CHAPTER (11)
GENERAL MYCOLOGY

• **Mycology** is the **study of fungi**

• **Fungi differ from bacteria in the following:**

Feature	Fungi	Bacteria
Size	Larger	Smaller
Nucleus	Eukaryotic	Prokaryotic
Mitochondria	Present	Absent
Ergosterol in cytoplasmic membrane	Present	Absent → **Mycoplasma** is the only bacteria that contains cholesterol in cytoplasmic membrane
Cell wall content	Chitin	Peptidoglycan
Spores	For reproduction → Reproduction may be by both sexual (meiotic), or asexual (mitotic) spores	For survival
Metabolism	• Heterotrophic • No obligate anaerobes	• Hetero- & autotrophic • Many obligate anaerobes

Morphological Forms:

① Yeasts	② Moulds
Grow as **single cells** (**round or oval**)	Consist of **long filaments (hyphae)** which may be: ❶ **Septate** (with cross walls) ❷ **Non-septate** (without cross walls)
Reproduce by **budding** & may form **pseudohyphae** (**hyphae with constrictions**; **sausage-like chain**)	They grow by **branching & tip elongation** → forming **mass called mycelium** on culture media
Examples include *Candida* & *Cryptococcus*	**Examples include** *Aspergillus, Penicillum* & *dermatophytes*

N.B.: **Dimorphic fungi** (e.g. *Histoplasma*)
Those that **can switch between the previous two forms** depending on the temperature
• At **body temperature** → they **grow as yeasts**
• At **room temperature** → they **grow as moulds** (hyphae)

Clinical Classification:

A- Mycotic infections:

① **Superficial mycoses**	Affecting **keratinized layers of skin**	e.g. *Pityriasis versicolor*
② **Cutaneous mycoses**	Affecting **deep layers of skin**	e.g. *candida* & *dermatophytes*
③ **Subcutaneous mycoses**	In which **fungi present in soil are implanted in subcutaneous tissue** by **trauma**	e.g. *mycetoma*
④ **Deep (systemic) mycoses**	Affecting **internal organs** **These fungi fall in two groups** ❶ **True pathogens:** Infecting **normal healthy individuals** → e.g. *Histoplasma* & *Blastomyces* ❷ **Opportunistic pathogens:** Infecting **immunocompromised individuals** → e.g. *Pneumocystis, Cryptococcus* & *Candida*	

B- Mycotoxicosis: → produced by **consumption of food containing fungal toxins** → e.g.
- **Mushroom poisoning** → causes damage to liver, kidney & bone marrow
- **Aflatoxin of *Aspergillus flavus*** → may cause chronic liver damage & cancer

C- Allergic disorders:
Spores of free-living fungi as *Aspergillus* may be **allergen in some cases** of atopy (asthma, hay fever, urticaria ... etc)

Pathogenesis:

- Infection with **certain systemic fungi** (e.g. *Histoplasma*) → elicits **granulomatous host defense** response (composed of **macrophages** & **helper T-cells**)

- Infection with other fungi (notably *Aspergillus*) elicits **pyogenic response** (composed of neutrophils)

Diagnosis of fungal infections:

Laboratory diagnosis of fungal infection involves 2 main diagnostic methods:

① Direct methods:
Which depend either on **detection of fungi &/or their antigens** in **patient's specimens**, or on **isolation of fungi**

② Indirect methods:
Which depend mainly on **detection of serum antibodies against suspected fungus** in systemic mycosis or, less frequently, on skin tests

Different methods used in **diagnosis of fungal infections**
are discussed in "Practical Microbiology & Immunology"

Anti-fungal Drugs:

- Because **fungi are eukaryotes →** the **range of non-toxic systemically active anti-fungal** drugs is still limited

- **Selective toxicity of anti-fungal drugs** is based on **presence of ergosterol in fungal cell membranes**, in contrast to **cholesterol found in human cell membranes** & **absence of sterols in bacterial cell membranes**

- Most commonly used drugs are:
  - ❶ **Amphotericin B**
  - ❷ **Mycostatin (nystatin)**
  - ❸ **Azole drugs** (e.g. fluconazole, ketoconazole & itraconazole)

Test Yourself

1) <u>**Fungi have the following characters EXCEPT:**</u>
   - a- They replicate sexually and asexually
   - b- They are eukaryotic
   - c- They have ergosterol in the cell membrane
   - d- They are heterotrophic
   - e- They are susceptible to antibacterial agents