

Fungi

CLS 212: Medical Microbiology
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General Characteristics of fungi

1. The study of fungi is called: **Mycology**.
2. All fungi are **Eukaryotic** organisms living everywhere on earth.
3. They are not plants.

	PLANT	FUNGUS
FOOD	Autotrophic Makes its own food	Heterotrophic depend on other organisms for food
PIGMENTS	Chlorophyll for photosynthesis	No pigments
CELL WALL	Contain Cellulose	Contain Chitin

➤ Heterotrophic organisms are 3 kinds:

A) Saprophytic: the fungus is living on dead organic matter.

B) Symbiotic: the fungus is living together with other organism.

C) Parasitic: the fungus is living in an organism and it is harmful to it **e.g.** *Candida albican*.

General Characteristics of Fungi

4. Beneficial fungi are important in the production of **cheeses and antibiotics** e.g. **Penicillin**.
5. Fungi also live on unlikely materials. Affect plastic and leather and spoil some food like jams, pickles,...
6. Most of Fungi are microscopic but some can be seen by naked eye e.g. **Mushrooms**.

Armillaria mellea



The biggest living microorganism in the world is a fungus called: *Armillaria ostoyae* of the species *Armillaria mellea*

Fungi can be:

1. Monomorphic

Fungi that has only one shape or morphology.

e.g. *Cladosporium bantianum*

Aspergillus fumigatus

2. Dimorphic (Diphasic)

Fungi which can have two different morphologies depending on the environmental factors e.g. Temperature.

➤ *Many dimorphic fungi are pathogenic but not all the pathogenic fungi are dimorphic.*

e.g. *Histoplasma*

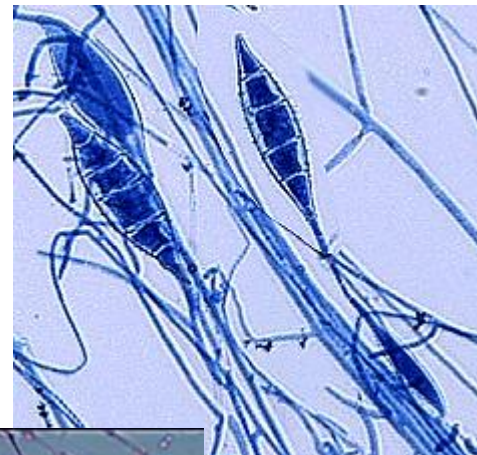
Blastomyces

Classification of Fungi

Classification of fungi change periodically. The kingdom Fungi is divided into 5 phyla depending on the mode of sexual reproduction.

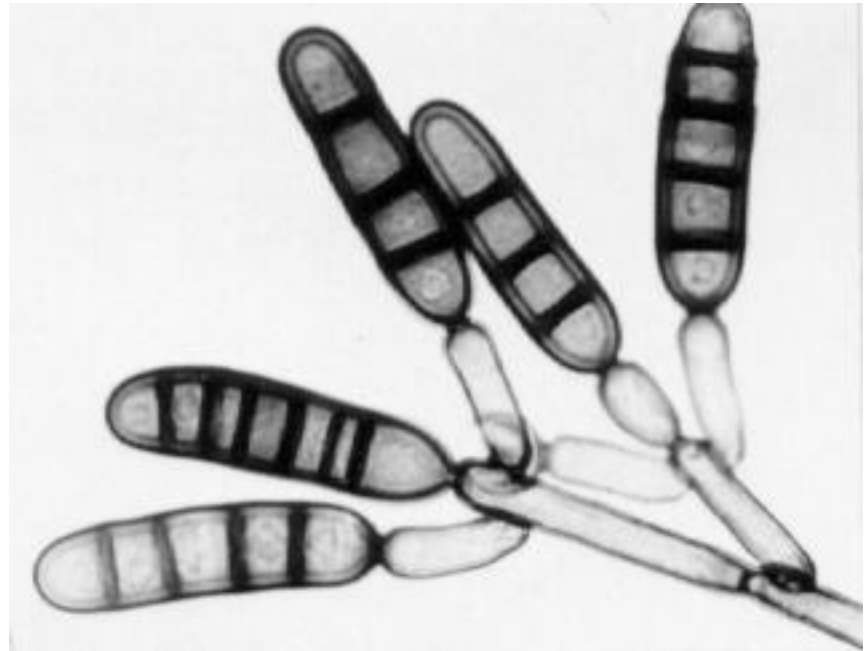
1. **Kingdom:** Fungi
2. **Phylum:** Ascomycota
3. **Class:** Euecomycetes
4. **Order:** Onygenales
5. **Family:** Arthrodermataceae
6. **Genus:** Microsporum
7. **Species:** canis

e.g. *Microsporum canis*



Deuteromycetes

A phylum of fungi that are without a sexual stage in their life cycle, reproducing only by asexual spores. Also called *imperfecti* because their life cycles are imperfect.

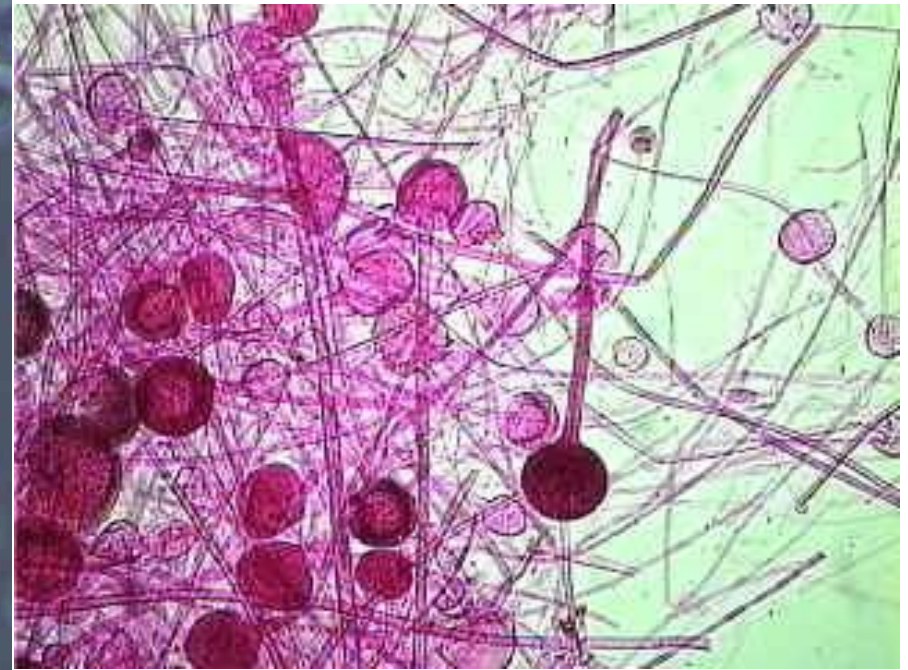
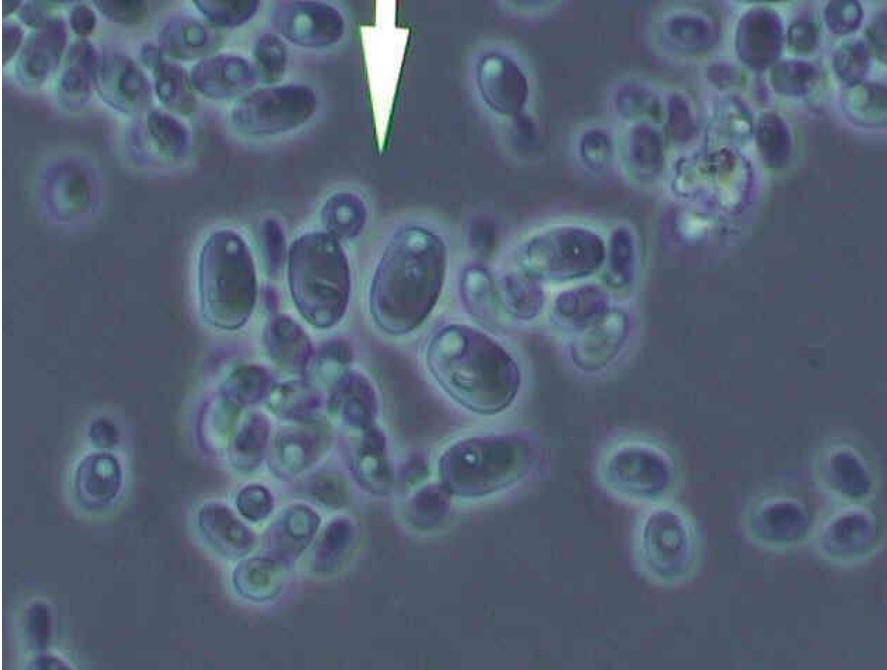


Structure of Fungi

Fungi can be

Unicellular = Yeasts

Multicellular = Molds

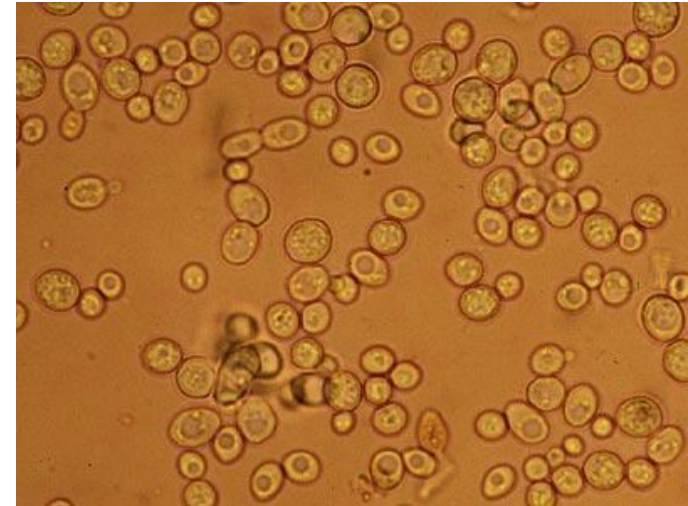


Yeasts

Yeasts are single-celled fungi (unicellular) that can only be seen under microscope.

Shape of Yeasts

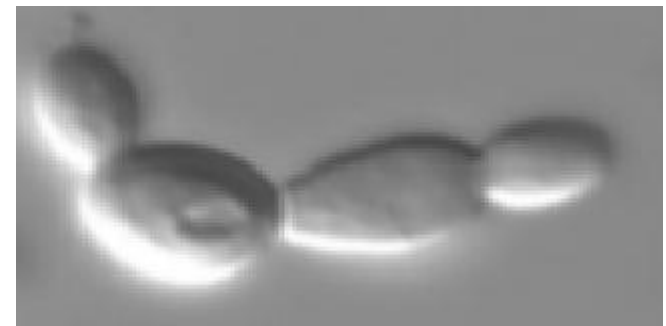
- a) **True yeasts:** Cell retain individually.
- b) **Pseudohyphae:** Elongated yeast cells attach to each other side by side forming a structure that looks like hyphae.



True Yeasts

Reproduction of Yeasts

Usually yeasts reproduce by **Budding** but some by **spore formation**.

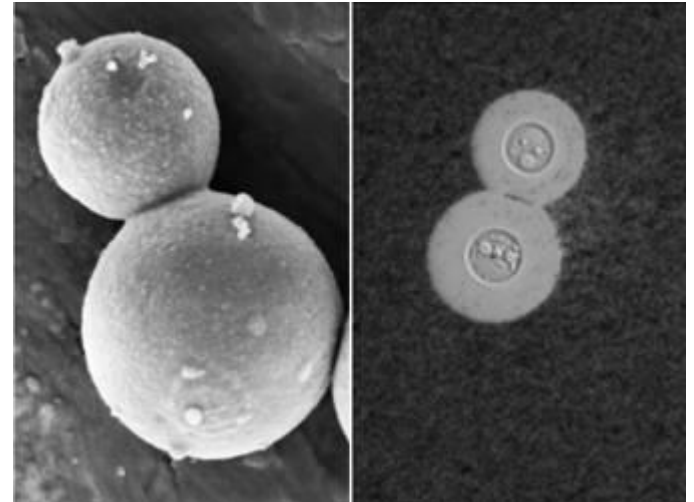


Pseudohyphae

Yeasts

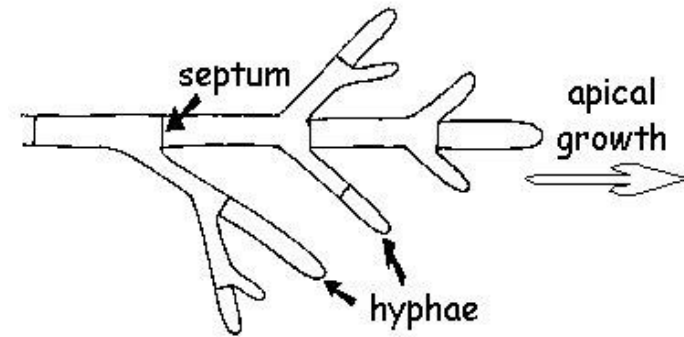
Examples of Yeasts

- *Saccharomyces cerevisiae* live on the skin of grapes and other fruits are responsible for the fermentation process of these fruits. This fungi is also used as “**Baker’s Yeast**” in baking and bread production.
- *Candida albicans* and *Cryptococcus neoformans* are human pathogens.

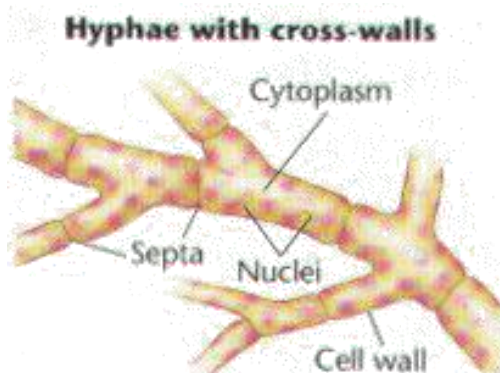


Molds

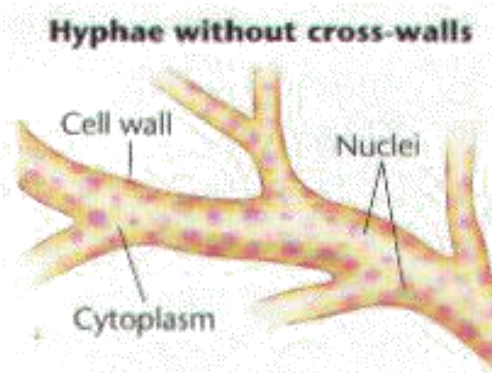
- Molds are multicellular fungi which are more complex than yeasts.
- The fungus form microscopic tubes or filaments called **hyphae** that contain cytoplasm & nuclei.
- hypha (single), hyphae (plural)= septum.
- A network of hyphae is called **mycelium**.
- **Hyphae can be:**



Septate hyphae



Non-septate hyphae



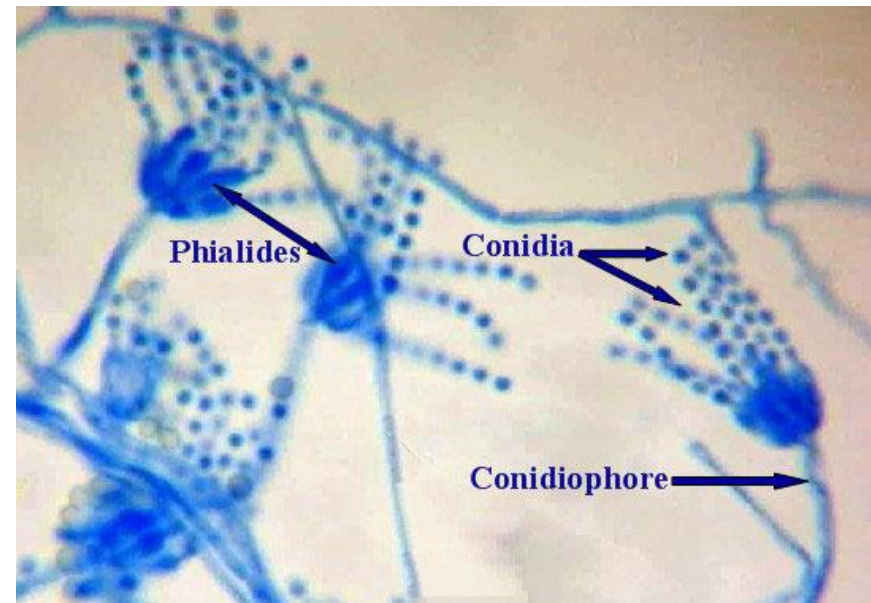
Molds

Reproduction of Molds

Molds reproduce by **spore formation**, either sexually or asexually.

Uses of Molds

- **Penicillium** used to produce the antibiotic penicillin.
- Some molds are used to produce enzymes and organic acids.
- For the production of different cheeses **e.g.** Blue cheese, Roquefort, ..



Reproduction of Fungi



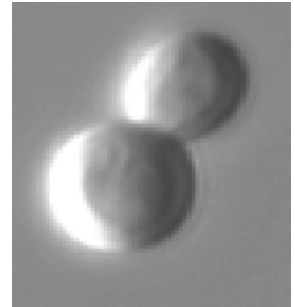
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graph TD; A[Reproduction of Fungi] --> B[Asexual Reproduction]; A --> C[Sexual Reproduction]
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Asexual
Reproduction

Sexual
Reproduction

I- Asexual Reproduction

Multiplying “multiple copies of the same organism” only by **Mitosis**.

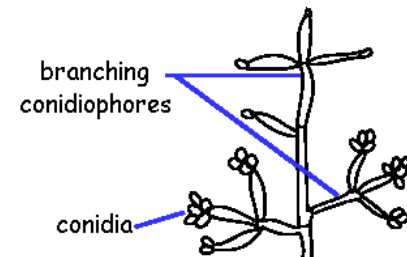
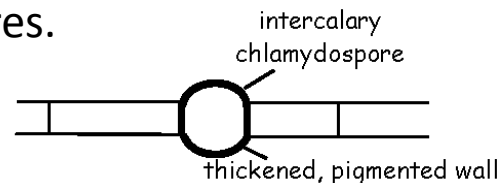
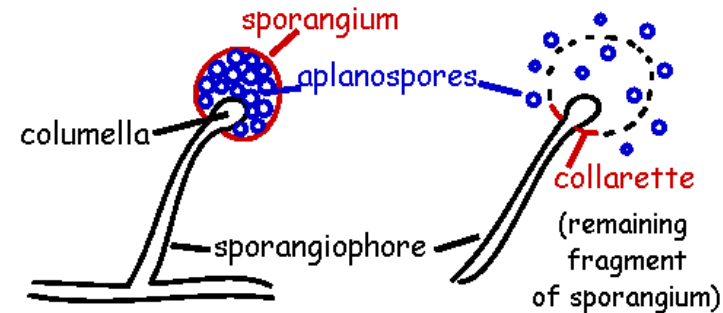


Budding in yeast

1. **Somatic:** **in yeasts** reproduce by **Budding**
in molds reproduce by **Hyphae Fragmentation**
2. **Spore Formation:** the end product is spore.

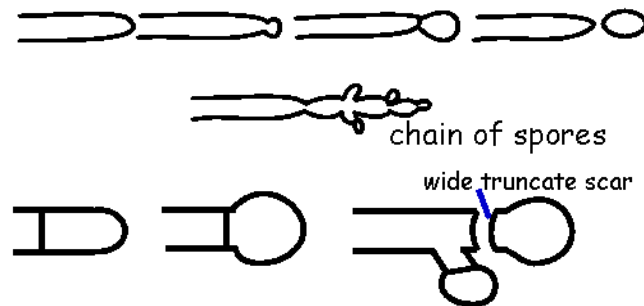
Types of Spore Formation:

- a. Sporangiospores in sporangium.
- b. Chlamydospores in or on hyphae
thick walled, resistant spore, terminal.
- c. Conidia on hypha or on conidiophores.

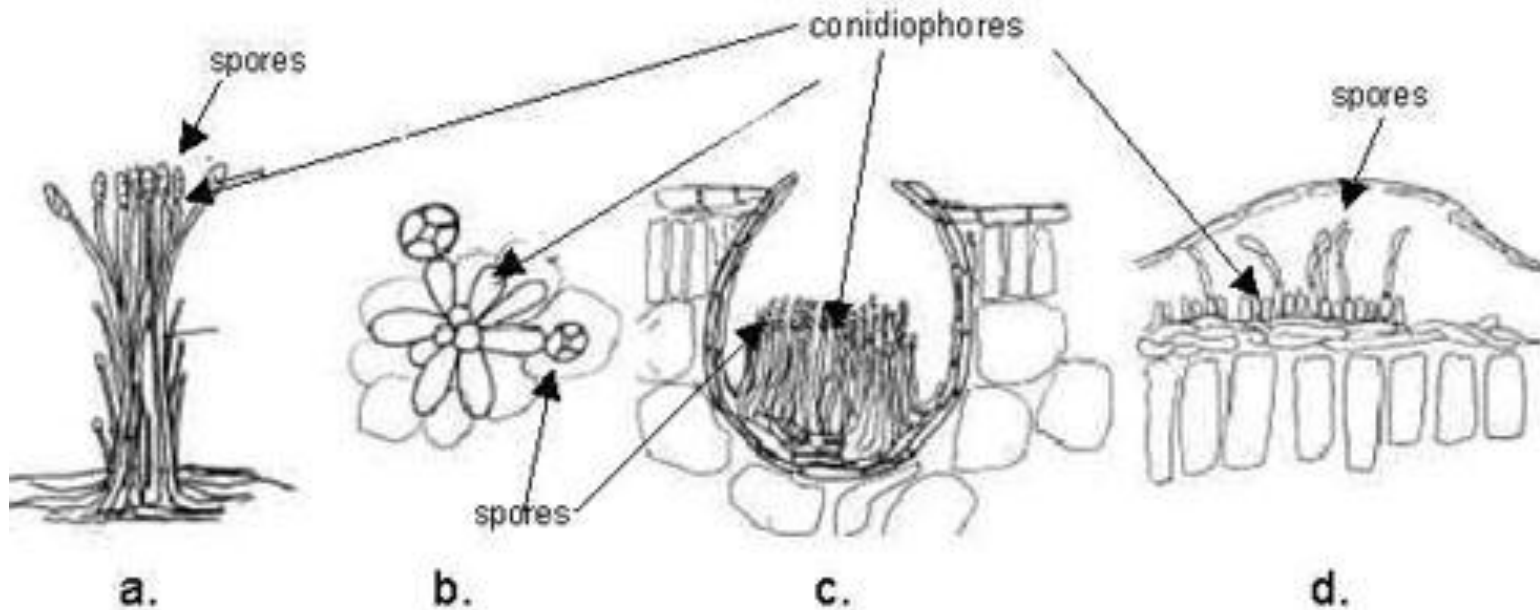


❖ Conidia have many types:

- Blastospore
- Arthrospore
- Aleuriospore



Examples of asexual reproduction in fungi:



a. Coremia, b. sporodochia, c. pycnidia and d. acervuli

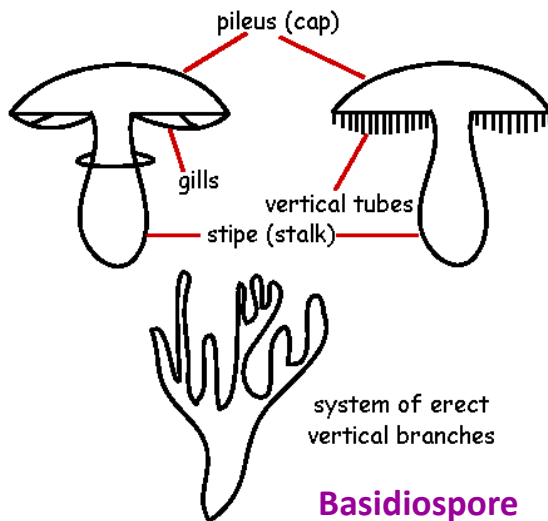
II- Sexual Reproduction

Sexual Reproduction happen by 3 stages:

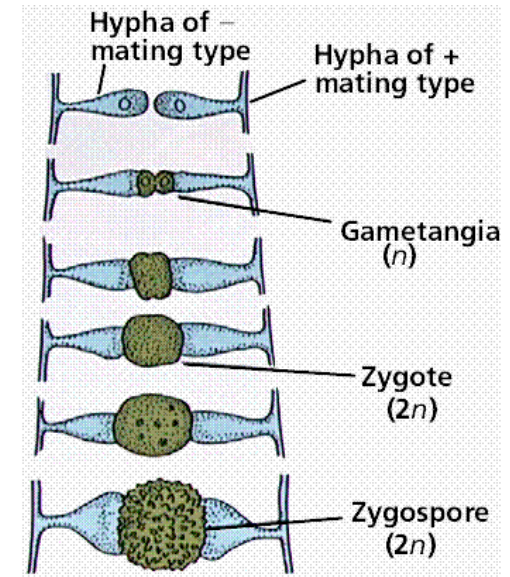
1. fusion
2. mitosis
3. miosis

Types of Sexual Spores:

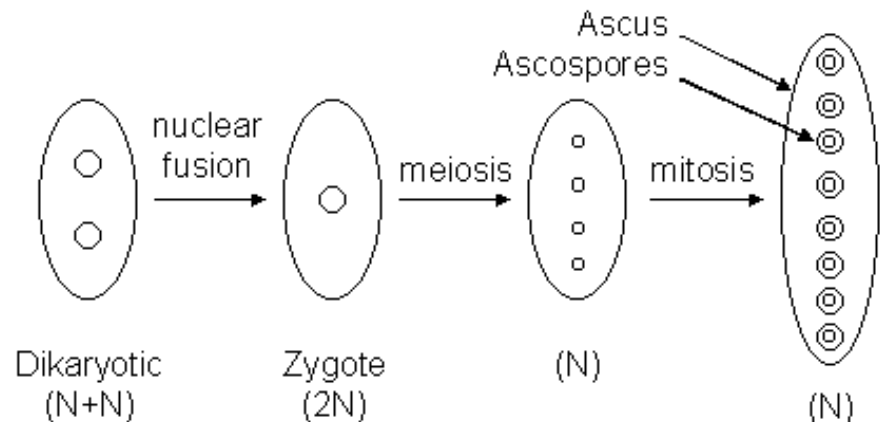
1. Oospore
2. Zygosporangium
3. Ascospore
4. Basidiospore



Basidiospore



zygosporangium



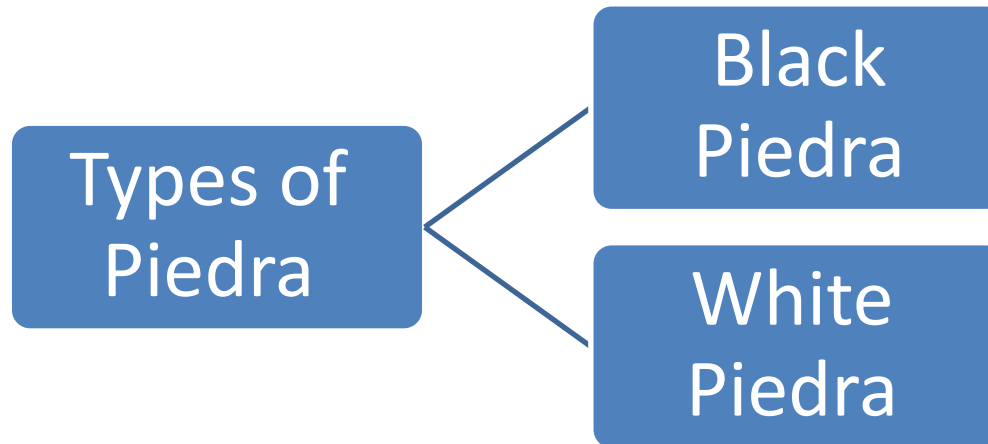
Ascospore

Diseases Caused by Fungi

1. Superficial mycosis: *Piedra*.
2. Coetaneous mycosis: Dermatophytes.
3. Subcutaneous mycosis.
4. Systemic mycosis.
5. Opportunistic mycosis: Candidosis.

Superficial Mycosis: *Piedra*

- Chronic.
- Superficial.
- **Effect:** Hair shaft only, producing nodules in scalp but it may affect:
 - Beard hair.
 - Mustache hair.



Black Piedra

- Hard, firm nodules.
- Black or dark brown.
- **Etiological Agent:** *Piedraia hortae*.
- Mold, "Ascomycete" which produce ascospores.
- Very slow growing in culture.



White Piedra

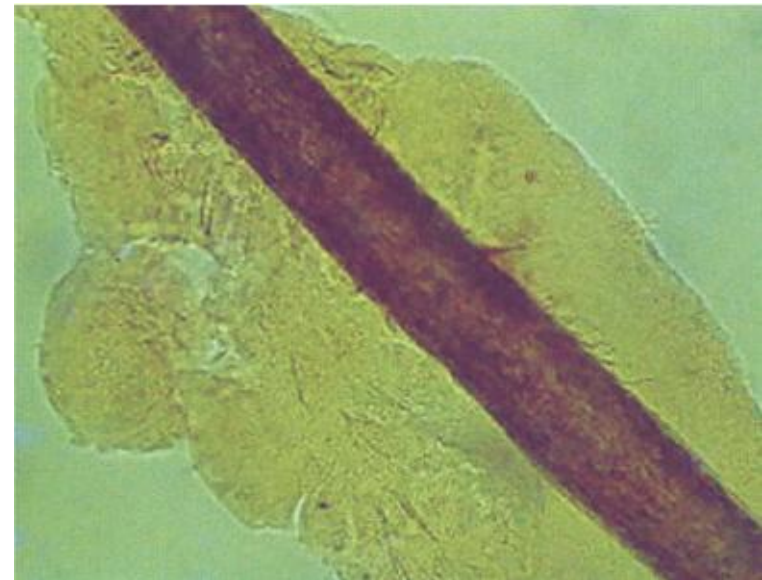
- Soft, less firm nodules.
- Brown cream in color.
- **Etiological agent:** *Trichosporon beigellii*.
- Imperfect yeast cells.
- Produce cream and beige colonies.
- Grows fast in culture, very common in KSA.

Treatment

1- Cream: 2% salicylic acid
3% sulfur ointment

2- Shampoo: Nizoral which contain ketoconazole.

3- Shave or Cut the hair: then clean the scalp with mild fungicidal.



Coetaneous Mycosis: *Dermatophytes*

- Skin infection.
- Affect all keratinized tissue: Hair, Nail, Skin, and stratum corneum.
- Common in children especially school age (2-12years).

Symptoms:

- Skin lesions called Tinea (or Ring worm).
- The lesion is scaly and cause itching.
- The margins are red or gray containing active fungus.
- In the beginning it is **mild** then it cause **toxic reaction** of the skin.

Transmission of infection:

- 1-By using personal stuff (e.g. Clothes).
- 2-House pets (cats and dogs).
- 3-Common in livestock animals (horses, sheep, and cows).
- 4-From the soil.

The Clinical Types of Dermatophytes

Tinea exists in any part of the body depending on the location it is given a different name:

Athlete's foot or *Tinea pedis*



Ringworm of the body or *Tinea corpora*



Scalp ringworm or *Tinea capitis*



Ringworm of the nail, Onychomycosis,
or *Tinea unguium*



Opportunistic Mycosis: *Candidosis*

- It is any infection caused by species of the fungus *Candida*.
- It is usually opportunistic but there are some forms are not.

1- Oral Thrush

Infection of the mouth surface by candida

Very common in:

- AIDS patients, young babies, new born, and children.
- Also it can occur in adults and very old people.



Lesion: White patches in the tongue and oral surfaces.

2- Diaper or Napkin rash

- **Common in:** Babies who their mothers do not change their diaper frequently.
- **Symptoms:** **Red area** in groin area. It may spread by the baby himself from the groin area to the face part .
- It usually goes away by correct conditions.



3- Vaginitis

Infection of vaginal mucosa by *candida*.

- **Symptoms:** itching, white or yellowish discharges from vaginal surface or pus.
- 60% of the vaginal discharge is caused by *candida*.
- It is very common in KSA.
- It is more in pregnant and diabetic ladies.