



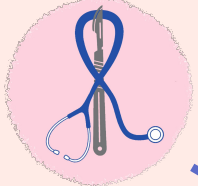
Microbiology Team
Med441

Fungi and their Pathogenesis



MED441
KING SAUD UNIVERSITY

Revised & Reviewed
by:
Abdulaziz & Bahammam
Faye Wael Sendi



Microbiology
Team441



Color Index:

- Main text
- Boys slides only
- Girls slides only
- Doctor's notes
- Extra information
- **Important**

Editing File

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 reproduction and identification of fungi

What is Mycology?..

- **Mycology:** the 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.

kingdoms

Kingdomt	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)

01

Eukaryotic organisms (They have a true nucleus)

True nucleus= Nucleic acid inside the nucleus surrounded by nuclear envelope

02

Heterotrophic (Saprobic, Symbiotic, Parasitic) Can not make their own food

03

Do not have chlorophyll (Achlorophyllous)

04

The cell is surrounded by rigid cell wall made of chitin & complex carbohydrates (Mannan, Glucan)

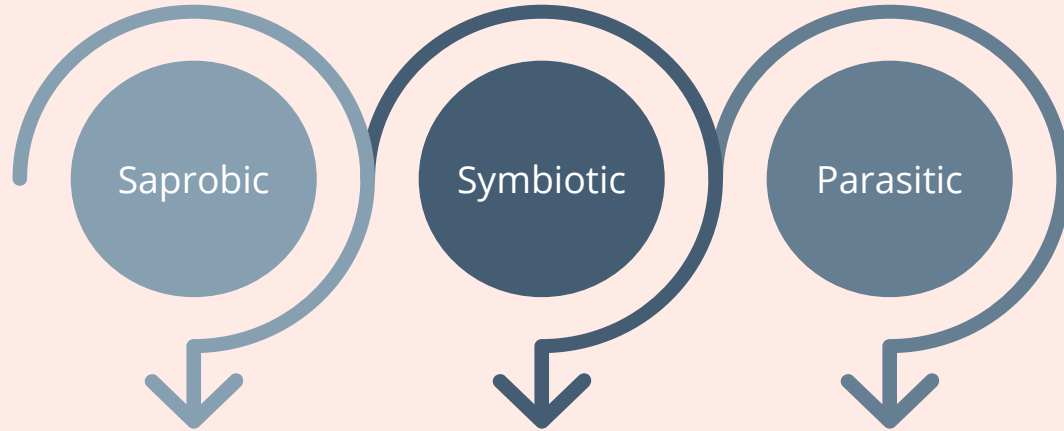
05

Cell membrane : (Sterol, Ergosterol)
Ergosterol is the target for esol. (Large antifungal group)

Dr. Note:
Mannan & Glucan have very important diagnostic and therapeutic values:
-Target for antifungal agent.
-Marker for diagnosing fungal infections.

What is a Fungus ?

Characteristics (distinguishing features)



Saprobiic

*Feed on dead tissues
or organic wastes. (*
Decomposers)
(Mainly in the soil)

Symbiotic

*Mutually beneficial
relationship
between a fungus &
another organism*
*(They live together without
causing any harm to each other)*

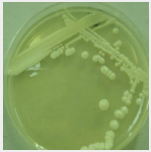
Parasitic

*Feeding on living
tissues of a host. (*
Disease)
*(The fungi will cause
some harm to the host)*

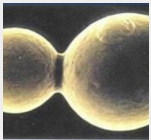
Morphology

Yeast

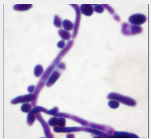
(Unicellular organisms)



Colony morphology
(Culture).
(Takes 24h-48h to grow)



Budding yeast cells (produce bud (daughter cell))



In Clinical samples budding yeast cells +/- Pseudohyphae
budding yeast cell appears round - oval shape, and some produce elongated yeast cells that look like hyphae but they are not.
(+/- means with or without)

Examples:

- Candida albicans, most common yeast that cause infection to human
- Saccharomyces cerevisiae
(الخميرة لصناعة الخبز)

Filamentous fungi

(Hyphae, Mycelium)

-Hyphae are multicellular filamentous structure, constituted by tubular cells with cell walls

-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/ Spore (Singular= conidium):
Asexual spores borne externally on hyphae or on a conidiophore (spore is resistant to environmental conditions)

Examples:

- Aspergillus, second common fungi that cause infections to human.
- Penicillium, fungi that produces penicillin (Antibiotic)
- Rhizopus (عفن الخبز)

Dimorphic

(Yeast & filamentous)

Have two forms depending on change in the **environmental factors**

1-Yeast form:

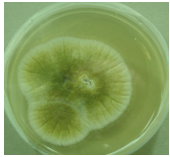
Parasitic form, Tissue form,
Cultured at 37° C

2-Filamentous form:

Saprophytic form, Cultured at 25° C

Mold \rightleftarrows Yeast

Filamentous fungi, cont..

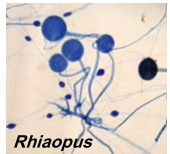


Dr. Notes:
Single colony of **Filamentous Fungi**: produce lots of filaments. With time they **produce conidia** (the greenish-yellowish color).



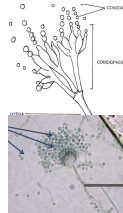
Penicillium,

Penicillium
Thousands of hyphae are linked together to form **mycelium**.



Rhiaopus

Rhizopus
عفن الخبز



Conidia/Spore
(singular=conidium)

Conidophore (حامل ابواغ)



Septa (hypha):
Cross-walls that divide hyphae into segments.
(septate hypha).

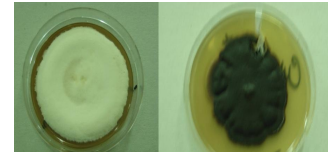
- If there is no cross walls, the hyphae are considered to be **(Non-septate)**.

-Moniliaceous mold

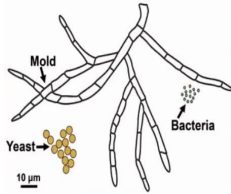
Hyaline or lightly pigmented conidia or hyphae, colorless.

-Dematiaceous mold

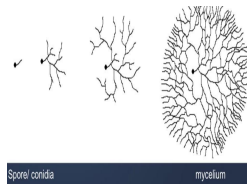
Are pigmented. Because of the pigments, the colonies appear dark, brown, or black.



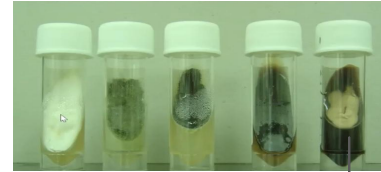
Filamentous fungi, cont..



-Yeast are larger than the bacteria.
-Filamentous fungi is quite larger than the yeast.



Hyphal growth from spores
-Each single spore/conidia will grow to form a new fungal colony/mycelium (full of hyphae) if there is a good environment for growth.



Pigment

Most of fungi start as white "only Filamentous growth". Coloration is due to the production of pigments or conidia.

Dr Note:

Most of the fungi reproduce asexually

Reproduction in fungi

Asexual: only mitotic cell division

Sexual

Somatic

Spore formation

1- Yeasts by budding

2- Molds by hyphal fragmentation. (if septate, Each fragment can grow)

Dr. Note: مو مهم تعرفون هذي الأنواع

- a) sporangiospores in sporangia
- b) chlamydospores in or on hyphae
- c) conidia (conidium) on hypha or on conidiophores

Fusion, mitosis, meiosis.

Spores

-Small airborne particles by which fungi reproduce.

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

-Filamentous fungi can be identified by just looking at the morphology of spores, no further biochemical assays are required.

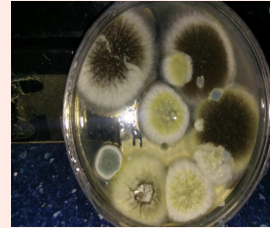
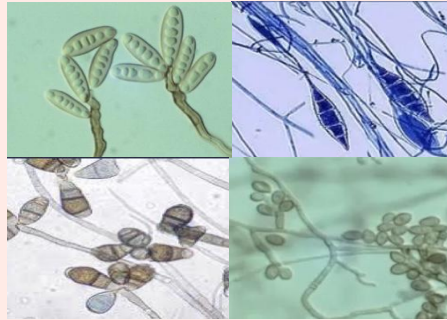


plate air exposed for 5 minutes and incubated for 1 week

- Filamentous fungi, 4-5 types.
- Left for 5 minutes in a protected clean environment, and yet we can see how much fungi and spores are formed.
- This indicates that the air is full of spores.

PATHOGENICITY OF FUNGI

- not all fungi can cause disease

- Fungi are all around us, widely distributed in Nature (air, water, soil, decaying organic debris) They can cause many diseases to humans.

Such as:

01

Cause **superficial infections.**

02

some can cause **allergic reactions**

03

Few cause **invasive infections**

PATHOGENICITY OF FUNGI

- **To cause the disease:**

01

Thermotolerance
(The ability to survive high temp)

02

Ability to survive in tissue environment

03

Ability to withstand host defenses

MCQs:

Q1) Sterol is a component of?

- | | | | |
|--------------|--------------|-------------------|------------|
| A) Cell wall | B) Cytoplasm | C) Cell membrane. | D) Nucleus |
|--------------|--------------|-------------------|------------|

Q2) Spores are produced by?

- | | | | |
|------------|------------|------------------|------------|
| A) Mitosis | B) meiosis | C) Spore forming | D) budding |
|------------|------------|------------------|------------|

Q3) An example of yeast is?

- | | | | |
|----------------|----------------|-------------|--------------------|
| A) Aspergillus | B) Penicillium | C) Rhizopus | D) Candida albican |
|----------------|----------------|-------------|--------------------|

Q4) Which of the following is not found in the cell wall of fungi?

- | | | | |
|-----------|---------------|-----------|-----------|
| A) Mannan | B) Ergosterol | C) Chitin | D) Glucan |
|-----------|---------------|-----------|-----------|

Questions and Answers:

Q1: What is the difference between moniliaceous mold and dematiaceous mold?

Q2: Enumerate 3 diseases caused by fungi?

Q3: List 2 examples of yeast fungi?

A1:

-Moniliaceous mold

Hyaline or lightly pigmented conidia or hyphae, colorless.

-Dematiaceous mold

Are pigmented. Because of the pigments, the colonies appear dark, brown, or black.

A2:

- 1-superficial infections
- 2- allergic reactions
- 3- invasive infections

A3:

Candida albicans
Saccharomyces cerevisiae

Team Leaders:

Reuf Alahmari

Subleader: Alanoud Alhaider

Abdulaziz Alqahtani



Microbiology Team
Med441



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KING SAUD UNIVERSITY

Team Members:

Ghadah Alqahtani

Rana Almazrou

Abdulaziz Alqahtani

Sulaiman Aldhalaan

Ghadeer Alturaifi

Reem Alkulaibi



Abdullah Abdulrazaq

Turki Alkhalifa

Leen Alrajhi

Sarah Alhamlan

Ali Basfar

Nawaf Almadi

Manar Abdullah

Sarah Alshammari

Bader Alshahrani

Ziyad Alzammam

Maram Alenazi



Shahad Almuqbil

Fahad Alhifhti

Nada Alsaif

Yara Almufleh

Firas Alqahtani

Norah Alotaibi

Mohammed Alqahtani



Contact us:
microbiologyteam441@gmail.com