Mycology

o **Mycology:** is the branch of biology concerned with the study of fungi, including their genetic and biochemical properties, their taxonomy and their use to humans as a source for medicine and food as well as their dangers, such as toxicity or infection.

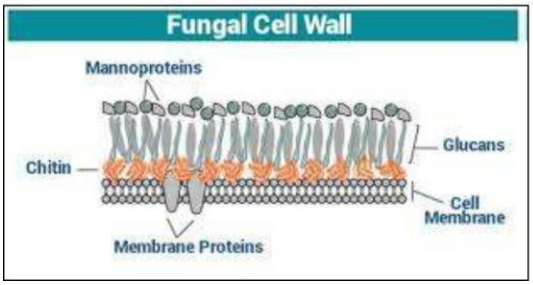
o **Fungi (singular: fungus):** are a kingdom of usually multicellular eukaryotic organisms that include microorganisms such as yeasts and moulds, as well as the more familiar mushrooms. These organisms are classified as a kingdom, fungi, which is separate from the other eukaryotic life kingdoms of plants and animals.

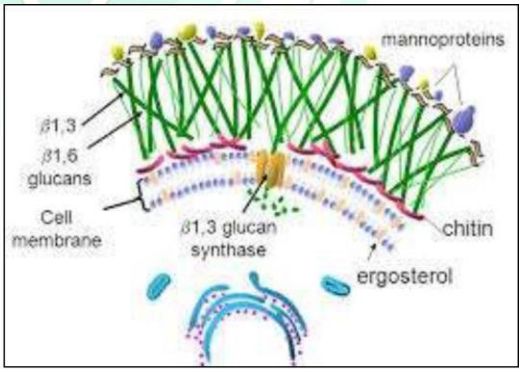
o The fungus kingdom includes an enormous diversity of taxa with varied ecologies, life cycle strategies, and morphologies ranging from unicellular aquatic chytrids to large mushrooms.

o Fungal Biology and Classification show similarities and differences between the fungi and other major life form groups.

Animals	Plants	Fungi	Bacteria
Free-living	Attached	Attached & Free-living	Free-living
No Cell Wall (chitin exoskeletons)	Cell Wall (cellulose)	**Cell Wall (chitin)**	Cell Wall (NAG-NAM)
Heterotrophic	Autotrophic	Heterotrophic	Both
Requires O_2	Requires CO_2 & O_2	Requires O_2	Varies
80S = 60S & 40S Ribosomes	**80S** = 60S & 40S Ribosomes	**80S** = 60S & 40S Ribosomes	**70S** = 50S & 30S Ribosomes
Nulceus	Nucleus	Nucleus	No nucleus

- Cell wall of fungus is made up of chitin, glucans, mannans and complex polysaccharides. Cell wall consists of chitin not peptidoglycan like bacteria. Cell membrane contains ergosterol.





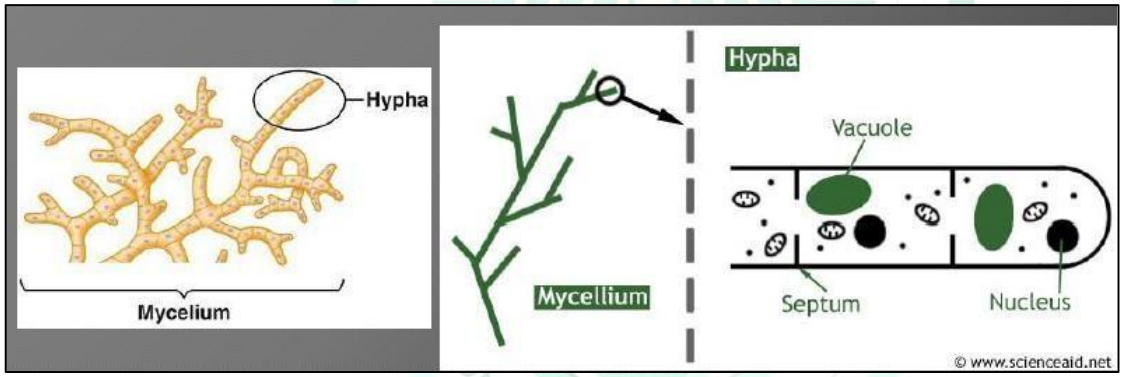
I. Diversity of Fungi

Fungi have a worldwide distribution, and grow in a wide range of habitats, including extreme environments such as deserts or areas with high salt concentrations or ionizing radiation as well as in deep sea sediments. Some can survive the intense UV and cosmic radiation encountered during space travel.

II. Morphology

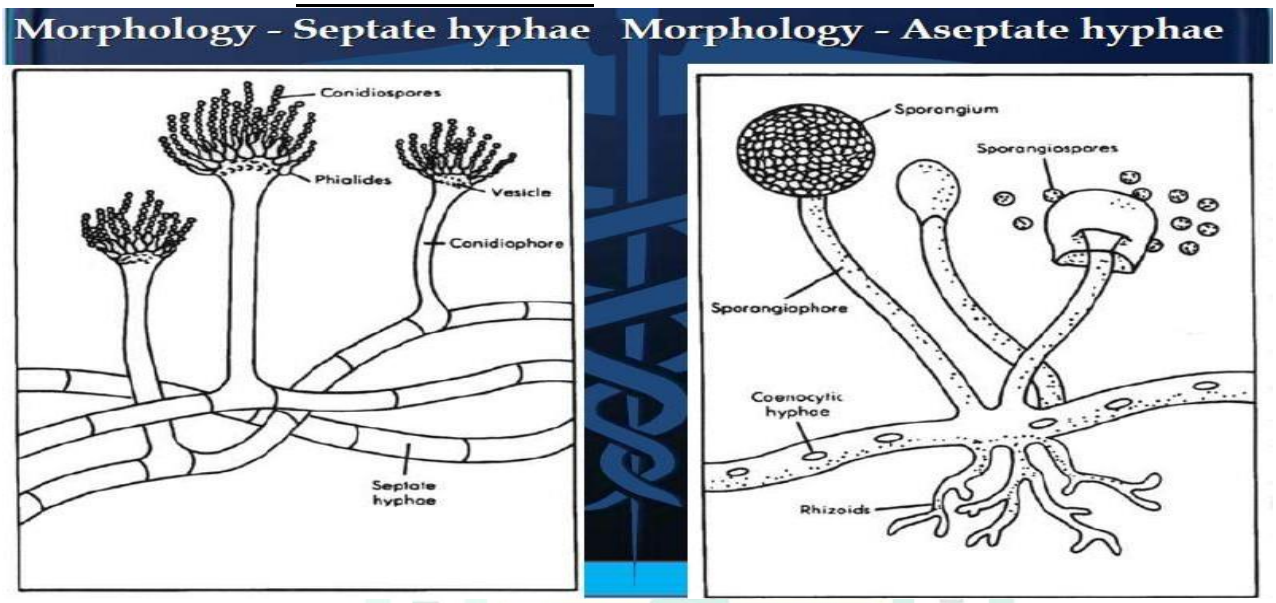
i. Microscopic structures

o Most fungi grow as hyphae (single: hypha), which are cylindrical, thread-like structures 2–10 µm in diameter and up to several centimetres in length. Hyphae grow at their tips; new hyphae are typically formed by emergence of new tips along existing hyphae by a process called **branching**.



o Hyphae also sometimes fuse when they come into contact, a process called hyphal fusion (or anastomosis). These growth processes lead to the development of a mycelium (Pl: Mycelia), an interconnected network of hyphae.

o Hyphae can be either **Septate** or **A Septate** (**Coenocytic**). **Septate hyphae** are divided into compartments separated by cross walls (internal cell walls, called septa (Single: septum) with each compartment containing one or more nuclei. **Coenocytic hyphae** are not compartmentalized. Septa have pores that allow cytoplasm, organelles, and sometimes nuclei to pass through. Coenocytic hyphae are in essence multinucleate super cells.

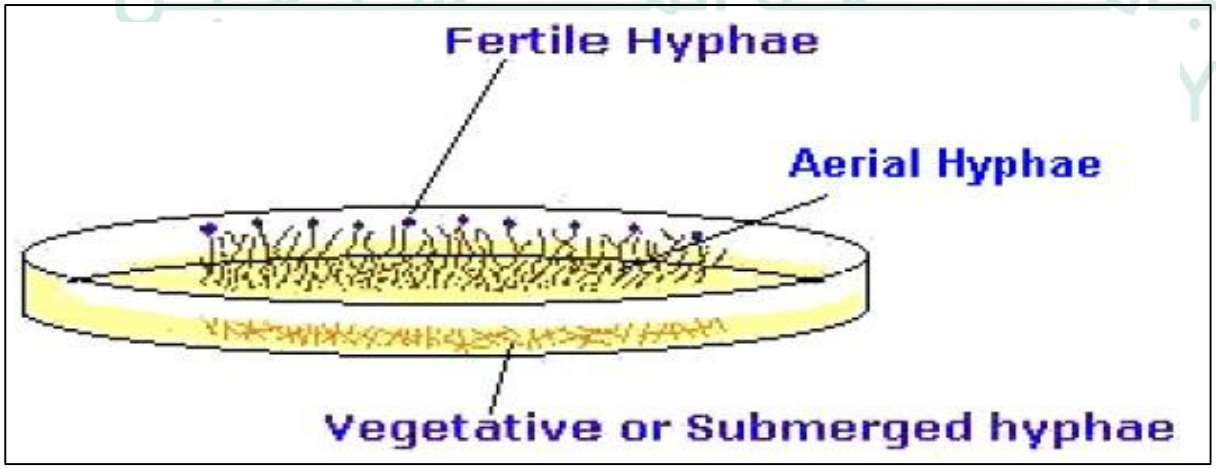


o **Based on their function, mycelia are grouped into three kinds:-**

1. Vegetative mycelia are those that penetrate the surface of the medium and absorb nutrients.

2. Aerial mycelia are those that grow above the agar surface.

3. Fertile mycelia are aerial hyphae that bear reproductive structures such as conidia or sporangia.



ii. Macroscopic structures

o Fungal mycelia can become visible to the naked eye, for example, such as damp walls and spoiled food, where they are commonly called moulds.

o Mycelia grown on solid agar media in laboratory petri dishes are usually referred to as colonies. These colonies can exhibit growth shapes and colours that can be used as diagnostic features in the identification of species or groups.

o The fruit bodies of the basidiomycetes (basidiocarps) and some ascomycetes can sometimes grow very large, and many are well known as mushrooms.

III. Advantages, disadvantages of fungi and their economic importance.

a-Beneficial Effects of Fungi:

1. Decomposition - nutrient and carbon recycling.

2. Biosynthetic factories. The fermentation property is used for the industrial production of alcohols, fats, citric, oxalic and gluconic acids.

3. In medicine - a number of antibiotic are obtained from fungal species. Important sources of antibiotics, such as Penicillin.

4. Model organisms for biochemical and genetic studies. Eg: *Neurospora crassa*

5. *Saccharomyces cerviciae* is extensively used in recombinant DNA technology, which includes the Hepatitis B Vaccine.

6. As food - food like mushrooms and dried yeast which provide us protein.

7. Yeasts provide nutritional supplements such as vitamins and cofactors.

8. Food industries - in bakeries for making bread, alcohol, acids. Penicillium is used to flavour Roquefort and Camembert cheeses.

9. Ergot produced by *Claviceps purpurea* contains medically important alkaloids that help in inducing uterine contractions, controlling bleeding and treating migraine.

10. **In agriculture** - like making the soil fertile

b-Harmful Effects of Fungi:

1- Plant diseases - like blight of potato

2- Spoilage of food - Spoilage of agriculture produce such as vegetables and cereals.

3- Destruction of food, lumber, paper, and cloth.

4- Mycotoxicosis: result of eating moldy food or grains in which the fungus has produced toxic metabolites (e.g. aflatoxin)

5- Animal and human diseases, including allergies.

6- Human diseases (Mycoses): It spectrum of human diseases including the following infections: Superficial, Cutaneous, Subcutaneous, Systemic and Opportunistic

7- Toxins produced by poisonous mushrooms and within food

IV. Fungal Nutrition

Fungi=absorptive heterotrophs •Animals=phagotrophic heterotroph

•Heterotroph (chemo-organotrophs):an organism incapable of synthesizing carbohydrates from inorganic sources; requires preformed organic compounds produced by other organisms

•Plants=autotrophs

Heterotrophy -

An organism that cannot synthesize its own food and is dependent on complex organic substances for nutrition.

•Heterotropic by absorption

*secrete digestive enzymes *digest macromolecules outside the body

*absorb digested nutrients

There are three nutritional mode:

*Saprophytic = feed on dead tissues or organic waste (decomposers) *Parasitic = digestion of live organisms, causing disease *Mutualistic = beneficial relationship between a fungus and another organism