



Introduction to Mycology & Fungal cell structure

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Course: Medical Mycology

Summer School

Lecture 1

Syllabus

1. *Introduction to Mycology*
2. *Fungal structure and function*
3. *Fungal Infection and types*
4. *Antifungal Therapy*
5. *Dermatophytes*
6. *Candida sp.*
7. *Aspergillus sp*
8. *Histoplasma capsulatum*
9. *Cryptococcus*

Objectives

- Mycology and Medical Mycology
- Fungal Cell

What is Mycology:



Mycology is a branch of Microbiology concerned with the study of fungi, and yeast including their genetic and biochemical **properties**, their **taxonomy** and their use to human as a **source of food**, **traditional medicine**, as well as their **dangers**, such as **toxicity** or **infection**.

A Microbiologist specialized in mycology is called a **mycologist**

- **Medical Mycology:** The study of fungi causing human and animal diseases, focusing on pathogenesis, diagnosis, virulence, and antifungal therapy.

What are Fungi:

The kingdom Fungi is composed of unicellular or multicellular, eukaryotic, heterotrophic microbes. Each fungal cell contains a full array of organelles and is bound by a rigid cell wall containing chitin, glucan, and/or cellulose.



- **General Characteristics of Fungi:**
 - **Eukaryotic** organisms containing membrane-bound organelles and DNA wrapped around histone proteins.
 - **Non-motile, heterotrophic** microbes that absorb external nutrients.
 - **Unicellular** or **multicellular** forms bound by a rigid **chitin/glucan** cell wall.
- **Distribution:** Ubiquitous in nature—found in soil, water, air, and host mucosa wherever moisture is present.

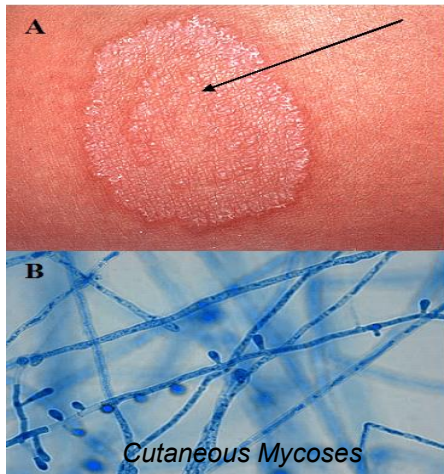


Medical Impact & Pathogenicity Principles

- **Primary vs. Opportunistic Pathogens:**
 - **Primary Pathogens:** Capable of establishing infection in healthy hosts (e.g., *Coccidioides* species).
 - **Opportunistic Pathogens:** Any fungus growing at 37°C can cause disease in immunocompromised hosts.
- **Factors Influencing Disease Severity:**
 - **Host Factors:** Immune status, underlying health conditions, and immunosuppressive therapy.
 - **Infectious Load:** Number of spores/conidia or yeast cells inhaled, ingested, or injected.

Classification of Mycoses

1. **Superficial Mycoses:** Affect the outermost layers of skin and hair.
2. **Cutaneous Mycoses:** Affect deeper epidermal layers, skin, hair, and nails (caused by dermatophytes).
3. **Subcutaneous Mycoses:** Involve subcutaneous tissue, connective tissue, muscle, and fascia.
4. **Systemic Mycoses:**
 - **A) Systemic Primary:** Caused by dimorphic fungi in healthy hosts.
 - **B) Systemic Opportunistic:** Exploit host immune deficiencies (exogenous or endogenous normal flora).



Systemic Mycoses

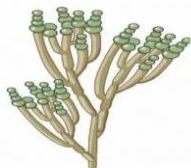
Gross Morphological Forms of Fungi

- **Yeast Form:** Unicellular, spherical to egg-shaped cells with a single nucleus; non-motile.
- **Mold (Filamentous) Form:** Multicellular structures consisting of thread-like filaments called **hyphae** that aggregate into a **mycelium**.
- **Dimorphic Fungi:** Fungi that alternate between Yeast and Mold forms via the **YM Shift** in response to environmental conditions.

Morphological Comparison



Characteristic	Yeast Form	Mold (Filamentous) Form
Cellular Organization	Unicellular	Multicellular
Microscopic Structure	Oval/spherical cells	Thread-like hyphae forming a mycelium
Reproduction	Budding, transverse division, or sexual spores	Apical hyphal elongation & spore formation
Motility	Non-motile (no flagella)	Non-motile
Representative Examples	Saccharomyces, Cryptococcus	Penicillium, Aspergillus



Mold

Molds are fungi form in multicellular fibers called hyphae



Yeast

Yeasts are fungi growing as unicellular

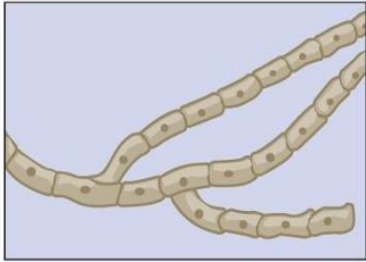


Hyphal Architecture & Types

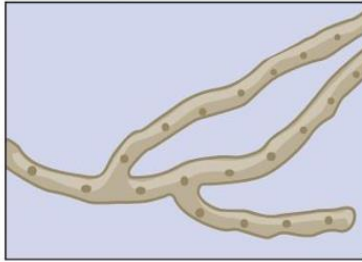
- **Septate Hyphae:** Divided into regular cellular compartments by internal cross-walls called **septa**.
 - Septal pores allow cytoplasm, ribosomes, mitochondria, and nuclei to stream between cells.
- **Coenocytic (Non-septate) Hyphae:** Lack septa; exist as continuous, multi-nucleated tubes with uninterrupted protoplasmic flow.
- **Pseudohyphae:** Chains of newly budded yeast cells that remain attached end-to-end without separating.

Types of Fungal hyphae

septate hyphae

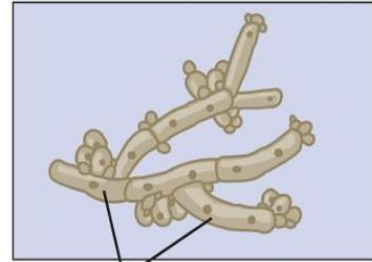


coenocytic (nonseptate) hyphae



molds

pseudohyphae



yeast cells

Lecture Summary

- Mycology: Study of fungi; medical mycology focuses on fungi causing human and animal disease, including pathogenesis, diagnosis, virulence, and antifungal therapy.
- Fungal characteristics: Fungi are eukaryotic, non-motile, heterotrophic organisms with a rigid chitin/glucan cell wall; they may be unicellular or multicellular.
- Clinical importance: Fungi may be primary or opportunistic pathogens. Disease severity depends on host factors and infectious load.
- Mycoses: Superficial, cutaneous, subcutaneous, and systemic mycoses; systemic infections may be primary or opportunistic.
- Morphology: Yeast are unicellular; molds consist of hyphae forming mycelium; dimorphic fungi can switch between yeast and mold forms.
- Hyphae: Hyphae may be septate or coenocytic (non-septate); pseudohyphae are chains of attached budding yeast cells.