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GENERAL MYCOLOGY

BY:

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- **Mycology** is the study of fungi
- **Eukaryotic** organisms
- Have a **rigid cell wall**.(and cell membrane)
- **Obligate** or **facultative aerobes**.
- Require **preformed source of carbon.**
- **Natural habitats** **environment** (*Candida albicans* **N. Flora.**)

- About **80,000 species**, **<400** are **medically** important, **<50** species cause **fungal infections of humans** and other animals.
- Production of **food and spirits** –by:1) using yeast in bakery
  2)making blue cheese
- **Medicine** [**antibiotics (penicillin)** and **immunosuppressive drugs (cyclosporine)**].
- Fungal infections are **mycoses** . Mycoses may be classified as **superficial, cutaneous, subcutaneous, or systemic**.

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Structure & Growth:

Two fungal structures are medically important:

(1) The Fungal rigid cell wall:

- Consists of chitin, β-glucanglucan,-
- **Shape**, **protection, antigenic.**
- **Dematiaceous fungi ??**. Melanisedcell wall (brown,black color and melanine is a virulence factor .
- **(2) fungal cell membrane:**

Sterol is Ergosterol.

- Both cell wall (chitin and β-glucan) And fungal cell membrane (ergosterol) are the targets of the treatment of mycoses because they differ than the host membrane and wall

Fungi are eukaryotic, so have similar protein synthsis stracture of the host , we cant attack the ribosome

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Classification of fungi:

Two basic forms of fungi : **yeasts** and **molds** (or **moulds**).

Fungi column similar to the bacteria colomn

Yeasts(ex:candida):

- **Single** cells.
- Reproduce by **asexual budding** (blastoconidia).
- Yeast colonies are usually soft, opaque, 1–3 mm in size, and cream-glucancolored.

Mainly produced cells are Not equal in size

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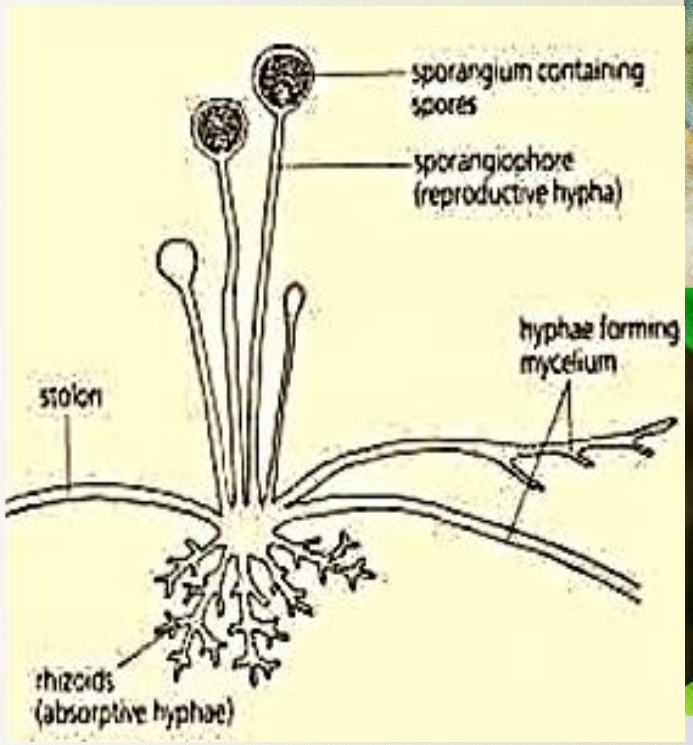
Molds:

long filaments of cells (**hyphae**) form a **mat** (**mycelium**: Fluffy surface masses of hyphae and hidden growth into tissue or lab medium, absorbs nutrients(rhizoids)).

Reproduce by cell division.



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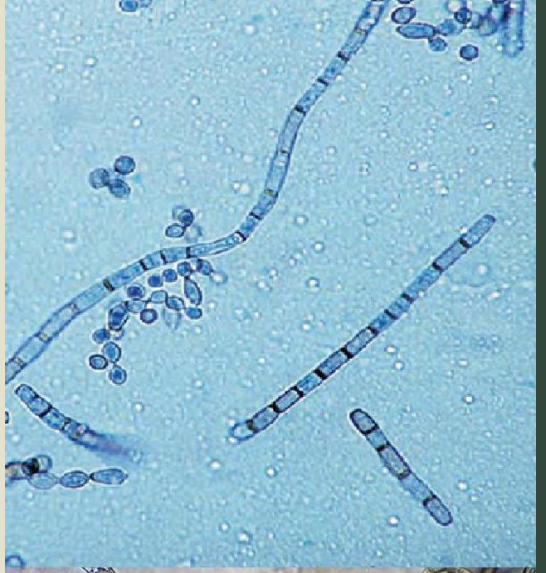
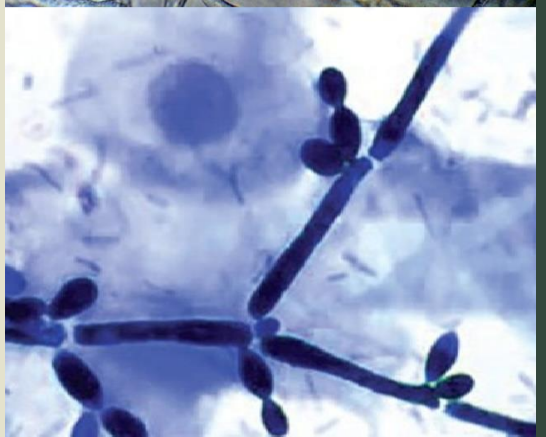
- Spores in fungi is used for reproduction
- Sporangiophore reproductive hypha

- **Aerial hyphae** project above the surface of the mycelium and usually bear the reproductive structures (sporangium containing spores)of the mold.
- Hyphae may be **dematiaceous** or hyaline.
- Some hyphae are **Septate hyphae**, Others **nonseptate hyphae(multinucleated)**.
- **Pseudohyphae** □ ***Candida albicans.***





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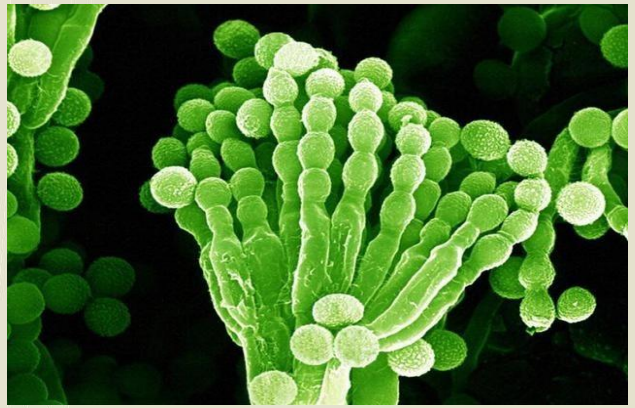
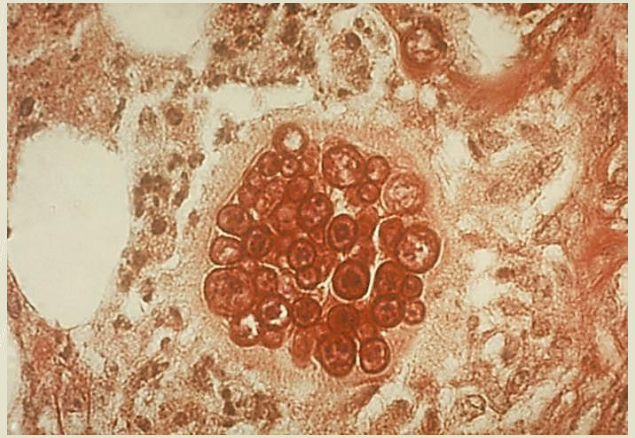
Pseudohyphae: in the process of the asexual production “budding” in complete separation with connection of another cell it will start to elongate “sausage structure” –elongation of the blastospores and incomplete separation

It looke like septate hyphae , but the organels “cell content” are completely separated from each other “lack cytoplasmic connection between cells.

- Some fungi are **dimorphic** (form diff. structures, **yeasts or molds, at diff. temp**.) (or some other form such as a **spherule**). **Spherule**: a **thick-walled spherical structure enclosing endospores** **Coccidioides.**

Example : it forms a mold structure in the environment but inside (human) it forms a spherule structure





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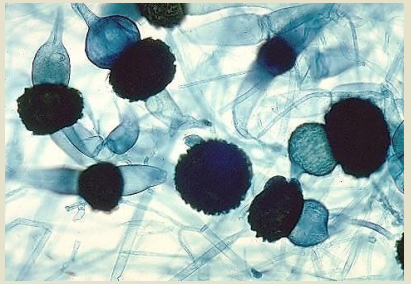
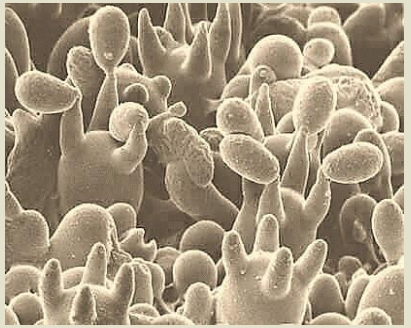
Some fungi reproduce **sexually by mating and forming sexual spores** (e.g., **zygospores**, **ascospores**, and **basidiospores**).

- **Zygospores** are **single large** spores with **thick walls.**



- **Ascospores** are formed in a **sac** called **ascus**.

- **Basidiospores** are formed **externally on the tip** of a **basidium**.



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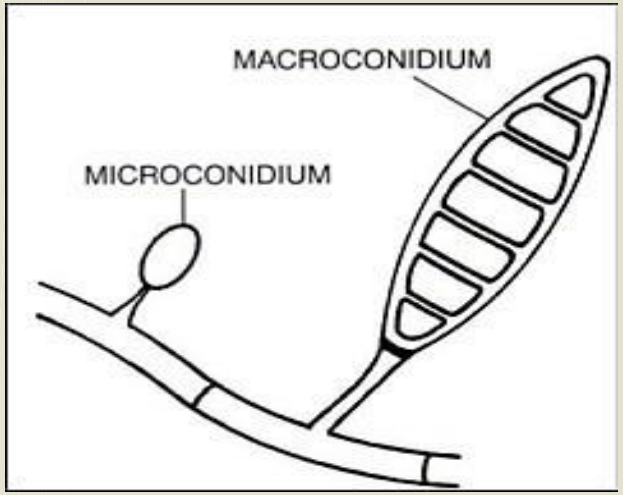
Medical important of fungi are usually imperfect

Fungi that **do not form sexual spores** are termed "imperfect" and are classified as **fungi imperfecti.**



- Most fungi of **medical interest propagate asexually** by forming **conidia** (**asexual spores**)
- The **shape, color, and arrangement** of conidia aid in the **identification** of fungi.
- **Microconidia** and **Macroconidia**.

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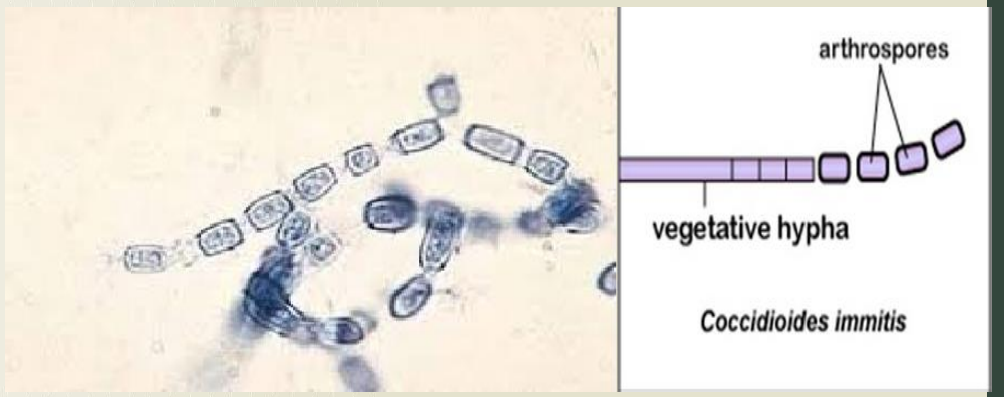
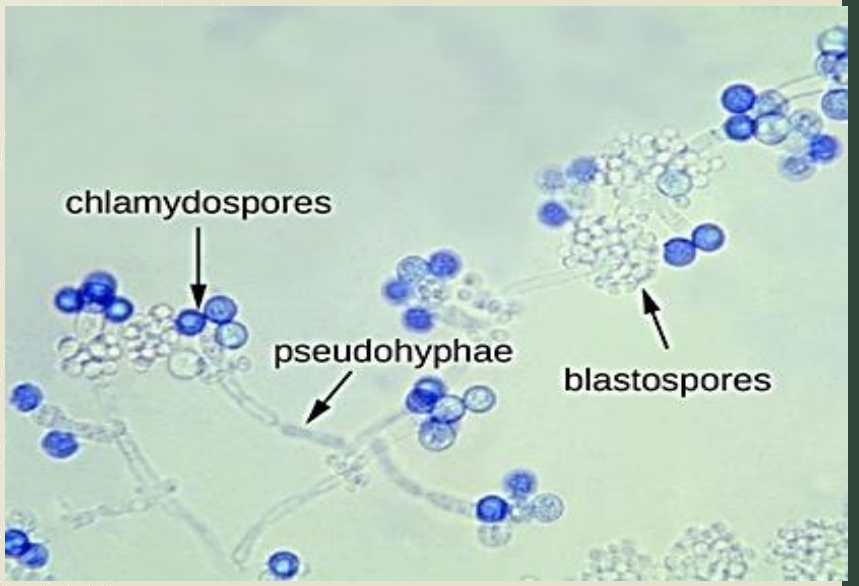
Some important conidia are:

1. **Arthrospores:** fragmentation of the ends of **hyphae** (*Coccidioides immitis).*



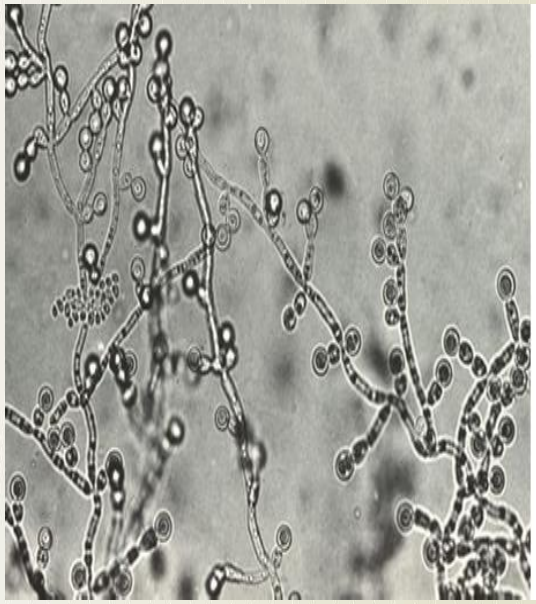
2. **Chlamydospores: rounded, thick-walled**, and quite resistant (the terminal chlamydospores of *Can. albicans*).

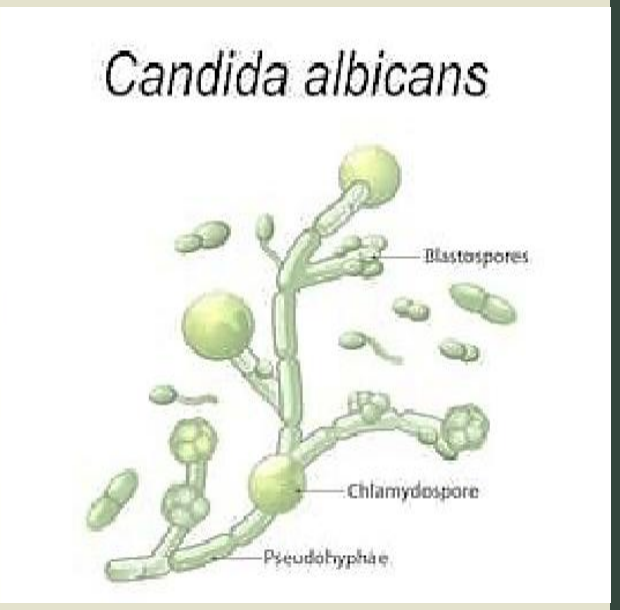


Budding candida : .. – elongation and incomplete separation pseudohyphae.

-- complete separation and gathering of spores in clumps around pseudohyphae " blastospores"

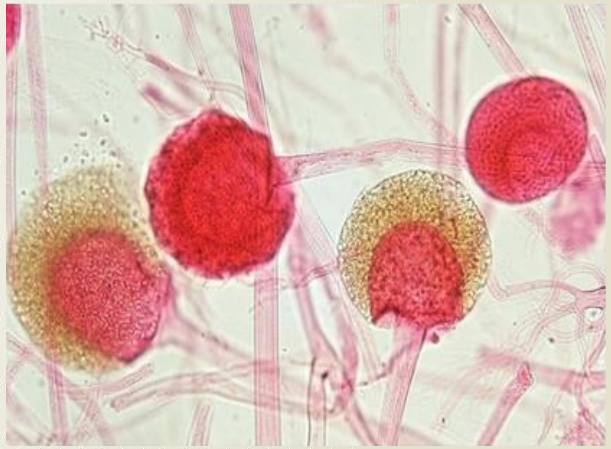
3. Blastospores: formed by the **budding process** by which **yeasts** reproduce asexually (*Can. Albicans)*.

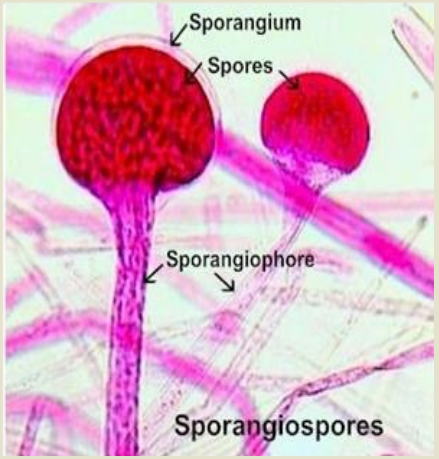




4. Sporangiospores: formed within a sac (**sporangium**) on a stalk by **molds** such as *Rhizopus* and *Mucor*.

Ex: bread and fruit mold





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Pathogenesis:

- **Granulomatous** → **Histoplasma** and **Coccidioides** → (**macrophages and helper T cells**). Produce granuloma , cell mediated"
- **Pyogenic** → **Aspergillus, Mucor, and Sporothrix** → (**neutrophils**). Ex: ringworm infection
- **Systemic fungi** → **skin tests** → **delayed hypersensitivity** (manifested as **induration** of the skin).
- **Positive** skin test **only** indicates that **infection has occurred**.
- A **false-negative** skin test can occur in patients with **reduced cell-mediated immunity.**

HIV : patient are more supseted to mycoses

To test the cell mediated immunity of patient we use skin test against candida "because its normal flora"

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Host defe nse:

- **Intact skin** Against dermatofights
- **Fatty acids** Against dermatofights
- **Hormones** at puberty Against ringwarm
- In RT: **mm of nasopharynx** Against spores
- Alveolar **macrophages** Against spores
- Cell mediated immune response protective
- Immunosuppression opportunistic infection

Fungal Toxins & Allergies:

Mycotoxicosis:

- **Amanita mushrooms** **liver necrosis** two fungal toxins (hepatotoxins).

- Ingestion of peanuts and grains contaminated with ***Aspergillus flavus*** causes **liver cancer** due to **aflatoxin** (potent carcinogen) It safe for children

Allergies to fungal spores:

Inhalation of the spores of ***Aspergillus fumigatus*** allergic bronchopulmonary aspergillosis. "IGE"

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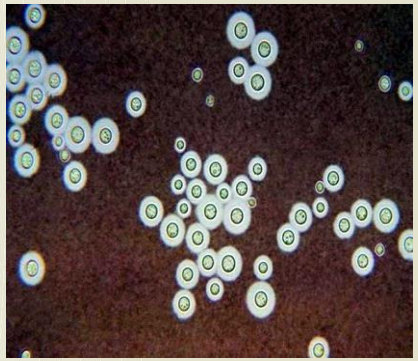
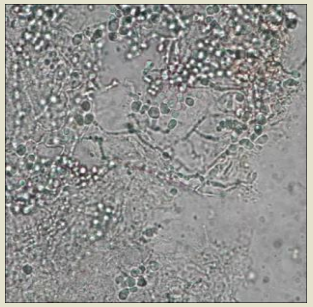
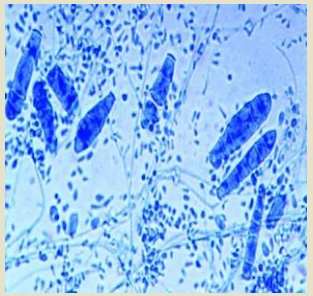
DIRECT MICROSCOPIC EXAMINATION:





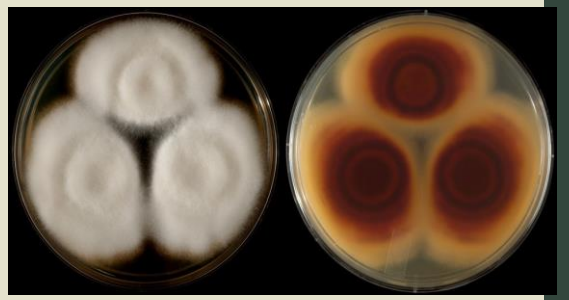


10% **KOH preparation** fungal structures. India ink, Lactophenol cotton blue,…. ??

Destroy the host tissue and keep the fungi intact

CULTURE: Sabouraud Dextrose Agar (SDA).

- Acidic media
- contain antibiotic
- Unsuitable for bacteria



Antibiotic – chloramphenicol for bacteria
-- cycloheximide for saprophytic fungal organism

We examine the plate from both ends

Candida need 48h to grow in culture other need almost a month

SEROLOGICAL TESTS: for the presence of fungal antigens and antibodies. Two commonly used tests are those for **cryptococcal antigen** in **spinal fluid** and for ***Coccidioides* antibodies** in the **patient's serum**

Late Agglutination test

Complement fixation test

DNA PROBES. **For culture that take along time**

Antifungal Therapy:

- The **selective toxicity** of **amphotericin B** and the **azole** group of drugs is based on the presence of **ergosterol.**

- The selective toxicity of **caspofungin,** is based on cell wall, **β-glucan**

  site of action of the antifungal drug caspofungin.

Azole : inhibit the sunthesis of the ergosterol

Amphotericin B : bind to cell wall at ergosterols site and make pores

Caspofungin : inhibit B-glucan synthesis

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Than k you

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