

# *Fungi*



# *Introduction*

- Study of fungi called **mycology**.
- ✓ **Some fungi are beneficial: ex**
  - a) Important in production of some foods, ex: cheeses, bread.
  - b) Important in production of some antibiotics, ex: penicillin
- ✓ **Some fungi are harmful**, they cause deterioration of leather, plastic and spoilage of jams, pickles, and many other foods.

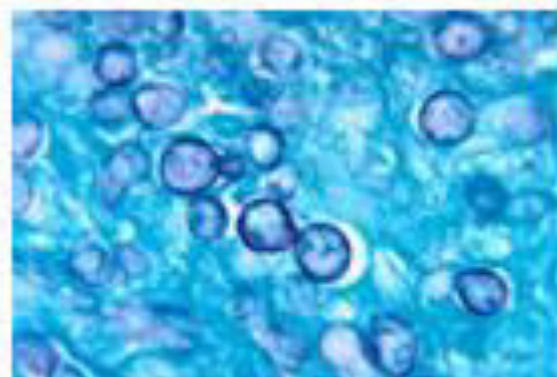
# *Classification of Fungi*

## **Fungi**

Yeasts

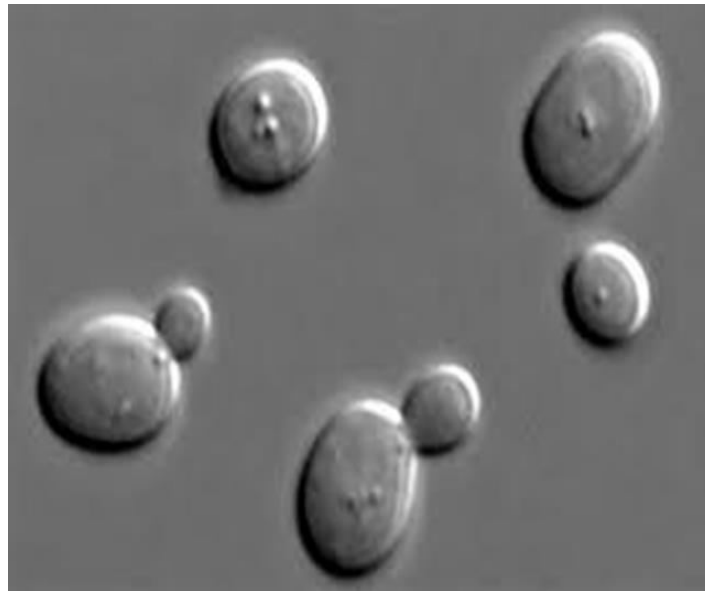
Molds

Fleshy Fungi



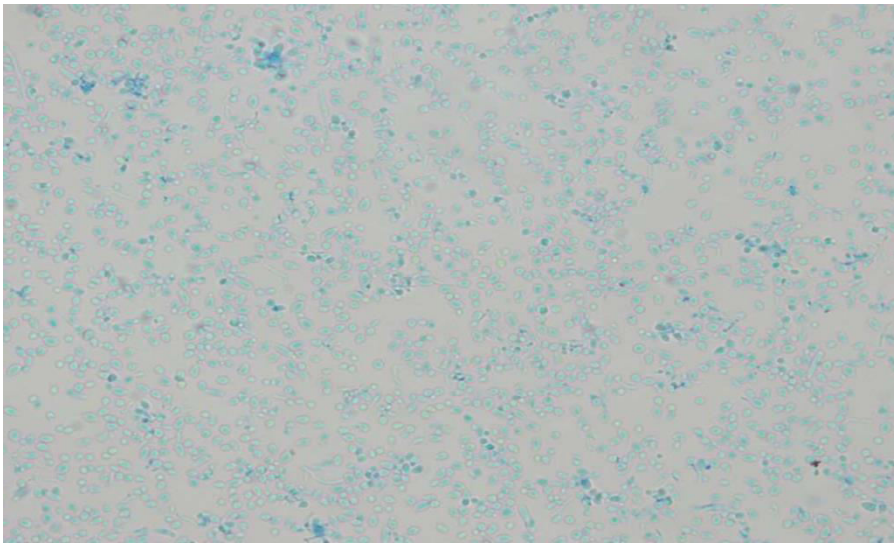
# *Yeasts*

- Unicellular fungi.
- Spherical (or oval) in shape.
- Reproduce by **Budding** but some by **Spore formation.**



# *Yeasts*

**Yeasts under microscope**



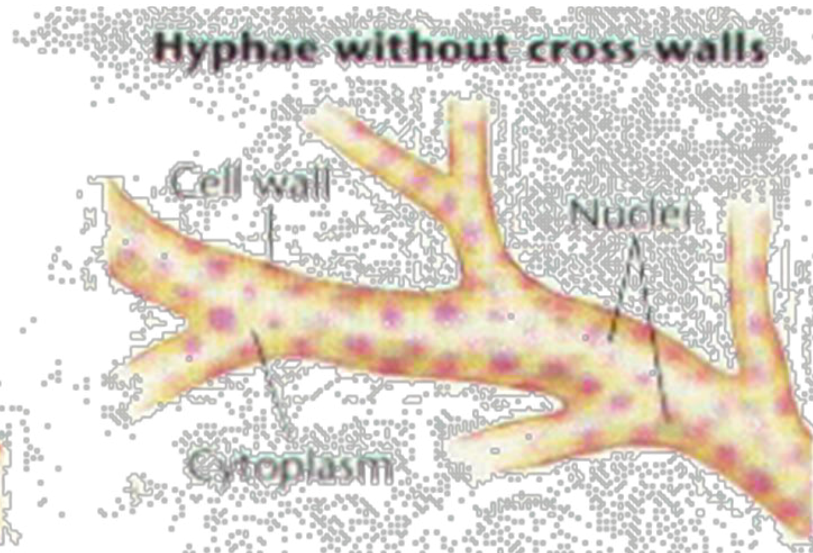
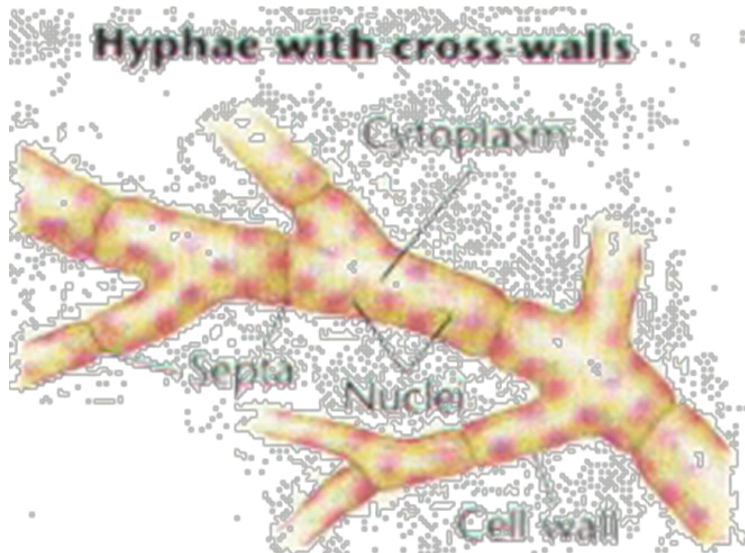
**Yeast in culture media**



# *Molds*

- multicellular fungi which are more complex than yeasts.
- The molds are made up of microscopic filaments called **hyphae** (sing., **hypha**) that contain cytoplasm & nuclei.
- **Hyphae can be:**
  - *Septate hyphae*
  - *Non-septate hyphae (aseptate hyphae)*
- Reproduce by **spore formation** (sexually or asexually), some molds reproduce by **hyphal extension**

# *Molds*



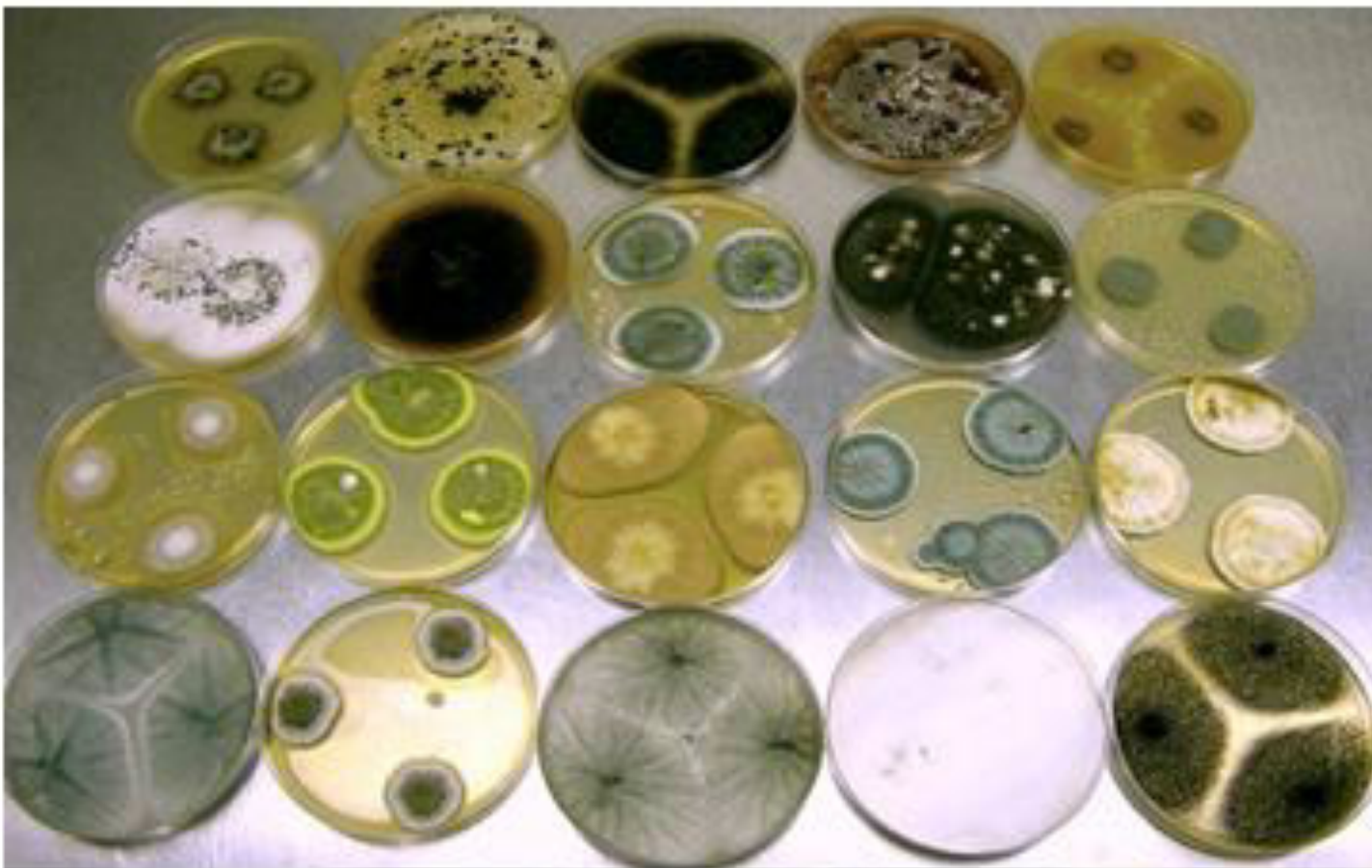
# *Molds*

## **Molds under microscope**



# *Molds*

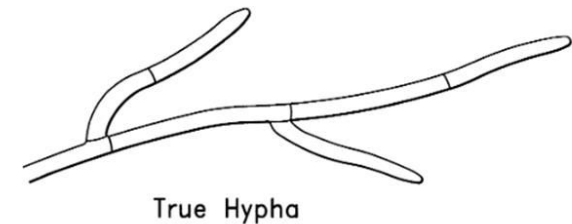
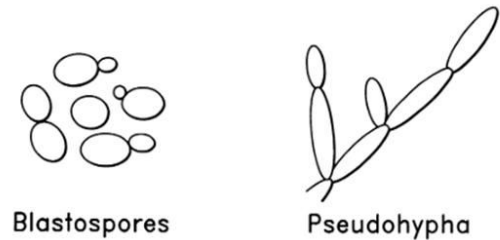
## **Molds in culture media**

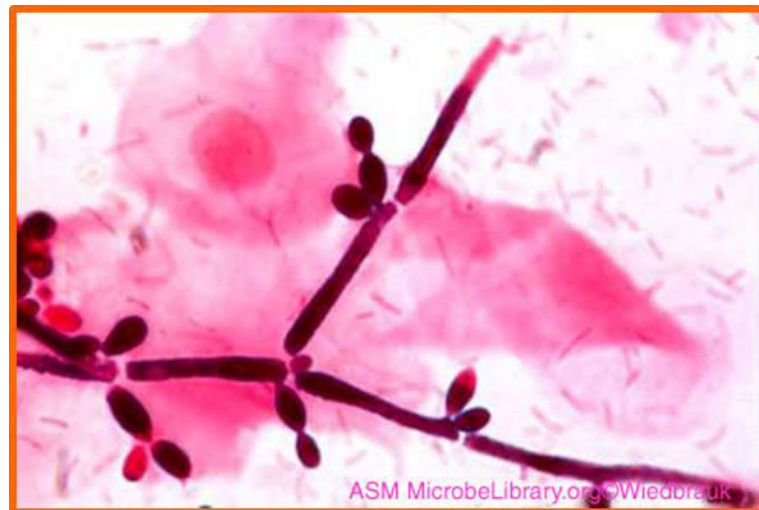
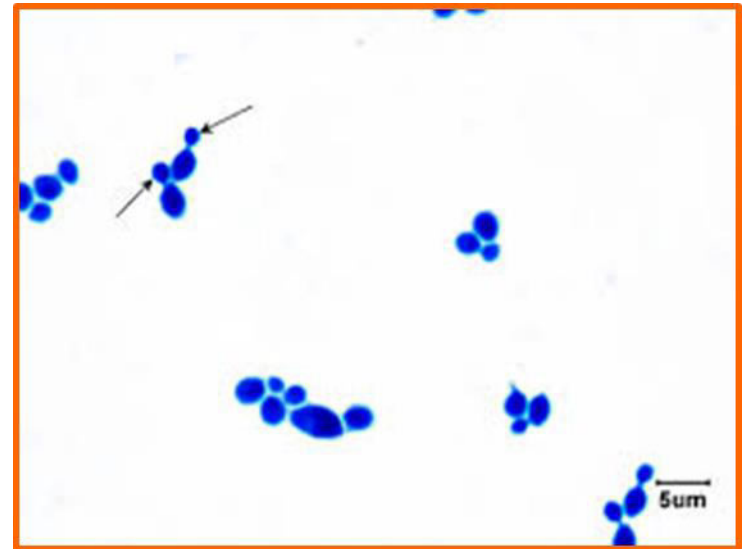
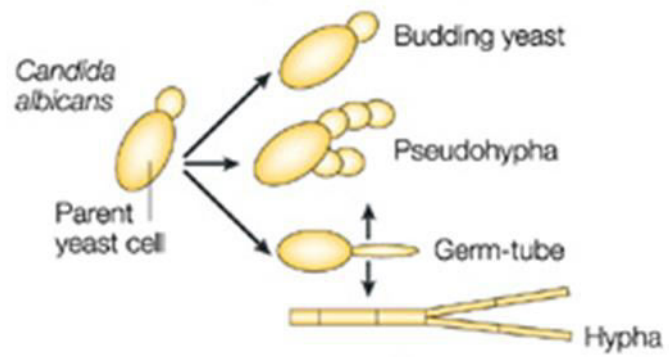


# *Candida spp.*

## General Characteristics:

- it is yeast.
- Shape:
  - ✓ Round, or oval yeast cells (most often seen as budding yeast cells).
  - ✓ Under certain conditions, including those found in infection, they can form hyphae.





- Culture:
  - ✓ Most *Candida spp.* grow rapidly on Sabouraud's agar media or on enriched bacteriologic media such as blood agar.
  - ✓ They form smooth, white colonies.

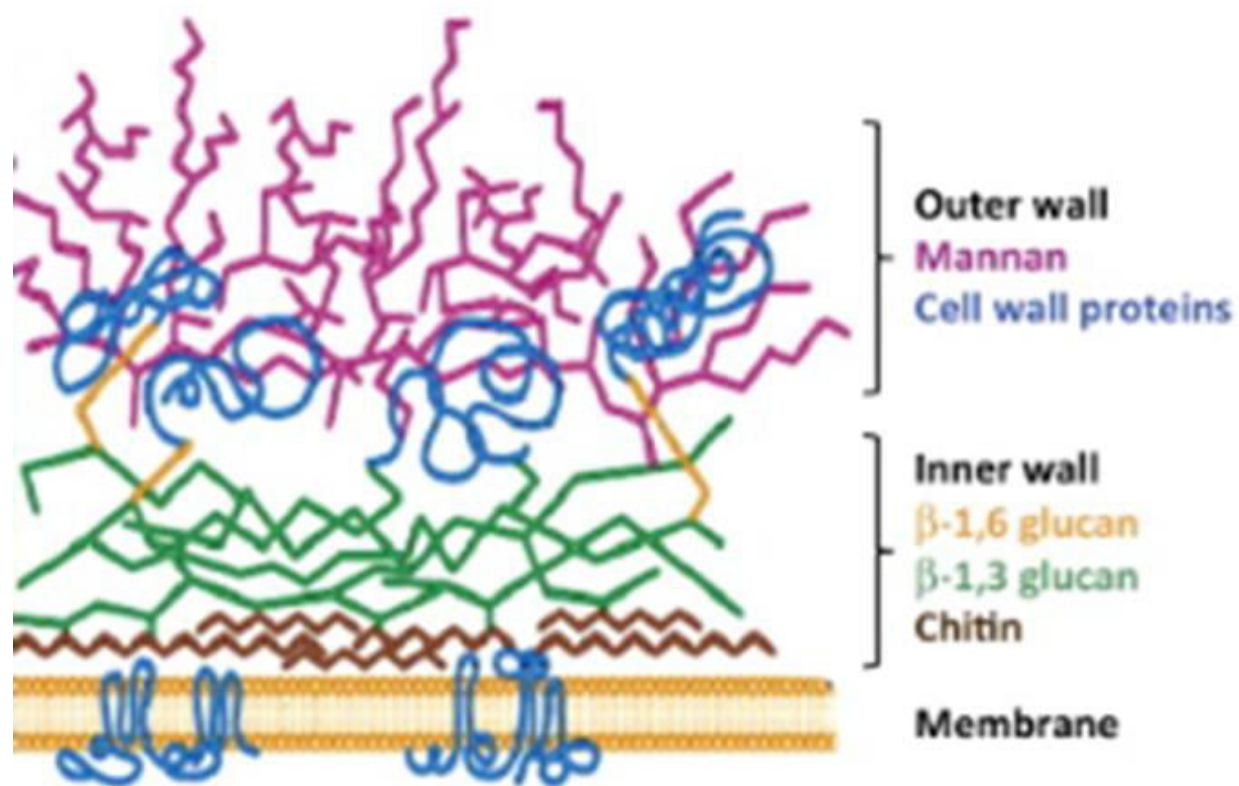


- There are over 150 Candida species, fewer than 10 appear in human disease.
- The most common cause of disease is *Candida albicans*.

# Cell Wall of *C. albicans*

Cell wall of *C. albicans* composed of 2 layers:

- The outer layer contains a number of polysaccharide called Mannan with a protein, this layer called mannoproteins.
- The inner layer contains polysaccharide called Glucan, and Chitin alone or in complexes with protein.
- The exact composition of the cell wall and surface components varies under different growth conditions.



# Epidemiology of *C. albicans*

## It is a member of :

- Oro-pharyngeal flora.
- Gastrointestinal flora
- Female genital tract flora.

## So it cause opportunistic infection.

## Infection:

- Usually endogenous.
- Can be done by direct mucosal contact with lesions (ex. Sexually)
- Invasive procedures and indwelling devices may provide the portal of entry (ex. indwelling catheters). (**Candida demonstrated capacity to form biofilms on the plastics used in medical devices**)
- Prolonged use to antibacterial agents can lead to infection.
- Elevated glucose concentration is also associated with Candida infections (ex. DM).

**Pathogenesis:** the disease can be:

- **Localized form**, seen as:
  - ✓ Erythema and white patches on moist skin fold (ex. diaper rash), or on mucosal surfaces (ex. oral thrush).
  - ✓ Itching and thick white discharge of vulvovaginitis.
- **Disseminated form**, is limited and almost exclusively seen in immunocompromised.

# Candidiasis

- Candidiasis: fungal infections caused by *Candida*, ex:

## **Oral candidiasis (Oral thrush):**

- Infection of the mouth surface
- Very common in: AIDS patients, infant, individuals with diabetes mellitus, and very old people.
- Symptoms: white patches in the tongue and oral surfaces



# Candidiasis

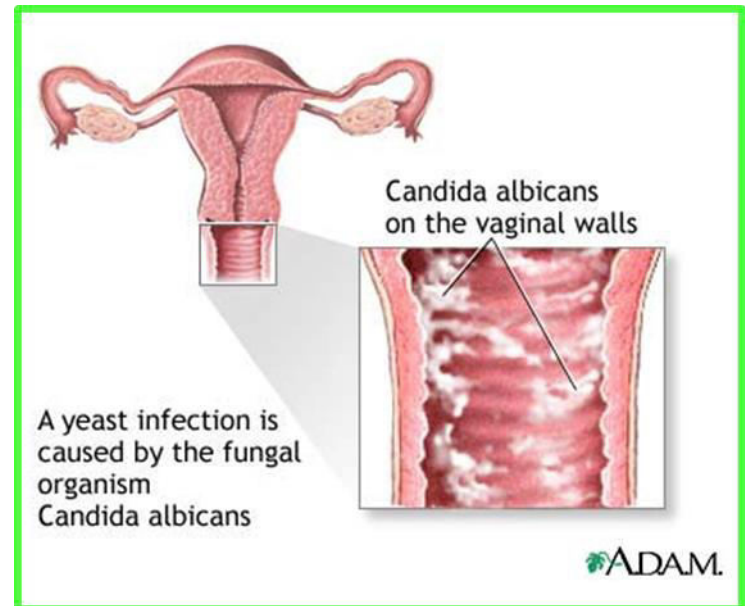
## 2. Diaper or Napkin rash

- Symptoms: red color 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- Vaginal candidiasis (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.



# Diagnosis and Treatment

- **Stains:** use KOH stain and Lacto phenol cotton blue stain for superficial lesions to see yeast and hyphae.
- **Culture:** growth on selective, differential media to differentiate between Candida species.
- **Biochemical test:** sugar utilization test are done to differentiate the organism
- Specimen is dependent on type of infection.

## **Treatment:**

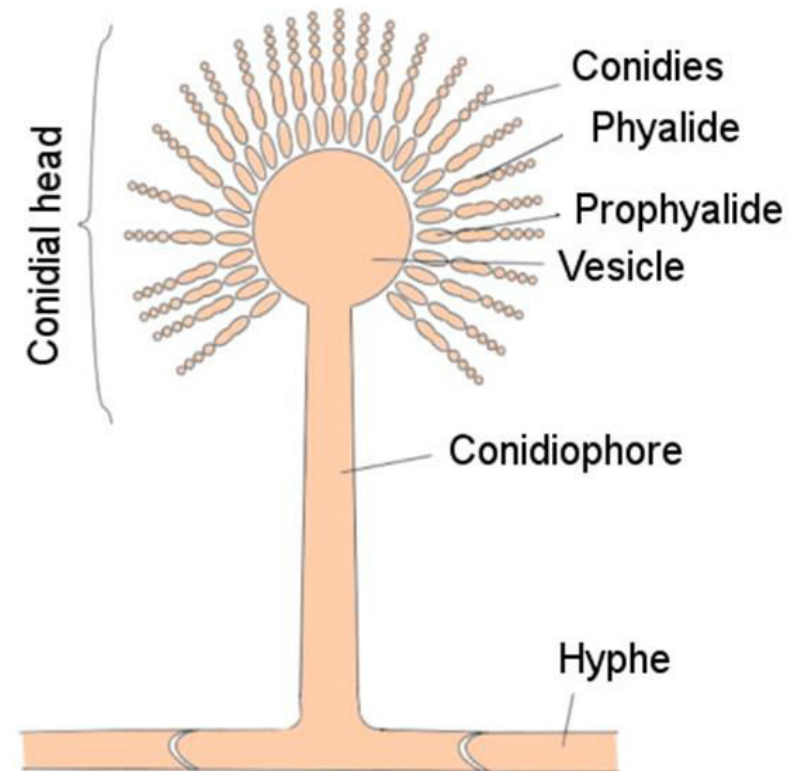
- Using topical antifungals such as nystatin.
- Amphotericin B or fluconazole can be used for invasive disease.

# *Aspergillus spp.*

## General Characteristics:

- It is mold.
- Shape (structure):
  - ✓ Have branching septate hyphae,
  - ✓ Have a characteristic arrangement of conidiophore, vesicle, phyalide and conidia.

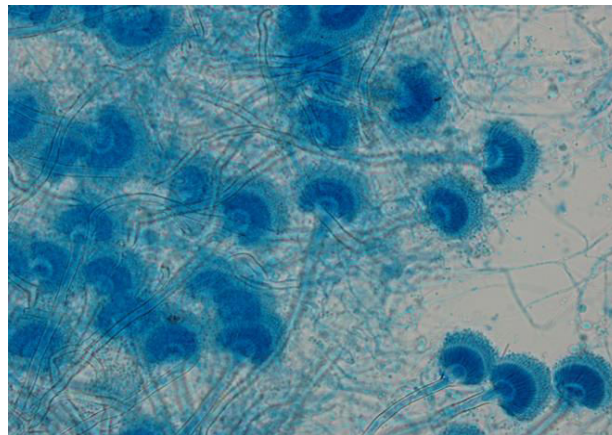
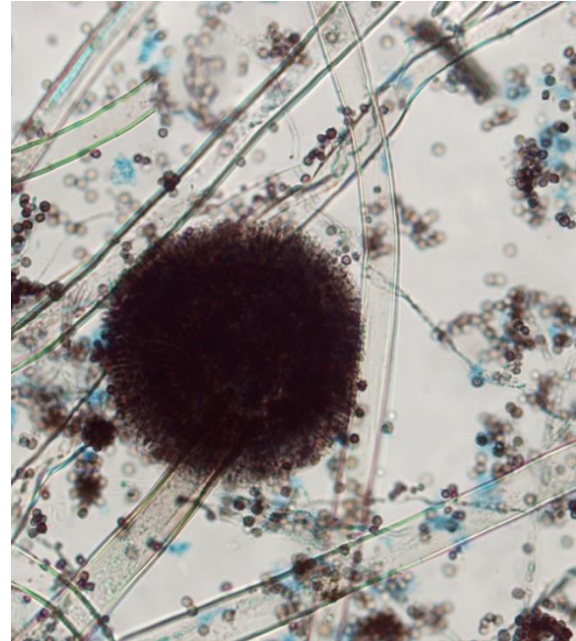
(Different species are defined based on the differentiation in their structure).



***A. fumigatus***

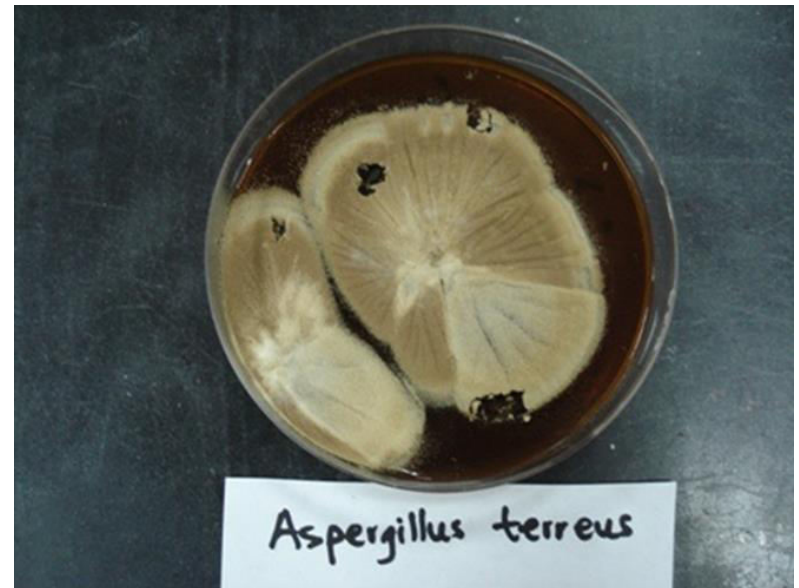


***A. niger***



***A. terreus***

- Culture:
  - ✓ Rapidly growing molds.
  - ✓ Colonies appear in 1 to 2 days.
  - ✓ Colonies give different colors and texture.
- Human infections are mainly by *A. fumigatus* & *A. flavus*.





# Epidemiology

- *Aspergillus sp.* are air contaminant fungi (or saprophytic fungi), and widely distributed in nature.
- Adapt to a wide range of environmental conditions.
- The conidia are like bacterial spores they can resist heat and survive well in the environment.
- The infection is usually through inhalation of these conidia.
- Hospital air and air ducts can be a source of nosocomial *Aspergillus* infections.

# Aspergillosis

- Aspergillosis: fungal infection caused by *Aspergillus spp.*
- Infection usually occurs in lungs – spores germinate in lungs and form fungal balls; can colonize sinuses, ear canals, eyelids, and conjunctiva.
- Invasive Aspergillosis can produce necrotic pneumonia, and infection of brain, heart, and other organs.

# Manifestation

- Allergic aspergillosis: marked eosinophilia and specific IgG.
- Invasive infection: occurs in the preexisting pulmonary disease (ex. Asthma, TB) or immunosuppression.
  - ✓ The organism is highly invasive and can invade blood vessels.
  - ✓ Often fungus ball can be seen in cavities.
  - ✓ Pneumonia in immunocompromised host has a very bad prognosis with very high mortality.

# Diagnosis

- It is easy to isolate and identify in the lab.
- Stain: with Lacto phenol cotton blue
- Culture: do culture and diagnosis is based on morphological characteristic.
- Serologic method: to detect anti-Aspergillus Ab in patient serum (this method useful for allergic disease only)
- Direct aspirate or biopsy is required to distinguish colonization from invasion.

# Treatment

- Usually a combination of antifungal drugs is recommended for invasive aspergillosis.
- No regimen is considered highly effective , because the mortality rate of invasive disease approaches 100%.
- Amphotericin B, azoles, and other drugs can be used.
- Usually surgical removal of localized lesion is helpful.

# Fungal Corneal Ulcer

- It occurs more in warm and humid climate.
- Risk factors include:
  - ✓ Trauma to the cornea.
  - ✓ Trauma related to contact lens wear.
  - ✓ Chronic keratitis.
  - ✓ Corneal surgery.

# Etiology of Fungal Corneal Ulcer

*Aspergillus fumigatus*



*Candida albicans*



*Fusarium*



# Treatment of Mycotic Keratitis

- If not treated early it may lead to corneal blindness.
- Treatment can include any (or combination) of the following:
  - ✓ Amphotericin B .
  - ✓ Fluconazole.
  - ✓ Nystatin
  - ✓ Miconazole.
  - ✓ Oral antifungal agents may be used.

# *Fusarium spp.*

- It cause superficial infections.
- It can cause locally and disseminated infections; which occurs almost in severely immunocompromised patients.
- Fusarium species are also important plant pathogens that cause various diseases on cereal grains.
- It is widely distributed in soil, plants, plant debris and in water.
- It has a septate hyphea just like *Aspergillus* species.

