CIE Biology GCSE

1: Characteristics and classification of living organisms

Notes

Characteristics of living organisms:
All living organisms undergo these processes:

- **Movement** - Living organisms are able to move all or part of themselves. Animals can move to find food or escape predators, whilst plants can move their leaves to catch more sunlight.
- **Respiration** - this is a series of chemical reactions that occurs in cells, leading to the breakdown of nutrient molecules to release energy for metabolism.
- **Sensitivity** - living organisms can detect changes in their internal or external environments and respond to these changes.
- **Growth** - organisms grow, leading to a permanent increase in size. This can be measured through dry mass, cell size or number of cells.
- **Reproduction** - living organisms reproduce to create more organisms of their kind.
- **Excretion** - waste products from metabolic reactions are removed from the organism. This includes toxic materials, excess substances and carbon dioxide from respiration.
- **Nutrition** - organisms take in materials for development. These materials are used in chemical reactions to produce energy for growth and repair. Animals require organic compounds, ions and water. Whereas plants take in light, carbon dioxide, water and ions for use in photosynthesis.

Viruses are not classified as living as they do not have the ability to complete these processes. Viruses are non-cellular and consist of **genetic material surrounded by a protein coat.** When they reach a target cell, they inject this genetic material into the cell which is then replicated to reproduce the virus. This harms the target cell which is unable to function normally.

Classification

Classification is used to group different **species**. A group of organisms belong to the same species if they can **reproduce to produce fertile offspring**.

Organisms are classified by **evolutionary relationships**.
These can be found by studying **physical characteristics and DNA base sequences**.

Traditionally, organisms were categorized based on **morphology** and **anatomy**. The structure of bones and organs were studied through dissections and organisms were grouped based on similarities. With the advancement of modern science and technology, **DNA sequencing** studies, e.g. the human genome project, have become possible. This allows DNA for each species to be mapped and compared. Therefore, species with similar ancestors are more easily

found as they have a close DNA base sequence. This is more accurate than comparing physical characteristics as different species living in the same habitat often **evolve similar traits** and hence resemble each other. As DNA codes for the amino acid sequence in proteins, proteins can also be studied to find evolutionary relationships.

Organisms are named using the **binomial naming system**. This system uses their ***Latin* names** and consists of two words. The first refers to the organism's **genus**, and the second to its **species**. For example, humans are classified as *Homo sapiens.*

The five kingdoms

The five kingdoms are **Animal, Plant, Fungus, Prokaryote and Protoctista**. The features of cells can be used to help categorize organisms into one of these kingdoms. For example, animal cells do not contain a cell wall or chlorophyll whereas plant cells do.

Features of cells:

- **Cytoplasm** - A jelly-like material within the cell in which reactions occur. The cytoplasm contains organelles such as the nucleus and ribosomes.
- **Cell membrane** - a thin membrane that surrounds the cell. It controls entry and exit of substances.
- **DNA** - genetic material contained in the nucleus which codes for proteins.
- **Ribosomes** - site of protein synthesis.
- **Enzymes** - catalyse reactions such as respiration in the cell.

Within the animal kingdom, organisms are further categorized into **vertebrates and arthropods.** Vertebrates are animals which **contain a backbone,** such as mammals, birds, reptiles, amphibians and fish. Arthropods do not contain a backbone and are identified through their **exoskeleton** and **segmented body**. Arthropods include myriapods, insects, arachnids and crustaceans.

The plant kingdom is split into **flowering and non-flowering plants**.

There are two divisions of flowering plants: **dicotyledons and monocotyledons**, which are identified by their leaves.

Non-flowering plants, such as **ferns**, reproduce through **spores** rather than by producing seeds.