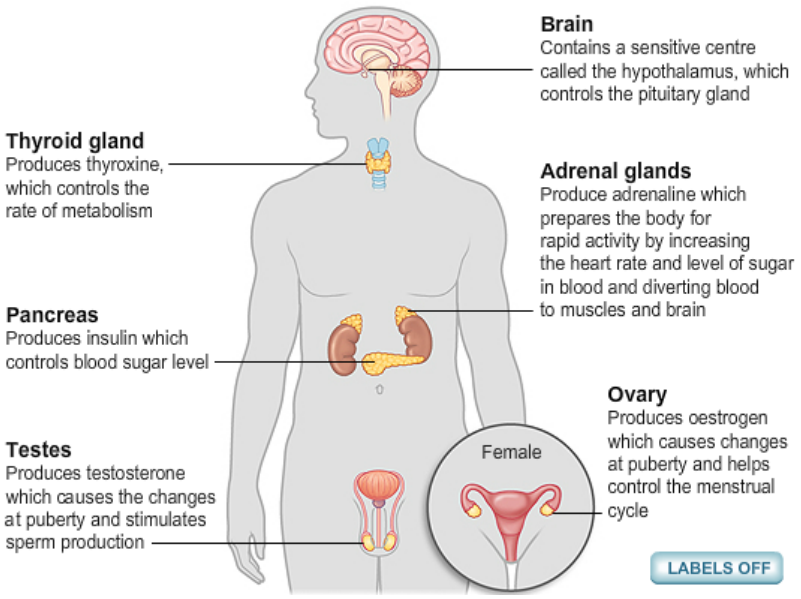
The Reflex Arc – **an automatic response**



A – Receptor (reacts to a stimulus)
B – Sensory Neuron (carries message to the co-ordinator/CNS)
C – Relay Neuron **Gaps between neurons are called SYNAPSES**
D – Motor Neuron (carries message away from co-ordinator/CNS
E – Effector (a muscle or gland)

B1.2.2 Control in the human body – Hormones and Homeostasis

Hormones: The endocrine system **produces hormones** in parts of the body called **glands**. These are **chemicals** that help control body functions.
The glands **release the hormones** into the **blood** where they are carried to **target organs**.
Hormones travel a lot **slower** than **nerve** messages but their effects are usually **longer lasting** and they **act quickly**.
Hormones **control** things like **menstruation in women** as well as the changes that occur to our bodies during **puberty** and **homeostasis.**



Factors controlled by homeostasis:

Water content– water leaves the body by: lungs when we breathe out, skin when we sweat, kidneys in the urine

Ion content– ions are lost by: skin when we sweat, kidneys in the urine

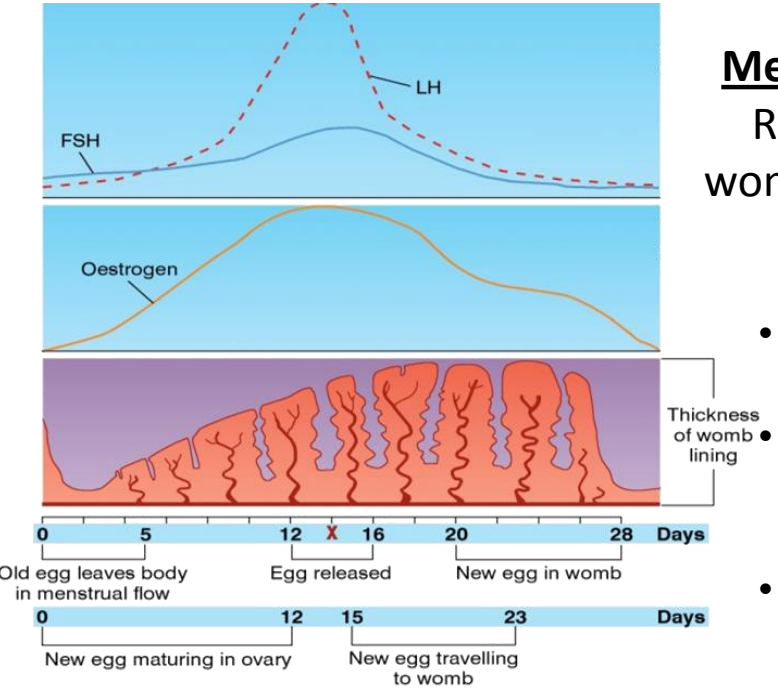
Temperature – to maintain the temperature at which enzymes work best for chemical reactions in the cells. Normal body temperature is 37^{o}C

Blood glucose levels – controlled by the pancreas to provide the cells with a constant supply of energy.

SAS survival manual says to conserve water:
- Avoid exercise, stay in the shade, don't lie on hot ground – **no sweating.**
- Don't eat – **digestion uses up water.**
- Don't talk and breathe through your mouth – **so no water lost from mouth.**

B1.2.2 Control in the human body – Menstrual Cycle

Hormone	Produced in...	Causes...
FSH Follicle stimulating Hormone	**Pituitary Gland**	**Egg to mature stimulates ovary to produce oestrogen**
Oestrogen	**Ovaries**	**Lining of the womb to develop. Stimulates pituitary gland to make LH**
LH Luteinising hormone	**Pituitary Gland**	**Triggers release of egg from the ovary**
Progesterone	**Ovaries**	**Maintains the lining of the womb**



<u>Menstrual cycle 28 days</u>

Reproductive cycle in women. Brought about by ***hormones.***

- **Womb lining thickens**
- **Eggs released from ovary after 14 days: ovulation**
- **If not fertilised the womb lining and egg come out as a period**

Controlling fertility:

<u>Contraception</u> :Inhibits production of FSH so eggs don't mature in the ovaries.

<u>Fertility treatments</u>: FSH used to stimulate eggs to mature and trigger oestrogen production. IVF - eggs collected and fertilised in the lab then implanted

Advantages - fewer children (cost), women freedom.

Disadvantages - expensive, multiple births, embryo use

B1.2.3 Control in plants -Auxins

Tropism – plant growth response to a stimulus.
Phototropism – Plant growth response to light.
Geotropism –Plant growth response to gravity.
Positive Tropism – towards the stimulus.
Negative Tropism – away from the stimulus.
Auxin – Plant growth hormone.

Uses of plant Hormones

Selective Weed killers – Auxin makes broad leaved plants grow out of control and die.

Rooting Powder – Auxin makes cuttings develop roots quickly.

Seedless Fruit – Flowers sprayed with hormones to make fruit develop but not seeds.

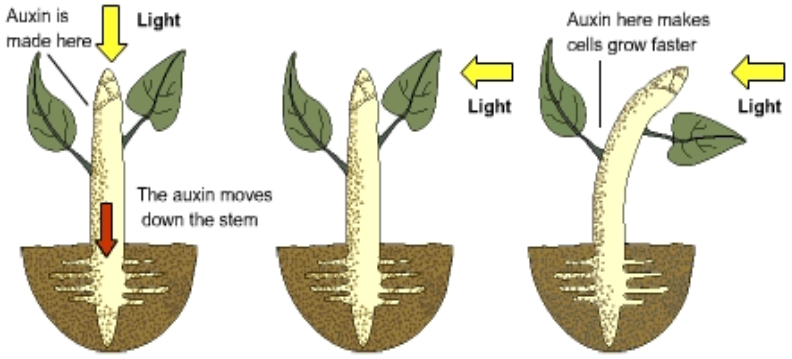
Fruit Ripening – Farmers use hormones to control fruit ripening.

Phototropism

Auxin produced in **the tip of the shoot**

Auxin moves to shaded side of the stem

Auxin causes **cell elongation**

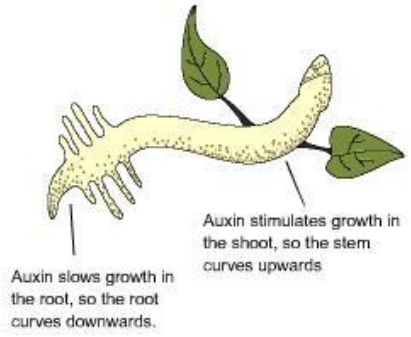


Geotropism

Auxin produced in the **tip of the root**

Auxins have **opposite effect in the root**

Auxins stop elongation and root grows down



AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.3 The use and abuse of drugs

Drugs affect our body chemistry. Medical drugs are developed and tested before being used to relieve illness or disease. Drugs may also be used recreationally as people like the effect on the body. Some drugs are addictive. Some athletes take drugs to improve performance. People cannot make sensible decisions about drugs unless they know their full effects.

- **B1.3.1 Drugs**

No Higher Tier content

B1.3.1 Drugs – Different Types

Drugs are chemicals that change the way our body works, can change metabolism and behaviour.

Beneficial: Statins, antibiotics: Medical drugs are developed and tested before being used to relieve illness or disease.

Recreational: Drugs may also be used recreationally as people like the effect on the body. Some drugs are addictive.

Legal: coffee, cigarettes, alcohol: Millions of people take these so health impact is much bigger than for illegal drugs

Illegal: cocaine, ecstasy, heroin: Affect nervous system

Statins: Drugs that lower **cholesterol** in the blood and stop the **liver** producing too much cholesterol. Patients should also have a healthy diet. This **reduces** the risk of heart disease.

Medicines - A good medicine is:

Effective – *prevent / cure a disease / ease symptoms*

Safe – *not toxic or unacceptable side effects*

Stable – *use the medicine in normal conditions and able to be stored.* **Developing drugs** can take **many years** and costs **hundreds of millions £/$.**

They are ***tested*** on cells, tissues and organs **before** animal testing and human trials.

Placebo – pill that does not contain the drug

Double blind trial – neither doctor or patient knows who has the real drug.

Thalidomide Used in 1950s as treatment for morning sickness. Tests on pregnant animals not carried out until 1968. Affected foetuses – born with severe limb deformities. Was banned now used to treat leprosy!

Addiction: dependent – can't function without the drug. More and more is needed for same effects. Addicts may turn to crime to fund drug habits, more likely to get STDs, mental / physical health problems ***Withdrawal symptoms*** – cravings, aches, sweating etc

Cannabis is an illegal drug. Cannabis smoke contains chemicals which may cause mental illness in some people.

B1.3.1 Drugs – In sport

Sport	Drug type	Why use them?	Problems
Bodybuilding	Painkillers	Compete when injured	Exacerbates injury
Archery	Beta blockers	Steady hands	Insomnia, depression
Cycling	Erythropoietin	More Red blood cells - oxygen to legs	Kidney disease
Sprinting	Anabolic steroids	Muscle growth	Sexual characteristic change increased aggressive behaviour

Random drugs tests.

- **Athletes** that are caught are **banned**.
- **Some medicines** contain **banned** substances so they need to be careful.
- **Some drugs** are found naturally in the **body** as **levels vary** it can be **difficult to find cheaters**

Ethics:

- People should be able to do what they want with their body regardless of risk
- Only the richest / most sponsored people can cheat
- Desire to win and be the best
- Other athletes are using them
- Claim they didn't know they were cheating, coaches gave them 'supplements'

AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.4 Interdependence and adaptation

Organisms are well adapted to survive in their normal environment. Population size depends on a variety of factors including competition, predation, disease and human influences. Changes in the environment may affect the distribution and behaviour of organisms.

- **B1.4.1 Adaptations**
- **B1.4.2 Environmental change**

No Higher Tier content

B1.4.1 Adaptations

Living organisms need to survive and reproduce

- **Plants need**: light, carbon dioxide, water, oxygen, nutrients
- **Animals need**: food, water, shelter, mates, territory
- **Microorganisms** needs depend - some are light plants, some like animals and some need no oxygen or light

Being the most **competitive** means an organism will be more likely to survive and pass its **genes** on to its offspring

Animal survival

Surface area: volume ratio

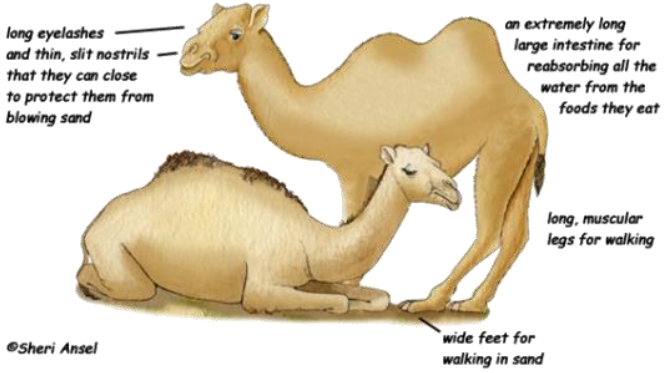
Mammals in a cool climate grow to a **large size** (e.g. Whales) to keep their ratio as small as possible to maintain body heat

Camouflage : Important in **predators** and **prey**
Dependent on environment (arctic hares brown in summer and white in winter)

Extremophiles have adaptations for living in extreme conditions. Such as high heat and pressures e.g. deep ocean volcanoes!

Dry climates

Deserts may be hot in day and freezing at night. Lack of water. Often **active at night** rather than day. Can't sweat or will lose water. **Large surface area:volume** to lose heat through skin. **Big ears**- lose heat. **Thin fur, little body fat**



Remember:
Plants have adaptations too. They need **light, water and space with nutrients to grow**.

Cold Climates:
Small surface area:volume e.g. Ears. **Insulation** – blubber (thick layer of fat under skin), fur coat Fat layer also provides a food supply during winter)

B1.4.2 Environmental change

Changes in an environment can be measured by looking at **living indicators (Mosses and Lichens)** These are very sensitive to changes in **AIR pollution.**

As **environmental changes** happen the distribution of organisms **also changes**. We can collect information on these changes but it is difficult to do it a way that can be repeated by others making it difficult to draw conclusion and say why the change has happened.

Water pollution: harmful substances into rivers, lakes etc. **Some invertebrate animals cannot survive** in polluted water **their presence or absence** shows if water **is polluted**.

The **environment** can **change** due **living factors** like a new **predator or disease** or a **non-living factor** like a **temperature rise** or **lack of sun and water**. Environmental changes can be measured using **non-living** indicators such as **oxygen/CO_2 levels, temperature and rainfall.**

Level of water pollution	Indicator species
clean	mayfly larva
low	freshwater shrimp
high	water louse
very high	rat-tailed maggot, sludgeworm

<u>Bees</u>

Disease (CCD) affecting honey bees

Bees are important for **pollination** of plants – apples, raspberries, cucumbers etc

Cause unknown – pesticides? Climate?

AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.5 Energy and biomass in food chains

By observing the numbers and sizes of the organisms in food chains we can find out what happens to energy and biomass as it passes along the food chain.

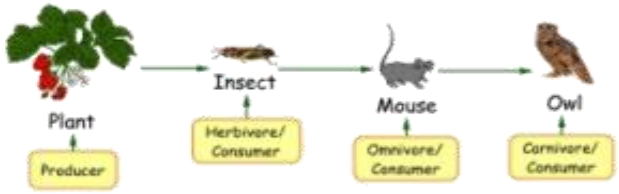
- **B1.5.1 Energy in biomass**

No Higher Tier content

B1.5.1 Energy in biomass

Trophic level – organisms that feed at the same level
Interdependence – organisms in an area that depend on each other
Dynamic relationship – constantly changing populations

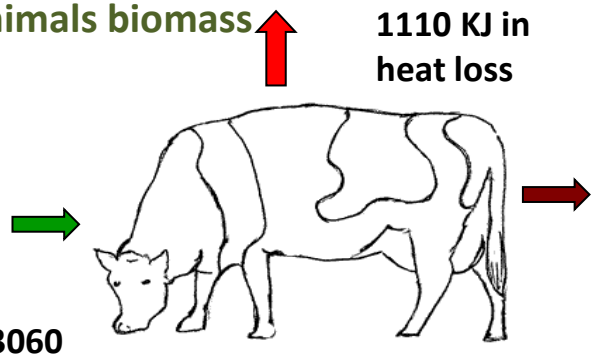
The Food Chain Of An Owl



A food chain shows the path of energy from one living thing to another. Decomposers like bacteria, are necessary for all food chains.

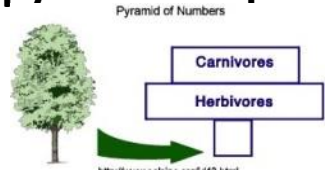
Plants are producers . They are **always** at the start of food chains, pyramids of numbers and pyramids of biomass.

Energy that will become part of the animals biomass

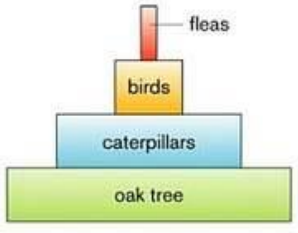


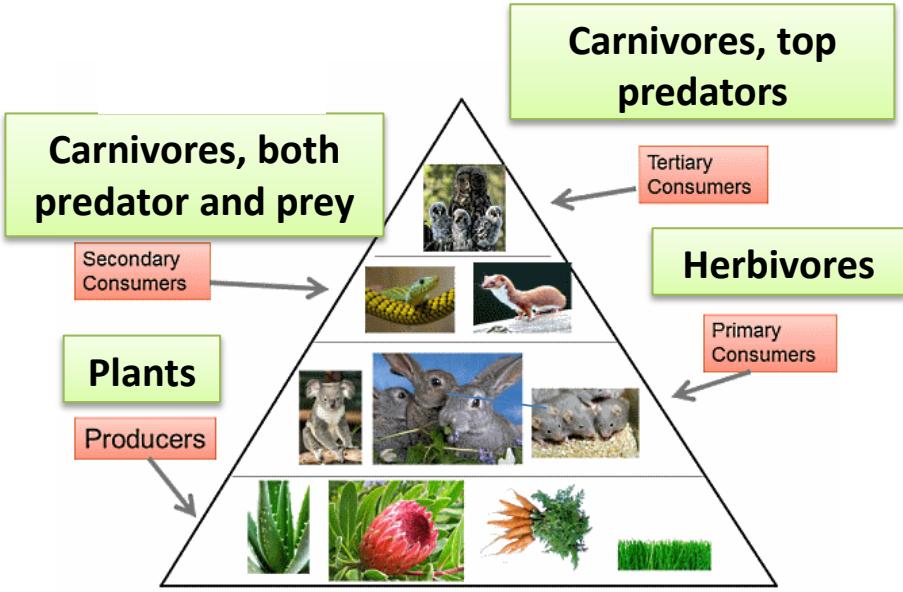
Biomass is the dry mass of living material in an animal or plant.

Pyramids of numbers just tell you how **many of each organism** you have in **each step** of the **food chain**. ***Not*** about the energy being passed on. **They don't have to be pyramid shaped**.



Pyramid of Biomass. The biomass of each organism in a food chain. Labelled layer for each thing in your food chain The **producer is always the biggest layer** and it is **always pyramid shaped**.





AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.6 Waste materials from plants and animals

Many trees shed their leaves each year and most animals produce droppings at least once a day. All plants and animals eventually die. Microorganisms play an important part in decomposing this material so that it can be used again by plants. The same material is recycled over and over again and can lead to stable communities.

- **B1.6.1 Decay processes**
- **B1.6.2 The carbon cycle**

No Higher Tier content

B1.6.1 Decay processes

Detritus feeders (e.g. Maggots, worms) start the process by eating dead animals and producing waste material

Decomposers (microorganisms) digest everything, using some of the nutrients to grow and reproduce

They produce waste products – CO_2, water and nutrients

This recycling means the soil contains mineral ions plants need to grow and cleans up dead organisms

Conditions for decay

Warm: Chemical reactions in microorganisms work faster when warm. Reactions slow down and stop if too cold, enzymes denatured if too hot.

Moist: Easier to dissolve food, prevents drying out microorganisms grow better.

Plenty of oxygen: Decomposers respire, need oxygen to release energy

Bacteria and **fungi** are the **main** groups of **decomposer.**

Using Decay – decay helps to **recycle resources**. **Sewage treatment plants** use **micro-organisms** to break down our waste and **gardeners** use **compost heaps** to do the same.

The **decaying material** makes good **fertilizer**.

Recycling waste reduces landfill and is much better for the environment.

B1.6.2 The carbon cycle

Detritivores – worms and maggots that feed on dead material
Decomposer – organisms (bacteria and fungi) that feeds on dead material starting the process of decay

The amount of carbon is fixed

Carbon is recycled as carbon dioxide (CO_2) through **respiration** and **photosynthesis**.

Photosynthesis: green plants and algae remove CO_2 from the atmosphere – passed on when plants are eaten. Plants use CO2 to make carbohydrates, fats and proteins.

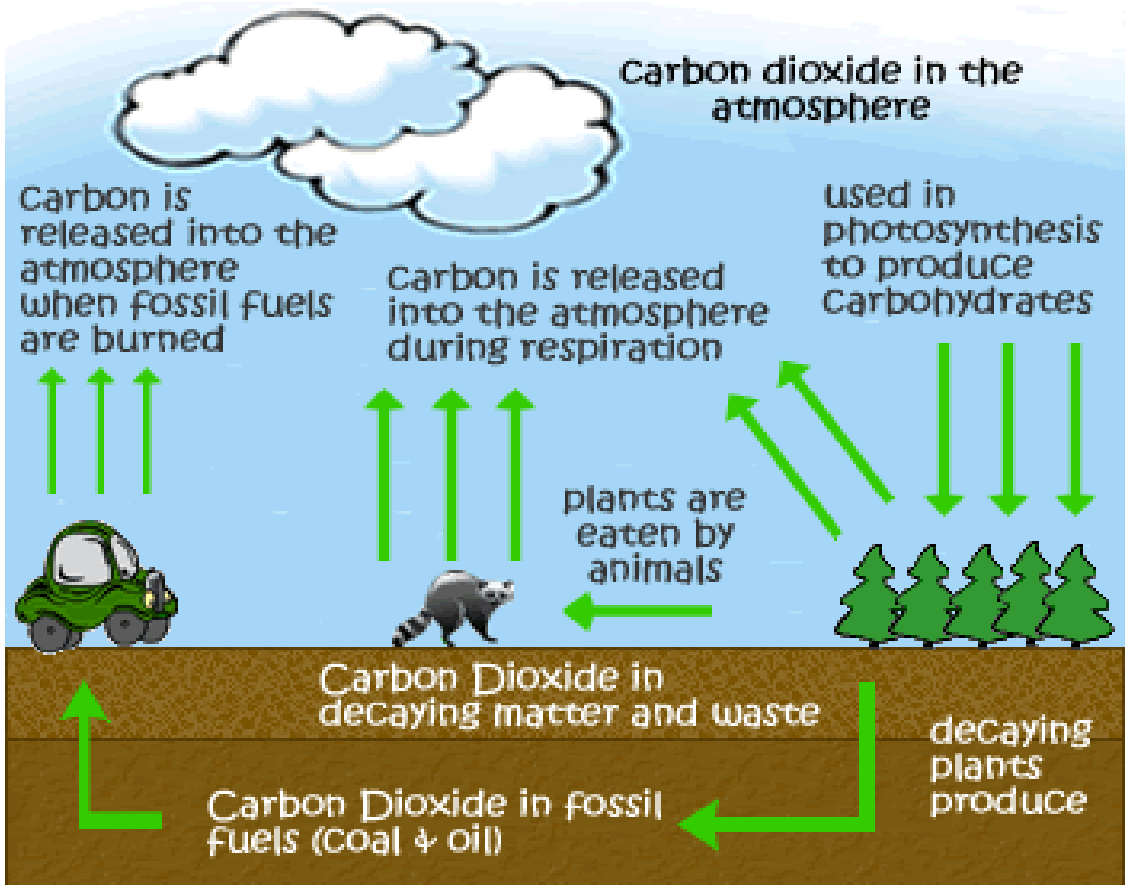
Carbon dioxide + water → glucose + oxygen

Respiration: living organisms use oxygen to break down glucose CO_2 is a waste product. Decomposers respire too

Glucose + oxygen → carbon dioxide + water

Combustion: fossil fuels contain carbon , when we burn then CO_2 is produced

Fuel + oxygen → carbon dioxide + water



Chalk and some other sedimentary rocks is formed from the **fossilised remains of sea creatures**. When these rocks are exposed to **rain** (which is slightly acid), the **rock dissolves** and **more CO_2** is **released.**

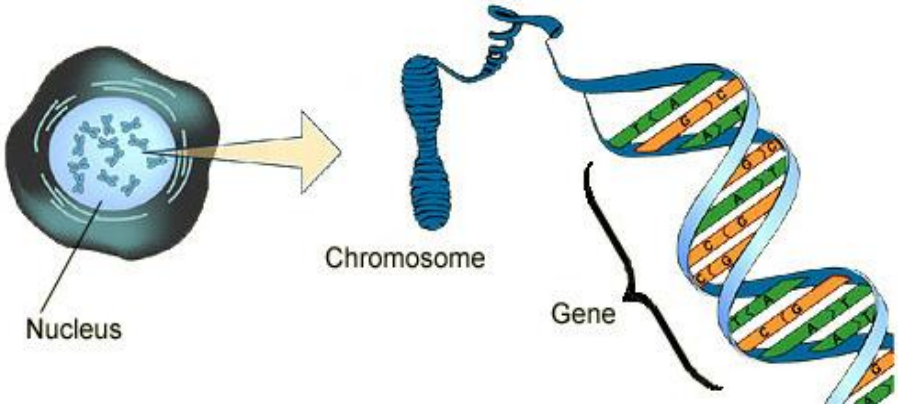
AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.7 Genetic variation and its control

There are not only differences between different species of plants and animals but also between individuals of the same species. These differences are due partly to the information in the cells they have inherited from their parents and partly to the different environments in which the individuals live and grow. Asexual reproduction can be used to produce individuals that are genetically identical to their parent. Scientists can now add, remove or change genes to produce the plants and animals they want.

- **B1.7.1 Why organisms are different**
- **B1.7.2 Reproduction**

No Higher Tier content

B1.7.1 Why organisms are different



Genetic information is in the **nucleus** of **cells** Inside the nucleus are **chromosomes** made up of **DNA** – **humans** have **46 chromosomes** (23 pairs) **fruit flies** have **8 chromosomes** (4 pairs)

Genes are a section of **DNA** and control **enzymes** and **proteins** made in our body

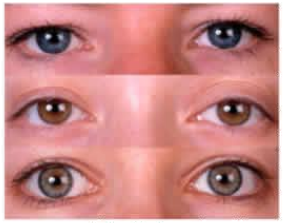
Genes are passed on to you in the **sex cells** (gametes) from your **parents** – they come in pairs

Genetic Variations: Passed on from **parent**s in your genes E.g. Eye colour, gender, shape of nose

Environmental Variations: Due to the way of **life** E.g. Scars, accents, hair length

Combined causes of variations: E.g. Height, weight

Blonde or Black Hair Colour



Eye Colour

Genetic Variation in Maize Plants (Corn on the Cob)

Investigating variety: scientists study twins adopted by different families compared to identical twins brought up together and non-identical twins.

B1.7.2 Reproduction

Reproduction can be sexual or asexual. Sexual reproduction produces **variation**. Asexual reproduction produces **clones**.

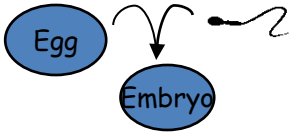
In **sexual** reproduction **two parents** are involved. A mixture of genes is created.
This **variety** is good as it helps us **cope with changes** and diseases as a species.
Occurs in animals and some plants e.g. flowering plants.

Advantages – allows evolution, variation, increases chances of species survival

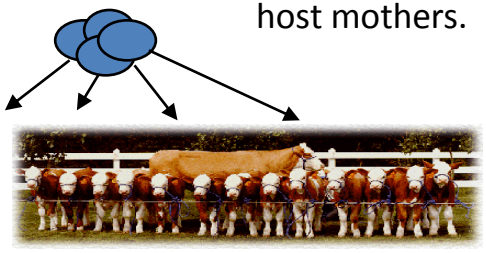
Disadvantages – need to find a partner, waste energy. Waste in producing gametes, slower

Asexual reproduction involves only **one parent**. So there is **no genetic variety (CLONES)**.
Occurs in bacteria and some plants e.g. strawberries.

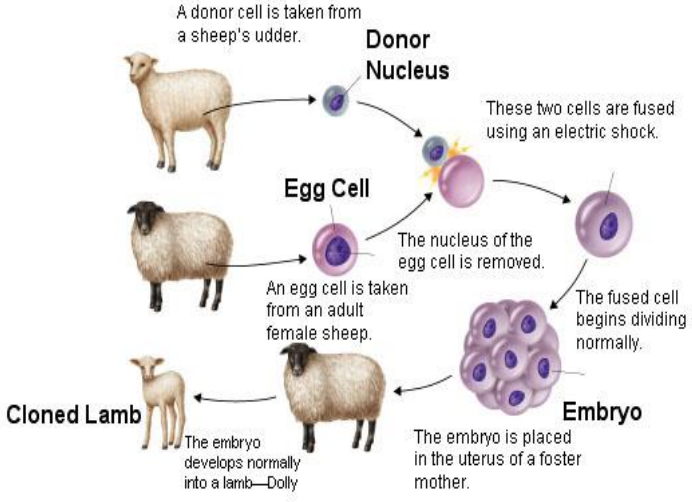
Embryo Transplant a developing embryo is removed from an animal and the cells split apart. The cells are grown for a while before being implanted into separate host mothers



Cells split apart and implanted into separate host mothers.

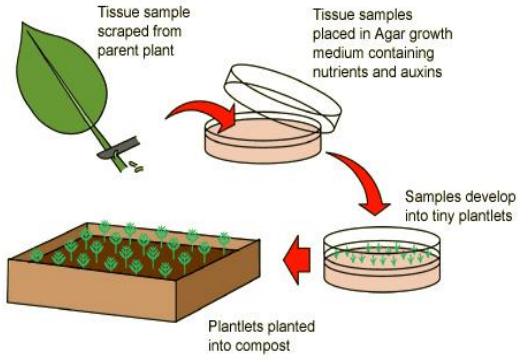


Adult Cell Cloning (reproductive cloning)- a nucleus is removed from an egg cell and replaced with a nucleus from another animals body cell.



Cloning Techniques –Plants

Taking Cuttings: take part of a plant use auxins to grow roots and plant in soil. **Tissue culture:** Tissue sample scrapped from the parent plant, grown in nutrient agar and treated with auxins then developed into tiny plants.



AQA Knowledge PowerPoint
Unit 1 Biology 1 B1.8 Evolution

Particular genes or accidental changes in the genes of plants or animals may give them characteristics which enable them to survive better. Over time this may result in entirely new species. There are different theories of evolution. Darwin's theory is the most widely accepted.

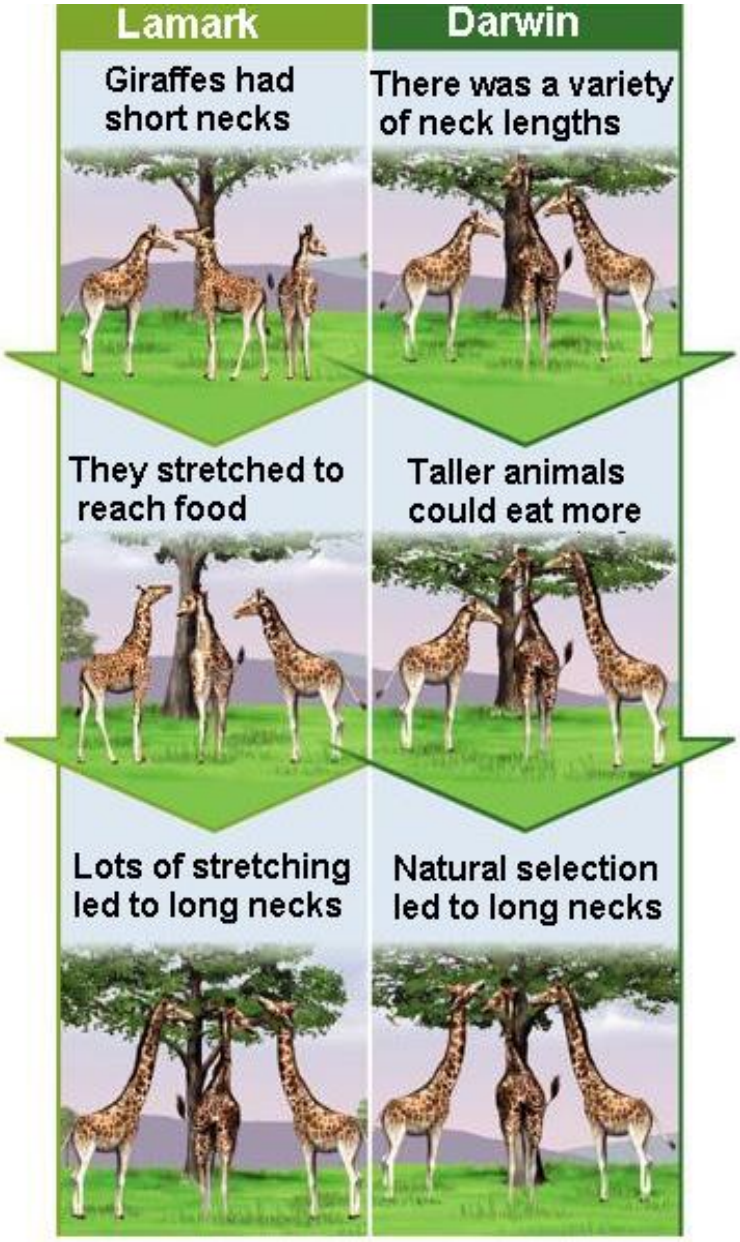
- **B1.8.1 Evolution**

No Higher Tier content

B1.8.1 Evolution- Theories

All species of living things alive today have evolved from the first simple life forms.

Jean-Baptiste **Lamarck** - French biologist
His idea was that **every animal evolved from primitive worms** - The change was caused by the inheritance of **acquired characteristics**



Charles **Darwin** travelled the Galapago Islands and noticed animals were **adapted to their surroundings** – his theory is that all living organisms have **evolved from simpler life forms**. This process has come about by **natural selection – accepted theory.**

Problems with Lamarck:
No evidence - People didn't like to think they descended from worms **- People could see clearly that changes were not passed onto their children** (e.g. Big muscles)

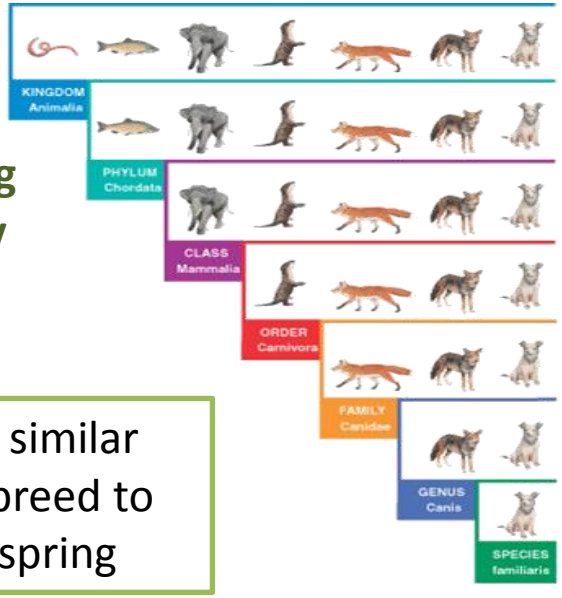
Why did people object?
Religious – god made the world
Not enough evidence
No way to explain inheritance – genetics not known about
It took 50 years after Darwin's theory was published to discover how inheritance and *variation* worked

B1.8.1 Evolution- Classification

Similarities and differences

Different organisms can be classified by studying their similarities and differences. These studies also help us to understand the evolutionary relationships between different organisms.

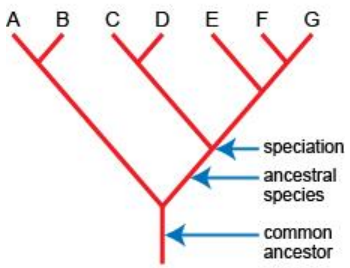
Biologists classify living organisms according to how closely they are related to one another.



Species: A group of similar organisms that can breed to produce fertile offspring

Evolutionary tree

DNA evidence used to decide which species an animal belongs to and work out evolutionary relationships



Darwin's theory of Evolution by Natural Selection

Variation –populations of organisms have variations.

Over-production –produce more young than will survive to adulthood.

Struggle for existence – competition for survival between the organisms

Survival – those with advantageous characteristics are more likely to survive **Advantageous characteristics inherited** – better adapted organisms are more likely to **Reproduce** successfully passing on the advantageous characteristics to their offspring in their genes.

Gradual change – over a period of time the more individuals with the advantageous characteristics in the population.

New evidence from DNA research and the emergence of resistant organisms supports Darwin's theory