
Biological Classification - Part 2

Objectives

After going through this lesson, the learners will be able to understand the following:

- Introduction
- Three Phases
- Kingdom Fungi
- Kingdom Plantae
- Kingdom Animalia
- Summary

Content Outline

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- Three Phases
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Introduction

Kingdom Fungi

This kingdom includes over 4000 genera and 80,000 species. It is a very large and diverse group.

The study of fungi is known as “Mycology”. The various common groups of fungi are called moulds, rusts, smuts, mushrooms, toad stools, puff balls etc.

Fungus have cellular organization either Unicellular, or multicellular, eukaryotic (having nucleus), with proper cell wall sometimes made up of fungal cellulose, sometimes chitin, or both, (but not pure cellulose). **Fungus have a Filament** like structure known as hyphae, which can be coenocytic, or septate or aseptate which in mass is called mycelium, in the form of thallus (not differentiated into stem, roots and leaves). Mycelium is always uniseriate and never bi or multi seriate. Body is extremely delicate. Fungus are devoid of chlorophyll or other photosynthetic pigments and non green in color and they are completely heterotrophic in nature. Most are Saprophytic (saprobes) organisms, which absorb food from dead and

decaying matter. The digestive enzymes are secreted through their cell wall into the medium which convert the complex food into simpler food for absorption. e.g. Mucor, Penicillium, Aspergillus, Agaricus (Mushroom) etc. Basically fungus are decomposers, they help in recycling of inorganic and organic molecules in the biosphere. Some forms of fungi are parasitic in nature, and cause diseases in plants and animals. e.g. rust fungi, and smut fungi. While some grow in Symbiotic association with algae, to form lichens and show symbiotic relationships, while some forms of fungus grow with the roots of higher plants and form mycorrhiza. Reserve food in fungi is glycogen, fat and oil (but not starch).

Fungus can be useful as well as harmful also. They can cause diseases in humans, plants, and animals and can also be used in industries in the production of various products like hormones, bread etc.

Fungus shows all the three methods of reproduction – are vegetative reproduction, (by fragmentation, budding, fission etc.), asexual reproduction by the means of spores, mitospores (asexual spores) like zoospores, aplanospores, conidiospores and meiospores (sexual spores) like, meioaplanospores, meiozoospores, ascospores, and basidiospores etc., and sexual reproduction, which is of extremely different type in different fungi. Lower fungi show isogamy, in which fusion of spores and gametes takes place which may be flagellate or aflagellate. Some fungi show oogamy in which fusion takes place between larger non-flagellate female gamete and a smaller male gamete. Female sex organs are oogonium and male sex organs are anthredium. Sexual reproduction occurs in fungi by the fusion of sex cells (i.e., gametes) which occurs in Three Phases.

Three Phases

- a) Plasmogamy**
- b) Karyogamy**
- c) Meiosis**

- a) **Plasmogamy** – It is the first stage of sexual reproduction in which fusion of cytoplasm of the two opposite sex cells occur.
- b) **Karyogamy** – It is a fusion of two nucleus after plasmogamy which resulted in the formation of Synkaryon.

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- c) **Meiosis** – It is the division of diploid nucleus, in higher forms of fungi, the karyogamy is delayed after plasmogamy and the fungus remains in the stages of dikaryophase.

Classification of Fungi – The true fungi or Eumycetes are classified into following four classes as follows –

Lower fungi with unseptate, coenocytic thallus (mycelium) (**Phycomycetes**)

Higher fungi with well developed, septate mycelium –

Endogenously formed Ascospores within Ascus (**Ascomycetes**)

Exogenously formed basidiospores on Basidium (**Basidiomycetes**)

Sexual reproduction absent, reproduction by conidia only (**Deuteromycetes – Fungi Imperfecti**)

A. Ascomycetes – (Ascus: sac, mycetes: fungus), (The Sac Fungi)

The fungal forms included under Ascomycetes are commonly called **Sac Fungi**. These fungi are unicellular, haploid fungi, parasitic (**uncinula**) or saprophytic (**Penicillium, Aspergillus**) in nature. Some parasitic forms of Ascomycetes are disease causing in plants i.e.,: pathogenic in nature. e.g. **Powdery mildews**, the black mold (**Aspergillus**), blue mold (**Penicillium**).



In the majority of Ascomycetes, the thallus is highly developed, branched and with septate mycelium. The cells are uni, bi or multinucleate. Their hyphae wall is composed of cellulose and contains chitin.

These fungi produce endogenous meiospores called ascospores in special sac like structures called ascus.

The sac-like ascus is formed by the fusion of two types of hyphae. The two haploid nuclei of opposite hyphae fuse together and form the diploid ascus. The eight ascospores are formed in one ascus by the process of meiosis during sexual reproduction. In some ascomycetes (cup fungi and edible morels), many asci are borne in a fruiting body called ascocarp.



The main feature of Ascomycetes is the absence of motile structure in their life. They reproduce vegetatively, asexually and sexually. Vegetative reproduction takes place by **fragmentation of mycelium** which is very common. Asexual reproduction takes place by budding, fission by the formation of conidia which borne on conidiophores (special types of hyphae.), while sexual reproduction is oogamous through ascospores which are within the mycelium i.e, in a sac like structure called ascus in which gametes present, which are which are non-motile represented as (+) an (-). The fusion of gametes followed by meiosis which results in the formation of haploid ascus.

Examples of Ascomycetes are Yeast, Aspergillus, Penicillium etc.



Economic Importance –

The Ascomycetes are extremely important to man because of their beneficial as well as harmful activities.

Beneficial Activities –

Many examples of fungi like **Aspergillus**, and **Penicillium** are used in bakery, brewing, manufacturing of some organic acids, vitamins, cheese etc. Few forms of fungi like **Morchella** are edible and form highly prized food in continental Europe.

Harmful Activities –

The parasitic **Ascomycetes** are the worst enemies of man, as they cause serious diseases in plants (Powdery Mildew of grapes, Ergot of rye) and animals, including man (Athlete's Foot). Some saprophytic ascomycetes (*Aspergillus*, *Penicillium* etc.) cause spoilage of food, leather, fabrics, timber etc.

B. Basidiomycetes – (The Club Fungi)

This is the most advanced class of kingdom fungi. They are called club fungi because of a club shaped of mycelium known as basidium which produces basidiospores which are 4 in number. The fungi of class Basidiomycetes are commonly known as mushrooms, puff balls, rusts, smuts etc. which are **saprophytic** species.



Basidiomycetes are grown in soil, on logs, and tree stumps and in living plant bodies as parasites, e.g., rusts and smuts. The **rusts** and **smuts** are the most dangerous parasites of **food crops**. These fungi are the best decomposers of wood materials like cellulose and lignin. Some forms of class Basidiomycetes are parasitic in nature which causes destructive diseases in various plants and animals.



The thallus of Basidiomycetes fungus is a highly branched perennial mycelium.

The fungi of class Basidiomycetes have filamentous, branched and septate hyphae, which in mass is called mycelium. Each septum has a central pore. In the life cycle of basidiomycetes passes through **two different phases** –

- a) **Monokaryotic Phase (Primary mycelium)** — short lived phase, does not contain any sex organs, it never produces basidia or basidiospores.
- b) **Dikaryotic phase (secondary mycelium)** — long lived phase, each cell contains two nuclei one (+) and another (-) strain nucleus.

These fungi reproduce by different types of spores. **Sexual reproduction** is very much reduced and involves union of two nuclei of opposite (+ and -) in a dikaryon which is called **karyogamy**. The sex organs never formed. They reproduces under **three sexual reproductive stages** – **plasmogamy, karyogamy and meiosis**. No motile structures are present in their life cycle. In higher forms of Basidiomycetes produce fruiting bodies called basidiocarps. Examples of Basidiomycetes are – Agaricus, Bracket Fungi, Ustilago etc.



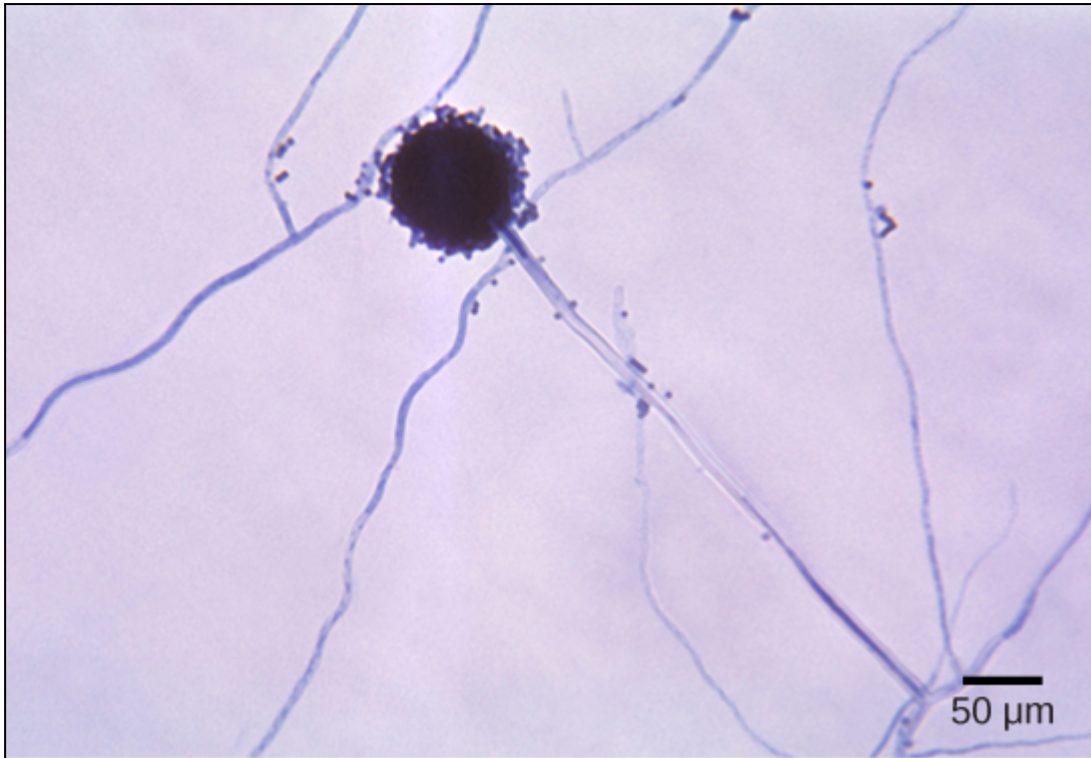
Economic Importance –

Some forms of basidiomycetes are edible and have great demand like *Agaricus*. *Coprinus* is used in manufacturing of oil ink, some mushrooms (**toad stools**) are highly poisonous. Pore fungi cause heavy damage in railway tracks and timber and **make them weak**. Many basidiomycetes form **mycorrhizal association** with the roots of forest trees and help them in absorption of nutrients. *Clavatia* (**puff ball**) contains an **anti-cancer substance called Clavacin**. Rusts and smuts cause many dangerous diseases of important crop plants resulting in heavy losses.

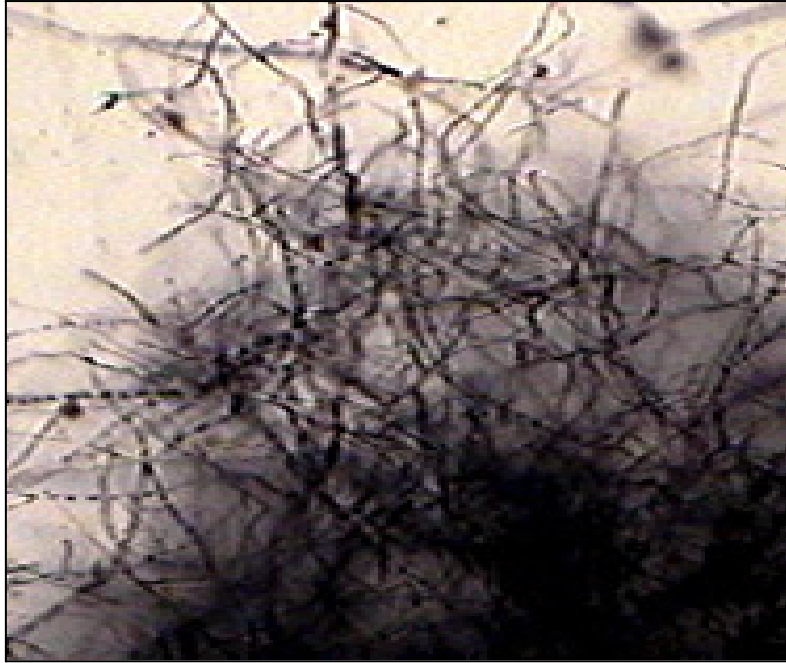
C. Deuteromycetes – (The Fungi Imperfecti) – (The Imperfect Fungi)

In Deuteromycetes, the **asexual life cycle is known as imperfect stage** while the **sexual stage is called perfect stage**. There are thousands of imperfect fungi of which many are saprophyte and many are parasitic in nature. A imperfect fungus called *Arthrobotrys* is a predatory fungus which feeds on living worms called nematodes. So, these are called Nematophagous fungi.

The thallus structure of deuteromycetes are well developed, septa with central pore, highly branched, septate mycelium. In the majority of imperfect fungi mycelium is monokaryotic and dikaryotic mycelium is also not uncommon.

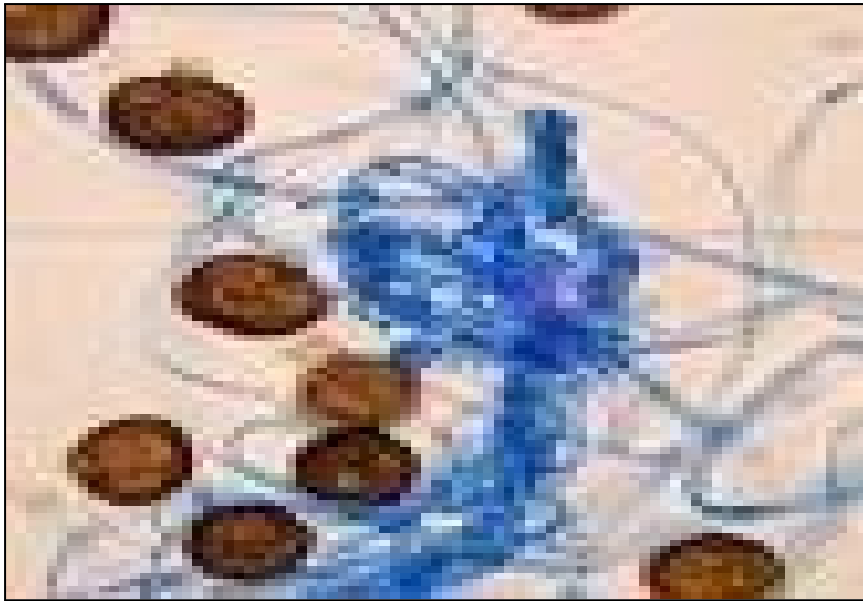


Most forms of Deuteromycetes are parasitic and responsible for causing diseases in animals, plants and humans. Fungi Imperfecti are extremely important because many of them are pathogenic and cause many harmful diseases in plants, animals and in man. Imperfect fungi have a large impact on everyday human life. The food industry relies on them for ripening some cheeses. The blue [veins](#) in Roquefort cheese and the white crust on Camembert are the result of fungal growth. Many fungal diseases that infect humans belong to this group including species which cause ringworm, athletes foot, aspergillosis, and candida which form the "yeast infections" known to many.



They reproduce by sexual and asexual reproduction. Asexual reproduction occurs by the formation of Conidia etc. which produces exogenously on erect conidiophores. Conidia's are always non motile, non –flagellate. Sexual reproduction is absent. **Some examples are – Trichoderma, Alternaria etc.** Some of these fungi do not produce spores. Non Sporulating fungi are able to propagate themselves by fragmenting the hyphae or by producing a mass of hyphae called a sclerotium.





Kingdom Plantae

Photosynthetic producers:

The members of kingdom plantae are **immobile (some forms), multicellular, eukaryotic, with proper cell wall composed of cellulose, having body with proper tissue and organ like structures, green plants from algae to angiosperms. They are either autotrophs, parasitic, insectivores (*Nepenthes, Drosera*), while some show symbiotic relationship (*Legumes*).** These are the primary source of organic food and ATP energy source for all living organisms, and the only source of Oxygen on earth.



Hence these are the most essential and primary source of energy of any ecosystem on this earth. They store food mainly in the form of starch. They do not follow definite growth patterns and adults do not resemble the miniature ones. They do not show sensory and neuromotor mechanisms.



The

Plant

Kingdom is classified into divisions such as **Algae, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms**. Among these, Algae are the simplest, primitive and aquatic plants, while the rest are terrestrial in nature. Algae contains chlorophyll but some have additional **red pigment phycoerythrin called Red Algae**, while some others have additional **yellowish brown pigment, called brown algae**. The mode of reproduction in algae is **vegetative (by fragmentation), asexual (by spores), and sexual (by gametes and gamete union)**. Angiosperms are the most evolved, highly specialized, complicated plants, with proper vascular tissue and a well differentiated body.



These are flowering plants which produce both seeds and fruits. Angiosperms are classified as Dicotyledons and Monocotyledons. Reproduction occurs either by asexually or sexually. In general the life cycle of this group of plants is completed in two phases, gametophyte (n) and sporophyte (2n), which alternate with one another. The diploid zygote (2n) undergoes meiosis to form haploid (n) spores which germinate into gametophyte. Then, these gametes (male and female) fuse to form zygote (2n) again which gives rise to sporophyte. The phenomenon is called alternation of generation.



Kingdom Animalia includes multicellular, Eukaryotic, without chlorophyll, no cell wall, cellular tissue or organ type of body organization is present in different forms. **They are mobile due to the contraction and relaxation of muscles.** Organisms that live rooted to one spot are **sessile** and those that move around are **motile**. Even the most sessile animals can move at least part of their bodies. This movement is dependent on how animals obtain food. **Nutrition is heterotrophic**, or some forms are parasitic in nature **like tapeworm and roundworms. Most animals inhabit the seas**, with fewer in fresh water and even fewer on land. Animal cells are held together by structural **proteins** such as collagen. Animals range in size from no more than a few cells (like the mesozoans) to organisms weighing many tons (like the blue whale). The bodies of most animals (all except sponges) are made up of cells organized into **tissues**.

Each tissue is specialized to perform specific functions.

In most animals, **tissues** are organized into even more specialized **organs**.

Cells form tissues, tissues form organs, and organs form organ systems. This is how an organism develops.

These cells have to differentiate and become specialized in various ways.

Cell Structure: The nucleus, nucleolus, ribosomes, smooth ER, rough ER, nuclear membrane, Golgi bodies, lysosomes, mitochondria, centrioles, cytoskeleton, vacuoles.

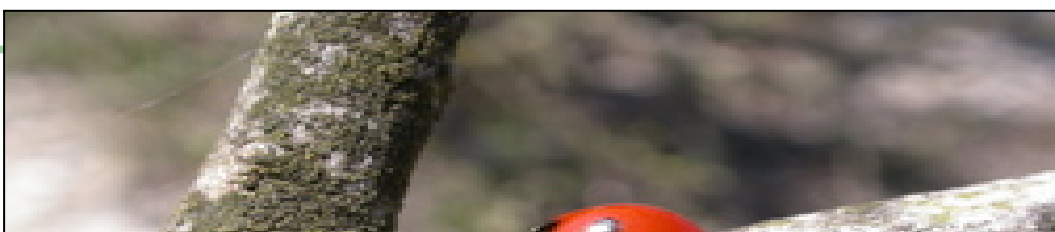
They show quick response to external stimuli through the transmission of nerve impulse by nerve cells. Sponges do not possess nerve cells. They have reserved food in the form of Glycogen or fat. They follow a definite growth pattern and grow into adults which resemble miniature ones. The higher forms show sensory and neuromotor mechanisms.



Adult animals develop from **embryos**: small masses of unspecialized cells.

Simple animals can regenerate or grow back missing parts.

It is observed that the Biologically diverse animals are classified taking into account certain common fundamental features. The features are body pattern, body symmetry, segmentation, body cavity or coelom, morphology etc.



Animal world shows immense biological diversity, but all animals perform the same basic functions necessary for survival.



Most animals reproduce **sexually**, by means of **differentiated haploid cells (eggs and sperm)**.

Most animals are **diploid**, meaning that the cells of adults contain two copies of the genetic material.

Summary

Sexual Reproduction occurs sexually by gamete formation in specialized organs called gonads.