

# UNIT- FUNGI

# Characteristics of Fungi

## Body form

- unicellular
- filamentous (tube-like strands called hypha (singular) or hyphae (plural))
- mycelium = aggregate of hyphae
- sclerotium = hardened mass of mycelium that generally serves as an overwintering stage.
- multicellular, such as mycelial cords, rhizomorphs, and fruit bodies (mushrooms)

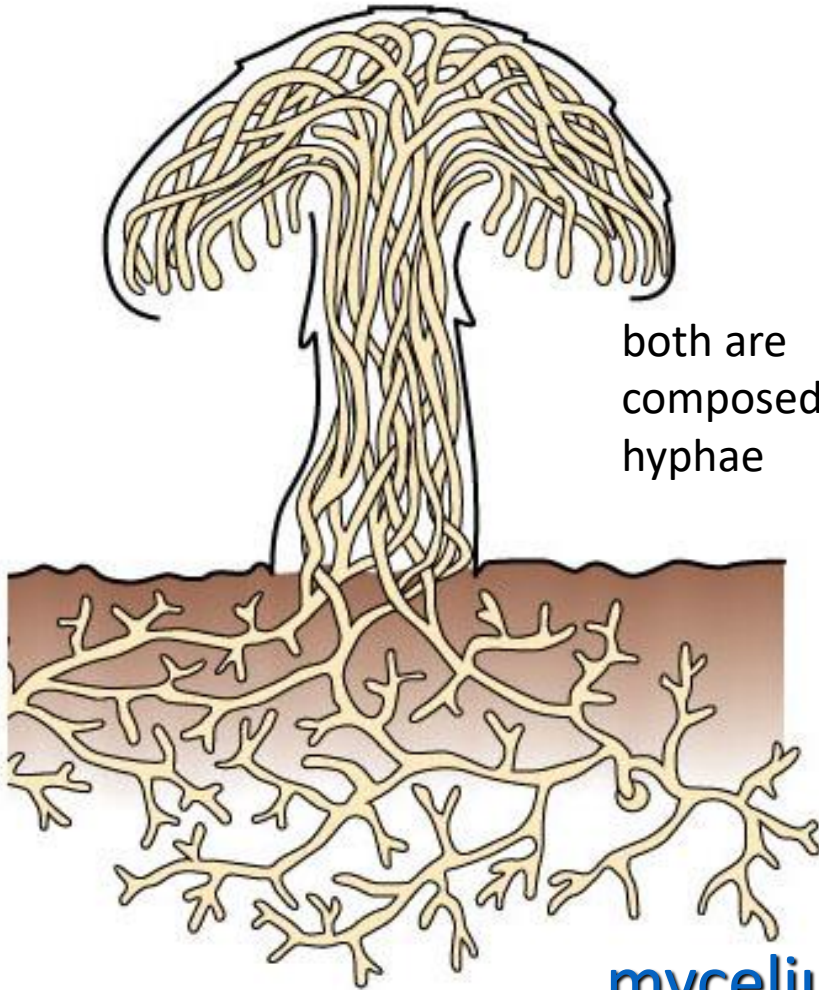
- Saprophytes or saprobes - feed on dead tissues or organic waste (decomposers)
- Symbionts - mutually beneficial relationship between a fungus and another organism
- Parasites - feeding on living tissue of a host.

- Fungus is often hidden from view. It grows through its food source (substratum), excretes extracellular digestive enzymes, and absorbs dissolved food.
- Indeterminate clonal growth.
- Vegetative phase of fungus is generally sedentary.
- Cell wall present, composed of cellulose and/or chitin.
- Food storage - generally in the form of lipids and glycogen.
- Eukaryotes - true nucleus and other organelles present.
- All fungi require water and oxygen (no obligate anaerobes).
- Fungi grow in almost every habitat imaginable, as long as there is some type of organic matter present and the environment is not too extreme.
- Diverse group, number of described species is somewhere between 69,000 to 100,000 (estimated 1.5 million species total).

fruiting bodies



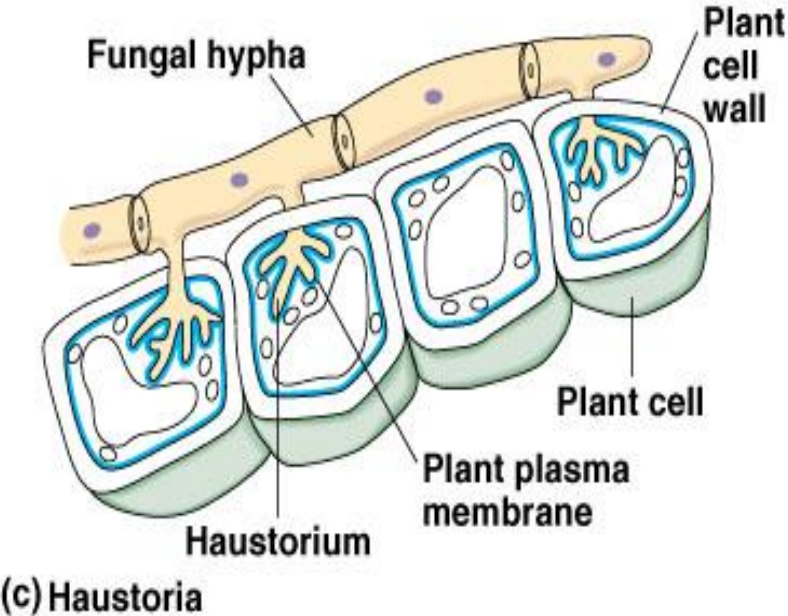
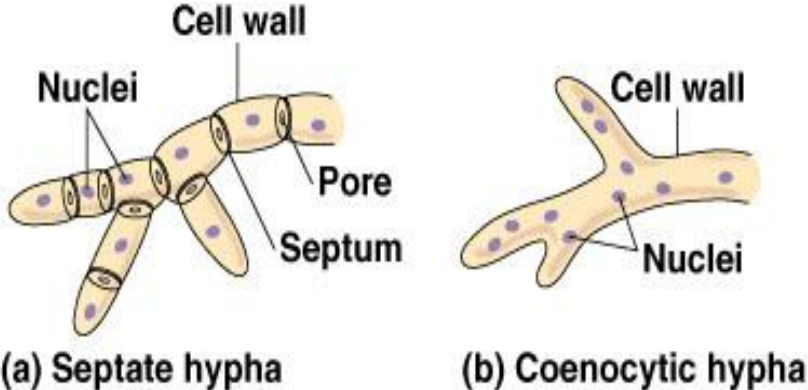
both are  
composed of  
hyphae



mycelium



# Hyphae



# Mycorrhizae

- “Fungus roots”
- Mutualism between:
  - Fungus (nutrient & water uptake for plant)
  - Plant (carbohydrate for fungus)
- Several kinds
  - Zygomycota – hyphae invade root cells
  - Ascomycota & Basidiomycota – hyphae invade root but don’t penetrate cells

**Extremely** important ecological role of fungi!

# Lichens

- “Mutualism” between
  - Fungus – structure
  - Alga or cyanobacterium – provides food
- Three main types of lichens:
  - **Crustose lichens** form flat crusty plates.
  - **Foliose lichens** are leafy in appearance, although lobed or branched structures are not true leaves.
  - **Fruticose lichens** are even more finely branched and may hang down like beards from branches or grow up from the ground like tiny shrubs.



# Reproduce by spores

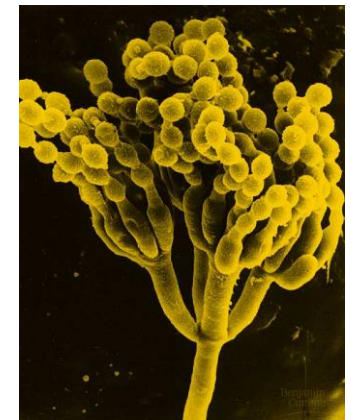
- Spores are reproductive cells
  - Sexual (meiotic in origin)
  - Asexual (mitotic in origin)
- Formed:
  - Directly on hyphae
  - Inside sporangia
  - Fruiting bodies



*Amanita* fruiting body



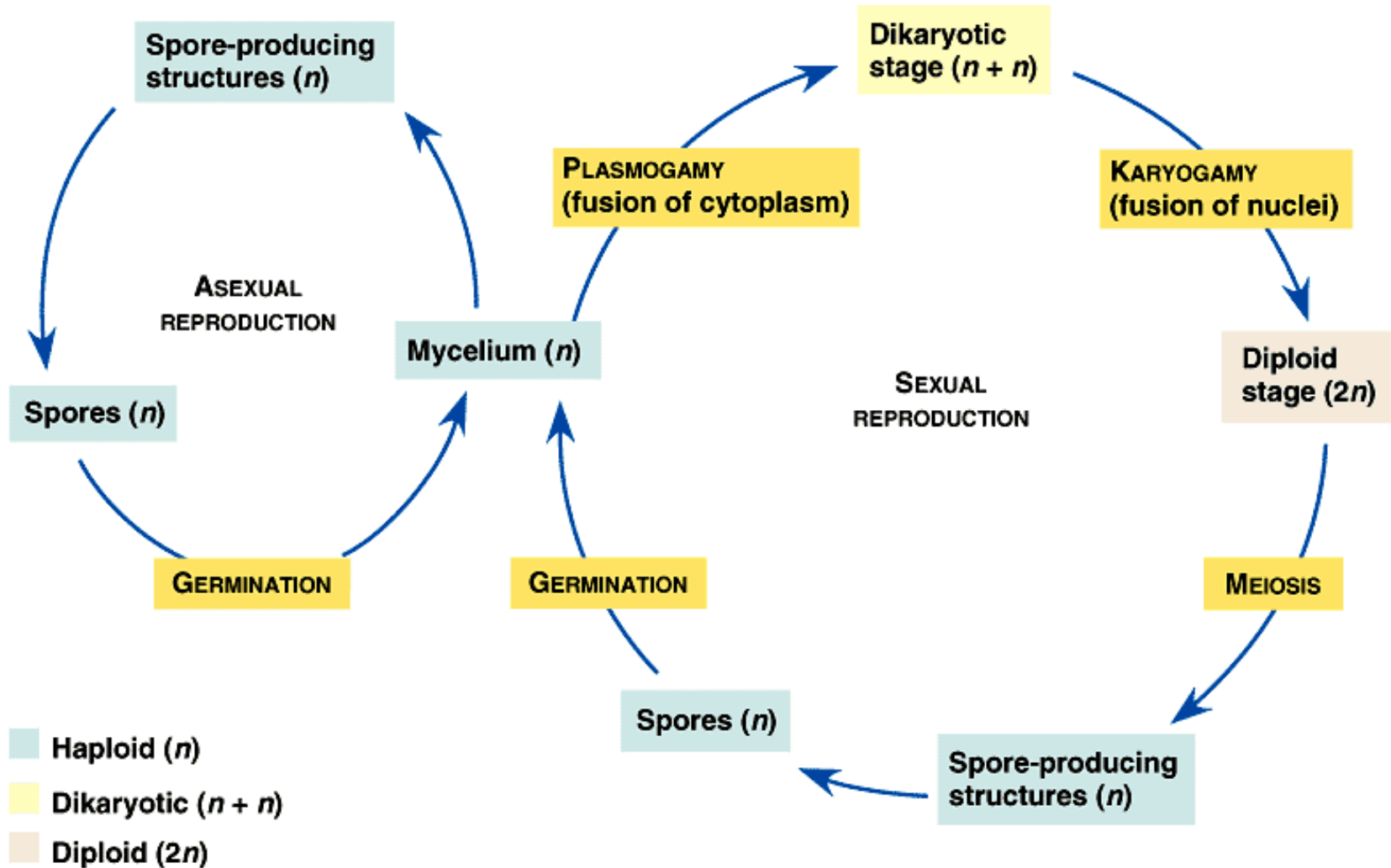
*Pilobolus* sporangia



*Penicillium* hyphae  
with conidia



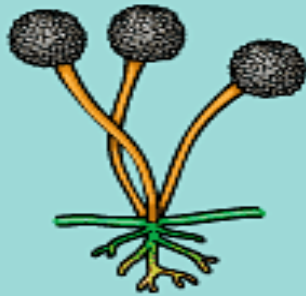
# Generalized Life Cycle of a Fungus



**Chytrids**



**Zygozote fungi**



**Sac fungi**



**Club fungi**



**Chytridiomycota**

**Zygomycota**

**Ascomycota**

**Basidiomycota**

zygosporangia

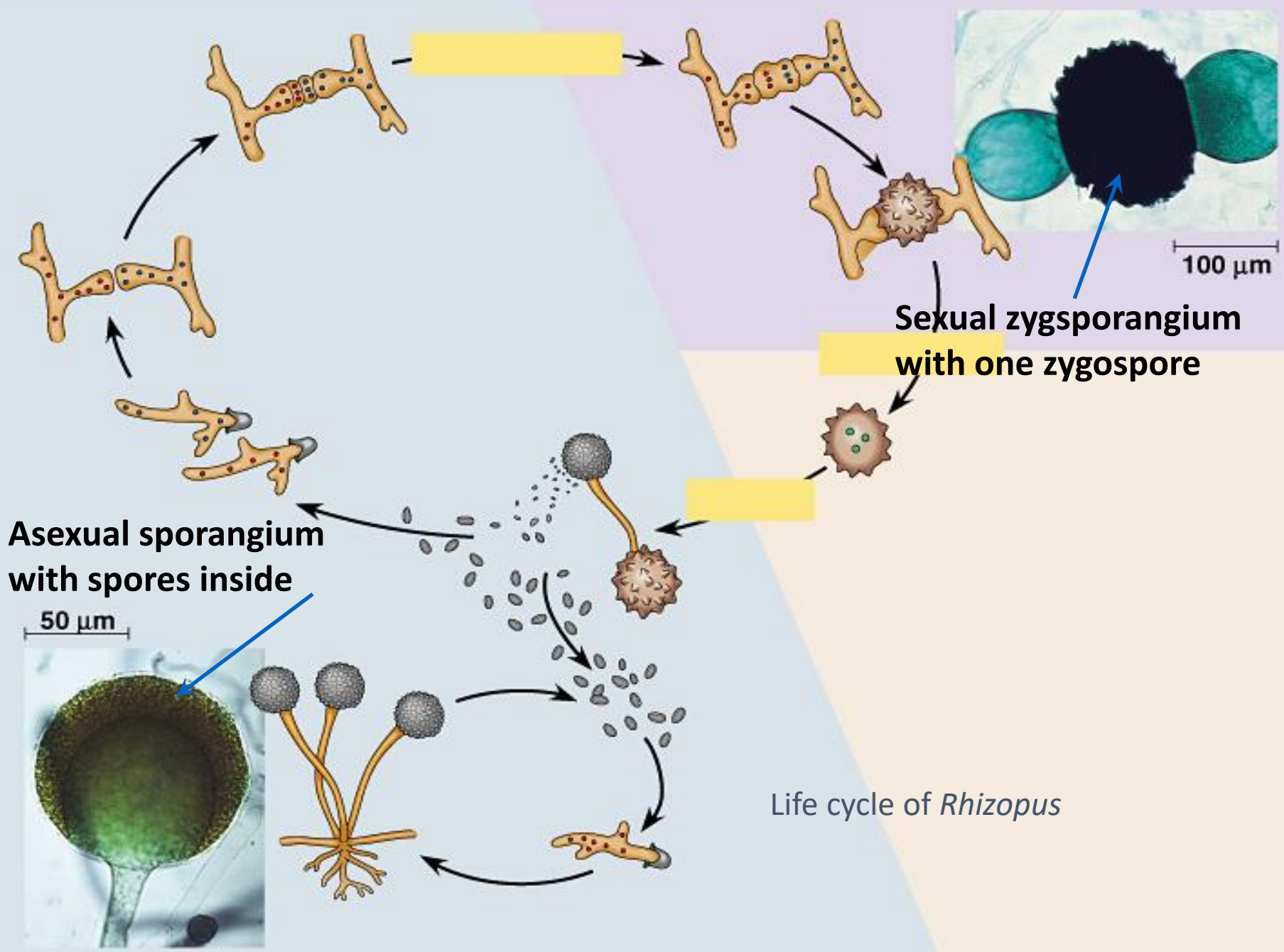
asci

basidia

motile spores

**Loss of flagella**

**Classification & Phylogeny**



Asexual sporangium with spores inside

50 μm

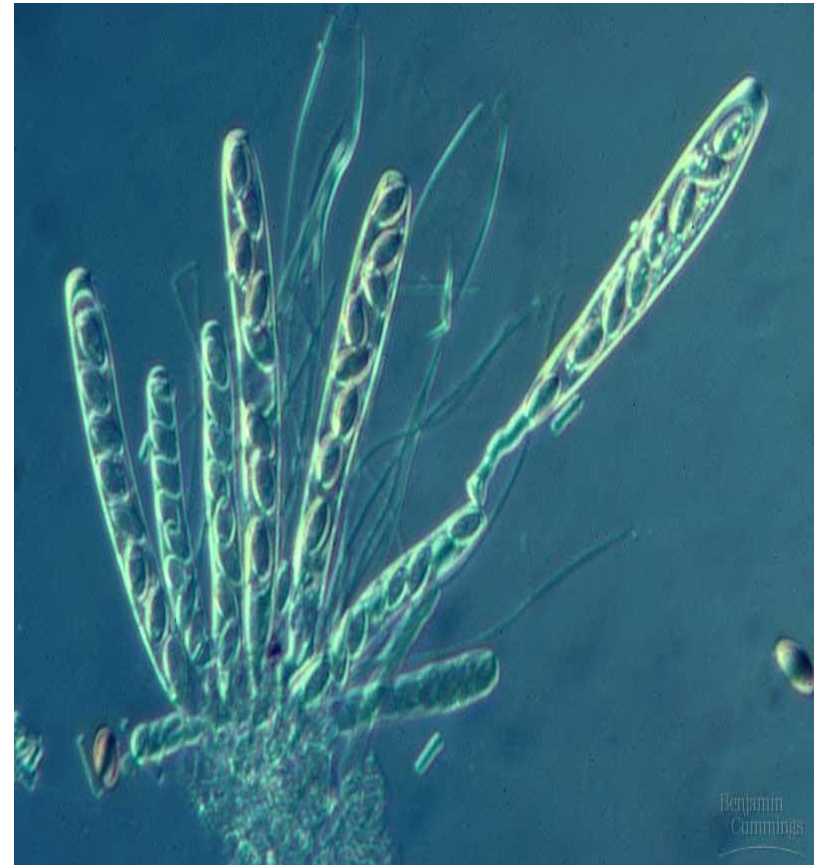
Sexual zygospore with one zygospore

100 μm

Life cycle of *Rhizopus*

# Ascomycota – “sac fungi”

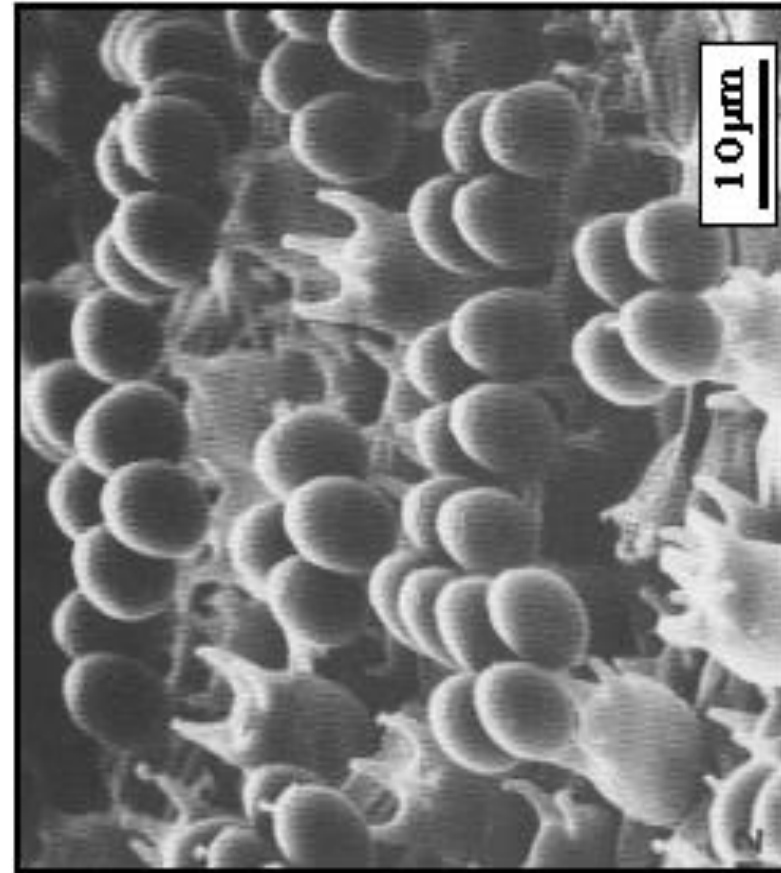
- Sexual Reproduction – asci (sing. = ascus)
- Asex. Reprod. – common
- Cup fungi, morels, truffles
- Important plant parasites & saprobes
- Yeast - *Saccharomyces*
- Decomposers, pathogens, and found in most lichens



A cluster of asci with spores inside

# Basidiomycota – “club fungi”

- Sexual Reproduction – basidia
- Asexual reprod – not so common
- Long-lived **dikaryotic** mycelia
- Rusts & smuts –plant parasites
- Mushrooms, polypores, puffballs, boletes, bird’s nest fungi
- Enzymes decompose wood, leaves, and other organic materials
- Decomposers, pathogens, and some form mycorrhizal associations with plants



SEM of basidia and spores

haploid  
mycelium

Hyphal fusion of  
haploid mycelia

mycelium and fruiting body  
are dikaryotic

# Mushroom Life Cycle

N

2N

N+N

Meiosis

Nuclear fusion in  
basidium

young basidia - the only  
diploid cells



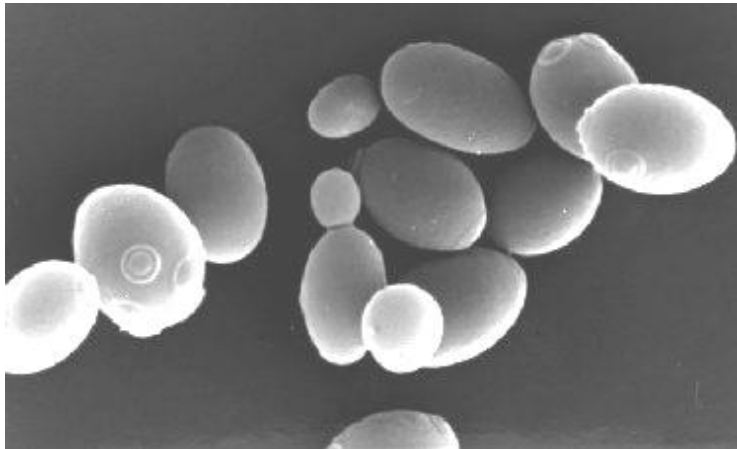
1  $\mu$ m

# Deuteromycota – Form Phylum “Imperfect Fungi”

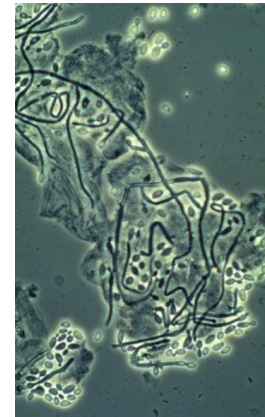
- Fungi that seldom or never reproduce sexually.
- Asexual reproduction by vegetative growth and production of asexual spores common.

# Yeasts

- Single celled fungi
- Adapted to liquids
  - Plant saps
  - Water films
  - Moist animal tissues



*Saccharomyces*



*Candida*



# HUMAN-FUNGUS INTERACTIONS

- **Beneficial Effects of Fungi**

- Decomposition - nutrient and carbon recycling.
- Biosynthetic factories. Can be used to produce drugs, antibiotics, alcohol, acids, food (e.g., fermented products, mushrooms).
- Model organisms for biochemical and genetic studies.

- **Harmful Effects of Fungi**

- Destruction of food, lumber, paper, and cloth.
- Animal and human diseases, including allergies.
- Toxins produced by poisonous mushrooms and within food (e.g., grain, cheese, etc.).
- Plant diseases.