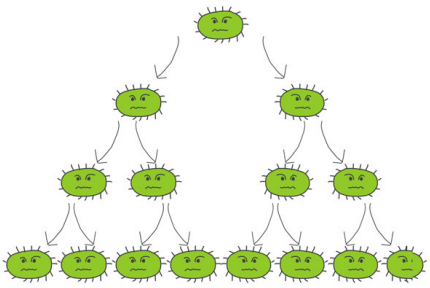
National 4 Biology
Unit 2 summary notes

1. Reproduction

For a species to survive it must be able to produce more offspring. Living things can reproduce in different ways – **asexual reproduction** and **sexual reproduction**.

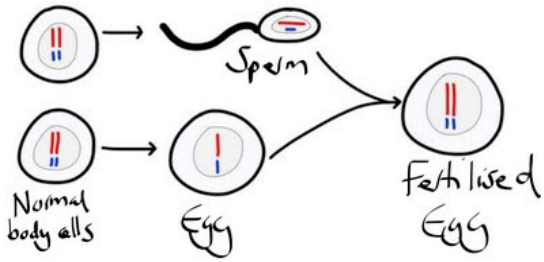
Asexual Reproduction



A bacterium reproduces by asexual reproduction. When a bacterium reproduces it simply copies its DNA and then divides in half - we call this process **cell division**. This means in asexual reproduction there is only one parent and all the offspring are identical to that parent. The diagram below shows asexual reproduction in bacteria. One bacterium divides to form two, which both divide to form four which each divide again to form eight bacteria. Asexual reproduction can grow populations very quickly. Yeast also reproduce by asexual reproduction. You can see yeast reproducing below by forming "buds". These buds will eventually form separate but identical cells. Plants can reproduce by asexual reproduction too. They do this by producing structures such as **bulbs**, **plantlets** and **tubers**.

Sexual Reproduction

Most animals and flowering plants reproduce by what we call sexual reproduction. In sexual reproduction, there are two parents and all the offspring are different from each other. In humans, an egg is produced monthly. Sperm produced in the testicles travel along the sperm duct and are placed in the vagina by the penis. They travel up and fertilise the egg in the oviduct. The fertilised egg then travels to the uterus to grow during pregnancy. In fish, sperm and eggs meet in the water, but the parents leave after and do not look after the young. Different organisms produce different number of eggs. The greater the number of eggs produced, the less their survival chance. This is usually because their level of parental care is less.



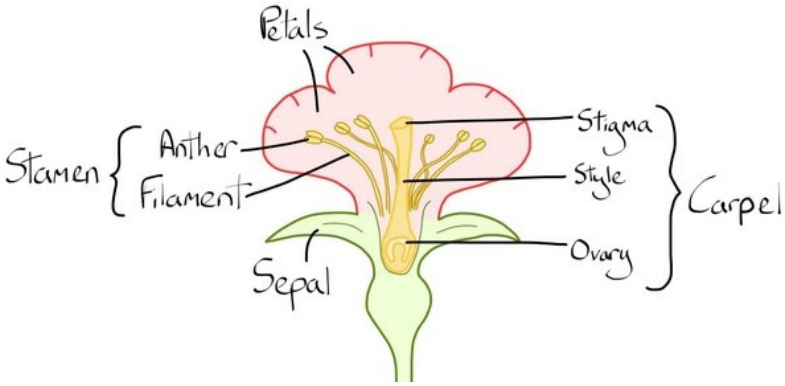
The DNA in the offspring is a mixture of both parents. Sexual reproduction is very important because it **creates variation in the offspring**. Variation is important because it create individuals with new combination of genes. These combinations of genes may give the individuals useful characteristics such as **resistance to disease**, **tolerance to drought** and other useful characteristics. The more variation there is in a population the more likely it is to be able to be able to survive changes in the environment.

2. Growing plants

Propagation of Plants Propagation is just another way of saying "making more". When people talk about propagation of plants they are just talking about how growers increase their supply of plants.

Growing plants from seed

Plants reproduce by sexual reproduction by using **flowers** to produce **seeds**. Pollination happens when the pollen (male sex cell) travels from the anther by insects or the wind to the stigma of another plant. Pollen grows a pollen tube down to the ovary where its nucleus joins with the nucleus of the female sex cell, the ovule. Fertilisation happens and a seed is formed. Seeds are finally dispersed away from the parent by the wind, animal internal (the animal eats then excretes the seeds elsewhere) or animal external (the seed sticks to the animal's coat then falls off elsewhere).



Growing plants without seeds

Plants can reproduce naturally by **asexual reproduction** which produces **identical** offspring. **Bulbs** are plant's underground food stores which contain side buds to grow into new plants. These bulbs will produce new plants which are genetically identical to the parent. **Runners** make new plants at the end of long bendy stems e.g. strawberries. Some plants naturally produce miniature version of themselves called **plantlets** e.g. Mexican hat plants.

Plantlet

Runner

Bulb

Some people use **artificial** ways of propagating plants. You can take sections of the stem or leaf of a plant, called **cuttings,** using scissors. After planting the cutting, given the right conditions, they can grow into a whole new plant.

3. Commercial uses of plants

Plants are grown to provide food, fuel, raw materials, medicines and more. Growers are keen to maximise their yield of plants to maximise their profit. You have already seen how some growers ensure that limiting factors do not inhibit the growth of their plants.

Pharming is a new technology which involves **genetically engineering plants** so that they produce **medicinal products**. It is hoped that this could eventually be a cheap way to mass produce medicines. It is conceived that it might even be possible to deliver medicines or vaccines in ordinary foods.

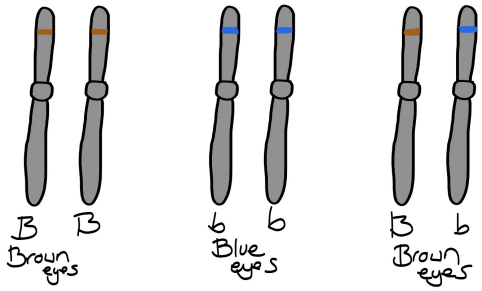
4. Genetic information

Genetic information

We inherit our DNA and our genes from our parents. Half our DNA came from our mother, half our DNA came from our father. If we know what types of genes two parents have, we can predict the chance that children will inherit certain characteristics. This is useful where parents know that they may be a carrier for a genetic condition.

Let's look at our DNA. We already know that it is organised into chromosomes. You may also know that these chromosomes come in **pairs**. One chromosome in each pair came from your mother, the other from your father.

Dominant and recessive genes. Here is the same pair of chromosomes but in three different people. We are looking at one particular gene on these pair of chromosomes and that is for **eye colour**.



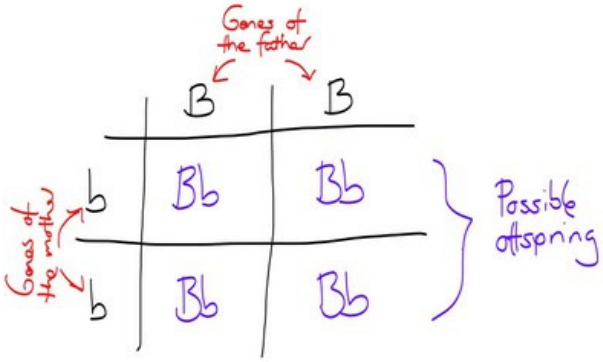
Person A has inherited a copy of the brown eyed gene from both parents (BB) - so they will have brown eyes. Person B has inherited a copy of the blue eyed gene from both parents (bb) - so they will have blue eyes. Person C will have brown eyes. This is because brown eyes are **dominant** to blue eyes. Blue eyes are **recessive** in this example. Dominant genes will always show their effect over recessive genes.

Genetics crosses

If we know what type of genes two parents have, we can predict what characteristics their children will have. In this example we have a blue eyed mother and a brown eyed father. The mother must have two copies of the blue eyed gene (bb) because she has the recessive characteristic - blue eyes. The father could have Bb or BB. Lets assume in this case the father is BB.

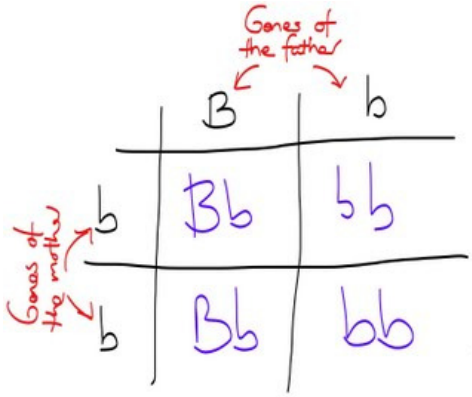
We know that one chromosome will be inherited from the mother and one from the father but it is not possible to predict which one. We need to look at all the possibilities. We can do this by doing genetic crosses. On one side of the cross we put the type of

genes held by the mother. On the old side of the cross we put the type of genes held by the father. By completing the cross we can see the different gene combinations that can arise.



What if the father had a copy of both the brown and blue eyed gene (Bb)? What would our cross look like then? Lets repeat the exercise but with the new genes for the father.

In this case the possible gene combinations in the children are Bb, Bb (Brown eyes) and bb, bb (Blue eyes). This means the couple will have a 50:50 chance of having brown or blue eyed children.



5. Growth and development

We have looked at how our genes affect the features of living things, however the features of living things are down to more than just their genes.
There is another important thing which affects how living things grow and develop which is their **environment**. With plants, seeds need WOW – water, oxygen, warmth - to germinate. The term **optimum** means the conditions a plant grows best in, e.g. its optimum was at 20 °C. Once germination has happened, plants also need light. Any deficiency (lack of) minerals such as nitrogen, phosphorus and potassium will slow a plant's growth. Exposure to UV light will also damage a plant's growth.

We don't need to tell you that a balanced diet, water, minerals and vitamins are required for healthy growth and development in humans but you may not know about why these vitamins or food groups are important. Your diet should have a balance between the three main food groups - **carbohydrate**, **protein** and **fat**.

- **Carbohydrates** are food such as bread, pasta, rice and potatoes. These are important because they give you energy. Carbohydrates breakdown to form glucose which you should remember is used in respiration.
- **Protein** is found in foods such as meat, fish, pulses, eggs and tofu. Protein is used to make up the basic framework of the body's tissues and organs. Protein can be used for energy but only in cases of starvation.
- **Fat** is useful in the body for insulation. It is stored under the skin and keeps us warm. Fat is also important because it helps absorb and carry certain vitamins in the blood. Fat, however, is very high in energy and should only be eaten in moderation. It is important to know the difference between saturated fat and unsaturated fat.
    - Eating a diet high in **saturated fat** can lead to high cholesterol levels in the blood which can lead to various cardiovascular diseases. Saturated fat is found in butter, cheese, animal fat.

- Eating more **unsaturated fats** can actually lower cholesterol levels in the blood. Unsaturated fats can be found in food like olive oil, oily fish and nuts.

- **Vitamins and minerals**: You should also get plenty of vitamins and minerals by eating at least five portions of **fruit** and **vegetables** per day. The table below shows some vitamins and minerals and their function in the body.

Vitamin or mineral	**Foods found in**	**Function in human body**
Vitamin A	Milk, eggs, liver, carrots.	Prevent eye problems.
Vitamin B12	Fish, red meat, poultry, milk, cheese and eggs.	Helps make red blood cells.
Vitamin C	Citrus fruits, peppers, tomatoes, broccoli and spinach.	Healthy bones teeth and gums.
Vitamin D	Your skin makes it when you are in the sun! It is also found in egg yolks, oily fish	To absorb calcium (see below)
Calcium	Milk and other dairy products.	Strong healthy bones
Iron	Red meat, fish, lentils, beans, green leafy vegetables. Some cereals are also fortified with iron.	Helps red blood cells carry oxygen around the body.

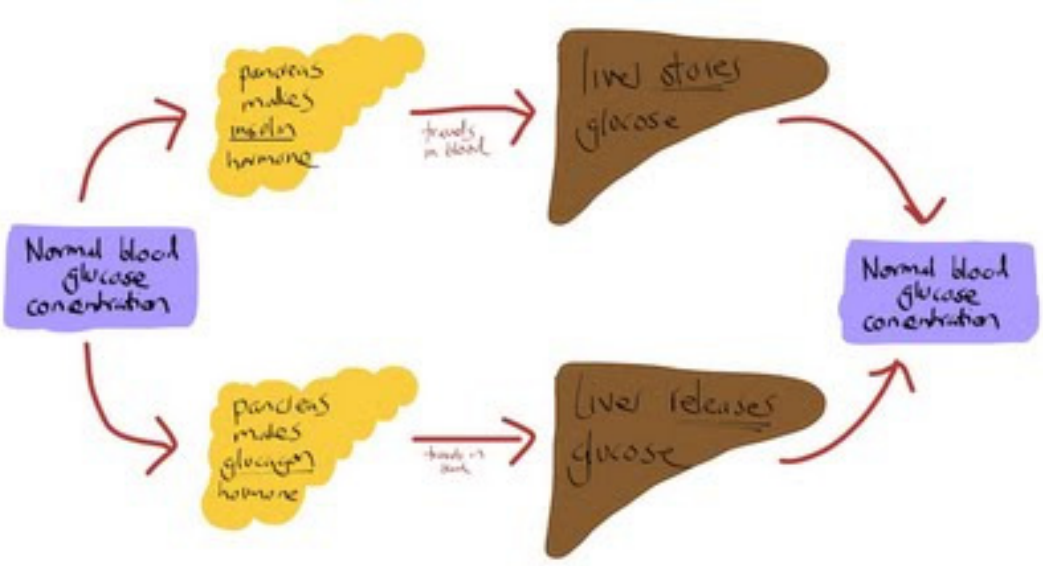
6. Homeostasis

Living things must be able to keep their internal environment constant despite changes in the environment. We call this **homeostasis**.

Humans maintain a **constant body temperature of 37^{O}C**. This means that the body temperature is always kept at the best temperature for **enzymes**. So how do we achieve this? Our **brain** monitors and recognises any changes in temperature. It then sends messages through our **nerves** to different parts of the body to bring our temperature back to normal. Think about how our body reacts to being cold. We get **pale skin**, we **shiver** and get **goosebumps**. These are all methods that the body uses to warm itself up again. The pale skin is a result of blood being diverted away from our skin. This means that less heat is lost from the blood through our skin. Shivering is a very fast contraction of our muscles. When our muscles are working they create heat and this warms our body. Lastly goose bumps are a result of tiny muscles attached to the hairs on our skin pulling the hair into an upright position. This traps an insulating layer of air and helps minimise any heat lost from the body. Think again about how our body reacts to being hot. We get **red in the face** and we **sweat**. The red face is a result of blood being diverted to our skin to maximise heat being lost through our skin. Sweating is a clever way to maximise heat lost from our skin. Sweat glands in our skin secrete a liquid onto our skin. This liquid evaporates from the skin and takes heat energy away.

You may need to look back at **unit 1** to remind yourself why glucose is so important to our body. In short, the cells of our body need a constant supply of glucose for the process of respiration. In respiration, our cells break down glucose to release energy. This energy can be used to power all the chemical reactions in our cells. If our blood glucose is too low our cells cannot get the energy they need. If our blood glucose concentration is persistently too high this damages our blood vessels and organs. It is therefore vital to keep a perfect balance.

The job of keeping our blood glucose concentration under control is down to the **liver** and **pancreas**. Excess glucose is stored in the liver and released again as we need it. The pancreas monitors the blood glucose concentration and releases hormones which tell the liver to either store glucose or release it.



Diabetes may be inherited or caused by lack of exercise and a diet too high in sugars. People with type 1 **diabetes** do not have the hormone which causes blood glucose to be stored in the liver when its level gets too high. This hormone is called **insulin**. People with diabetes need to test their blood glucose concentration regularly and inject insulin with every meal. This insulin is made by genetic engineering.

7. Control and communication

Parts of our body can communicate with other parts with our nervous system. Special cells called **receptors** pick up information and send it to the brain along our **nerves**. The brain picks up the information and makes an appropriate response. The more receptors we have, the more sensitive an area is. This explains why areas like our finger tips, lips and face are so sensitive.