Bottisham Village College

KNOWLEDGE ORGANISER

BIOLOGY

YEAR 10 ALL YEAR

KNOWLEDGE ORGANISERS

At Bottisham Village College, we are striving to create a five-year curriculum plan that builds effective revision strategies into homework and lessons, to ensure that students are able to place powerful knowledge into their long-term memories. Additionally, we hope that this will help build effective learning strategies from early in their time here at the college.

Based on evidence, we know that regular recall activities are the best way of achieving this goal and committing powerful knowledge into the students' memories.

At the start of each term, we shall publish all the knowledge organisers that students will require for their studies in each curriculum area. These will cover a range of aspects: facts, dates, characters, quotes, precise definitions and important vocabulary. We are clear: if this fundamental knowledge is secured, students can then develop their higher-level skills of analysis and critical understanding with greater depth.

They will be given an electronic A4 Knowledge Organiser (KO) booklet for each term containing all of the knowledge required. In lessons, Bottisham staff will be regularly testing this fundamental knowledge, using short -quizzes or even more formal "Faculty Knowledge Tests".

The best way to use these organisers at home, is to follow a simple mantra:

1. Look at a certain aspects of a particular knowledge organiser
2. Cover up part of their knowledge organiser
3. Write it out from memory
4. Check and correct any spelling mistakes, missing bits or mistakes

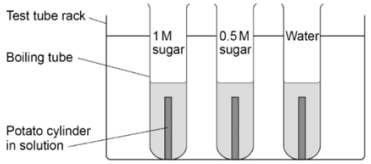
So simple but so effective.

Cell Biology Year 10

A. Key words.

Dilute Solution	A dilute solution of sugar contains a high concentration of water. It has a low concentration of sugar
Concentrated Solution	A concentrated sugar solution contains a relatively low concentration of water and a high concentration of sugar
Osmosis	Diffusion of water through a partially permeable membrane (surface that only lets small particles through). Moves from dilute solution to a more concentrated solution
Partially Permeable Membrane	Membrane that only lets small particles through
Vacuole	Sack filled with sap. Keeps cell rigid
Active transport	Moves substances from a low to a high concentration. Needs energy
Mitosis	Cell division to produce two identical cells for growth and repair of organisms
Stem Cells	Undifferentiated cells that have the ability to turn into another cell. This can be for medical purposes
Differentiate	The process where cells become specialised for a particular function
Meristem Cells	Undifferentiated cells in plants found in active regions of the stem and roots

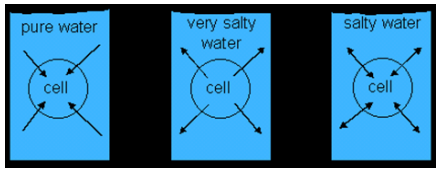
B. Required Practical: Osmosis: Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.



Results

-High concentration of sugar in solution = water moves out of potato cells into the solution. Potato loses mass.

-Low concentration of sugar in solution = water moves into the potato cells from the solution. Potato gains mass.



-If no water goes in or out of the potato overall and it doesn't change mass, then the solution is exactly the same concentration as inside the potato

C. Cell Cycle

Process by which body cells divide. Three stages:

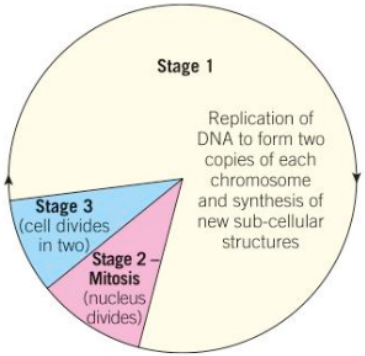
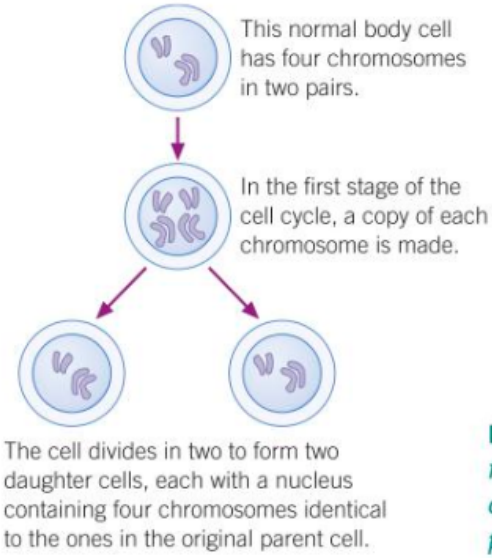


Figure 2 *The cell cycle. In rapidly growing tissue, stage 1 may only be a few hours, but in adult animals it can last for years*

D. Mitosis—Cell division



E. Stem Cells

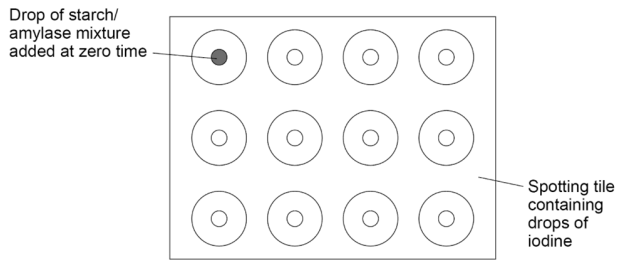
- An egg and sperm cell fuse to form a zygote (a fertilised egg cell)
- That cell divides and becomes a ball of cells—an embryo
- The cells in this embryo are embryonic stem cells
- Embryonic stem cells differentiate to form all of the specialised cells in your body
- Adult stem cells are undifferentiated cells of an organism that can give rise to many more cells of the same type e.g liver
- Treatment with stem cells may be able to help conditions such as paralysis and diabetes
- Stem cells from plant meristems are used to produce new plant clones quickly and economically for research, horticulture and agriculture

Organisation Year 10

A. Key words.

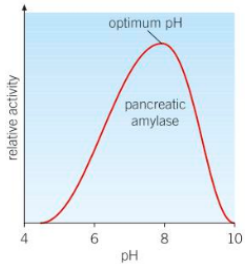
Carbohydrases	Enzymes that break down carbohydrates. Amylase is an example.
Amylase	An enzyme produced by the salivary glands and pancreas which breaks down start into glucose
Protease	An enzyme produced by the stomach, pancreas and small intestines that breaks down protein into amino acids
Lipase	An enzyme produced by the pancreas and small intestines that breaks down fat into fatty acids and glycerol
Enzyme	A biological catalyst made of proteins that speeds up reactions
Catalyst	A chemical which speeds up a chemical reaction but is not used up
Benign	A tumour that does not spread around the body
Malignant	A tumour that spreads aggressively throughout the body
Active site	The location on enzymes where the reactants fit
Non communicable	Diseases that are not infectious. Cannot be caught from another organism.
Bile	Neutralises food as it moves from stomach to small intestines

B. Required Practical: Enzymes and pH



Iodine solution is added to each well. A solution of starch and amylase at pH1 is added to the first well. Every 30 seconds, transfer solution to the next well until solution no longer goes blue/ black.

Independent Variable: pH of solution
Dependent Variable: time taken for starch to be broken down by amylase (when iodine solution to stop turning black)



C. Enzymes

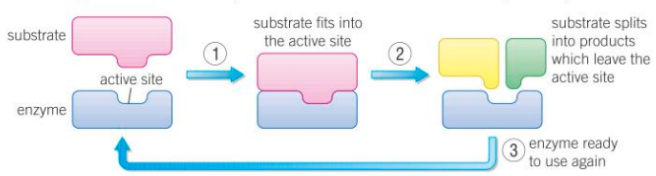
Enzymes speed up chemical reactions and work best at 40°. There are specific enzymes for different reactions.

Temperature:

At higher temperatures, there are more collisions between enzyme and reactants so more reactions happen. If temperature increases too much, enzymes denature so the reactant can't fit in the active site.

Lock and Key Model:

The lock and key theory is a model of how enzymes work. The reactants fit into the active site of the enzyme before the reaction takes place.



D. Non Communicable Diseases

The Heart:

Problems with the heart: blocked coronary arteries, heart attack, faulty valves, hole in the heart

Treatments: Drugs (i.e. statins), transplants, artificial hearts, replacement valves (biological or mechanical), stents (keep coronary arteries open)

Risk Factors: obesity, high blood pressure, fatty foods

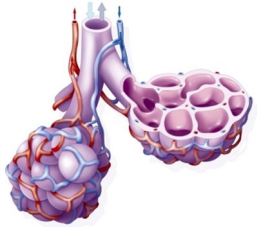
Cancer:

Cancer is caused by cells dividing uncontrollably. This causes a mass of cells to develop called a tumour. If a small number of these cells break off and grow in another part of your body, this is called a secondary tumour.

Common risk factors for cancer include diet, weight, tobacco and alcohol.

E. Gas Exchange

Respiratory System:



Adaptations to increase gas exchange in the alveoli:

1) Large surface area
2) Good blood supply
3) Thin walls– short diffusion distance
4) Moist lining

Transpiration:

Transpiration is loss of water vapour through stomata by evaporation. As water evaporates, it pulls more water up from the xylem. The constant flow of water from the roots to the leaves is called the transpiration stream.

Carbon dioxide diffuses into the leaf through the stomata.

Stomata can be open or closed. This is controlled by guard cells.

Infection and Response

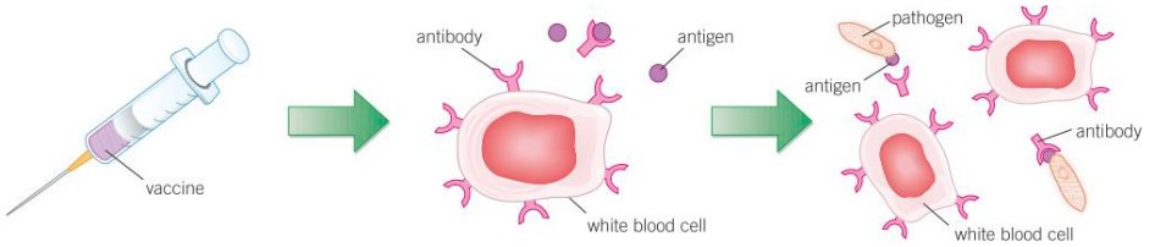
Year 10 Combined

A. Keywords.

Antibody	A chemical produced by lymphocytes (a type of white blood cell). These are a complimentary shape to antigens.
Antigen	A protein marker on the surface of a cell
Herd Immunity	If a large proportion of the population is immune to a disease, the spread of the pathogen is very much reduced
Antibiotic	Medicines that kill specific bacteria (they do not kill viruses)
Vaccine	A dead or inactive pathogen used to develop immunity to an infection in a healthy person
Pre-Clinical Testing	Is carried out on a potential new medicine in a lab using cells, tissues and live animals
Clinical Trials	Tests potential new drugs on healthy people and patient volunteers
Placebo	A medicine that does not contain the active drug being tested
Painkillers	No effect on the pathogens but do reduce the symptoms of illness. Eg aspirin and paracetamol
Efficacy	How well the drug cures the disease, or improves symptoms
Toxicity	How safe a drug is and whether or not it produces any unacceptable side effects
Dosage	This varies, and has to be closely controlled, as too high a concentration might be toxic

B. Vaccines

Vaccines help to prevent illness in an individual by immunising them so that their white blood cells respond more quickly to the same infection in the future.



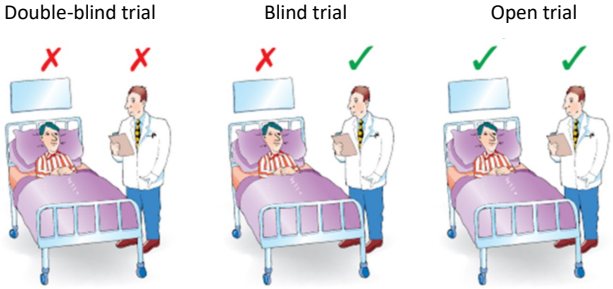
Small amounts of dead or inactive pathogen are put into your body, often by injection.

The antigens in the vaccine stimulate your white blood cells into making antibodies. The antibodies destroy the antigens without any risk of you getting the disease.

You are immune to future infections by the pathogen. That's because your body can respond rapidly and make the correct antibody as if you had already had the disease.

C. Drug Trials

Drugs are tested for their effectiveness, the doctor and patient may or may not be told whether they are being given a placebo

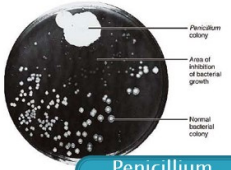


D. Discovering Drugs

Willow – contains salicylic acid which is used to make aspirin

Digitalis (Foxglove) – a drug used in treating heart problems

Traditionally drugs were extracted from different plants, this was before they could be made synthetically.



Penicillium notatum– produces penicillin, an antibiotic

E. Discovery and Development of Drugs

Modern Drug Trials

- Potentially useful substance found
- Active ingredient is identified
  (Active ingredient manufactured synthetically if possible
- Preclinical trials in laboratories on cells and tissues then animals to determine safety and efficacy
- Stage 1 Clinical Trials:
  Small group of *healthy* volunteers given low doses to check drugs are safe & work as predicted by the pre-clinical trials.
- Data is independently **peer-reviewed**
- Stage 2 Clinical Trials:
  Small groups of patients with the disease are treated to see if the drug actually works and what dosage (strength) is needed.
- Stage 3 Clinical Trials:
  Large patient group, use of **placebo**, **double-blind trials** and statistical testing of the significance of the results
- Drugs are approved for use

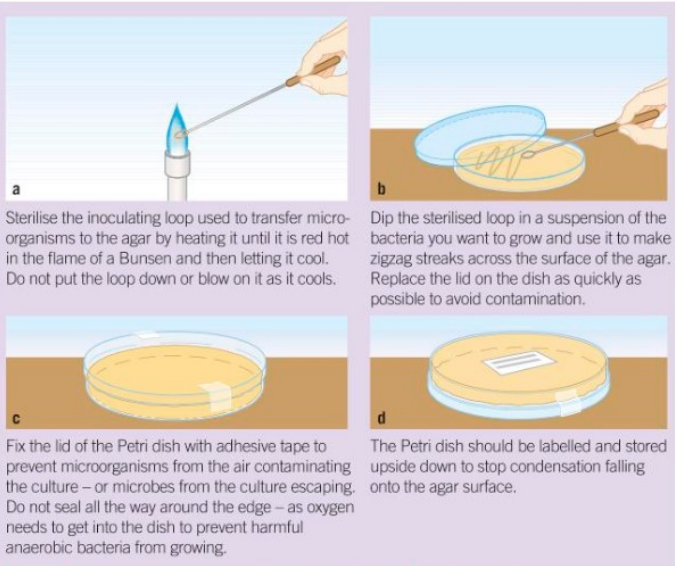
Infection and Response

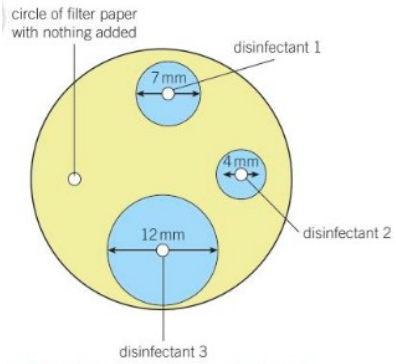
Year 10 Separate Foundation

A. Keywords.

Culture Medium	A liquid or gel used to support the growth of microorganisms. Often containing specific nutrients.
Inoculate	Introducing microorganisms to a culture medium
Binary Fission	Reproduction by simple cell division in bacteria
Antibiotic	Medicines that kill specific bacteria (they do not kill viruses)
Vaccine	A dead or inactive pathogen used to develop immunity to an infection in a healthy person
Pre-Clinical Testing	Is carried out on a potential new medicine in a lab using cells, tissues and live animals
Clinical Trials	Tests potential new drugs on healthy people and patient volunteers
Placebo	A medicine that does not contain the active drug being tested
Efficacy	How well the drug cures the disease, or improves symptoms
Toxicity	How safe a drug is and whether or not it produces any unacceptable side effects
Dosage	This varies, and has to be closely controlled, as too high a concentration might be toxic
Chlorosis	The yellowing of leaves when the cannot make chlorophyll due to lack of magnesium ions
Aphid	Insects that penetrate the phloem and feed on the sugars. They act as vectors that carry pathogens like viruses

B. Required Practical: Microbiology: Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition.





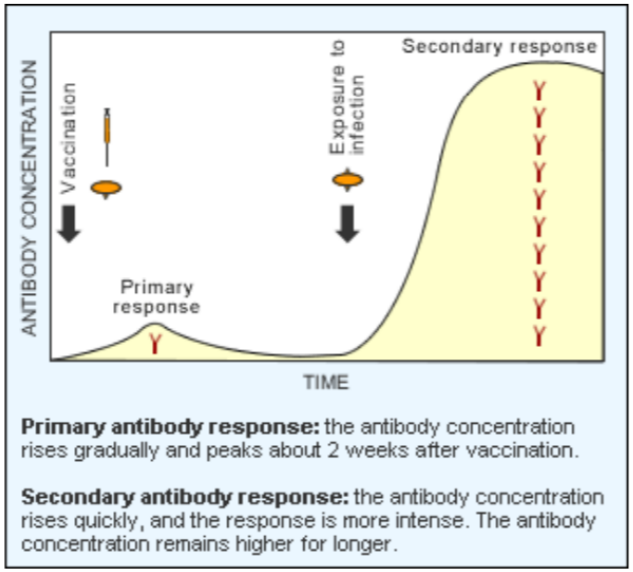
C. Plant ion deficiencies and defence responses

Physical Barriers: cell walls, waxy cuticle, bark, dead cells, dead leaves

Chemical Barrier: Antibacterial chemicals and poisons

Mechanical adaptations: Thorns, hairs, leaves that droop and curl when touched, mimicry

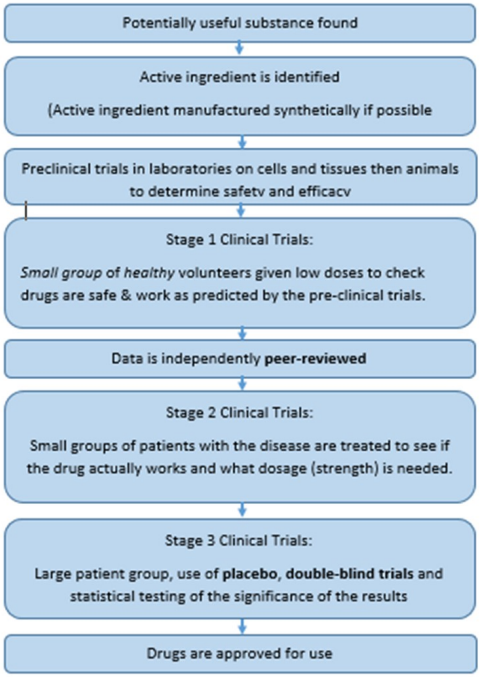
D. Immune Response



Primary antibody response: the antibody concentration rises gradually and peaks about 2 weeks after vaccination.

Secondary antibody response: the antibody concentration rises quickly, and the response is more intense. The antibody concentration remains higher for longer.

E. Discovery and Development of Drugs

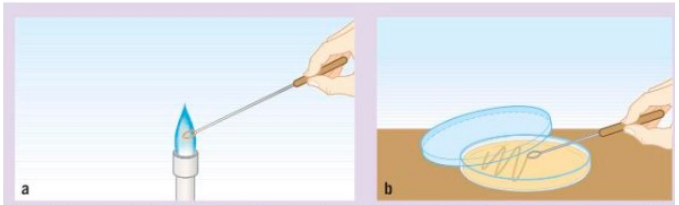


Infection and Response
Year 10 Separate Higher

A. Keywords.

Culture Medium	A liquid or gel used to support the growth of microorganisms. Often containing specific nutrients.
Inoculate	Introducing microorganisms to a culture medium
Binary Fission	Reproduction by simple cell division in bacteria
Antibiotic	Medicines that kill specific bacteria (they do not kill viruses)
Vaccine	A dead or inactive pathogen used to develop immunity to an infection in a healthy person
Pre-Clinical Testing	Is carried out on a potential new medicine in a lab using cells, tissues and live animals
Clinical Trials	Tests potential new drugs on healthy people and patient volunteers
Placebo	A medicine that does not contain the active drug being tested
Monoclonal Antibody	Produced from a single clone of cells. Each one is specific to one antigen. This means they can target specific cells and be used in
Hybridomas	Cells created during the production of MABs by fusing a lymphocyte and a tumour cell
Chlorosis	The yellowing of leaves when the cannot make chlorophyll due to lack of magnesium ions
Aphid	Insects that penetrate the phloem and feed on the sugars. They act as vectors that carry pathogens like viruses

B. Required Practical: Microbiology: Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition.

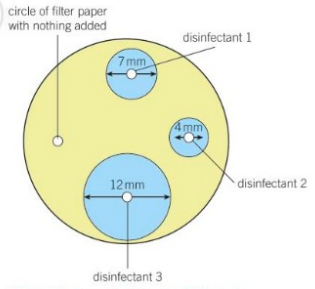


Sterilise the inoculating loop used to transfer micro-organisms to the agar by heating it until it is red hot in the flame of a Bunsen and then letting it cool. Do not put the loop down or blow on it as it cools.

Dip the sterilised loop in a suspension of the bacteria you want to grow and use it to make zigzag streaks across the surface of the agar. Replace the lid on the dish as quickly as possible to avoid contamination.

Fix the lid of the Petri dish with adhesive tape to prevent microorganisms from the air contaminating the culture – or microbes from the culture escaping. Do not seal all the way around the edge – as oxygen needs to get into the dish to prevent harmful anaerobic bacteria from growing.

The Petri dish should be labelled and stored upside down to stop condensation falling onto the agar surface.



C. Plant ion deficiencies and defence responses

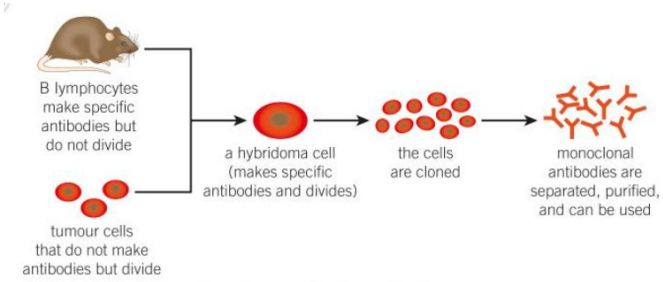
Physical Barriers: cell walls, waxy cuticle, bark, dead cells, dead leaves

Chemical Barrier: Antibacterial chemicals and poisons

Mechanical adaptations: Thorns, hairs, leaves that droop and curl when touched, mimicry

Detection of plant diseases: looking at symptoms, gardening manuals, Google it, lab test and monoclonal antibody testing

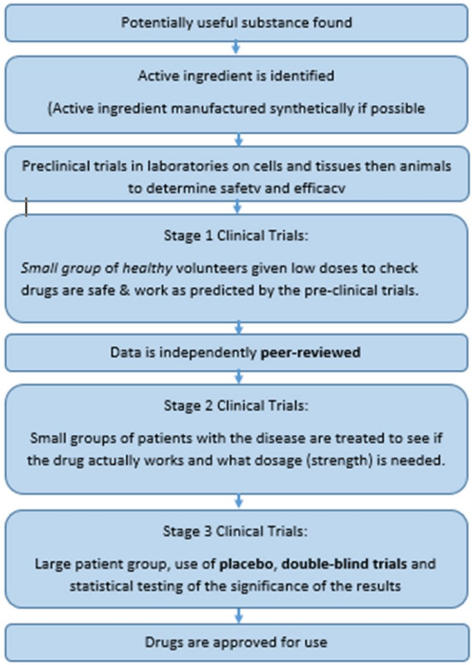
D. Monoclonal Antibodies



Uses of monoclonal antibodies:

1. They bind to HCG in pregnancy tests
2. They are used to treat diseases (they bind to the antigens on cancer cells)
3. Used to measure hormone levels in the blood
4. To identify or locate specific molecules in cells or tissues

E. Discovery and Development of Drugs



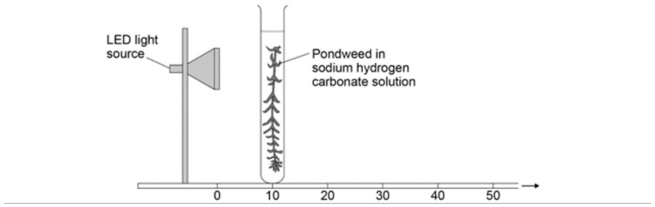
Bioenergetics Year 10 Foundation

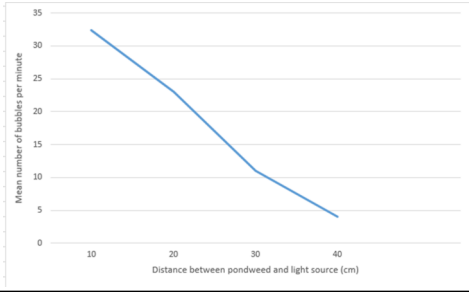
A. Keywords.

Photosynthesis	The process by which plants make food using carbon dioxide, water and light. Carbon + Water → Glucose + Oxygen dioxide
Glucose	A simple sugar. A product of respiration
Lipids	Include fats and oils. They are made of carbon, hydrogen and oxygen
Limiting Factor	Anything that reduces or stops the rate of a reaction
Cellulose	The complex carbohydrate that makes up plant cell walls and gives them strength
Chlorophyll	The green pigment contained in chloroplasts
Chloroplast	The organelle in which photosynthesis takes place
Respiration	The process by which living things release energy from glucose.
Mitochondria	Found in the cytoplasm. Perform respiration to release energy
Metabolism	The sum of all the chemical reactions that happen in an organism
Oxygen Debt	The amount of extra oxygen the body needs after exercise to break down lactic acid
Lactic Acid	A waste product of anaerobic respiration in animal cells

B. Required Practical: **Photosynthesis**: Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.

1. Set up a test tube rack containing a boiling tube at a distance of 10 cm away from the light source
2. Fill the boiling tube with the sodium hydrogen carbonate solution.
3. Put the piece of pondweed into the boiling tube with the cut end at the top. Gently push the pondweed down with the glass rod.
4. Leave the boiling tube for 5 minutes.
5. Start the stop watch and count the number of bubbles produced in one minute.



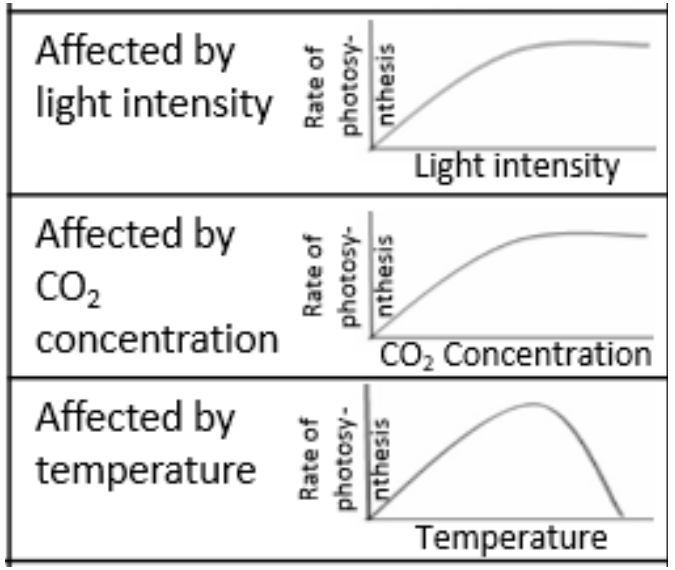


C. Uses of Glucose

Glucose is made in plants during photosynthesis. Plants use this glucose in a number of ways:

- Respiration: Glucose + Oxygen → Carbon + Water dioxide
- Store it as insoluble starch (main energy store in plants)
- Use it to make cellulose to strengthen cell walls
- To make lipids (fats and oils) (another energy store)
- To make amino acids by combining glucose with nitrates and other mineral ions from the soil. These amino acids are then built up in to proteins (e.g. enzymes)

D. Rate of Photosynthesis



D. Metabolic Reactions

Some of the most common metabolic reactions include:

- The conversion of glucose to starch, glycogen and cellulose
- The formation of lipids
- The use of glucose and nitrate ions to form amino acids to make proteins
- The reactions of respiration
- The reactions of photosynthesis
- The breakdown of excess proteins in the liver to form urea for excretion in the urine by kidneys

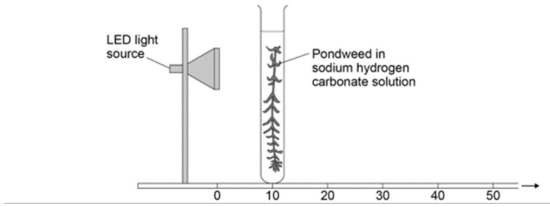
Bioenergetics Year 10 Higher

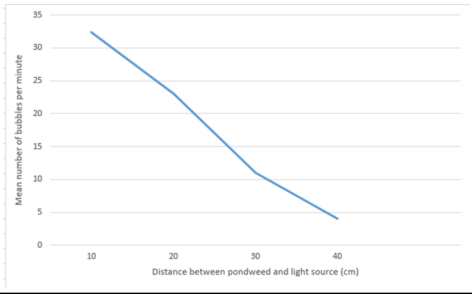
A. Keywords.

Photosynthesis	The process by which plants make food using carbon dioxide, water and light. Carbon + Water → Glucose + Oxygen dioxide
Glucose	A simple sugar. A product of respiration
Lipids	Include fats and oils. They are made of carbon, hydrogen and oxygen
Limiting Factor	Anything that reduces or stops the rate of a reaction
Cellulose	The complex carbohydrate that makes up plant cell walls and gives them strength
Chlorophyll	The green pigment contained in chloroplasts
Chloroplast	The organelle in which photosynthesis takes place
Respiration	The process by which living things release energy from glucose.
Mitochondria	Found in the cytoplasm. Perform respiration to release energy
Metabolism	The sum of all the chemical reactions that happen in an organism
Oxygen Debt	The amount of extra oxygen the body needs after exercise to break down lactic acid
Lactic Acid	A waste product of anaerobic respiration in animal cells

B. Required Practical: **Photosynthesis**: Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.

1. Set up a test tube rack containing a boiling tube at a distance of 10 cm away from the light source
2. Fill the boiling tube with the sodium hydrogen carbonate solution.
3. Put the piece of pondweed into the boiling tube with the cut end at the top. Gently push the pondweed down with the glass rod.
4. Leave the boiling tube for 5 minutes.
5. Start the stop watch and count the number of bubbles produced in one minute.



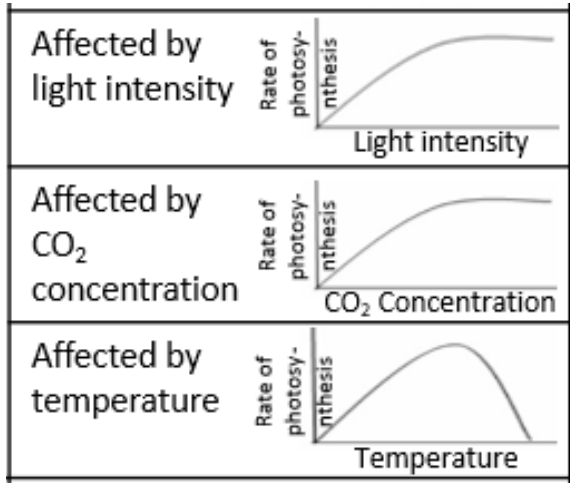


C. Uses of Glucose

Glucose is made in plants during photosynthesis. Plants use this glucose in a number of ways:

- Respiration: Glucose + Oxygen → Carbon + Water dioxide
- Store it as insoluble starch (main energy store in plants)
- Use it to make cellulose to strengthen cell walls
- To make lipids (fats and oils) (another energy store)
- To make amino acids by combining glucose with nitrates and other mineral ions from the soil. These amino acids are then built up in to proteins (e.g. enzymes)

D. Rate of Photosynthesis



Light intensity and the inverse square law:

As the distance of the light from the plant increases, the light intensity decreases.

$$\text{Light intensity} \propto \frac{1}{\text{distance}^2}$$

D. Metabolic Reactions

- The conversion of glucose to starch, glycogen and cellulose
- The formation of lipids
- The use of glucose and nitrate ions to form amino acids to make proteins
- The reactions of respiration
- The reactions of photosynthesis
- The breakdown of excess proteins in the liver to form urea for excretion in the urine by kidneys

The role of the liver

One of the important roles of the liver is dealing with lactic acid produced by muscles during anaerobic respiration. The blood transports lactic acid to the liver where it is converted back to glucose.

Ecology Year 10

A. Keywords.

Community	Group of interdependent living organisms in an ecosystem
Interdependence	The relationships between different organisms in a community
Quantitative Sampling	Records the numbers of organisms rather than just the type
Quadrat	A sample area used for measuring the abundance and distribution of plants in the field
Abundance	A measure of how common or rare a species is in a habitat
Transect	A measured line along which samples are taken using a quadrat
Competition	Living organisms strive against each other for resources, food, light
Adaptation	Special features that make an organism well suited to its habitat
Extremophile	Organisms that live in very extreme environments such as high pressure / temperature / salt concentrations
Producer	Plants and algae that photosynthesise and make their own sugars
Primary Consumer	Animals that eat producers
Secondary Consumer	Animals that eat primary consumers

B: Organisms in their Environment

An ecosystem is made up of a community of organisms interacting with the non-living (**abiotic**) and living (**biotic**) elements in the environment. In a **stable community** all the species and environmental factors are in balance and the **population size** is fairly constant.

Biotic Factors

- availability of food
- new predators arriving
- new pathogens
- new competitors.

Abiotic factors

- light intensity
- temperature
- moisture levels
- soil pH and mineral content
- wind intensity and direction
- the carbon dioxide levels for plants
- the availability of oxygen for aquatic animals.

C: Required Practical

How to Find the number of daisy plants in a field

1. **Place two tape measures at right angles in the field to be samples. One tape measure is the x axis the other is the y axis**
2. **Use random numbers to give you coordinates, one for the x axis and one for the y axis**
3. **Place the quadrat where these coordinates meet**
4. **Count the number of daisies in the quadrat**
5. **Repeat at least 10 times**
6. **Work out the mean average number of daisies per quadrat**

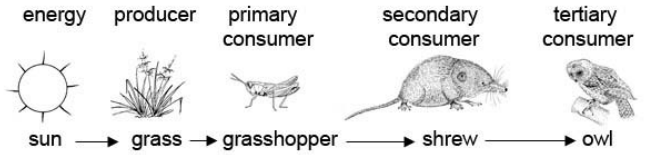
average number of plants per quadrat × number of quadrats that fit on the lawn = total number of plants on the lawn

D: Adapt, Compete, Survive!

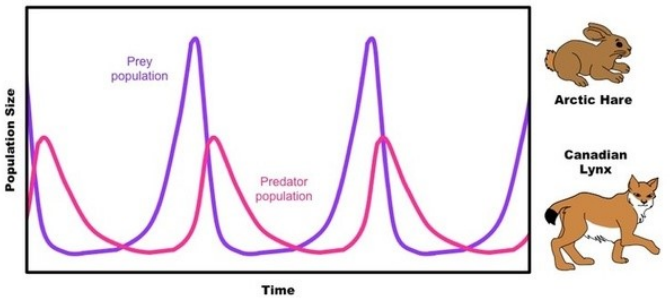
Plants and animals that are better adapted to their habitat are better at competing and striving for resources. Plants compete for light, space, water and mineral nutrients. Animals compete for food, territory and mates. Organisms that compete effectively will survive longer and be more successful. Adaptations can be

- Structural— shape, colour, camouflage
- Behavioural—migration, hibernation, tool use
- Functional - antifreeze inside cells, delayed embryo implantation
- Extremophiles are very well adapted to challenging environments and can compete and survive in harsh conditions. Some bacteria can live at very high temperatures (45°C—80°C) and have specially adapted enzymes that don't denature.

E: Feeding Relationships



When prey increases, predator numbers rise—food plentiful



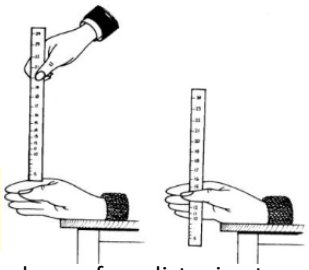
When prey decreases, predator numbers fall—food limiting

Year 10 Homeostasis

A. Keywords.

Homeostasis	The regulation of the internal conditions in response to external changes.
Stimulus	A change in the environment —heat, light, pressure, sound
Receptor	Specialised cell that detects changes in the environment (stimuli) found in sense organs
Coordination Centre	The processing centre that receives, organises and sends out electrical impulses (CNS)
Effector	Muscles and glands which contract to bring about a response
Sensory Neurone	A specialised cell that transmits electrical impulses into the brain and spinal cord (CNS)
Motor Neurone	A specialised cell that transmits impulses from the brain and spinal cord (CNS) to effectors.
Nerve	A bundle of hundreds or thousands
Impulse	An electrical pathway transmitted
CNS	Central Nervous System made up of
Reflex Action	A rapid, involuntary , automatic response that does not involve the conscious part of your brain
Synapse	A gap or junction between two

B. Required Practical measuring reaction times



- To react quickly to your surroundings
- To co-ordinate your behaviour
- Survival

Independent variable: choose only one from listening to music or drinking caffeine . Perform the test with different sound volumes / caffeine concentrations.

Control test : no music / no caffeine

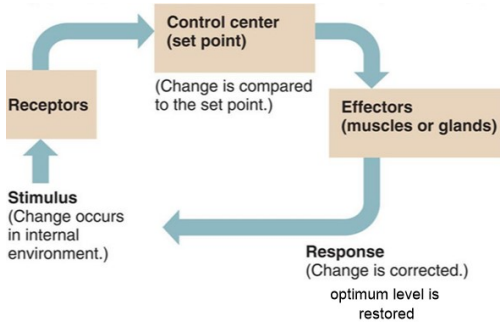
Dependent variable: Time taken to drop the ruler, this is the reaction time. Repeat several times in each condition then calculate a mean average. Test a large sample size.

Control variables: room temp, back ground noise level, same person, same ruler, same starting position, same person dropping the ruler, same age

C. Control Systems

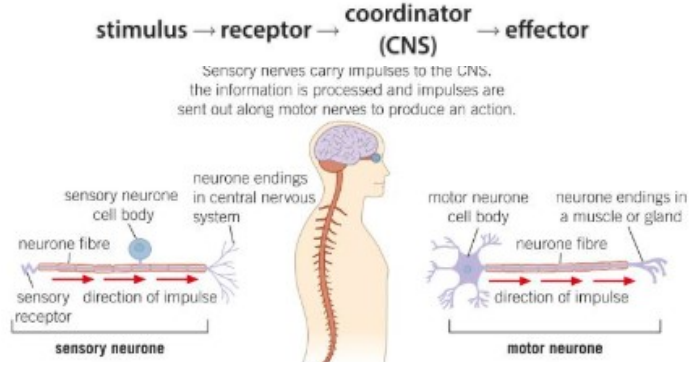
Receptors	Detect changing conditions / stimuli
Processing centre	Recieves & coordinates the information
Effectors	Brings about change / makes a response

Receptor cells are inside—eyes, ears, nose, tongue, skin



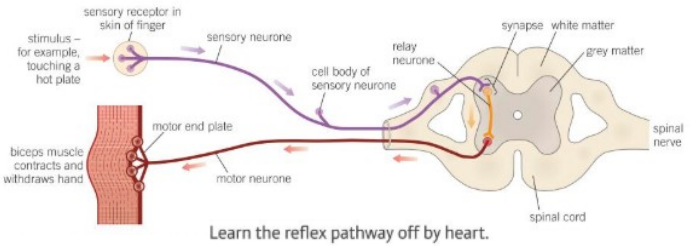
Homeostasis and control systems ensure that enzymes work in optimal conditions. Body temperature, water levels and blood glucose levels all need to be controlled.

D. Organisation of the Nervous System



- The nervous system uses electrical impulses which allow you to respond quickly to stimuli in your surroundings and coordinate your behaviour.
- Stimuli include; light, sound, temperature changes, pressure and chemical changes.
- The receptors to detect stimuli are in your sense organs, when these are triggered impulses pass along sensory neurones to your brain.
- Your brain processes the information and sends impulses along motor nerves to effectors. A response is made.

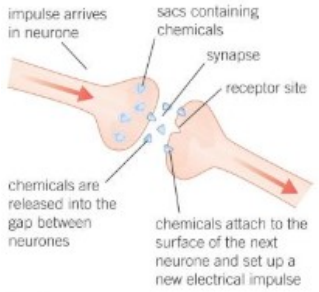
E. Reflex Arcs



Learn the reflex pathway off by heart.

stimulus → receptor → sensory neurone → relay neurone → motor neurone → effector → response.

When an impulse arrives at the junction (gap) between two neurones, chemicals are released that cross the gap by diffusion. The chemicals arrive at receptor sites on the next neurone and start a new impulse



Inheritance, Variation and Evolution
Year 10
Separate and Combined

A. Keywords.	
Evolution	The gradual change in a species over time, from a common ancestor , by the process of natural selection.
Extinction	The permanent loss of all members of a species caused by; new predators, new diseases, more successful competitors, environmental changes or a single catastrophic event.
Antibiotic	Medicines that kill specific bacteria (they do not kill viruses).
Antibiotic resistance	Some bacteria have a natural mutation that means they are not killed by a specific antibiotic.
Mutation	A change in the genetic material (DNA) of an organism that happens by chance.
MRSA	A type of bacteria that is very resistant to almost all known antibiotics and can't be killed by them.
Classification	The organisation of living organisms into groups according to their similarities.
Species	A group of organisms that can breed together to produce fertile offspring.
Domain	The highest level of classification. There are three domains.
Archaea	One of the three domains containing

B. Fossil Record

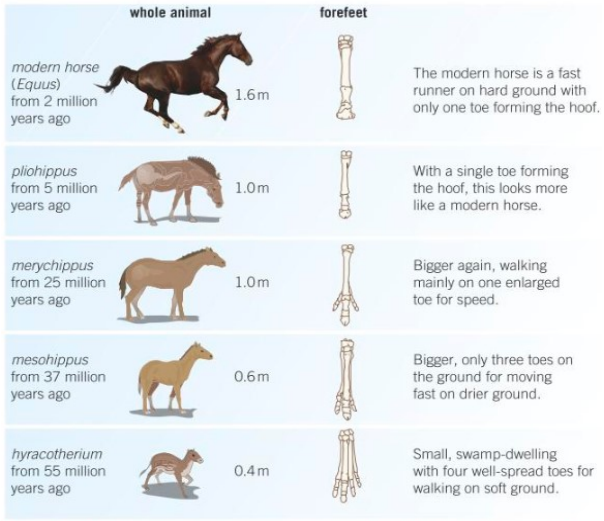


Figure 1 *The evolutionary history of the horse based on the fossil record*

Fossils can show the gradual change in organisms over time. Horses have a near complete fossil record.

C. Antibiotic Resistance

Only prescribe antibiotics if absolutely necessary, patients should be given the correct antibiotic, patients should always complete the course. Developing new antibiotics is a costly and slow process.

Hospitals need to be really clean with excellent hygiene to stop MRSA and other resistant bacteria from spreading.

Visitors and staff should wash hands before and after seeing patients with soap and hot water or alcohol hand gel.

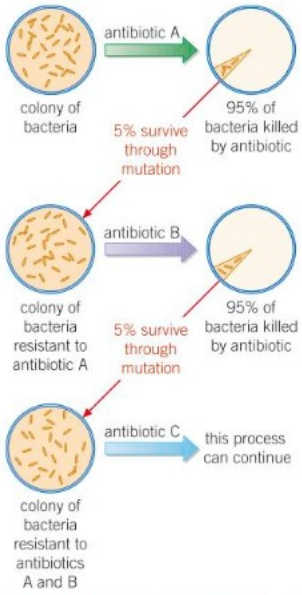


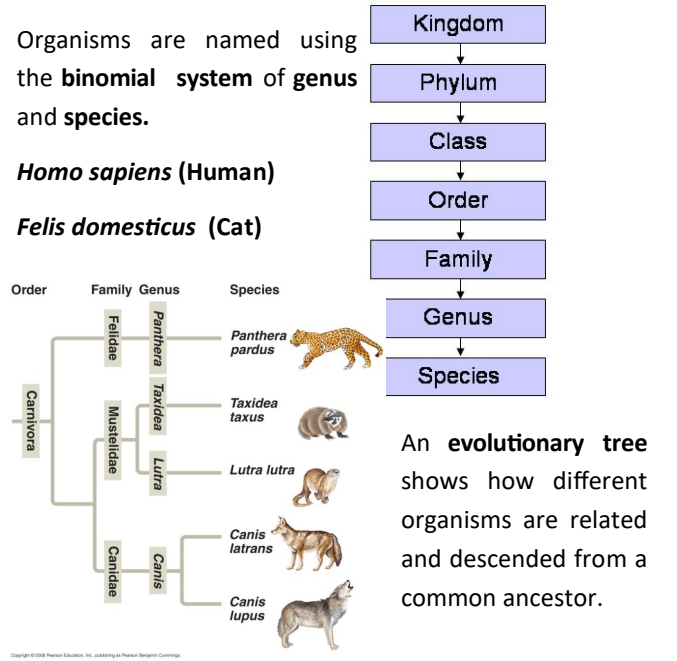
Figure 1 *Bacteria can develop resistance to many different antibiotics in a process of natural selection, as this simple model shows*

D: Classification

Organisms are named using the **binomial system** of **genus** and **species.**

Homo sapiens **(Human)**

Felis domesticus **(Cat)**

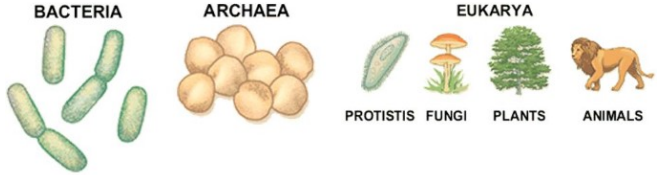


An **evolutionary tree** shows how different organisms are related and descended from a common ancestor.

E. Three Domain System (Carl Woese)

Three Domains of Life

- In the three-domain system of classifications, all known organisms belong to one of three domains–Bacteria, Archaea, or Eukarya.



True bacteria and cyanobacteria which can photosynthesise (Eubacteria)

Primitive forms of bacteria that includes the extremophiles (Archaebacteria)

Eukaryota: organisms with cells that contain a nucleus with DNA inside (Protists, Fungi, Plants and Animals)

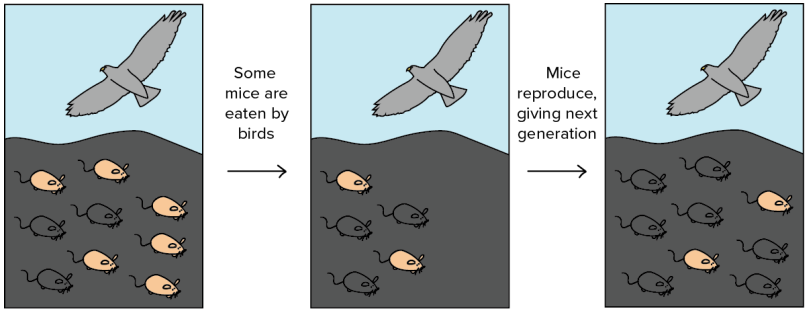
Inheritance, Variation and Evolution

Year 10 Combined Foundation

A. Keywords.

Evolution	The gradual change in a species over time, from a common ancestor , by the process of natural selection.
Variation	Variation is the differences between individuals caused by genetic inheritance, environmental factors or a
Nurture	Variation and differences caused entirely by the environment you live in e.g. a scar, the language you speak
Mutation	A change in the genetic material (DNA) of an organism.
Natural selection	The process by which evolution takes place –organisms that are best suited to their environment will survive to reproduce and pass on their useful characteristics to their offspring.
Selective breeding	Human select animals or plants for breeding because they have a specific characteristic.
Fossil	Remains of organisms from millions of years ago.
Extinction	The permanent loss of all members of a species.
Genetic engineering	The process by which scientists can change the genotype of an organism
GM	Genetically Modified (GM) organisms have had their genes changed or manipulated by scientists.

B. Natural Selection



A population of mice has moved into a new area where the rocks are very dark. Due to natural genetic variation, some mice are black, while others are tan.

Tan mice are more visible to predatory birds than black mice. Thus, tan mice are eaten at higher frequency than black mice. Only the surviving mice reach reproductive age and leave offspring.

Because black mice had a higher chance of leaving offspring than tan mice, the next generation contains a higher fraction of black mice than the previous generation.

Natural selection is a process that works as follows:

1) Individuals show large variations 2) The best adapted individuals will survive and reproduce 3) Specific genes are passed on

C. Selective Breeding

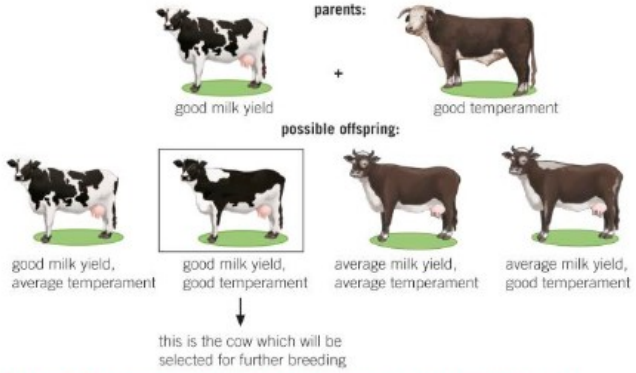
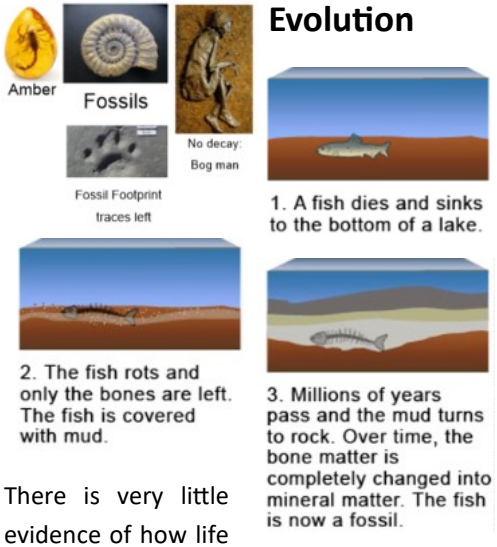


Figure 2 *Sometimes an animal or plant with one desirable trait will be cross-bred with organisms showing another desirable trait. Only the offspring showing both of the favoured features will be used for further breeding*

Desirable traits: disease resistance, increased food production in plants and animals, domestic dogs with gentle nature, heavily scented flowers

Problems: genetic defects due to inbreeding

D. Evidence for Evolution



There is very little evidence of how life on earth started. Few fossils exist

E. Ethics of Genetic Engineering

For GM crops

- Increased crop yield
- Resistant to insect attack
- Resistant to weed killer (herbicide)
- Increased nutrient content e.g. potatoes with more starch
- Drought resistant
- Disease resistant

Against GM crops

- GM seeds are expensive
- GM crops may affect populations of wild plants (via pollen)
- Uncertainty about safety of GM crops and allergy risk
- Some people feel it is unethical

Inheritance, Variation and Evolution

Year 10 Combined Higher

A. Keywords.	
Evolution	The gradual change in a species over time, from a common ancestor , by the process of natural selection.
Variation	Variation is the differences between individuals caused by genetic inheritance, environmental factors or a combination of both.
Nurture	Variation and differences caused entirely by the environment you live in e.g. a scar, the language you speak
Mutation	A change in the genetic material (DNA) of an organism.
Natural selection	The process by which evolution takes place –organisms that are best suited to their environment will survive to reproduce and pass on their useful characteristics to their offspring.
Selective breeding	Human select animals or plants for breeding because they have a specific characteristic.
Fossil	Remains of organisms from millions of years ago.
Extinction	The permanent loss of all members of a species.
Genetic engineering	The process by which scientists can change the genotype of an organism
GM	Genetically Modified (GM) organisms have had their genes changed or manipulated by scientists.

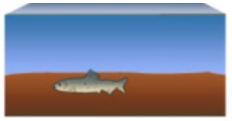
B. Natural Selection

The peppered moth shows variation—a speckled wild type and a **mutant** black moth. They are adapted to camouflage on tree bark and avoid being eaten by predators.

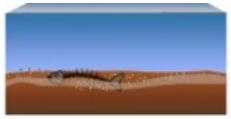
Natural selection is a process that works as follows:

1) Individuals show large variations 2) The best adapted individuals will survive and reproduce 3) Specific genes are passed on

D. Evidence for Evolution



1. A fish dies and sinks to the bottom of a lake.



2. The fish rots and only the bones are left. The fish is covered with mud.

3. Millions of years pass and the mud turns to rock. Over time, the bone matter is completely changed into mineral matter. The fish is now a fossil.

There is very little evidence of how life on earth started. Few fossils exist.

F. Ethics of Genetic Engineering

For GM crops

- Increased crop yield
- Resistant to insect attack
- Resistant to weed killer (herbicide)
- Increased nutrient content e.g. potatoes with more starch
- Drought resistant
- Disease resistant

Against GM crops

- GM seeds are expensive
- GM crops may affect populations of wild plants (via pollen)
- Uncertainty about safety of GM crops and allergy risk
- Some people feel it is unethical

C. Selective Breeding

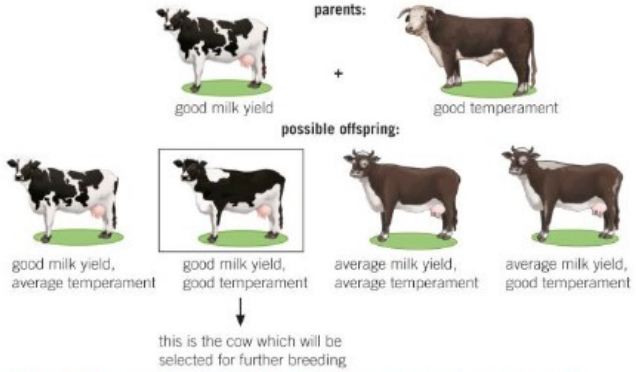


Figure 2 *Sometimes an animal or plant with one desirable trait will be cross-bred with organisms showing another desirable trait. Only the offspring showing both of the favoured features will be used for further breeding*

Desirable traits: disease resistance, increased food production in plants and animals, domestic dogs with gentle nature, heavily scented flowers

Problems: genetic defects due to inbreeding

E: Genetic Engineering

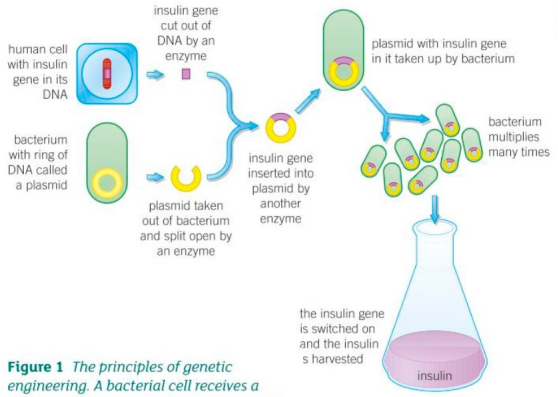


Figure 1 *The principles of genetic engineering. A bacterial cell receives a human gene so it makes a human protein – in this case, the hormone insulin*

Genes from the chromosomes of humans and other organisms can be 'cut out' using enzymes and transferred to the cells of bacteria or other organisms using a vector which is usually a bacterial plasmid or virus.

Inheritance, Variation and Evolution
Year 10 Separate Foundation

A. Keywords.	
Evolution	The gradual change in a species over time, from a common ancestor , by the process of natural selection.
Variation	Variation is the differences between individuals caused by genetic inheritance, environmental factors or a
Nurture	Variation and differences caused entirely by the environment you live in e.g. a scar, the language you speak
Mutation	A change in the genetic material (DNA) of an organism.
Natural selection	The process by which evolution takes place –organisms that are best suited to their environment will survive to reproduce and pass on their useful characteristics to their offspring.
Selective breeding	Human select animals or plants for breeding because they have a specific characteristic.
Fossil	Remains of organisms from millions of years ago.
Extinction	The permanent loss of all members of a species.
Genetic engineering	The process by which scientists can change the genotype of an organism
GM	Genetically Modified (GM) organisms have had their genes changed or manipulated by scientists.

B. Natural Selection

The peppered moth shows variation—a speckled wild type and a **mutant** black moth. They are adapted to camouflage on tree bark and avoid being eaten by predators.

Natural selection is a process that works as follows:

1) Individuals show large variations 2) The best adapted individuals will survive and reproduce 3) Specific genes are passed on

D. Theories for Evolution

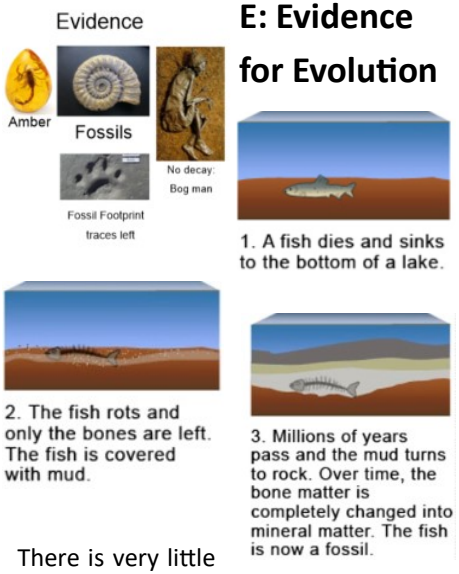
Lamarck: If animals used something a lot over a lifetime it would grow and develop and be passed onto its offspring. There was no evidence to support this theory.

Darwin: Proposed the theory of natural selection and collected data and evidence to support it. The fossil record also supports it. Darwin had no knowledge of genetics, the fossil record was incomplete and his theory took time to be accepted

Wallace: Independently proposed the same theory of natural selection as Darwin and collected evidence to support it.

Speciation: The formation of a new species by evolution, requires geographic or environmental isolation and separate natural selection. Eventually successful interbreeding is no longer possible.

E: Evidence for Evolution



There is very little evidence of how life on earth start-

C. Selective Breeding

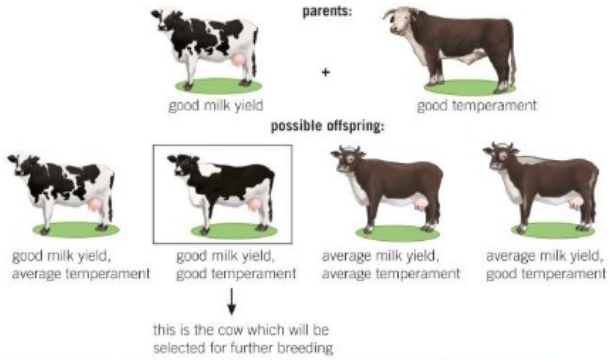


Figure 2 *Sometimes an animal or plant with one desirable trait will be cross-bred with organisms showing another desirable trait. Only the offspring showing both of the favoured features will be used for further breeding*

Desirable traits: disease resistance, increased food production in plants and animals, domestic dogs with gentle nature, heavily scented flowers

Problems: genetic defects due to inbreeding

F. Ethics of Genetic Engineering

For GM crops

- Increased crop yield
- Resistant to insect attack
- Resistant to weed killer (herbicide)
- Increased nutrient content e.g. potatoes with more starch
- Drought resistant
- Disease resistant

Against GM crops

- GM seeds are expensive
- GM crops may affect populations of wild plants (via pollen)
- Uncertainty about safety of GM crops and allergy risk
- Some people feel it is unethical

Inheritance, Variation and Evolution
Year 10 Separate Higher

A. Key words.	
Evolution	The gradual change in a species over time, from a common ancestor , by the process of natural selection.
Variation	Variation is the differences between individuals caused by genetic inheritance, environmental factors or a combination of both.
Nurture	Variation and differences caused entirely by the environment you live in e.g. a scar, the language you speak
Mutation	A change in the genetic material (DNA) of an organism.
Natural selection	The process by which evolution takes place –organisms that are best suited to their environment will survive to reproduce and pass on their useful characteristics to their offspring.
Selective breeding	Human select animals or plants for breeding because they have a specific characteristic.
Fossil	Remains of organisms from millions of years ago.
Extinction	The permanent loss of all members of a species.
Genetic engineering	The process by which scientists can change the genotype of an organism
GM	Genetically Modified (GM) organisms have had their genes changed or manipulated by scientists.

B. Natural Selection

The peppered moth shows variation—a speckled wild type and a **mutant** black moth. They are adapted to camouflage on tree bark and avoid being eaten by predators.

Natural selection is a process that works as follows:

1) Individuals show large variations 2) The best adapted individuals will survive and reproduce 3) Specific genes are passed on

D. Theories for Evolution

Lamarck: If animals used something a lot over a lifetime it would grow and develop and be passed onto its offspring. There was no evidence to support this theory.

Darwin: Proposed the theory of natural selection and collected data and evidence to support it. The fossil record also supports it. Darwin had no knowledge of genetics, the fossil record was incomplete and his theory took time to be accepted

Wallace: Independently proposed the same theory of natural selection as Darwin and collected evidence to support it.

Speciation: The formation of a new species by evolution, requires geographic or environmental isolation and separate natural selection. Eventually successful interbreeding is no longer possible.

F. Ethics of Genetic Engineering

For GM crops

- Increased crop yield
- Resistant to insect attack
- Resistant to weed killer (herbicide)
- Increased nutrient content e.g. potatoes with more starch

Against GM crops

- GM seeds are expensive
- GM crops may affect populations of wild plants (via pollen)
- Uncertainty about safety of GM crops and allergy risk
- Some people

C. Selective Breeding

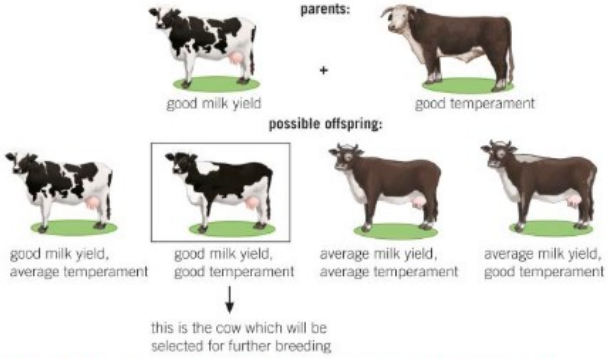


Figure 2 *Sometimes an animal or plant with one desirable trait will be cross-bred with organisms showing another desirable trait. Only the offspring showing both of the favoured features will be used for further breeding*

Desirable traits: disease resistance, increased food production in plants and animals, domestic dogs with gentle nature, heavily scented flowers

Problems: genetic defects due to inbreeding

E: Genetic Engineering

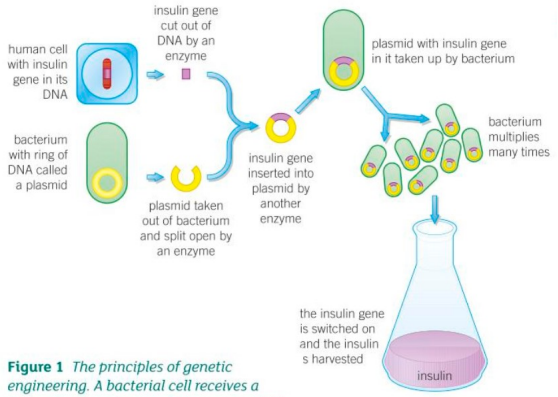


Figure 1 *The principles of genetic engineering. A bacterial cell receives a human gene so it makes a human protein – in this case, the hormone insulin*

Genes from the chromosomes of humans and other organisms can be 'cut out' using enzymes and transferred to the cells of bacteria or other organisms using a vector which