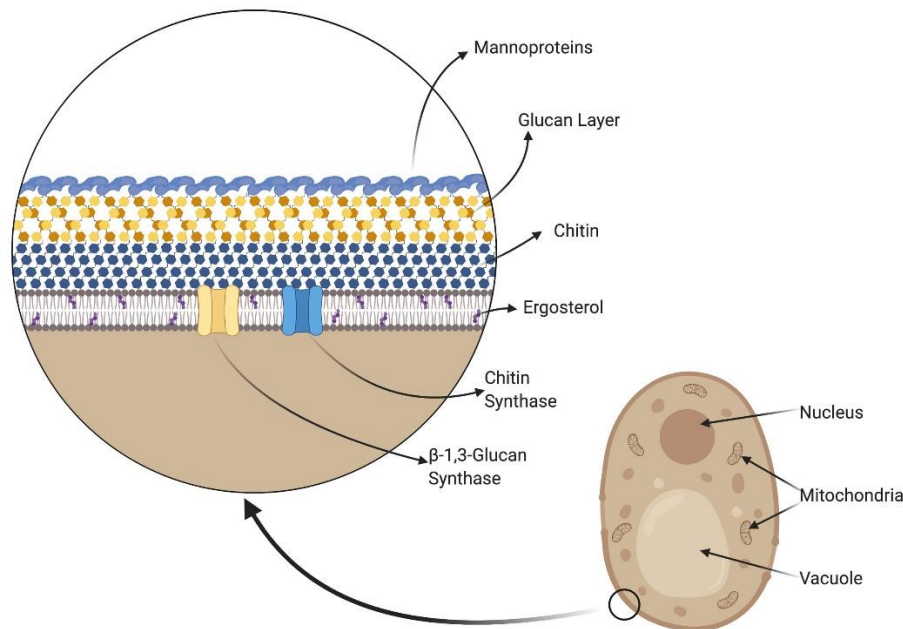


Introduction to Mycology

1. Fungi are **eukaryotic** organisms.
2. Fungal membranes contain **ergosterol** rather than cholesterol found in other eukaryotic membranes.
3. The cell wall surrounding fungal cells, which differs in composition from bacterial cell walls, contains **chitin, glucans, and protein**.



Fungal cell wall and cell membrane

** Ergosterol is unique to fungal membranes.*

** Ergosterol and cell wall metabolism are antifungal drug targets.*

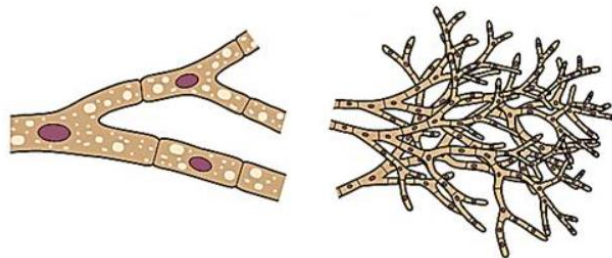
How fungi differ from Bacteria:

1. All true fungi are **aerobic**, that mean they need oxygen for their development, reproduction and metabolisms, while bacteria are **aerobic, anaerobic and facultative**.
2. Cell type: Fungi are Eukaryote they have nuclear materials which is organized into chromosomes- nuclei of fungi are similar to the nuclei of mammalian cell, while bacteria are prokaryotic.
3. Hydrogen ion concentration-pH: In contrast to bacteria, fungi prefer an acid medium for growth, pH range for fungi between **3.8-5.6**, with a pH 5.5 being near the optimum for most species investigated. While bacteria need pH for growth between 7.0-7.6.

4. Cell wall structure: Cell wall contains large amount of **chitin, cellulose, hemicellulose-N-acetyl glucosamine**, 5-10% protein, 50-60% carbohydrate - **Glucan**, while bacteria contain peptidoglycan.
5. All fungi require very high sugar concentrations in the Lab. Media for the growth- 4-5%, while bacteria require 1.5% of sugar.
6. All fungi are Gram positive structure.
7. All fungi are sensitive to antifungal agents and resist to antibacterial agents according to cell wall structure.

Morphology of Fungi

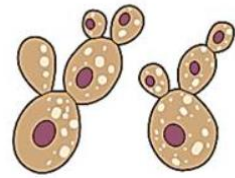
1. **Molds, or filamentous fungi**, are composed of a mass of branching, thread-like tubular filaments (**hyphae**) Generally 3-10 microns in diameter, that elongate at their tips.
 - Septate hyphae are divided into individual walled-off cells, each containing a nucleus.
 - Aseptate (coenocytic) hyphae are hollow and multinucleate.
 - Hyphae that penetrate the supporting medium and absorb nutrients are called “**vegetative hyphae**”, certain species possess rootlike structure called **rhizoids**. In contrast, aerial hyphae project above the surface of medium are called “**reproductive hyphae**”. As the hyphae continue to grow and branched a mat of growth called **mycelium**. Specialized hyphae that bear the reproductive structures are called **conidiophore** or **sporangioophore**.



Hypha, septate, or nonseptate.

Mycelium: web of branched hyphae.

2. **Yeasts** are unicellular, usually round fungi, varying in diameter from 3 μ m to 15 μ m, do not form spores but reproduce by budding of the parent cells, such as *Cryptococcus neoformans*.
 - Some yeasts develop pseudohyphae, which are strings of elongated cells linked like sausages.

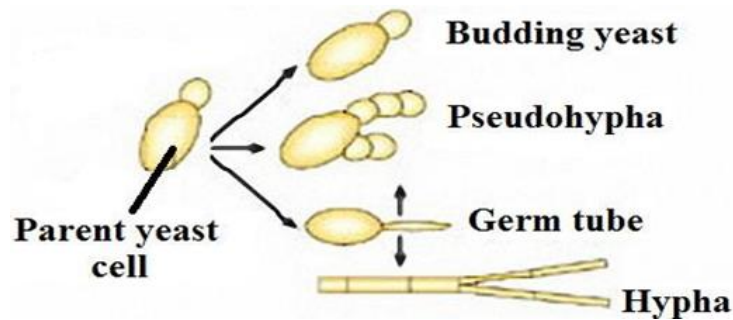


Yeast form, budding



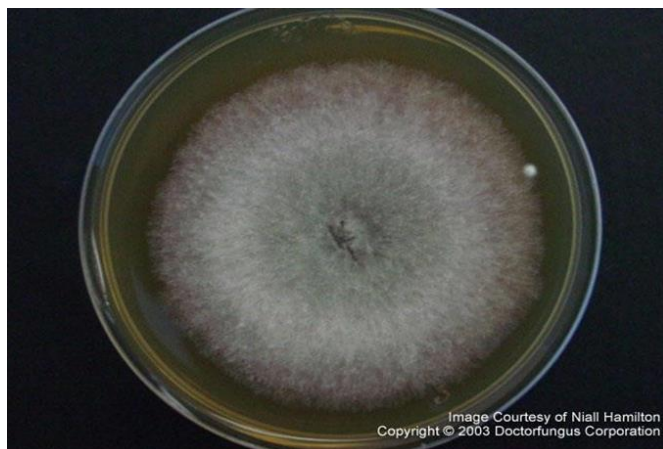
Pseudomycelium

3. **Dimorphic fungi** exist as molds or yeasts depending on temperature or other environmental factors. * *Dimorphic fungi are yeasts at 37°C and molds at lower temperatures.*
4. **Yeast-like fungi:** Also reproduce by budding and grow as non-branching filament called **pseudohyphae**, such as *Candida albicans*.



- Most mold fungi are **psychrophilic** (20-30°C) and cannot grow at 37°C but only pathogenic fungi that cause systemic infections can grow at 37°C (**mesophilic**, 35-37°C).

The mycelium of fungus generally beings as a short-germ-tube emerging from a germinating spore. Fungal colony tend to be circular in out-line on solid medium, while the mycelium has a tendency to grow more or less equally in all directions from central point, and to develop colony. You can observe this by growing certain fungi on liquid and solid media.

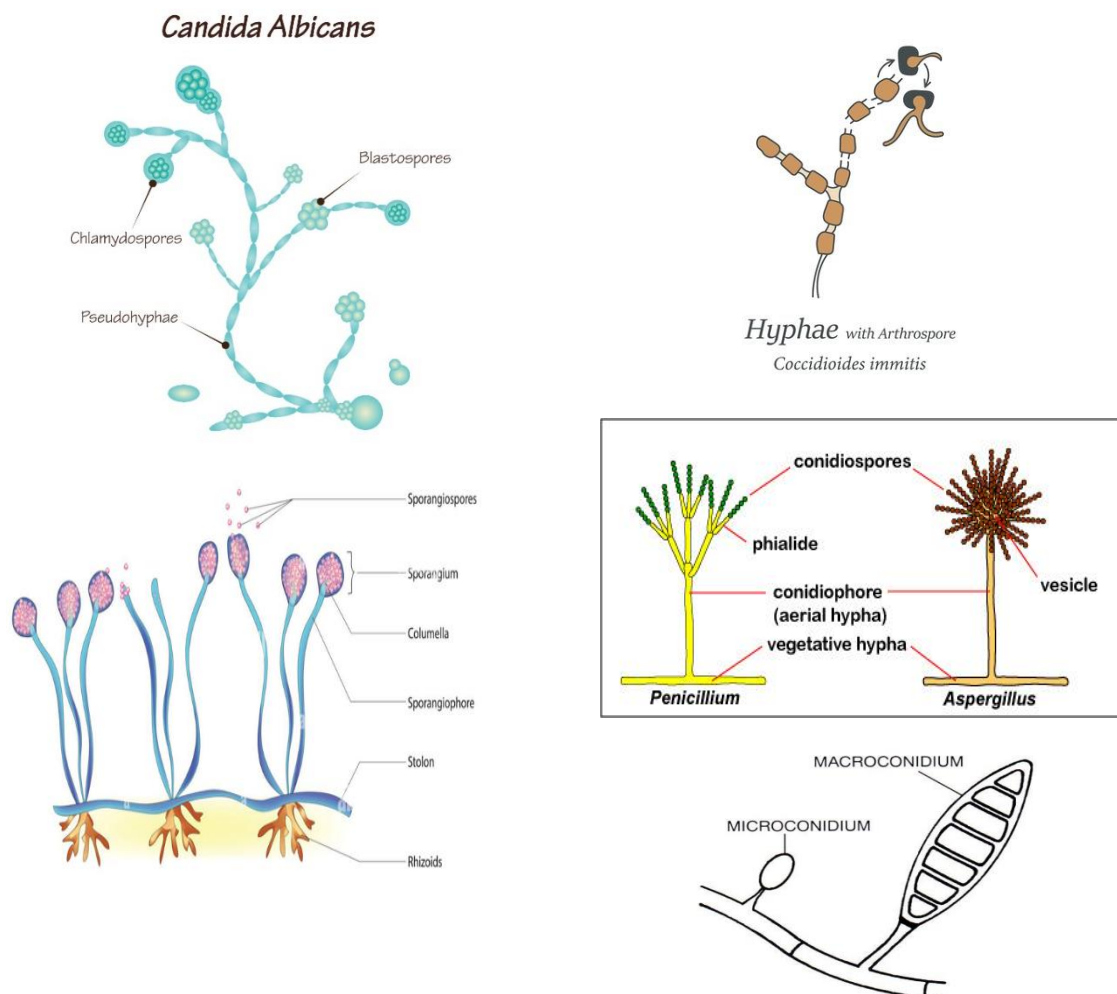


Reproduction of fungi

Most fungi reproduce by forming **spores**. Spore – seed: a simple propagating unit without an **embryo** that serves in the production of new individuals of the same species. Spores are similar to the seed of higher plants in their functions. There are **two** types of spores:

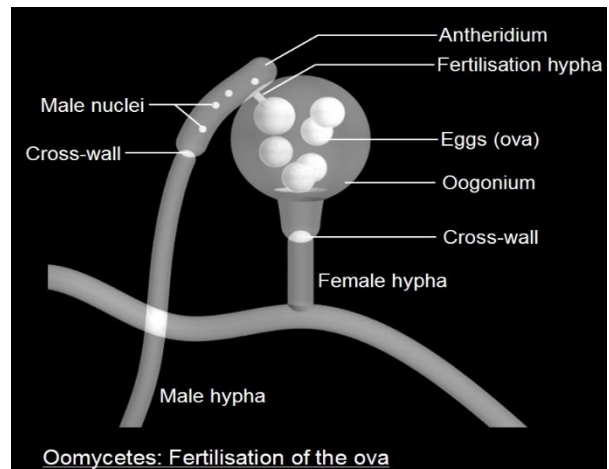
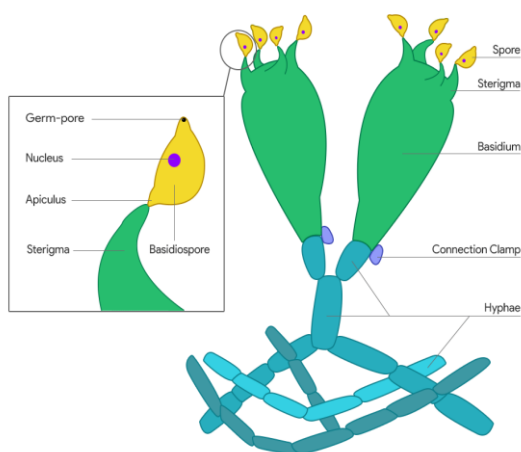
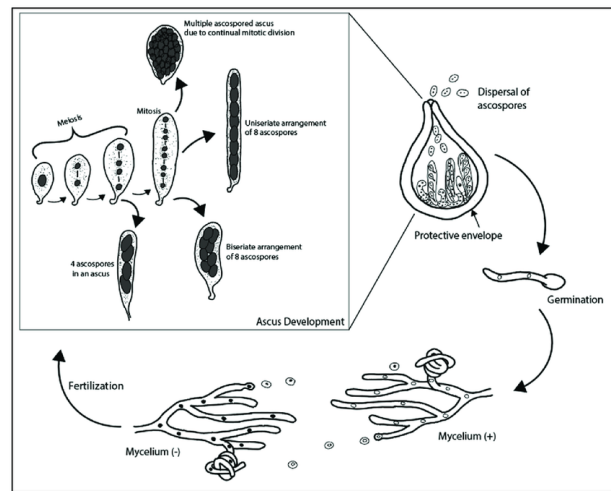
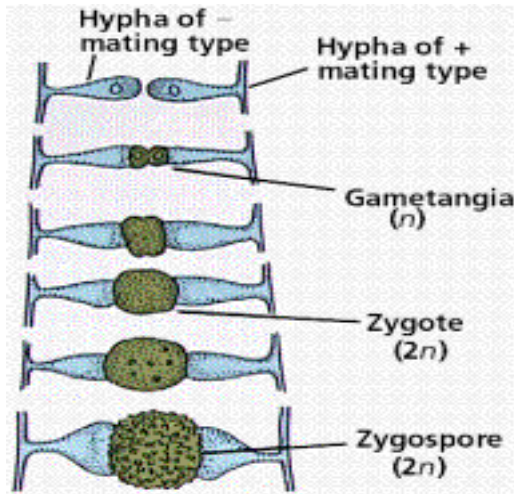
1) Asexual spores:

- Blastospores:** spore formation through budding process, this process occurs only in yeasts such as *Candida*.
- Chlamydoconidia:** conidia are rounded, and thick wall, formed on terminal ends or intercalary hyphae cells, as in *Candida*.
- Arthrospores:** result from fragmentation of hyphae, as in *Coccidioides*.
- Sporangiospores:** several conidia are formed internally within sac which termed sporangia, as in *Rhizopus*, *Mucor*.
- Conidiospores:** several conidia are formed in chains on terminal ends of specialized hyphae, as in *Aspergillus*, *Penicillium*.
- Microconidia and macroconidia** as in dermatophytes.



1) Sexual spores:

- a. **Zygospor**e is single large spore which surrounded by thick walls, result from mating of two nuclei.
- b. **Ascospores** are 4-8 spores formed internally in sac-like structure called **ascus**.
- c. **Basidiospores** are 4 spores formed externally on tip of club-shaped structure called **basidium**.
- d. **Oospores**: This type of spore formed inside cell called **Oogonium**.



Living mode of fungi:

In nature fungi obtain their food:

1. **Parasites**: by infecting living organisms this including:
 - a. **Obligate parasites**: these can't live except on living protoplasm.
 - b. **Facultative parasites**: these can live on living protoplasm or on dead matter

2. **Saprobies:** by attacking dead organic matter this including:
 - a. **Obligate saprobies:** These can live on dead matter and incapable of infecting living organisms.
 - b. **Facultative saprobies:** These can live on dead matter and capable of infecting living organisms.
3. **Symbiotic:** by relationships with plants as in Lichens and mycorrhiza (Ecto and Endotrophic).