



Microbiology

Slide #: 10-Mycology
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Sheet Slide



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Introduction Medical Mycology

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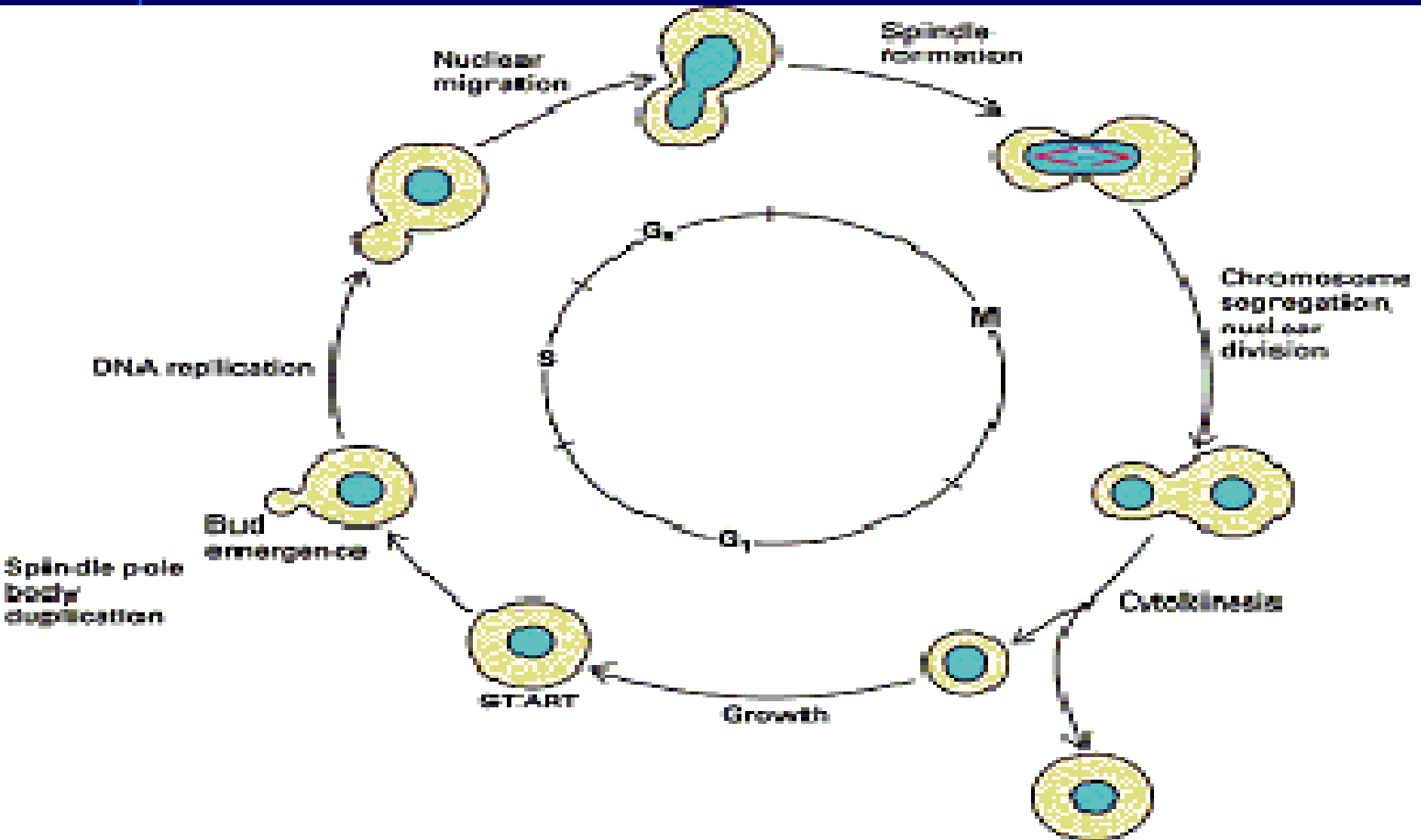
University of Jordan

General Fungi-1

Fungi are eukaryotic microorganisms.. Larger than bacteria.. Essentially Aerobic .. Mostly found in Nature living in association with plants ..Many as harmful organisms..Others free saprophytes on dead organic substances..More than 100000 types .. Few associated with human diseases.

- Two major Groups:
- **Yeasts** (unicellular cells; 0.5-4 um)..develop large colonies / growth on culture agar media.. Mostly reproduce **asexually by budding** one or more buds.. A few reproduce by binary fission

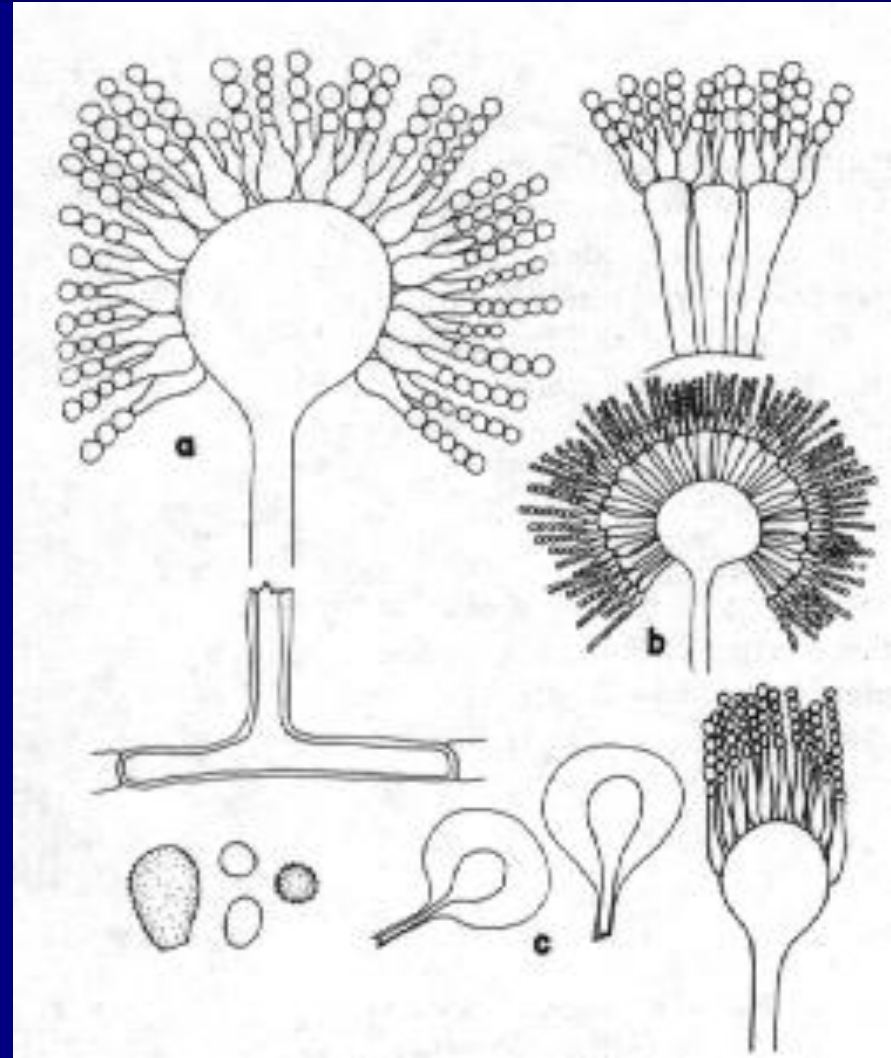
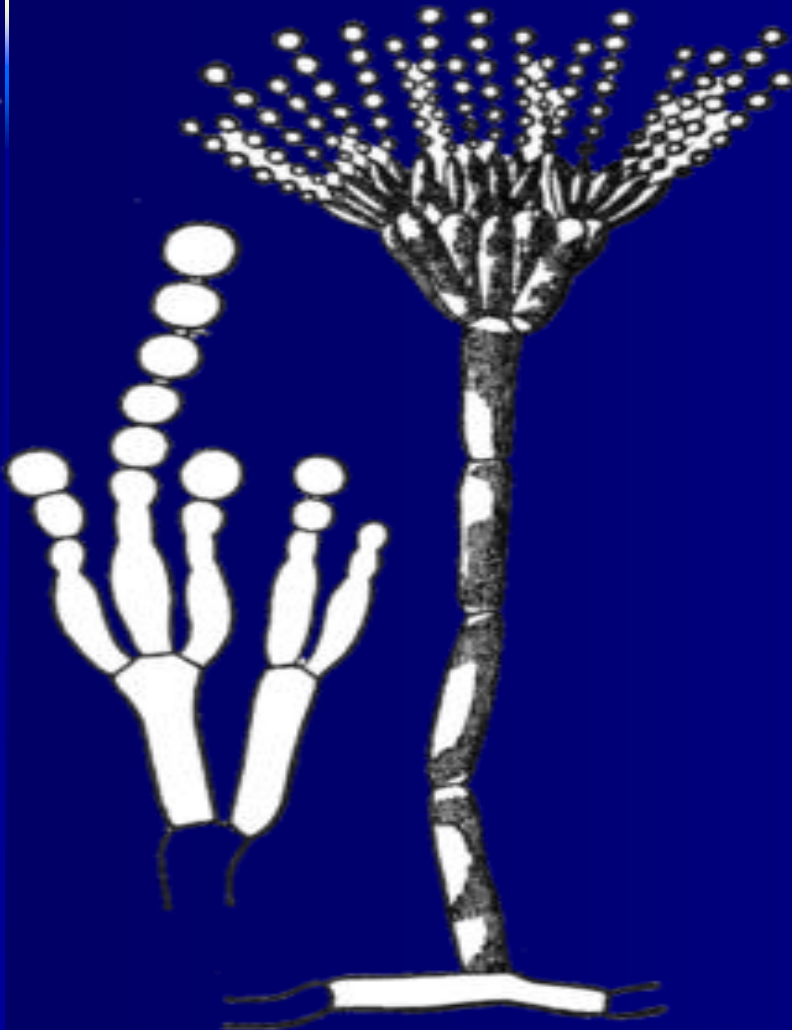
Growth of Yeast Cell



Baker's yeast/ *Saccharomyces cerevisiae*.. glucose
Fermentation.. CO_2 + alcohol ..Important in
Production Bread.. Vitamins.. Biogenetic
..Medical drugs like Insulin.

- **2-Molds/ filamentous Fungi**.. composed of various cellular structures, reproduction by **spores, hyphae**.. different morphological types of Hyphae/ filaments.. Single cells up 20um .. extension of single spore/ hypha cell into branching nest of filamental cells.
- Growth in vitro **Aerial & Vegetative Mycelium**

Filmental Fungi: Pencillium- Aspergillus



Growth of Fungi

- Fungi have **chemoheterotrophic metabolisms**
..obtaining nutrients through decompose complex organic materials..Plants biomass into small molecules & basic elements..Require for growth water/ moist, carbon source & various minerals
- Fungi/ certain type **mushrooms** can be used food, have high nutritional value.. Minerals..Some produce Antibiotics
- Fungal contamination most types of food / may cause fatal disease.. Few Fungi produce **mycotoxins**

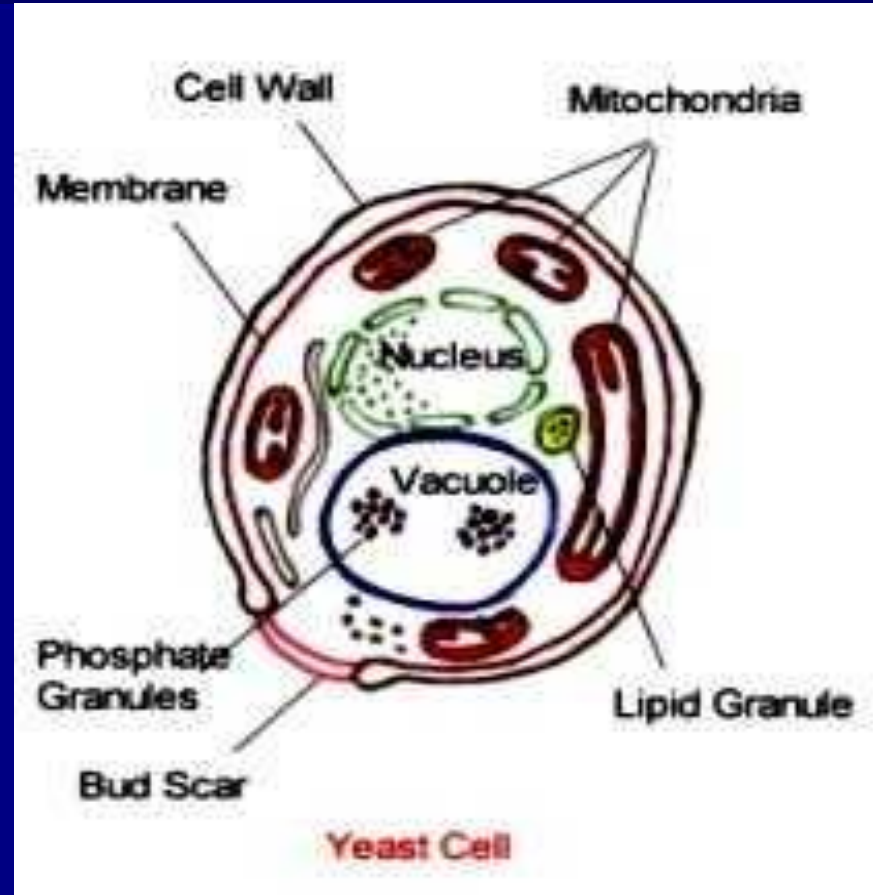
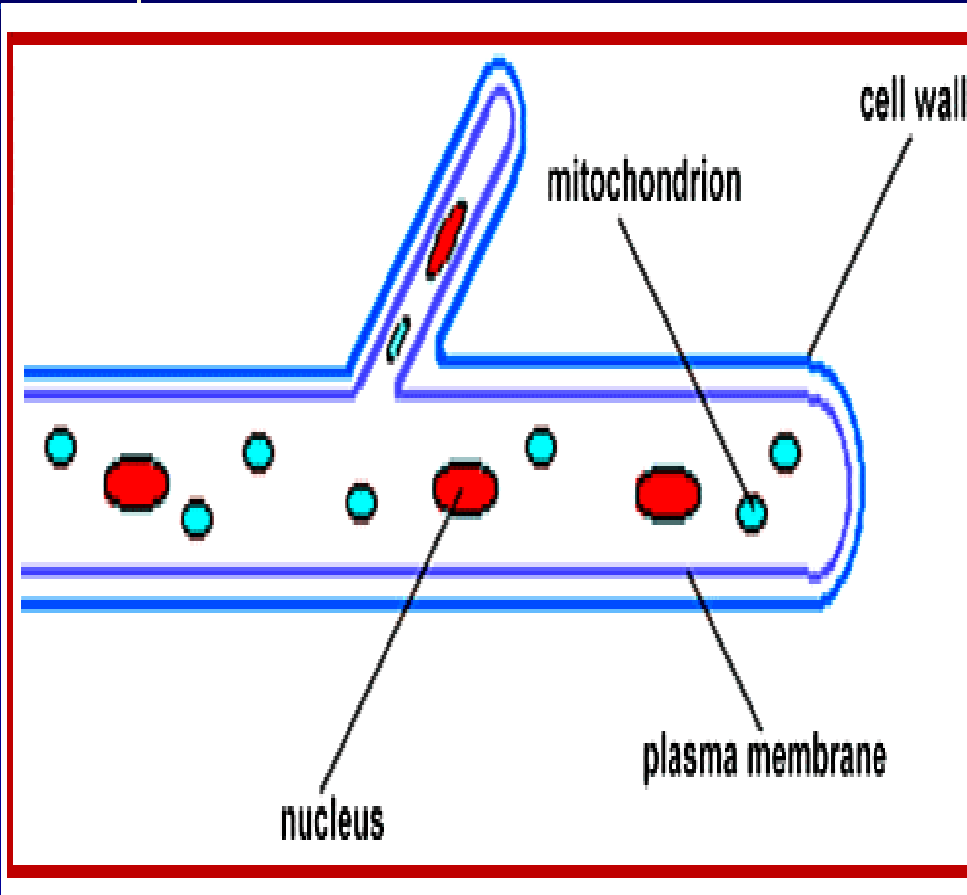
1-Aminata Toxic Mushroom
2-Non-Toxic Mushroom in Nature



Fungi cell Structures

- About **100 Fungi types** are opportunistic pathogens.. Yeasts are part of normal flora.. Oral cavity-intestine-Vagina.. Opportunistic pathogens.. Few types like ***Cryptococcus neoformans*** true pathogens
- All are not susceptible to antibacterial drugs or phages
- **Fungi Cell wall**: Mostly complex polysaccharides (chitin,) less amount glucan, mannan . **Cell membrane**: lipid-phosphate & protein .. Their Plasma membranes containing **Ergosterol**,
- Cytoplasm contains microtubules composed of tubulin/Specific Protein..Mitochondria, Lipids & phosphate granules.

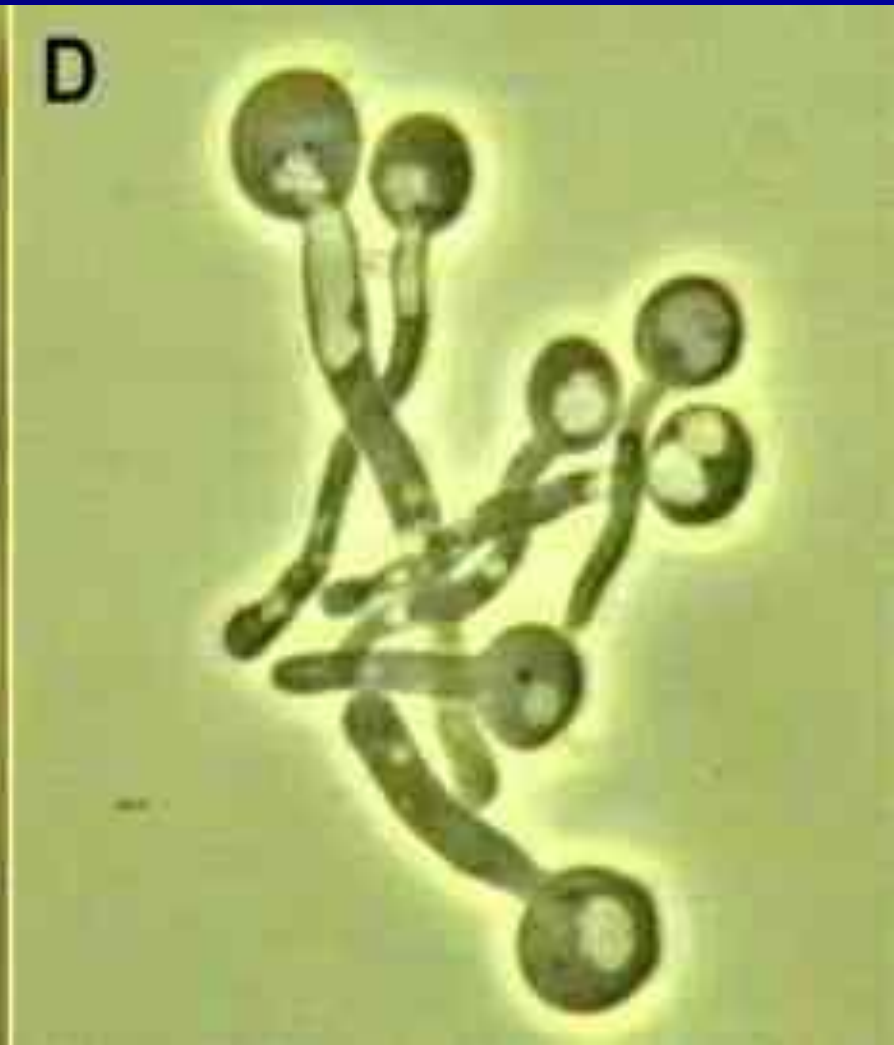
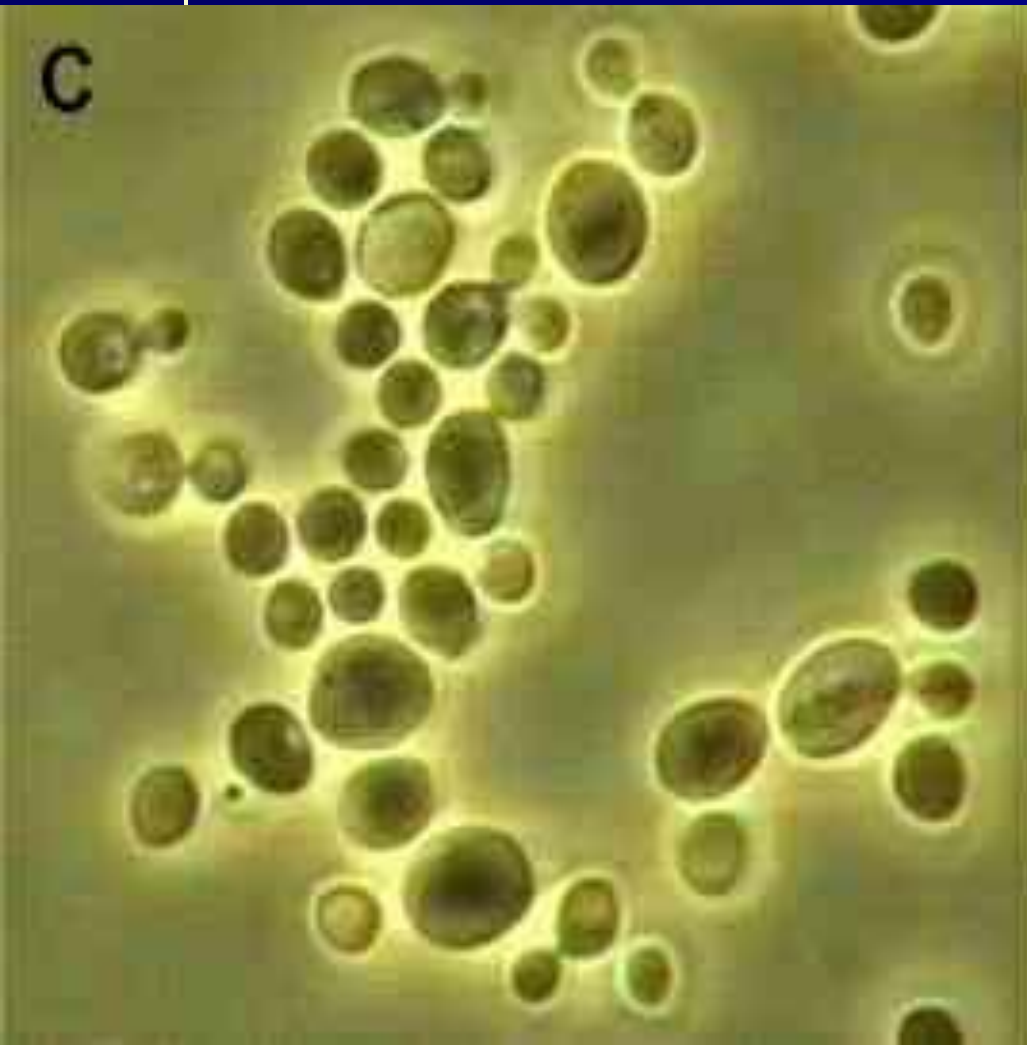
Hypha Cell-Yeast Cell



Growth in Human tissues

- **Pathogenic Yeasts** produce often elongated oval cell & Pseudohyphae on body mucosal cells.. Mild inflammation.. More erythematous lesions ..
- **Pathogenic Mold:** single and multiply filaments.. cell fragments in infected tissue.. Rarely spores.. Superficial lesions without inflammation
- **Antifungal drugs:** Nystatin, Fluconazole, Amphotericin B, Caspofungin .. All react with ergosterol forming complex molecules.. damage cell membrane.

Budding Yeast & Germ Tubes demonstrated in Serum test



Capsulated Yeast / Cryptococcus neoformans (India ink test)

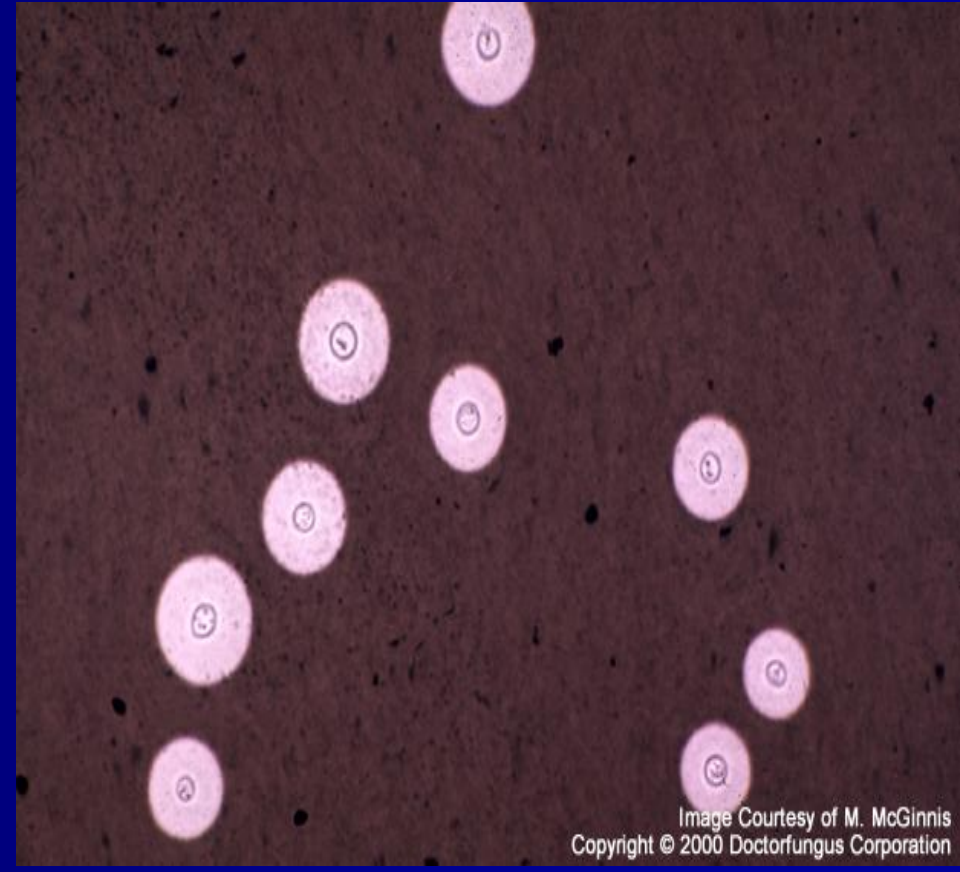
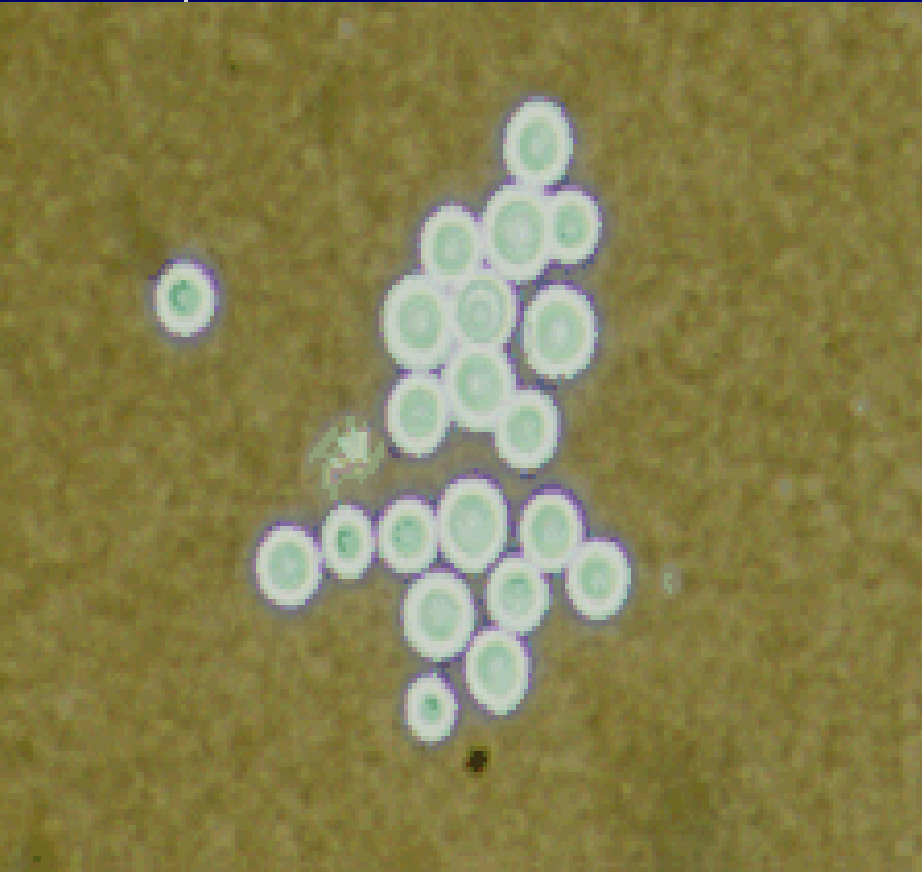


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Filaments Fungi/ Molds

Molds form multicellular filaments/ hyphae .. non-septat / septat hyphae.. spores of different sizes & structures, arrangement , color.. A mass of hyphae and spores represent by Aerial & Vegetative Mycelium

- **Dimorphic Pathogenic fungi** grow as Yeasts or Yeast-like structure in vivo at 37°C, but as in vitro as Molds 20 -40°C
- **Lab Identification**: Direct smear .. Culture on Sabourauds dextrose agar/ blood agar.. Slow or rapid growth (2-30 days).. Morphology & reproduction of spores/yeast cells/ Filaments (Hyphae) .. Colors of Micro/Macro Conidia.. Arrangement of spores on vertical hyphae /aerial mycelium .. Hyphae with or without septa / single septum..type and color of spores. No specific antibodies/ serological tests

Human Mycosis-1

- Dermatophytosis / Superficial Mycoses / Cutaneous Mycoses
- **Ringworm / Tinea** : A superficial dermatophyte infection characterized by either inflammatory or non-inflammatory lesions on skin ..Erythematic lesion..Allergic reaction .. Involve superficial keratinize/Dead tissues.. **skin, hair, Nails.**
- Dermatophytes: *Trichophyton - Microsporium , Epidermophyton* .. many species ..Worldwide distribution.. Spores, Hyphae fragments.. Transmission ..human & animals & environment, . **Tinea corporis**: All dermatophytes can cause similar skin lesions

Human Mycosis-2

- **Tinea corporis/versicolor** / Pityriasis versicolor..
Malassezia furfur , common lipophilic yeast.. normal skin flora.. Lives on oils and fats.. Mostly endogenous infection..very common among young adults.
- **Clinical Features:** Discoloration..hyper/ hypo pigmentation skin spots..face, arms.. any body site..
Rarely erythematic skin lesions, Allergic reaction , Skin scaling.. activated by various factors.. stress conditions, fever, warm & humid environment.
- **Diagnosis:** Clinical picture.. Direct smear spherical & thin filaments yeast.. Difficulty in isolation, cultivation & identification .. Mostly Self-limited 1-3 weeks

Human Mycosis-3

- **Hair:** Tinea capitis, Hairshaft /hair follicles. Scalp, Endo-Exothrix ..composed large number of spores , sticky material.. Common in Children.. Rarely Adults.. Infection spread rapidly by contact with infected hair ..Outbreaks in schools.
- **Nail:** Tinea unguium. **Tinea pedis**.. Feet fingers & interspaces, moist skin lesions, Common in Adults, develop chronic lesion..difficult to cure
- **Causative agents:** Mostly Epidermophyton species. Less *Trichophyton* & *Microsporium* species

Tinea corporis-

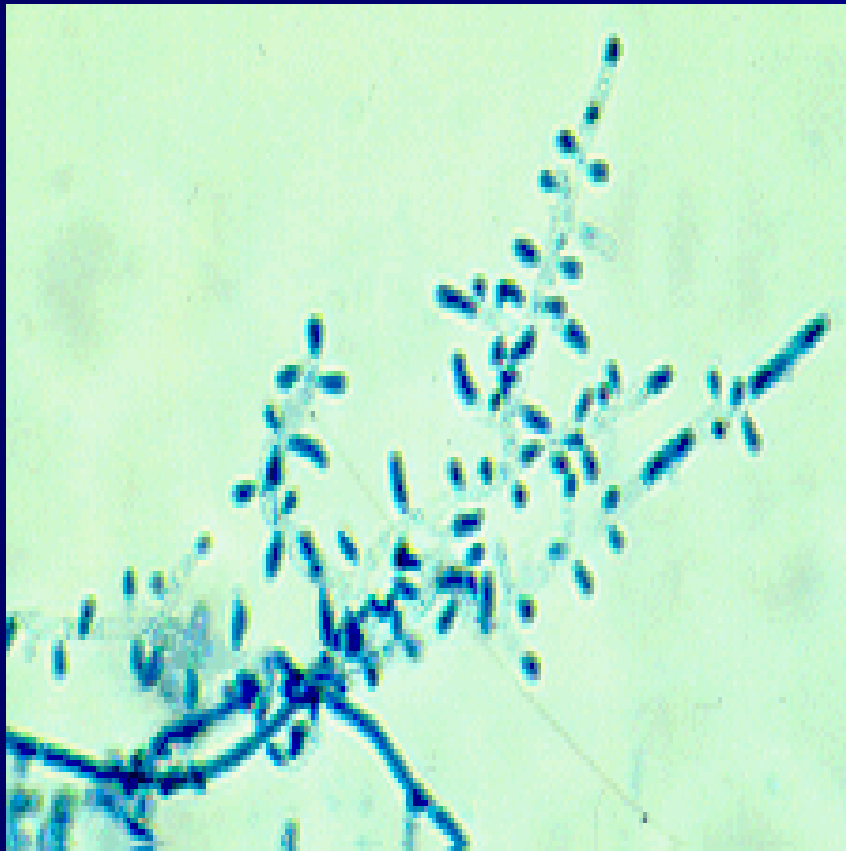
Pityriasis versicolor



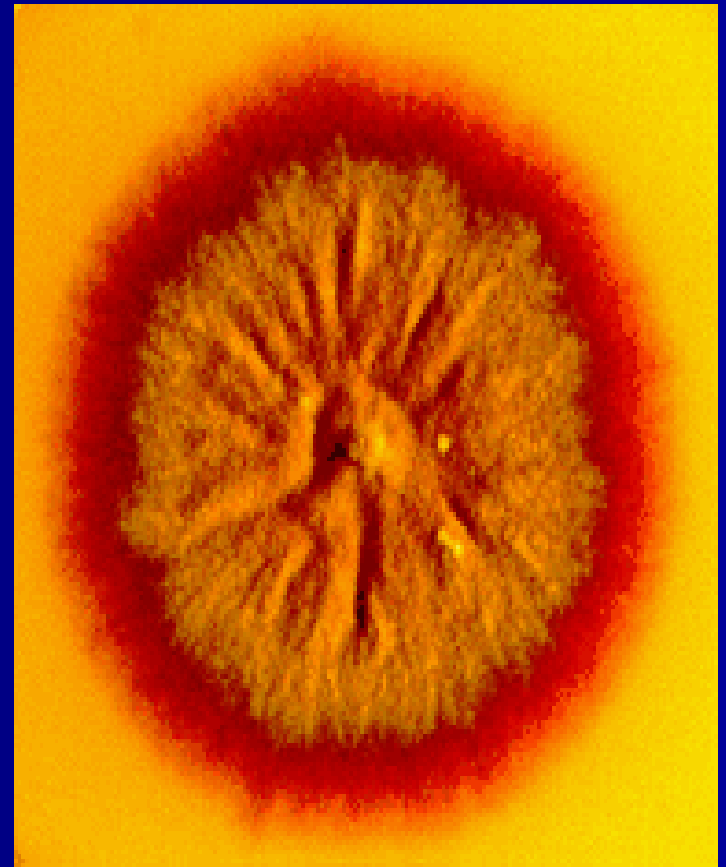
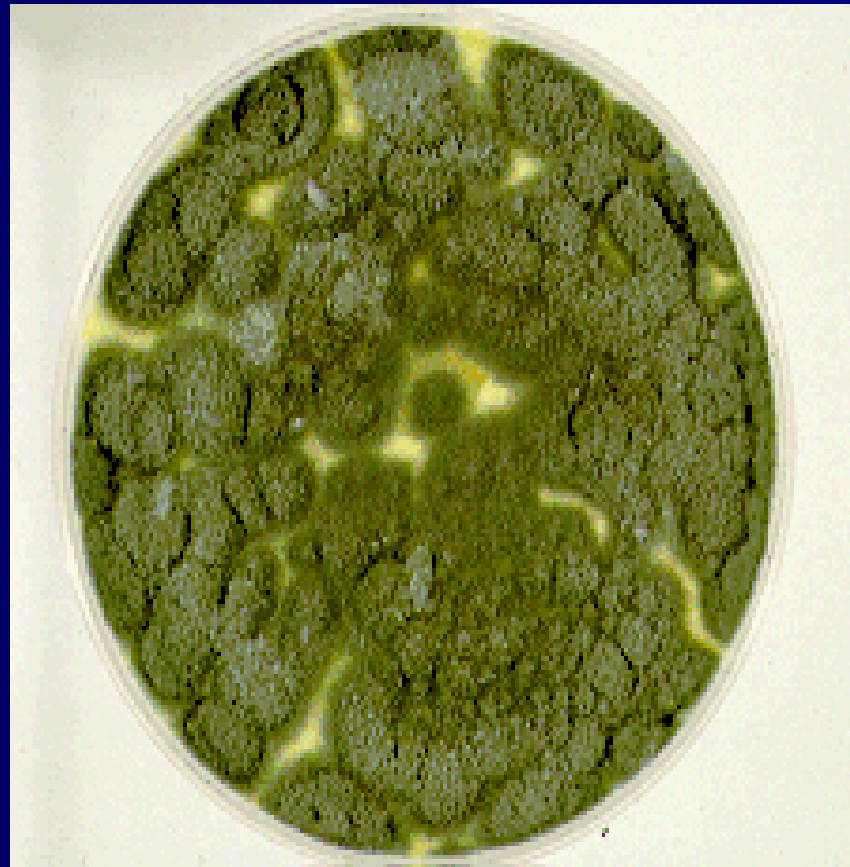
Tinea unguium – Tinea Tineacapitis



Microconidia-Macroconidia



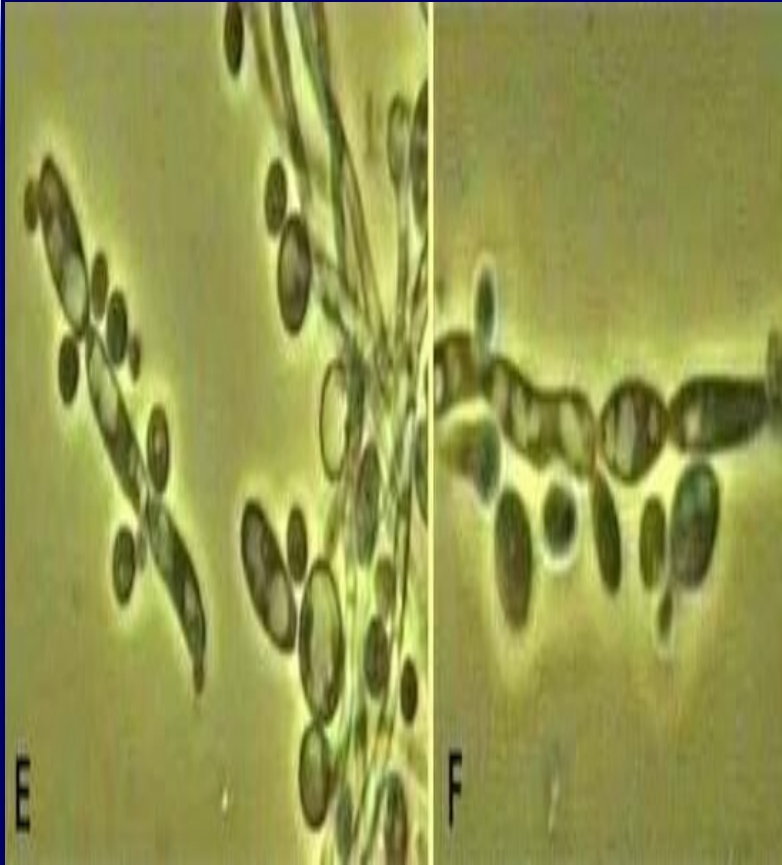
Penicillium-Trichophyton spp.



Yeast /Candida species

- **Candidiasis/ Candidosis:** *C. albicans* (50-70%).. Less *C. glabrata*, *C. tropicalis.*, *C. Krusei.* & Others spp.
- Part normal body Flora.. Mouth, Vagina, Skin, Intestine, Urinary tract.
- **Opportunistic Pathogens**.. mostly endogenous infection, arising from overgrowth of the fungus .. intensive use of antimicrobial drugs.. Inhibiting normal flora.. Underlining diseases, compromised host, Radiation, Toxic drugs
- **Exogenous infection** .. catheters or prosthetic devices.. Respiratory tubes.. person-to-person transmission,
- Common Nosocomial Infection.
- **Clinical Features:** Oral mucosa.. Thrush .. Throat- Pharynx, Lung , Candidiasis ,vaginal Candidiasis.. discharge & Irritation, Candidemia, meningitis.

Candida Pseudohyphae (Chlamydo-Blastospores)



Candida Trush



Other Yeast Infection

- Encapsulated *C. neoformans*.. Large Capsule..cause a chronic- subacute- acute pulmonary.. May spread to blood, CNS.. causes ..systemic or meningitic disease.. Often isolated from pigeon, Birds excreta.
- *C. neoformans* has a world-wide distribution.. now one of the most significant opportunistic pathogens in humans.. immunodeficient ..AIDS patients..

Mold infection: Aspergillosis-1

- ***Aspergillus species*** are common in nature .. Spores spread with dust particles..Inhalation. . Few develop Allergy or clinical disease
- *A. fumigatus, A. flavus, A. niger.* Common Human Aspergillosis
- **Allergic Bronchopulmonary Aspergillosis:** Presence of conidia or transient growth of the organism in body Respiratory tract associated with Granuloma ,allergic reaction, eosinophilia,Lung Asthma. Nose/Sinuses, Ear/Otitis externa (Otomycosis) often associated with swelling, pain & black discharge.

Aspergillosis-2

- Pulmonary lesions in preformed cavities .. debilitated tissues.. Common in Tuberculosis & Lung carcinoma patients..fatal.
- **Localized Lesions**: Eye , Sinuses, External Otitis infection ..Surgery & Antifungal Treatment.
- **Mycotoxiosis** : Worldwide million cases due to ingested contaminated foods with mycotoxin .. Mostly mild gastrointestinal symptoms..various fungi.
- *A. flavus* .. Produce fatal **Aflatoxins**
- Few micrograms cause acute Liver cirrhosis, Edema & hemorrhage in lung kidneys, coma & Death.
- Common :Grains, Peanuts, Ground nuts, Rice, Milk Powder .. Due to storage food under bad not dry condition

1-Aspergillus niger growth
2- Wet preparation, Aspergillus

