

A scanning electron micrograph (SEM) of a fungal structure. The image shows a network of yellowish, thread-like hyphae against a dark green background. Two prominent, light-colored, spherical spores are visible, one near the top center and another slightly below and to the right. The hyphae are interconnected, forming a complex web.

Introduction to Fungi

Classification, Morphology and
Pathogenicity

Introduction

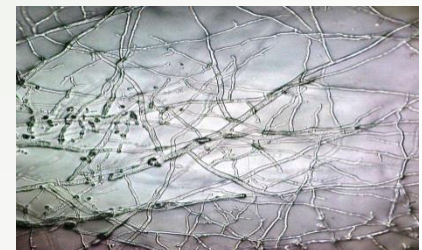
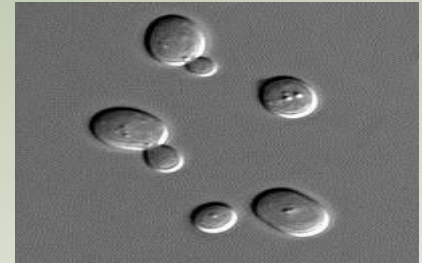
- Mykes (Greek word) : Mushroom
- Differ from bacteria and other prokaryotes:
 1. Cell walls containing chitin (rigidity & support), mannan & other polysaccharides
 2. Cytoplasmic membrane contains Ergosterols
 3. Possess true nuclei with nuclear membrane & paired chromosomes
 4. Divide asexually, sexually or by both
 5. Unicellular or multicellular

Characteristics of Fungus

- Diverse group of chemoheterotrophs
- Over 100,000 fungal species identified
- Only about 100 are human or animal pathogens
- Most human fungal infections are nosocomial and/or occur in immunocompromised individuals (opportunistic infections)
- Saprophytic fungus
- Parasitic fungus
- Most are aerobes or facultative anaerobes

Understanding the Terms in Mycology

- Simplest fungus >> Unicellular budding yeast
- Hyphae
- Mycelium
- Aerial Mycelium
- Vegetative mycelium



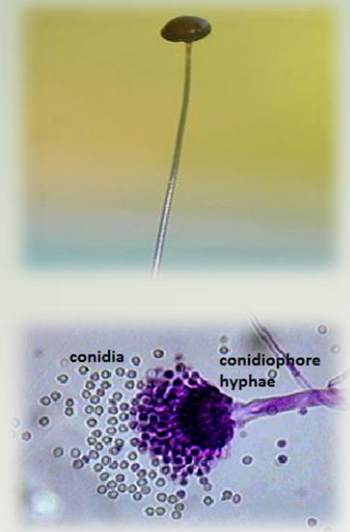
Understanding the Terms in Mycology

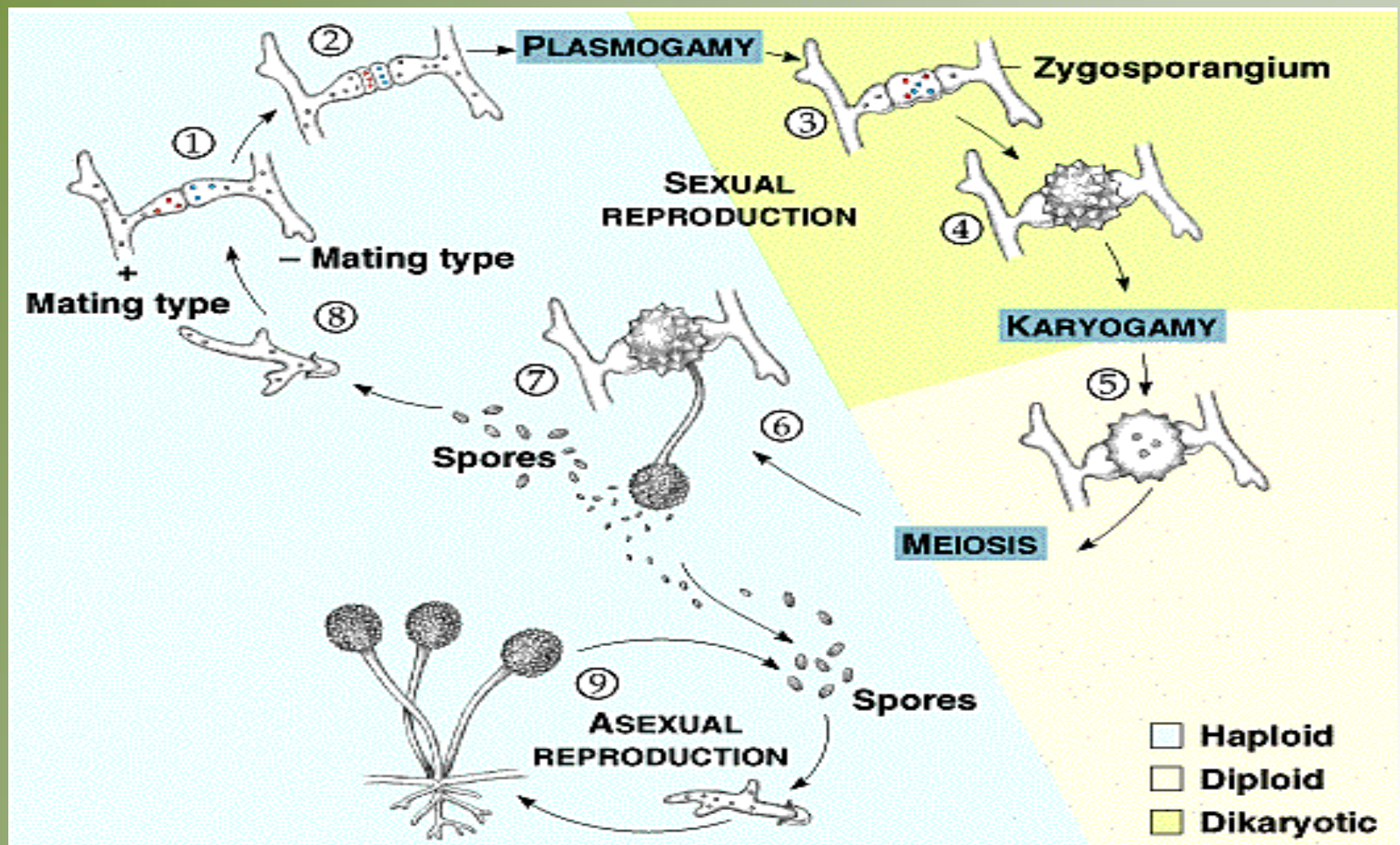
Reproduction in fungi

- A. Sexual
- B. Asexual reproduction
- C. Asexual spores

Fungi Classification

- **Eukaryotes**
 - ✓ Nucleus and Cell walls composed of chitin
 - ✓ Molds & mushrooms are multicellular
 - ✓ Yeasts are unicellular
- **Eumycetes (True fungi)**
 - Classified by method of reproduction
 1. **Zygomycetes**
 2. **Basidiomycetes**
 3. **Ascomycetes**
 4. **Chytridiomycetes**
 5. **Deuteromycetes**





Fungi Classification

- **Depending on Morphology**

- A. Yeasts

- B. Yeast like fungi

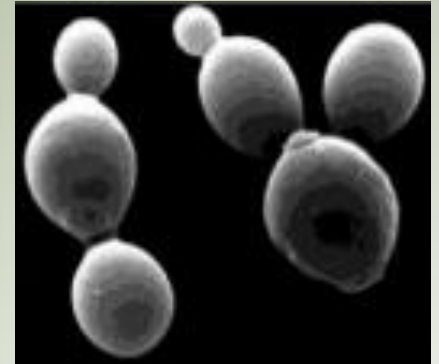
- C. Molds

- D. Dimorphic fungi

- E. Fleshy fungi

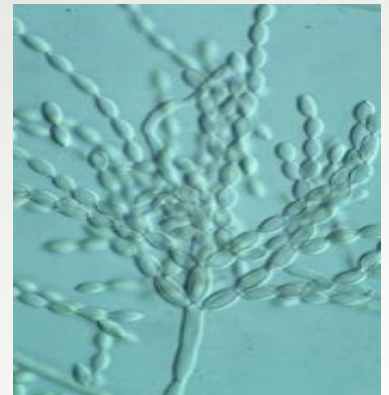
A. Yeast

- **Unicellular**, Nucleated rounded fungi
- Reproduce by budding
- Colony on solid media are usually white to beige and appear much like bacterial colonies
- Some genera produce mucoid colonies
- Yeast are used in the preparation in the variety of foods



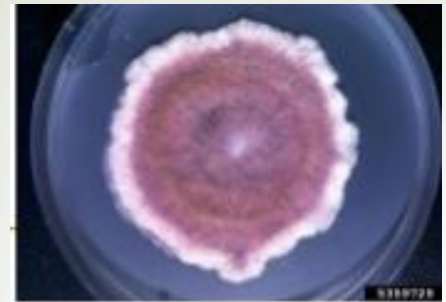
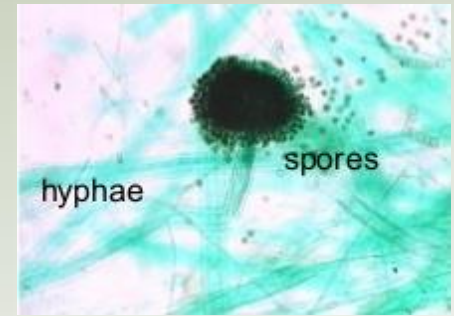
B. Yeast like Fungi

- Grow partly as yeasts and partly as elongated cells resembling hyphae which are called pseudo hyphae
- e.g. *Candida albicans*



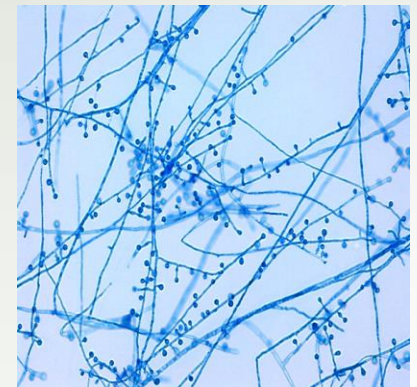
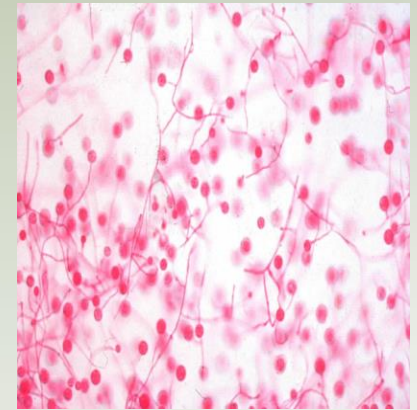
C. Moulds

- **Multicellular**, Filamentous with hyphae
- Produce conidia [spores]
- Colonies on solid agar are downy, fluffy, cottony
- Most mold colonies are pigmented which aid in identification hyphae spores
- *Penicillium* and *Cephalosporium*



D. Dimorphic fungi

- Occur in 2 forms:
 - ✓ Molds (Filaments) @ 25 °C (soil)
 - ✓ Yeasts @ 37 °C (in host tissue)
- Most fungi causing systemic infections are dimorphic:
 - ✓ *Histoplasma capsulatum*
 - ✓ *Blastomyces dermatidis*



E. Fleshy fungi

- Mushrooms

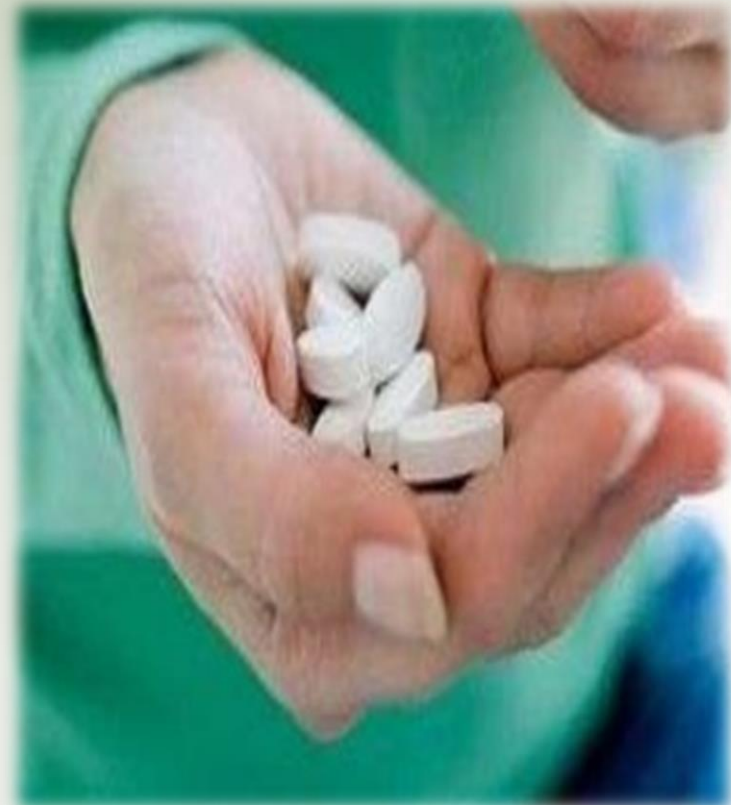


Fungi clinical Classification

- A. Superficial mycosis
- B. Subcutaneous mycosis
- C. Systemic mycosis
 - Primary pathogens
 - Opportunistic pathogens
- D. Microbial intoxication

Predisposing factors

- Use of Antibiotics
- Use of steroids
- Immunosuppressive conditions



Superficial mycosis

- **The skin, hair, nail and mucous membranes**

- A. Dermatophytosis (Ringworm) Form

- ✓ Is a complex of diseases affecting the outermost keratinized tissues of hair, nail and parts of the skin
 - ✓ Caused by dermatophytes mould fungi
 - ✓ Infect both human and animal

- B. Yeast infections

- ✓ Affect the skin, nail and the mucous membrane of the mouth and vagina
 - ✓ Usually caused by commensal *Candida* species



Subcutaneous mycosis

- Infection caused by a variety of fungi
- Found in tropical or sub-tropical regions
- Fungi present in soil
- Introduced into subcutaneous tissues by trauma
- The common subcutaneous mycosis is Mycetoma



Systemic mycosis

- Deep seated fungal infection
- Occur through inhalation of air-borne spores
- Initially as a pulmonary infection
- Then may disseminated to other organ
- Caused by:
 - Primary pathogens
 - Opportunistic pathogens



Fungal Identification: Microscopy

- 20 % KOH in water
- Gram stain
- India ink
- Calcoflour white (Electron Microscope)
- Giemsa staining

Fungal Identification: Culture

- Blood agar
- Malt agar
- Glucose peptone agar (Sabouraud's)
 - Chloramphenicol and Cyclohexamide
- @ 28 °C +/- 37 °C
- Yeast 2-3 days
- Dermatophytes 1-2 weeks
- Common Moulds < 1 week
- Cryptococcus up to 6 weeks

Fungal Identification: Other tests

- Histology
- Serology
 - ELISA
 - Immunodiffusion
- Molecular biology
 - PCR

Treatment

- Most antifungal agent are for topical use
- Few administrated systemically

Useful Properties of Fungi



Source of food
e.g. mushrooms



Fermentation - Production of
alcohol, bread, cheese
e.g. *Sacchromyces* spps



Antibiotic production
e.g. Penicillin from
Penicillium notatum

Useful Properties of Fungi



Photos: Teri Robert

Ergot from *Claviceps purpurea*, used to induce uterine contractions



Vaccines for Hepatitis B – *Sacchromyces cerevisiae*