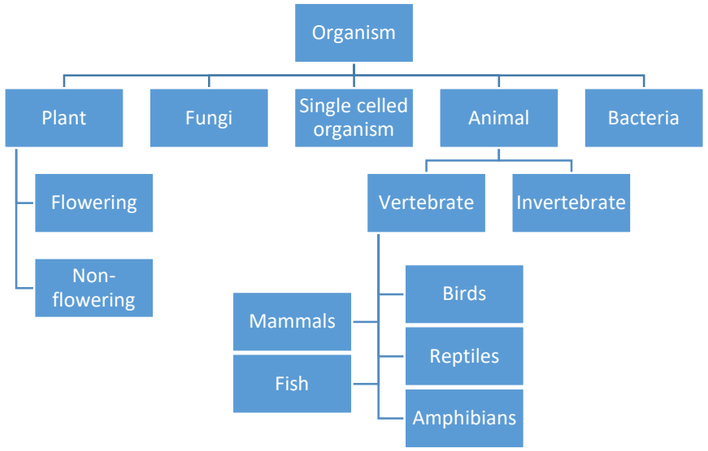
GCSE Science – Biology 2

2.1 – Classification

All living organisms can be classified into groups based on their characteristics. The main groups are shown below.



Non-flowering plants – do not produce flowers e.g. ferns and mosses;
Flowering plants – produce flowers;
Invertebrates – do not have a backbone e.g. insects;
Vertebrates – have a backbone.

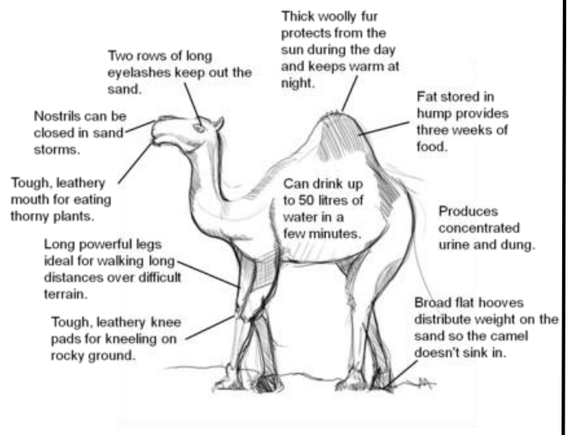
2.2 – Adaptations

Morphological adaptation is a structural change which gives an organism a greater chance of survival in its habitat.

Common examples
- Large ears- Large surface area to lose heat
- Fur- Camouflage to their environment
- Think fur- reduce heat loss

Behavioral adaptation is the way an organism reacts to its environment which aids its survival.

Common example
- Active during the night- too hot for the animal in the day

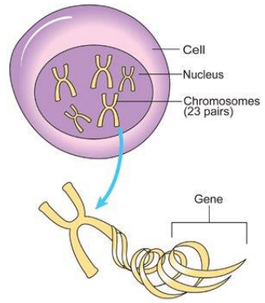


2.3 – DNA and chromosomes

The DNA stored inside a cells nucleus has all the information required to reproduce that organism.

However the DNA is not just thrown into the nucleus, it is arranged in 'X' shaped clumps called chromosomes.

A human cell contains 23 pairs of identical chromosomes, so 46 chromosomes in total. Other organisms contain different numbers of chromosomes, a carrot contains 9 pairs of chromosomes and an American paddle fish contains 60!



The only cells in an organisms body that contain less chromosomes are the sex cells (sperm and egg cells). Each sex cell contains half the usual number of chromosomes. This means that a human sex cell will contain 23 chromosomes in total.

So when a sperm cell and an egg cell fuse the total number of chromosomes present is 46. So you get half your genetic information from your Mum and half from your Dad.

2.4 – Cell division

Organisms must carry out cell division to;

- Repair damaged tissue
- Replace old/worn out cells
- Growth
- Reproduction

There are two types of cell division, Mitosis and Meiosis.

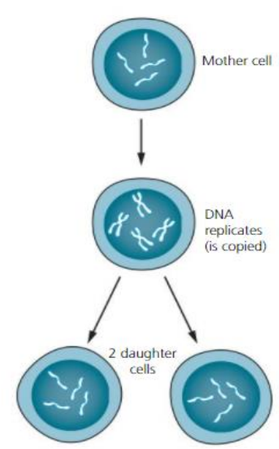


Figure 8.4 Cell division by mitosis.

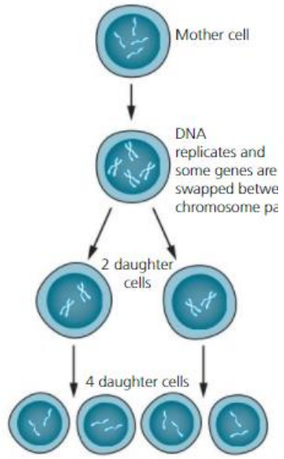
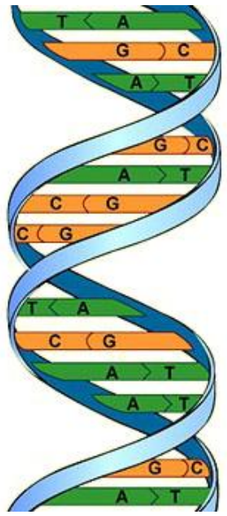


Figure 8.5 Cell division by meiosis.

2.5 – Fossil fuels

DNA consists of 2 long strands of alternating sugar and phosphate molecules.

- The chains are twisted to form a double helix.
- There are pairs of bases holding the chains together. The 4 bases are A (adenine), T (thymine), C (cytosine) and G (guanine). The sequence of the bases forms the instructions, in a form of code, for the making of proteins.
- The 'code' consists of triplets (groups of three) of bases along the DNA. Each triplet codes for an individual amino acid.



2.6 – Key terms

Keywords	Definitions
Gamete	Gametes are sex cells, for example male gametes are sperm cells and female gametes are eggs.
Chromosome	A length of DNA that contains many genes, found in the nucleus and visible during cell division.
Gene	A short length of DNA that codes for one protein.
Allele	A variety of a gene
Dominant	The allele that shows in the phenotype whenever it is present (shown by a capital letter)
Recessive	The allele that is hidden when a dominant allele is present (shown by a lower case letter).
Homozygous	A homozygote contains 2 identical alleles for the gene involved
Heterozygous	A heterozygote contains 2 different alleles for the gene involved.

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2.7 – Mutations

Mutation is a change in a **gene** or **chromosome**. It is a rare, random change in the genetic material, and in some cases it can be inherited.

Causes of mutation

Mutation can be spontaneous. It just happens, or it can happen because of: ionising radiation, chemical **mutagens** – such as tar from cigarette smoke.

Effects of mutation

A mutation may be **neutral** and have no effect. For example, the protein that a mutated gene produces may work just as well as the protein from the normal gene.
A mutation may sometimes be beneficial. For example, people who are carriers (heterozygous) for the sickle cell **allele** are more resistant to malaria (a tropical disease) than people who do not have the mutated gene.
Some mutations can be harmful. A change in the gene might produce a faulty or non-functioning protein, resulting in a genetic disease, such as cystic fibrosis.

2.8 – Evolution

Principles of evolution by natural selection

The idea behind the theory of **evolution** through the process of natural selection is that all **species** of living things have evolved from simple life forms over a period of time. Individuals that are poorly adapted to their environment are less likely to survive and reproduce. Their genes are less likely to be passed on to the next generation.

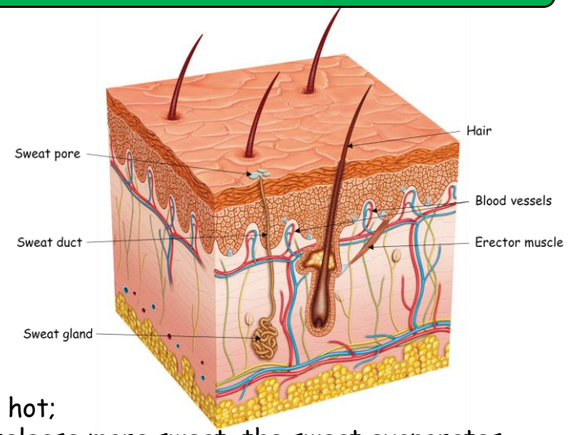
Modelling natural selection

Method

1. Use a piece of green card as a background.
2. Randomly place 20 green and 20 white pieces of string on the card to represent populations of prey organisms.
3. Using a forceps to represent the mouth of the predator, collect as many pieces of string as you can in 10 seconds.
4. Count how many green and white pieces are left and record.
5. Repeat the process twice more.

2.9 – Skin

The skin has a vital role in homeostasis, specifically maintaining a constant temperature.



When we are too hot;
- Sweat glands release more sweat, the sweat evaporates removing heat energy.
- The blood vessels closest to the surface of the skin dilate (get wider) allowing more heat to be lost.
- Erector muscles relax and hairs lie flat on the skin.

When we are too cold;
- Muscles contract rapidly (shivering), this requires energy from respiration, some of this energy is released as heat.
- The blood vessels closest to the skin constrict (get narrower) allowing less blood flow through the skin and conserving heat.

2.10 – Homeostasis

Homeostasis is the maintenance of a constant internal environment. The nervous system and hormones are responsible for this.
- Body temperature – Sweating to decrease temperature, shivering to increase.
- Blood sugar levels – Insulin (a hormone) released from the pancreases controls this.
- Water content – Controlled by the urine produced by the kidneys.

If homeostasis is not maintained then the body can start to shut down and will ultimately lead to death.

Hormones are commonly used by the body to maintain homeostasis, they are chemical messengers, carried by the blood, which control many body functions.

Insulin
Insulin is a hormone released by the pancreas to keep glucose levels in the blood within a constant range. When glucose in the blood rises, insulin is released, which causes the liver to reduce glucose in the blood by converting it into glycogen and storing it.

2.11 – Microorganisms

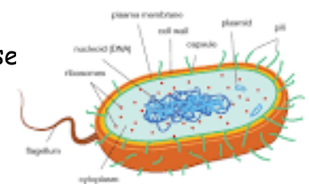
Micro-organisms this term is used to describe any living thing that we need to use a microscope to be able to see.
For example, bacteria, viruses, fungi and protists.

Protists are small organisms that are usually single celled, but eukaryotic. This means they have a nucleus.

There are good microorganism that are vital for health, for example intestinal bacteria that aid digestion.

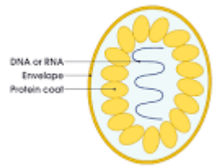
Micro-organisms that are not good for us are called **pathogens**. These cause disease and are also responsible for things like food spoilage.

Bacteria are single celled organisms.
They are different from animal cells because they have a **cell wall** AND **no membrane bound nucleus**.



They are thought to have been the earliest known form of life.

Viruses are just a protein coat with some genes in the middle. There is no cytoplasm or cell membrane.
They are even smaller than bacteria and were first seen in 1931.



2.12 – Pathogens

Pathogens spread in a number of ways.

For example:

Direct contact or body fluids Some diseases are passed on by skin-to-skin contact, eg. Skin diseases. You can also pass on disease by personal contact such as in your blood, saliva, semen and vaginal fluids.

Aerosol infection coughing, sneezing, talking and breathing can put droplets in the air that may contain pathogens. These are then breathed in by another person.

Water If the water is contaminated, drinking the water will pass on the pathogen.
There are other ways that you can pass on pathogens, such as insect bites, and contaminated food.

We can prevent these, by good personal hygiene, use of condoms, and using things like mosquito nets.