222 MBIO
Microbial Fine Structure

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Fungal Cell Structure

- Lab 6 -

Kingdom Fungi – General Characteristics

- **Eukaryotic Organization:** Fungi are eukaryotic organisms containing a true nucleus and membrane-bound organelles.
- **Achlorophyllous:** They lack chlorophyll and are entirely **incapable** of photosynthesis
- **Absorptive Heterotrophs:** Fungi **obtain nutrients** by secreting enzymes to break down organic matter and then **absorbing** the resulting compounds.
- The study of fungi is called **Mycology.**

Ecological Lifestyles

Saprophytes

Feed on dead or decaying organic matter.

Many soil fungi, including species of ***Aspergillus***.

Parasites

Derive nutrients from living plants, animals, or other fungi.

Candida albicans - (human pathogen)

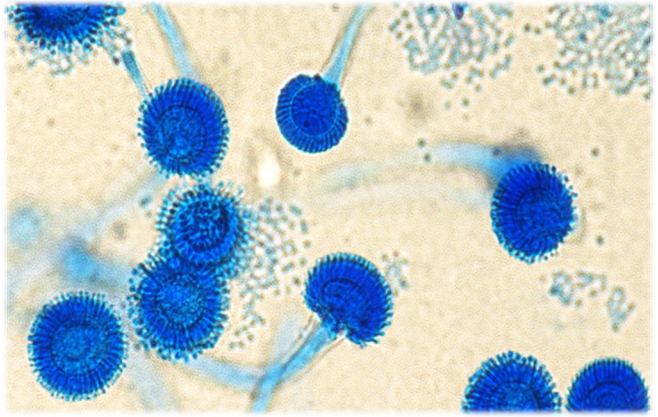
Symbionts (Mutualists)

Live in mutually beneficial relationships

Cladonia

(lichen-forming fungi)

Cladonia



Aspergillus sp.

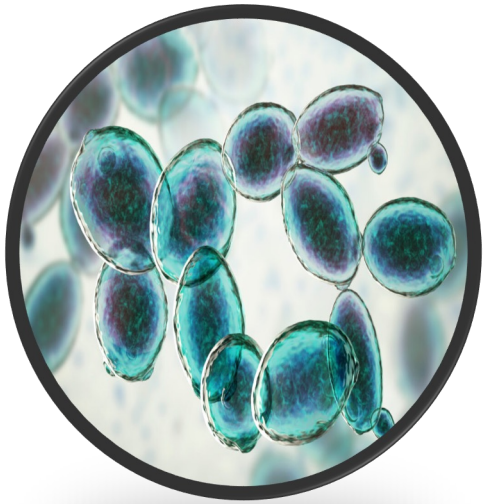
Candida albicans

Fungal Cell Structure

Unicellular Fungi (Yeasts):

Microscopic, single-celled organisms that typically reproduce by budding.

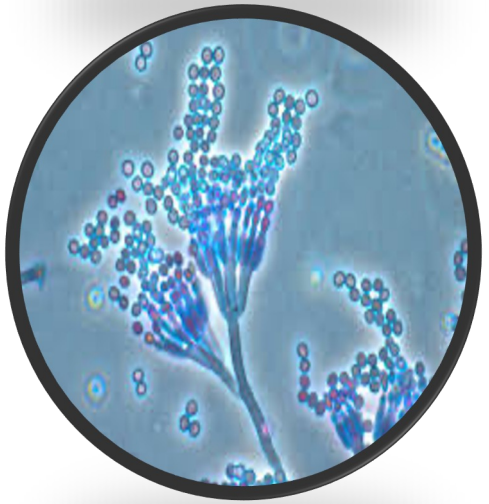
Example: ***Saccharomyces*** sp.



Multicellular Fungi (Molds/Filamentous):

Composed of long, thread-like structures called Hyphae, which collectively form a Mycelium.

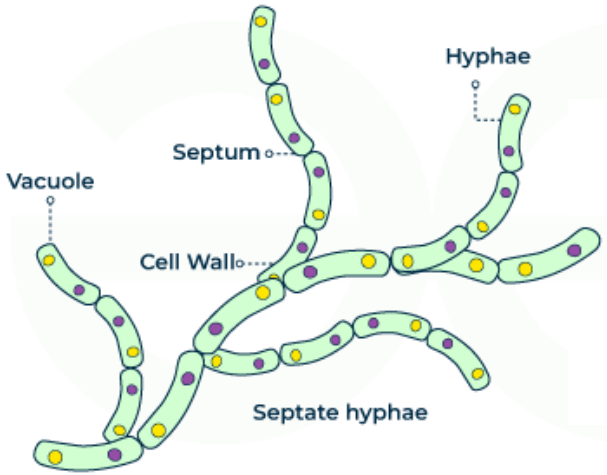
Example: ***Penicillium*** sp.



Types of Hyphae

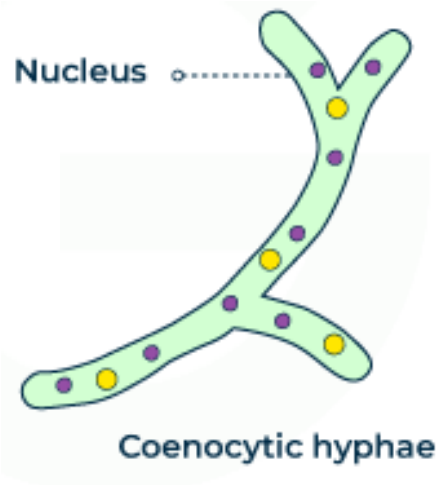
Septate Hyphae:

Divided into individual cells by internal cross-walls called Septa (singular: septum).



Non-septate (Coenocytic) Hyphae:

Lack cross-walls, appearing as long, continuous cells with multiple nuclei



The Cell Wall

- The rigid, outermost boundary of the fungal cell that encloses the protoplast.

- **Primary Functions:**

- **Morphological Stability:** Maintains the characteristic shape of the fungal cell.

- **Osmotic Protection:** Protects from bursting (osmotic lysis) by providing a counter-pressure to internal turgor.

- **Mechanical Defense:** Guards the internal organelles against physical injury and environmental stress.

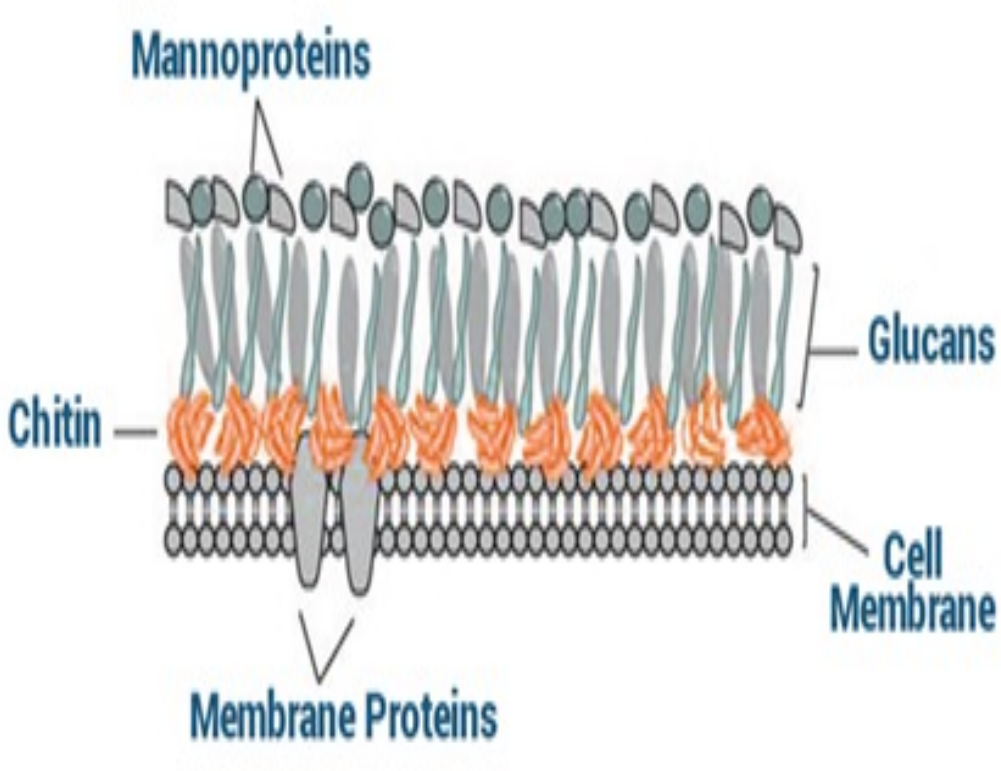
- **Filtration:** Regulating the passage of various substances.

- **Chemical Composition:**

- **Chitin:** A N-acetylglucosamine polymer that provides structural strength.

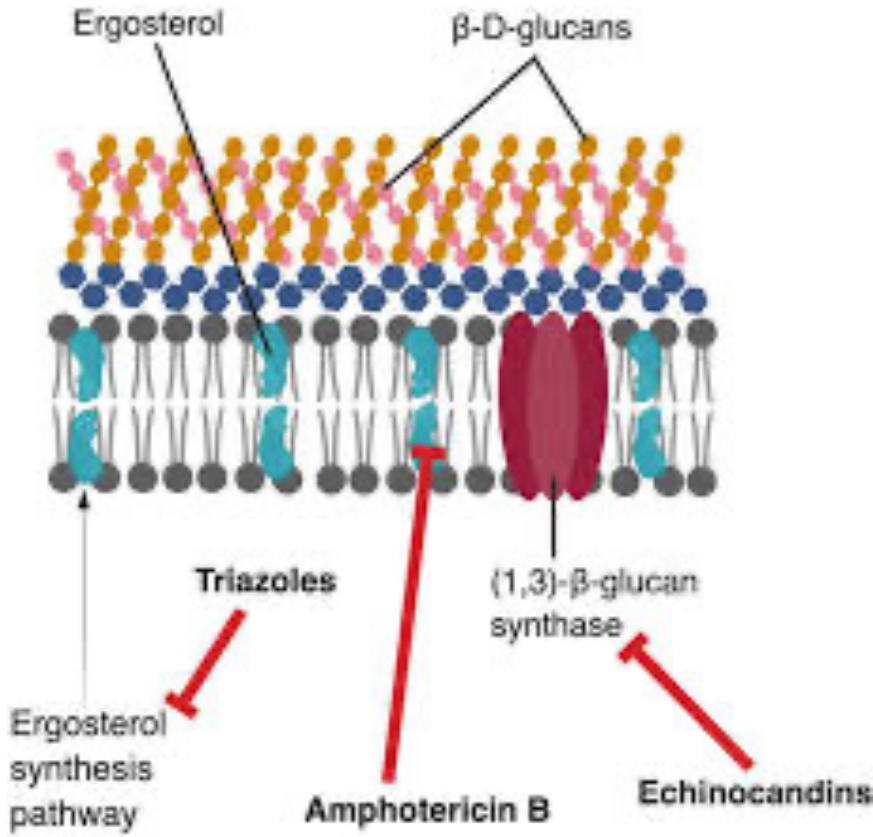
- **Glucans:** Polysaccharides that form the framework of the wall matrix.

- **Proteins:** Primarily mannoproteins, which are often located in the outer layers and are essential for structural integrity.



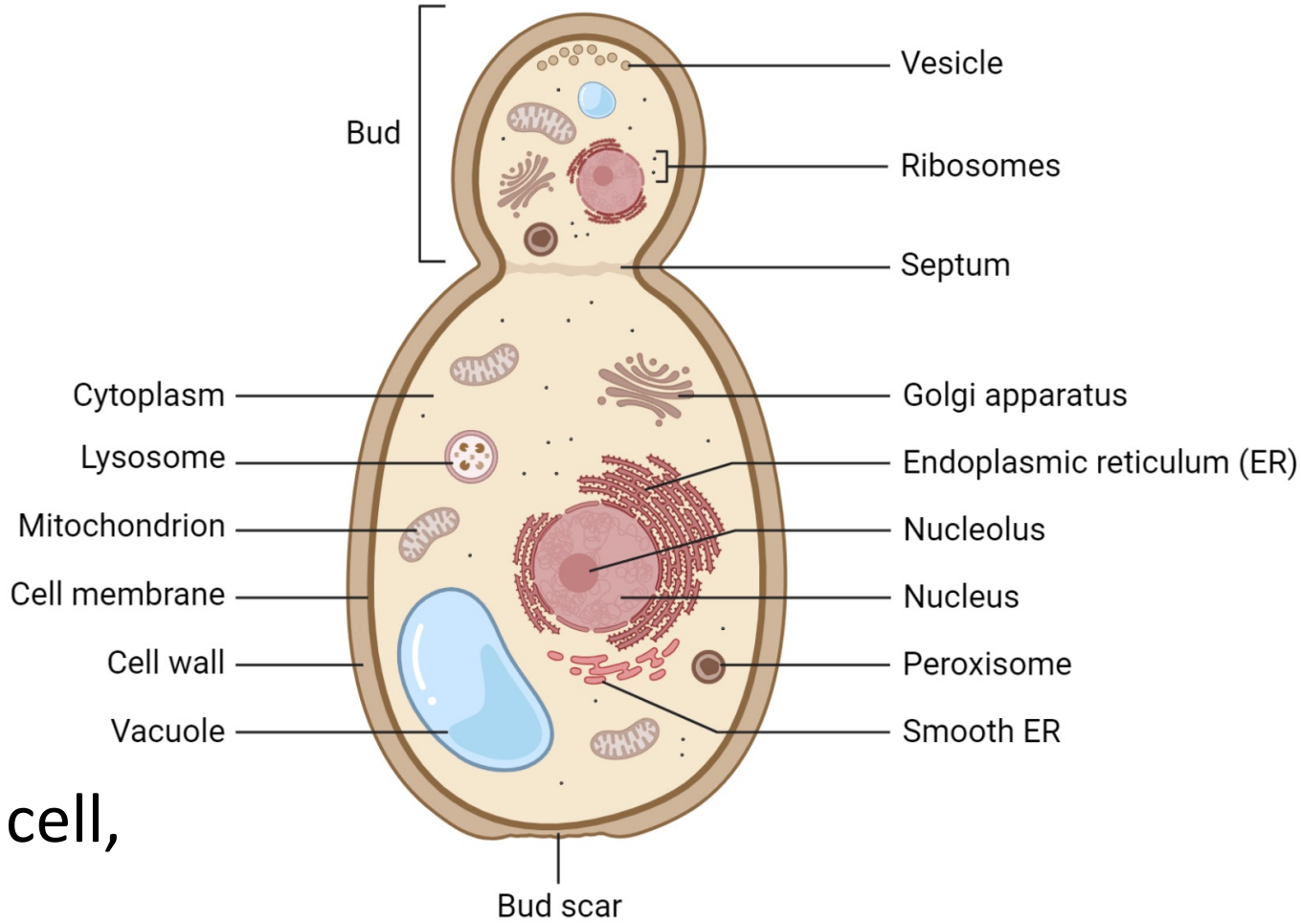
Cytoplasmic Membrane

- A thin, semi-permeable layer located directly beneath the cell wall.
- It regulates the selective passage of nutrients and waste materials into and out of the cell.
- **Ergosterol** is a unique sterol in the fungal membrane that maintains structural integrity and serves as the primary target for many antifungal drugs.

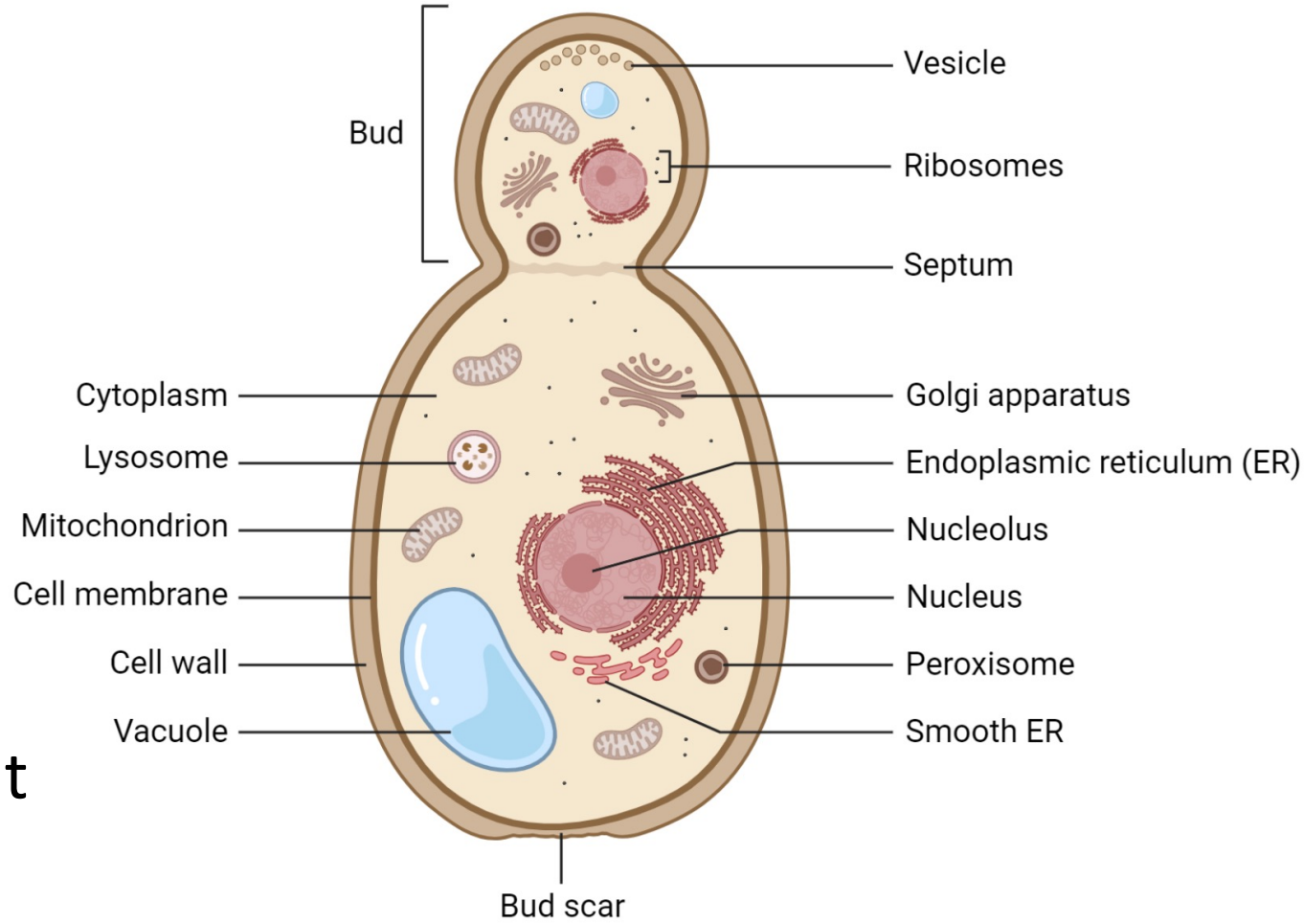


Organelles

- **Mitochondria** → regulating cell death/aging, and energy production.
- **Ribosomes** → Protein synthesis
- **Endoplasmic reticulum** → protein decoration and lipid synthesis.
- **Nucleus** → The control centre of the cell, typical of eukaryotic organization.



- **Golgi complex** ➞ protein and lipid transportation across different cell region.
- **Vacuoles** ➞ Storing food in the form of Glycogen, and osmoregulation.
- **Microbodies** ➞ Such as Lysosomes and Peroxisomes which are important in the metabolic functions.

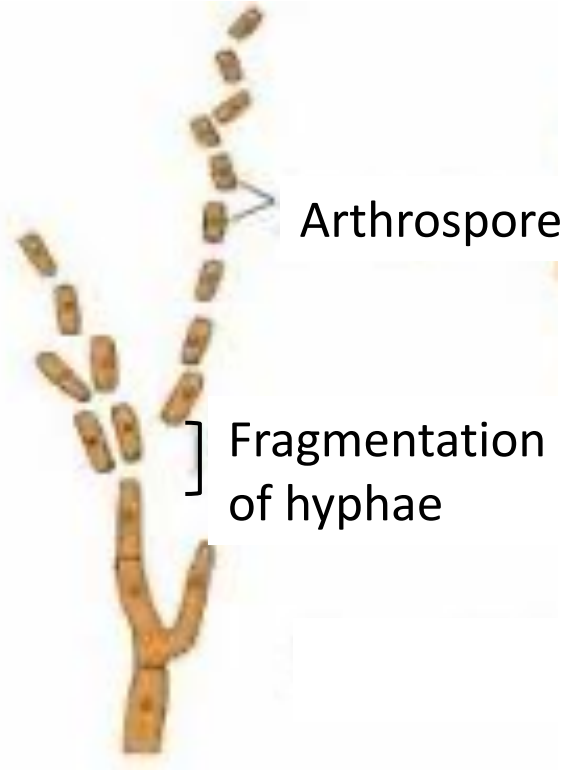


Reproductive Structures

❖ A sexual Reproduction

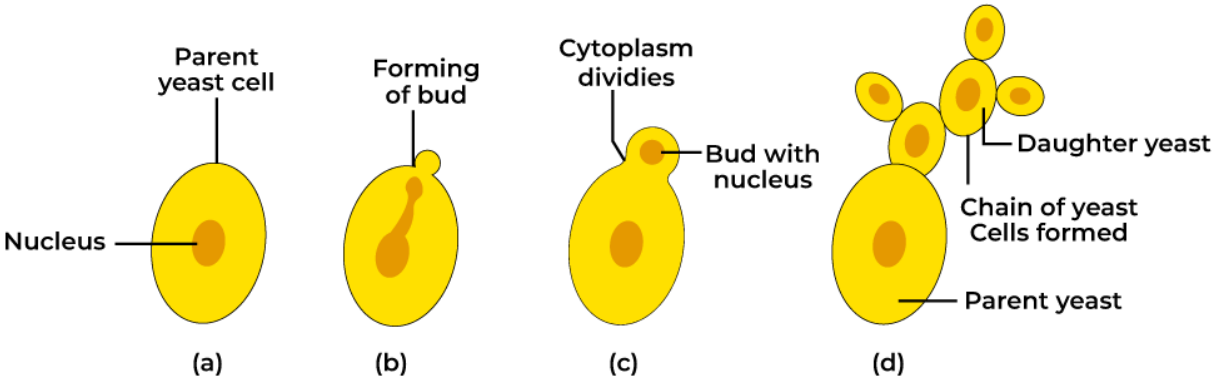
- **Fragmentation:**

- the hyphae in the parent organism breaks into pieces/fragments, each capable of developing into a new fungus.



- **Budding:**

- Common in yeast, small outgrowth (bud) grows from the parent cell.

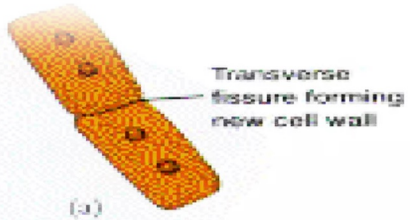


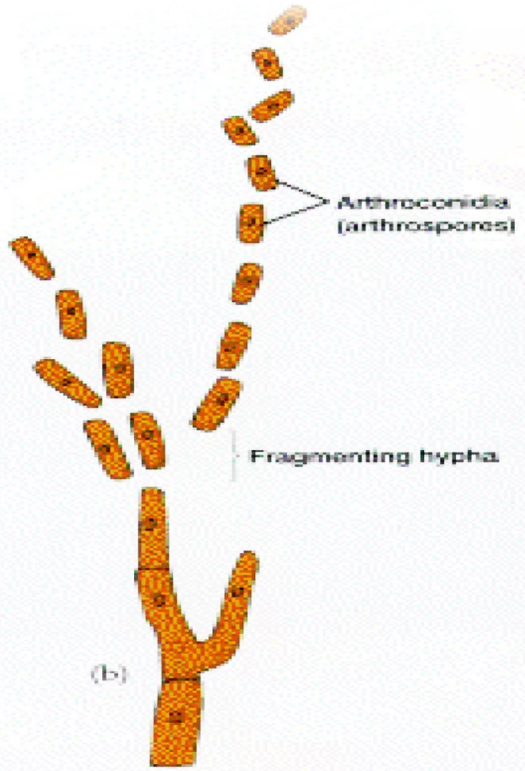
- **Formation of Asexual spores:**

- Formed by the hyphae of one organism, once they germinate, they become organisms that are genetically identical to the parent.

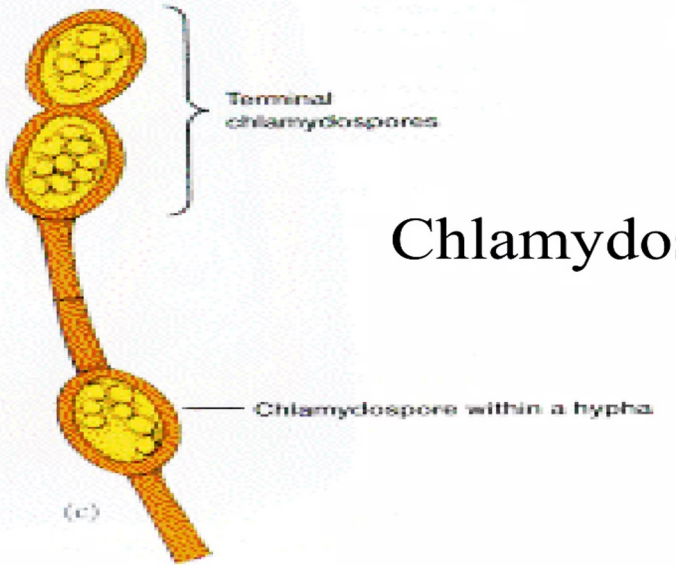
Type	Description	Example
Sporangiospores	formed within a sac-like structure called a **Sporangium**.	- *Rhizopus* - *Mucor*
Conidiospores (Conidia)	Produced at the tips or sides of specialized hyphae known as Conidiophores; they are **not** enclosed in a sac.	- *Penicillium* - *Aspergillus*
Arthrospore (Oidia)	Thick-walled spores formed by the fragmentation of septate hyphae into individual cells.	- *Geotrichum candidum*
Blastospore	Produced through the process of **Budding**.	- *Saccharomyces*
Chlamydospores	Thick-walled resting spores formed by septation of hyphae into individual cells.	- *Candida albicans*

Arthrospores



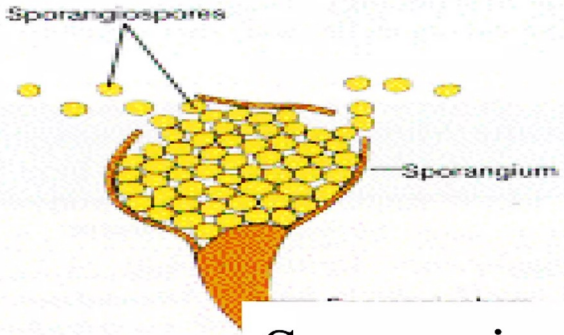


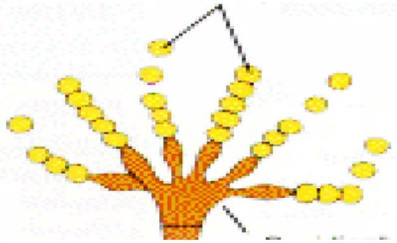
Chlamydospores



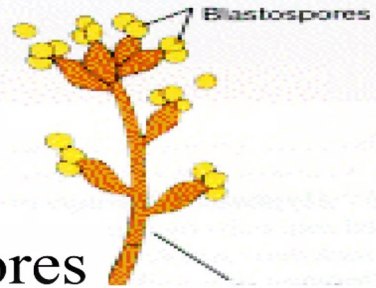
Conidiospores

Sporangiospores





Blastospores



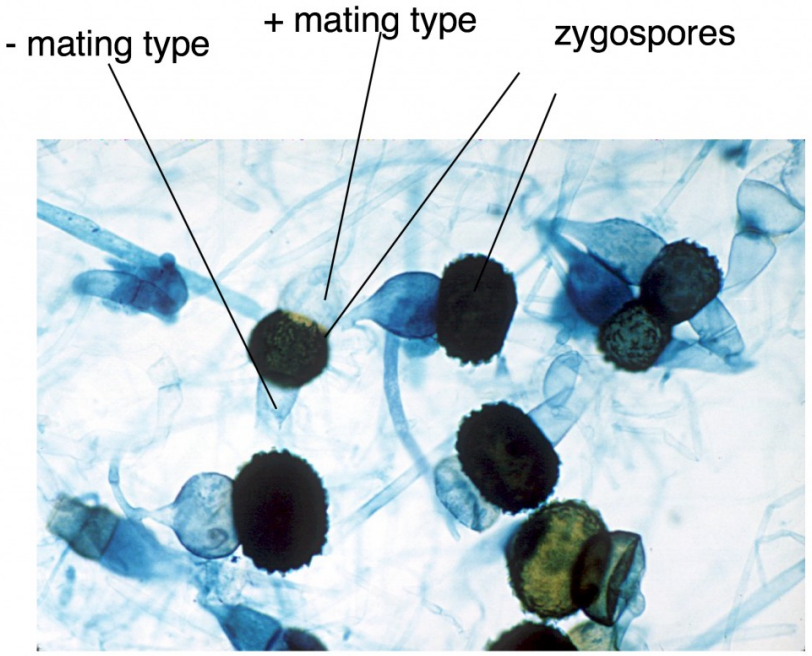
❖ Sexual Reproduction

- Sexual spore are result from the **fusion of nuclei** from two opposite mating strains of the same species of fungus.
- **Example:**
  - Zygospores
  - Oospores
  - Ascospores
  - Basidiospores

❖ Zygomycetes:

- **Zygospores** are large, thick-walled spores formed within a **Zygosporangium**.
- Result from the fusion of <u>two similar gametangia</u>.
- Example: ***Rhizopus and Mucor.***

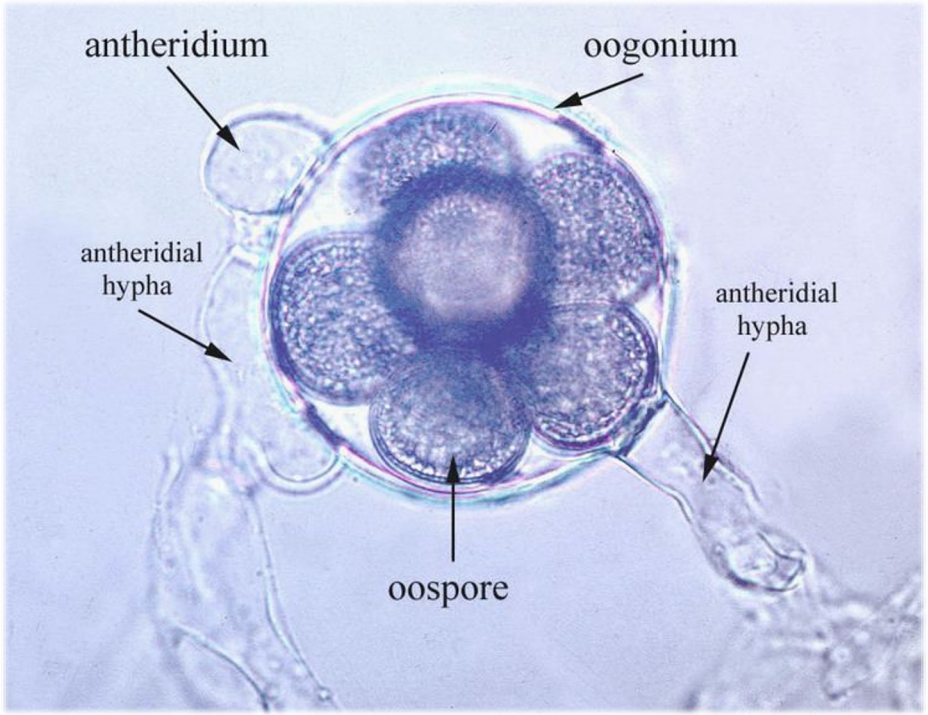
Asexual spores
(Conidiospores)

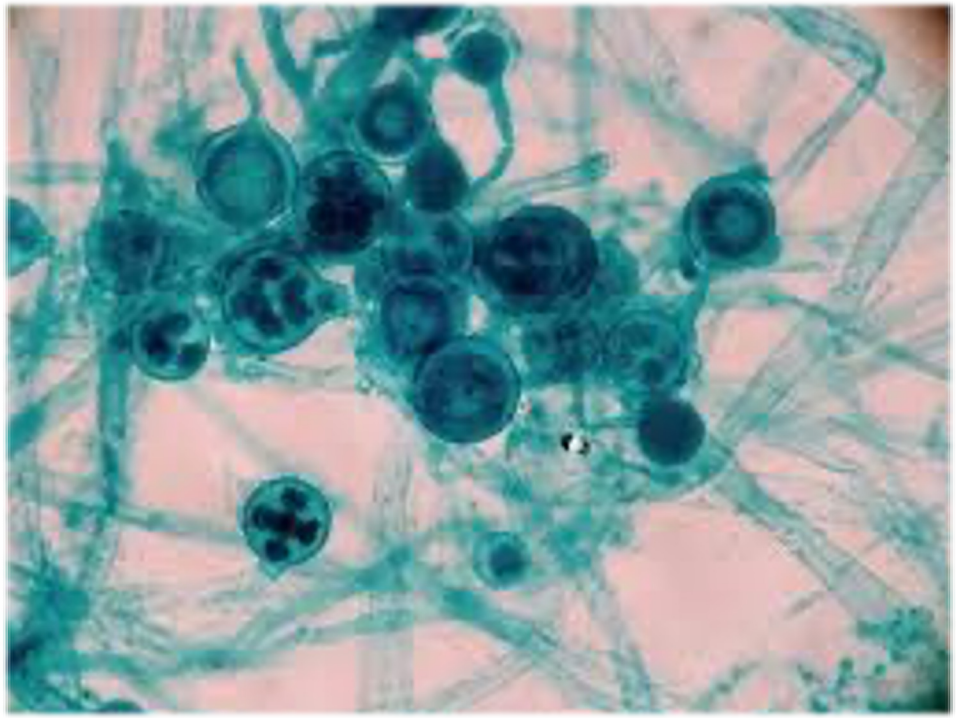


Sexual spores
(Zygospores)

❖ Oomycetes:

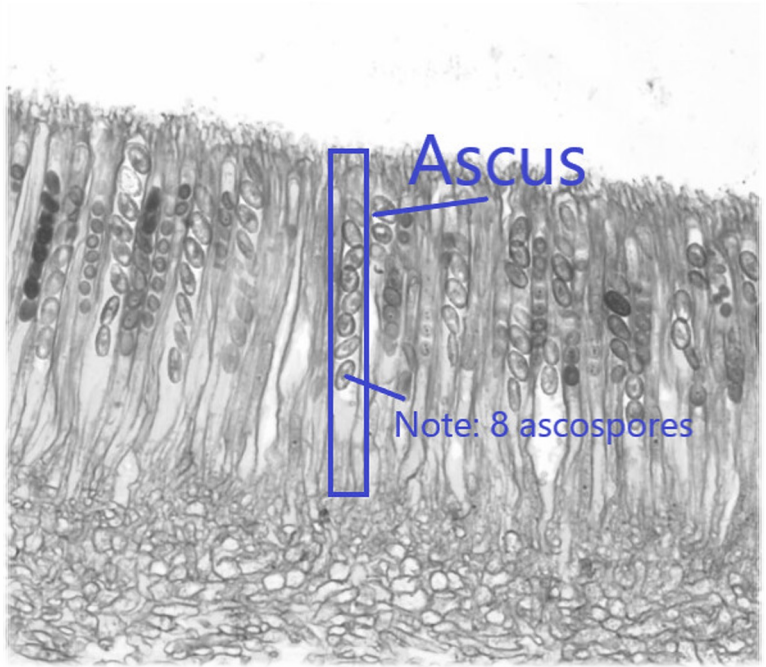
- **Oospores** produced within a specialized female structure called an **Oogonium**.
- Example: ***Saprolegnia***.

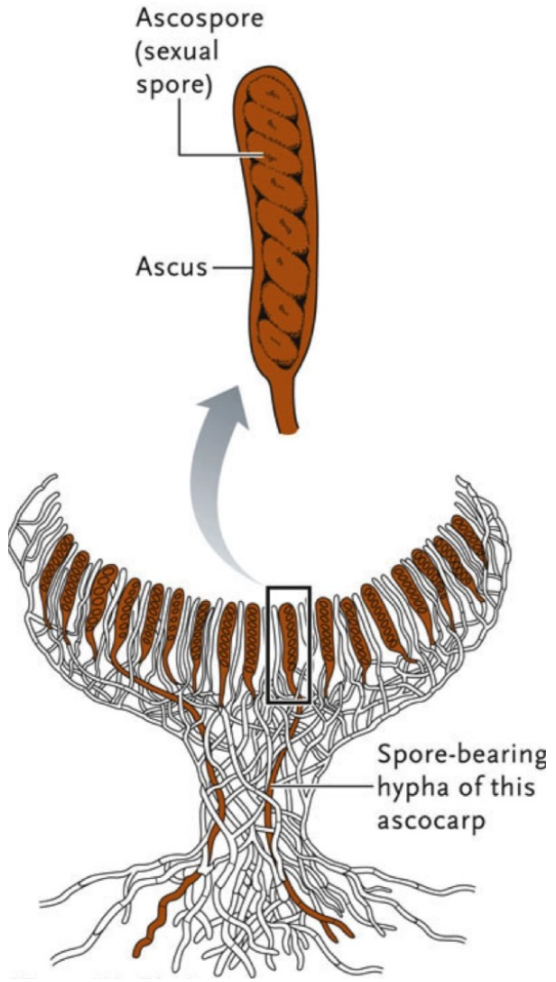




❖ Ascomycetes:

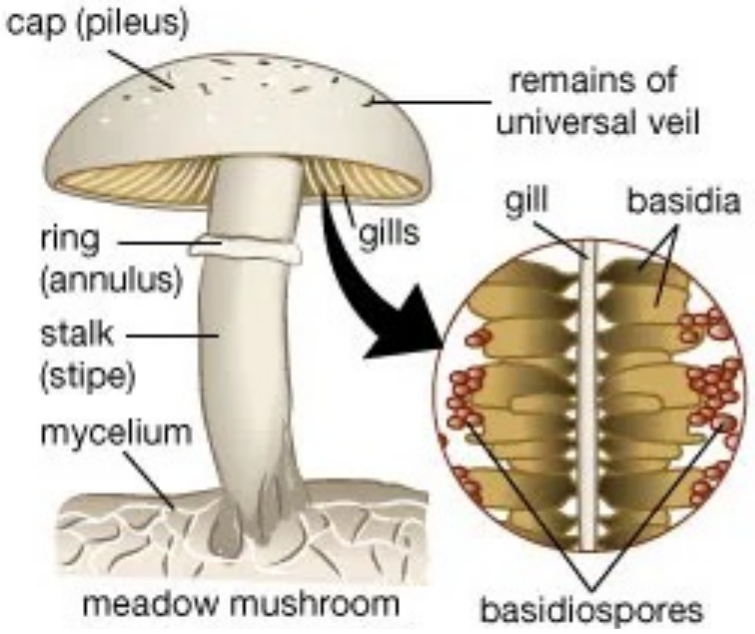
- **Ascospores** produced internally within a sac-like structure called an **Ascus**.
- Usually, eight ascospores are formed per ascus.
- Example: ***Aspergillus, Claviceps purpurea***

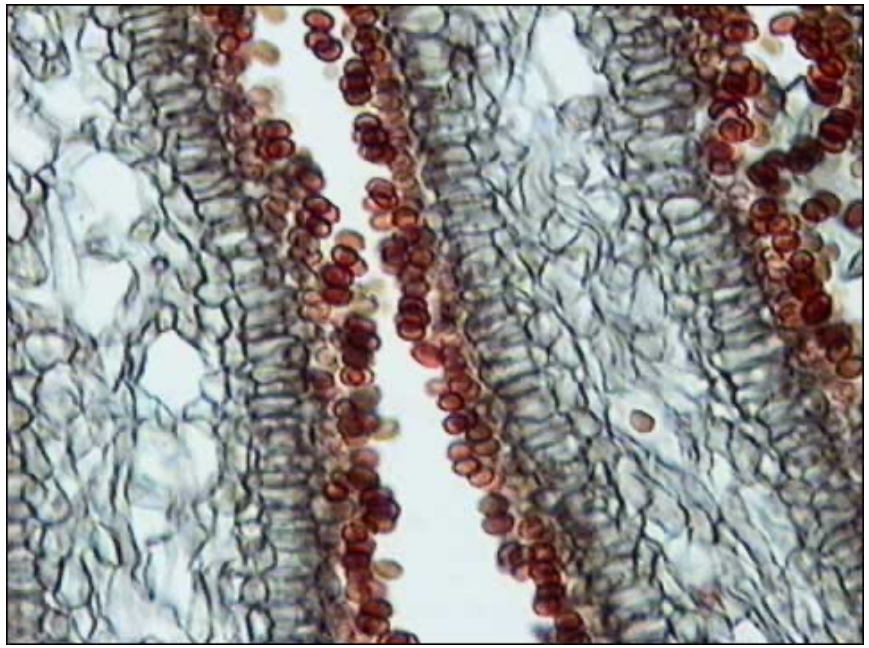




❖ Basidiomycetes:

- **Basidiospores** borne externally on a club-shaped structure called a **Basidium**.
- Typically, four basidiospores are produced per basidium.
- Example: ***Agaricus langei***





"Success in this course comes from practice, attention to detail, and responsibility in the laboratory. Engage actively and make the most of every practical session.."

End of the Lab 🤓