

# Introduction Medical Mycology

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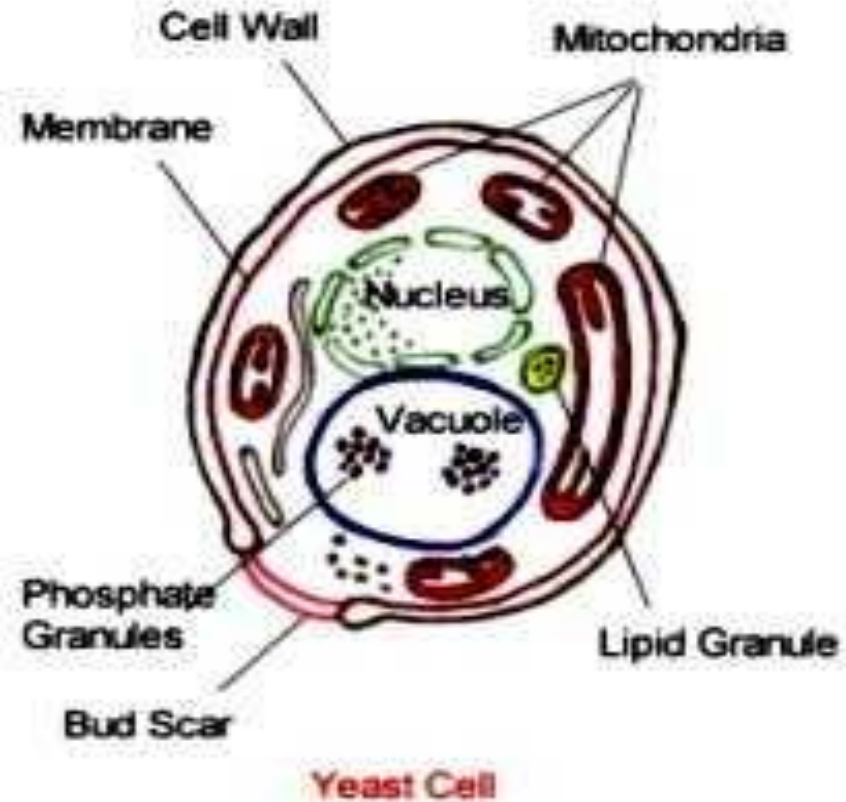
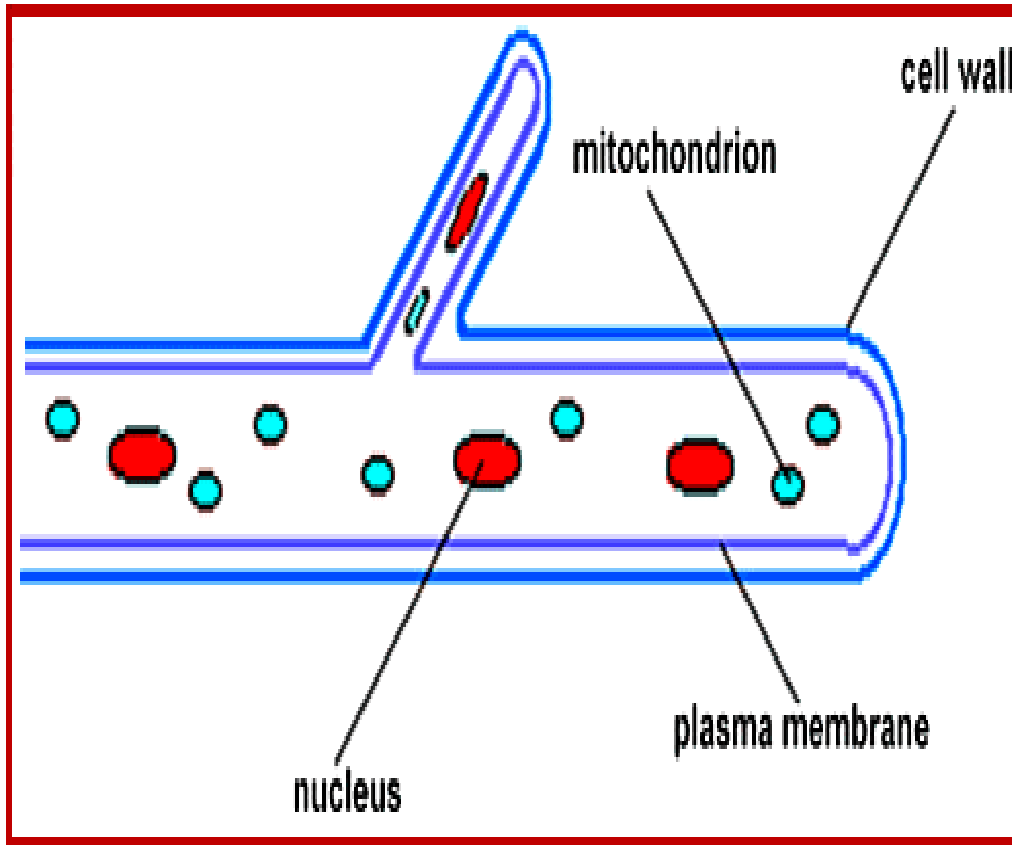
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# General Fungi-1

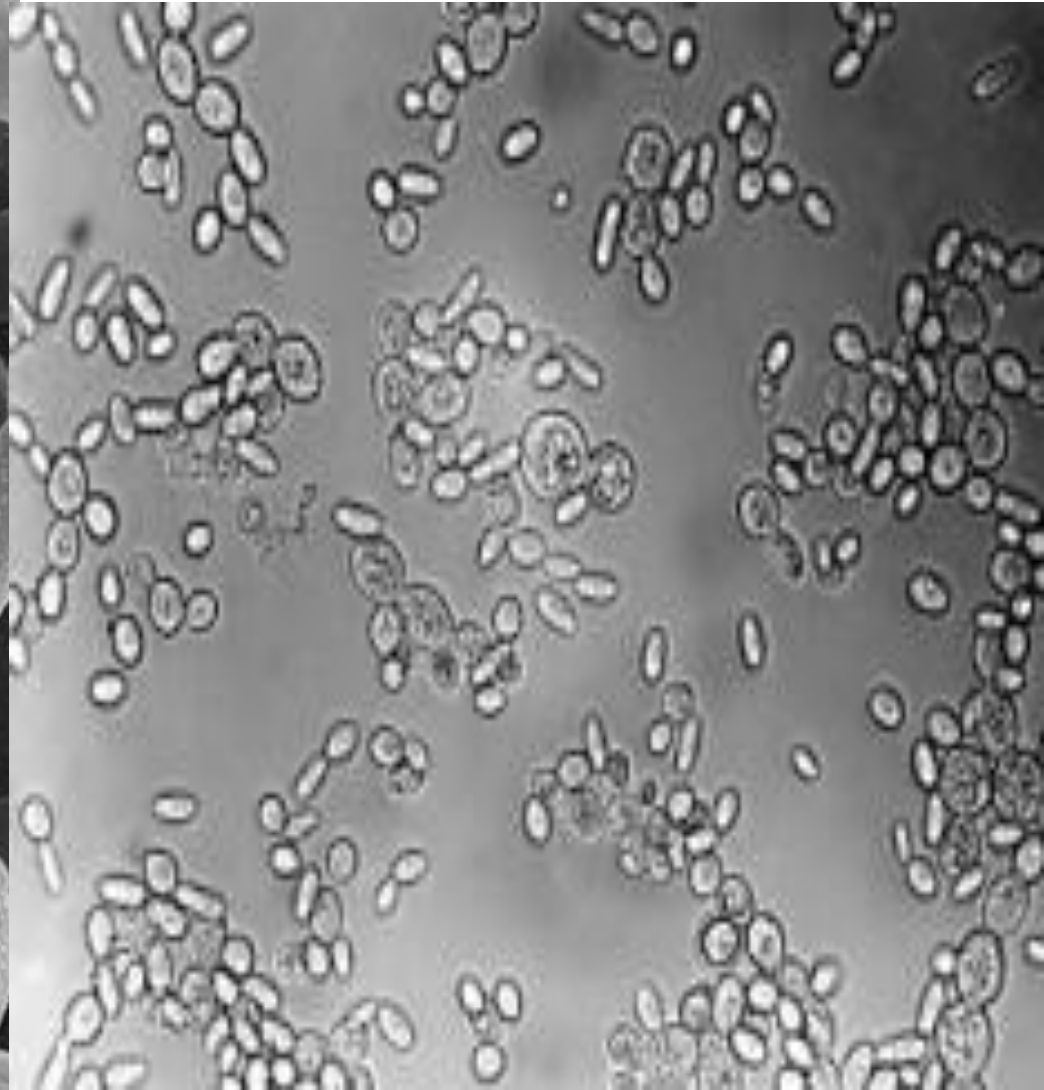
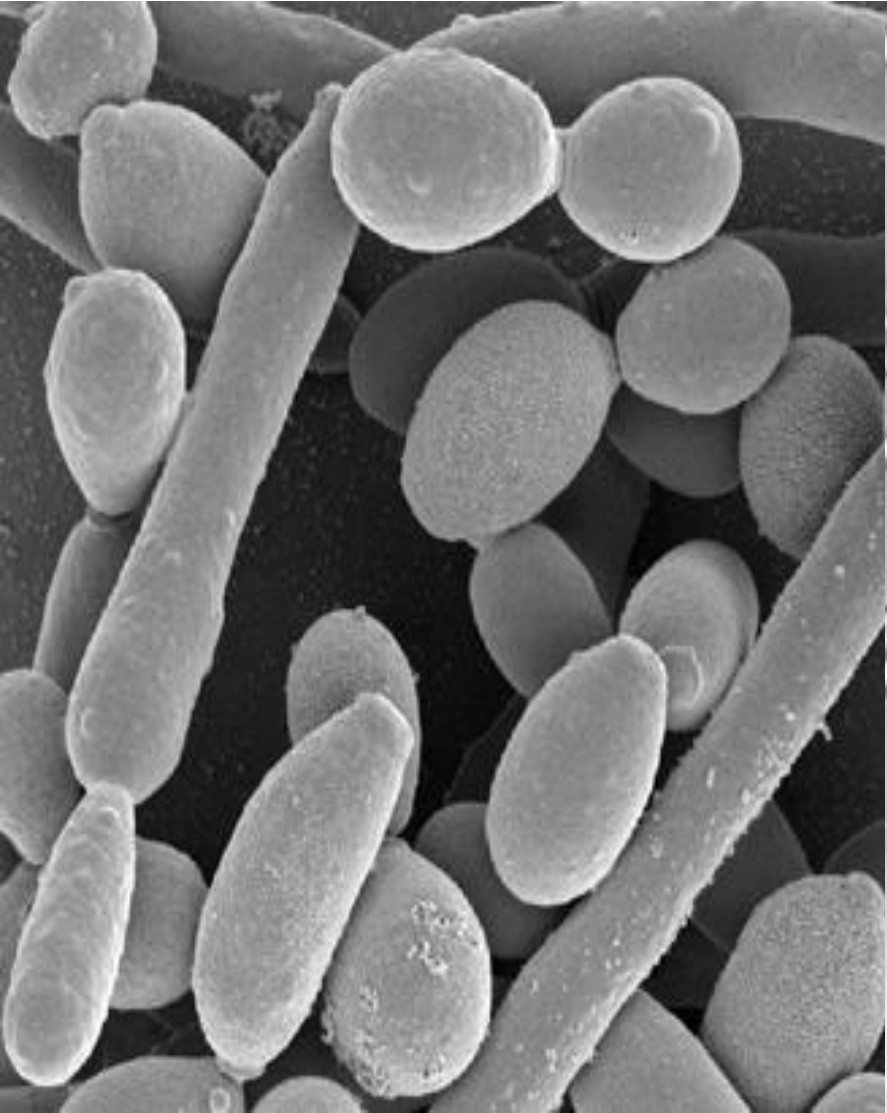
**Medical Mycology** deals with fungi cause human diseases directly (mycoses, allergies) or indirectly food poisoning.. **Mycotoxins**.

- About 100 Fungi are opportunistic pathogens.. Few Fungi are true pathogens.. Part of enviromental flora
- **Fungi** are Aerobic Eukaryotic microorganisms.. Larger than bacteria (0.5-2 um) occur as:
- **Yeasts** (unicellular oval cells) or Molds ( multi-cellular cells), hyphae/ branching filament or combination of both forms .. Various spores.. Yeasts.. Part human normal flora.. Oral -intestine-Genitals-Skin.. Incidence 5-20% in normal humans.

# Hypha (tubular Cell)-Yeast Cell structure



# Yeast Cells-Candida/ Budding yeast



## 2/ Cell Growth

- **Dimorphic Fungi..** grow as Yeast (in vivo) or Molds (in vitro).
- Molds /Multicellular fungi composed of Hyphae & Spores are widely distributed in nature.. decomposing organic/inorganic materials.
- Hyphae are found in randomly tangled masses called mycelia (aerial/vegetative mycelium).
- In molds, the mycelia often spread to fill the available space, limited by available nutrients.
- **Fungi** are heterotrophic.. essentially Aerobic .. Mostly found in Nature living in association with plants ..often as harmful organisms, or as free saprophytes on dead organic substances.

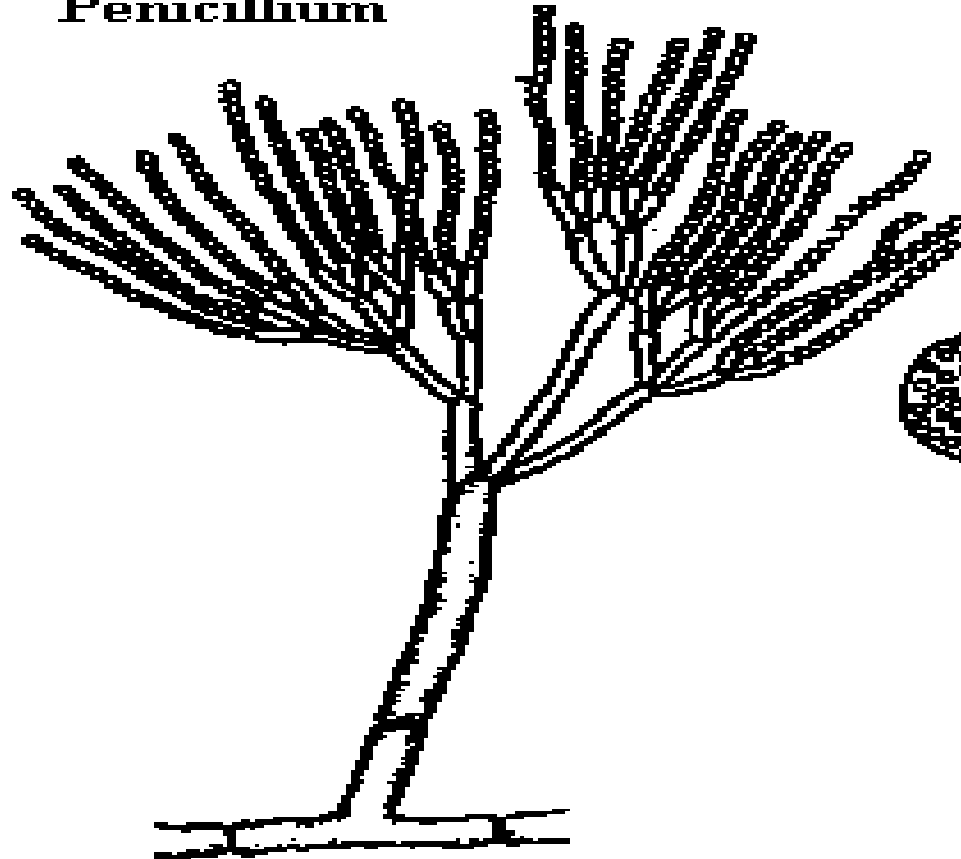
**Penicillium**

conidiospores

mycelium



**Penicillium**



**Mucor**



# Aminata Toxic Mushroom- Non-Toxic Mushroom in Nature

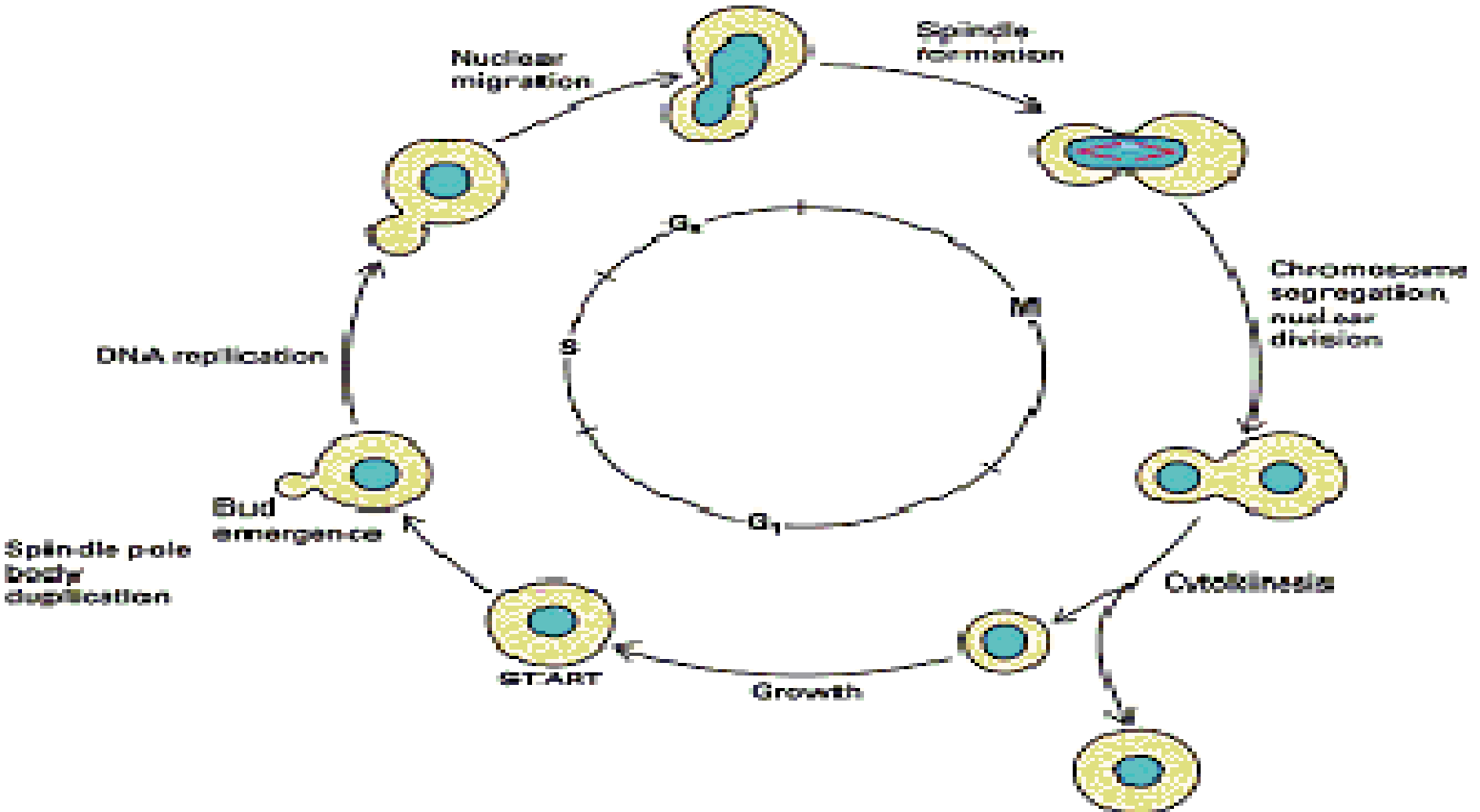


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- All Fungi are Aerobes.. have Chemoheterotrophic metabolisms, obtaining nutrients through enzymatic/chemical absorption.. Mineral, small sugar/protein molecules.
- Certain Fungi .. Producer Antibiotics.. Decompose organic materials.. Fresh & dry plants.. organic compounds.
- Molds Reproduction by various spores, hyphae.. apical extension of cells..
- Yeast Mostly reproduce asexually by budding.. although a few reproduce by binary fission (cell growth 12-15 minutes)



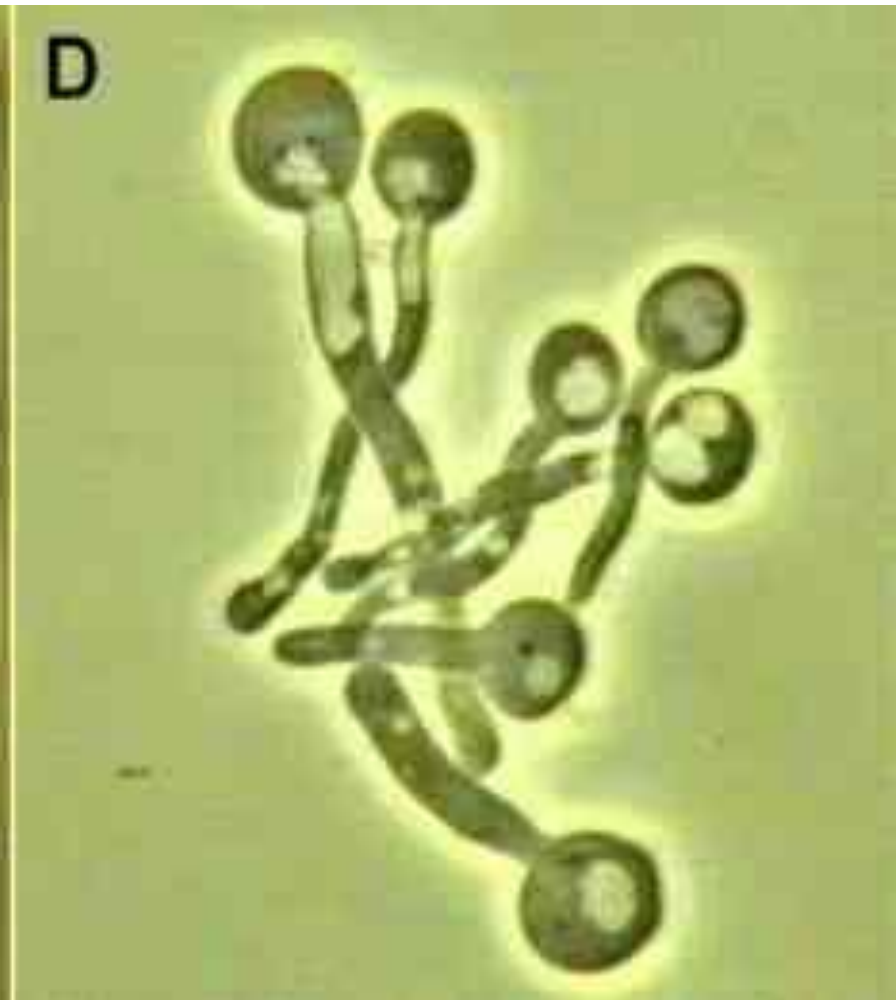
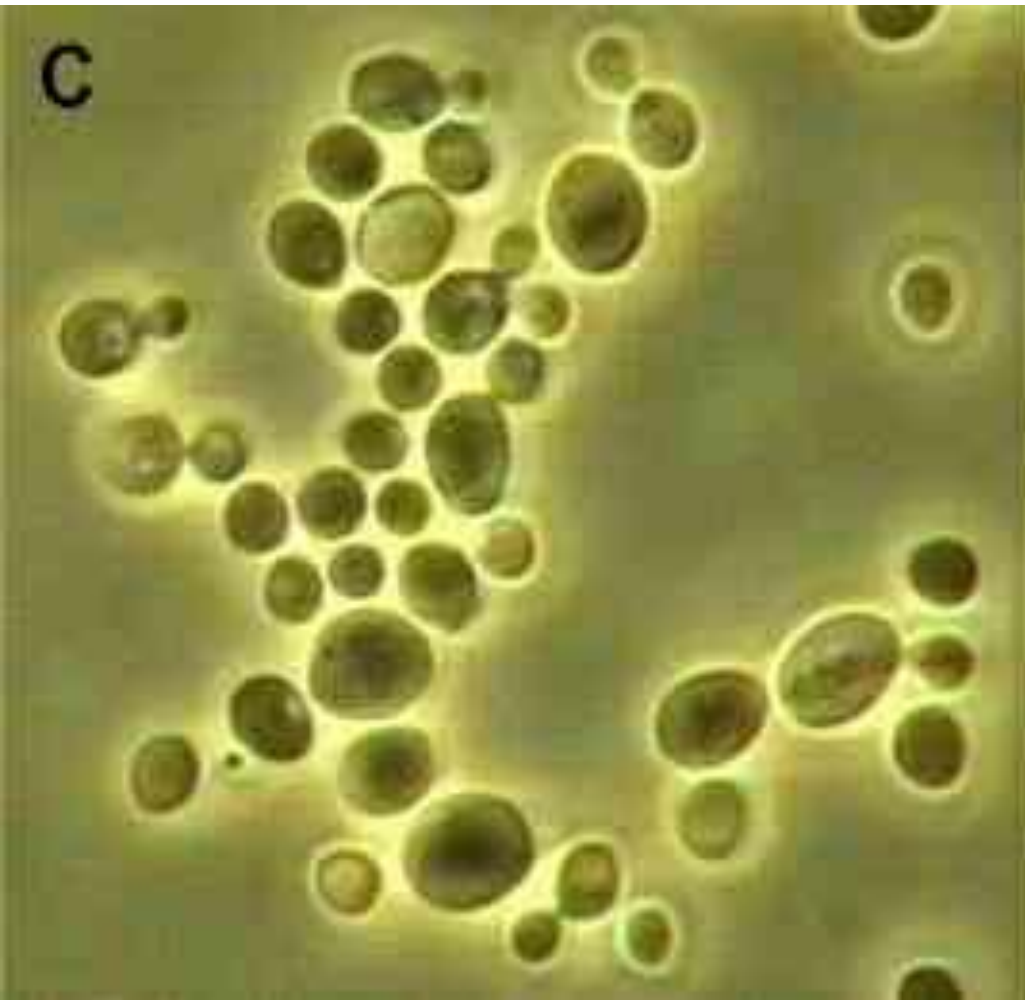
# Yeast Growth by Budding



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- **Baker's yeast**/ *Saccharomyces cerevisiae*.. Ferment Sugar.. Production Bread.. Vitamins, Proteins, Drugs Like Hepatitis vaccine.. Used in Genetic studies
- They are not susceptible to antibacterial drugs..phages
- Fungi Cell wall: Long chain Polysaccharides, mostly (chitin Polymers of *N-acytelglucosamine*).. Less  $\beta$ -glucan, mannan), lipid-phosphate-protein. Certain Yeast ( *Candida* spp.).. secret proteases & phospholipases, hemolysins.
- Their Plasma membranes containing Ergosterol, Cytoplasm contains microtubules composed of tubulin/Specific Protein
- **Yeasts** are single oval cell forms reproduce mostly by budding.. asexual reproduction.. Pseudohyphae produced in infected tissues.

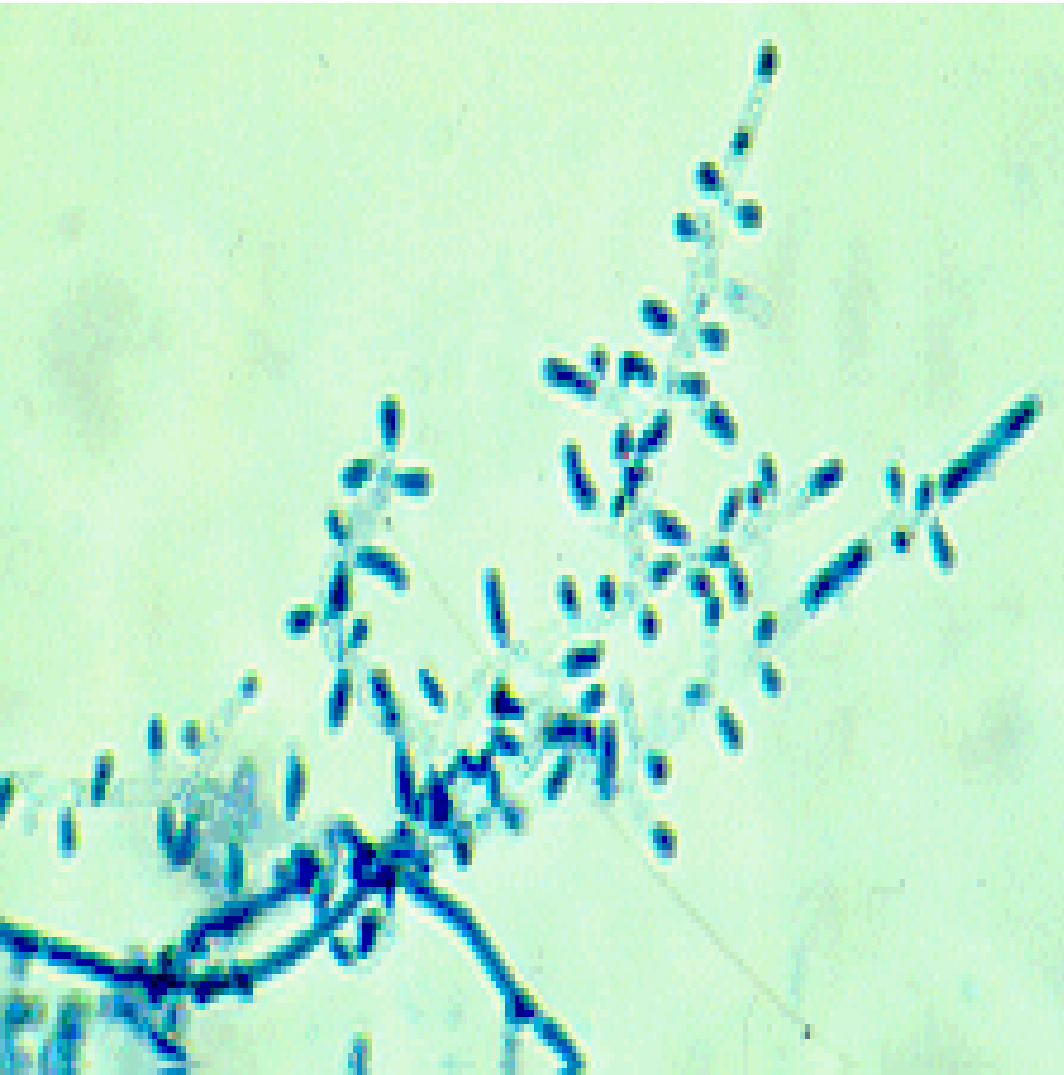
# Budding Yeast/Germ Tubes



# Filaments Fungi/ Molds

- Whereas molds form multicellular filaments/ hyphae .. non-septate/ septate hyphae.. spores of different sizes.. color.. arrangement .. A mass of hyphae represent Aerial & Vegetative Mycelium
- Dimorphic Pathogenic fungi grow as Yeasts or Yeast-like structure in vivo at 37°C, but as Molds at 25°C in vitro .
- Lab Identification: Depend mainly on their way of reproduction.. Conidia are asexual spores +hyphae (reproductive units) formed in various morphology structures.. **Microconidia**. Spores may be either asexual or sexual in origin. Asexual spores are produced in sac-like cells called Sporangia/ **Macroconidia**.

# Microconidia-Macroconidia



# Human Mycosis-1

- Superficial Mycoses/ Cutaneous Mycoses: Involve superficial keratinized.. Dead tissues.. skin, hair, Nails..
- Dermatophytes.. Worldwide distribution.. Spores, Hyphae fragments.. Common in nature, skin human, animals.
- Dermatophytosis - Ringworm / Tinea
- Skin-Body: Tinea corporis.. Most common.. Tinea versicolor / Pityriasis versicolor.. Yeast .. Malassezia furfur .. This Lipophilic yeast is normally found on the human skin and only becomes troublesome under certain conditions.. Causing chronic mild superficial infection ( stratum corneum).. increased in warm- humid environment.. Common under stress conditions.. Fever, Unknown Factors.. Allergic reaction.. Other dermatophytes may cause very similar infection.

# Human superficial Mycosis-2

- Discolored Skin spots.. macular patches.. Limited Inflammation and irritation.. commonly affect the back, underarm, upper arm, chest, lower legs, and neck. Occasionally it can also be present on the face.
- The yeasts can often be seen under the microscope within the lesions with typically round yeasts & filaments. Light to Dark patches on skin..
- **Hair**: Tinea capitis, Hairshaft..Scalp, Endo-Exothrix, Common in Children.. Rare Adults.. Infection Outbreaks .
- **Nail**: Tinea unguium, Tinea pedis, Feet fingers, Feet interspace, moist lesions, Common in Adults, Chronic
- **Causative agents**: *Dermatophytes*.. *Trichophyton* - *Microsporium* -, *Epidermophyton species*.

Tinea corporis-  
Pityriasis versicolor

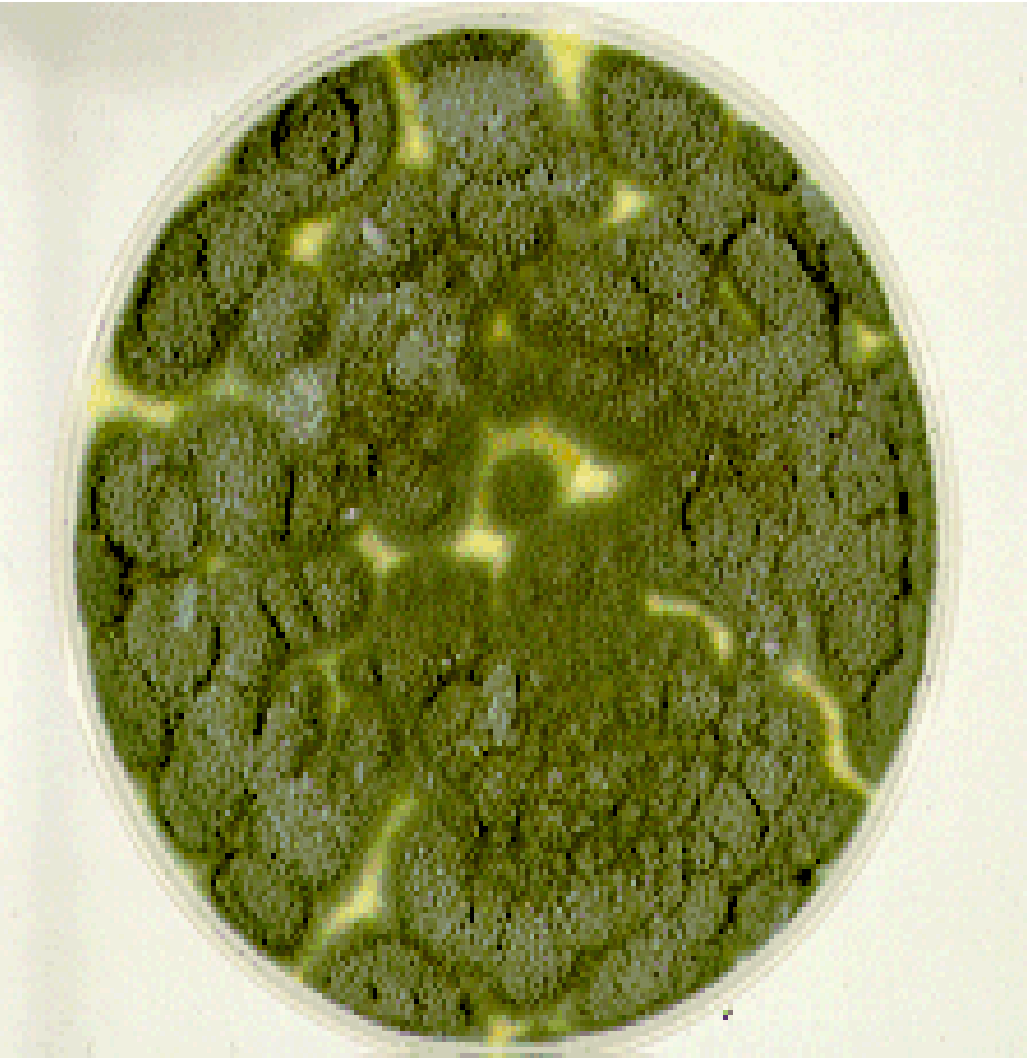




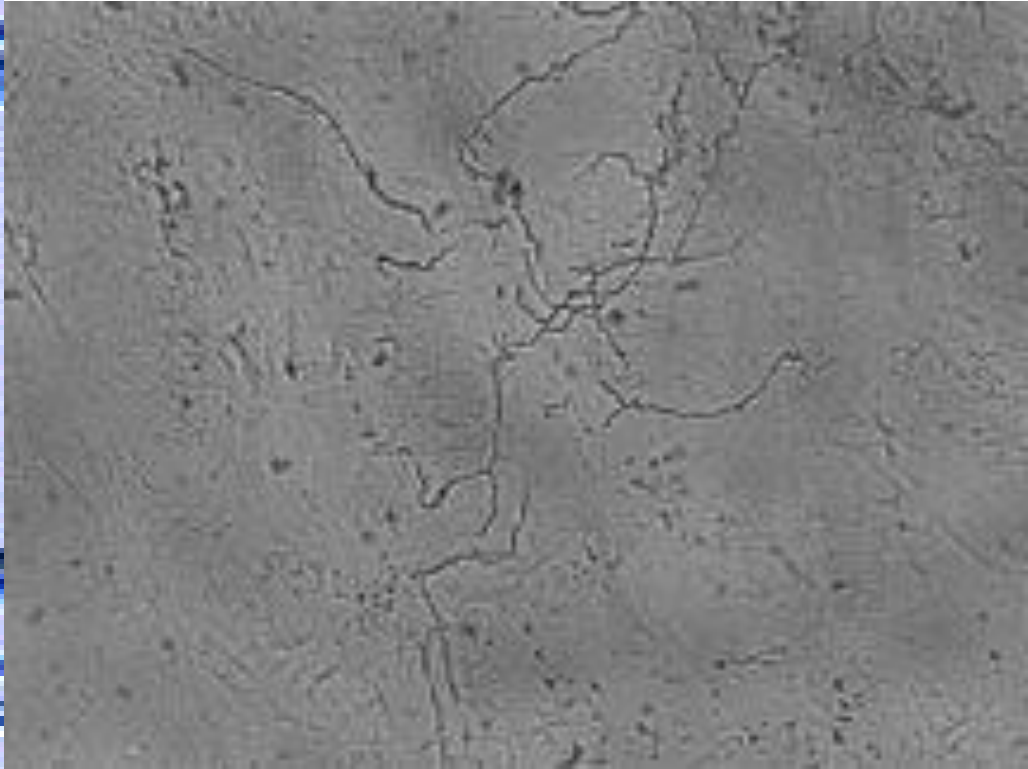
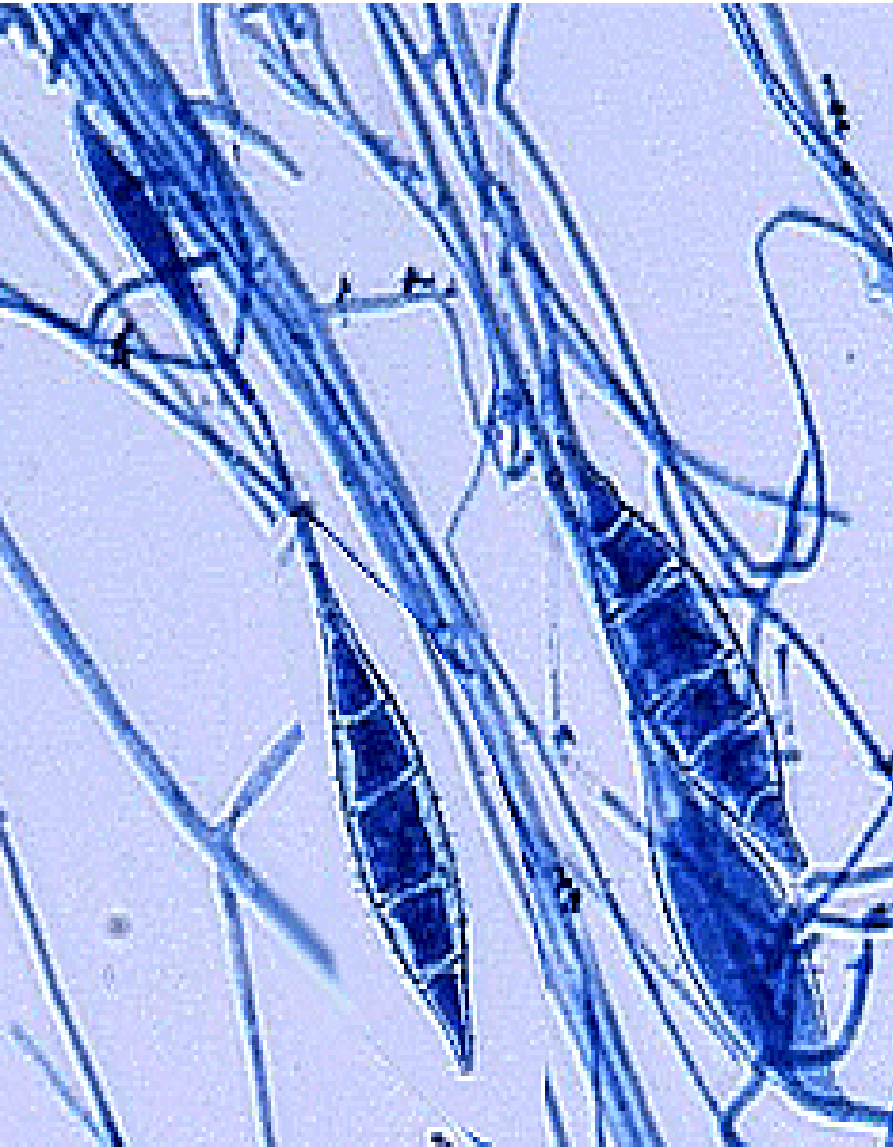
Tinea unguium –  
Tinea Tine acapitis



# Penicillin-Trichophyton spp.



# Microsporium Hyphae & Spores-Skin filaments/Hyphae



# Yeasts /Candida species

- **Candidiasis/ Candidiosis** : *C. albicans*, *C. glabrata*, *C. tropicalis.*, *C. Krusei.* Others spp. ..Less common Yeast: *Geotrichum spp.* , *Trichosporon spp.*
- Part normal body Flora.. Mouth, Vagina, Skin, Intestine, Urinary tract .. Common Opportunistic Infection
- **Opportunistic Pathogens**.. mostly an endogenous infection, arising from overgrowth of the fungus following intensive use of antimicrobial drugs.. Inhibiting normal flora.. Underlining diseases, compromised host, Radiation, Toxic drugs
- **It** may occasionally be acquired from exogenous sources .. catheters or prosthetic devices.. Respiratory tubes.. by person-to-person transmission.. Nosocomial Infection.

# Candidiasis -1

- **Oral Candidiasis** is showing characteristic patches of a creamy-white to grey pseudomembrane on Tong (Thrush)..  
Oral-gingival mucosa.. Throat.. Pharynx, Larynx.. composed of Pseudohyphae nest of *Candida cells*..
- Patients who wear **dentures** are often susceptible to develop **Candida stomatitis** .. the balance of the normal oral flora is disturbed by the presence of plastic dentures.. Xerostomia
- **Oesophageal Candidiasis**.. observed mostly in AIDS patients.. If patients not responded to first-line anti-Candida treatment, particularly fluconazole.. They may be infected with **Candida dubliniensis** .. resistant to this drug.

# Candidiasis -2

- \* **Candida infections** are now the most frequent cause of fungal infection in **immunocompromised patients**..
- \* Lesions in systemic Candidiasis may be localized in the mucosa of lung, urinary tract, liver, heart valves.. skin folds.. Causes pneumonia, endocarditis, chronic meningitis, Skin Lesions
- \* **Candida infections** may also be widely disseminated and associated with a septicaemia / candidaemia.
- \* **Systemic candidiasis** occurs mainly as an **opportunistic infection** in patients with an underlying disease
- \* Deep-seated Candidiasis is difficult to diagnose and treat, and its prognosis is generally poor.

# Candida Trush



# Candidiasis-3

- **Vaginal Candidiasis**.. inflammation the vaginal mucosa.. vaginal discharge, irritation, pain during urination, common in pregnant women, following use of antibiotics, sexual contact.. hormonal treatment.
- In healthy individuals, *Candida* infections are usually due to impaired epithelial barrier functions .. occur in all age.
- **Common Risk Factors** : Antibiotics, Oral steroids , Diabetes, Wearing denture, Immunodeficiency .. Leukemia, Cancer or HIV infection.. Radiation, Anticancer/immuno-depression drug treatment, Old age, Infants, organ transplantation.



# Candidiasis -4

- **Prevention**: Restore host immunity.. Control diabetes, Stop extensive use of Antibiotics, removing the underlining cause.. No vaccine is available.
- **Lab Diagnosis**: Microscopic Wet preparation.. Clinical specimens.. Tissue biopsies , Skin, Nails, Blood, CSF, Urine, Sputum, Oral swab.. Presence Budding cells.. Pseudohypha- Blastospores-Chlamydospores.
- **Culture**: Sabouraud dextrose agar, ChromCandida agar.. Aerobic Incubation Temp. 25-37C, 2 days, Sugar fermentation test.. Serological tests not significant
- **Treatment**: Topical.. Oral: Nystatin, Miconazol, Clotrimoxazol .. **Systemic**: fluconazol, Amphotercin B, All interact with Ergosterol ..causing Fungal Cell membrane disruption.

# 1-Candida Pseudohyphae-Chlamydo- Blastospores

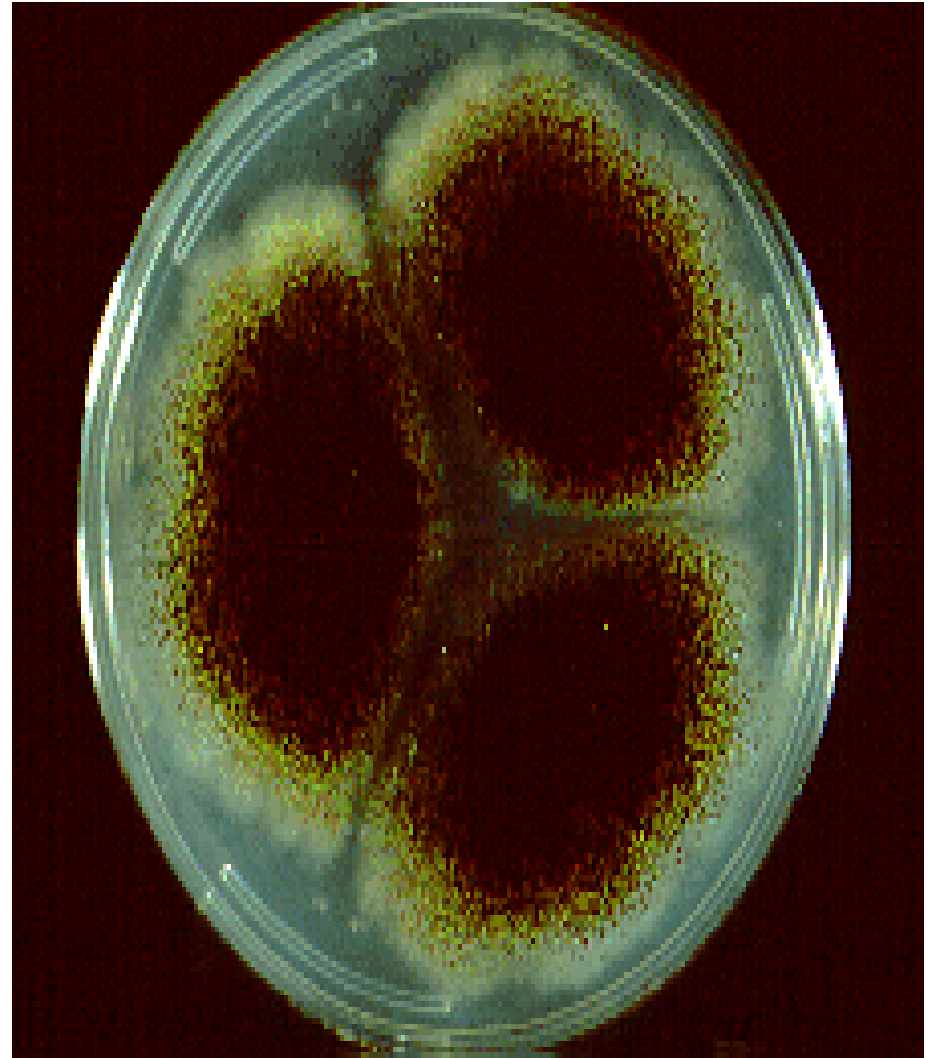
## 2-Gram-stain



# Aspergillosis-1

- **Aspergillosis / Zygomycosis:** *A. niger*, *A. fumigatus*., *A. flavus* / Producer of aflatoxins.. Food intoxication.. Rice, Nuts.. Peanuts.. Grains.. Cause severe liver cirrhosis.. high mortality.
- **Inhalation** of *Aspergillus* spores may lead to colonisation of existing lung & nasal cavities (**Aspergilloma**) or may cause hypersensitivity reaction (allergic Aspergillosis)..
- **Rarely** *Aspergillus* spp. may cause **invasive disease** of the lung, Sinuses, oral cavity .. disseminate to other organs.. Meninges /brain ..meningitis, brain abscess.. This form of disseminated **Aspergillosis** is seen in patients who are severely immun-compromised.

# Aspergillus niger-Conidial head-spores



# Cryptococcosis-2

- **Cryptococcosis:** Encapsulated Yeast *C. neoformans*.. Large polysaccharide capsule.. Common in Bird droppings.. Pigeons.. Human inhalation.. Chronic sinusitis, pneumonia, meningitis.. brain abscess .. Only immuno-Compromised host develop disease.
- Lab diagnosis: India ink wet preparation, culture on Sabouraud dextrose agar, Aerobic Incubation Temp. 25-37C, 4-7 days, Sugar fermentation tests.. Detection Cryptococcus antigen in blood.
- Surgical +Antifungal systemic treatment

# Capsulated Yeast / Cryptococcus neoformans (India ink test)

