Lecture Title:
Fungi and their pathogenesis

(Foundation Block, Microbiology)

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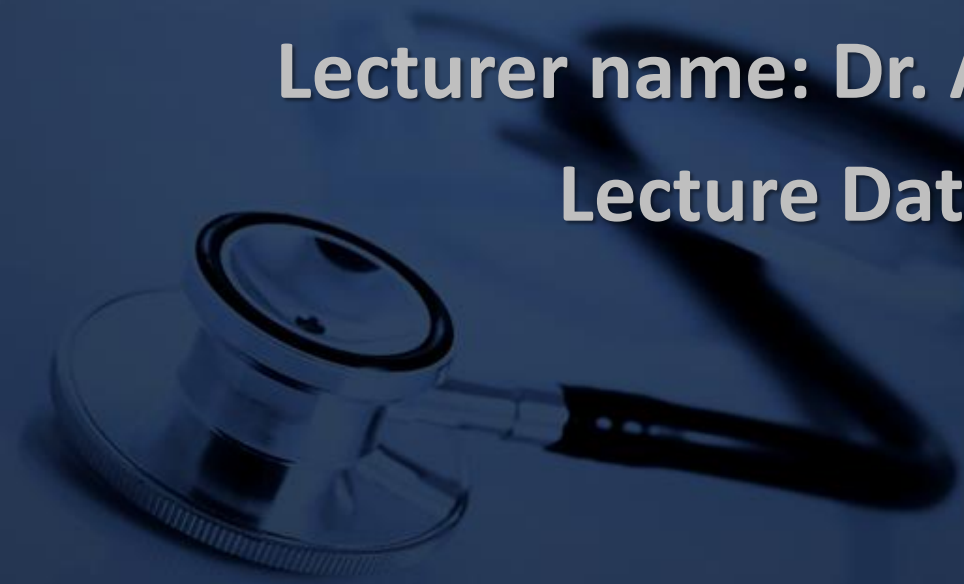
Lecture Date: Oct.-2012



Lecture Objectives..

- To describe the general characteristics of fungi and recognize a fungus from all other living organisms
- To establish familiarity with the terminology needed by medical students
- To know certain fundamental facts about classification and identification of fungi

What is Mycology?..

Mycology: Study of fungi
Kingdom myceteae (= Kingdom fungi)

Medical mycology : Study of medically important fungi and the mycotic diseases.

Mycoses: A disease caused by a fungus

What is Mycology?..

There are five kingdoms of living organisms

KINGDOM	CHARACTERISTIC	EXAMPLE
Monera	Prokaryocyte	Bacteria Actinomycetes
Protista	Eukaryocyte	Protozoa
Fungi	Eukaryocyte *	Fungi
Plantae	Eukaryocyte	Plants, Moss
Animalia	Eukaryocyte *	Arthropods Mammals Man

What is a Fungus ?

Characteristics (distinguishing features)

1) All Eukaryotic organisms (a true nucleus)

2) Heterotrophic (Saprobic, symbiotic, parasitic)

3) Do not have chlorophyll (Achlorophyllous)

4) The cell is surrounded by rigid cell wall made of chitin & complex carbohydates (Mannan, glucan)

5) Cell membrane : sterol, ergosterol

What is a Fungus ?

Characteristics (distinguishing features)

Saprobic

feed on dead tissues or organic waste (decomposers)

Symbiotic

mutually beneficial relationship between a fungus and another organism

Parasitic

feeding on living tissue of a host. (disease)

MORPHOLGY

1. Yeasts : are unicellular organisms

   e.g. ***Candida albicans, Saccharomyces cerevisiae***

2. Filamentous fungi (Hyphae, mycelium)

   Hyhpae are multicellular filamentous structures, constituted by tubular cells with cell walls.

   - Septate (Cross-walls that divide hyphae into segments) : **e.g. *Aspergillus, Penicillium,***
   - Non-septate (Coenocytic) e.g. ***Rhizopus***

3. Dimorphic

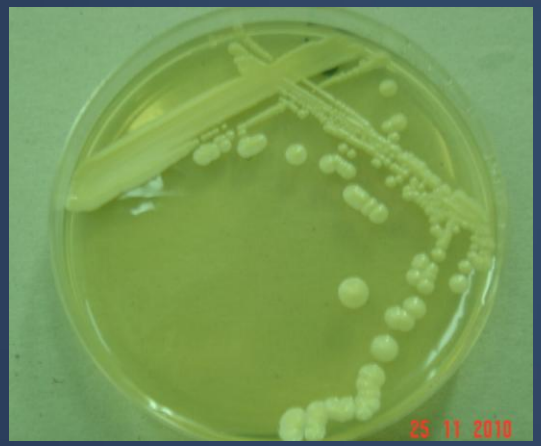
   - Yeast : Parasitic form, Tissue form, Cultured at 37° C
   - Mycelium: Saprophytic form, Cultured at 25 C

   Dimorphic: Have two forms depending on change in the environmental factors Mold form ⇄ Yeast form

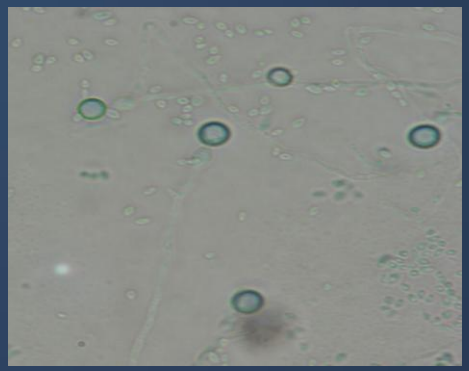
MORPHOLGY

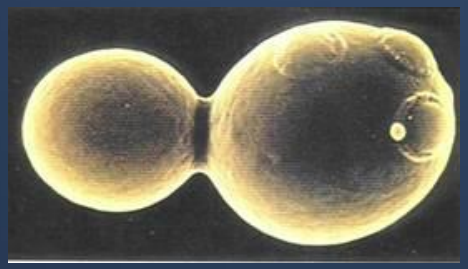
Yeast:

Colony morphology (Culture)

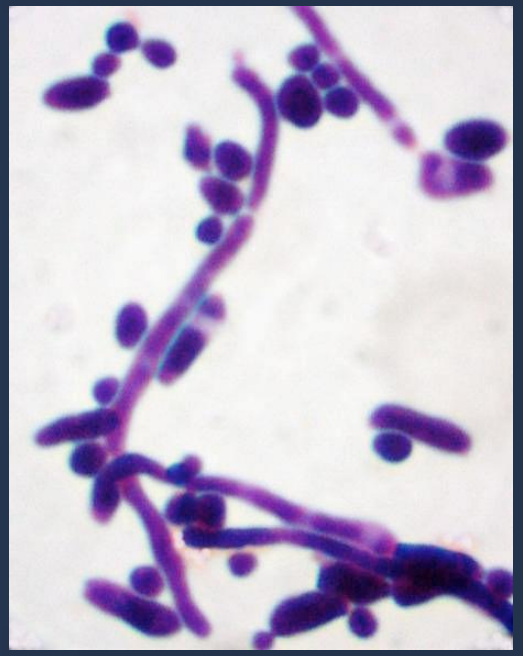


Have same appearance
How do we differentiate between them?





Budding yeast cell



In Clinical samples
Budding yeast cells
+/- Pseudohyphae

MORPHOLGY

Filamentous fungi (Mould=Mold)

A hypha (plural hyphae)

is a long, branching filamentous cell. hyphae are the main mode of vegetative growth.

Mycelium:

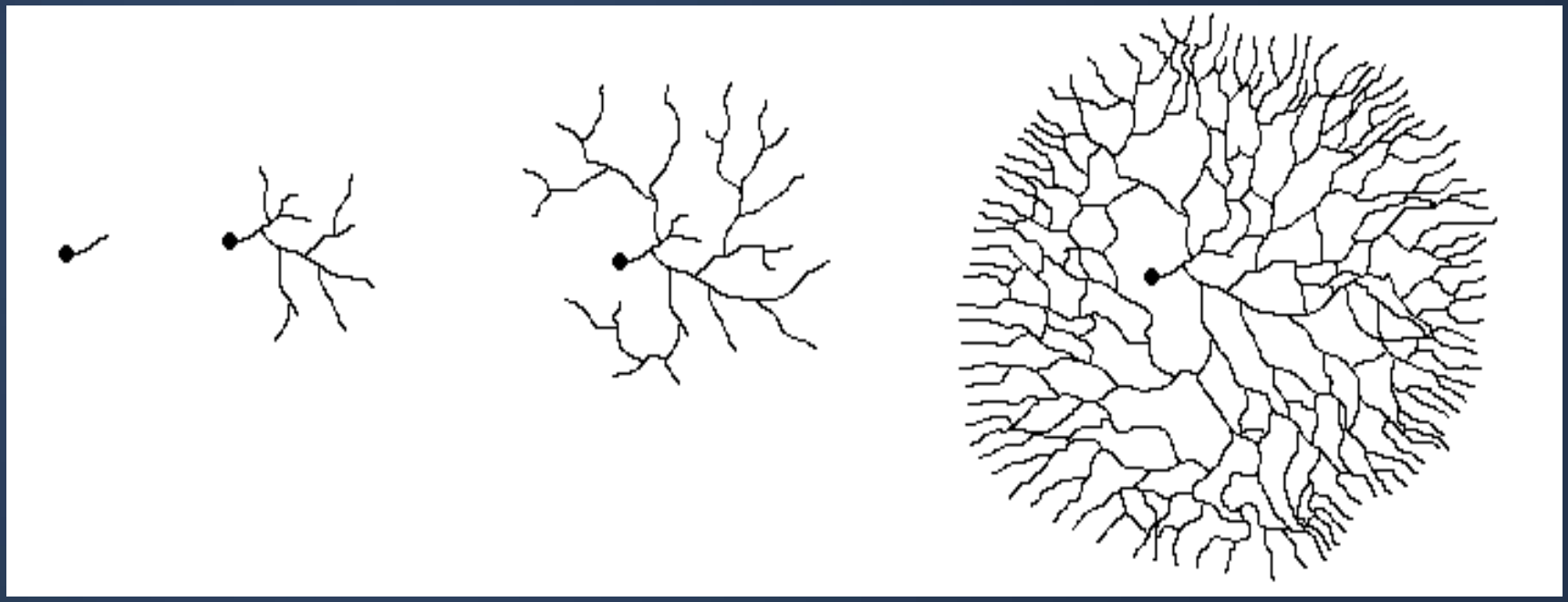
The intertwined mass of hyphae that forms the fungal colony.

Conidia (singular = conidium):

asexual spores borne externally on hyphae or on a conidiophore.

MORPHOLGY

Hyphal growth from spore

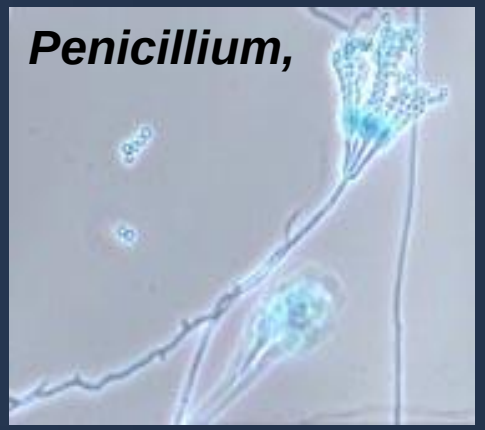


Spore/ conidia

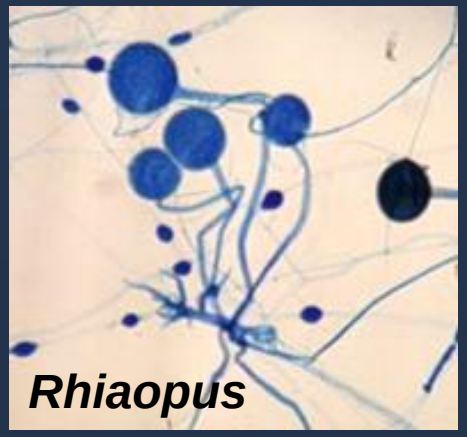
mycelium

MORPHOLGY

Mold...

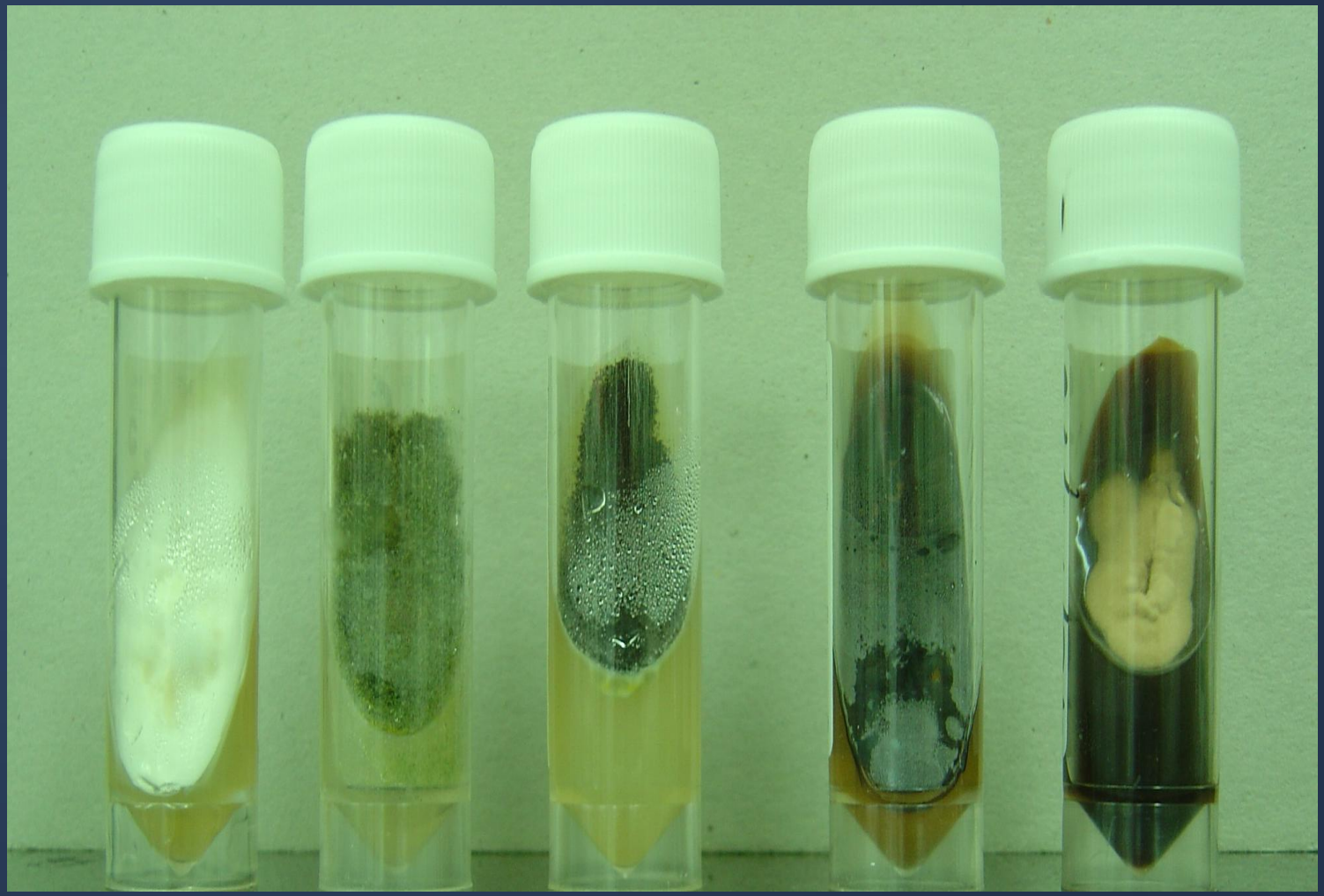


Penicillium,



Rhiaopus

MORPHOLGY



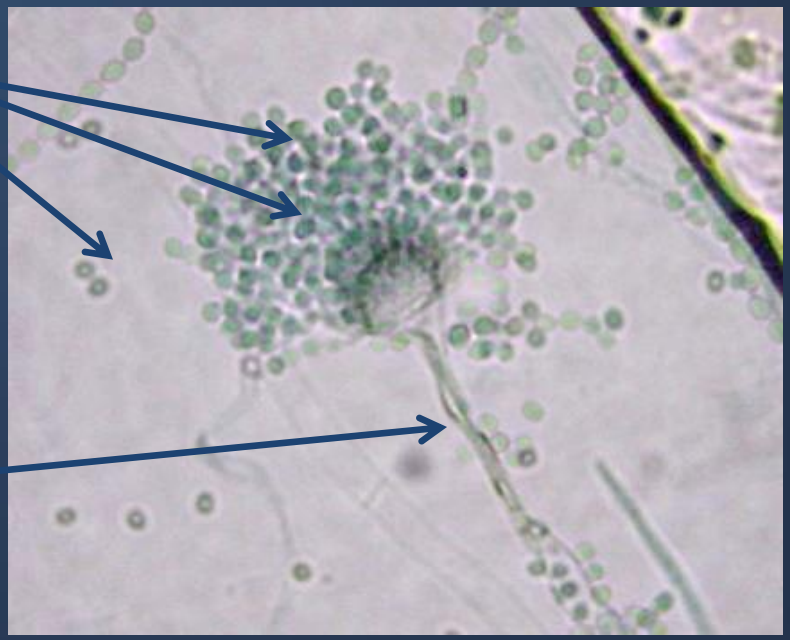
MORPHOLGY

Conidia (singular = conidium): asexual spores borne externally on hyphae or on a conidiophore.

Conidiophore: the specialized hyphal stalk on which conidia develop either singly or in Clusters.

Conidia

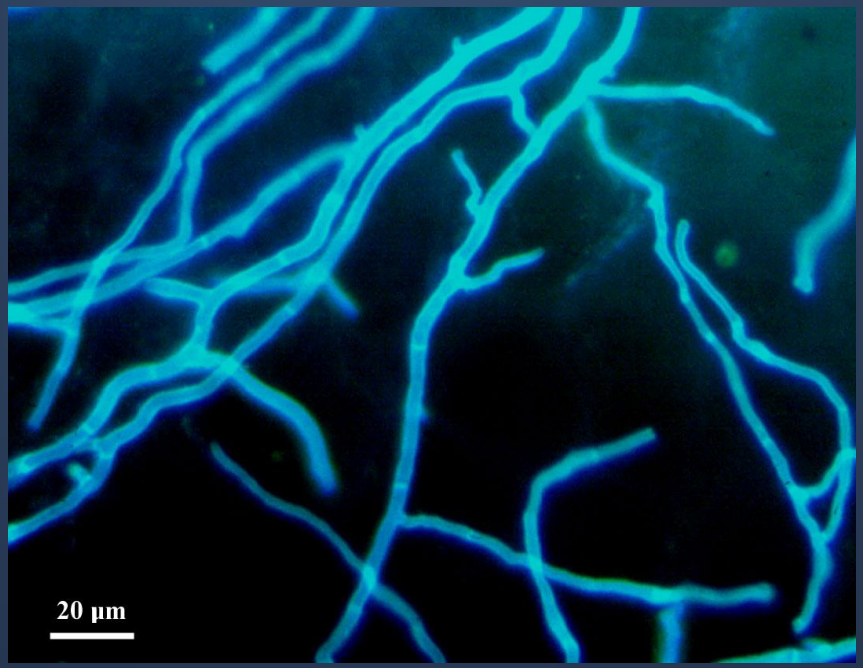
Conidiophore



Septa:

Cross-walls (septa) that divide hyphae into segments.

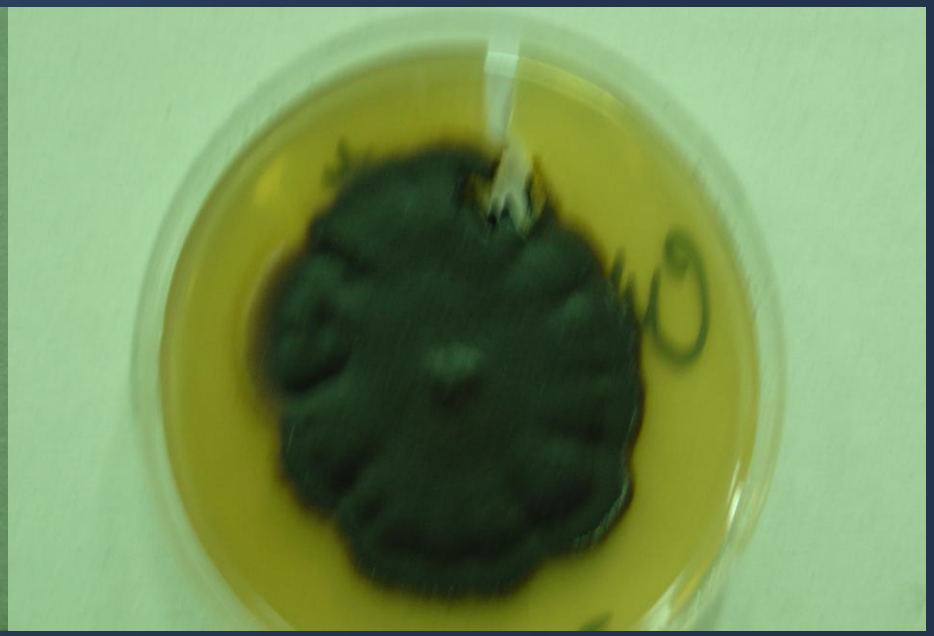
If there are no cross-walls, the hyphae are considered to be non-septate.



MORPHOLGY

Filamentous fungi (mold)

Moniliaceous molds
hyaline or lightly pigmented conidia or hyphae, colorless

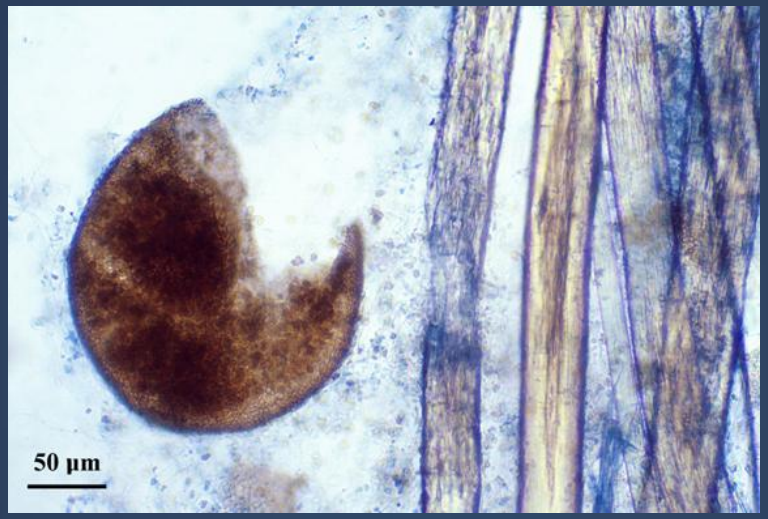


Reproduction in Fungi

I) **Asexual**: Only mitotic cell division

1) Somatic — Yeasts by budding
   Molds by hyphal fragmentation
2) Spore formation:
   a) Sporangiospores in sporangia
   b) Chlamydospores in or on hyphae
   c) Conidia (conidium) on hypha or on conidiophores

II) Sexual: Fusion, mitosis, meiosis
Sexual spores:
Oospore, Zygospore, Ascospore, Basidiospore


50 µm


20 µm

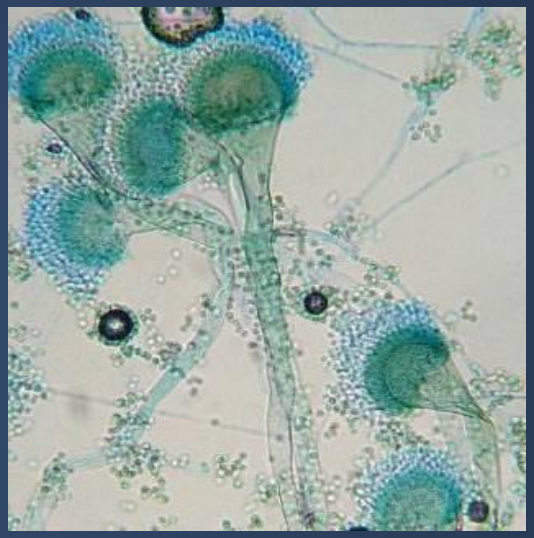
Spores?

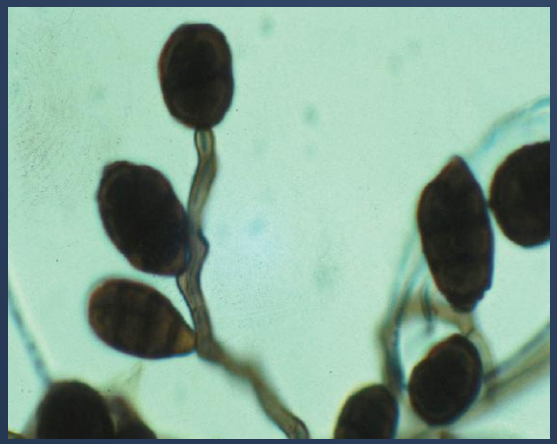
-These are the small airborne particles by which fungi reproduce.

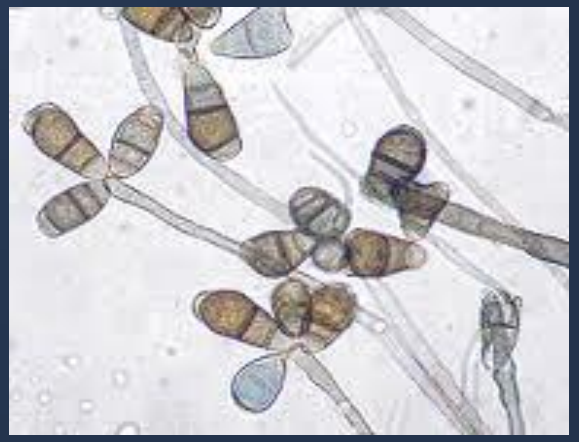
-They are produced by mitosis and readily disseminate in the air.

SPORES

Spores/ conidia?





General facts

- Fungi are all around us
- Widely distributed in nature (air, water, soil, decaying organic debris)
- We touch them, we swallow them, we breathe them

General facts

- Fungi play an important role in our ecosystem
  - They decompose and recycle things on earth, decomposers of organic matter (clean the environment)
  - Add nutrients to soil to help sustain plant life

- Some fungi are used for producing antibiotics, and other medications.

- We use fungi as source of food and also in cooking
  - e.g. Mushrooms, Truffles
    - ***Saccharomyces cerevisiae***

PATHOGENICITY OF FUNGI

However, fungi can cause diseases to humans

- Cause superficial infections
- some can cause allergic reactions
- Few cause invasive infections

To cause the disease:

1. Thermotolerance
2. Ability to survive in tissue environment
3. Ability to withstand host defenses

Thank You ☺

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