AQA GCSE Biology Unit 1 Summary Notes

11.1 Internal Control

The Nervous System

- The nervous system enables humans to react to their surroundings and coordinate their behaviour.
- Information from receptors passes along cells (called neurones) in nerves to the brain.
- **Nerve impulses** are electrical signals that travel along neurones.
- Nerve impulses travel at high speed.
- **Receptors** detect stimuli which include light, sound, changes in position, chemicals, touch, pressure, pain and temperature.
- **Sensory neurones** – transmit nerve impulses from the receptors to the CNS when a stimulus is detected.
- **Motor neurones** – transmit nerve impulses from the CNS to effectors, to bring about a response.
- **Effectors** are muscles or glands.

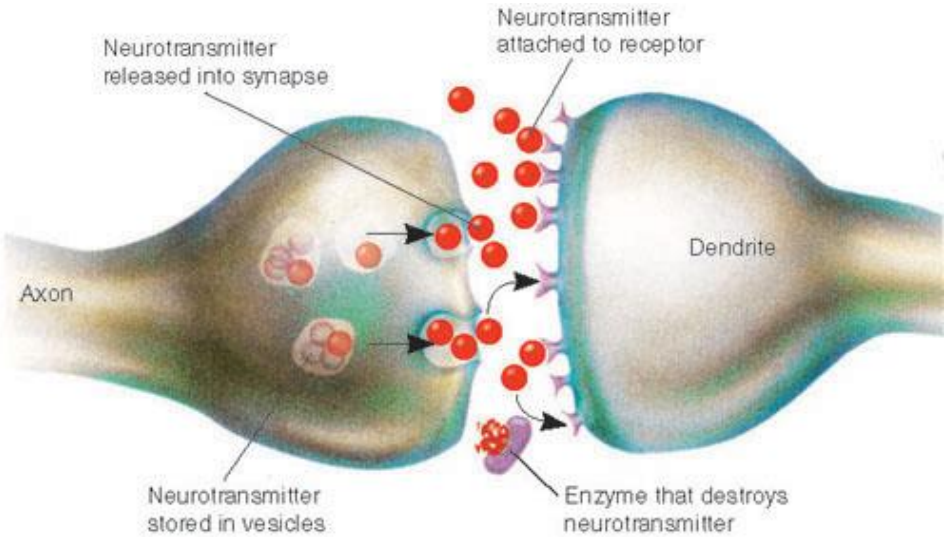
The nervous system can be defined into 2 areas
1. **Central nervous system (CNS)**
Brain and **spinal cord**
This coordinates the response

2. **Peripheral nervous system (PNS)**
Consists of nerves connecting the CNS to the rest of the body (eg the optic nerve and the sciatic nerve)

- **Nerves** are bundles of motor and sensory neurones.

Synapses

- The connections between neurones



- When the impulses reaches the end of the axon it causes a **chemical** to be released.
- They are called neurotransmitters.
- They **diffuse** across the gap and stimulate the impulse to continue in the next neurone.

Reflexes

- A **reflex** is a rapid automatic response to a stimulus, which does not involve conscious control.

Functions:

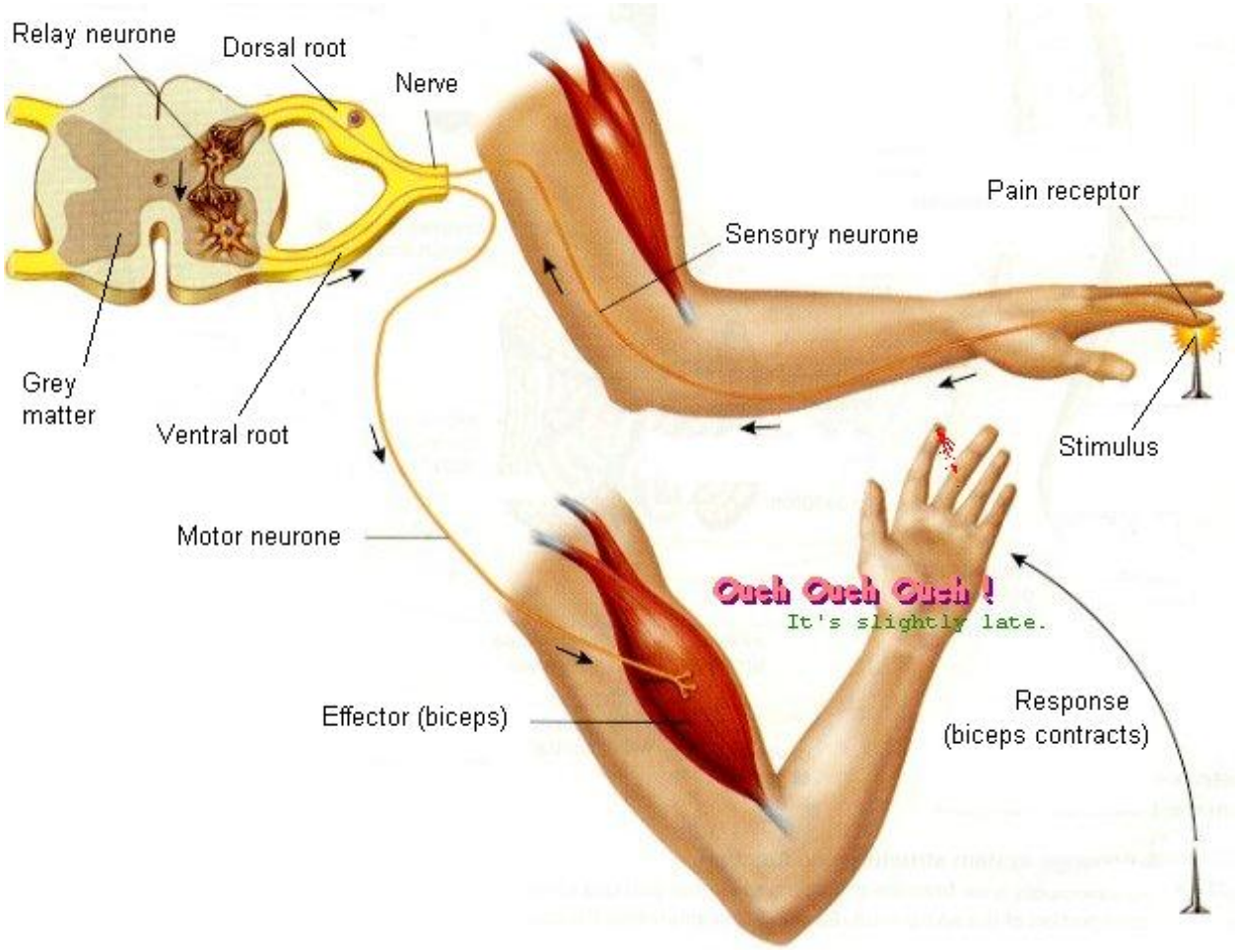
- Protection from dangerous stimuli.
  Eg hand withdrawal from a hot object.
- Maintenance of body processes
  eg. Heart rate and breathing
- Muscle coordination and posture
  Eg knee jerk

A **reflex arc** is the route taken by a nerve impulse from receptor to effector via the central nervous system to bring about a reflex action.

This involves:

1. A receptor
2. Sensory neurone
3. Relay neurone – a short connecting neurone in the CNS
4. A motor neurone
5. An effector

There is a synapse every time one neurone meets another one!



Hormones

- Many processes within the body are coordinated by chemical substances called hormones.
- Hormones are secreted by glands and are transported to their target organs by the bloodstream.
- Hormones regulate the functions of many organs and cells.

Hormones in the menstrual cycle

1) FSH – follicle stimulating hormone

Secreted from: pituitary gland

Effects: egg matures in ovary
Release of oestrogen from ovary

2) Oestrogen

Secreted from: ovaries

Effects: inhibits release of FSH
Causes release of LH

3) LH – luteinising hormone

Secreted from: pituitary gland

Effects: stimulates release of egg from ovary

Controlling Reproduction

Increasing fertility

FSH is given as a fertility drug to woman whose own level of FSH is too low to stimulate eggs to mature.

IVF – In Vitro Fertilisation:
- Fertility drugs are given to increase egg production.
- Eggs are removed and fertilised with sperm outside the body.
- These can be allowed to develop into embryos.
- They may be implanted back into the womb of the mother.

Benefits:
- Enables infertile couples to have children.
- Excess embryos can be used for research.

Concerns:
- Procedures are expensive.
- Health risks for the mother.
- Multiple births – some babies may die.
- People do not like embryos to be used for research.

Oral contraceptives

Contain hormones that inhibit FSH production so that no eggs mature.

Benefits:

It can reduce population growth in the developed world.

Concerns:

- Health problems – eg some increase the risk of blood clots.
- Religious objections to preventing conception.

Homeostasis

- The maintenance of a constant internal environment.

What are the main factors that are controlled?

Internal conditions which are controlled include:

- The water content of the body.
- The ion content of the body.
- Temperature.
- Blood sugar levels

Osmoregulation

- The process of water movement into or out of cells is called **osmosis.**
- We take in water and salts by drinking.
- We lose water by breathing, sweating, and urine production by the kidneys.
- We lose ions by sweating and urinating.
- The major control of water and ions is by our kidneys.

Blood sugar regulation

- We take in sugar as carbohydrate in our food.
- We control blood sugar levels by releasing insulin (a hormone) from the pancreas.
- Our cells need a constant supply of blood sugar for energy.

Thermoregulation

- Temperature regulation.
- Enzymes work best at $37^{O}C$.
- Above and below this by a few degrees, and our cellular reactions stop working.
- We control our body temperature using our skin, eg by sweating.

Sports Drinks

Contain salts (sodium and potassium ions), glucose and water.

Isotonic sports drinks

- The same concentration of ions as the body fluids
- Enables rapid uptake of glucose

Hypotonic sports drinks

- Lower concentration of ions than in body fluids.
- Enables rapid uptake of water by **osmosis.**

Hypertonic solutions – not in sports drinks

- Higher concentration of ions than in body fluids
- Water is drawn into the gut – this dehydrates you - not sensible in a sports drink!

11.2 Healthy lifestyles

Balanced Diet

- A healthy diet contains the right balance of different foods.
- A healthy diet contains the right amount of energy.
- It will provide carbohydrates for energy.
- It will provide fat for energy and insulation.
- It will provide protein for growth and repair.
- It will provide vitamins and minerals to help our bodies function well.
- It will provide fibre to ensure food moves through our digestive systems efficiently.
- It will provide water, which is essential for all body processes.

- If a diet is unbalanced a person is **malnourished.**
- This can lead to being too thin or fat and to deficiency diseases.

Balancing the energy

- If you use more calories than you eat you will lose weight.
- If you use less calories than eat you will gain weight.
- Doing exercise uses up lots of calories.

The effect of exercise on health

- Regular exercise keeps you healthy.
- It maintains a good metabolic rate.
- It requires energy so uses lots of calories.
- If they are not used up they are stored possibly as fat.

Metabolic rate

- The rate at which chemical reactions happen in the cells of your body.
- One major metabolic reaction is respiration.
    - This releases energy from the food we eat.
- Inherited factors affect metabolic rate:
    - Some people inherit genes that give them a higher or lower metabolic rate than others.
- The higher the proportion of muscle to fat in your body, the higher you metabolic rate:
    - Muscle cells use more energy.
- The more exercise you do the faster your metabolic rate:
    - More energy is needed.
- The warmer it is, the lower your metabolic rate:
    - We use less energy to keep our body temperature at 37^{o}C.
- Therefore, the less exercise you take, and the warmer it is, the less food you need.

Obesity

- Obesity is a disease where someone is carries too much body fat. Obese people have increased risk of life-threatening diseases.

- In the developed world too much food and too little exercise are leading to high levels of obesity.

Some diseases linked to excess weight:

- arthritis (worn joints)
- diabetes (high blood sugar)
- high blood pressure
- heart disease.

Malnourishment

- A person is malnourished if their diet is not balanced.
- This may lead to a person being too fat or too thin.
- It may also lead to deficiency diseases.
- Some people in the developing world suffer from health problems linked to lack of food.

Health problems connected with malnourishment include:

- Reduced resistance to infection – the immune system does not work correctly.
- Irregular periods in women.

What is cholesterol?

- A substance made by the liver.
- Found in the blood.
- The amount produced depends on diet and inherited factors.
- High levels increase risk of disease in the heart and blood vessels.
- Cholesterol is carried around the body by 2 types of lipoprotein.
- Low density (LDLs) & High density (HDLs).
- LDLs are ‘bad’ and can cause heart disease.
- HDLs are ‘good’.
- Balancing these is important to having a healthy heart.

- Saturated fats increase blood cholesterol levels.

- Monounsaturated and polyunsaturated fats may help both to reduce blood cholesterol levels and to improve the balance between LDLs and HDLs.

Salt

- Too much salt in the diet can lead to increased blood pressure for about 30% of the population.

Processed Food

- Processed food often contains a high proportion of fat and/or salt.

Statins

- Statins are a relatively new group of drugs used to lower blood cholesterol levels.
- However, some people are concerned that they may encourage people to continue eating unhealthy foods rather than following a healthy diet to reduce their cholesterol.

11.3 Drugs

Drug Abuse

- Drugs can be beneficial but may harm the body.
- Many drugs derived from natural substances have been known to indigenous peoples for many years.
- Some people use drugs recreationally.
- Some of these recreational drugs are more harmful than others.
- Some of these drugs are legal, some illegal.

What do abused drugs do?

- Drugs change the chemical processes in people's bodies.
- Drugs work by affecting synapses.
- Some drugs make them work faster (eg, caffeine).
- Some drugs make them work slower (eg. Cannabis).

Addiction and Withdrawal

- Drug abusers may become dependent or addicted to the drugs.
- They may suffer withdrawal symptoms without them.
- Heroin and cocaine are very addictive.
- The overall impact of legal drugs on health is much greater than the impact of illegal drugs, because far more people use them.
- There are concerns that cannabis may be a gateway drug:
    - It may increase the chance of users moving on to becoming addicted to drugs like cocaine or heroin.

Alcohol

- Alcohol affects the nervous system by slowing down reactions.
- It helps people relax.
- Too much may lead to lack of self-control, unconsciousness or even coma.
- Long term abuse eventually damages the liver and brain.

Smoking Tobacco

- Nicotine is the addictive substance in tobacco smoke.
    - This makes it difficult for people to stop smoking.
    - Nicotine patches and nicotine chewing gum can be used to help people stop smoking.
- Tobacco smoke contains carcinogens, which are chemicals that cause cancer:
    - The link between smoking tobacco and lung cancer has been known about for about 100 years.
    - However, this was only gradually accepted.
- Tobacco smoke also contains carbon monoxide which reduces the oxygen-carrying capacity of the blood.
- In pregnant women this can deprive a fetus of oxygen and lead to a low birth mass.

11.4 Infectious Disease

Pathogens

Microorganisms that cause infectious disease are called pathogens.

Bacteria

- Bacteria are very small single-celled organisms.
- Not all cause disease.
- Pathogenic bacteria reproduce rapidly inside the body and may produce poisons (toxins) which make us feel ill.
- Example: E.coli produces toxins that cause fever symptoms when we have food poisoning.

Viruses

- Viruses are much smaller than bacteria.
- All viruses are pathogens.
- Viruses produce toxins and they damage the cells in which they reproduce, leading to illness.
- Viruses replicate by invading cells, reproducing inside them and bursting them.
- This causes damage to tissues, leading to illness.
- Example: HIV virus damages white blood cells, reducing immunity and leading to AIDS.

Infection

There are many routes through which pathogens can enter the body:

Nasal passages	Insect bites
Mouth	Hair follicles
Urethra	Contaminated needles
Anus	Scratches and cuts
Vagina	Direct penetration

Disease occurs when large numbers of pathogenic micro-organisms enter the body.

Disease Transmission

Diseases are transmitted through:
1) Unhygienic conditions
2) Direct contact with infected people
3) Inhaling droplets from coughs or sneezes.

Preventing transmission

- In the 1850s, Ignaz Emmelweiss insisted that medical students washed their hands before delivering babies.
- This idea was not readily accepted – people were not aware of microorganisms.
- Nowadays, it is standard practice for people to wash hands after treating patients, to prevent disease being transmitted to other patients.

External protection from infection

- Skin is the first barrier.
- Trachea and lungs produce mucus that traps microorganisms.
- Blood clots seal the wound.
- The stomach secretes hydrochloric acid which kills microorganisms.
- Other protection:
    - Ear wax
    - Tears
    - Nostril hairs
    - Eyelashes

Internal defences

- The body has different ways of protecting itself against pathogens.
- White blood cells defend our internal environment from pathogens
- These form part of our immune system.

- There are 2 types of white blood cells:

1) Phagocytes
- Ingest and destroy microorganisms

2) Lymphocytes
- Produce antibodies that destroy specific pathogens
- Produce antitoxins that destroy toxins released by pathogens

Medicines

- Some medicines, including painkillers, help to relieve the symptoms of infectious disease, but do not kill the pathogens.
- Eg painkillers, hayfever drugs, asthma inhalers.

Antibiotics

- Antibiotics are substances that are used to cure bacterial infections by killing pathogenic bacteria inside the body.
- Antibiotics cannot be used to kill viral pathogens
- This is because viruses live and reproduce inside cells.
- It is difficult to develop drugs which kill viruses without also damaging the body's tissues.
- Penicillin is one example of an antibiotic. Other antibiotics include tetracycline and ampicillin.
- Antibiotics are only useful if they attack the bacteria and not the human body.

Antibiotic Resistant Bacteria

- Antibiotics have been overused.
- Resistant bacteria have now evolved. – how?
    - Bacteria reproduce rapidly.
    - In a large bacterial population, one bacterium may have a mutation that gives it resistance to antibiotics.

    - This survives and reproduces.
    - Soon all of the bacteria are resistant.

- Some bacteria are resistant to many different types of antibiotic eg Methicillin Resistant Staphylococcus Aureus (MRSA).
    - These bacteria can enter the body through wounds and cuts.
    - Healthy people's white blood cells would quickly destroy these bacteria.
    - People who are ill in hospital are likely to have reduced immunity to bacterial disease, and become infected more easily.

What can be done?

- Doctor's should only prescribe antibiotics when necessary – and not for viruses.
- It is important that if you are prescribed antibiotics you take the whole course.
    - A lot of people will stop taking the antibiotic when they feel better.
    - This is wrong!
    - If you do this, you leave a few bacteria inside your body.
    - These will reproduce, increasing the chance of some developing resistance.
- Farmers should use less antibiotics.
    - They use antibiotics to prevent illness in their animals.
    - This means that bacteria are exposed to antibiotics more often.
    - This gives the bacteria more opportunity to become resistant to the antibiotic.
- Scientists are trying to develop new versions of the antibiotics.
- Some antibiotics are developed but not used – just in case.
- Other medicines are being developed.
- Viruses that kill bacteria are being genetically modified to replace antibiotics.

Epidemics and Pandemics

Epidemics – diseases that spread widely through one country.

Pandemics – diseases that spread through several countries.

Eg bird influenza

- A viral disease similar to human influenza.
- It mainly affects birds, because it is easily transmitted from bird to bird.
- It rarely affects humans, because humans need to directly contact an infected bird.
- It cannot be transmitted from human to human.
- There are concerns that the virus will mutate to be able to be transmitted in this way.
- If it does this, it will start off by causing an epidemic, which may spread to become a pandemic.
- Many people will die….

Developing new medicines

- When new medical drugs are devised, they have to be extensively tested and trialed before being used.
- Drugs are tested in the laboratory to find if they are toxic.
- They are then trialed on human volunteers to discover any side effects.
- It can take many years before a newly discovered drug is available to be used,

Thalidomide

- Thalidomide is a drug that was developed as a sleeping pill.
- It was also found to be effective in relieving morning sickness in pregnant women.
- However, it had not been tested for this use.
- Unfortunately, many babies born to mothers who took the drug were born with severe limb abnormalities.
- The drug was then banned.
- More recently it is being used successfully to treat leprosy.

Immunisation

- People can be immunised against a disease by introducing small quantities of dead or inactive forms of the pathogen into the body (vaccination).
- Vaccines stimulate the white blood cells to produce antibodies that destroy the pathogens.
- This makes the person immune to future infections by the microorganism.
- The body can respond by rapidly making the correct antibody, in the same way as if the person had previously had the disease.
- An example is the MMR vaccine used to protect children against measles, mumps and rubella:
    - Many people decided not let their children be immunised with this vaccine because of a factually incorrect report linking the vaccine to autism.
    - People were unaware of the risks of catching any of these 3 diseases:
        - Measles can create a high fever, and can be fatal.
        - Mumps can lead to sterility in men.
        - Rubella can lead to brain damage in an unborn child if the mother catches it.
    - Incidences of these diseases are now rising again.

11.5 Adaptation and Competition

Survival

- To survive, organisms require a supply of materials from their surroundings and from the other living organisms there.

- Organisms live, grow and reproduce in places where, and at times when, conditions are suitable.

Physical (abiotic) factors:
- Light
- Oxygen
- Water
- Temperature

Living (biotic) factors:
- Food
- Predation
- Grazing
- Disease
- Competition – for: food, light, water, space.

Competition in Animals

Animals often compete with each other for:
- Food
- Mates
- Territory

Competition in Plants

Plants often compete with each other for:
- Light
- Water from the soil
- Nutrients from the soil

Adaptation

- Organisms have features (adaptations) which enable them to survive in the conditions in which they normally live
- The organisms that are best adapted to make use of their resources in a habitat are more likely to survive and increase in numbers
- For example:
    - To be able to obtain a certain food better.
    - To make it more difficult for predators or grazing animals to catch them or eat them. eg thorns, poisons and warning colours to deter predators.
    - To survive in extreme climates, eg arctic or deserts
- Their adaptation will effect their abundance compared to other populations in a habitat

Examples of extreme adaptations:

Camel

- The camel can go without food and water for 3 to 4 days.
- Fat stored in their humps provides long term food reserve, and a supply of metabolic water. The fat is not distributed around the body; this reduces insulation, allowing more heat loss.
- They are tall and thin, increasing their surface area to volume ratio, increasing heat loss by radiation.

Polar Bear

- Polar bear has thick fur and fat beneath its skin to insulate it.
- Their large, furry feet help to distribute their weight as they walk on a thin ice.
- They are white which camouflages them against the snow. This helps them to hunt.
- They are compact in shape, reducing their surface area to volume ratio; this reduces heat loss by radiation.

Desert plants

- Eg the cactus, require very little water to survive
- Leaves are spines.
- Spines guard against most browsing herbivorous animals.
- Spines also reduce their surface area, reducing water loss by evaporation
- A thick waxy coating surrounds the plant to reduce evaporation.
- Fewer 'stomata', reducing water loss
- Roots tend to spread sideways to catch rain water.

Arctic plants

- Many of the plants are small, growing close to the ground and very close together to avoid the wind and conserve heat.
- Some possess a light, fuzzy covering to insulate the buds so they can grow.
- Many are dark colors of blue and purple to absorb the heat from the sunlight even during the winter months.
- Because of the cold and short growing seasons, arctic plants grow very slowly.
- Some grow for ten years before they produce any buds for reproduction.

11.6 Reproduction and Variation

Genetic material

- A **cell** is the basic unit of life; all organisms are made up of cells.
- The **nucleus** is a large organelle found in all cells, that contains the genetic information. (Even red blood cells once had a nucleus).
- **DNA (Deoxyribose nucleic acid)** is the chemical found in the nucleus of all cells that contains the genetic information.
- **Chromosomes** are thread-like structures made of DNA found in the nucleus
- **Genes** are small sections of a chromosome that control the characteristics of an organism. Different genes control the development of different characteristics. Genes are passed on from parent to offspring, resulting in offspring having similar characteristics to their parents. Eg eye colour

Asexual reproduction

- There is no fusion of gametes and only one individual is needed as the parent.
- There is no mixing of genetic information and so no variation in the offspring.
- These genetically identical individuals are known as clones.

Examples:
- Bacteria or yeast cells use binary fission
- Plants can use runners, bulbs or vegetative propagation.
- Humans can create plant clones using cuttings and tissue cultures.
- Some invertebrate animals like starfish, worms and hydra.
- Humans can clone other animals, eg. Dolly the sheep.

Sexual reproduction

- Sexual reproduction - the joining (fusion) of male and female gametes.
- The mixture of the genetic information from two parents leads to variety in the offspring.
- Genes are passed on in the sex cells (gametes) from which the offspring develop.

The causes of variation

- Sexual reproduction - leads to variety in the offspring
- Asexual reproduction - no variation in the offspring.

Individuals within a species vary due to:

Genetic factors

- Meiosis – all gametes created by one person are genetically different.
- Random fertilisation
- Mutations

Environmental factors

- Nutrition
- Chemicals
- Temperature
- Light
- Physical forces

Cloning

- Humans can carry out various procedures to create clones of plants and animals.
- These new individuals (clones) are genetically identical to the parents.

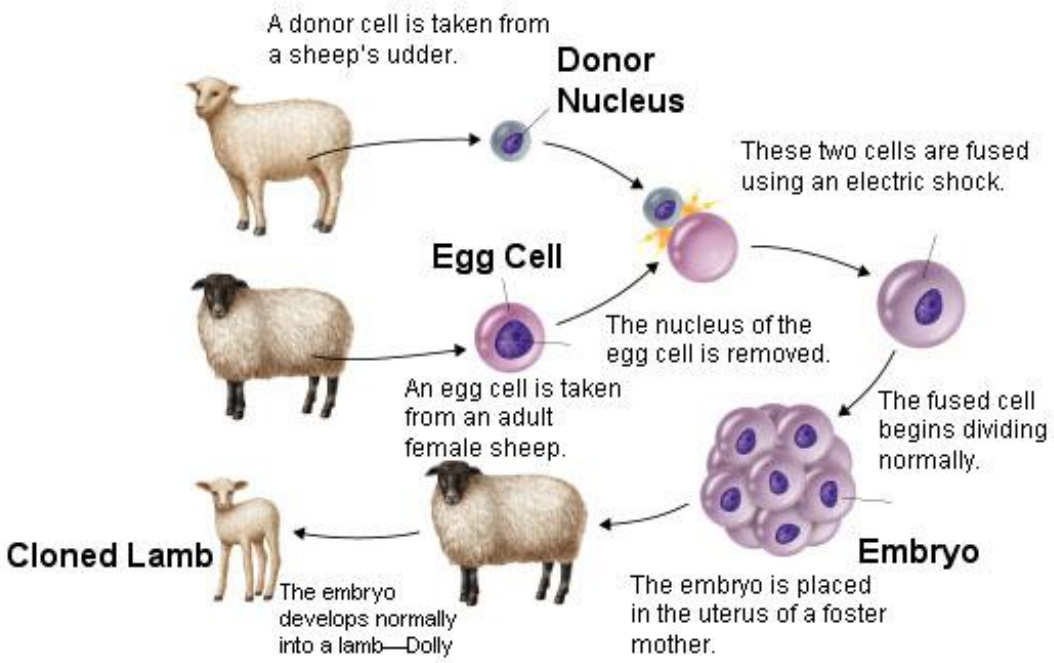
Cuttings:
- New plants can be produced quickly and cheaply by taking cuttings from older plants.

Tissue culture
- This uses small groups of cells from part of a plant to grow new plants.
- They are grown in special growth media that provides all the essential nutrients and conditions for growth.

Embryo transplants
- This involves splitting apart cells from a developing animal embryo before they become specialised.
- The identical embryos are then implanted into the wombs of host mothers.

Fusion cell cloning
- This involves replacing the nucleus of an egg cell with the nucleus of an adult cell.
- An electric shock is used to start the cell dividing to form an embryo.
- This could be used to create stem cells to grow new tissues or organs.

Adult cell cloning
- This involves implanting an embryo formed by fusion cell cloning into the womb of a host mother, where it develops until it is born.
- This could be used to clone animals with desired characteristics or even to save animals from extinction.



Concerns about cloning:
- People do not want human babies to be cloned.
- It produces lots of genetically identical individuals; they may struggle to survive if there is a change in the environment.

Genetic engineering

Genes from the chromosomes of humans and other organisms can be cut out using enzymes and transferred to cells of other organisms.

GM = Genetically modified

Examples of uses in food production:
- GM soya
- GM tomatoes
- Enzymes used to make vegetarian cheese

Examples of uses in medicine:
- Vaccine production
- Production of Factor VIII for haemophiliacs

Example in detail: Insulin production for diabetics.

What is insulin?
- Hormone made in the pancreas
- Controls blood sugar levels
- Allows glucose to be stored as glycogen

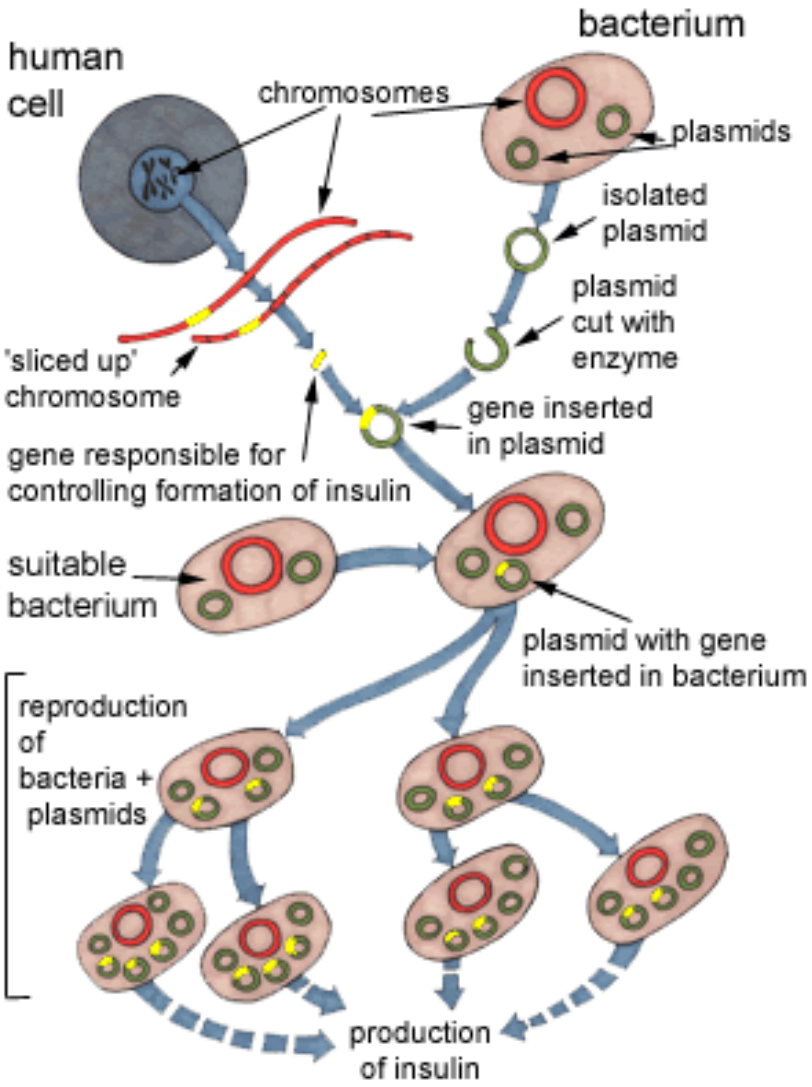
What is diabetes?
- Condition where people cannot produce their own insulin
- This means they cannot control their blood sugar levels

Genetic engineering uses:

- Restriction enzymes – enzymes that 'cut' out sections of DNA
- Plasmids – circular pieces of DNA found in bacteria
- Bacteria – simple, unicellular organisms
- Ligase enzymes – enzyme that binds DNA together

The process:

- Cut out the insulin gene from the DNA of a human cell using an enzyme.
- Remove a ring of DNA (a plasmid) from a bacterium and open it up using the same enzyme.
- Insert the insulin gene into the plasmid using another enzyme.
- Enable a bacterium to take up the altered plasmid.
- Put the bacterium in a fermenter, and it multiplies many times.
- Each new bacterium contains the plasmid with the insulin gene.
- The bacteria produce insulin which can be extracted.



Other uses of genetic engineering

Genes can also be transferred to the cells of animals or plants at an early stage in their development so that they develop with desired characteristics:

- Gene therapy in could be used to insert healthy genes into foetuses that would otherwise develop a genetic disease.
- Genes can be inserted into clumps of plant cells, so that the adult plant can produce a chemical that kills pests.

Concerns about genetic engineering:

- Their may be long-term, unpredicted effects of consuming GM plants.
- Genes for pesticide resistance may spread form GM plants to their wild relatives, creating pesticide resistant weeds.
- People may want to manipulate the genes of their future children.
- Vegetarians may consume genes from animals if plants are genetically modified.

11.7 Evolution

- The theory states that all species of living things which exist today have evolved from simple life-forms which first developed more than 3 billion years ago.

Origins of life

- These first organisms were very simple single-celled organisms, similar to bacteria.
- However, these rarely survive as fossils.
- Scientists cannot be certain about how life began on Earth.

Fossils

- Fossils provide evidence of how much (or how little) different organisms have changed since life developed on Earth.
- Studying the similarities and differences between species helps us to understand evolutionary and ecological relationships.

Conflicting theories on evolution

- In the 19th century, Darwin developed the theory of **natural selection** to explain the process of evolution.
- Before Darwin, Lamarck used a different theory.
- He used a theory of **acquired characteristics.**
- He argued that an individual's characteristics will change over its lifetime due to amount of use.
- Eg. Giraffes' necks get longer due to stretching for leaves.
- Then these characteristics were passed on to offspring.

What is wrong with this?

- Changes in the body do not change the genes.
- It is the other way round:

  Changes in genes (through mutations) can cause changes in the body.

Darwin's theory of natural selection

- All organisms produce large numbers of offspring.
- Individual organisms within a particular species may show a wide range of variation because of differences in their genes.
- There is a struggle for existence (eg. Predation).
- Individuals with characteristics most suited to the environment are more likely to survive to breed successfully.
- The genes which have enabled these individuals to survive are then passed on to the next generation.
- Future generations have a larger number of individuals with these useful genes.

Why did people not accept Darwin's ideas?

- Lack of knowledge about genes.
- Christians believed in creation.

Mutations

Most mutations are harmful or fatal. Occasionally, some mutations are useful.

How do mutations occur?

- Errors occur when the DNA is replicated prior to cell division:
- Errors may occur when chromosomes are separated during cell division:

What do mutations do?

- Genes control the synthesis of proteins.
- Therefore a change in a gene or a new sequence of genes can result in different proteins being synthesised.
- Different proteins can change a characteristic.

Eg skin colour is controlled by a protein called melanin. Albinism is a common mutation which prevents melanin being produced.

When new forms of a gene result from mutation, if the new characteristic is useful, there may be more rapid change in a species through natural selection.

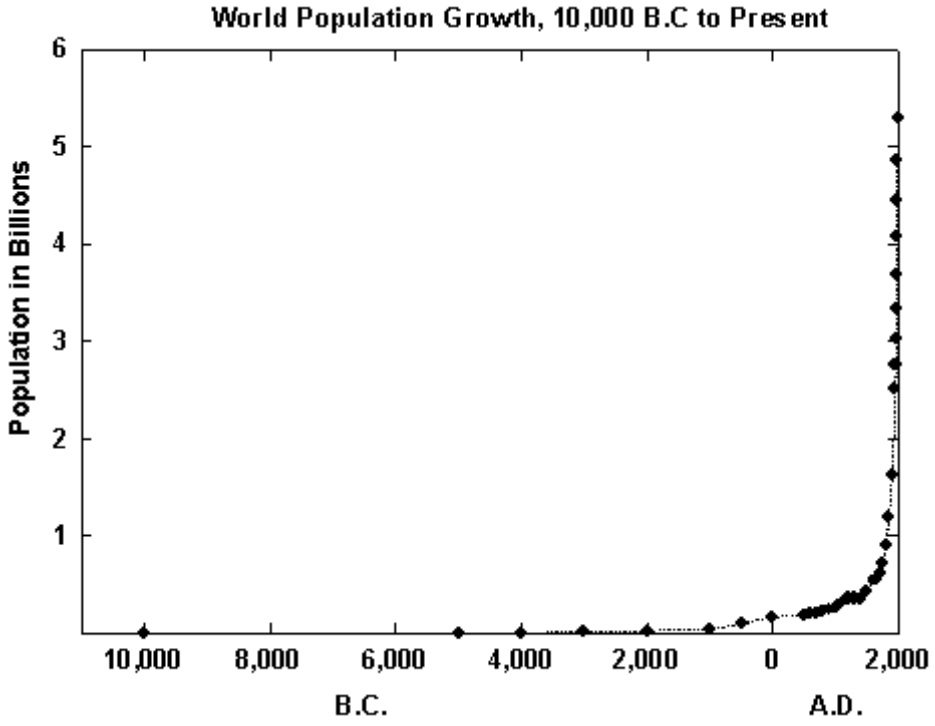
Extinctions

- The environment that suits a species may change
- New predators may arise
- New diseases may arise
- New competitors may arise
- If evolution does not occur to make them better adapted to the changes…..
- ……they may become **extinct!**

11.8 Human's Effect on the Environment

Human Population Explosion

- The human population is growing rapidly due to an increase in the standard of living.



Waste Production

- Raw materials including non-renewable energy resources are rapidly being used up and increasingly more waste is produced.
- Unless waste is properly handled, more pollution will be caused.

Land Use

Humans reduce the amount of land available for other animals and plants by:

- Building
- Quarrying
- Farming
- Dumping Waste

Deforestation

Large scale deforestation in tropical areas, for timber and to provide land for agriculture, has:

- Increased the release of carbon dioxide into the atmosphere (because of burning and the activities of microorganisms)
- Reduced the rate at which carbon dioxide is removed from the atmosphere (by photosynthesis) and locked-up for many years as wood.
- Loss of forest leads to reduction in biodiversity. Some of the organisms that are lost may be of future use.

Pollution

Waste may pollute:

- water with sewage, fertiliser or toxic chemicals;
- air - with smoke and gases such as sulfur dioxide;
- land - with toxic chemicals, such as pesticides and herbicides, which may be washed from land into water.

Sulfur dioxide contributes to acid rain:

- It dissolves in the rain forming sulphuric acid.
- This damages the leaves and the roots of trees.
- Rivers and streams become acidic.
- Aquatic plants and animals may die.

The Greenhouse Effect

- Carbon dioxide and methane in the atmosphere absorb most of the energy radiated by the Earth.
- Some of this energy is reradiated back to the Earth and so keeps the Earth warmer than it would otherwise be.

Global Warming

Deforestation has:

- increased the release of carbon dioxide into the atmosphere (because of burning and the activities of microorganisms);
- reduced the rate at which carbon dioxide is removed from the atmosphere and 'locked-up' for many years as wood.

- Increases in the numbers of cattle and rice fields have increased the amount of methane released into the atmosphere.
- These gases may be causing global warming by increasing the greenhouse effect.

An increase in the Earth's temperature of only a few degrees Celsius may cause:

- quite big changes in the Earth's climate;
- a rise in sea level.

Sustainable Development

As the human population grows we will require more resources.

Sustainable development is about how we should ensure that we:

- Conserve natural resources
- Reduce the damage we make to the environment
- Maintain biodiversity

Planning is needed at local, regional and global levels to manage sustainability.
Examples:

- Local – conservations sites eg SSSIs – Sites of Special Scientific Interest
- Regional – maintenance of green-belts around large cities.
- National – policies to increase use of renewable energy.
- Global – agreement between different coutries to reduce release of polluting gases.

Sustainability can include many different targets:

- Replant forests at the same rate at which they are cut down.
- Use fast growing trees.
- Replant hedgerows.
- Use organic fertilizers.
- Use less pesticides.
- Reduce the number of fish we catch.
- Recycle our waste.
- Reduce the amount of packaging we use.
- Use energy wisely:
    - Insulate houses
    - Use energy efficient light bulbs
    - Switch things off!
- Use public transport.
- Walk and cycle more.
- Use non-polluting fuels.
- Generate electricity using renewable sources of energy.
- Create SSSIs – Sites of Special Scientific Interest – to preserve rare and fragile ecosystems.

Monitoring the success of sustainability

Living organisms can be used as indicators of pollution:

- Lichens can be used as air pollution indicators:
    - They are very senitivie to pollution.
    - Less lichens are found in polluted areas.
- Invertebrate animals can be used as water pollution indicators.
    - Some invertebrate species tolerate different concentrations of pollution in water.