# Morphology of fungi

# Disclaimer

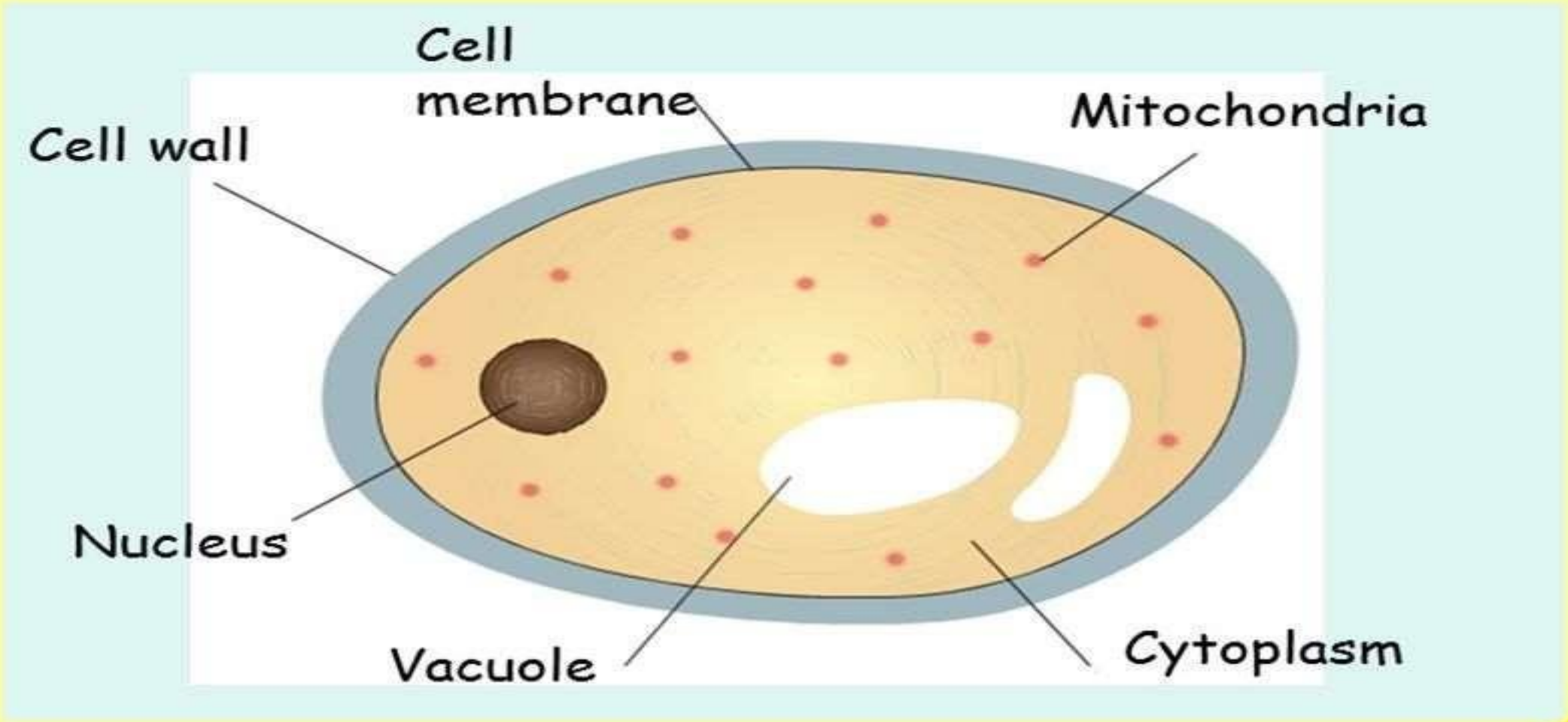
All the content material provided here is only for teaching purpose.

# Introduction

- ***Mykes*** (Greek word) : Mushroom
- Fungi are eukaryotic protista; differ from bacteria and other prokaryotes.

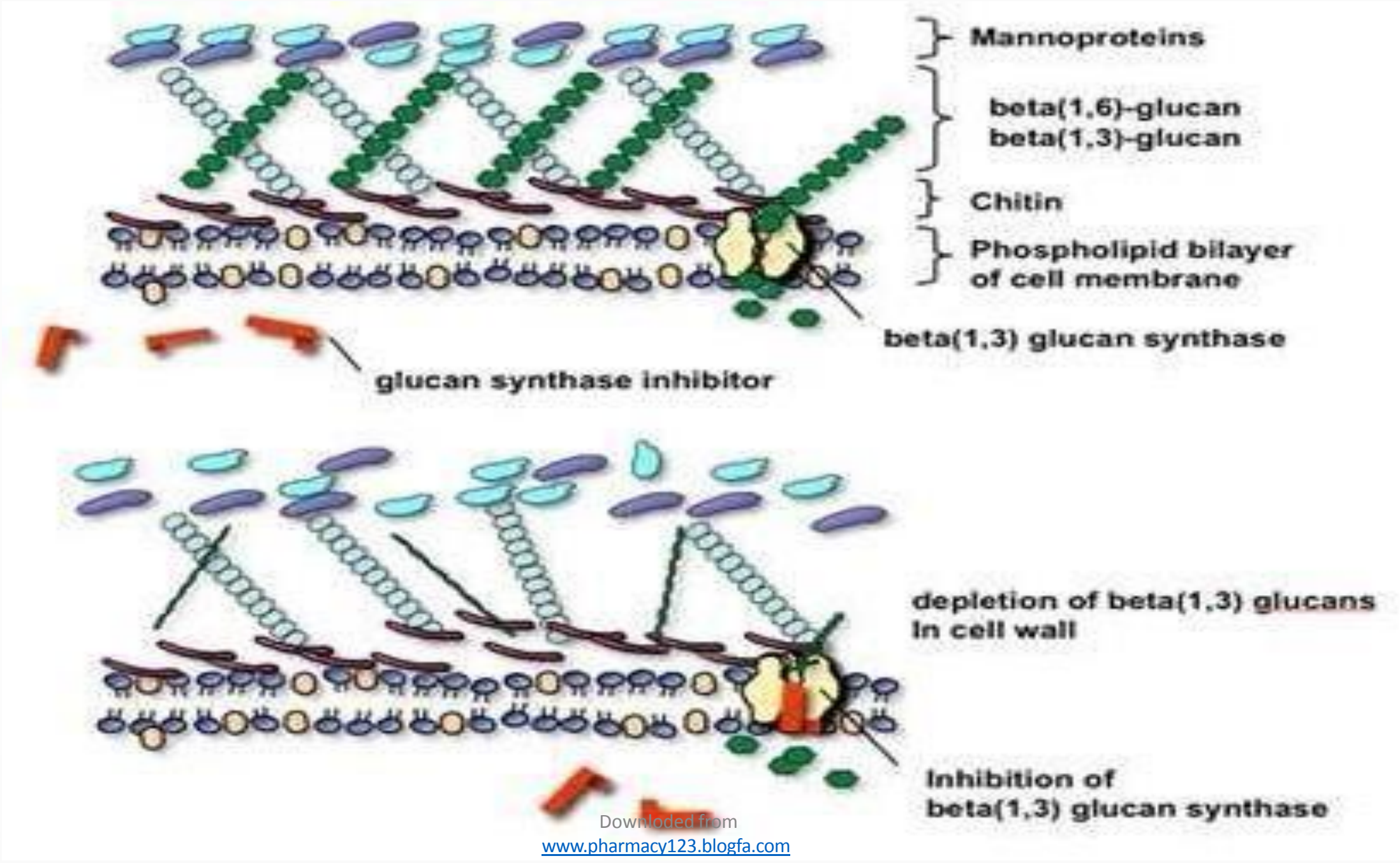
1. Cell walls containing **chitin** (rigidity & support), mannan & other polysaccharides
2. Cytoplasmic membrane contains ergosterols
3. Possess true nuclei with nuclear membrane & paired chromosomes
4. Cytoplasmic contents include mitochondria and endoplasmic reticulum
5. Divide asexually, sexually or by both
6. Unicellular or multicellular
7. Most fungi are obligate or facultative aerobes

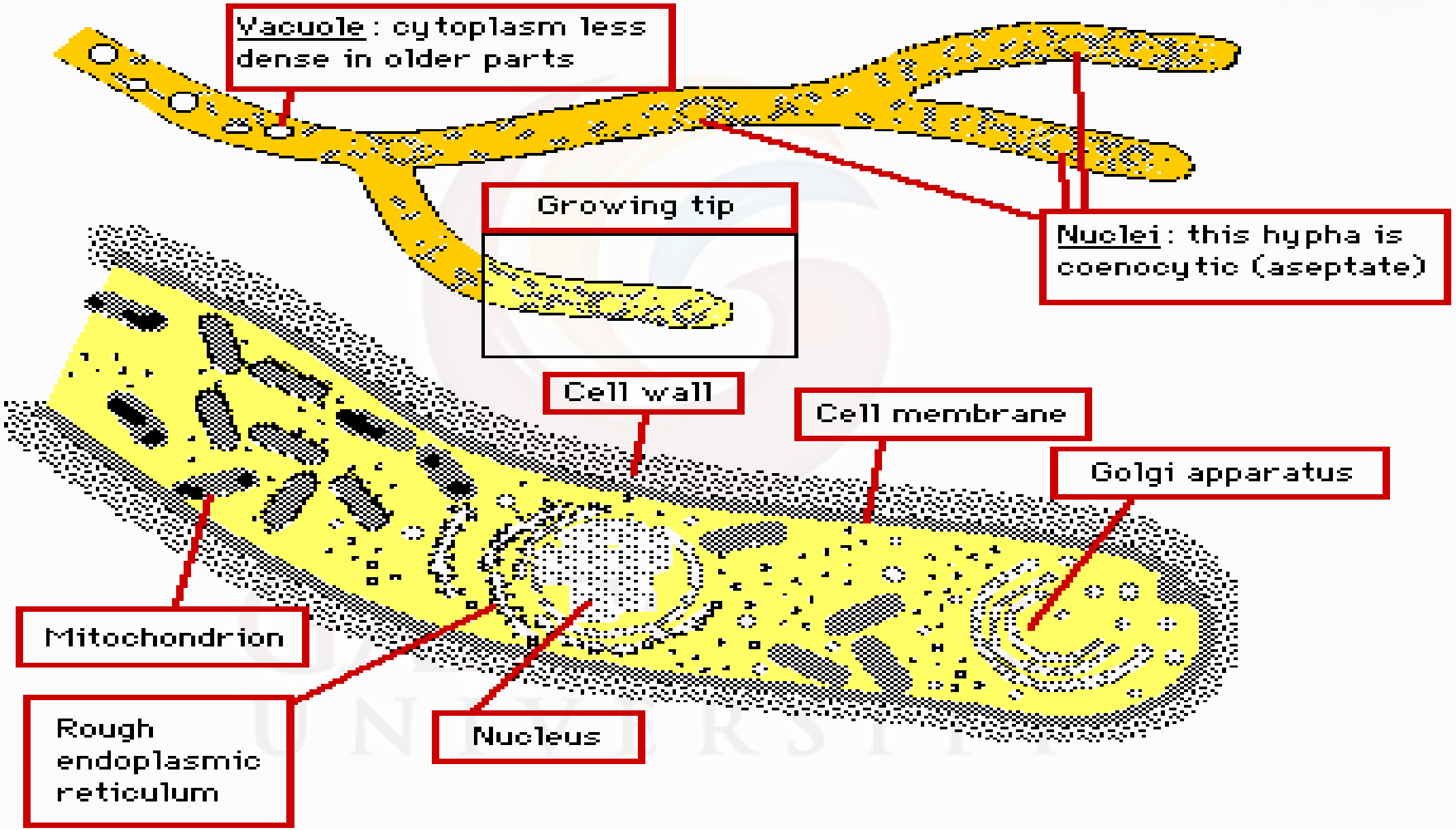
# Typical fungal cell



# Difference from Bacteria

- Cell wall consists of chitin not peptidoglycan like bacteria
- Thus fungi are resistant to antibiotics as penicillins
- Chitin is a polysaccharide composed of long chain of n- acetylglucosamine.
- Also the fungal cell wall contain other polysaccharide, β- glucan, which is the *site of action of some antifungal drugs.*
- Cell membrane consist of ergosterol rather than cholesterol like bacterial cell membrane
- Ergosterol is the site of action of antifungal drugs, amphotericin B & azole group

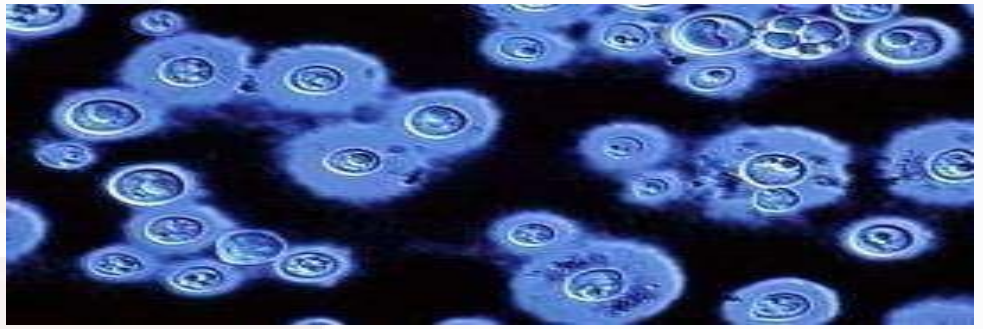



Vacuole: cytoplasm less dense in older parts
Growing tip
Nuclei: this hypha is coenocytic (aseptate)
Cell wall
Cell membrane
Golgi apparatus
Mitochondrion
Rough endoplasmic reticulum
Nucleus

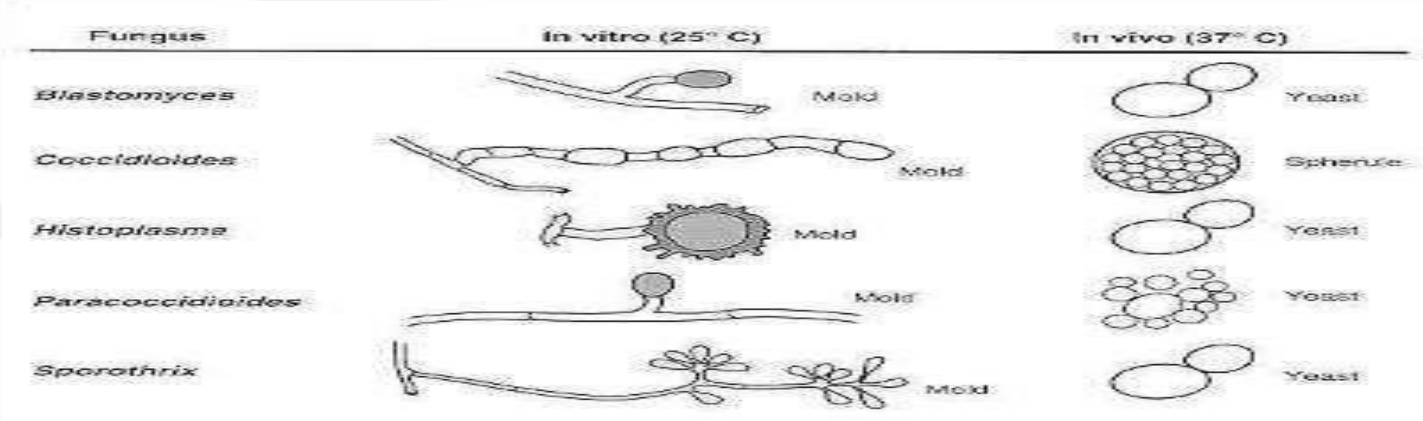
# Fungal Morphology

## Molds

## Yeasts



Many pathogenic fungi are **dimorphic**, forming hyphae at ambient temperatures but yeasts at body temperature.

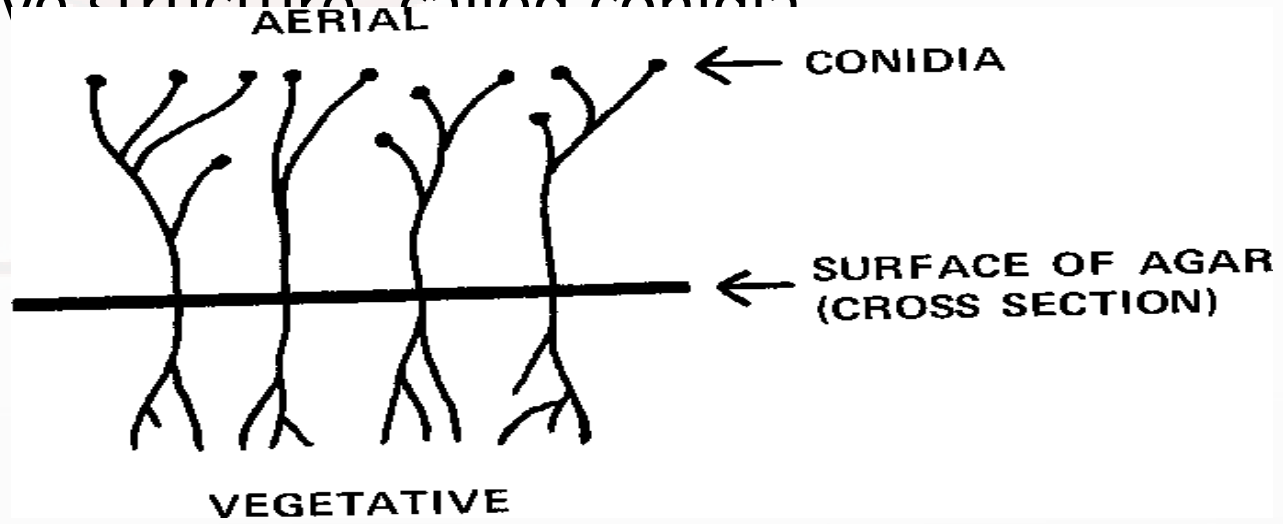


# Structure of Fungus

- **Yeast** :- Unicellular budding yeast
- **Hypha** :- Elongation of apical cell produces a tubular, thread like structure called hypha. Hyphae may be septate or nonseptate.
- **Mycelium** :- Tangled mass of hyphae is called mycelium. Fungi producing mycelia are called molds or filamentous fungi.

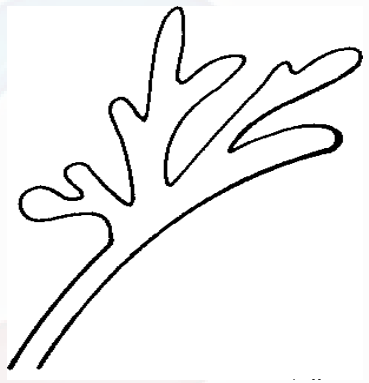
# Mycelium

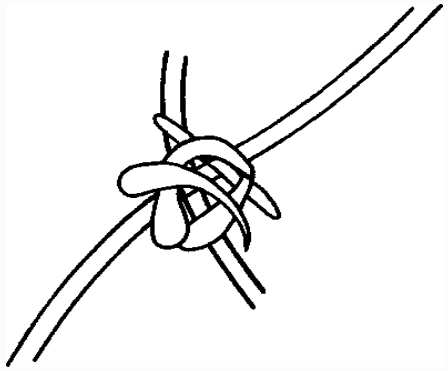
- Mass of branching intertwined hyphae
  a. Vegetative Mycelium- hyphae that penetrate the supporting medium and absorb nutrients
  b. Aerial Mycelium- hyphae projects above the surface of medium and bearr the reproductive structure called conidia

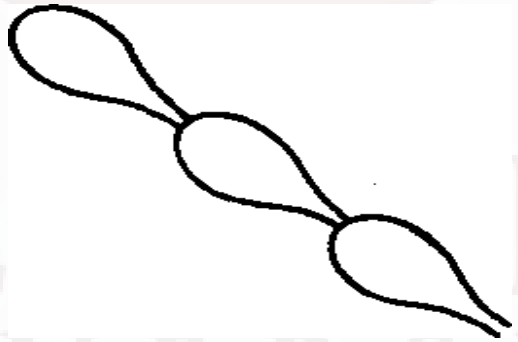


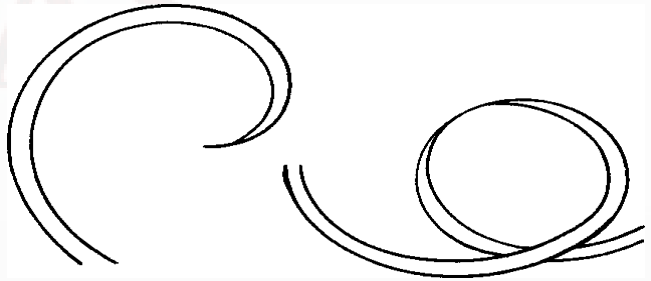
# Vegetative types

- Favic chandeliers
- Nodular organs
- Racquet hyphae
- Spiral hyphae









# Classification of fungi

1. Morphological classification

2. Systematic classification

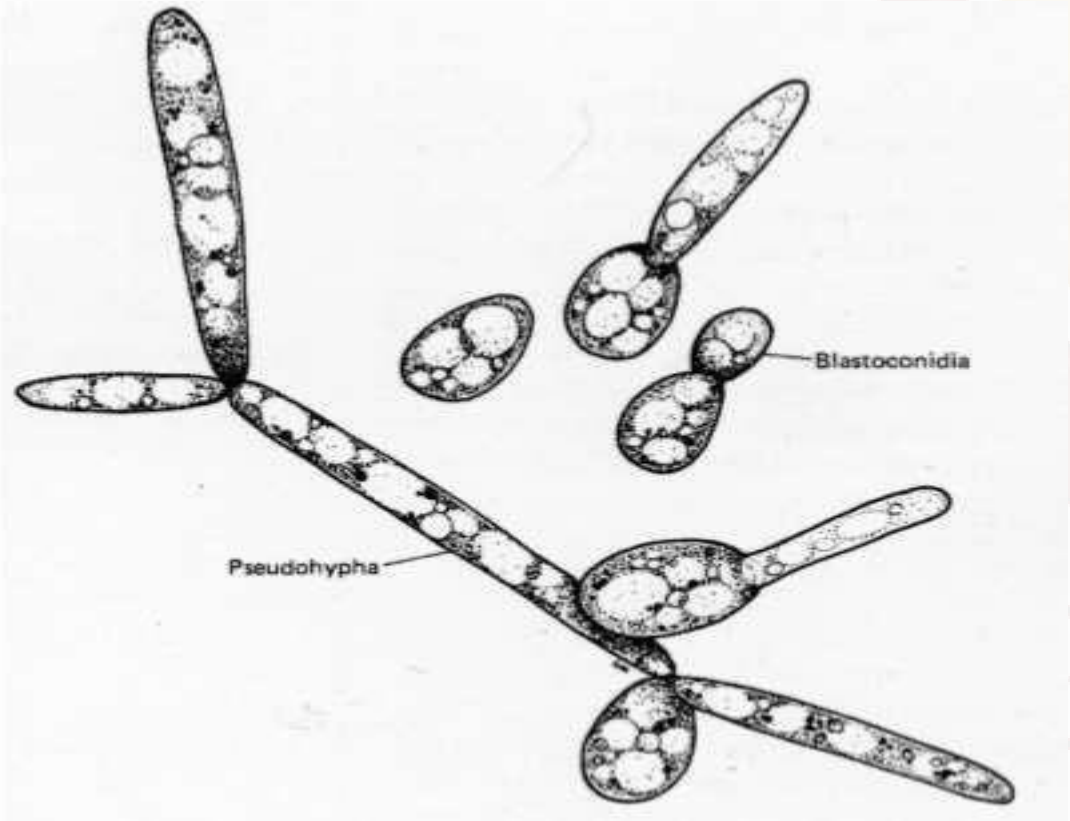
# Morphological classification

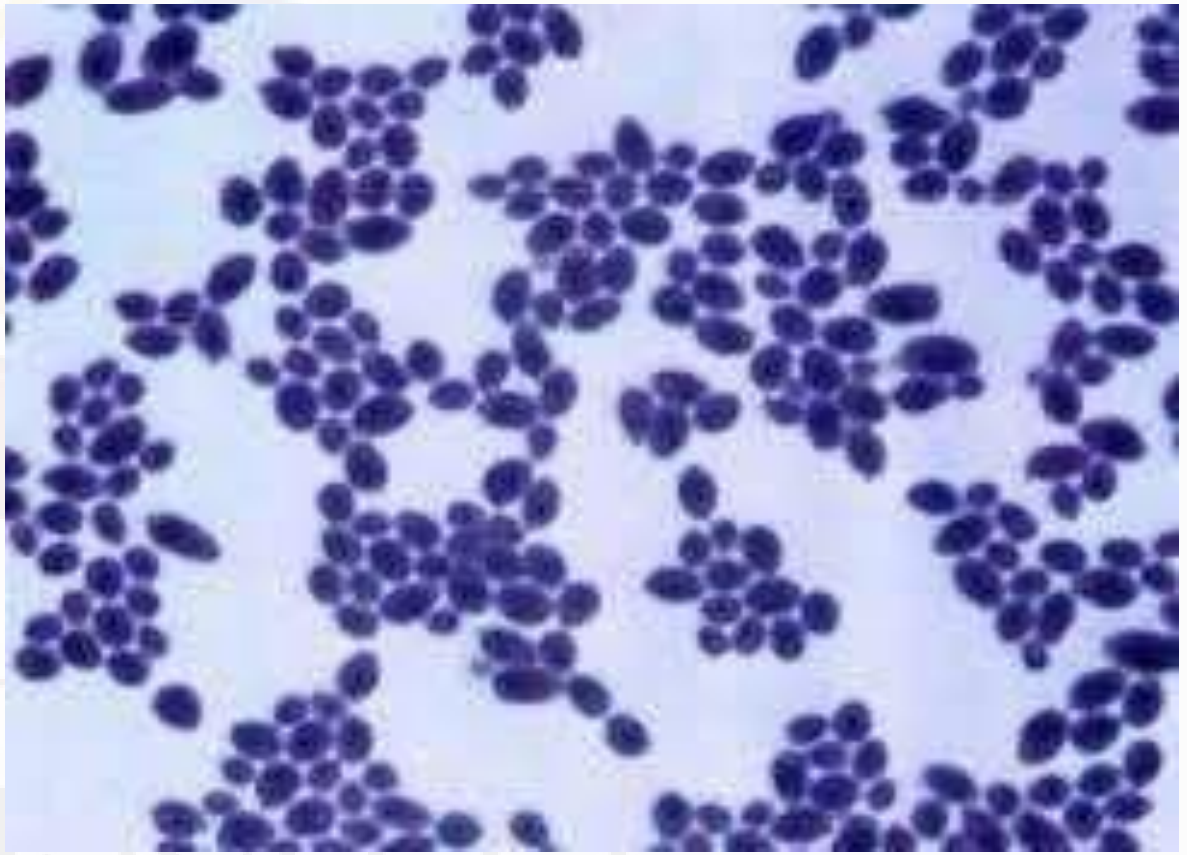
1. Yeasts
2. Yeast-like fungi
3. Filamentous fungi (molds)
4. Dimorphic fungi

# Yeasts

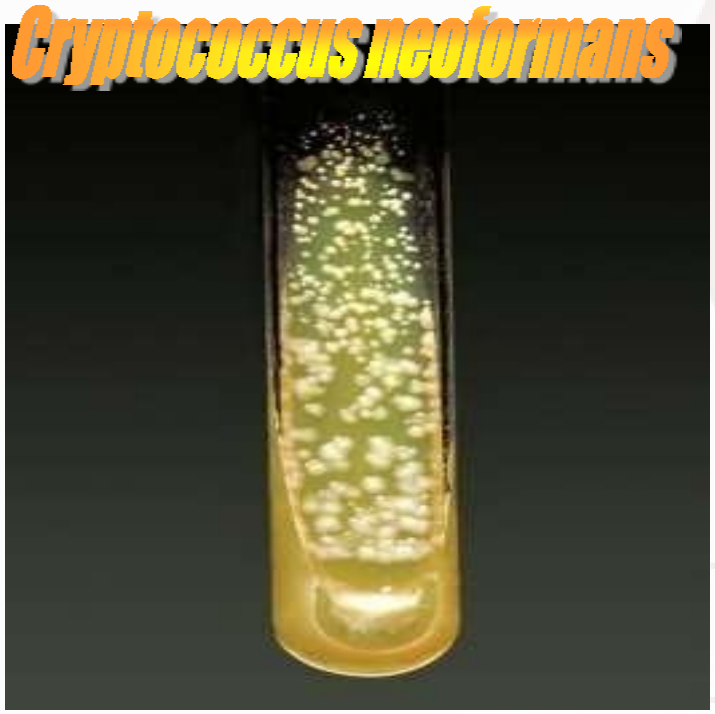
- These occur in the form of round or oval bodies which reproduce by an asexual process called budding in which the cell develops a protuberance which enlarges and eventually separates from the parent cell.
- Yeasts colonies resemble bacterial colonies in appearance and in consistency
- Examples are- *Saccharomyces cerevisiae, Cryptococcus neoformans*

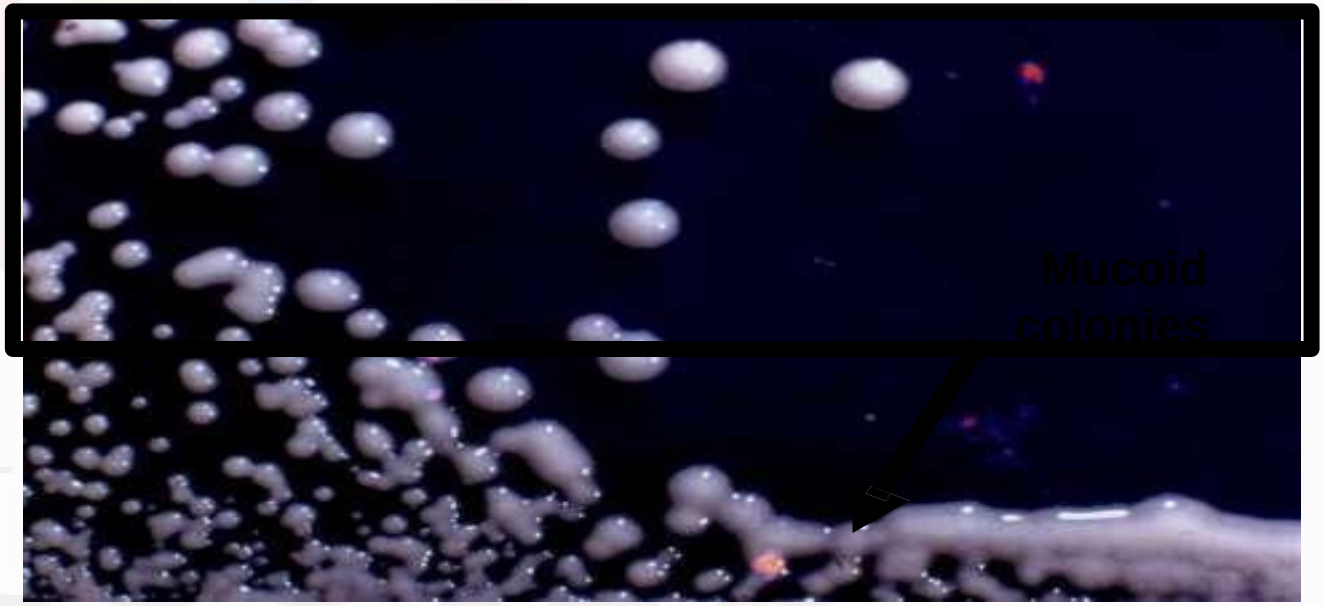
# Yeast form



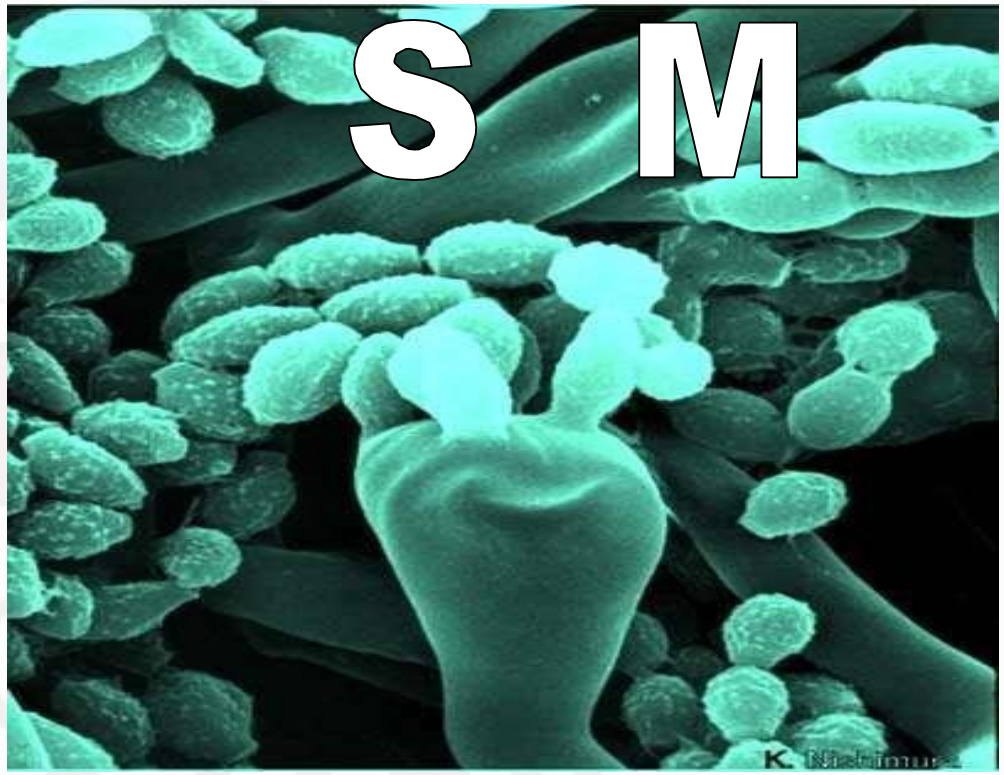
# Yeast colonies



# *Cryptococcus neoformans*

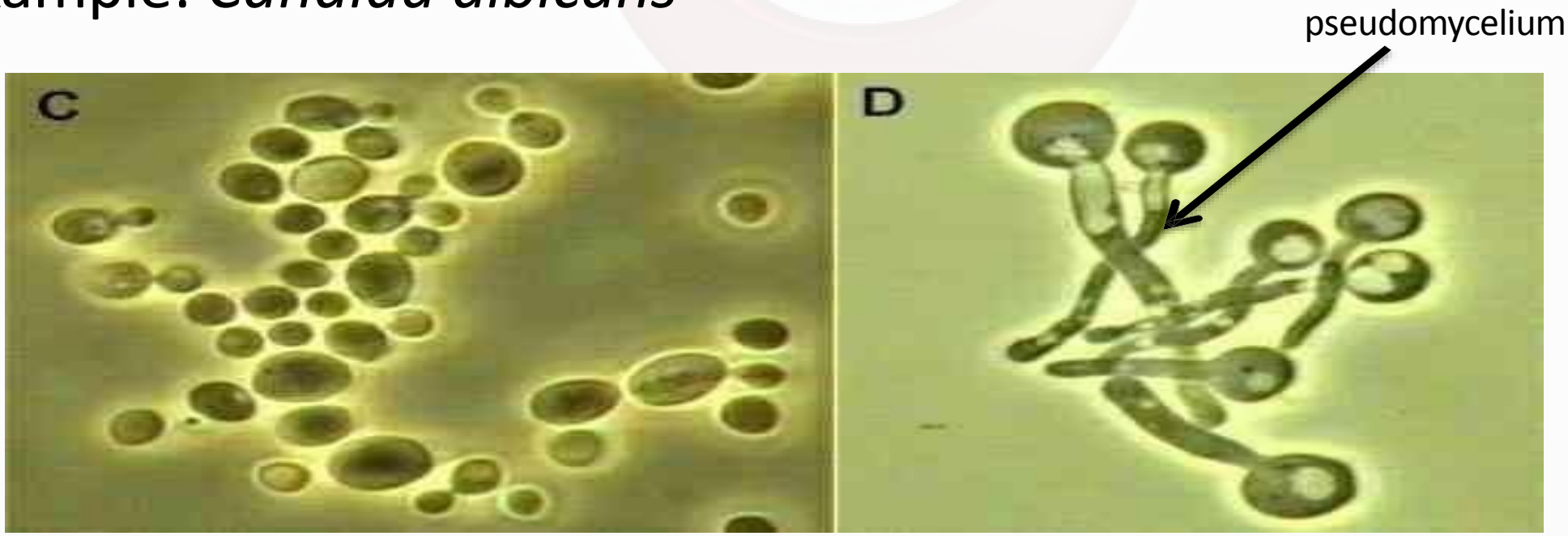




# Yeast-Like

- Yeast like fungi grow partly as yeast and partly as elongated cells resembling hyphae. The latter form a pseudomycelium.

Example: *Candida albicans*



# Molds or Filamentous Fungi

- The basic morphological elements of filamentous fungi are long branching filaments or hyphae, which intertwine to produce a mass of filaments or mycelium
- Colonies are strongly adherent to the medium and unlike most bacterial colonies cannot be emulsified in water
- The surface of these colonies may be velvety, powdery, or may show a cottony aerial mycelium.
- Reproduce by the formation of different types of spores
- Example: *Dermatophytes, Aspergillus, Penicillium, Mucor, Rhizopus*

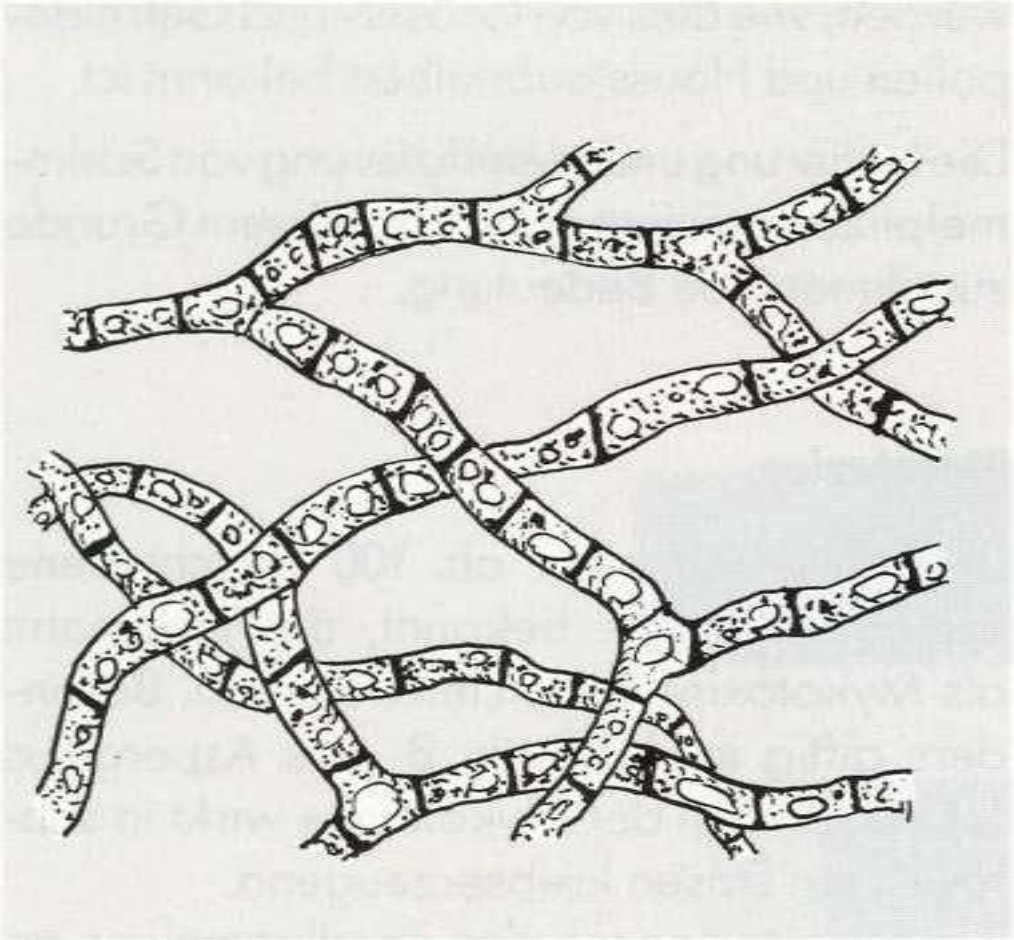


Abb. 47: Septiertes Myzel

mycelium: septate

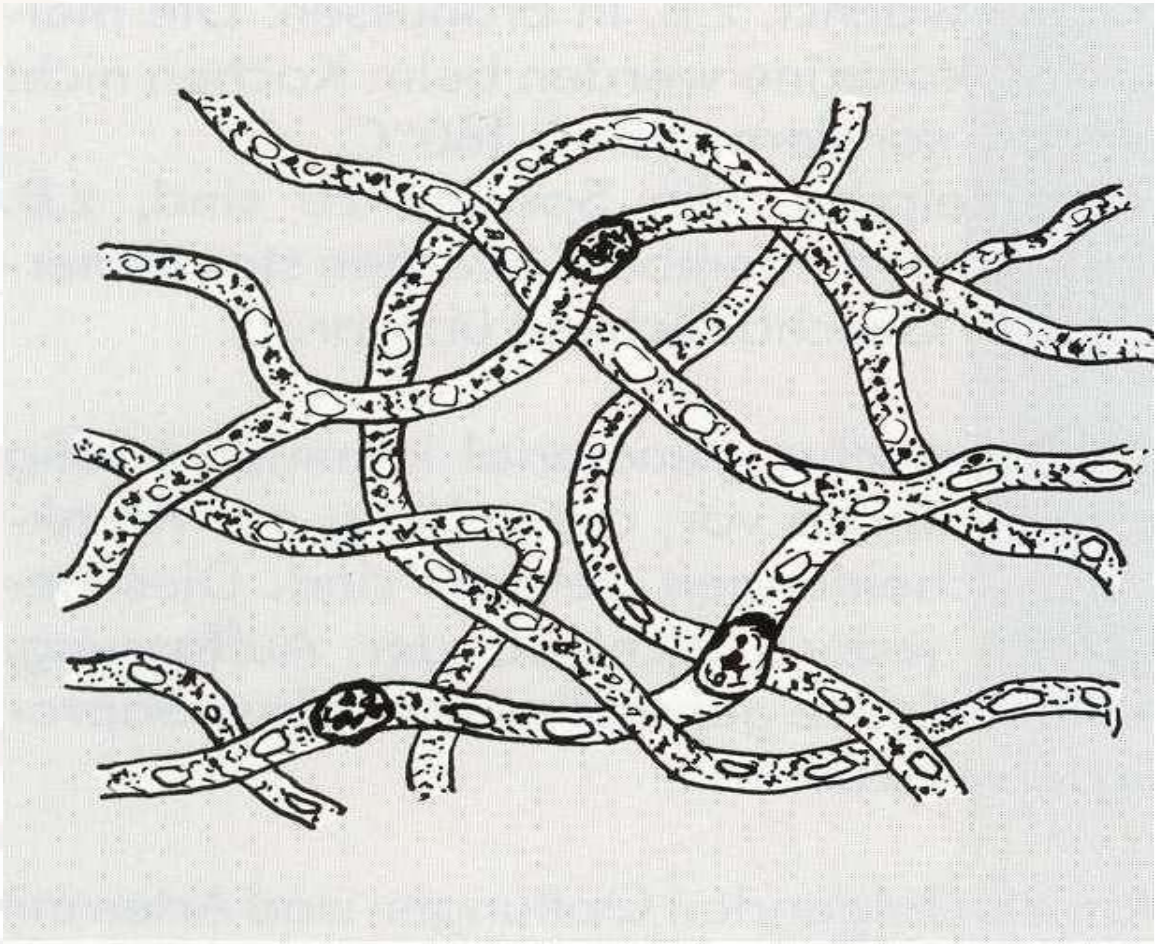
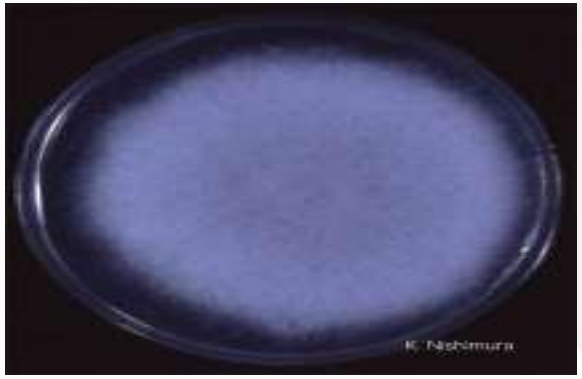
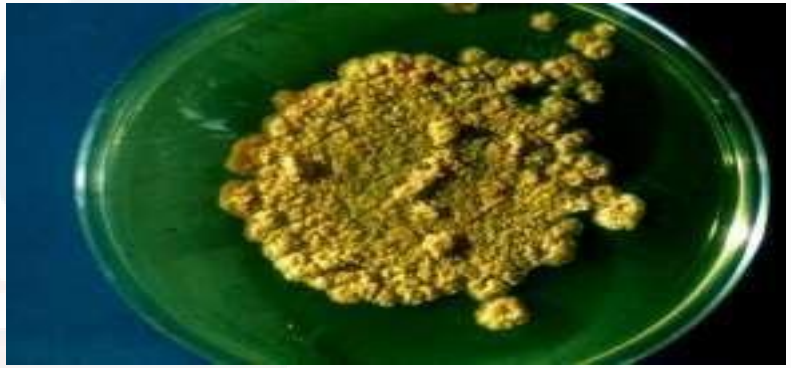


Abb. 48: Unseptiertes Myzel

mycelium: non septate

# Colony Morphology



# Dimorphic Fungi

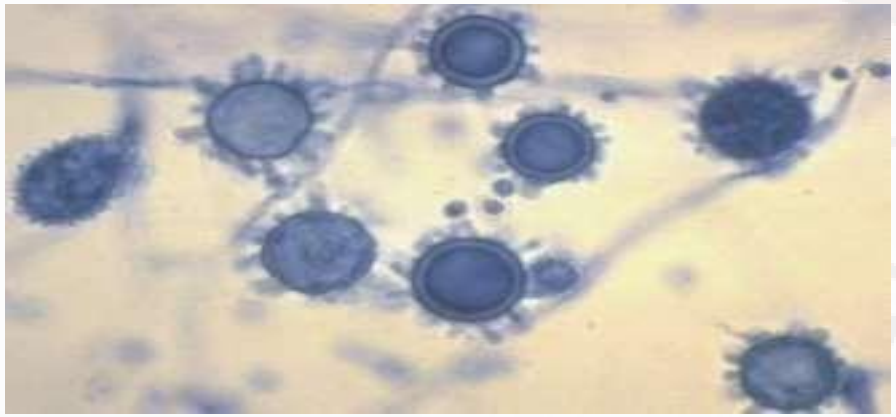
- These are fungi which exhibit a yeast form in the host tissue and in vitro at $37^0$C on enriched media and mycelial form in vitro at $25^0$C

Examples:

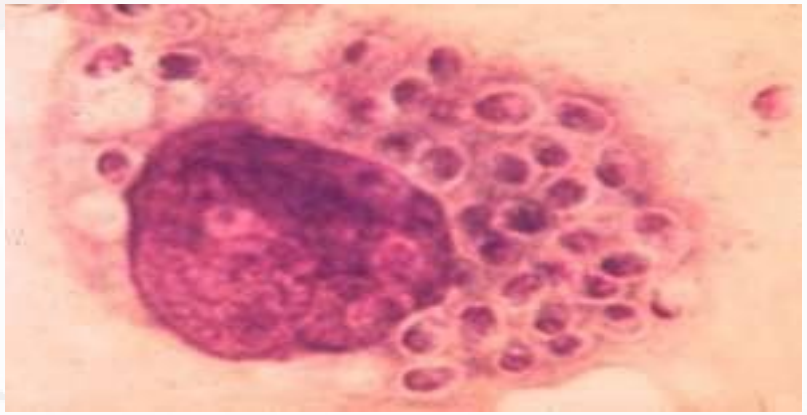
*Histoplasma capsulatum* *Blastomyces dermatitidis* *Coccidioides immitis* *Paracoccidoides brasiliesis* *Penicillium marneffei* *Sporothrix schenckii*

# *Histoplasma capsulatum* - Dimorphism

- Filamentous mold in environment
  - Thin septate hyphae, microconidia, and tuberculate macroconidia (8-14 µm)
- Budding yeast (2-4 µm) in tissue
  - Dimorphic transition is thermally dependent and reversible (25°C ↔ 37°C).



Hyphae, micro- and macroconidia



Yeast within histiocyte

# Systematic classification

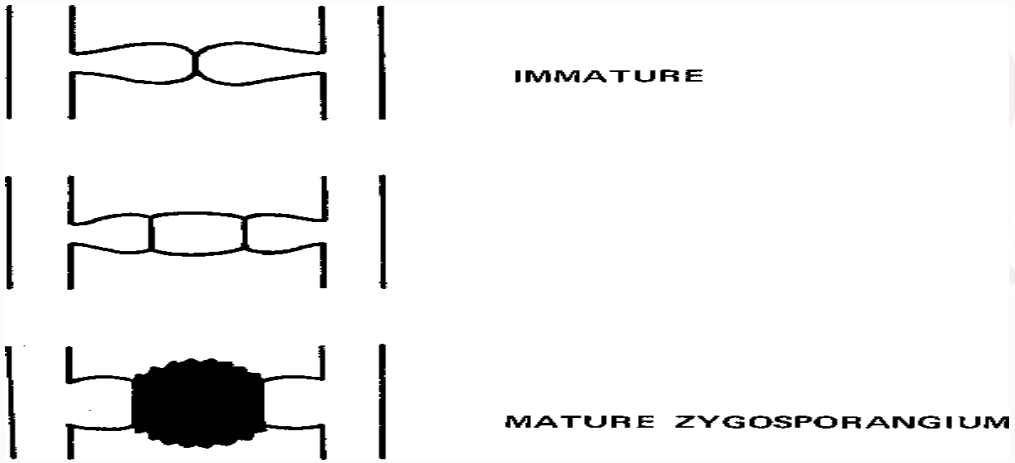
- Based on sexual spores formation: 4 classes

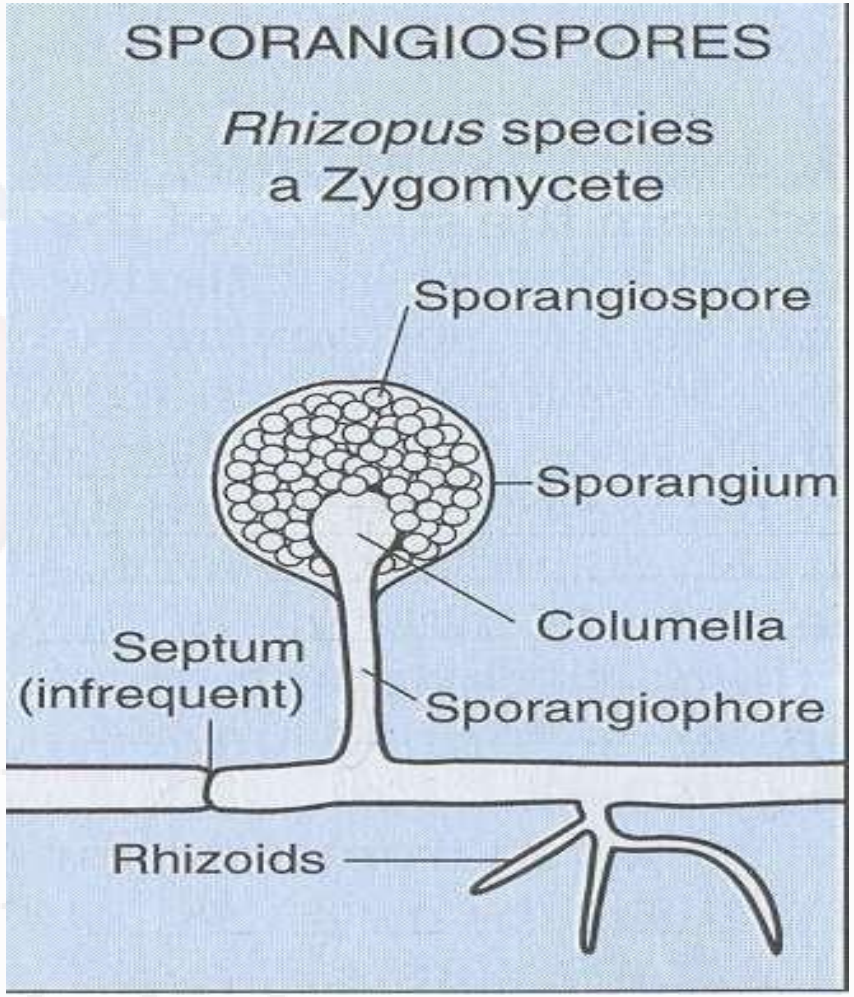
1. Zygomycetes
2. Ascomycetes
3. Basidiomycetes

reproduce sexually

4. Deuteromycetes (fungi imperfectii)

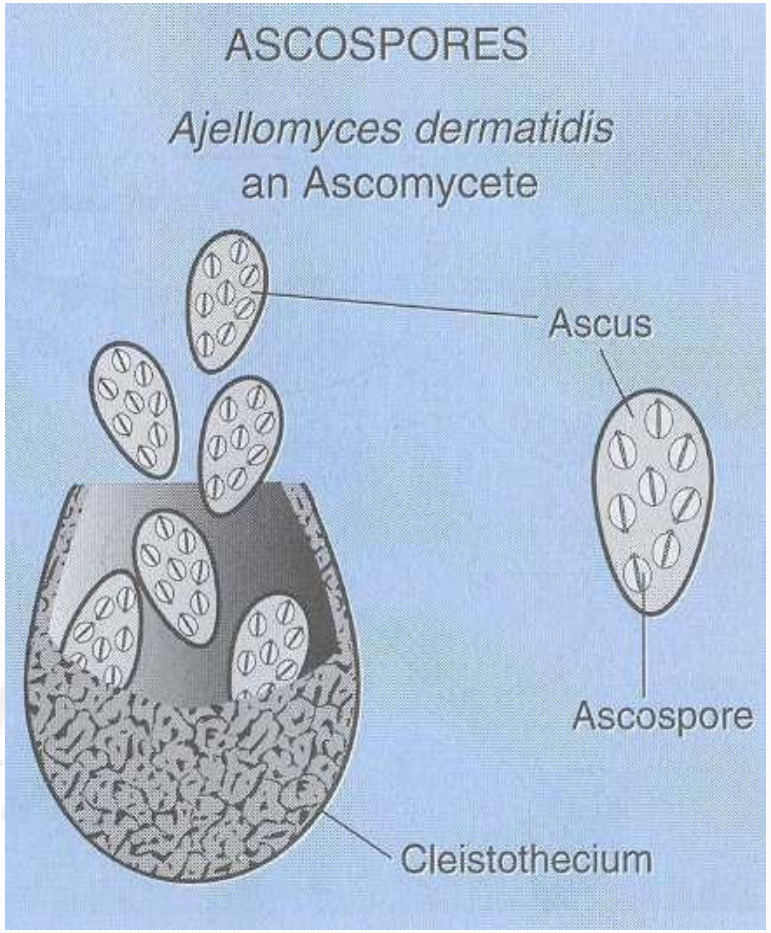
- Zygomycetes
  Zygote fungi
- Broad, nonseptate hyphae
- Asexual spores - **Sporangiospores:** present within a swollen sac- like structure called **Sporangium**
- **Examples:** Rhizopus, Absidia, Mucor



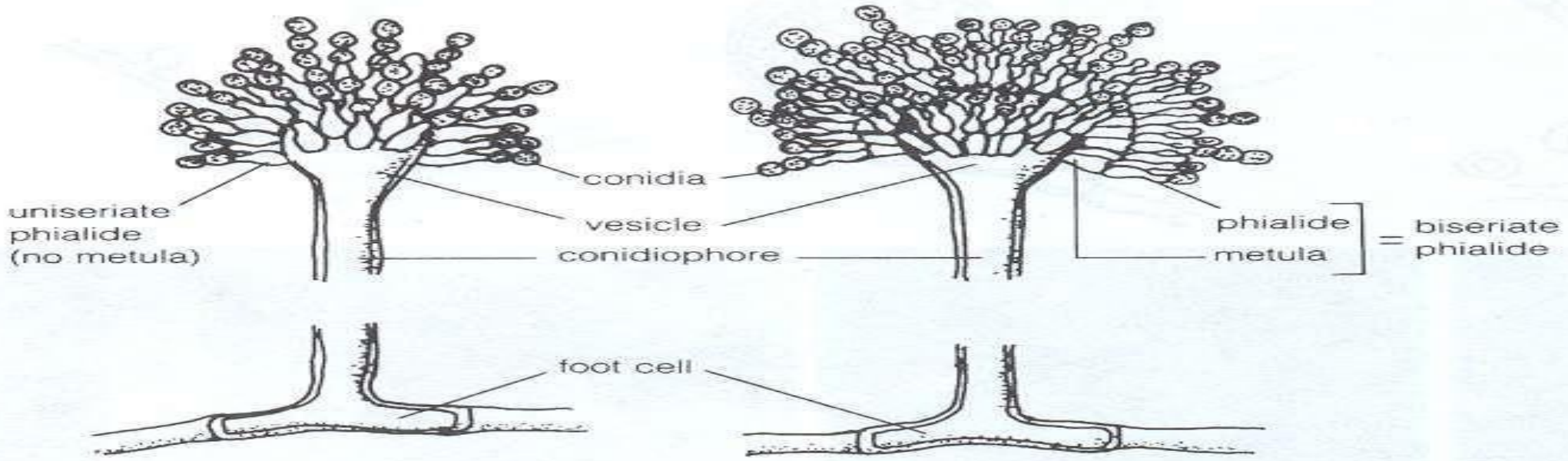
# Ascomycetes

- Sexual spores called ascospores are present within a sac like structure called Ascus.
- Each ascus has 4 to 8 ascospores
- Includes both yeasts and filamentous fungi



# Ascomycetes

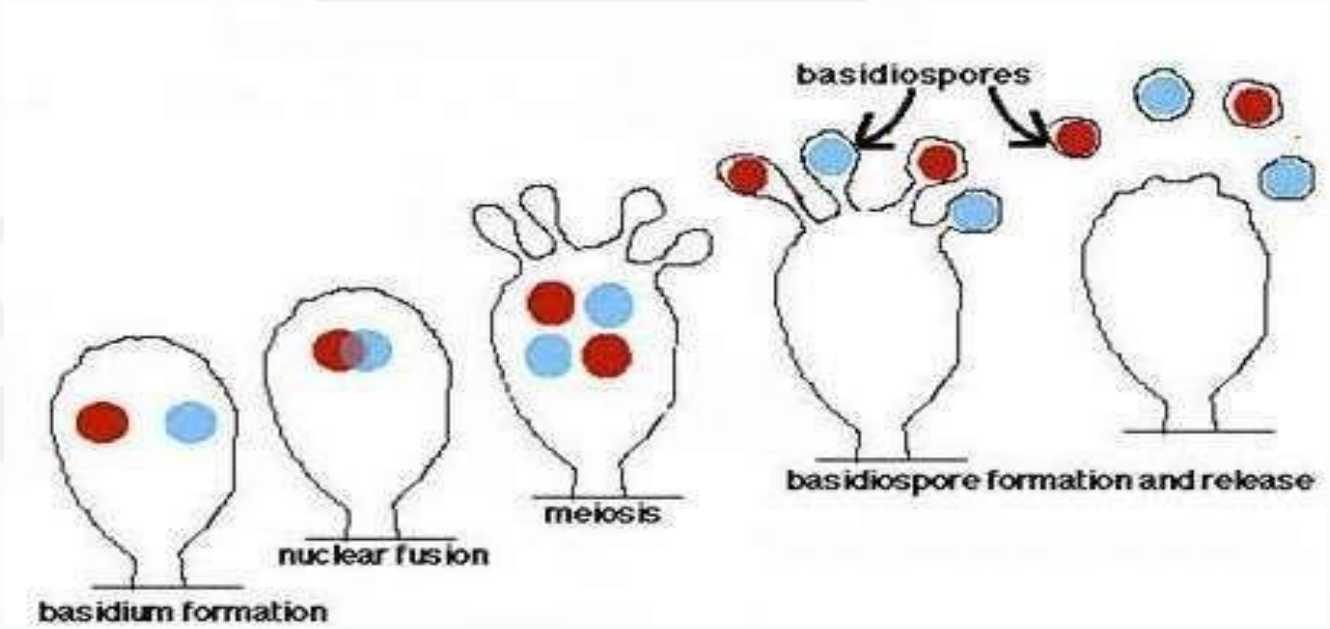
- Narrow, septate hyphae
- **Asexual spores are called conidia borne on conidiophore**
- Examples: Penicillium, Aspergillus



# Basidiomycetes

Sexual fusion results in the formation of a club shaped organ called base or basidium which bearspores called basidiospores

Examples: *Cryptococcus neoformans*, mushrooms



# Deuteromycetes or Fungi imperfectii

- Group of fungi whose sexual phases are not identified
- Grow as molds as well as yeasts
- Most fungi of medical importance belong to this class
- Examples: *Coccidioides immitis*, *Paracoccidioides brasiliensis*, *Candida albicans*

# Reproduction and sporulation

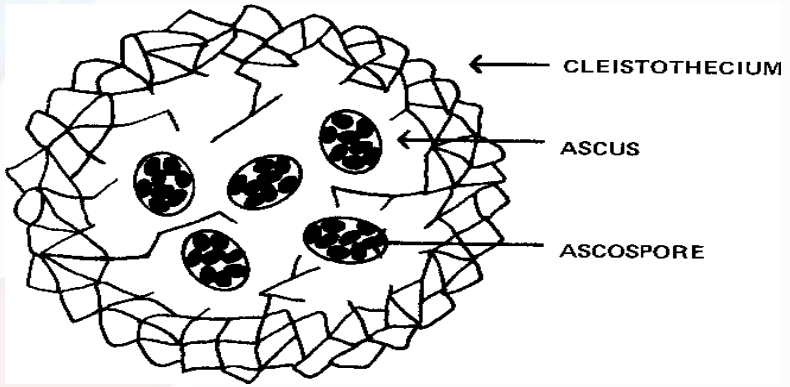
Types of fungal spores

1. Sexual spores

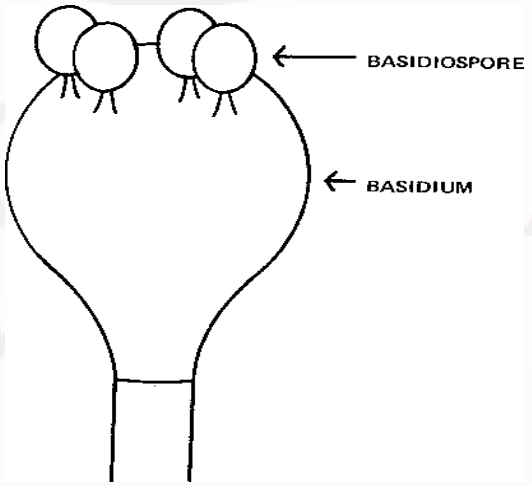
2. Asexual spores

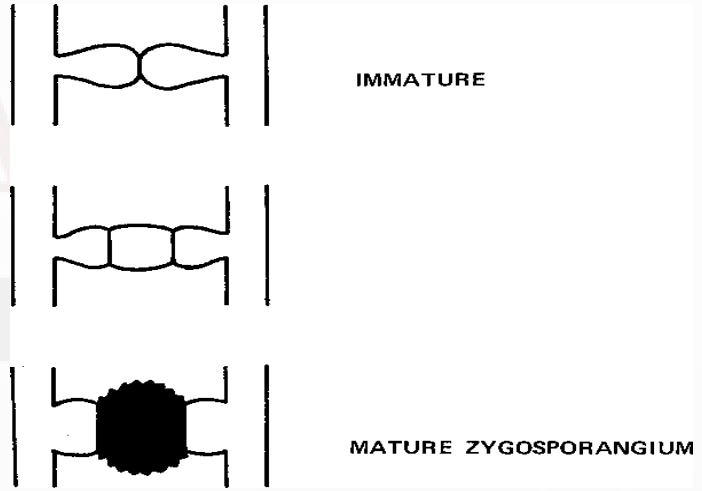
# Sexual spores

- Sexual spore is formed by fusion of cells and meiosis as in all forms of higher life
- Ascospores
  - Ascus
  - Ascocarp




- Basidiospores
- Zygospores



# Asexual spores

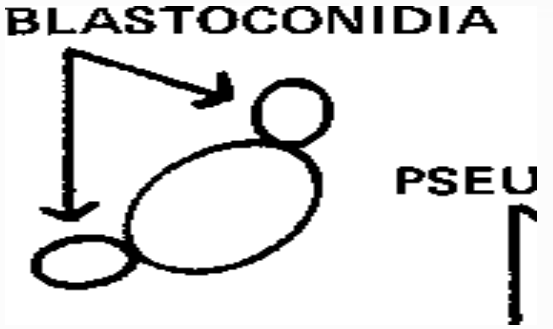
- These spores are produced by mitosis

1. Vegetative spores

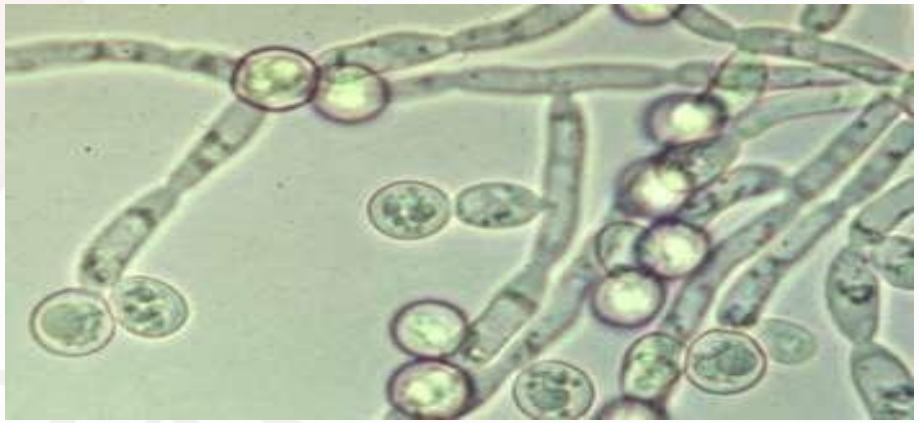
2. Aerial spores

# Vegetative spores

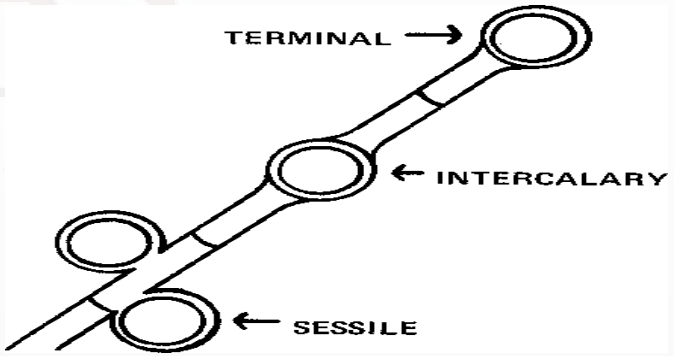
- **Blastospores:** These are formed by budding from parent cell, as in yeasts




- **Arthrospores –** formed by segmentation & condensation of hyphae

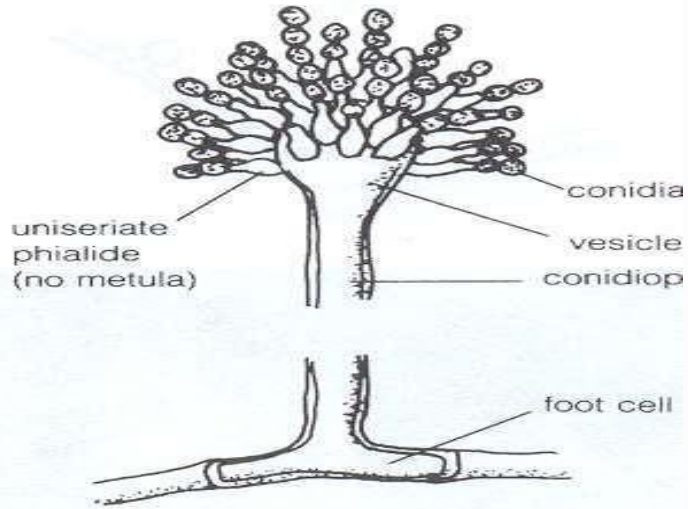


- **Chlamydospores –** thick walled resting spores developed by rounding up and thickening of hyphal segments.



# Aerial spores

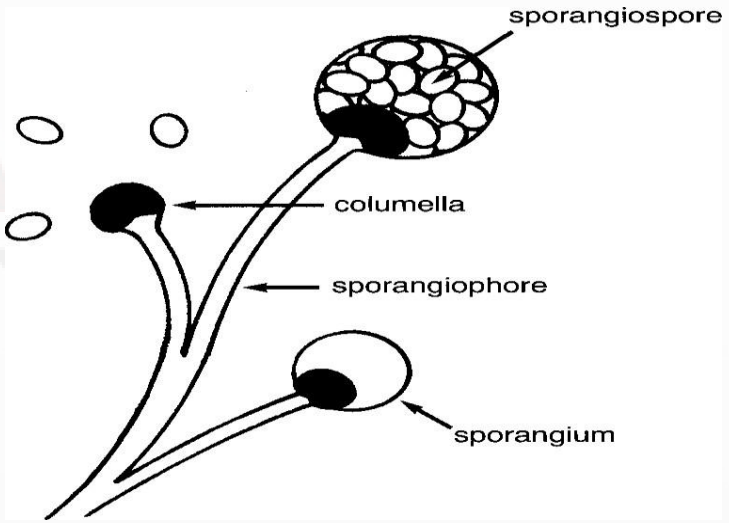
1. Conidiospores
   Spores borne externally on sides or tips of hyphae are called conidiospores or simply conidia




2. Microconidia- conidia are small and single

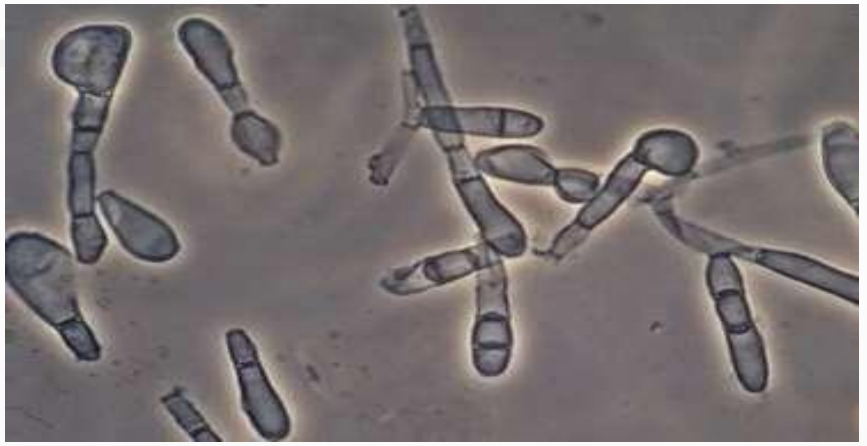
3. Macroconidia- conidia are large

4. Sporangiospores- spores forms Within the sporangiophores.

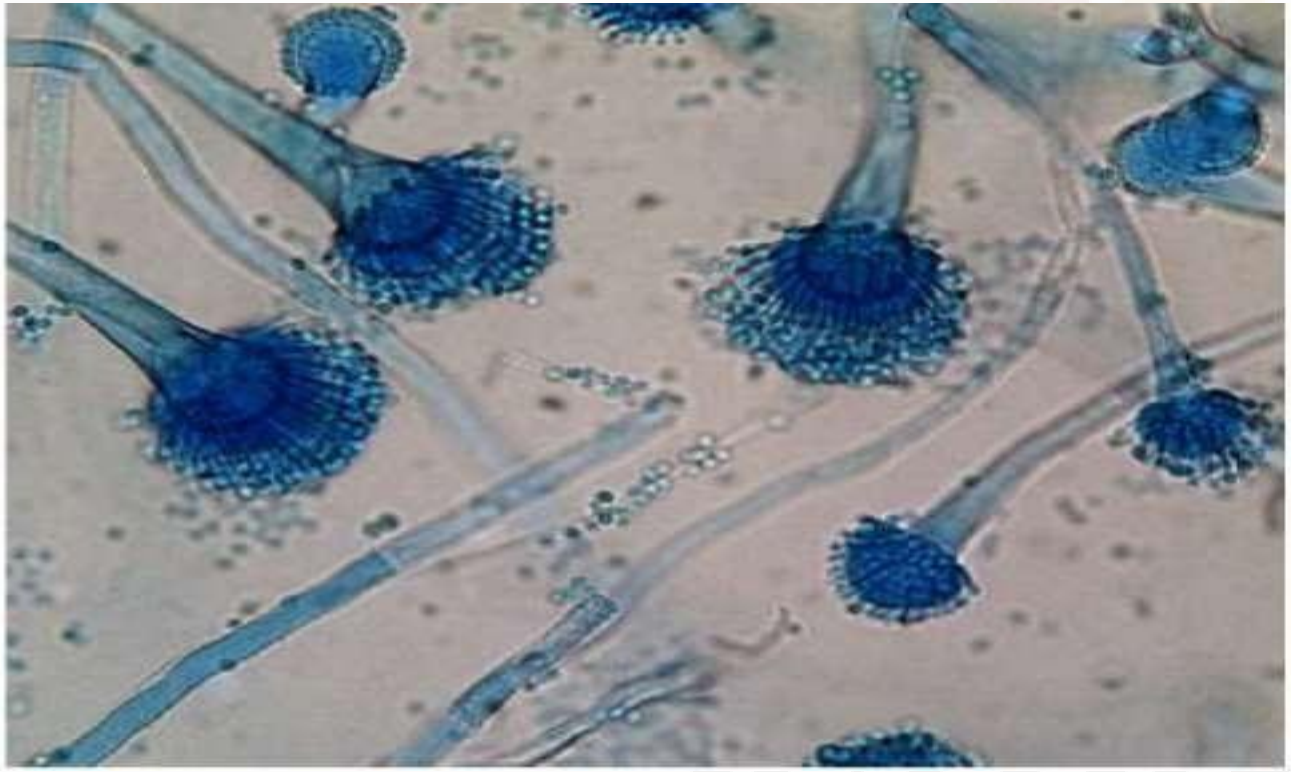


- Microconidia - Small, single celled

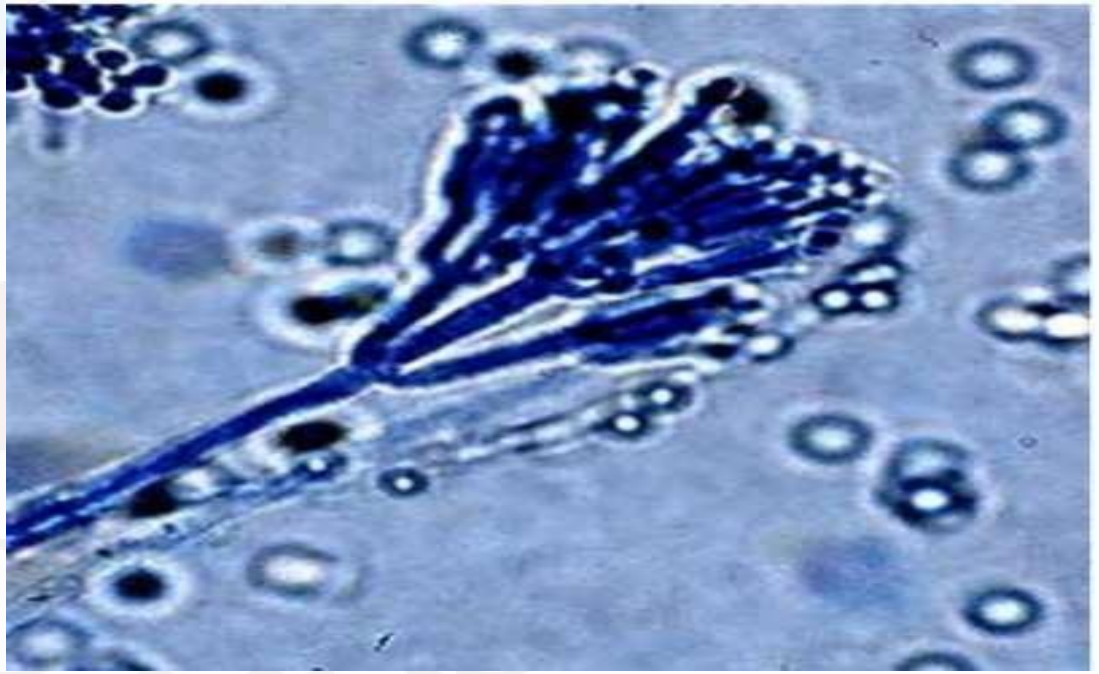
- Macroconidia – Large and septate and are often multicellular



# Pictures of fungi on LPCB mount



*Aspergillus*



*Penicillium*