General Mycology

General Microbiology
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General Mycology

- Mycology is the study of fungi.
- Mycosis is the diseases caused by fungi.

❖ **General characters of fungi:**

1- **Most of them** are saprophyets in soil (consume dead & decaying matter) and **few of them** are parasitic causing diseases in man & animals.

2- They are **eukaryotic cells** (has true nucleus, endoplasmic reticulum & mitochondria).

3- Have cell wall consisted primarily of chitin. So they resist penicillin and cephalosporins that inhibit the synthesis of cell wall peptidoglycan.

- ✓ Chitin is **a large, structural polysaccharide made from chains of modified glucose**.

4- Their cell membrane contains ergosterol in contrast to human cell membrane which contains cholesterol.

- **Ergosterol is a sterol that resides in the cell membranes of fungi and acts to maintain cell membrane integrity, similar to mammalian cholesterol**.

5- Most of them are obligate aerobes & need carbon for growth so live on decaying organic matter.

Beneficial effects of fungi

1. **The fermentation property is used for the industrial production of alcohol, fats, citric acids.**
2. **Sources of antibiotics such as Penicillin.**
3. **Some fungi are edible (mushrooms).**
4. **Yeasts provide nutritional supplements such as vitamins.**
5. **Some fungi produce Ergot alkaloids that help in inducing uterine contractions, controlling bleeding & treatment of migraine.**
   - **Ergot alkaloids** are potent α-blockers that cause direct smooth muscle contraction.

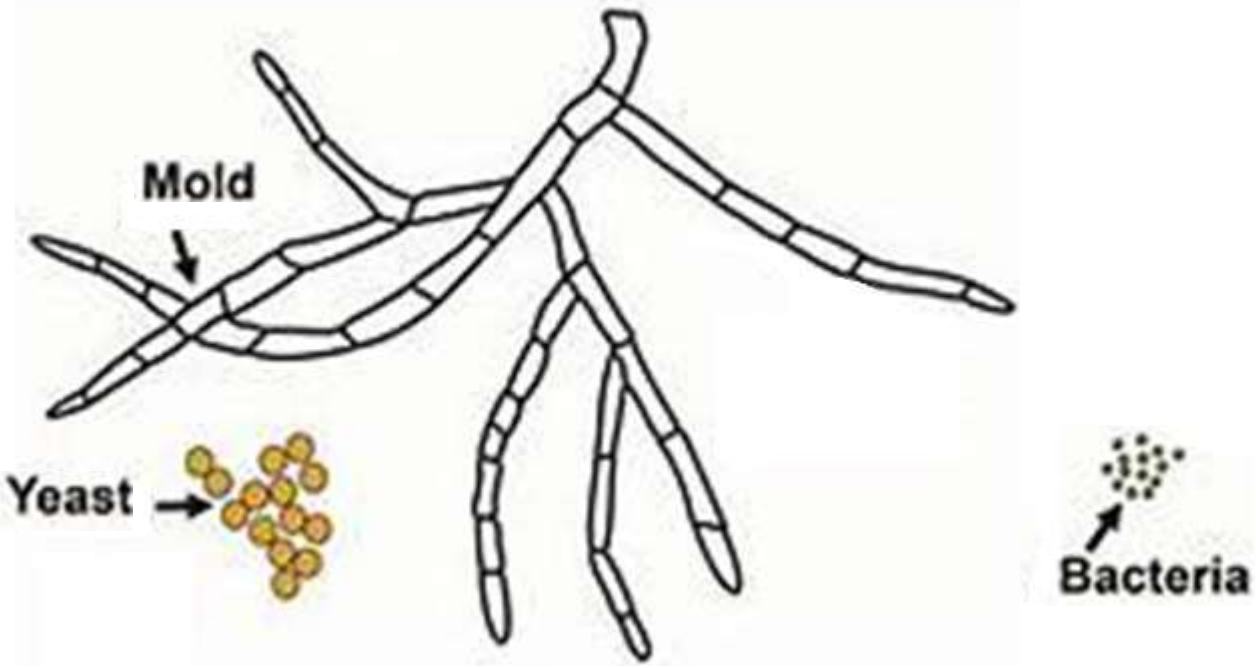
- **Some fungi are used to trap mosquito larvae so help in malaria control.**

Harmful effects of fungi

1. Destruction of food, wood, paper & clothes.
2. Animal & human diseases.
3. Plant diseases.
4. Spoilage of vegetables & cereals.
5. Toxins production.

Fungi, Yeasts, Molds

- A **mold** is a fungus that grows in the form of multicellular filaments called *hyphae*.
- **Yeasts** are fungi that can adopt a single-celled growth habit.



Structure of Fungi

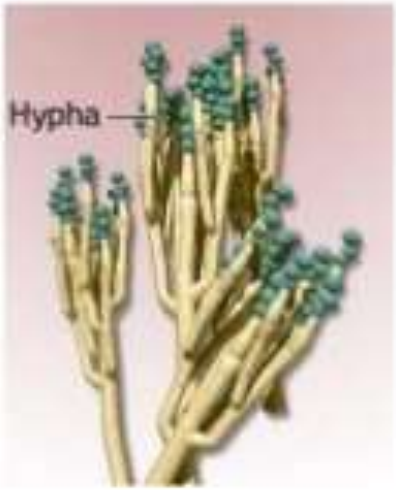
Fungi

Yeast

Yeasts are single-celled forms that reproduce by

Filamentous

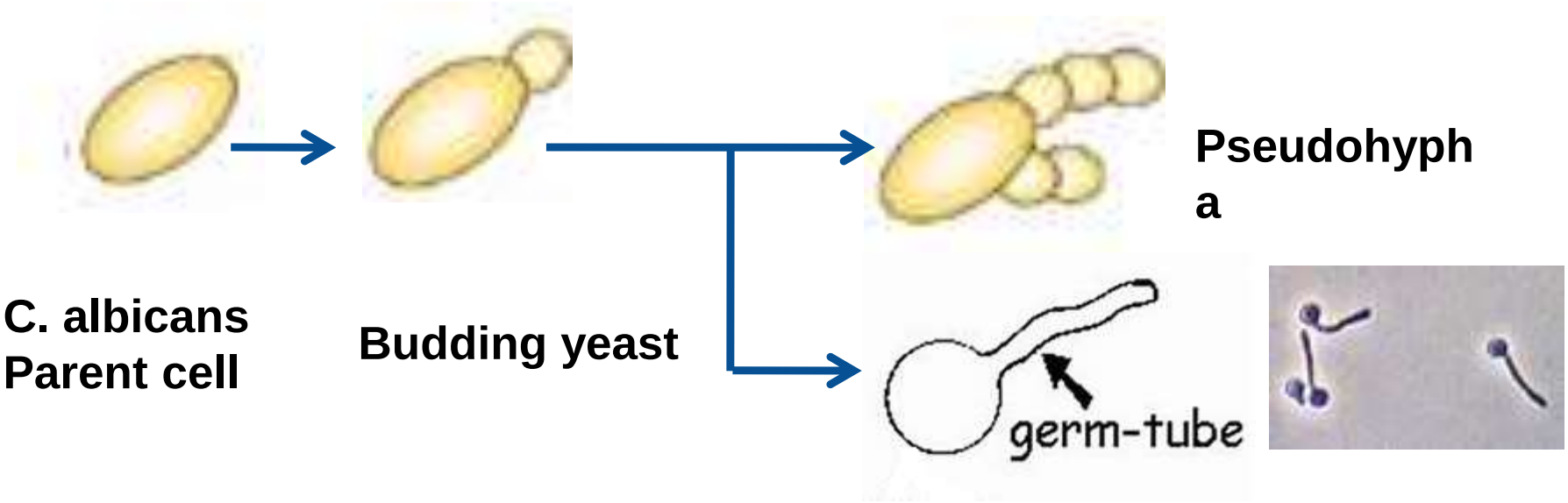
Also called as molds, form multicellular hyphae



Dimorphic

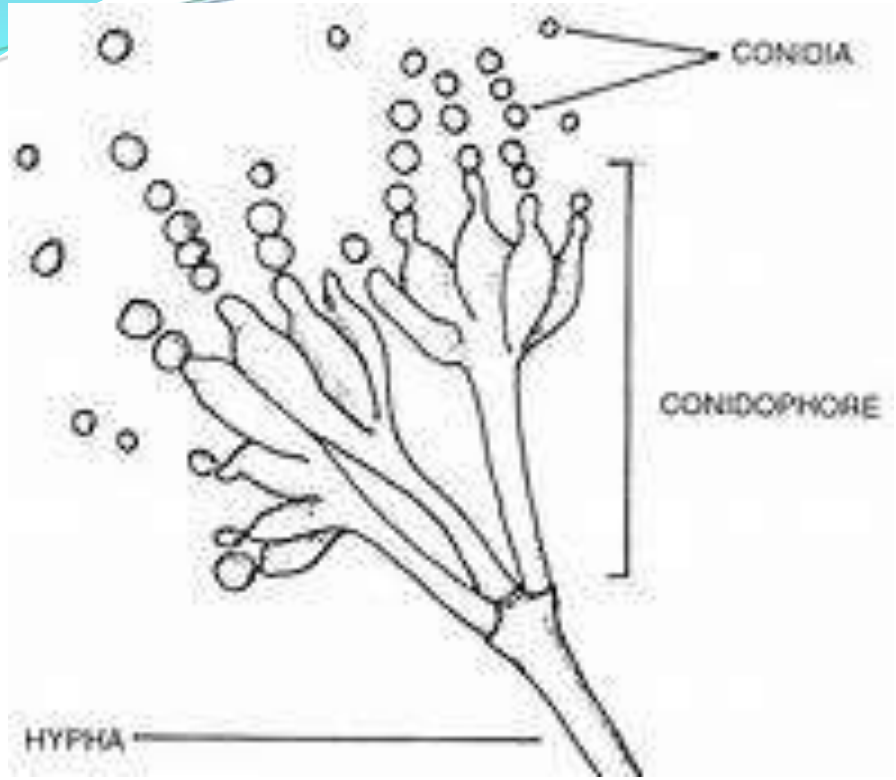
Dimorphic fungi grow as yeasts or spherules in vivo and in vitro at 37°C, but as molds at 25°C.

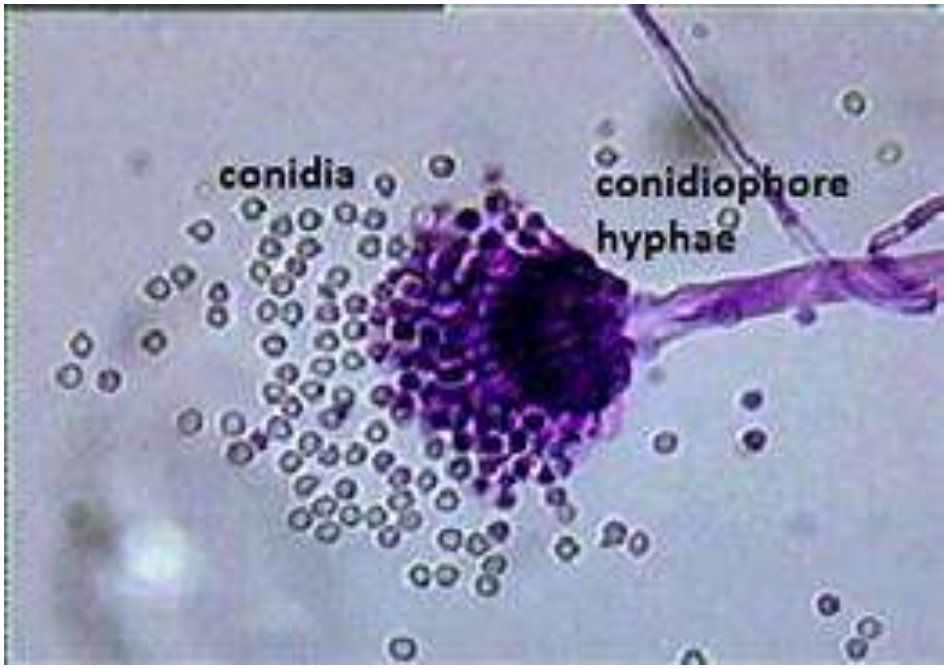
Structure of Fungi



When Candida is grown in human or sheep serum at 37°C for 3 hours, they forms a germ tubes (filamentous outgrowth), which can be detected with a wet films as filamentous outgrowth extending from yeast cells

Structure of Fungi





- **Hyphae (Hypha, singular): is a long, branching filamentous structure of a fungus with fruiting body on the top that give conidia .**
- **Hyphae may be septate, having internal septa, or nonseptate.**

Classification of Fungi

Morphological

1- Yeast:
-Oval or rounded.
- Multiply by budding.
Ex: *Candida albicans.*

2- Mold / Filamentous fungi:
- Have branching filaments (hyphae).
-They may be septate or non septate.
- Ex: *Dermatophytes & Aspergillus.*

3- Dimorphic fungi: occurs in 2 forms:
- Yeast form in tissues (at 37 C).
- Filamentous form in culture & environment (at 25 C).
- Ex: *Histoplasma capsulatum.*
- *Coccidioides immitis.*

Clinically

1- Superficial mycosis:
-Involves stratum corneum without tissue invasion.
- Ex: *Taenia versicolor*.

2- Cutaneous mycosis:
-Involves skin, nail & hair with tissue destruction.
-Ex: *Dermatophytes & Candida*.

3- Subcutaneous mycosis:
-Involves the subcut. tissues, ms & fascia.
- initiated by trauma. Ex. madura foot.

- 4- Systemic: primarily infects the lungs & can be disseminated to different organs.
Ex: - Primary pathogens: as *Histoplasma* & *Coccidioides*.
- Opportunistic fungi as *Aspergillus* & *Pneumocystis.*

❖**There are two other kinds of fungal diseases:**

a- Allergies to fungal spores, particularly those of *Aspergillus*. They cause mainly type I hypersensitivity reactions or atopy manifesting as bronchial asthma, fever , urticaria & eosinophilia.

b- Mycotoxicosis

These are diseases due to the consumption of food containing fungal toxins as:

1- Mycetismus a disease caused by Amanita mushrooms that produce fungal toxins. When ingested, they cause sever fatal damage to the liver and kidney.

2- Ergotism, is caused by the mould *Claviceps purpura*, which infects grains and produces ergotamine alkaloides that cause neurologic effects & gangrenous symptoms (due to vasoconstriction of blood vessels especially fingers & toes).

3-Aflatoxins produced by *Aspergillus flavus* when ingested with spoiled grains and peanuts. They are metabolized in the liver to epoxide, a potent carcinogen. they are hepatotoxic, and are suspected of causing hepatic carcinoma in man.

Diagnosis

1- Direct Microscopic Examination:

- KOH mount.
- Gram stain.
- Giemsa stain.
- Calcofluor white stain.
- India ink.

2- Culture:

- Sabouraud dextrose agar (SDA): either incubated at:

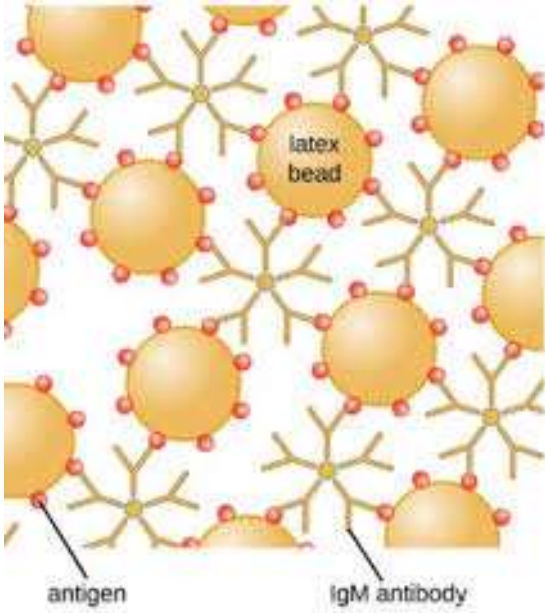
➢ 37 C ⟶ Body temperature for growth of yeast.

➢ 25 C ⟶ Room temperature for growth of mold.

3- Serology:

For Abs detection or fungal antigen.

- Latex agglutination ⟶ for IgM.
- ELISA ⟶ For IgM & IgG.
- Complement fixation ⟶ For IgG.



4- Direct fluorescent test can be applied on:

1- Histological section.

2- Culture.

5- Biopsy & histopathology: to show the.

6- Skin test.

7- PCR:

1- Rapid.

2- Species specific.

3- Expensive.

Treatment

Antifungal agents

1- Polyene derivatives

- Amphotericin B
- Nystatin

2- Azoles

- Ketoconazole
- Fluoconazole
- Itraconazole

3- Griseofulvin

4- Flucytosine