INTRODUCTION TO MEDICAL MYCOLOGY

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Fungi (yeast & molds) are eukaryotic organisms whereas bacteria are prokaryotic, they differ regarding;
Size-diameter •
  4 um------1um
Nucleus. •
Cytoplasm •
Cell membrane, •
  Sterol---absent in bacteria
Cell wall, •
  Chitin ----peptidoglycane

Thermal dimorphism. •
Metabolism. •
Vacuole: cytoplasm less dense in older parts

Growing tip

Nuclei: this hypha is coenocytic (aseptate)

Cell wall

Cell membrane

Golgi apparatus

Mitochondrion

Rough endoplasmic reticulum

Nucleus
Fungal cell wall

Consists of chitin not peptidoglycan like bacteria.

Thus fungi are insensitive to antibiotics as penicillins.
Mannoproteins
- beta(1,6)-glucan
- beta(1,3)-glucan

Chitin

Phospholipid bilayer of cell membrane

beta(1,3) glucan synthase

glucan synthase inhibitor

depletion of beta(1,3) glucans in cell wall

Inhibition of beta(1,3) glucan synthase
Chitin is a polysaccharide composed of a long chain of n-acetyleglucosamine.

Also the fungal cell wall contain other polysaccharide, B-glucan, which is the site of action of some antifungal drugs.
Fungal cell membrane

Consist of **ergosterol** rather than • **cholesterol** like bacterial cell membrane. **Ergosterol** is the site of action of antifungal • drugs, amphotericin B &azole group
Atmospheric & carbon source requirements

Most fungi are **obligatory aerobes**, some are **facultative anaerobes**, but none are **obligatory anaerobes**.

All fungi require a performed organic source of carbon – association with decaying matter.
Natural habitat

The environment. •
Exception *Candida albicans* is part of normal human flora.
Medical mycology is the study of mycoses of man and their etiologic agents. Mycoses are the diseases caused by fungi. Of the several thousands of species of fungi that are known, less than 100 are pathogenic to man.
In addition to those species which are generally recognized as pathogenic to man it is firmly established that under unusual circumstances of abnormal susceptibility of patient, or the traumatic implantation of the fungus, other fungi are capable of causing lesions. Those are called (Opportunistic Fungi.)
These circumstances may be:

1. A debilitating condition of the host, as Diabetes.
2. A concurrent disease such as leukaemia.
3. Prolonged treatment with corticosteroids.
4. Immunosuppressive drugs or an antibiotic for long duration.
Morphology of Fungi
Morphology of Fungi

1. Filamentous fungi (molds)
2. Yeasts
3. Yeast-like fungi
4. Dimorphic fungi
Filamentous Fungi

1. The basic morphological elements of filamentous fungi are long branching filaments or **hyphae**, which intertwine to produce a mass of filaments or **mycelium**.

2. Colonies are strongly **adherent** to the medium and unlike most bacterial colonies **cannot be emulsified** in water.
mycelium: septate

mycelium: non septate
Mycelia & Conidia

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3. The surface of these colonies may be velvety, powdery, or may show a cottony aerial mycelium.

4. Pigmentation of the colony itself and of the underlying medium is frequently present.
Colony Morphology
Yeasts

These occur in the form of round or oval bodies which reproduce by the formation of buds known as blastospores.

Yeasts colonies resemble bacterial colonies in appearance and in consistency.

The only pathogenic yeast in medical mycology is *Cryptococcus neoformans*. 
Yeast colonies

*Cryptococcus neoformans*

Mucoid colonies
Cryptococcus neoformans
Yeast-Like

1. These are fungi which occur in the form of budding yeast-like cells and as chains of elongated unbranched filamentous cells which present the appearance of broad septate hyphae. These hyphae intertwine to form a pseudomycelium.

2. The yeast-like fungi are grouped together in the genus *Candida).*
Candida Colonies

Candida albicans
Candida albicans
Thermally Dimorphic Fungi

These are fungi which exhibit a filamentous *mycelial* morphology (saprophytic phase) when grown at room temperature $27^\circ C$, but have a typical *yeast* morphology (parasitic phase) inside the body and when grown at $37^\circ C$ in the laboratory (e.g. Histoplasmosis).
Histoplasma capsulatum 27°C
Human fungal infection;

- Superficial
- Subcutaneous
- Systemic
Superficial mycoses
Subcutaneous mycoses

Mycetoma

Sporotrichosis

Chromomycosis
Systemic Mycoses
Systemic Mycoses

Deep mycoses
- Brain
- Lungs
- Heart
- Liver
- Spleen
- Kidney

Superficial, cutaneous, subcutaneous mycoses
- Superficial (hair, nail, skin)
- Cutaneous (hair, nail, skin)
- Subcutaneous
Thank You