



Bottisham Village College

KNOWLEDGE ORGANISER

BIOLOGY

YEAR 11 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:



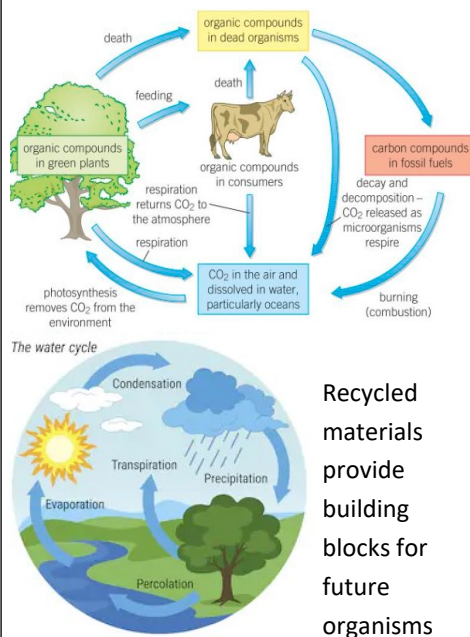
- 1. Look at a certain aspects of a particular knowledge organiser**
- 2. Cover up part of their knowledge organiser**
- 3. Write it out from memory**
- 4. Check and correct any spelling mistakes, missing bits or mistakes**

So simple but so effective.

A. Keywords.

Decomposer	Microorganisms that break down excreted waste products and dead bodies
Biodiversity	A measure of the variety of all the different species of organisms on earth
Water Pollution	When fertilisers from farming and untreated sewage are washed into our rivers streams and lakes
Bioaccumulation	Toxins enter food chains. Toxins build up and accumulate in living tissues at each stage in the food chain. Consumers have more toxins than producers
Acid rain	Fossil fuels containing sulphur make sulphur dioxide when burnt. This dissolves in water to make acid rain
Smog	A polluting haze of smoke particles, sulphur dioxide and nitrogen oxides
Deforestation	The removal of natural forests for timber and to clear ground for farming and human development
Peat Bog	A nutrient rich soil, formed by the partial decomposition of plant matter in the wet acidic conditions of bogs and fens
The Greenhouse Effect	Atmospheric gases like methane and carbon dioxide, absorb energy and radiate it back to earth.
Global Warming	The rise in global temperatures as a result of burning fossil fuels and releasing excess greenhouse gases.

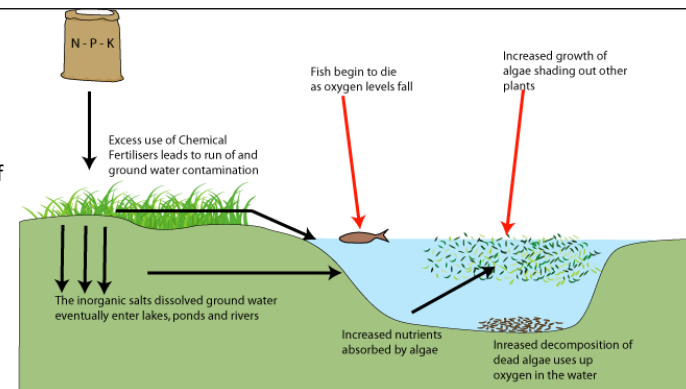
B: Carbon and Water Cycles



D: Water

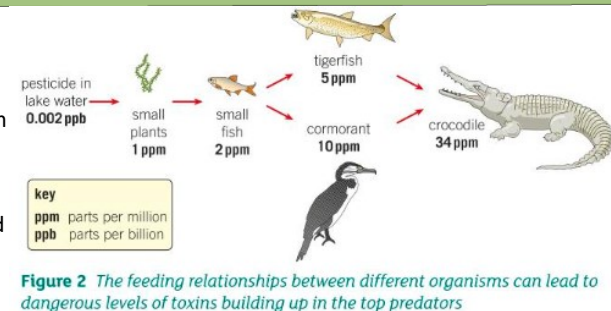
Pollution

Increased levels of nutrients in water from sewage or fertilisers has consequences e.g. reduced biodiversity

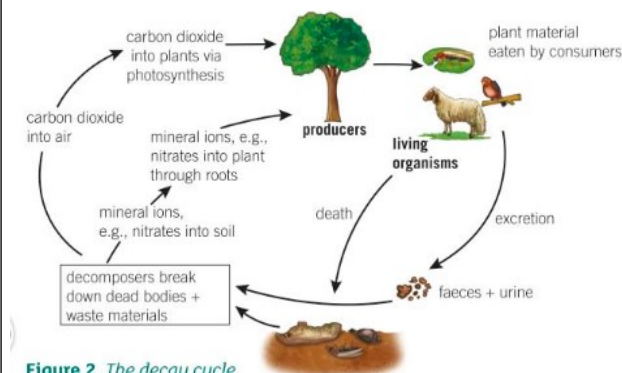


E: Land Pollution

Caused by landfill and from toxic chemicals such as pesticides and herbicides. These may build up in food chains or be washed into lakes / rivers.



C: Decay



Decomposers need to respire, usually aerobically, this recycles carbon as carbon dioxide, which plants use for photosynthesis. Decomposers return mineral ions such as nitrates back to the soil for plants to absorb through their roots. Nitrates are used to make proteins.

E: The Greenhouse effect

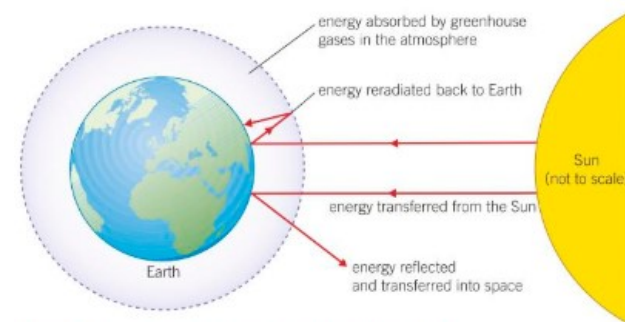


Figure 2 The greenhouse effect – vital for life on Earth

Global warming is increased by carbon dioxide and methane building up in the atmosphere. This increases the greenhouse effect. Whereas acid rain is caused by acidic gases (sulphur dioxide and nitrogen oxides) dissolving in rainwater. Global warming leads to changes to our climate and weather patterns. The consequences are; habitat loss, changes in migration patterns and species distribution, and reduced biodiversity.

Homeostasis Year 11a

Foundation

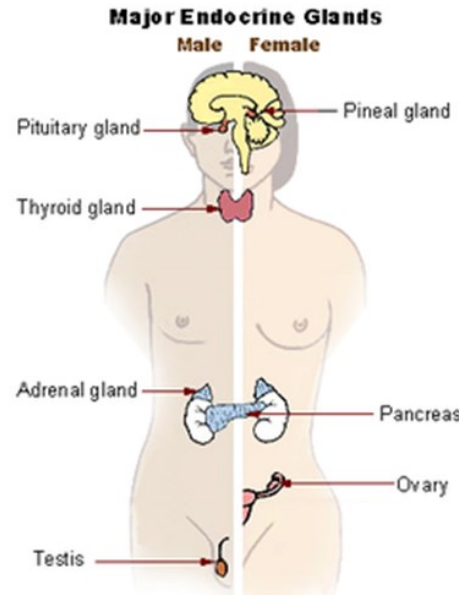
A. Keywords.

Endocrine System	Contains glands that secrete hormones into the bloodstream
Hormones	Chemical messages in the body
Oestrogen	Main female reproductive hormone. From ovaries
Insulin	A hormone that causes cells to take glucose from blood. Liver and muscle cells store as glycogen
Glycogen	A storage carbohydrate found in the liver and muscles
Type 1 Diabetes	A medical condition that usually develops in younger people, preventing the production of insulin
Type 2 Diabetes	A medical condition that usually develops in later life, preventing the person producing enough insulin or preventing cells from responding to insulin
Pituitary Gland	'Master gland' in the brain that secretes hormones that act on other glands
Testosterone	Main male reproductive hormone. From testes. Starts sperm production
Ovulation	The release of a mature egg from the ovary

B. Endocrine System

The glands in the body detect and secrete different hormones.

Hormones are chemical signals that stimulate glands and muscles to respond to changing conditions in the body

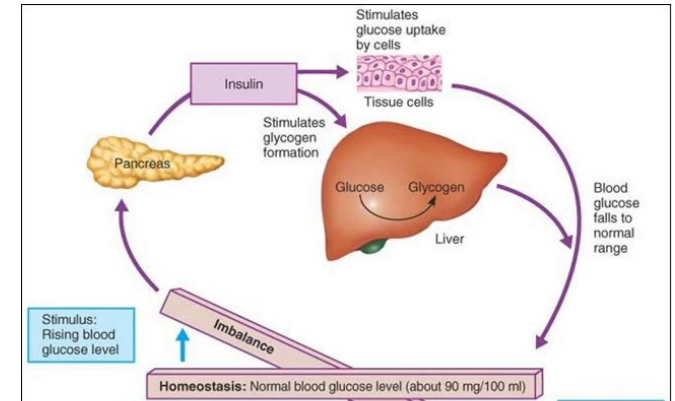


C. Hormones and the menstrual cycle

Hormone	Secreted by	Role
FSH	Pituitary Gland	Causes eggs to mature
LH	Pituitary Gland	Stimulates the release of an egg at ovulation
Oestrogen	Ovaries	Causes the lining of the uterus to develop
Progesterone	Ovaries	Maintains the lining of the uterus

D. Control of blood glucose levels

The liver and pancreas work together to regulate blood glucose levels.



E. Contraception

To prevent pregnancy, you need to prevent the egg and sperm meeting or a fertilised egg implanting in the uterus.

Hormone-based contraception—oral contraceptives that contain hormones to inhibit FSH production so that no eggs mature. Injection, implant or skin patch of slow release progesterone to inhibit the maturation and release of eggs for a number of months or years.

Chemical methods—chemicals that kill or disable sperm are known as spermicides.

Barrier methods—condoms and diaphragms which prevent the sperm reaching an egg.

Intrauterine devices—small structures inserted into the uterus by a doctor which prevent the implantation of an embryo or release a hormone to prevent the build up of the uterus lining.

Abstinence—if people do not have sex they will not get pregnant. Not having sex around the time of ovulation or when the egg is in the oviduct means sperm cannot fertilise the egg.

Surgical methods—in men, sperm ducts are cut and tied to prevent sperm getting into the semen. In women, the oviducts are cut and tied to prevent the egg reaching the uterus and the sperm reaching the egg.

Homeostasis Year 11a

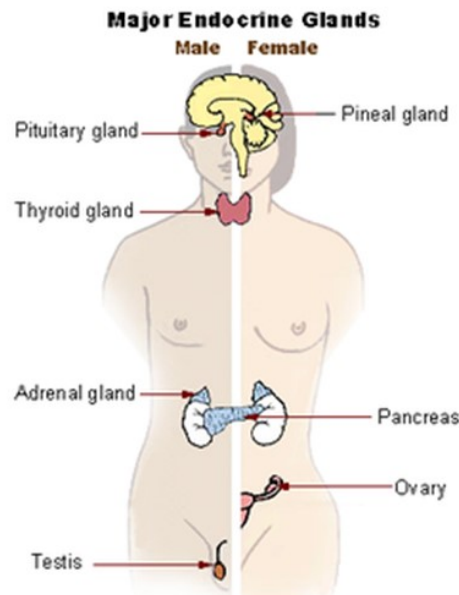
Higher

A. Keywords.

Endocrine System	Contains glands that secrete hormones into the bloodstream
Hormones	Chemical messages in the body
Adrenaline	A hormone released from the adrenal glands. Increases heart rate in fight or flight response
Insulin	A hormone that causes cells to take glucose from blood. Liver and muscle cells store as glycogen
Glucagon	A hormone that converts glycogen into glucose. Interacts with insulin in negative feedback cycle to control glucose
Type 1 Diabetes	A medical condition that usually develops in younger people, preventing the production of insulin
Type 2 Diabetes	A medical condition that usually develops in later life, preventing the person producing enough insulin or preventing cells from responding to insulin
Pituitary Gland	'Master gland' in the brain that secretes hormones that act on other glands
Negative Feedback	A homeostatic mechanism by which the body detects a change and makes an adjustment to return itself to normal
Ovulation	The release of a mature egg from the ovary

B. Endocrine System

The glands in the body detect and secrete different hormones.



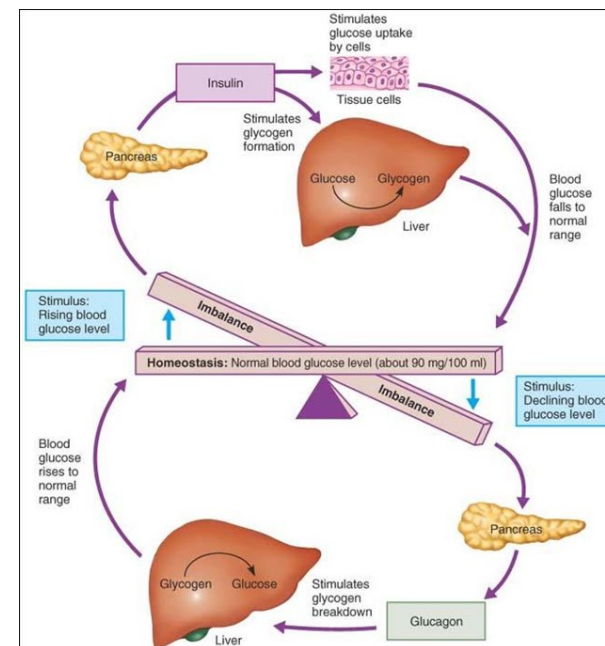
Hormones are chemical signals that stimulate glands and muscles to respond to changing conditions in the body

C. Hormones and the menstrual cycle

Hormone	Secreted by	Role
FSH	Pituitary Gland	Causes eggs to mature Stimulates the ovary to produce oestrogen
LH	Pituitary Gland	Triggers ovulation
Oestrogen	Ovaries	Causes the lining of the uterus to develop Inhibits FSH Stimulates release of LH
Progesterone	Ovaries	Maintains the lining of the uterus Inhibits the release of FSH and LH

D. Control of blood glucose levels

The liver and pancreas work together to regulate blood glucose levels.



E. Infertility Treatments

Some women do not make enough FSH to stimulate the maturation of eggs in their ovaries. Artificial FSH can be used as a fertility drug. An artificial form of LH can then be used to trigger ovulation.

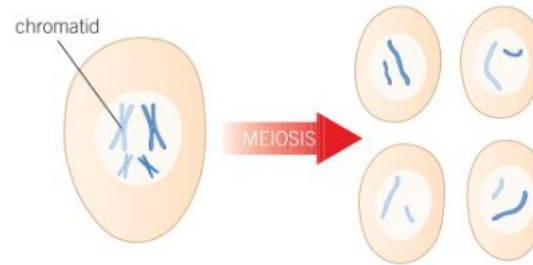
In vitro fertilisation

- IVF involves giving a mother FSH and LH to stimulate the maturation of several eggs.
- The eggs are collected from the mother and fertilised by sperm from the father in the 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.

A. Keywords.

Asexual Reproduction	Involves only one individual and the offspring are genetically identical to the parent.
Sexual Reproduction	Involves the fusion of gametes producing genetic variation in the offspring.
Meiosis	A two stage process of cell division that halves the number of chromosomes and produces gametes.
Gametes	Sex cells e.g. egg (ovum), sperm.
Fertilisation	Gametes fuse and join together.
Genome	The entire genetic material of an organism.
Zygote	The fertilised egg cell formed by the fusion of gametes.
Homozygote	An individual with two identical alleles for a characteristic e.g. BB, bb.
Heterozygote	An individual with different alleles for the same characteristic e.g. Bb
Genotype	Genetic makeup of an individual. The alleles present.
Phenotype	Physical appearance of an organism.
Allele	Different forms of the same gene

B. Sexual Reproduction—Meiosis



Meiosis

Chromosomes replicate, which copies the genetic information.

Two cell divisions occur.

Only half of the chromosomes go to each of the new daughter cells.

Four daughter cells produced.

Daughter cells are all genetically different.

Occurs in the formation of gametes during sexual reproduction.

C. Inheritance in Action



Figure 1 The DNA double helix

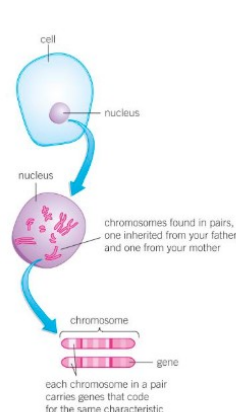


Figure 2 The relationship between a cell, the nucleus, the chromosomes, and the genes

Phenotype: brown fur

Genotype: bb

Phenotype: black fur

Genotype: BB or Bb

Cross 1: bb × BB

Gametes	B	B
b	Bb	Bb
b	Bb	Bb

Offspring:

genotype: all Bb

phenotype: all black fur

Cross 2: bb × Bb

Gametes	B	b
b	Bb	bb
b	Bb	bb

Offspring:

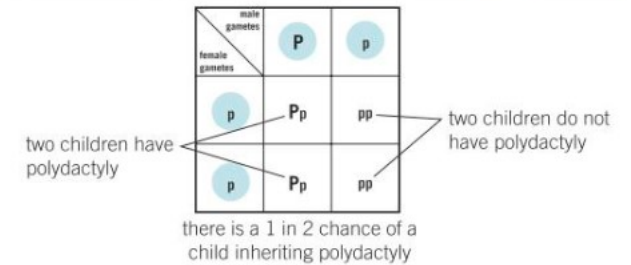
genotype: 50% Bb, 50% bb

phenotype: 50% black fur, 50% brown fur

Figure 2 Determining phenotype

D. Genetic Disorders

parents	father has polydactyly	mother does not have polydactyly
parents' genes	Pp	pp
parents' gametes	P p	p p



Polydactyly is a DOMINANT genetic disorder that causes extra digits to form. The PUNNETT SQUARE above shows how it is passed on. Cystic Fibrosis is a RECESSIVE genetic disorder of the lungs and digestive system. Some people are CARRIERS.

E. Sex Determination

Female = XX

Male = XY

XX × XY

Gametes	X	Y
X	XX	XY
X	XX	XY

Figure 2 Using a Punnett square to determine sex inheritance

F. Screening for Genetic Disorders

- Cells from embryos and fetuses can be screened for the alleles that cause many genetic disorders
- There are economic, social and ethical concerns about embryo screening
- These include; risk of miscarriage, false positive/negative results and cost of testing.

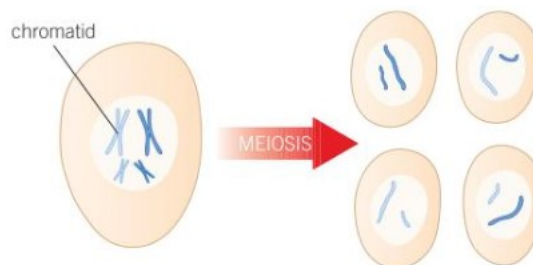


Inheritance, Variation and Evolution Year 11a Separate

A. Keywords.

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Meiosis	A two stage process of cell division that halves the number of chromosomes and produces gametes.
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Meiosis

Chromosomes replicate, which copies the genetic information.

Two cell divisions occur.

Only half of the chromosomes go to each of the new daughter cells.

Four daughter cells produced.

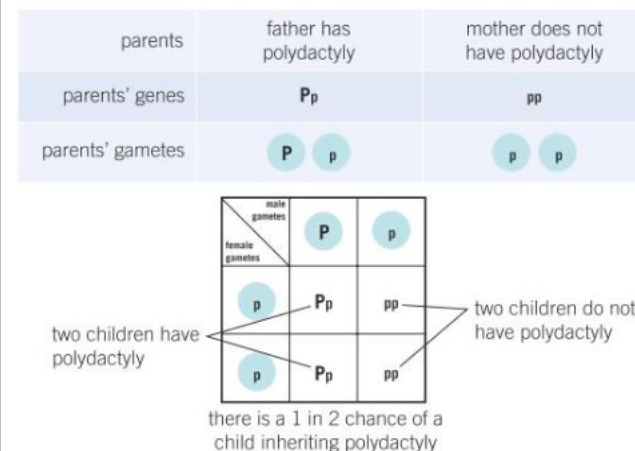
Daughter cells are all genetically different.

Occurs in the formation of gametes during sexual reproduction.

C. Advantages/disadvantages of sexual / asexual reproduction.

- Sexual reproduction produces variation that promotes survival via natural selection when the environment changes but it is slower, needs two gametes and is time / energy consuming.
- Asexual reproduction needs only one parent, is faster, time and energy efficient and produces many genetically identical offspring. These may be more susceptible to disease or environmental change.
- Plants / Fungi / Malaria Parasites can use both sexual and asexual reproduction depending on the environmental conditions.
- Plants use flowers for sexual reproduction to make seeds and runners, bulbs and tubers for asexual reproduction.

D. Genetic Disorders



Polydactyly is a DOMINANT genetic disorder that causes extra digits to form. The PUNNETT SQUARE above shows how it is passed on. Cystic Fibrosis is a RECESSIVE genetic disorder of the lungs and digestive system. Some people are CARRIERS.

E. Sex Determination

Female = XX Male = XY

XX x XY

Gametes	X	Y
X	XX	XY
X	XX	XY

Figure 2 Using a Punnett square to determine sex inheritance

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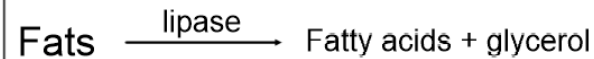
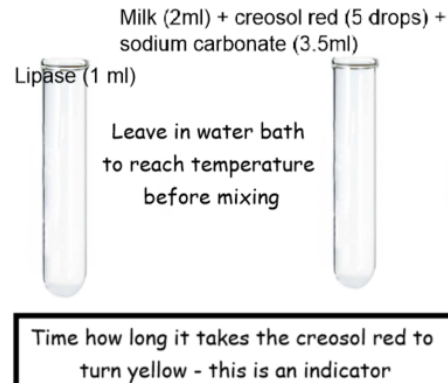
Ecology Year 11b pt.1

Separate

A. Keywords.

Decomposition	The breakdown of dead organic matter
Compost	A brown crumbly soil made by decomposers. Rich in nutrients.
Anaerobic decay	Decomposition by bacteria in the absence of oxygen (anaerobic respiration).
Biogas	Methane gas (CH ₄). Made by decay in anaerobic conditions.
Biomass	The amount (weight) of biological material.
Trophic level	A feeding level in an ecosystem.
Producer	A plant or an algae that makes sugars by photosynthesis.
Primary Consumer	Animals that eat producers (herbivores).
Secondary Consumer	Animals that eat primary consumers (carnivores or omnivores).
Tertiary Consumer	Animals that eat secondary consumers (usually carnivores).
Apex Predator	Carnivores with no predators.
Incident Energy	Light energy from the sun.

B. Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change(Required Practical)



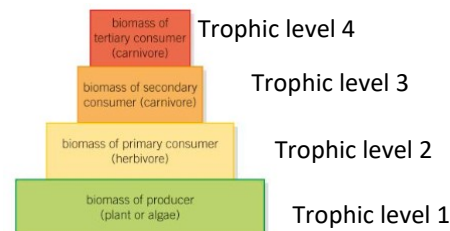
The pH drops when fats break down into fatty acids

D Impact Of Change (HIGHER)

Negative changes	Positive changes
global warming and climate change	maintaining rain forests
the effects of acid rain on soil	reducing water pollution and monitoring pH
pollution from farms and factories	restricting access to sites of special scientific interest
	conservation measures such as replanting hedgerows and woodlands

E: Biomass

Pyramids:



C Rate of Decay

Factors that could affect the rate of decomposition

microbes temperature oxygen pH
moisture build up of toxins

up to 1 year to decay to make compost

temperature inside can get up to 70°C in aerobic conditions

brown, crumbly soil (compost)



garden waste
kitchen waste

Recycles nutrients
Natural fertilizer

Well rotted manure is also an excellent fertiliser

F Trophic Levels and Biomass

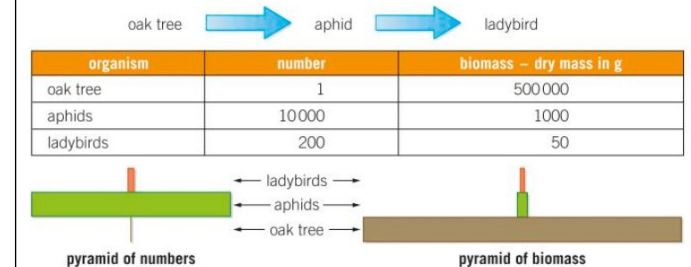
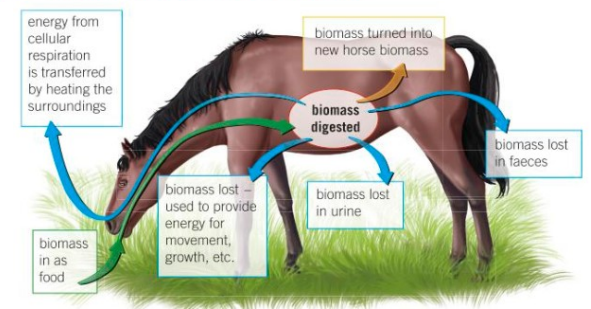


Figure 4 A pyramid of biomass is drawn to scale to represent the biomass of the organisms at each level of a food chain



A. Keywords.

Sustainability	Meeting the needs of people today without damaging Earth for the people of the future.
Food security	Having enough food to feed a population.
Fish farming	Fish in captivity are bred for fast growth. They live in underwater cages and are fed a high protein diet.
Fish stocks	The number (population) of a species of fish in a certain area.
Quota	A strictly enforced limit on the number and type of fish that are allowed to be caught.
Biotechnology	The exploitation of a biological process for human benefit
Fermenter	A container used for growing a population of micro-organisms in controlled conditions.
fermentation	Anaerobic respiration in microorganisms to make ethanol and carbon dioxide and release energy . Can also make methane.
Culture	Growing a population of micro-organisms e.g. <i>fusarium</i> ,
<i>Fusarium</i>	A species of fungus (micro-organism) used to produce Mycoprotein

B. Factors affecting food security

Factors affecting food security include:

- increasing birth rates
- changing diets in developed countries resulting in scarce food resources being transported around the world
- new pests and pathogens affecting farming
- environmental changes affecting food production
- the cost of agricultural inputs
- conflicts affecting access to water or food.

C. Making food production more efficient

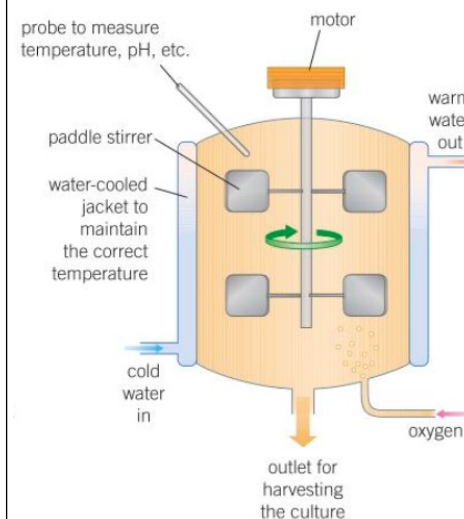
- Feeding livestock a high animal protein diet to increase growth rate (but this makes the food chain less efficient as it adds a trophic level)
- Limiting movement of animals, reduces muscular respiration, so more energy is used for growth (biomass)
- Controlling the environmental temperature so less energy is used for respiration to keep warm and more is used for growth (biomass)
- Using fertilizers to increase crop yields
- Genetically modifying crops (GM crops) to make them disease resistant, pest resistant, drought resistant or to increase crop yield and nutritional content.

D. Over-Fishing



Uncontrolled overfishing means that fish stocks in our oceans are in sharp decline. Fish stocks become very low especially if breeding fish are caught. To make fishing sustainable breeding must be allowed to continue successfully. Controlling the holes in nets allows smaller fish to escape so that they can grow and breed.

E. Biotechnology and food production



Glucose syrup is added as a food source for the fungus to respire and release energy to grow, and make proteins. The fungal biomass is harvested, dried and used to make the Mycoprotein.

The fungus *Fusarium* is grown inside the fermenter. The aerobic conditions are controlled, monitored and kept stable. Mycoprotein (Quorn) is produced.

Homeostasis Year 11b

Separate Higher

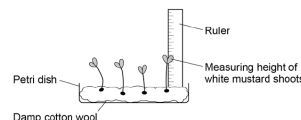
A. Keywords.

Cerebral Cortex	Part of the brain concerned with consciousness, intelligence, memory and language
Cerebellum	Part of the brain concerned mainly with coordinating muscular activity and balance
Medulla	Part of the brain concerned with unconscious activities such as controlling heartbeat and breathing
Suspensory Ligaments	The ligaments that connect the lens of the eye to the ciliary muscles
Ciliary Muscles	Muscles that contract and relax to change the shape of the lens of the eye
Dialysis	The process of cleaning the blood through a dialysis machine when the kidneys fail
ADH	A hormone that helps control the water balance of the body and affects the amount of urine produced by the kidney
Phototropism	Plants response to light due to auxins causing unequal growth rates in plant shoots
Geotropism or Gravotropism	Plants response to gravity due to auxins causing unequal growth rates in plant roots
Auxin	A plant hormone that controls the responses of plants to light and gravity
Gibberellins	Plant hormones that are important in initiating seed germination
Ethene	Plant hormone that controls fruit ripening

B. Required Practical—Plant Responses: Investigate the effect of light or gravity on the growth of newly germinated seedlings.

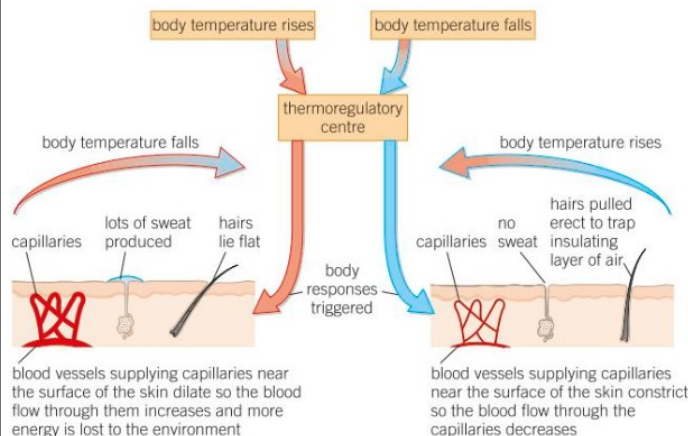
Method

- Set up three petri dishes containing cotton wool soaked in equal amounts of water.
- Put ten mustard seeds in each dish.
- Put the dishes in a warm place. They must not be disturbed or moved.
- Allow the mustard seeds to germinate.
Water daily with equal amounts of water to each dish.
- Each dish should have the same number of seedlings after the seeds have germinated. Remove excess seedlings from any dish that has too many.
- Measure the height of each seedling in mm.



The responses of plants to light are controlled by auxin. The response happens because of an uneven distribution of this hormone in the shoot. Auxin moves from the side of the shoot where light is falling to the unlit side of the shoot. The cells on that side respond to the hormone by growing more and so the shoot bends towards the light.

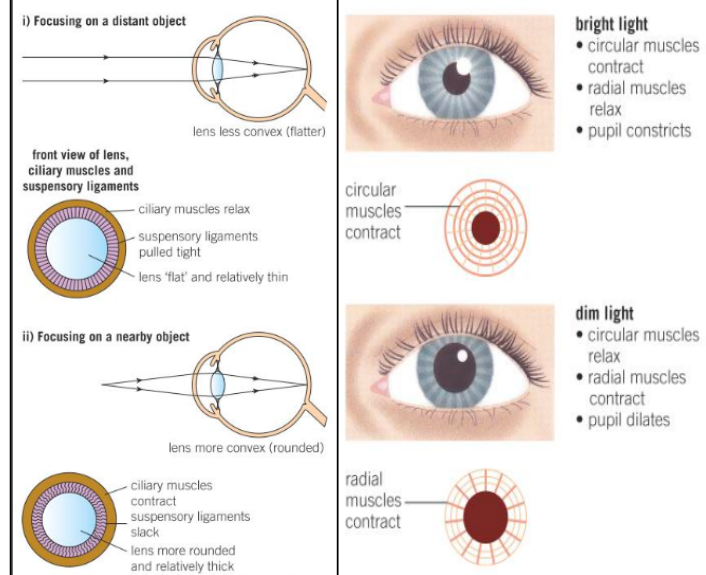
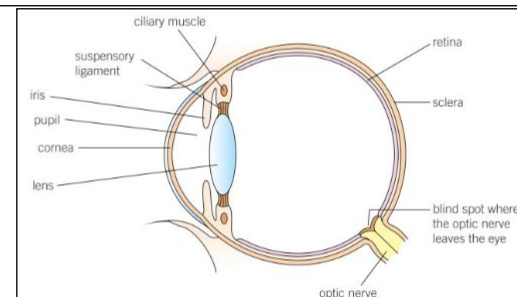
E. Controlling Body Temperature



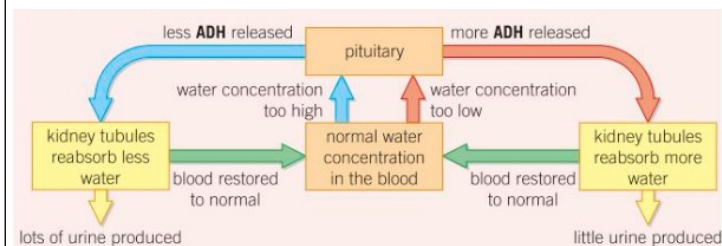
Control of your core body temperature relies on the thermoregulatory centre in the hypothalamus of your brain which contains receptors that are sensitive to the temperature of the blood. The skin also contains receptors and sends nerve impulses to the thermoregulatory centre.

D. The Eye

The muscles in the eye respond to light as a stimulus.



C. ADH and Water Balance



Kidneys remove toxic urea from the body in urine, along with excess water and mineral ions that are not needed. The amount of water in the blood is maintained at a constant level by a negative feedback system involving the hormone ADH. ADH is secreted by the pituitary gland in the brain.

Homeostasis Year 11b

Separate Foundation

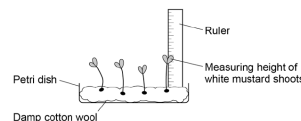
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Ciliary Muscles	Muscles that contract and relax to change the shape of the lens of the eye
Retina	Contains light sensitive cells that convert light into electric impulses
Iris	Coloured region of muscle that controls size of pupil
Lens	Refracts light so that it focusses on retina at back of eye
Dialysis	The process of cleaning the blood through a dialysis machine when the kidneys fail
Phototropism	Plants response to light due to auxins causing unequal growth rates in plant shoots
Geotropism or Gravitropism	Plants response to gravity due to auxins causing unequal growth rates in plant roots
Auxin	A plant hormone that controls the responses of plants to light and gravity

B. Required Practical—Plant Responses: Investigate the effect of light or gravity on the growth of newly germinated seedlings.

Method

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C. Plant Responses—Gravitropism

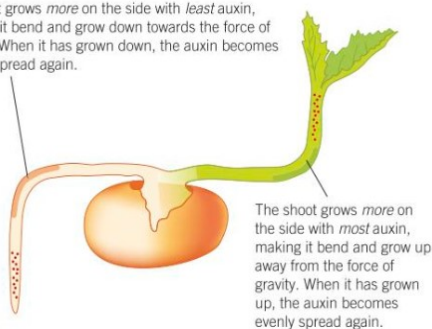
- 1 A normal young bean plant is laid on its side in the dark. Auxin is equally spread through the tissues.



- 2 In the root, more auxin gathers on the lower side.

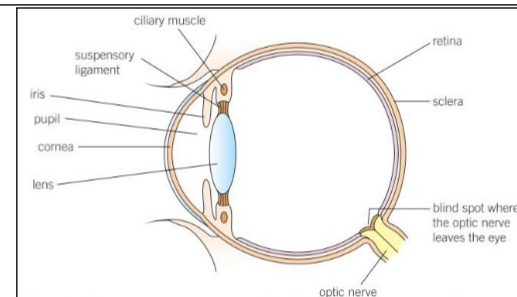


- 3 The root grows *more* on the side with *least* auxin, making it bend and grow down towards the force of gravity. When it has grown down, the auxin becomes evenly spread again.

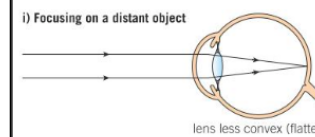


D. The Eye

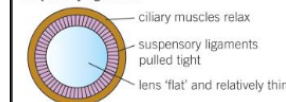
The muscles in the eye respond to light as a stimulus.



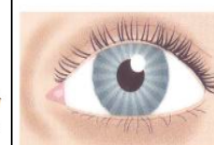
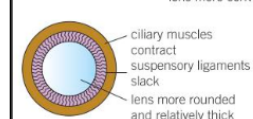
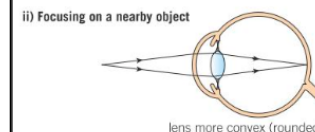
i) Focusing on a distant object



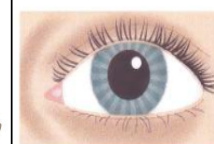
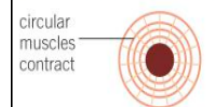
front view of lens, ciliary muscles and suspensory ligaments



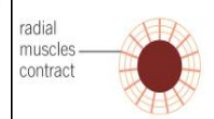
ii) Focusing on a nearby object



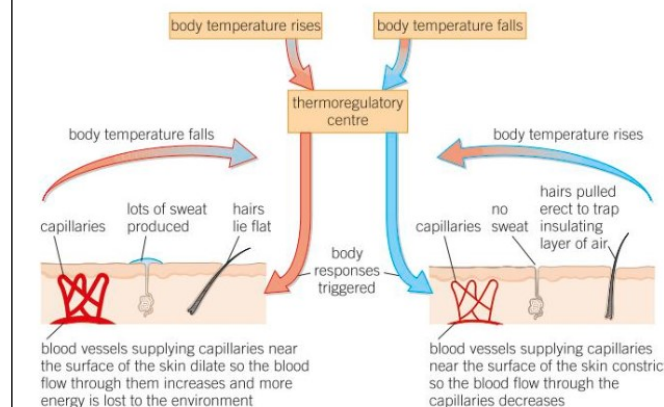
- bright light**
- circular muscles contract
 - radial muscles relax
 - pupil constricts



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



E. Controlling Body Temperature



The thermoregulatory centre is in the hypothalamus in the brain. It has receptors that detect changes in the temperature of the blood. The temperature receptors in the skin also send impulses to the thermoregulatory centre.



Inheritance, Variation and Evolution

Year 11b Separate Foundation

A. Keywords.

Nucleotide	A key unit of DNA structure—made from a sugar, a base and a phosphate group
Base	Nitrogen containing compounds that form the DNA ladder. Four types exist called A,G,C and T.
Cloning	The production of genetically identical offspring by asexual reproduction.
Tissue Culture	A modern way of cloning plants that allows thousands of new plants to be created from one piece of plant tissue.
Gregor Mendel (b.1822)	An Austrian monk said to be the grandfather of genetics. His work with pea plants built the foundations for the genetic crosses we do today. He had no knowledge of genes / DNA as they had yet to be discovered.
James Watson and Frances Crick	The first scientists to build a 3-D model of DNA's double helix structure in 1953.
Maurice Wilkins and Rosalind Franklin	Wilkins released X-ray images of DNA made by Rosalind Franklin. These helped Watson and Crick decipher DNA's structure.

B. DNA Structure

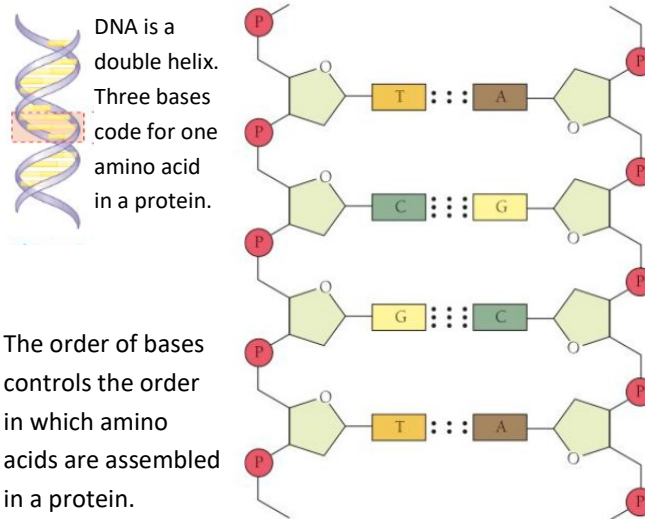


Figure 2 The way the bases bind is vital to the structure of the DNA and the way it works

C. Cloning — Animals (Embryo Cloning)

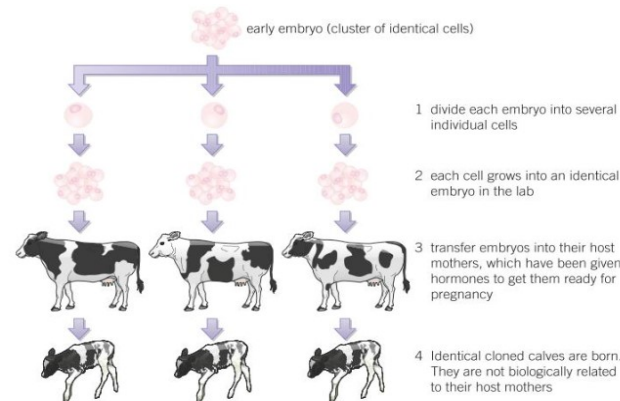
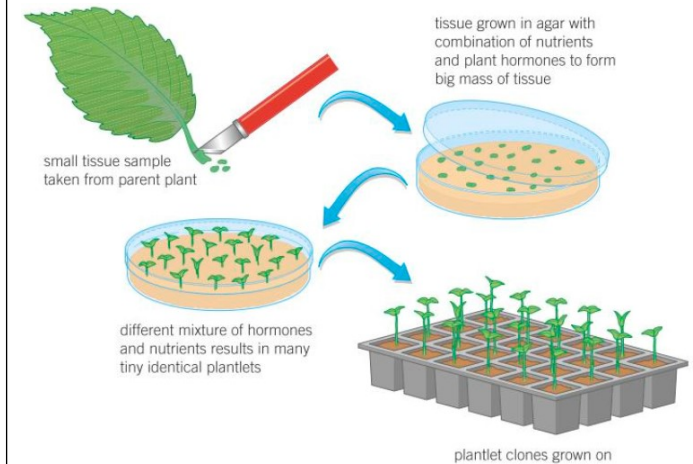


Figure 2 Cloning cattle embryos

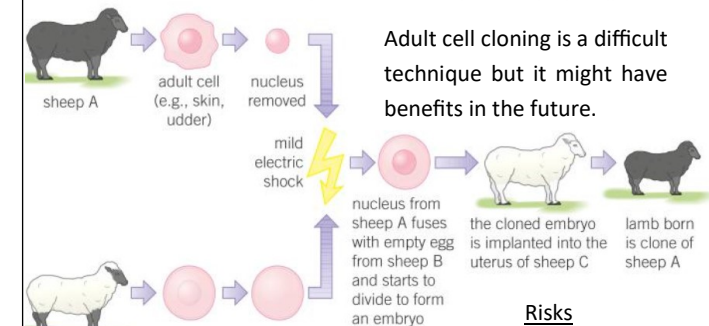
- Fertility hormones are used so that a cow produces lots of eggs. These are fertilised with a bull's sperm.
- Each new embryo is divided into individual cells.
- These grow into multiple cloned embryos which are transplanted into host mothers. They are all genetically identical.

D. Cloning — Plants (Tissue Culture)



Plants can also be cloned by taking cuttings and using plant hormones to encourage root growth. This is how gardeners can make many genetically identical plants from one parent plant.

E. Adult Cell Cloning e.g. Dolly the Sheep



Risks

Adult cell cloning is a difficult technique but it might have benefits in the future.

Ethical issues are raised. Could lead to human cloning or 'designer' babies.

Cloning reduces genetic variation which makes a population more susceptible to environmental changes or new diseases.

Benefits

Cloning genetically engineered animals that can make large quantities of human medicines

Save animals from extinction

Cloning pets or prized farm animals

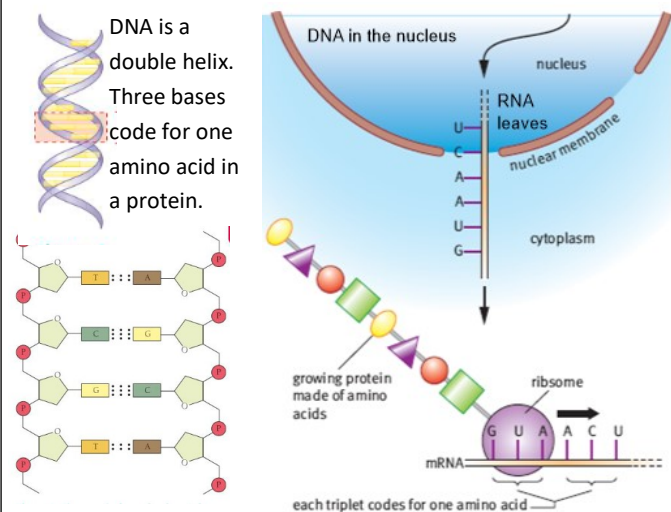
Inheritance, Variation and Evolution

Year 11b Separate Higher

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Base	Nitrogen containing compounds that form the DNA ladder. Four types exist called A,G,C and T.
Gene Expression	When a gene is 'switched on' it makes a protein and is said to be expressed.
Mutation	A change in the genetic material (DNA) of an organism.
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Tissue Culture	A modern way of cloning plants that allows thousands of new plants to be created from one piece of plant tissue.
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B. DNA Structure and Protein synthesis



The order of bases controls the order in which amino acids are assembled in a protein. RNA forms a template of the gene (DNA) in the nucleus. It makes proteins in the cytoplasm using a ribosome to align amino acids. The protein made folds up into a unique shape.

C. Gene Expression and Mutation

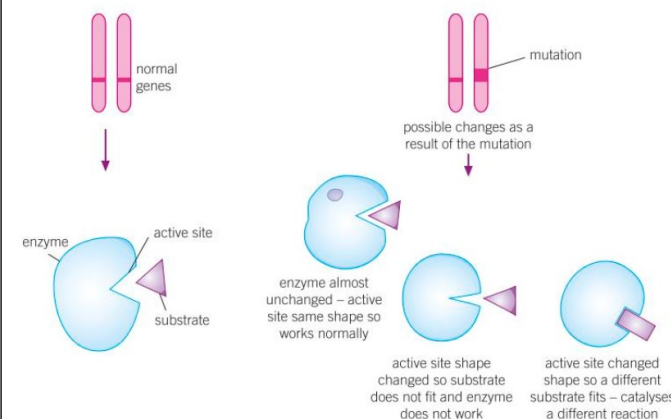
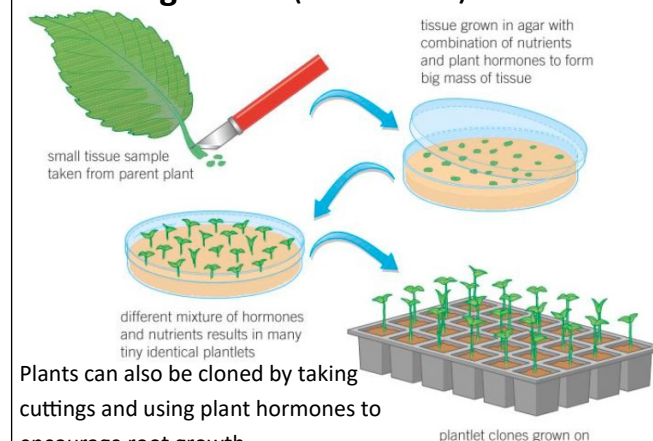


Figure 3 The effects of a mutation in a gene range from nothing at all, to a catastrophic failure to produce a vital enzyme, to an improvement in the activity of the enzymes made

Not all parts of the DNA code for proteins. Non-coding parts switch genes on/off. Mutations occur continuously. Most don't alter the protein made. A few mutations can change the shape or function of a protein. This could be an advantage / disadvantage.

D. Cloning— Plants (Tissue Culture)

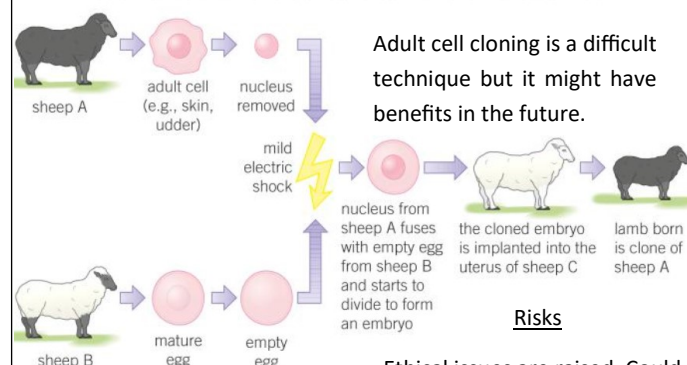


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