

Introduction Medical Mycology

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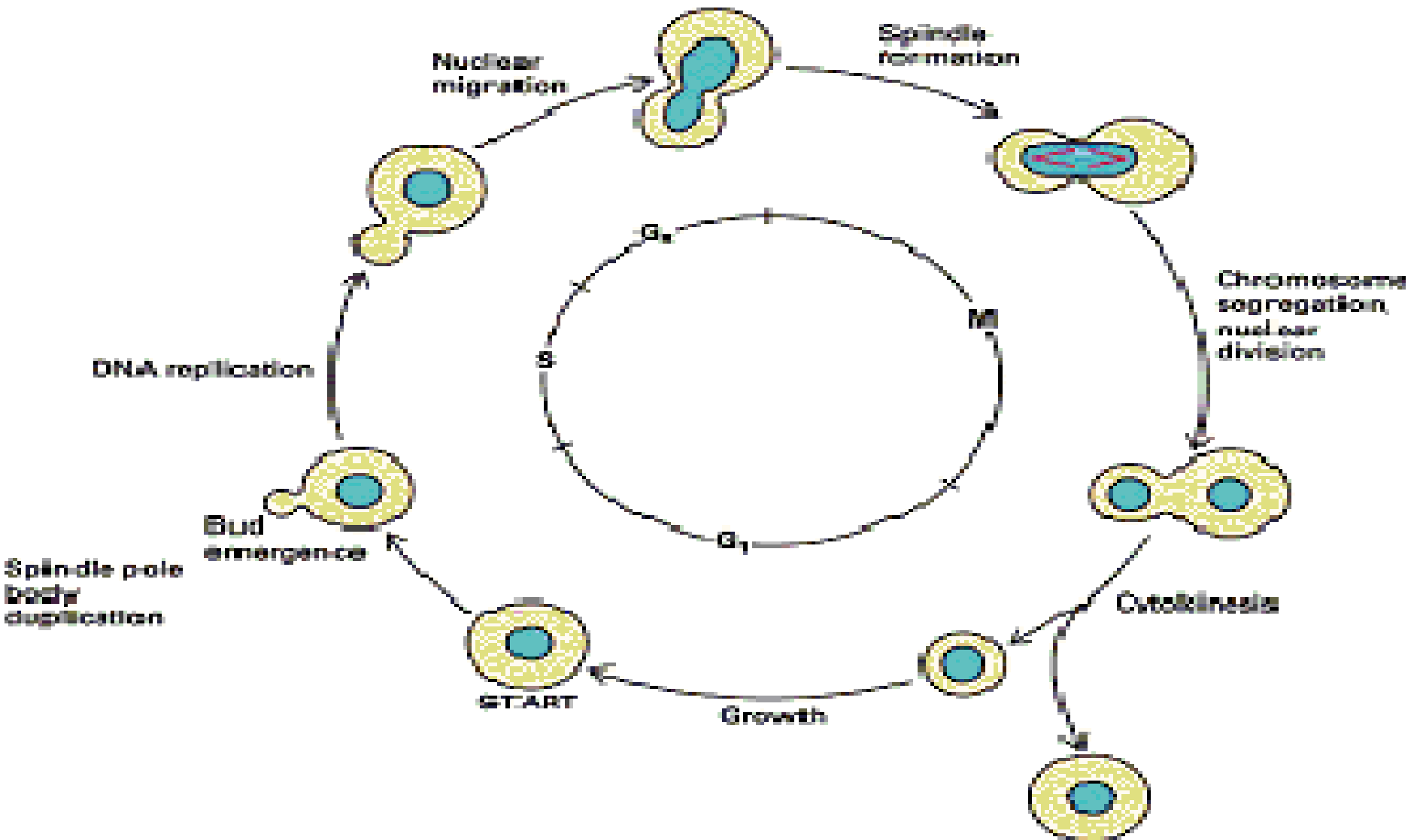
University of Jordan

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, diameter 0.5-4 μm ..develop large colonies / growth on culture agar media.. Mostly reproduce **asexually by budding** one or more buds.. A few reproduce by binary fission

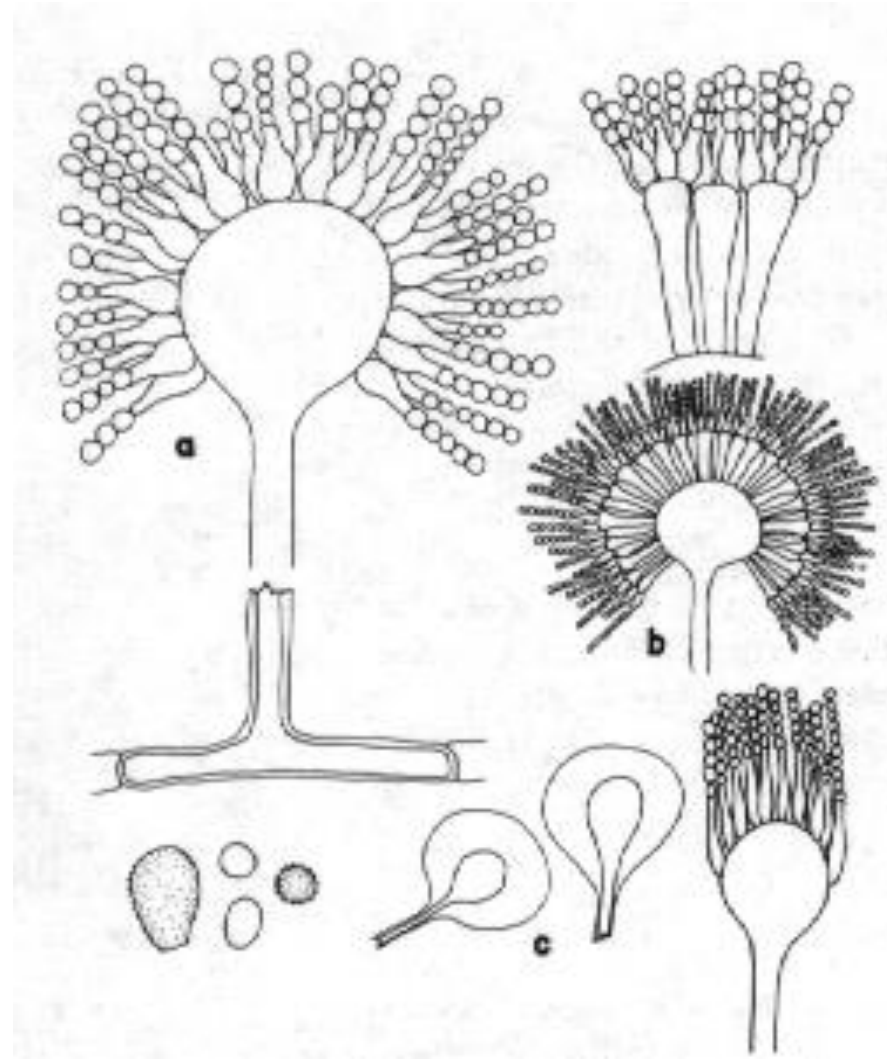
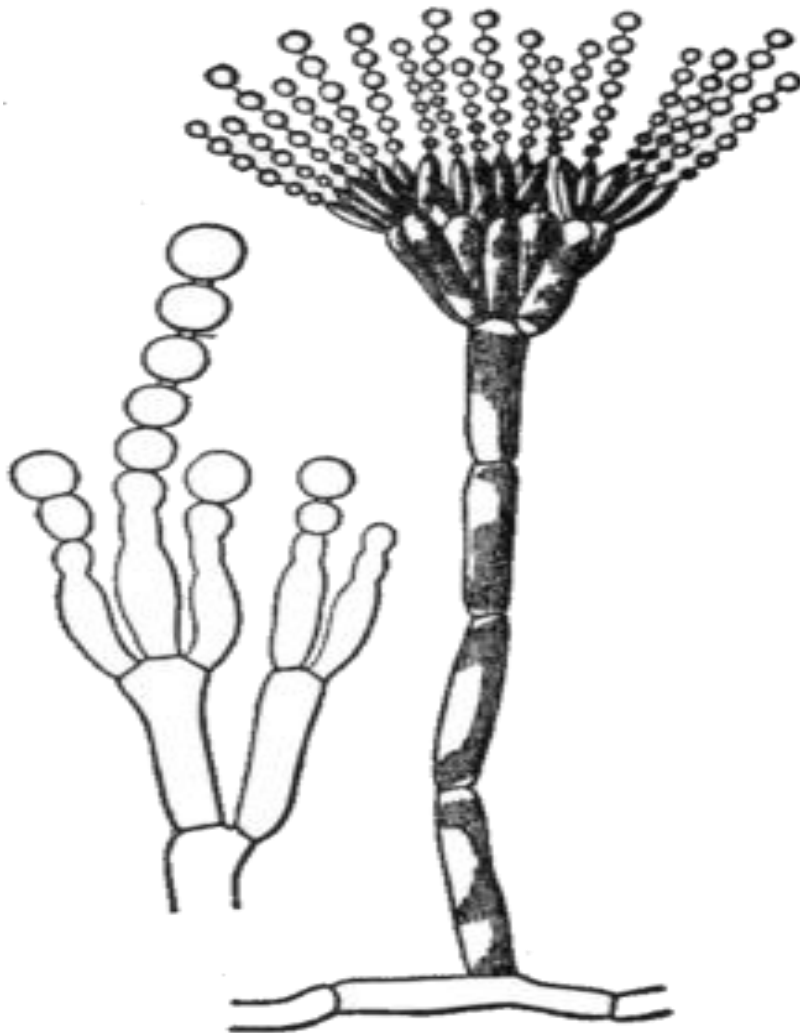
Growth of Yeast Cell



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 length up 20um .. extension of single spore/ hyphal cell into branching nest of filaments/ cells..Nest of cells called mycelium.
- Growth in vitro **Aerial & Vegetative Mycelium**

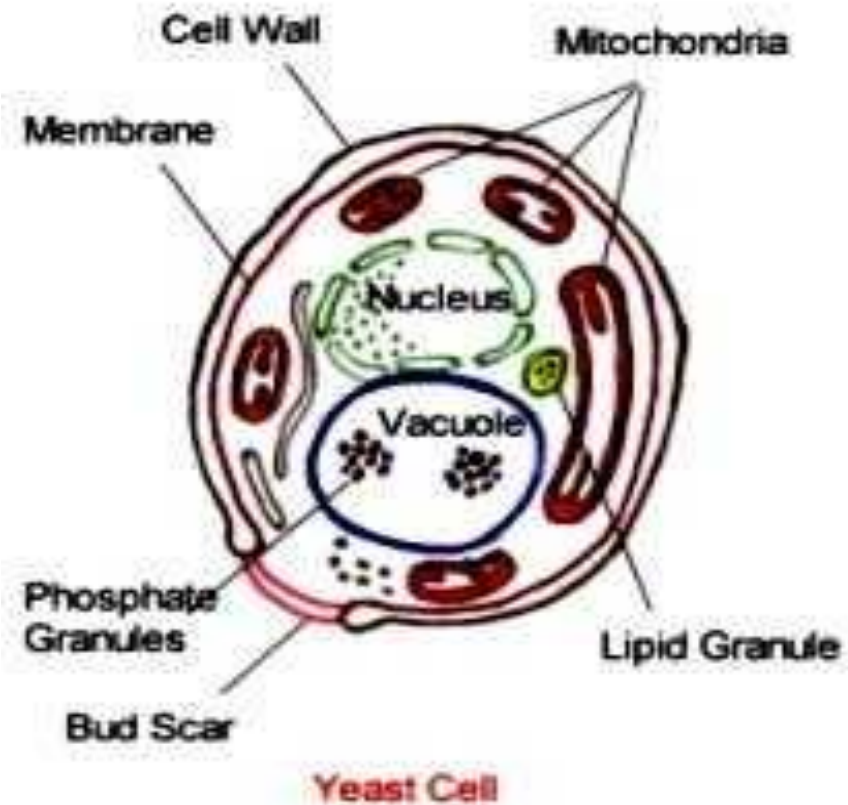
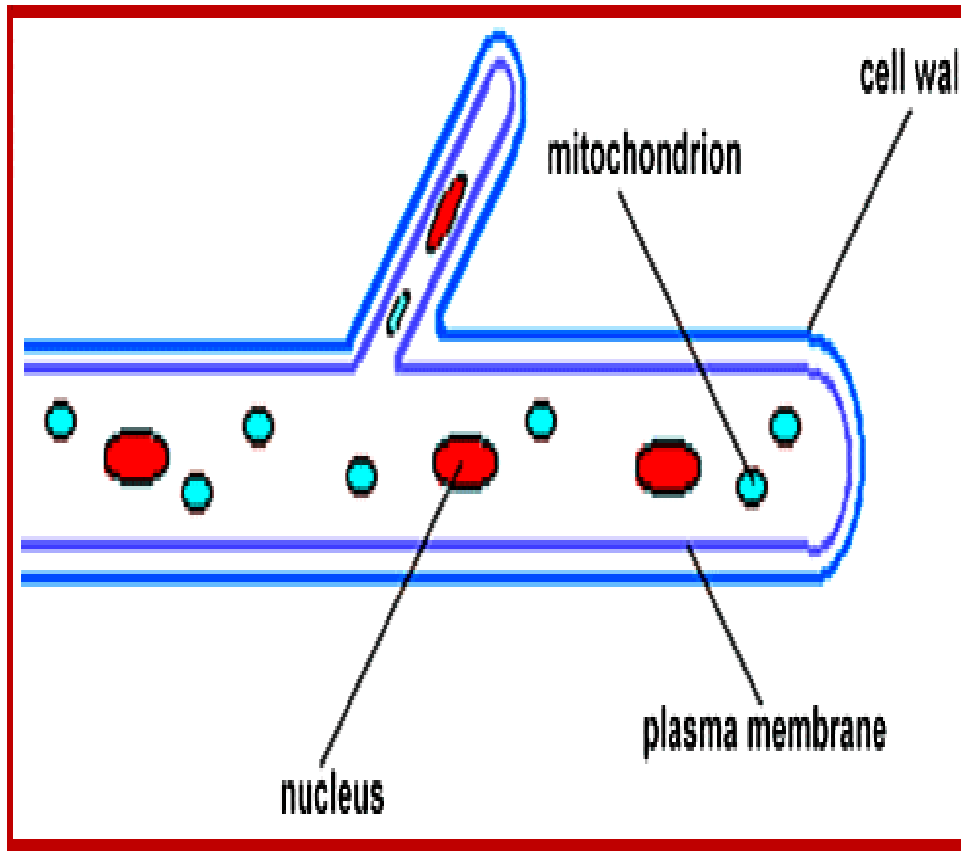
Filmental Fungi: Pencilliun- Aspergillus



Fungi cell Structures

- About **100 Fungi types** are opportunistic pathogens.. Yeasts are part of normal body flora.. Oral cavity-intestine-Vagina.. Opportunistic pathogens.. Few types like ***Cryptococcus neoformans*** are true pathogens
- All are not susceptible to **antibacterial drugs or phages**
- **Fungi Cell wall**: Mostly complex polysaccharides (chitin).. is a long-chain polymer of N-acetyl glucosamine, few amount glucan , mannan . **Cell membrane**: lipid-phosphate & protein .. Their Plasma membranes containing **Ergosterol**
- Yeast cytoplasm contains cell nucleus (16 chromosomes; 6250 genes).. microtubules composed of tubulin /Specific Protein..Mitochondria, Lipids & phosphate granules.

Hypha Cell-Yeast Cell



Growth of Fungi

- Yeast cell grows by **Mitosis**.. Chromosomes in nucleus are separated into two identical sets of chromosomes.. Each new cell will have the same nucleus..asexual growth.
- 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



Growth in Human tissues

- **Pathogenic Yeasts/ Candida species:** Attached to receptors in human mucosal cells.. Colonization.. produce often elongated oval cell & pseudohyphae as nest / biofilm.. Cause irritation followed by mild inflammation & erythematous lesions.. localized lesions.. No systemic infection under normal health conditions.
- **Pathogenic Mold:** single and multiply filaments.. cell fragments in infected tissue.. Rarely spores.. Superficial / internal lesions without inflammation or systemic disease.
- **Antifungal drugs:** Nystatin, Amphotericin B, Azoles, Caspofungin .. All react with ergosterol ..forming complex molecules or inhibit its production.. damage cell membrane.

Filamentous 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 globosa/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.. Feet fingers & skin interspaces: **Tinea pedis**.. moist skin lesions, Common in Adults, develop chronic lesion..difficult to cure
- **Causative agents:** Mostly Epidermophyton species. Less *Trichophyton* & *Microsporium* species

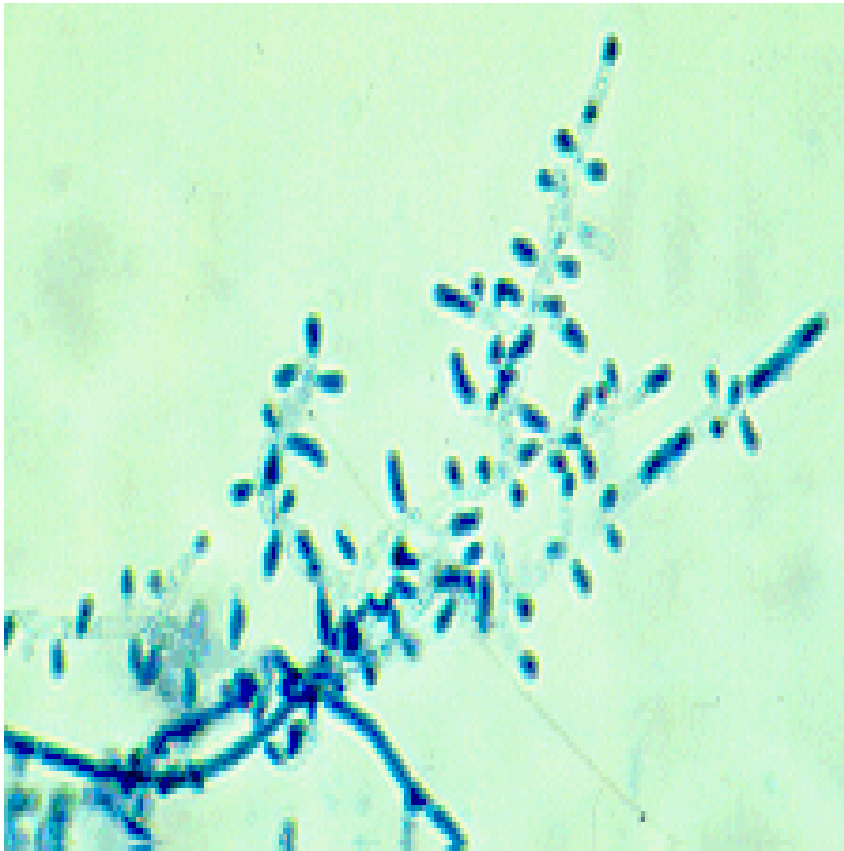
Tinea corporis- Pityriasis versicolor



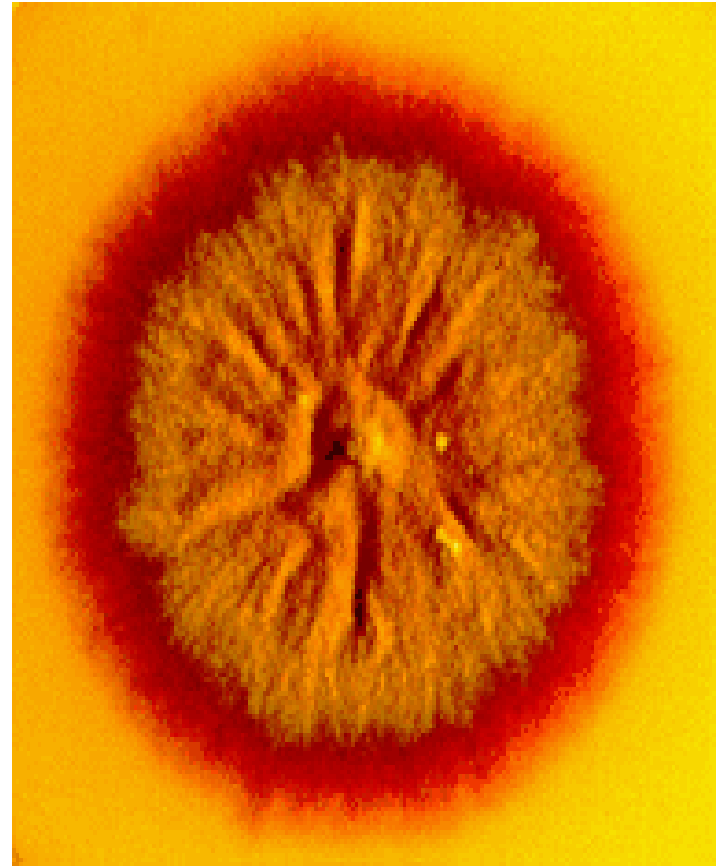
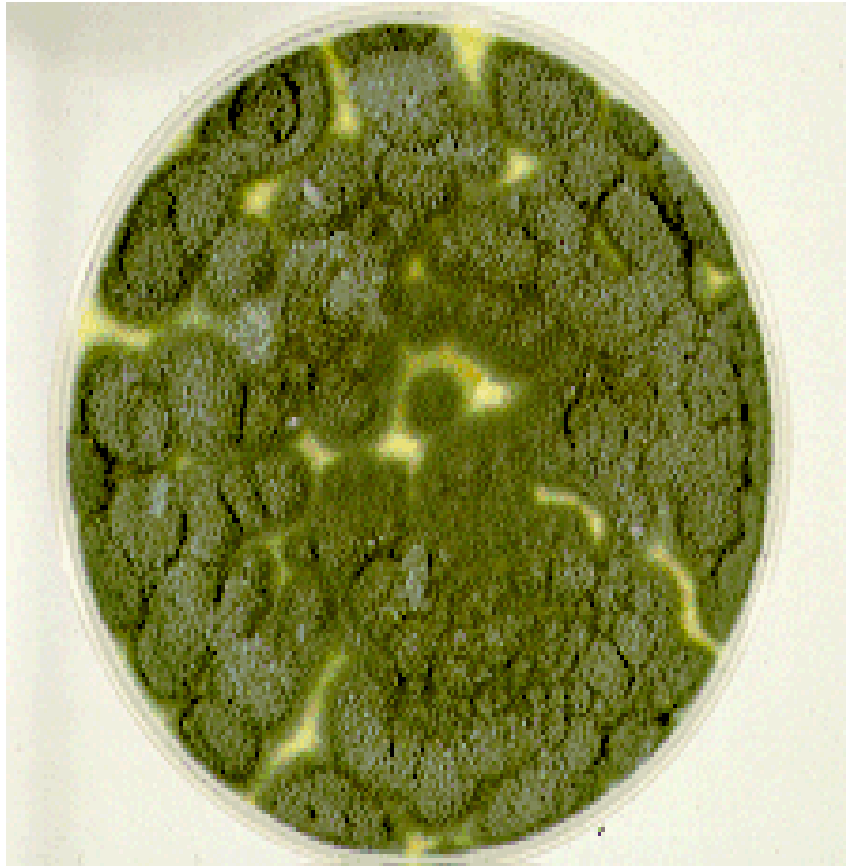
Tinea unguium – Tinea Tineacapitis



Microconidia-Macroconidia



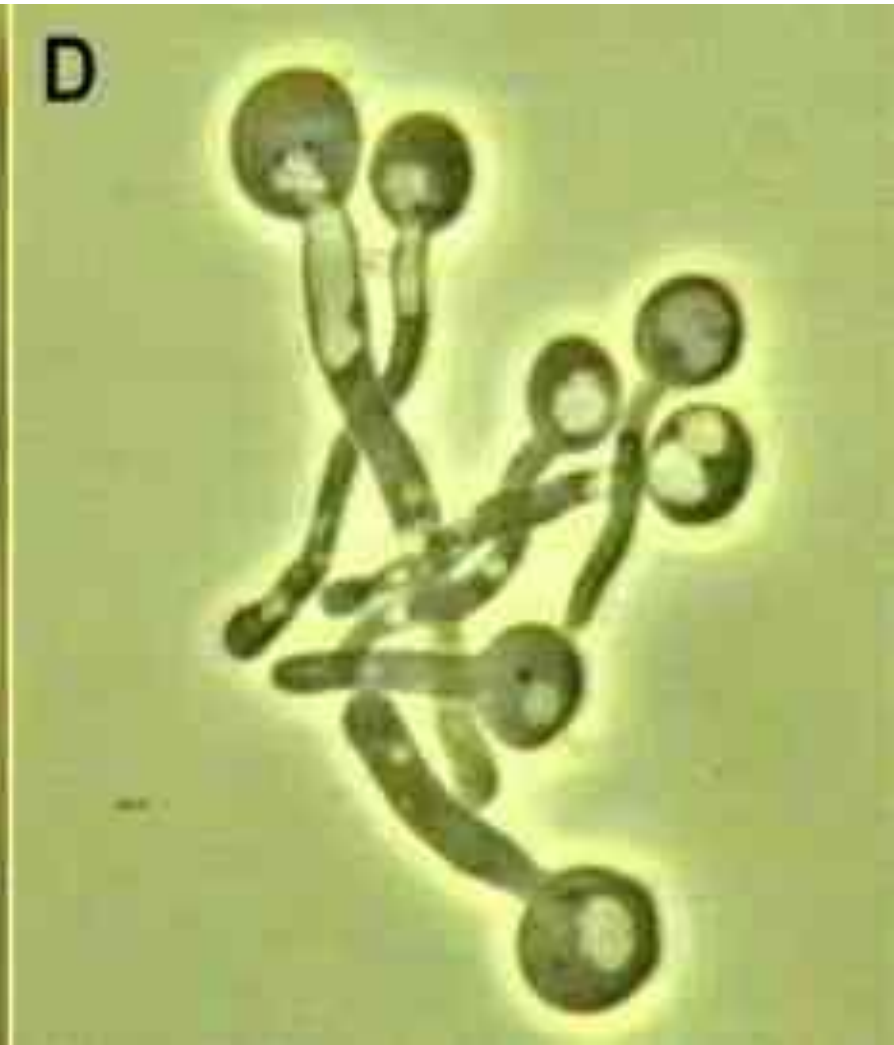
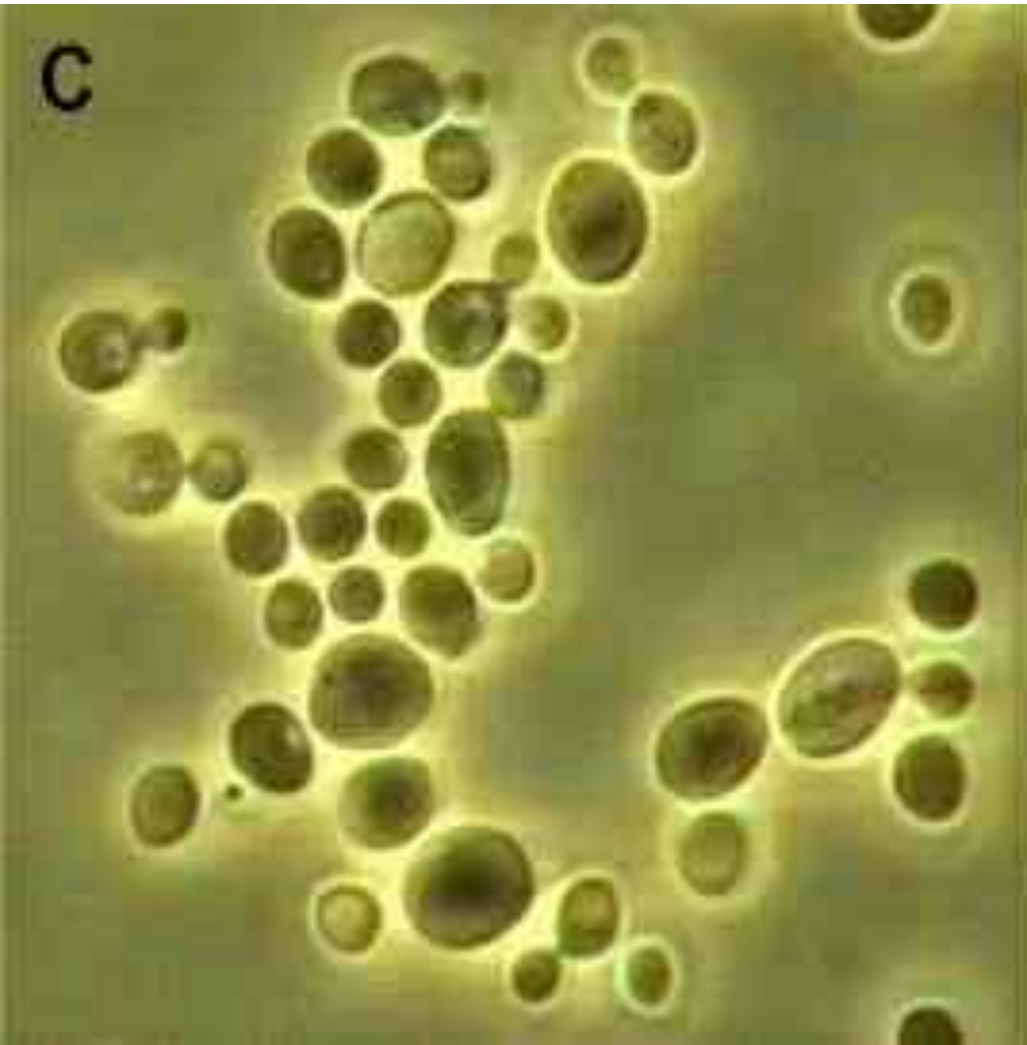
Penicillium-Trichophyton spp.



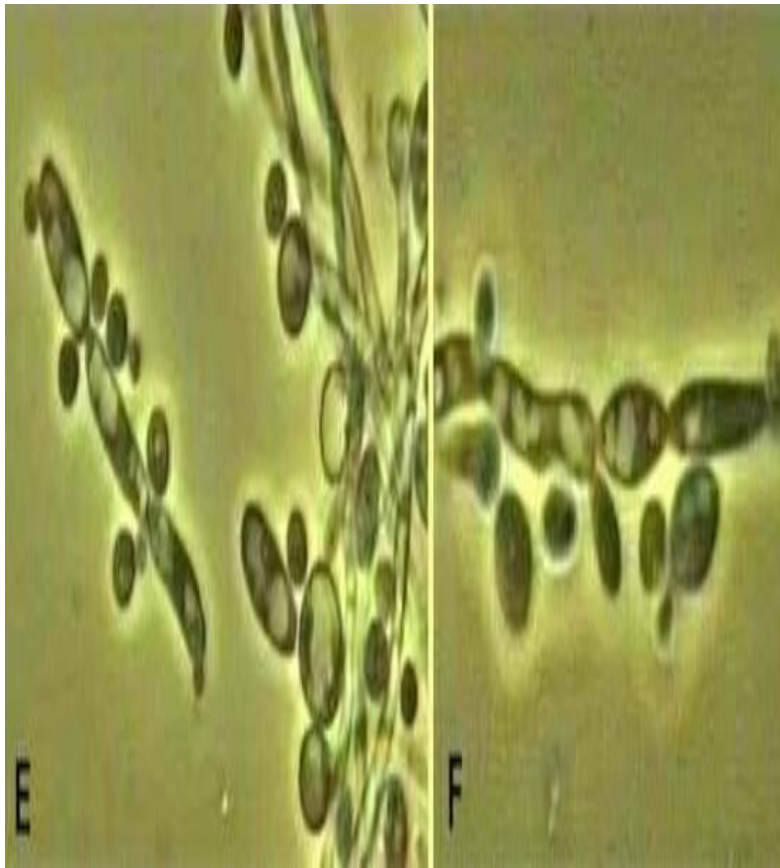
Yeast /Candida species

- **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..High mortality.

Budding Yeast & Germ Tubes demonstrated in Serum test



Candida Pseudohyphae (Chlamydo-Blastospores)



Candida Trush

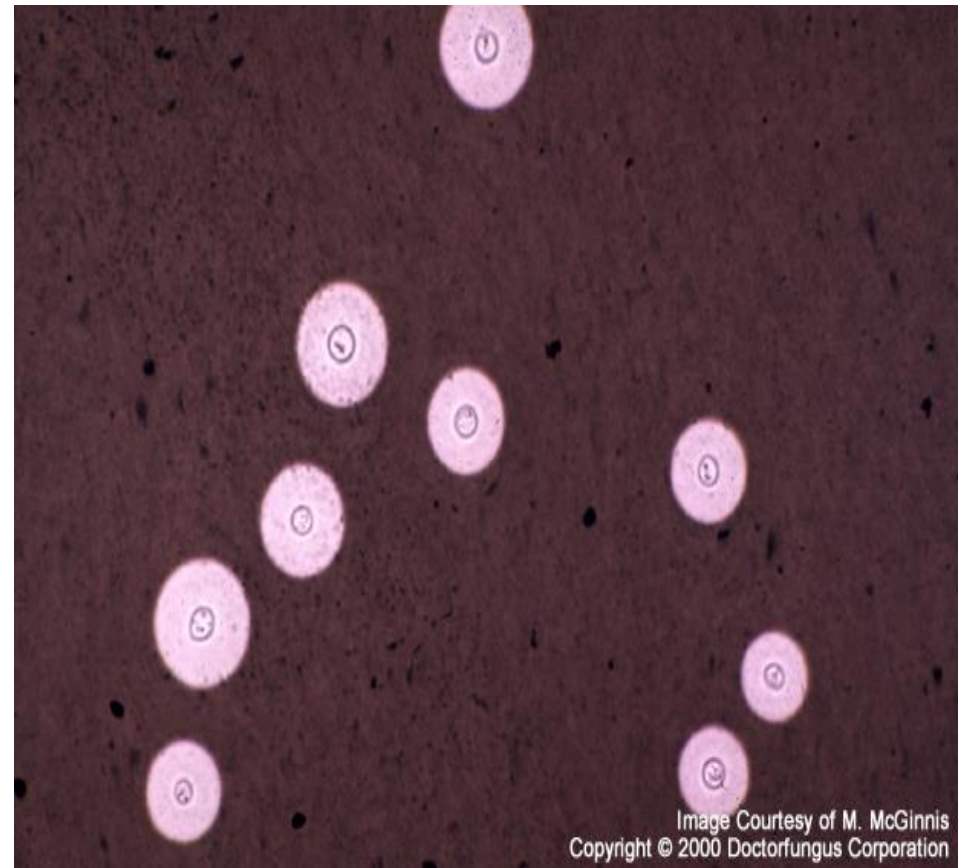
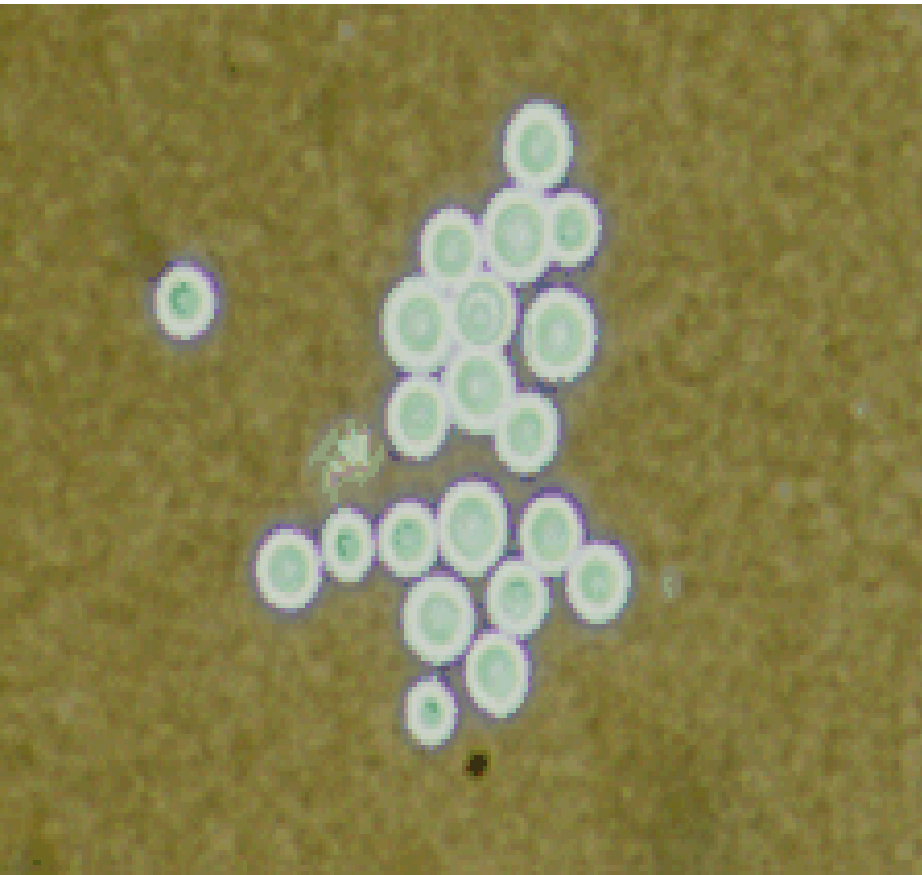


Other Yeast Infection

- Encapsulated *C. neoformans*.. Large polysaccharide 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..

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Capsulated Yeast / *Cryptococcus neoformans* (India ink test)



Mold infection: Aspergillosis-1

- ***Aspergillus species*** are common in nature .. Aerobic growth .. Spores spread with dust particles.. Easily contaminate all types of fresh food products.. rich in sugar & polysaccharid.. Grains, Peanuts, Ground nuts, Rice, Milk Powder .. Due to storage food under wet not dry condition
- Opportunistic Pathogenic type (*A. niger*) used in commercial microbial fermentations.. Alcoholic beverages, Citric acid, Enzymes.
- **Pathogens:** *A. fumigatus*, *A. flavus*, *A. niger*. Common Human Aspergillosis.. Inhalation.. Few develop Allergy or clinical disease
- **Allergic Bronchopulmonary Aspergillosis:** Presence of conidia or transient growth of the organism in body Respiratory tract associated with Granuloma ,allergic reaction, eosinophilia.. Lung /malignancy/asthma.

Aspergillosis-2

- Pulmonary lesions in preformed cavities .. debilitated tissues.. Common in Tuberculosis & Lung carcinoma patients..fatal outcome.
- **Localized Lesions**: Eye ,Sinuses, Cornea ulceration, Ear/Otitis Externa (Otomycosis) often associated with swelling, pain & black discharge.
- Treatment: Surgery & Antifungal Treatment.
- **Mycotoxiosis** : *A. flavus* ..releases fatal aflatoxins
- Worldwide million cases due to ingested contaminated protein rich foods with toxin causing liver cancer & damage.. Human & animals. Other *Aspergillus* spp. & filamentous fungi.. Mostly mild gastrointestinal symptoms..
- **Invasive aspergillosis**.. Acute Liver cirrhosis, Edema & hemorrhage in lung , kidneys..mostly in immunocompromised.. High fatality .

- 1-Aspergillus niger growth
- 2- Wet preparation, Aspergillus

