



## Medically Important Fungi

Fungi: are eukaryotic and nonphotosynthetic, which are the great practical and ecological importance; they include mushrooms, puffballs woody bracket fungi, molds and yeasts.

### Structure and function:

Fungi differ from bacteria in size, cellular organization, and methods of reproduction fungus is a general term that includes two different forms

a- Molds b- Yeasts c-Dimorphic (two form)

**A- Molds:** Structural unit is the hypha, filaments of hyphae can be subdivided into multicellular forms by cross walls, or septa, mold growth resulting in cobweblike aggregation of hyphae is called. mycelium, spores are the specialized reproductive cells of molds.

**B- Yeasts:** Oval to spherical cells that form moist shining colonies, some yeasts may produce capsules Reproduce asexually by producing new buds.

**C- Dimorphism:** Under certain environmental conditions some fungi exhibit two different forms, appearing as either molds or yeasts. This phenomenon is called dimorphism (e.g: Blastomyces Histoplasma).

### Reproduction and spores:

Type of spore & sporulation process are both important to fungal identification & classification Fungi spores function as reproductive cells spores are generated either asexually or sexually.

**1- Asexual spores** include Arthrospores Blastospores Chlamydo spores, Conidia, Sporangiospores, and Zoospores.

Under appropriate conditions of nutrition, moisture, pH and temperature, fungal spores germinate and produce one or more long structure called germ tubes Germ tubes subsequently develop into hyphae.

**2- Sexual spores** include Ascospores, Basidiospores, Oospores and Zygo spores.

### **Ultrastructure of fungi:**

Cellular membranes contain sterols, a property that separates fungi from procaryotes The cell walls of filamentous fungi are composed of thin, threadlike structures called microfibrils (which are composed of chitin) and cellulose. Yeast cell - walls contain the polysaccharides glucan and mannan, as well as lipids, and amino sugar glucosamine.

Pili appears on the cell walls of various yeasts. These structures are similar to those of bacteria and may involved with sexual reproduction of yeasts.

**Cultivation of fungi:** Molds & Yeasts can be grown & studied by cultural methods similar to those used for many bacteria. Media used for fungus cultivation are modified to limit the growth of other microbes. Ingredients used for this purpose include antibiotics, dyes, high concentrations of sugars, and compounds that lower pH of media.

**Types of media:** three basic types of media are used:

a. **Natural media** (e.g., carrot plugs, potato slices)

b. **Dehydrated media** (e.g., Sabouraud dextrose agar)

c. **Synthetic** (defined) media (media with known chemical composition).

**Classification** several properties of fungi are used in fungus classification. These include:

- a- Methods of reproduction
- b- Mycelial formation
- c- Cellular structure and formation.

**Five fungal classes are recognized on the basis of their method of reproduction:**

Ascomycetes, Basidiomycetes, Deuteromycetes (fungi imperfect), Oomycetes and Zygomycetes.

**Classification of mycotic infections:**

It is customary & useful to group the fungal diseases, or mycoses according to the tissues and organs affected and the disease pattern.

### **1- Cutaneous (superficial) mycoses**

Also called dermatophytosis, these common dermatophytes.

Dermatophytes fall in to three genera Epidermophyton, and Microsporum. Trichophyton .

Fungi that attack mainly the epidermis, hair, nails, and mucosal surfaces called superficial fungi.

The disease caused by such agents include the various forms of Ring worm or Tinea (from the Latin meaning "growing moth") and Candida infections of mucosal surfaces, such as thrush and vulvovaginitis.

Superficial Mycoses are further classified on the basis of the location of the effects produced by the causative fungus .e.g:

- Ring worm of the scalp is **Tinea capitis**.
- Ring worm of the feet is **Tinea pedis**.

Clinical significance characterized by itching, scaling skin patches that become **inflamed** & **weeping**.

**2- Subcutaneous mycoses** are fungal infections of the dermis, subcutaneous tissue, and bone.

These infections acquired through traumatic lacerations or puncture wounds. for example :

**a- Sporotrichosis** the infection characterized by a granulomatous ulcer at the puncture site, may produce secondary lesions along the draining lymphatics The causative organisms *Sporothrix schenckii*.

**b- Mycetoma** (Madura foot): appears as a localized abscess, usually on the feet. Abscess discharges pus, serum, and blood through sinuses, most common fungi are *Madurella grisea*.

**3- Systemic mycoses** infections in which the causative agent invade the subepithelial tissues are known as deep seated, deep, or systemic mycoses.

Entry into the host is by inhalation or airborne spores, germinate in the lungs, dissemination can occur to any organ of the body leads to destroy tissue.

**a- Coccidioidomycosis:** caused by *C. immitis*. Lung of patient with acute coccidioid pneumonia possible sites of infection are central nervous system & bone.

**b- Histoplasmosis** caused by *Histoplasma capsulatum*. pulmonary infections may be acute, chronic, progressive & fatal possible sites of infection are skin, bone, genitourinary tract.

#### **4- Opportunistic mycoses:**

Some fungi are opportunistic pathogens. They are not normally pathogenic to healthy persons, but under certain conditions, they can produce severe infections. Among these opportunistic agents are:

*Aspergillus, Candida, Cryptococcus, mucor and Rhizopus.*

Predisposing factors to opportunistic infection are: chronic, anemia, methabolic disorders, and intensive treatment with broad spectrum antibiotics and drugs that suppress antibody formation.

**a- Candidiasis (Thrush):** is caused by *Candida albicans*, are normal body flora found in skin mouth, vagina & intestine. Both oral & vaginal inections are treated topically with nystatin or clotrimazole.

**b- Cryptococcosis** is caused by *Cryptococcus neoformans* the organism has a characteristic polysaccharide capsule that surrounds the budding yeast cell. A positive capsual stain on CSF can give a quick diaganosis of cryptococcal meningitis. the most common form of cryptococcosis is a mild, subclinical lung infection. In immunocompromised patients the infection often disseminates to the brain & menings, with fatal consequences The antifungal drugs used are amphotericin B and flucytosine.

**c- Aspergillosis** is caused by several species of the genus *Aspergillus* but primarily by *A. fumigatus*. The most severs & often fatal form of

aspergillosis is acute invasive infection of the lung. from which the infection can be disseminated to the brain, Gastrointestinal tract(GI tract), and other organs. A less severe, noninvasive lung infection give rise to fungus ball (**aspergilloma**).

Although the lung is the most common primary site of infection, eye, ear, nasal sinuses, and skin can also be primary sites.

*Aspergillus* hyphae characteristically form V-shaped branches (septate hyphae that branch at 45-degree angle).

Treatment of *Aspergillus* infections is typically by **Amphotericin B** and surgical removal of fungal masses or infected tissue.

