

## CLASSIFICATION OF LIVING ORGANISMS

The main purpose of the classification is to group the living things on the earth according to their kinship relations and make it easier to understand them in a regular system. The science that serves this purpose is known as **Systematics** or **Taxonomy**.

Taxonomy consists of the words "taxis" (regulation, classification) and "nomos" (rule, rule, law) in Greek. The meaning of taxonomy is to set rules and laws on the classification. Systematics is the science dealing with the diversity of organisms and of any and all relationships among them.

### HISTORY OF CLASSIFICATION

Aristotle (384-322 B.C.), was one of the first scientists to organize living things. He developed the first classification system, which divided all known organisms into two groups (**Plants** and **Animals**). The basis of this classification is to classify the living things based on their external appearances, living conditions, the basis of analogical organs and morphologic similarity. Nowadays, this classification has lost its validity. Phylogenetic classification is currently used in the classification of living things.

The basic principles of scientific classification were first introduced by Carl Linnaeus (1707-1778) and he is known as the father of taxonomy. Linnaeus, like Aristotle, classified organisms according to their traits. The classification systems of both Aristotle and Linnaeus started with the same two groups (Plants and Animals). Linnaeus called these groups, kingdoms. Unlike Aristotle, Linnaeus divided the kingdom into levels (Class, Order, Genera, Species etc.). Organisms were placed in these levels based on traits, including similarities of body parts, physical form such as size, shape, and methods of feeding. In addition, he established a simple method of naming each species. This method is called **binomial system**. According to binominal system, each species is represented by two names. The first part of the

species name identifies the genus to which the species belongs; the second part identifies the species within the genus (for example *Amanita muscaria*).

In addition to plants and animals, Ernst Haeckel (1834-1919) has been proposed to be a third world, called "Protista", which contains all the microscopic organisms. He later included the **Bacteria** as the fourth kingdom to this classification. Robert H. Whittaker (1920-1980) has further refined this idea to include a fifth world under the name **Fungi**.

In 1990, Carl Woese separated the living organisms into three domains (**Bacteria**, **Archaea** and **Eukaryota**). Although living organisms have been classified in different forms throughout history, they are now grouped phylogenetically by the use of molecular biological techniques. Although **Archaea** and **Bacteria** domains are prokaryotic, **Archaea** is closer to **Eucaryota** than **Bacteria**.

### SYSTEMATICS OF CRYPTOGRAMAE

Plantae, the evolutionary most advanced Eukaryota after kingdom Animalia, includes autotrophic organisms with cell wall containing cellulose, containing chloroplasts and thus capable of photosynthesis. Kingdom Plantae, which has approximately 360.000 widely distributed species, is mainly divided into Phanerogamae and Cryptogamae.

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**Algae, Fungi, Mosses, and Ferns** took part in the kingdom Plantae when Cryptogamme Biology course was the first time included in the curriculum of Ankara University, Faculty of Science, Department of Biology. According to the current classification (Carl Woese, 1990) these living groups are examined under different taxonomic categories.

*Cyanophyta* members which were previously known as blue-green algae are currently called *Cyanobacteria* and classified under domain **Bacteria**. While the other algae, together

with fungi-like protists (*Myxomycota*, *Plasmodiophoromycota*, *Acrasiomycota*, *Dictyosteliomycota*, *Oomycota*, *Labyrinthulomycota*, and *Hyphochytriomycota* members) are classified under the kingdom *Protista*, *Chytridiomycota*, *Zygomycota*, *Ascomycota*, and *Basidiomycota* divisions are classified under kingdom **Fungi**.

According to the current systematics, only **Bryophyta** (Mosses) and **Pteridophyta** (Ferns) among the four 4 living groups (**Algae**, **Fungi**, **Mosses**, and **Ferns**) which were previously known as Cryptogammes are still classified under kingdom **Plantae**.

## REPRODUCTION IN PLANTS

**1. Asexual Reproduction:** Asexual reproduction produces individuals that are genetically identical to the parent plant. This is a process in which a new organism is produced from a single parent without the involvement of gametes or sex cells. Many unicellular and multicellular organisms reproduce asexually.

**A. Spore formation:** Spore formation is a method of asexual reproduction which occurs in cryptogams. The method of spore formation occurs in both unicellular and multi-cellular organisms. This process takes place in plants. In spore formation, the parent plant produces hundreds of reproductive units called spores in its spore case. When this spore case of the plant bursts, these spores travel in air and land. Finally, they germinate and produce new organisms.

**i. Exospores:** They are spores that some cells in the main plant bring to the outside and do not occur in a special sac.

**i1. Conidiospores:** They are found in some fungi members (filamentous Ascomycota and Deuteromycetes). These spores take place on reproductive hyphae (conidiofor, conidiophore).

**i2. Basidiomycota:** This is a reproductive spore produced by Basidiomycota members. These spores occur on reproductive hyphae called basidium.

**İ3. Ecidiospore:** They are conidiospores with double-nucleus (for example *Puccinia graminis* spores).

**i4. Uredospores:** They are thin-walled spores produced by the uredium of the rust fungi (for example *Puccinia graminis* spores).

**i.5. Teliospores:** They are dark brown colored, thick-walled resting spore of rust and smut fungi. These spores are initially dikaryotic, later becomes diploid during germination.

**i6. Ustilospore:** They are dikaryotic at first, then becomes diploid during germination (*Ustilago*).

**ii. Endospores:** They are formed within cells which are specialized and called sporangia. There are two types of endospores (Isospores and Anisospores).

**ii1. Isospores:** Spores are morphologically the same shape and size. There are two main types of isospores (Zoospores and Aplanospores).

**ii1a. Zoospores:** They are motile asexual spores using flagellum for locomotion. These spores occur in zoosporangia.

**ii1b. Aplanospores:** They are nonmotile asexual spores produced within the sporangium in certain fungi and formed by rejuvenescence in certain algae (*Ascospores*, *Tetraspores* and *Carpospores*).

**Ascospores:** They are produced inside an ascus.

**Tetraspores:** These spores are produced by the tetrasporophytic (diploid) phase in the life history of algae in the *Rhodophyta* as a result of meiosis.

**Carpospores:** They are diploid spores which were produced by red algae.

**ii2. Anisospores:** They are sexual spores exhibiting sexual dimorphism especially of size.

**B. Vegetative Propagation:** In vegetative propagation, parts of a plant such as stems, roots, and leaves are used to grow a new plant. It happens with simple cell divisions or with vegetative parts that develop into independent individuals, separated from the main plant. There are various types.

**B1. Binary Fission:** In binary fission, the parent cell divides into two after reaching a point where it has fully grown.

**B2. Multiple Fission:** Multiple fission is also a process of asexual reproduction in which parent cell splits to form many new organisms.

**B3. Budding:** The word bud means small outgrowth. In the process of budding, a small bud grows on the body of parent organism and when the time comes it detaches itself to form a new organism.

**B4. Regeneration:** This is an asexual method of reproduction. In this process, if the body of a parent organism gets cut, then each cut part can regenerate and form a whole new organism from its body parts. This happens because when the body of an organism that can undergo regeneration gets cut then the cells of the cut body part divide rapidly and form a ball of cells. These cells then move to their proper places to form organs and body parts.

**2. Sexual Reproduction:** Sexual reproduction involves the process of fusion of gametes which produces new individuals that are genetically different from their parents. Sexual reproduction involves two fundamental processes which are meiosis and fertilization. Meiosis is the process of rearrangements of genes and is a reductional division of cells, where the chromosomes are reduced to a haploid set. Fertilization is the process of fusion of the haploid gametes to form a diploid zygote. Most of the plants undergo alternation of the generation with two phases, a gametophyte phase, and a sporophyte phase. In algae, sexual reproduction happens by the means of conjugation where two similar organisms fuse and exchange genetic material and split apart. Algae also undergo the process of alteration of generations. Two different generations haploid and diploid are produced.

**A. Autogamy:** Autogamy is to the fusion of two gametes that come from one individual. The production of gametes by the division of a single parent cell is frequently found in unicellular organisms.

**B. Isogamy:** Isogamy is a form of sexual reproduction that involves gametes of similar morphology.

**C. Anisogamy:** Anisogamy (Heterogamy) is the form of sexual reproduction that involves the union or fusion of two gametes, which differ in size or form.

**D. Oogamy:** Oogamy is the familiar form of sexual reproduction. It is a form of anisogamy in which the female gamete is significantly larger than male gamete.

**E. Gametangiogamy:** Gametangiogamy is the fusion or copulation of whole gametangia for examples (some *Zygomycota* and *Ascomycota* members).

**F. Somatogamy:** The fusion of two somatic hyphae acting as gametes for two sexually compatible mycelia.

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