

**CLASSIFICATION:** - Classification of organisms may be defined as a system of arrangement of organisms into different groups and sub-groups on the basis of their similarities, differences and relationship.

**Classification of organisms is also known as taxonomy. It has the following advantages.**

1. Classification makes the study of a wide variety of organisms convenient and easy.
2. It is not possible for man to know about all the organisms but the study of a few representatives from each taxonomic group gives a general idea of all life forms at a glance.
3. Classification also reveals the interrelationship among different groups of organisms.
4. Correct identification of an organism and its placement in a definite taxonomic group is the basic requirement of various branches of biological sciences. Thus, classification of organisms provides a base for the development of other biological sciences.

### **BASIS OF CLASSIFICATION:-**

**Classification can be done on the following basis.**

1. **Cells are prokaryotic or eukaryotic.** Organisms may be grouped into two broad categories on the basis whether they possess prokaryotic cells or eukaryotic cells. In case of prokaryotic cells the nuclei and other organelles are not clearly demarcated. The eukaryotic cells, on the other hand, have membrane-bound organelles, including a nucleus.
2. **Cells occur singly or in clusters.** Many organisms are unicellular, i.e. made up of only one cell, e.g. Amoeba. Others are multicellular, i.e., cells group together to form single organism (e.g., insect). In case of multicellular organisms the different groups of cells carry out specialized functions
3. **Organism is photosynthetic or takes food from outside.** Green plants perform photosynthesis and synthesize their own food. Animals cannot perform photosynthesis. They get food from outside.
4. **Organization of different body parts.** Grouping of organisms may be done on the basis of body organization. For example, plants possess stem, root and leaves. Similarly, the animals possess specialized organs to perform different functions. The characteristic based on body design used for classification of plants is quite different when used for classifying animals.

**Systems of classification:-**

R H Whittaker in 1969, suggested five kingdom classification on the basis of (i) presence or absence of a nucleus (ii) unicells or multicells and (iii) mode of nutrition.

He proposed five kingdoms:

1. *Monera*, 2. *Protista*, 3. *Fungi*, 4. *Plantae* and 5. *Animalia*.

**Monera:** - these organisms do not have a defined nucleus or organelles, nor do any of them show multi-cellular body designs. They show diversity based on many other characteristics. Some of the organisms of this group are either autotrophic or heterotrophic. This group includes bacteria, blue-green algae or cyanobacteria and mycoplasma.

**Protista:-** This group includes many kinds of unicellular eukaryotic organisms. Some of these organisms use cilia or flagella for moving around. Their mode of nutrition can be autotrophic or heterotrophic. Examples are unicellular algae, diatoms and protozoans.

**Fungi:-** these are heterotrophic eukaryotic organisms. They are saprophytes and thrive on decaying organic material. They have cell-walls made of chitin. Examples are yeast and mushrooms.

**Plantae:-** these are multi-cellular eukaryotes with cell walls. They are autotrophs and used chlorophyll for photosynthesis. All plants are included in this group.

**Animalia:-** these includes all multi-cellular organisms. They are heterotrophs.

**NOMENCLATURE:-**

Naming a correct scientific name to an organism or a taxon is called **nomenclature**. It involves the principals governed by set rules formulated by international bodies so that a particular organism or taxon is known by its specific name throughout the world.

**BINOMIAL NOMENCLATURE:-**

According to the binomial system of nomenclature, the scientific name of an organism consist of two separate components – first one designates the **genus** (generic name) and the second one designates the species (specific name). For example, the scientific binomial name of human species is *Homo sapiens*, where first name *Homo* is generic and the second name *sapiens* is a specific. *Homo sapiens* are understood to mean humans all over the world. Since this system of naming organisms gives two names to an organism, it is known as a **binomial nomenclature**.

**Various ranks used in classification (Hierarchy of classification).**

In classification, the organisms that closely resemble one another are placed in a group. These groups are further placed in large groups on the basis of close similarities. The larger groups are again placed in still larger grouping levels or ranks in classification are known as categories. Each category has its specific name.

There are seven major categories:

- |            |   |             |          |
|------------|---|-------------|----------|
| 1. Species | 2. Genus                                      | 3. Family   | 4. Order |
| 5. Class   | 6. Phylum (for animals)/division (for plants) | 7. Kingdom. |          |

1. Species. Species is the lowest category regarded as basic unit classification. It is a group of similar individuals which resembles with each other in morphology, breed among themselves but not with others and probably descended from a common ancestor.
2. Genus. A genus is a group of closely resembling species having a common ancestry. A; the species in a genus show similarities in broad features of their organization but differ in minor details.
3. Family. A family represents a larger group of closely related genera. It is composed of one or more genera.
4. Oder. An order is a group of closely related families.
5. Class. A class is a group of related orders.
6. Phylum/Division. Phylum (in case of animals) or Division (in case of plants) is a group of related classes.
7. Kingdom. Kingdom is the highest category in biological classification. It is group of phyla (in case of animals) or divisions (in case of plants).

**Mainly, the following rules apply to scientific names:**

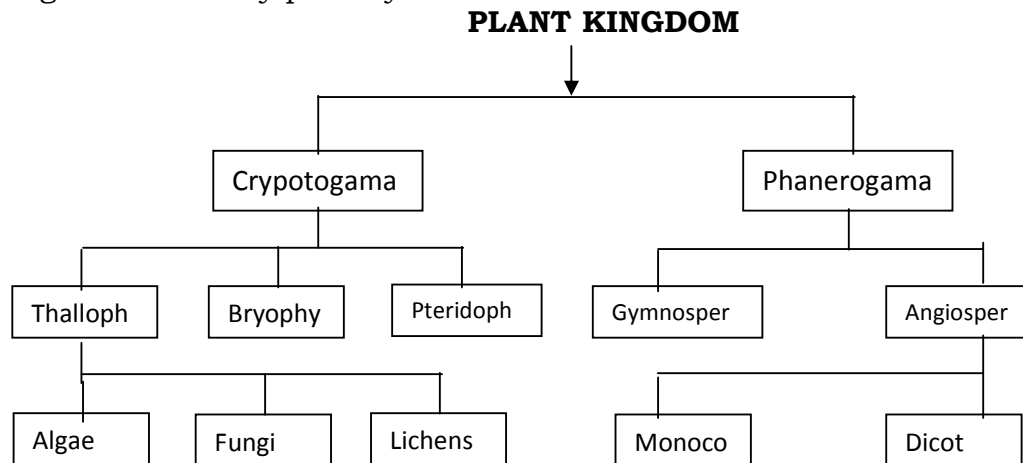
They were initially framed by Linnzeus. And were revised in 9<sup>th</sup> and 20<sup>th</sup> century through international code of Botinical Nomenclature (ICBN) and international code of Zoological nomenclature (ICZN). They are as followes:

1. Each organisms has a distinct scientific name having a words, generic and scientific.
2. The generic and specific words should not have less then three letters or more than 12(twelve) letters.
3. The generic name is written first. It is like a noun . Is first letter is always capital.
4. The specific word is written after the generic name, It starts with small letter.
5. The name of the discoverer is appended to the two-word scientific name either In full or abbreviate form e.g., mangifera indic . L(L stands for Linnaeus).
6. Scientific name is printed in italics hand written name is underlined.
7. When an organism has been given different scientific names by different workers the “law of priority” is followed that is old valid name is accepted and others rejected.

**KINGDOM PLANTAE:-**

Characteristics features of kingdom plantae.

- i) They are made of eukaryotic cells.
- ii) They are multicellular.
- iii) The cells have wall made of cellulose.
- iv) They store carbohydrates such as starch.
- v) Some cells (except in some parasites) contain chloroplast.
- vi) The organisms feed by photosynthesis.



According to the classification proposed by eicher, plant kingdom is divided in to two subkingdoms i.e cryptogamae and phanerogamae.

❖ **CRYPTOGAMAE:-** These are known as lower plants. The flower/seed are absent and hence these are considered to have hidden reproductive organs. It is categorized into 3 divisions.

**1).THALLOPHYTA:-** Thallophytes have a body which is not differentiated into stem, root and leaves. This kind of undifferentiated body is called thallus, hence the name thallophytes.

It has the following characteristics.

- (1) The plant body is thalloid i.e., cannot be differentiated into stem, root and leaves.
- (2) The vascular system is absent in such plants.
- (3) The reproductive organs are single called and there is no embryo formation.

Thallophyta is further subdivided into:

- (A) Algae
- (B) Fungi
- (C) Lichens

(A) **ALGAE** : They generally include aquatic plants. Some 20,000 species of algae are known. The main characteristics are as under :

1. They are generally chlorophyllous thallophytes in which vascular tissues are absent.
2. The plant body is thalloid i.e., cannot be differentiated into root, stem and leaves.
3. They are found in fresh water resources as well as in sea water.
4. They are autotrophic because of the presence of chlorophyll in leaves. The reserve food is generally a carbohydrate.
5. The cell wall is double layered. The outer layer is made of pectin and inner layer is made cellulose.
6. They may be unicellular as well as multicellular.
7. A few members such as chlamydomonas are motile.
8. They reproduce by vegetative, asexual as well as sexual methods. The sex organs are unicelled and lack a sterile covering around them.

**Example** : oedogonium, Chara, Sargassum, Ectocarpus, Chlamydomonas, Ulothrix etc.

(B) **FUNGI** : it is a large group of over 90,000 species. They show the following characteristics :

1. They are achlorophyllous and nonvascular plants.
2. The plant body may be unicelled or thalloid, made of branched or unbranched filamentous structures, the hyphae.
3. The network of hyphae is called mycelium.
4. The hyphae may be aseptate or septate and each cell may be uni-or multinucleate.
5. The cell wall is made of chitin or fungal cellulose.
6. They show heterotrophic mode of nutrition.
7. The reserved food is in the form of glycogen and oil globules.
8. They reproduce by asexual or sexual methods.
9. The sex organs are unicelled and lack a sterile covering around them. The higher forms lack distinct sex organs.

**Example** : Rhizopus, Yeast, Agaricus (Mushroom) etc.

(C) **LICHENS** : They represent a symbiotic association of a fungus and a alga in which two organisms are so closely associated with each other as to form a single plant. They are show growing long lived plants. The commonly grow on leaves, tree trunks, old logs, soils and rocks. Some lichens occur in extreme conditions of cold, humidity and drought.

In these plants the algal part prepares the food and the fungal part shows reproduction. Thus, their association is mutualistic.

**2). BRYOPHYTA:-** Bryophytes are simple terrestrial plants.

They have over 25,000 species. They show the following characteristics:-

1. They live in damp and sandy habitats hence they are called amphibians of the plant kingdom. They are often found to grow during rainy season forming green carpets or mats on damp soil, rocks, walls, tree trunks etc.
2. The vascular tissues are absent.
3. The roots are absent and instead rhizoids are present. They may be unicellular or multicellular.

4. The reproduction takes place by vegetative or sexual methods.
5. The vegetative reproduction is quite common through fragmentation tubes, gemmae, buds, adventitious branches etc.
6. They show distinct alternation of generation.

**Example:** Riccia, Marchantia, Funaria (Moss).

**(iii). PTERIDOPHYTA:** - These are the oldest vascular plants this includes the ferns. The important characteristics are.

1. The plant body is differentiated into roots, stem, and leaves.
2. The dominant phase or plant body is a sporophyte.
3. They are seedless vascular plants and hence called vascular cryptogams.
4. The gametophyte is small or inconspicuous.
5. The sex organs are multicellular.
6. The fertilization requires water medium results in the formation of zygote.
7. They show distinct alternation of generation.

**Example :** Selaginella, Adiantum, Dryopteris.

**PHANEROGAMAE:** - They are seed bearing plants. The plant body is differentiated into true stem, leaves and root. A well developed vascular system is present in phanerogams. Sex organs are multicellular.

On the basis of fruit formation, they are classified into two subdivisions.

(a) **Gymnosperme** and (b) **Angiosperme**

**(a). GYMNOSPERME:-** the term is made from two Greek words : gymo – means naked and sperme means seed. The plants of this group bear naked seeds and are usually perennial, evergreen and woody. It has nearly 650 living species. Their chief characteristics are:-

1. They have well developed vascular tissues but lack vessels. The 'flowers' compose two types of sporophylls i.e., microsporophylls and megasporophylls.
2. The pollination is anemophilous and the fertilization does not require water medium. There is formation of pollen tube. (Siphonogamous)
3. The zygote develops into an embryo.
4. Since the ovules are not covered by a coat there is no fruit formation. They are naked.

**Example :** Cycas, Pinus and Ephedra etc.

**(b). ANGIOSPERMAE:-** The word is made from two Greek words: anger means covered and sperma means seed. The seeds develop inside an organ which is modified to become a fruit. These are also called flowering plants. They are most abundant and conspicuous plants with about 2,00,000 species. The general characteristics are.

1. They are usually terrestrial plants. The plant body is sporophytic.
2. The plants may be herbaceous or woody. They may be annual, biennial or perennial.
3. A well developed vascular system is present in them. The xylem has vessels.
4. The angiosperms are characterized by the presence of the double fertilization forming a zygote and the primary endosperm, the nutritive tissue.
5. During fertilization the nonflagellate male gametes are carried by a pollen tube (siphonogamous).
6. Fertilized ovules ripen into seed thus the ovary is converted into a fruit.

**Example :** Brassica campestris (Mustard), Pisum sativum (pea) etc.

Angiosperms are divided into Monocots and Dicots.

**i. Monocot:-** monocots bear seeds which have a single cotyledon or seed leaf. The veins on their leaves are parallel to each other. Their vascular bundles are arranged in a complex manner.

**Example :** Palms, Bamboos, Sugar – can, rice etc.

**ii. Dicot:-** the seeds of dicot have two cotyledons. The veins on their leaves are like a network. Their vascular bundles are arranged in a ring. Their root system consists of a main tap root with smaller branches.

## **KINGDOM ANIMALAE**

Characteristics features of kingdom Animalae are:-

- I. The organisms are made up of eukaryotic cells.
- II. The body of animals is multicellular.
- III. The cells do not contain cell wall, but contain only cell membrane.
- IV. They do not perform photosynthesis but have heterotrophic nutrition.
- V. They have the power of locomotion.
- VI. They show increased sensitivity through the nervous system.

**Basis of animal classification:-** They are many features used for distinguishing broad categories of animals. These features include organization, symmetry, body cavity, number of embryonic cell layers and presence of absence of notochord.

### **Organization**

Animals are multicellular. But their body cells may or may not be recognized into tissues and organ systems. For example, animals such as sponges are aggregate of cells. They are at a cellular level of organization. Human beings have organs and systems for performing body functions and are at the organ-system level of organization.

### **Symmetry**

Symmetry means dividing the body into equal and identical parts. Sponges are symmetrical. Cnidaria are radially symmetrical and all other animals are bilaterally symmetrical.

### **Body Cavity**

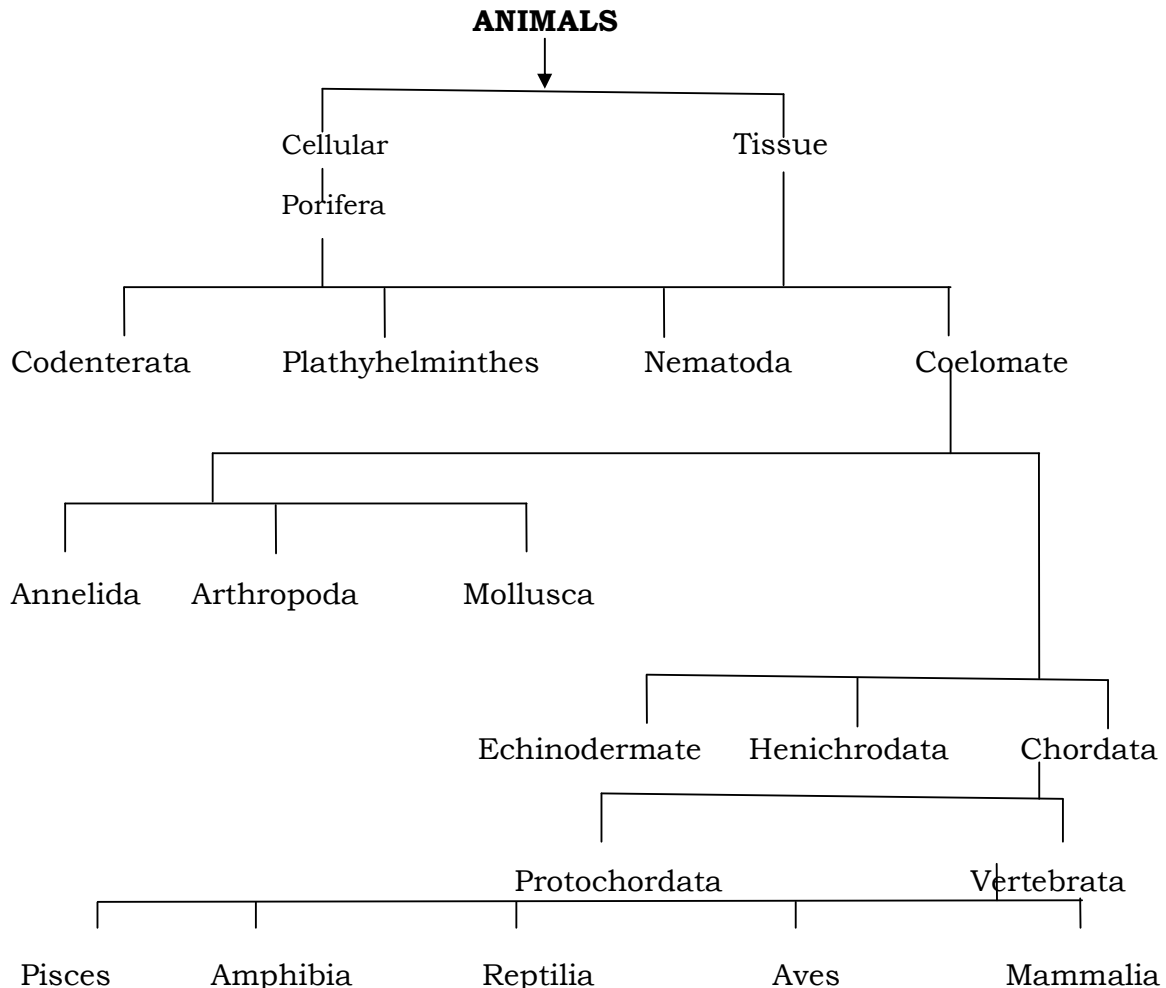
Body cavity or coelom is a cavity between the body wall and the food canal. It is absent in Acoelomates and present in Eucoelomates. The body cavity of roundworms is not true and is known as Pseudocoelom.

### **Embryonic layers**

There are three layers of cells-ectoderm (outer layer), mesoderm (middle layer), and endoderm (inner layer) in the embryo which give rise to parts of the body of animals. Sponges and Cnidaria do not have mesoderm in their embryos and are called *diploblastic*. Others animals have three layers of cells and are called *triploblastic*.

### **Notochord**

The notochord is a stiff rod running along the body, close to the dorsal surface. The notochord helps to provide support to the animal. All chordates possess a notochord at some stage of their development. The notochord is absent in vertebrate animals, also termed as non-chordates.



**(1) PORIFERA:-**

The word means organisms with holes. These are non-motile animals attached to some solid support. They have holes all over the body. These animals are covered with a hard outside layer or skeleton. They are commonly called sponges and are mainly found in marine habitats. Example: Euplectelia; sycon etc.

**(2) COELENTERATA:-**

These are aquatic animals. They show body. The body is made of two layer of cells; one makes up cells on the outside and the other makes the inner living body of the body. They have a gut cavity with a single opening for food and waste material. Example: hydra, Jellyfish.

**(3) PLATHELMINTHES:-**

These are generally called flatworms they do not have a body cavity. The body is bilaterally symmetrical. Some of them are free, living in water and soil, but most are parasites. There are three layers of cells in them and thus are called triploblastic. They range from a few millimeters to a few centimeters in size. Reproduction is mostly sexual. Example: Planarians, Liverflukes.

**(4) NEMATODA:-**

The organisms belonging to this group are mostly parasites having slender, elongated bodies. Tapering at each end. Their body is bilaterally symmetrical and triploblastic. These cause diseases such as elephantiasis etc. Example: Ascaris, Lumbricoides.

(5) **ANNELIDA:-** 'Annelid' means ringed. The annelids are worms with body appearing as if made up of series of rings. Annelids are a coelomates, triploblastic animals. There is extensive organ differentiation. Their body is segmented. Each segment possesses a similar pattern of organs. These may be aquatic or terrestrial and some live in tubes. Example: Earthworms, leeches.

(6) **ARTHROPODA:-** 'Arthro' means jointed and 'pod' means legs. Thus, arthropoda means jointed legs. These are triploblastic coelomates. They are metamericly segmented. They have an open circulatory system. The coelomic cavity is blood-filled. They possess a hard exoskeleton. Sexes are usually separate. Example : Prawns, Butterflies, Hies, Crabs.

(7) **Mollusca:-** the mollusca are animals with a coelomate triploblastic body. There is bilateral symmetry. They have an open circulatory system and kidney like organs for excretion. The body is often protected by a shell. They use a muscular foot to move. Sexes are separate or united. Example: Snails, Mussels.

(8) **ECHINODERMATA:-** 'Echinos' means hedgehog, and 'derma' means skin. These are spiny skinned organisms. They are exclusively free-living marine animals. They are triploblastic and have a coelomic cavity. They have peculiar features of regeneration of lost parts. Sexes are separate. Example: Starfish and sea urchin.

(9) **PROTOCHORDATA:-** these are bilaterally symmetrical, triploblastic coelomate animals. Notochord is present at some stage at some stage of their life history. These are marine animals they have a closed blood system, they have a post-anal tail. Example: Herdmania, Amphioxus.

(10) **VERTEBRATA:-** these animals have a true vertebral column and internal skeleton. Vertebrates are bilaterally symmetrical, triploblastic, Coelomic and segmented, with complex differentiated body tissues and organs.

(1). **PISCES:-** These are fish and live exclusively in water. Their skin is covered with scales. They use oxygen dissolved in water by gills. They are cold – blooded and their hearts have only two chambers. They lay eggs. The two important classes of fishes are cartilaginous fishes and osteichthyes fishes. Example: sharks, Tuna, Rohu etc.

(2). **AMPHIBIANS:-** Amphibians means 'Amphi' 'double' and bios 'life'. They are partly adapted to live on land, and partly in water. Most amphibians lay their eggs in water. These have three chambered hearts. Example: Frogs, Toads and salamanders etc.

(3). **REPTILES:-** these animals can live solely on land and are very less dependent on water. These are cold blooded, have scales and breathe through lungs. These have three chambered heart (except crocodiles). They lay eggs covered with waterproof shells. Their skin is water proof and is covered with waterproof horny scales. Example: Lizards, Snakes, Crocodiles, and Dinosaurs.

(4). **AVES:-** 'AVIS' means birds, evolved from reptiles and have many similarities with them. These are warm-blooded and have a four chambered heart. They lay eggs. Birds are distinguished because their bodies are covered with feathers, and two forelimbs modified for flight. They breathe through lungs. Examples: Cuckoo, crow, Sparrow etc.

(5). **MAMMALIA:-** Mammals are warm-blooded animals with four-chambered hearts. They have mammary glands for the production of milk to nourish their young. Their skin has hairs as well as sweat and oil glands. Most mammals give birth to their young their ones. Sexes are separate. Example: Man, Tiger, At etc.