Fungi

Fungi(sing. Fungus) were previously were grouped as thalophytes, belonging to plant kingdom. Thallous is a plant body that has no distinct roots, shoots and stems. But now they are regarded as an independent kingdom.

About 90,000 fungal species have been described; however, some estimates of total numbers suggest that 1.5 million species may exist.

The four major Divisions of fungi are:

Zygomycetes:

The bread mold, *Rhizopus siolanifei* is a very common member of this division.

Ascomycetes:

The division *Ascomycota* contains the fungi called ascomycetcs, commonly known as the **sac fungi.** This division includes

Basidiomycetes:

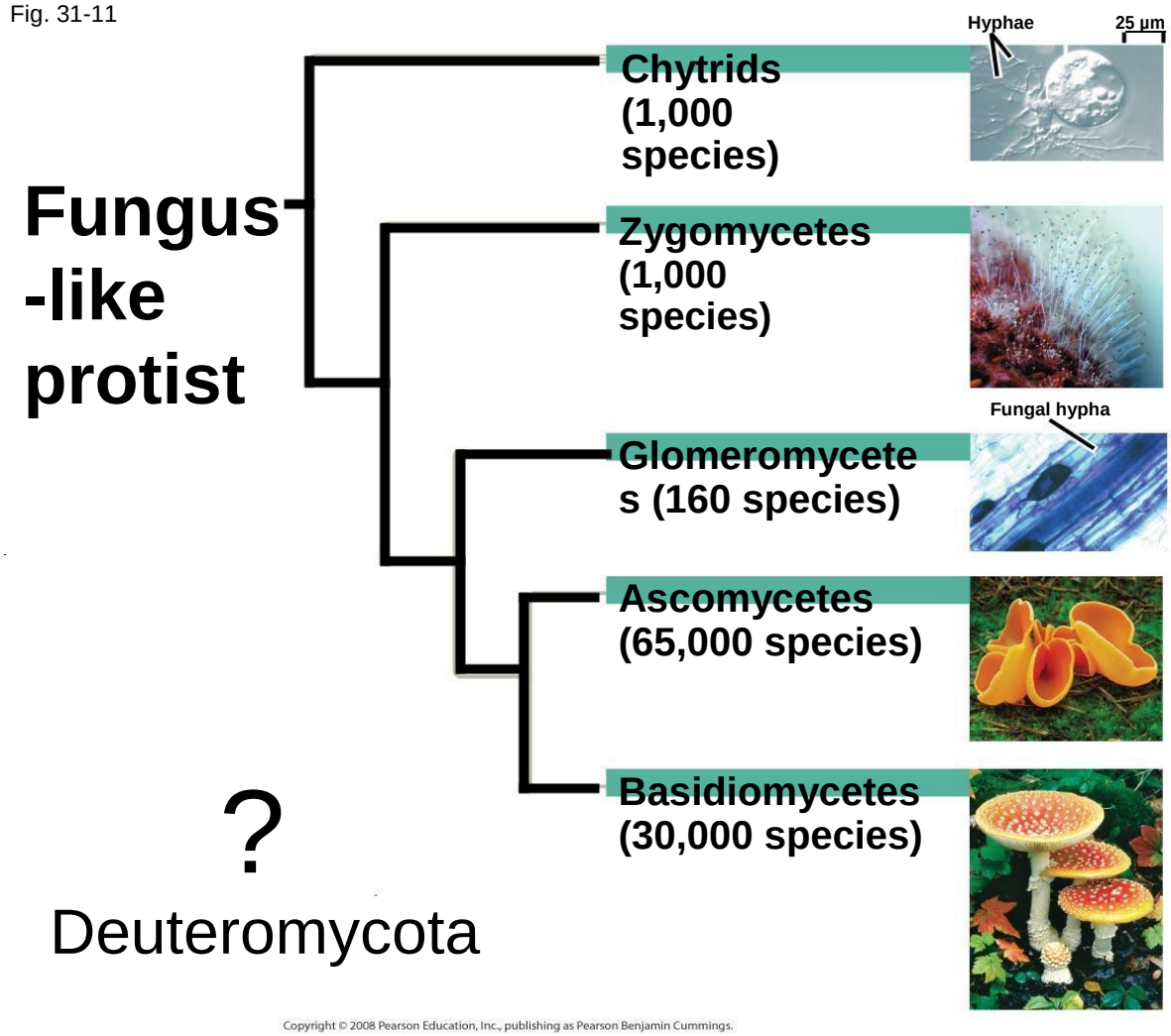
The division *Basidiomycota* contains the **basidiomycetes,** commonly known as the club fungi.

Chytridiomycetes:

The simplest of the true fungi belong to the division *Chytridiomycota.* This division contains one class, *Cliytridiomycetes,* and its members are known familiarly as the chytrids.

Chytrids are thought to have been derived from a protozoan ancestor having similar flagellation.

Fig. 31-11



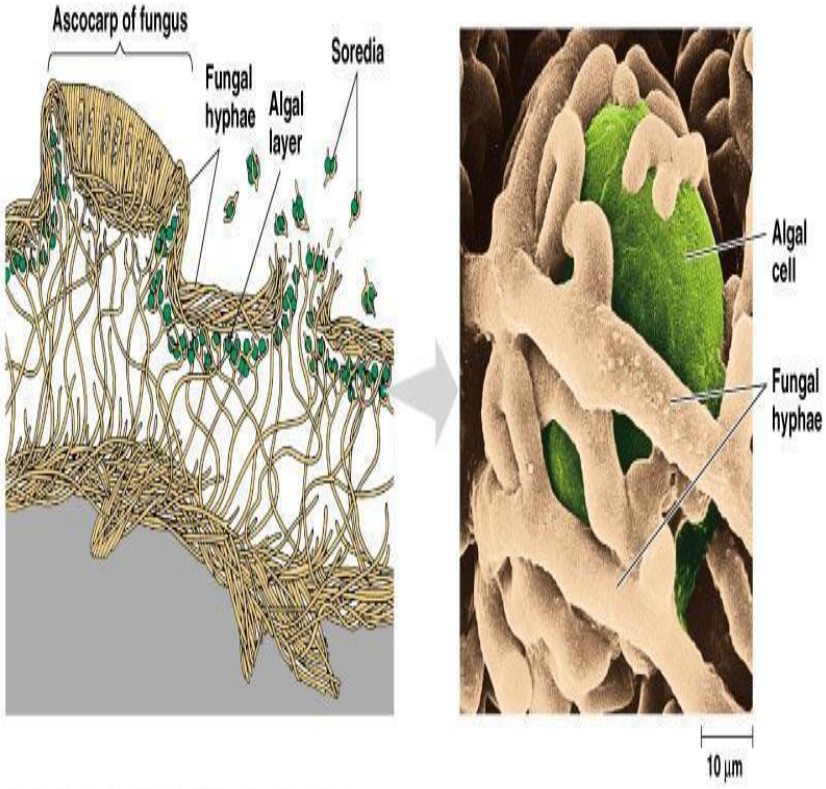
Habitat

i- Fungi are primarily terrestrial organisms, although a few are freshwater or marine. Usually they are found in the moist damp places and decomposing organic matter.

ii- Many are pathogenic and infect plants and animals.

iii- About three-fourths of all vascular plants form associations (called mycorrhizae) between their roots and fungi.

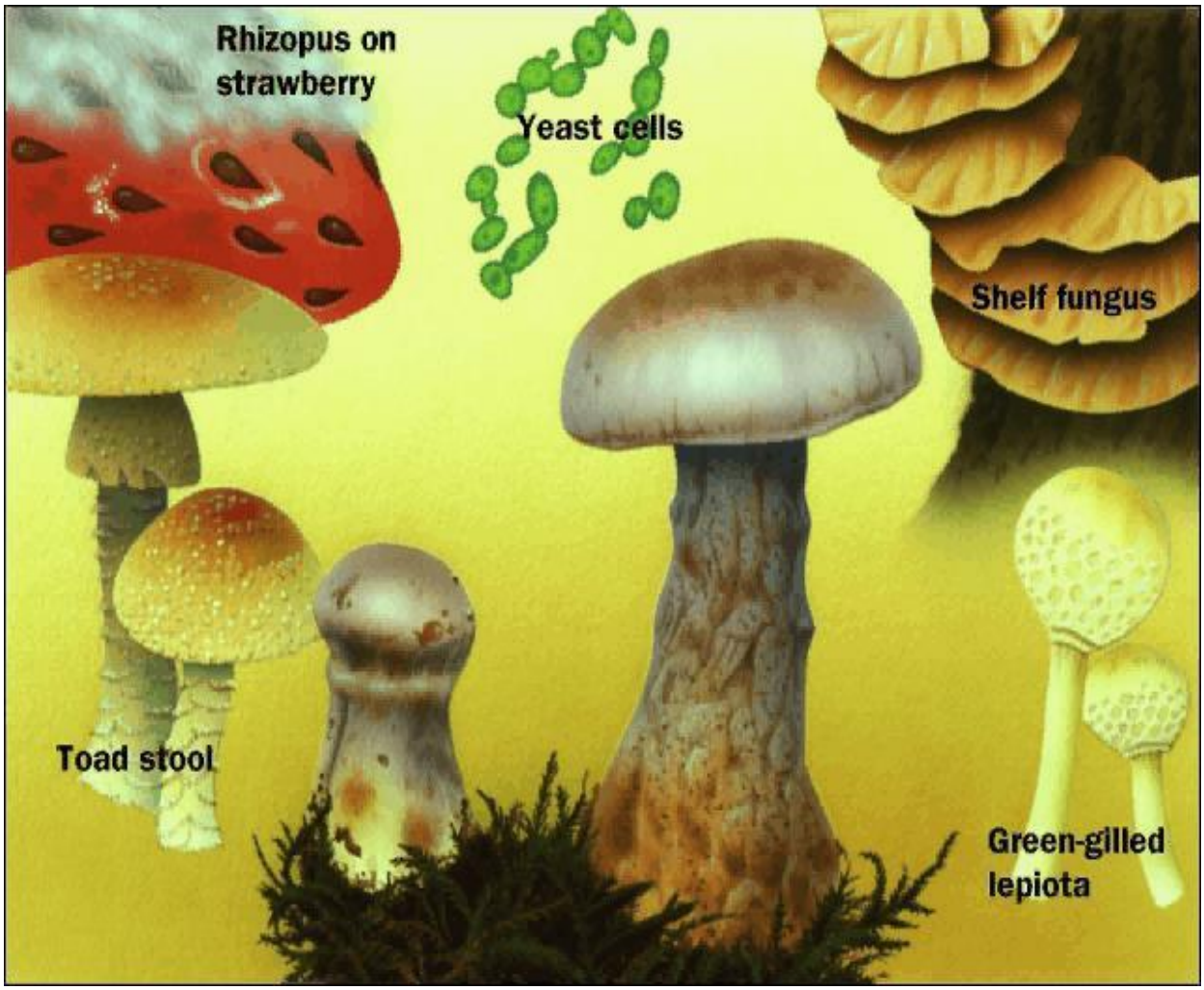
iv- Lichens are associations of fungi and either algae or cyanobacteria.



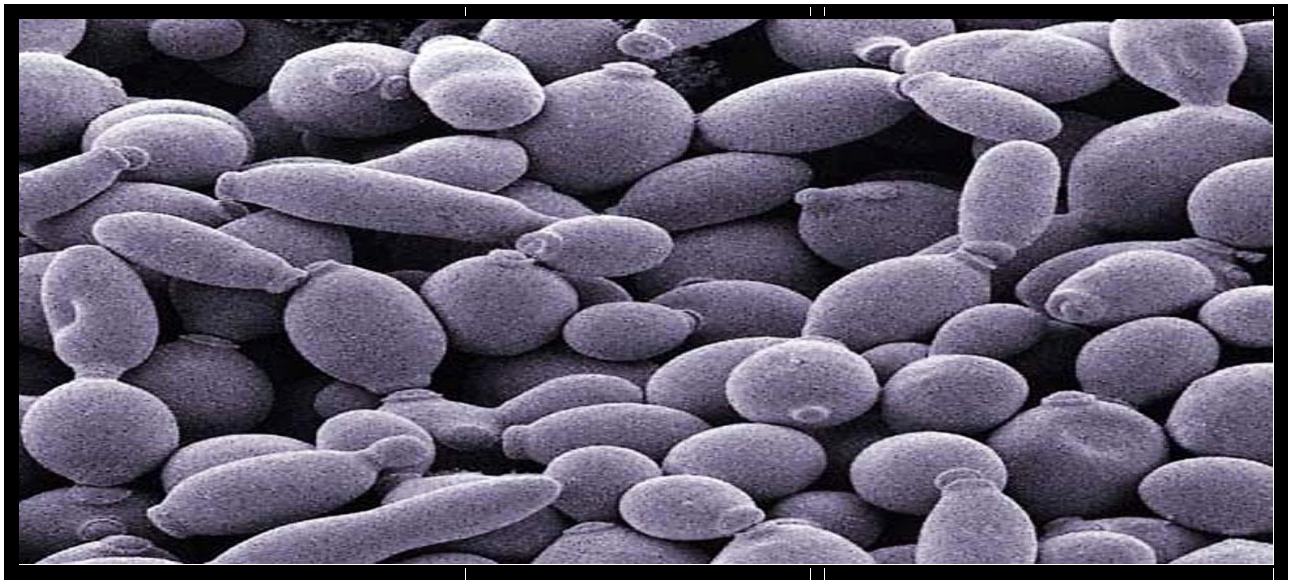
v.Fungi also are found in the upper portions of many plants. These endophytic fungi affect plant reproduction and palatability to herbivores.

Structure:

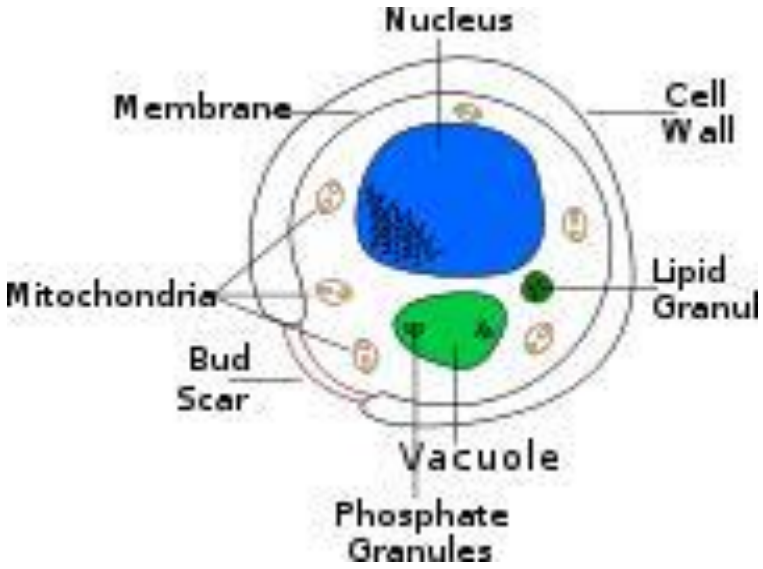
The body or vegetative structure of a fungus is called a thallus. It varies in complexity and size, ranging from the single-cell microscopic yeasts to multicellular molds, macroscopic puffballs, and mushrooms



Yeast



Yeast is a unicellular fungus that has a single nucleus. Generally yeast cells are larger than bacteria, vary considerably in size and are commonly spherical to egg shaped. They have no flagella but do possess most of the other eukaryotic organelles.



SIZE:

Yeast size can vary greatly depending on the species, typically measuring 3–4 μm in diameter, although some yeasts can reach over 40 μm.

TYPES: Almost 1500 species of yeast has been described.

Importance of Yeast

1- Fermentation: They respire by anaerobic respiration. They ferment the carbohydrates into ethanol (alcohol) and CO_2 .This process is very important in wine, beer and bread making.

Saccharomyces *cerevisiae* is used in baking and fermenting alcoholic beverages.

2-Research; It is also extremely important as a model organism in modern cell biology research, and is one of the most thoroughly researched eukaryotic microorganisms.

3-Candida albicans, are opportunistic pathogens and can cause infections in humans. *Candida* is commonly found as a commensal yeast in the mucus membranes of humans and other warm-blooded animals

4- **Biofuel industry**: Yeasts have recently been used to generate electricity in microbial fuel cells, and produce ethanol for the biofuel industry.

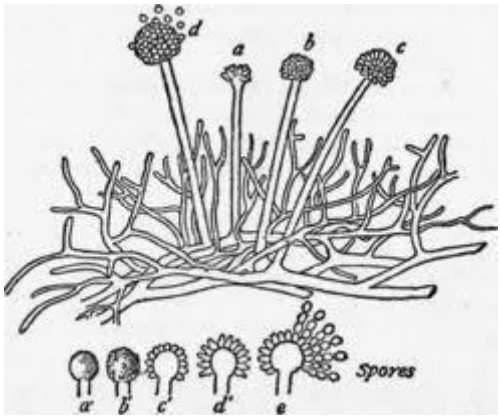
5- Spoilage of Wine: The growth of some yeast such as Zygosaccharomyces and Brettanomyces in wine can result in wine faults and subsequent spoilage.

6- **Spoilage of food:** Yeasts are able to grow in foods with a low pH, (5.0 or lower) and even in the presence of common preservatives sugars, organic acids and other easily metabolized carbon sources. In this way they spoil food.

Methylene Blue is used to test for the presence of live yeast cells.

Molds

Molds are multicellular fungi. **Hyphae: A** mold consists of long, branched, threadlike filaments of cells called **hyphae** that form a mycelium ,a tangled mass or tissue like aggregation .



Non Septate Hyphae:

They are not divide into cells by cross walls called septa. These hyphae are called **coenocytic** hyphae.

Septate Hyphae:

The hyphae of other fungi have cross walls called septa with either a single pore or multiple pores that permit cytoplasm streaming. These hyphae are termed **septate**. Hyphae are composed of an outer cell wall and an inner lumen, which contains the cytosol and organelles

Dimorphic Hyphae in Animals:

Many fungi, especially those that cause diseases in human and animals, are dimorphic that is, they have two forms. Dimorphic fungi can change from (1) the yeast (Y) form in the animal to (2) the mold or **mycelial** form (M) in the externernal environment in response to changes in various environmental factors (nutrients, CO2 tension, oxidation-reduction potentials, temperature). This shift is called the **YM shift**.

Yeast form ----------> mycelial form

Animal **Environment**

Dimorphic Hyphae in plants:

In plant-associate; fungi the opposite type of dimorphism exists: the mycelial form occurs in the plant and the yeast form in the external environment.

Mycelial form ----------> Yeast form
Plant **Environment**

Cell wall:

The cell wall of fungi is composed of chitin. Chitin is more resistant to cellulose and lignin which make up plant cell wall

Nutrition: **1-**

Saprotrophs:

They get energy by decomposition of dead organic substances. Like many bacteria, fungi release hydrolytic exoenzymes that digest external substrates. They then absorb the soluble products. They are **chemo-organo-heterotrophs** and use organic compounds as a source of carbon, electrons, and energy.

2-Parasites

They may be either Obligate parasites or Facultative Parasites.

Obligate parasites: They can grow only on the host cell through special hyphal tips called haustoria.

Facultative: Besides living on their hosts they can also survive on the growth media. **Symbionts**

i. Lichens: It is symbiotic association between a fungus and alga.
ii. Mycorrhizae: It is symbiotic association between fungus and the roots of vascular plants.

Respiration:

Fungi usually are **aerobic**. Some yeast, however, are **facultatively anaerobic** and can obtain energy by fermentation, such as in the production of ethyl alcohol from glucose. Obligatory anaerobic fungi are found in the rumen of cattle.

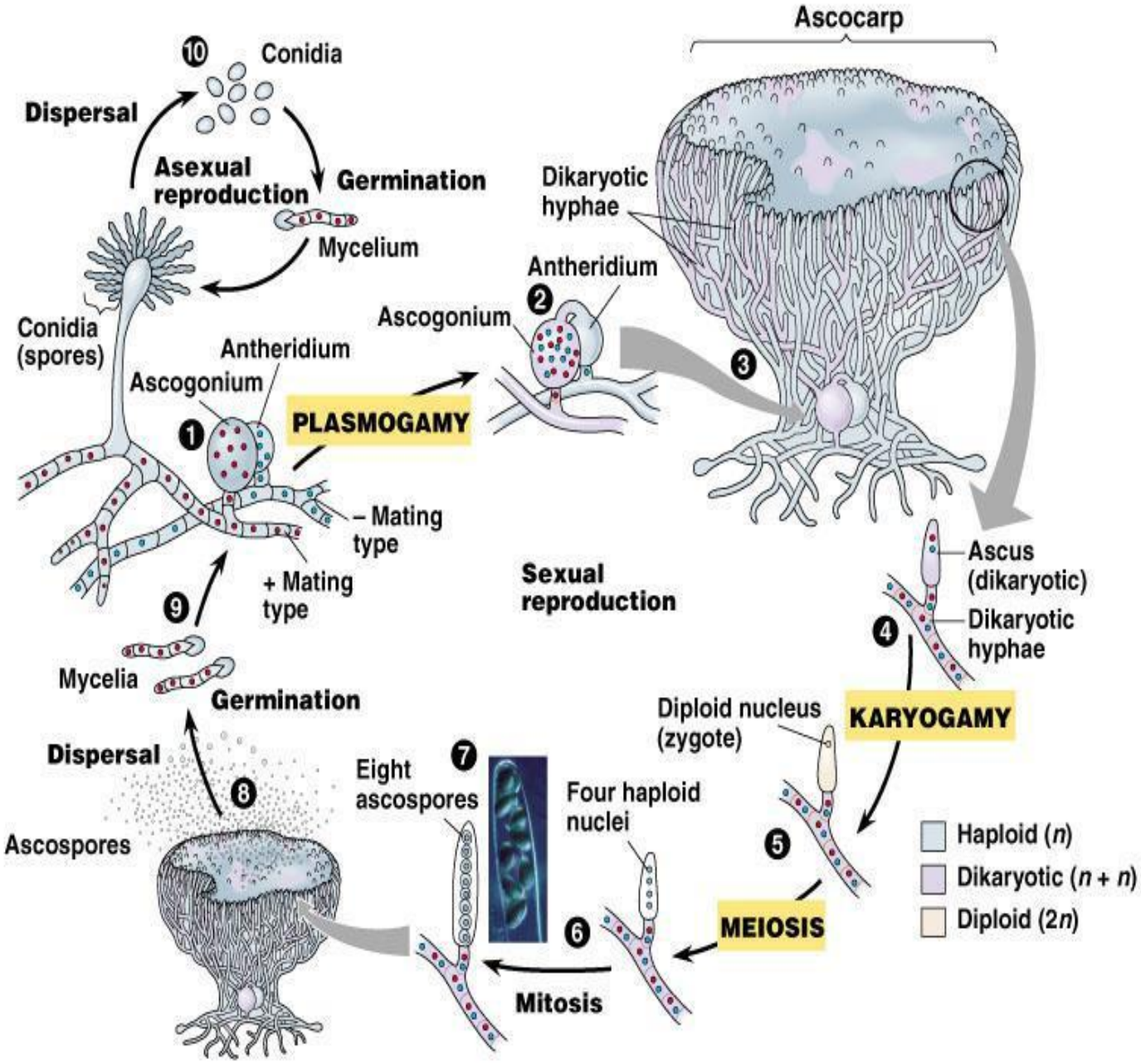
Reproduction:

Yeast: Budding

Asexual Reproduction in Molds:

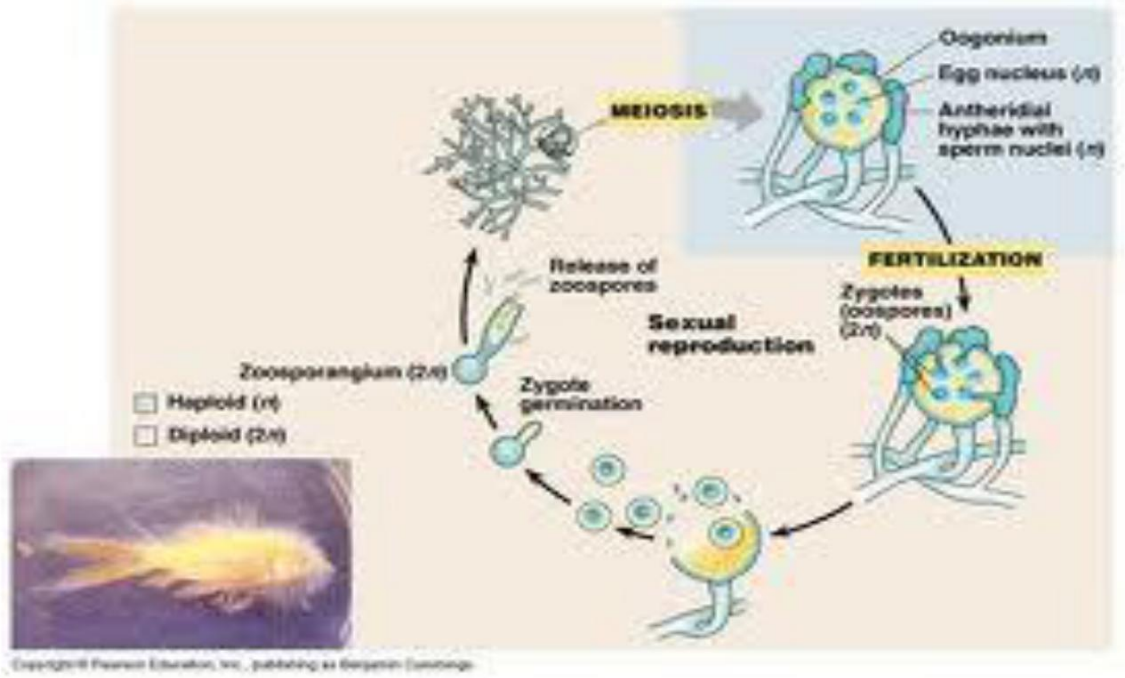
i- Spores ii-Conida iii- Fragmentation

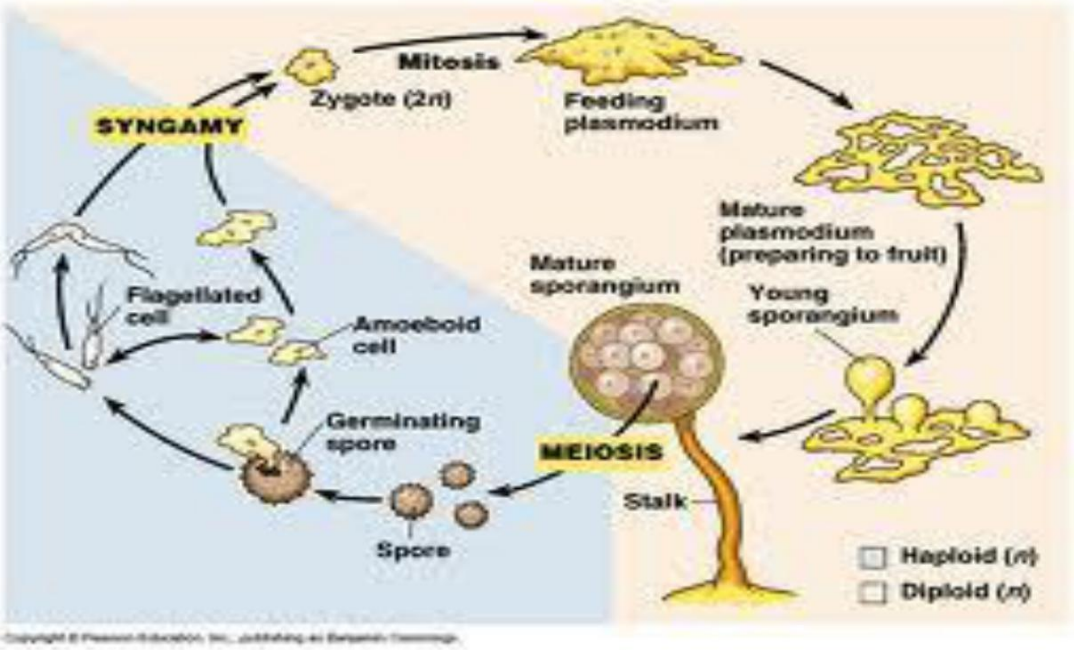
Sexual Reproduction


Ascocarp
10 Conidia
Dispersal
Asexual reproduction
Germination
Mycelium
Dikaryotic hyphae
Antheridium
2
Ascogonium
Conidia (spores)
Antheridium
Ascogonium
1
PLASMOGAMY
3
– Mating type
+ Mating type
Sexual reproduction
Ascus (dikaryotic)
Dikaryotic hyphae
4
9
Mycelia
Germination
Diploid nucleus (zygote)
KARYOGAMY
Dispersal
8
7
Eight ascospores
Four haploid nuclei
5
Ascospores
Haploid (n)
Dikaryotic (n + n)
Diploid (2n)
MEIOSIS
6
Mitosis

Slime Molds and Water Molds

The slime molds and water molds resemble fungi in only appearance and life-style. In their cellular organization, reproduction, and life cycles, they are phylogenetically distinct





(Slime mold) (Water mold)

Division Myxomycota (A cellular Slime Molds)

Under appropriate conditions plasmodial (a cellular) slime molds exist as streaming masses of colorful protoplasm that creep along in an amoeboid fashion over moist, rotting logs, leaves, and other organic matter. Feeding is by phagocytosis. Because this streaming mass lacks cell walls, it is called a plasmodium .The plasmodium contains many nuclei, and as the organism grows, the diploid nuclei divide repeatedly.

Division Acrasiomycota (Cellular Slime Molds)

The vegetative stage of cellular slime molds consists of individual amoeboid cells termed myxamoebae the myxamoebae feed phagocytically on bacteria and yeasts. When food is plentiful, they divide repeatedly by mitosis and cytokinesis, producing new daughter myxamoebae. A fruiting body called a sorus or sorocarp forms and matures and then produces spores The spores are eventually released, and when conditions become favorable, they germinate (o release haploid amoebae and repeat the cycle.

Division Oomycota

Members of the division *Oomycota* are collectively known as oomycetes or water molds. Oomycetes resemble true fungi only in appearance, consisting of finely branched filaments called hyphae. However, oomyceles have cell walls of cellulose, whereas the walls of most fungi are made of chitin. Oomycetes