Unit -5-Classification (I)

- There are at least 5 million different kinds of organisms on earth of which about one and half million are documented.
- To understand and study the diversify of these living things scientists group them in categories and give these categories particular names.
- These group of similar living things is called **Classification.**
- Biologists classify living things for the following reasons:

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1) To simplify their study.
2) To avoid confusion.
3) To try understand how life is originated.

- Every organism is assigned to **species** and species are grouped into **genus (plu. genera**) which consists of one or more species.
- The name of organisms are written with the name of the genus first, followed by a distinctive word indicating the specific name.

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- In turn genera are grouped into f**amilies** ,families into **orders** ,orders into **classes,** classes into **phyla** (some times referred division in plants, fungi and algae), phyla into **kingdom.**
- Therefore, this established natural classification is an expression of evolutionary relationships between different groups of organisms.
- It is assumed that organisms in the same group are closely related whilst in separate groups are more distantly related.

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What is a species?

- The most important unit of clasification is species**.**
- Different groups define species in many different ways. But, the most common and widely used definition of species is:
- A group of organisms that are closely related and produce viable and fertile offspring. Example a horse and a donkey look similar but, the offspring, mule, is not fertile. Hence, donkeys and horses are not the same species.

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- The different cattle breeds are variants of the same species.

How are living things classified?

- As already explained living things are classified based on their similarities.
- The similarities observed could be on or inside their bodies. Example of animals can be grouped based on similarities of their limbs. (i.e. the limbs are made on the same basic plan).
- The limbs of a bat, horse, bird, human and whale all have the same basic pattern though they are used in different ways.

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- The front limbs of a bat are adapted as wings to fly and climbing, those of a horse for galloping, those of a bird are also used for flying, those of a human front limbs for using tools and of a whale for swimming.
- These limbs are called **homologous** structures.
- They have **pentadactyle** limb pattern (or five digit plan) which is useful both to classify the organisms and tracing back their ancestors through ancient history.

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- Classification began centuries ago based on careful observation of scientists.
- Now, in the 21st century, we use technology to allow us to look at genetic make- up of living organisms so that we can be sure they are related to each other-or not.
- Originally scientists just looked closely at the external and some times inner appearance or morphology of organisms.
- Classification was based on the degree of similarity and differences of structures.

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- However, there is a huge variation within a group of closely related organisms.
- Today there are more sophisticated ways of comparing organisms, e.g. using fundamental chemicals such as DNA, RNA and Proteins.
- The science of classification is known as **taxonomy** and group of organisms categorized into groups are called **taxa.**

Naming living things

- There are many countries in the world with various languages. People name living things with their own languages. Hence, it becomes impossible for one scientist to know what organism another scientist is

talking about. It is very difficult to understand each other using common names.

- The problem is solved by using scientific name for organisms that are classified.
- Taxonomy began with the work of Aristotle, a philosopher who lived in Greece 384-322 BC.
- Aristotle tried to create classification system for living organisms and grouped animals based on similarities as terrestrial and aquatic.
- He tried to give everything a scientific name. He called humans ‘rational animals’. But, his system was never finished.

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- Taxonomy became a serious science with the work of a Swedish scientist, Carl Linnaeus in the 18th century.
- Linnaeus loved to collect plants. He developed the **binomial system** of classification (nomenclature), i.e. naming organisms using two names.
- His classification system was written in a book called **The system of nature**.
- His system of classification is still used today.
- He suggested the way of organizing living things from kingdom down wards.

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- The two names of an organism are in Latin. Latin is considered as language of scholars everywhere even if it is no longer spoken.
- The binomial system of classification can be easily understood by most people, e.g. Wolf with different names in Ethiopia is known to all as *Canis simensis-so w*ith no confusion.

Rules for writing scientific names

1) The first name (the genus name) to which the organism belongs is written with capital letter. Some times the name of the genus is reduced to just the capital letter, e. g*. H. sapiens.*

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2) The second name is the name of the species to which the organism belongs. It is written in small letter.
3) The two names are underlined when hand written or in italics when printed. (Refer to pp.174-175, Student Textbook).

Classifying living organisms

- When you have come across living things that you did not recognize and could not classify, you have to have a means of identification.
- Biologists have developed a special method known as **biological key** (identification key). This simplest method of identification is **dicotous key**. (Refer p. 175, Student Textbook).

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The five kingdom system

- As we already studied in section 5.1, the system that scientists use to classify living things is known as **natural classification** system.
- Living things are put into groups called taxa based on their similarities and differences.
- The main taxa are kingdom, phylum(division), class, order, family, genus and species.

What is kingdom?

- Kingdom is the largest taxon and consists of all the other taxa. The modern classification contains 5 kingdoms namely:

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1. Monera (bacteria)
2. Protista (protoctista)
3. Fungi
4. Plantae
5. Animalia

- The classification mentioned above is known as 5 kingdom system.
- For many centuries scientists worked with other classification systems such as:
- Two kingdom system classification - Animalia and Plantae.

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- Three kingdom system classification - Animals, Plants, Protista (algae, fungi, protozoa).
- Four kingdom system classification - Monera (bacteria, blue green- algae), Protista (all nucleated algae, fungi and protozoa), Plantae (all plants), Animalia (all animals).
- There were a lot of problems with all these classification systems, hence, most scientists agree with the 5 kingdoms classification which give the most sense.
- Viruses are not grouped in any of these kingdoms above.

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They are placed in separate groups, because they do not have all the seven characteristics of life, although most scientists now classify them as living organisms**.**

Kingdom Monera

- Monera include Eubacteria and Cyanobacteria (all bacteria and blue green algae). They are single celled organisms that are **prokaryotes.**
- These organisms do not have separate nucleus with nuclear membrane and membrane bounded organelles like mitochondria, chloroplast and Golgi-bodies.

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- They are all microscopic and reproduce by binary fission (simple splitting into two).
- Some of them can make their own food by photosynthesis and many of them are heterotrophic (rely on other organisms to get food).
- Examples include *Mycobacterium tuberculosis, haemophilus ducreyi.*
- Useful bacteria include soil fertilizing bacteria, milk processing bacteria and

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Kingdom Protista

- The protista are all microscopic single celled organisms that have nucleus (eukaryotes).
- Some biologists include also multicellular algae within this group. Their shape is highly complex.
- They include plant-like organisms that can move and animal like organisms that can not move.
- Protista make much of the plankton found in the oceans and are the basis of food supply for all organisms in the sea.
- The animal like protista are protozoans some of which cause serious of diseases in humans, e.g.

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Plasmodium falciparum, Entamoeba histolytica which causes dysentery and Trypanosoma, the blood parasite that causes sleeping sickness.

- Dinoflagellets are protista that are motile and cause **bioluminescence** in the seas and oceans when they produce greenish light.

Kingdom Fungi

- For many years the fungi were classified as plants but they do not make food by photosynthesis.
- Fungi are now put in separate kingdom- Fungi, because there is great difference between plants and fungi.

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- Fungi are either parasites or saprophytes. They have cell wall made up of a chemical substance called **chitin.**
- Their storage products are also different from plants, mostly oil and glycogen not starch.
- Fungi are large and very successful group consisting of around 80,000 species.
- They vary in size from single –celled yeasts to enormous puffballs and bracket fungi.
- Fungi are eukaryotic and usually multicellular.
- Saprophytic fungi usually produce huge number

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of spores, which float on the wind to other dead material.

- Fungi play a great role in the ecosystem as decomposers, e.g. Rhizopus (bread mould), Mucor and Pencillium.
- Fungi as parasites, feed on living organisms. They attack plants more than animals.
- Some fungi such as *Candida albicans* (thrush*) and Tinea pedis (*athlete's foot) affect people and other animals.
- Some fungi are **mutualistic**, i.e. live in association with equal benefits, e.g. Lichens

Classification:

- The kingdom plantae consists of non flowering and flowerig plants. It is split into a number of divisions similar to animal phyla. The four main divisions are:

1) Bryophytes - Mosses and Liverworts.
2) Pteridophyta (Filicinophyta) - the ferns.
3) Gymnosperms (coniferophyta) - the conifers.
4) Angiospermae (angiospermatophyta) - the true flowering plants.

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Division Bryophyta:

- The simplest land plants that most of them prefer wet and shade places. They need water for movement of gametes.
- They do not have true roots to anchor themselves. They do not have vascular tissue. The representative groups include mosses and liverworts.

Division pteridopyta

- They have true stem and leaves (fronds). Fern stems have rhizoids that grow horizontally bellow the soil.

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- Their stem and roots have vascular tissues. They have spores under their fronds that used for reproduction.
- Most ferns live in damp places. They are known as ornamental plants in houses.

Spermatophyta

- The most successful land plants with well developed leaves, stem and roots. They have well developed vascular tissues.
- The male gametes are contained in pollen grains and the female gametes within the embryo sac.
- After fertilization seed is formed that is enclosed in fruits.

- Spermatophyta are split into two divisions (gymnosperms and angiosperms).

Division Gymnospermae

- They are commonly called conifers (“naked seed plants”). They are fast growing and cultivated for timber. They grow in cold climates.

Main characteristics:

- Seeds are not enclosed in fruits. They have needle shaped leaves. They are ever green.

- The gymnosperms are divided into four groups. These include conifers, ginoks, cycads and gnetophytes.

Division Angiospermae

- These are the great flowering land plants on earth. The main characteristics include:

✓ They have flowers as reproductive organs, seeds enclosed in fruits, well developed vascular tissues.

- Sub division of angiosperms include class monocotyledons and dicotyledons based on the number of seed leaves they have.

Class monocotyledons (monocots)

- The monocots are highly important because they comprise cereal plants that forms staple diet of most of the world's populations.

Main characteristics:

- The embryo has single seed leaf (cotyledon).
- The stem contains scattered vascular bundles.
- They are small sized and wind pollinated. Examples are: grasses, orchids and maize.

Dicotyledons (dicots)

- They make most of the trees and vegetables.

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Main characteristics:

- The embryo has two seed leaves (cotyledons).
- The leaves are broader and have net work of veins.
- The stem contains a ring of vascular bundle.
- Some dicots reach great sizes.
- They are often insect pollinated. Dicots could be herbaceous or woody. Examples include peas, beans, jacaranda, eucalyptus, etc.