

# *Mycology Project*

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- ❖ See the CD for the images
- ❖ or , You can search those websites for more information & images:

<http://www.doctorfungus.org/>  
<http://www.mycology.adelaide.edu.au/>  
<http://www.mycology.net/>  
<http://www.google.com.sa/> ( for sure )

# *Introduction to Mycology*

**Mykes:** mushroom = fungi

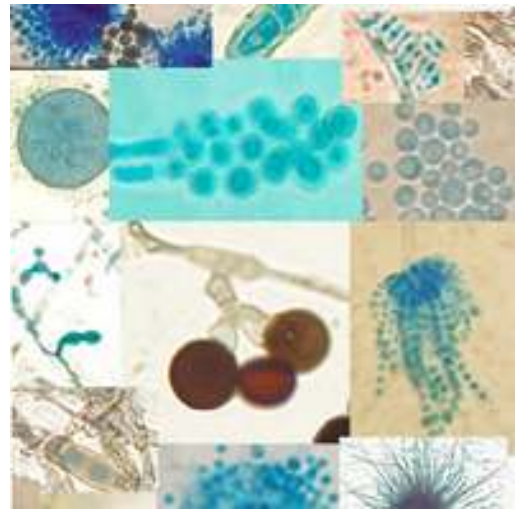
**Logos:** study of

**Mycology:** the branch of botany that studies fungi and fungus-caused diseases

**What are Fungi ? ( ☀ MCQ )**

Eukaryotic Organisms that have membrane-bound nuclei , unlike viruses or bacteria , and are Heterotrophic

**Heterotrophic :**organisms that require preformed organic carbon sources for growth



## ❖ **Characteristics Feature :**

1. All are Eukaryotes
2. Heterotrophic-Achlorophyllous ( doesn't contain chlorophyll ) , they can't synthesize their own food & depend on others for obtaining it .
3. They are either:
  - a. **Symbiotic** : no harm , live in harmony with host
  - b. **Parasitic** : harm others
  - c. **Saprobic**: live in waste matter
4. The cells are surrounded by a rigid cell wall made up of chitin & other complex carbohydrates ( most characteristic feature ) .
5. Have simple microscopic structure ( most human pathogenesis are Unicellular)
6. Reproduce by Spore formation ( Sporulation ) :
  - a. **Asexual sporulation**
  - b. **Sexual sporulation**

**How does fungi differ from plants ? ( ☀ MCQ )**

Plants are Autotrophic, they contain chlorophyll pigment & participate in photosynthesis

Fungi NEVER produced by Seeds

**How does fungal cell wall differ from bacterial cell wall ? ( ☀ MCQ )**

Bacterial cell wall form of :

- Peptidoglycan
- Lipopolysaccharides

Fungal wall form of :

- Chitin , N-acetylglucosamine polymers
- Glucans polymerase of glucose

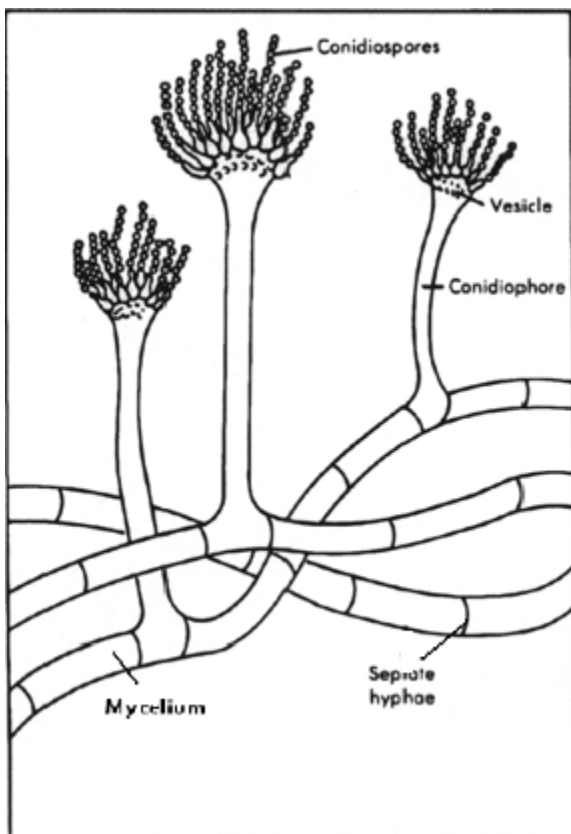
**N.B**  $\beta$ -Lactam antibiotics that interfere with bacterial cell wall production have **no effect** on fungi cell wall

❖ **There are two morphologic forms of fungi :**

1. Filamentous molds
2. Unicellular yeast

### Structure of the fungus :

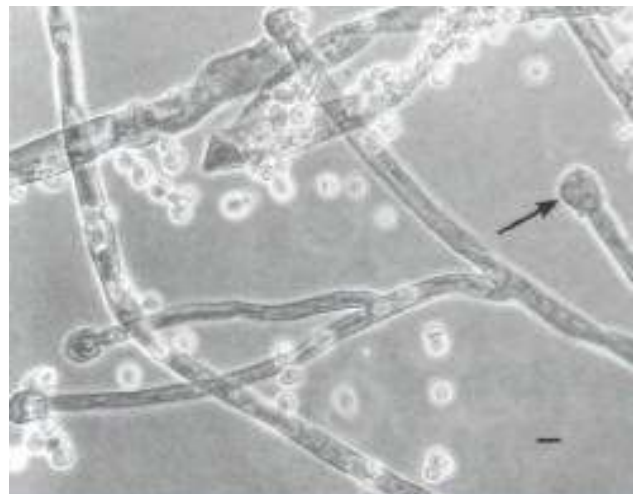
#### 1. Filamentous molds



Unit structure :

- **Mycelium / hypha** : mass of filamentous threads that resembles a "cotton ball" composed of intercommunicating individual threads of tubular cells called **Hypha**
- **Septa** : forms partitions between cells within hypha, it may be either : Septate or non-septate (coenocytic hyphae)
- **Thallus** : is vegetative body ; a simply fungus body

**E.g.** Aspergillus – Penicillium - & Rhizopus



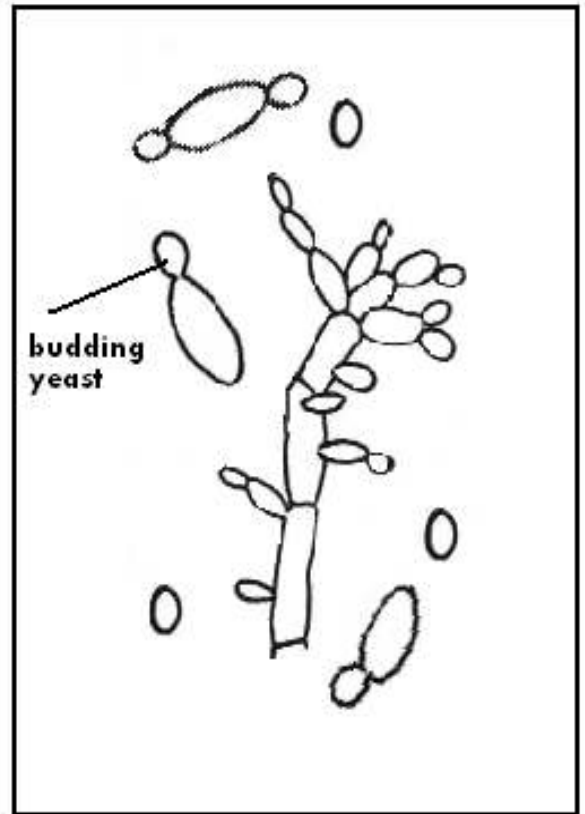
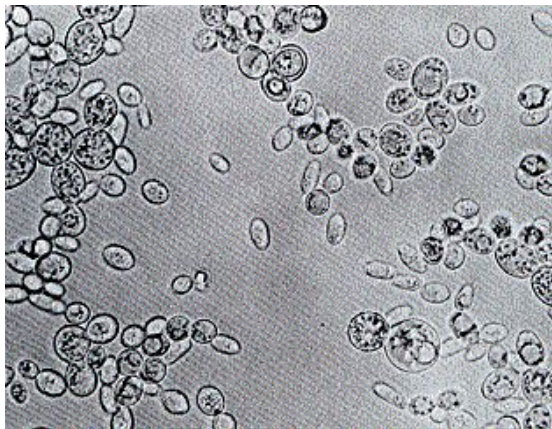
## 2. Unicellular yeast

Single cell & retain their individuality ,  
unconnected spheroid cells.

They are either :

- True Yeast , in which cells retain individuality like *saccharomyces cerevisiae* ( baking yeast )
- Yeast-like organisms ; filament-like structure , cells attached to each other side by side forming Pseudohypha like *candida albicans* ( normal flora )

**E.g.** *Sacchromyces cereviscie* - &  
*Candida albicans*



**What is the difference between Molds & Yeast ? ( ☼ MCQ )**

Molds	Yeast
<ul style="list-style-type: none"><li>- Filamentous molds grow by Branching &amp; Tip elongation of hypha</li><li>- More complex</li></ul>	<ul style="list-style-type: none"><li>- Yeast reproduce by Budding or Fission</li></ul>

### ❖ Dimorphic Fungi :

They change their morphology according to the environmental conditions  
e.g. temperature – medium – host - & culture

They are in Yeast form at 37°C & in Mold form at room temperature 25°C

**N.B “ Mold in Cold , Yeast in Heat “**

- Most fungi are Monomorphic & few are Dimorphic which are pathogenic ( ☼ MCQ )

## ❖ Reproduction :

### 1. Asexually

Through **Mitosis** ; one individual copies itself

There is two types :

- Somatic : in Yeast by Budding & in Mold by Hyphal fragmentation
- Spore formation : Sporangiospores in sporangia  
Chlamydospores in or on hypha  
Conidia
- major Asexual spore ( Blasto - Arthro - & Aleuri ) spores

### 2. Sexually

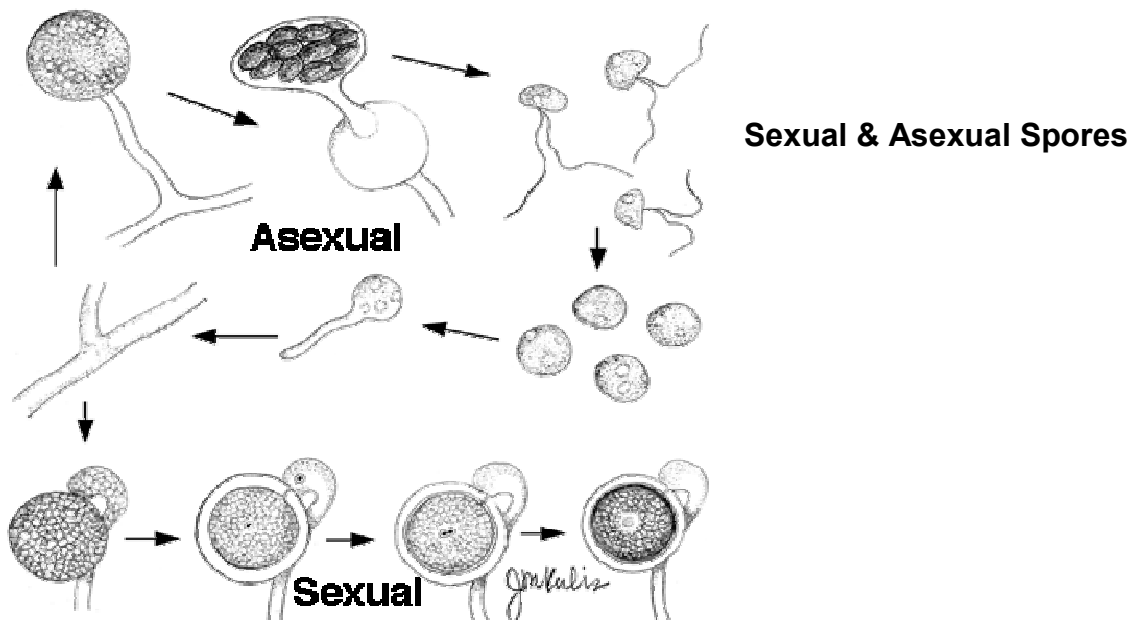
Through **Meiosis** ; two parent are needed

The process has 4 phases :

- Fusion
- Mitosis
- Meiosis
- & sexual spores ( Oospores - Zygospores - Ascospores -  
& Basidiospores )

e.g. Deuteromycetes - Zygomycete – Ascomycete – Basidiomycete

- Basidiomycete is highly poisonous ( food poisoning ) BUT has low pathogenicity
- Imperfect fungi **doesn't** reproduce sexually , instead they form primarily conidia  
e.g. Deuteromycetes which are the most pathogenic !!



❖ **Classification of Fungi :**  
( based on the level of involvement & depth of invagination )

1. Superficial Mycosis : limited to the hair & stratum corneum
2. Cutaneous Mycosis : limited to epidermis
3. Subcutaneous Mycosis : epidermis is breached
4. Systemic Mycosis : when there is significant penetration or dissemination to internal organ
5. Opportunistic Mycosis
6. Actinomycosis infections ( bacterial disease which similar to those caused by fungi )

**N.B** main function of Fungi : decomposition of organic compounds & waste

- Sexual reproduction induce :
  - Genetic mixing
  - Inheritanceof different Triates ( new )
- When fungi is ready , the produce Fruiting Bodies form  
Fruit body may form as a result of either sexual or asexual process
- **Fruit body** : is stalk & sac in which Spores are produced

*" Try not to be a person of success. But  
rather a person of value. "*

# Superficial Mycosis

## ❖ Introduction :

Superficial fungal infection which affect the **stratum corneum** ( the most outer layer of the skin – hair shaft - & nails )

They doesn't cause pain & Don't provoke the immune response cause not produced any antibody ( ☼ **MCQ** )

The patient go for seek for cosmetic reason

## ❖ The infection are caused by :

1. Tinea versicolor
2. Tinea nigra
3. Piedra

### 1. Tinea versicolor – Pityriasis versicolor

**Old name :** Pityrosporum orbicularis

**Caused by :** Malassezia furfur , Malassezia oralis

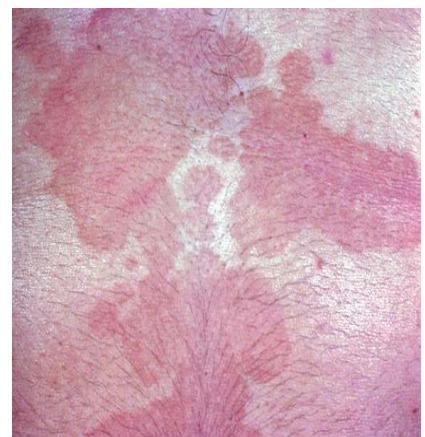


- It's a chronic superficial fungal infection .
- it affect the upper most dead tissue of the skin of chest (commonly) , abdomen , arm & soulders

**Clinical Features :** brown or discolored white patches

They don't tan even when exposed to sun light ( ☼ **MCQ** ) .

This disease affect any age & sex , Common anywhere in the world wide spread among people





### Causative Organism :

- **Malassezia furfur** : a yeast , unicellular , bipolar budding (blastomycetidae)
- It's **lipophilic** ( for growth in Lab. On SDA or microscopic agar we SHOULD add **Oily material** e.g. olive oil , oleic oil ) , Lipid is absolute requirement
- It's normal flora ( which utilizes fatty acids in the skin )
- Cause Endogenous infection & Autoinfections
- It's NOT contagious

### Diagnosis :

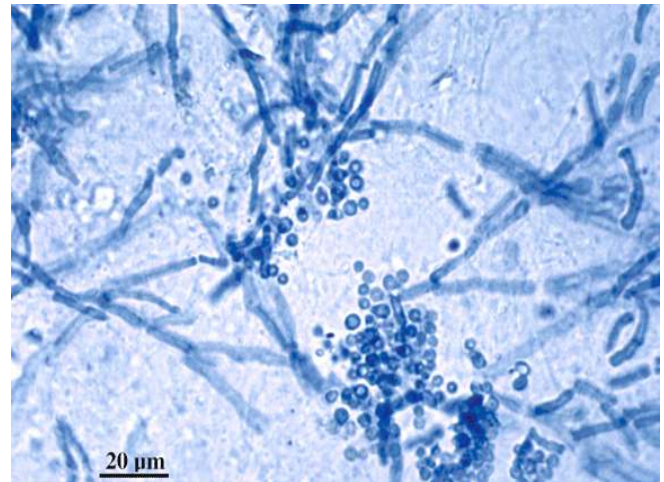
**Specimen** : skin scraping  
( stain smear directly )

### DME; Direct Microscopic

**Examination:** before you examine the sample under microscope , add saline 10%-20% KOH

**(why? )** To dissolve the human epithelium WITHOUT affecting the fungal material

- Don't use water nor normal saline



You'll see short hyphal strands & round yeast cells ( spaghetti & meat ball appearance )

**Culture** : SDA ; Sabroud Dextrose Agar common medium , Mycobiotic agar medium which is ( SDA + chloramphenicol+ cyclohexamide ) = Actidione with Oily substance .



NOT grow on media cause it needs Lipophilic , so we put an **Oily substance** ( ☼ **MCQ** )

- No Oil → false negative ( routinely )
- With Oil → Positive ( specific )
- Yeast ; are Fast grow fungi 1-2days



## 2. Tinea Nigra – Tinea palmaris/Plantaris

**New name :** Pheoanellomices Whernikii

**Caused by :** Exophiala Whernikii



- It's a chronic superficial fungal infection
- It affects primarily the sole & palm
- Found in tropical or subtropical region

**Clinical Feature :** Brown macules or Black stripes

### Causative Organism :

- **Exophiala Whernikii** : It's dermatocious ; dark in color & **Slowly** growing ( ☼ **MCQ** )
- It's in the form of Imperfect mold with septate hyphae
- It reproduce asexually by forming **Conidia** ( annellospores )
- It causes an Exogenous infection
- It's found in agriculture soil , woods , plants

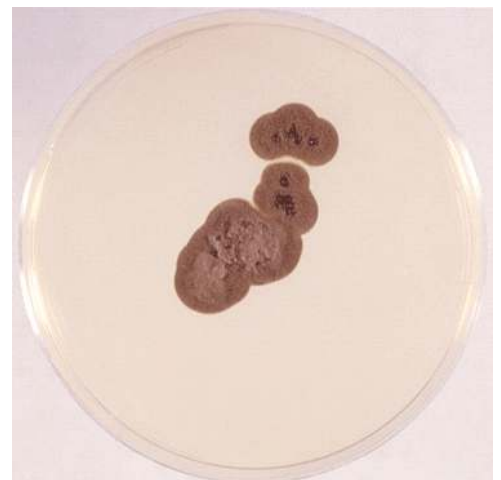
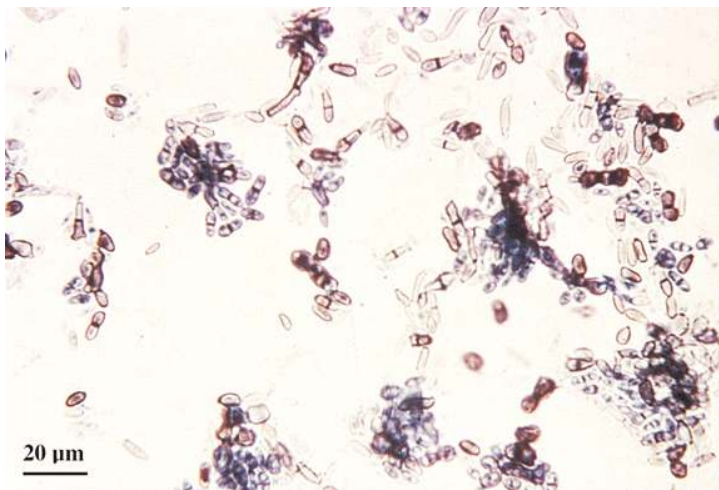
### Diagnosis :

**Specimen :** skin scraping + KOH

**DME :** septate hyphae + annellospores

**Culture :** black gray colonies

- SDA & Mycobiotic agar very slow ( general in all dermatocious )



## N.B



- We use KOH for biopsy specimen , in order to examine in DME
- Direct microscopic ( skin scraping ) realizing it to see fungal in human tissue

Lacto phenol Teased Mount ( **LTM** ) when use it in culture it kills the fungus  
Lacto phenol Cotton Blue ( **LPCB** ) **no** effect in human tissue

## 3. Piedra

- It's chronic superficial fungal infection
- It affect the **hair shaft** , usually affect the scalp hair & Mustache & beard hair
- Neither skin nor hair follicle will be affected ( ☼ **MCQ** )

Their will be visible & palpable nodules along the hair shaft ≤ 1mm  
They are made of **Fungal Elements**

	Black Piedra	White Piedra
<b>Attachment to shaft</b>	Firm	Loose
<b>Texture</b>	Hard	Soft
<b>Color</b>	 Black-brown (not common in KSA )	 White – creamy ( found in KSA ( ☼ <b>MCQ</b> ) )
<b>Agent</b>	<ul style="list-style-type: none"><li>○ <b>Piedra Hortae</b> : perfect mold , reproduces sexually by forming Ascospores</li><li>○ Slowly growing 1-2 weeks</li></ul>	<ul style="list-style-type: none"><li>○ <b>Trichosporon Begillii</b> : imperfect yeast , has pseudohyphae , form Arthrospores &amp; Blastospores</li><li>○ Fast growing 1-2 days</li></ul>
<b>Growth on SDA</b>	<ul style="list-style-type: none"><li>○ +ve cerebriform colony</li><li>○ Colonies of Piedraia hortae are slow growing, small, folded, velvety and dark brown to black in color</li></ul>	<ul style="list-style-type: none"><li>○ +ve</li><li>○ Trichosporon colonies are yeast-like, rapid growing, smooth, wrinkled, raised, folded, glabrous to velvety, dull, brittle, waxy, white, or yellowish white to cream colored.</li></ul>
<b>Growth on Mycobiotic agar</b>	+ve	-ve ( the growth is inhibited by Cyclohexamide ( ☼ <b>MCQ</b> ) )

**Lab. Investigation :**

the specimen is obtained from the infected hair follicles then KOH & culture is done

In KOH :

- **Black piedra** will show nodule firmly sticking to hair shaft
- **White piedra** will show nodules appearing soft & shedding has cream color mass of spore of disasting pseudohyphae

❖ **Treatment of Superficial Mycosis :**

<b>Tinea Versicolor &amp; Tinea Nigra</b>	<b>Piedra</b>
<ul style="list-style-type: none"><li>- Use cream or ointment ( topical)</li><li>- 2% salicylic acid</li><li>- 3% sulfur ointment</li><li>- Whitfield benzoic acid</li><li>- Nizoral shampoo ( ketoconazole)</li></ul>	<ul style="list-style-type: none"><li>- Cut or shave hair &amp; wash with antifungal (bichloride mercury)</li><li>- Nizoral shampoo ( ketoconazole)</li></ul>

- Nizoral is an antifungal drug ; it shouldn't be used frequently because it **affects the liver** & some people have sensitivity from it

*" They may forget what you said, but they will never forget how you make them feel. "*

## *Cutaneous Dermatophytosis*

### ❖ **Introduction :**

They are chronic fungal infection of the keratinized tissue of the body mainly by :

1. stratum corneum ( outer most layer of the skin )
2. Hair-Skin appendage
3. Nail

They affect both dead & living tissue , utilize keratin to grow

It's a contagious disease ( ☼ **MCQ** )

### ❖ **Causative Agent :**

Imperfect monolinicous ( light color ) mold with septate hyaline , helical , racquet or chandelier-like hyphae

- They are primary pathogens which produce **Alkaline material** in the medium
- They are sensitive to **Griseofulvin** & resistant to **Cyclohexamide** so they grow on Mycobiotic Agar ( ☼ **MCQ** )
- They produce **Asexual Spores** ( annellospores )
- More common in Children ; school age But Adult also are infected
- This disease is found anywhere , especially in **Low Hygiene**

### **N.B**

Cutaneous Mycoses → Itching + Little Pain

Superficial Mycoses → no Itching

### ❖ **Clinical Presentation**

Skin lesion appears like a Ring = Annular in shape so that it is called **Tinea** or **Ring worm** or **Wall**

- Annular in shape
- Necrotic center & popular in margin ( red or gray )
- Active fungus in the margin
- Case itching
- Appear anywhere in the body
- Affect smooth non hairy skin & hairy skin , all type of skin

**N.B** That margins are elevated & the center is Necrotic ( scaly-whitish or lighter in color ) , the margin is elevated & deeper in color

- Specimen should be obtained from the **Periphery** & NOT from necrotic center

Each site has a medical term :

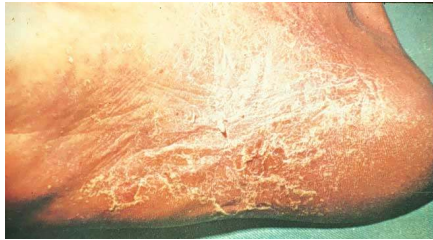
**1. Tinea Capitis ( Barber's itch shop )**

Affect hair , hair follicle & scalp

Hair breaks down & fall up unlike in Piedra  
( ☀ **MCQ** )



- For diagnosis use **Wood's Lamp** , it emits filtered UV light so that the infected hair sends back florescenece



**2. Tinea Pedis (Athletes foot ) ,  
(Swimming pool itch )**

Common dermatology infection

**3. Tinea Cruris ( Jock's itching )**

Affects the genital area , buttock , gluteal area

Dhobie itch ( in groin ) transmitted with Sex or Toilet

Sometimes become Endemic in Child school



**4. Tinea Mannum** Affects the hand

**5. Tinea Barbae** Affects the beard

**6. Tinea Unginum** Affects the nails ,



**7. Tinea Corporis** Affects non-hairy flabrous skin  
( Tinea circinata , Tinea imbricate )





### ❖ Epidemiology :

A patient may have more than 2 infections :

Epidemics  
Pandemics  
Out breaks

Are possible in countries with poor Hygiene

- It affect children more
- It's acquired from Humans , STD , Animals ; Pets , Soil , Familial ..etc

### ❖ Clinical Symptoms :

1. Kerion
2. Favus

Is the more advanced lesion of dermatophytosis

**Both** of them affect the scalp causing more sever itching more than Tinea Capitis

#### Kerion :

- Is Tumor , like lesion coverd by Skin
- Cause sever itching
- The kerion is not a swelling BUT the lesion has a Dome appearance due to production of Pus from the hair follicles
- So the infection lead to pustular inflammation & release of the pus
- The infected hair will accumulate
- "Due to break down" forming a dome from this the word kerion coming



#### Favus :

- Advanced fangal scalp infection cause sever itching & pain
- The lesion is dry & painful
- Intense itching
- Bad smell
- Has a scale over the surface
- Yellowish in color known as **Scatulum** or **Scatula**
- This is **Tinea Farosum** or **Favus** lesion symptoms



<b>Favus</b>	<b>Kerion</b>
<ul style="list-style-type: none"> <li>- Common on scalp more sever</li> <li>- Dry-yellowish in color</li> <li>- Has a bad smell</li> <li>- <b>Caused by</b> : Trichophyton Tonsuran</li> </ul>	<ul style="list-style-type: none"> <li>- Postural inflammation of hair follicles</li> <li>- Infected dead hair fall &amp; accumulate</li> <li>- In lesion – dome shaped lesion + pus</li> <li>- <b>Caused by</b> : Trichophyton Schoenteini</li> </ul>

### ❖ Dermatophytosis

- Contagious disease found anywhere in the world ( so if someone got in one member of a family u should treat all of them )
- More in less hygienous communities
- Children are affected more than adults

### Diagnosis :

The hairs infected with dermatophytes when exposed to **filtered U.V** produced by wood's especially microsporum spp. Become Fluroscent with different colors depending on the infectious species

- This helps in diagnosis & localization of the infected hairs

### Transmission of Infection :

1. **Human** → **Human** : by using others towels , nail cutters & bed covers
2. **Animal** → **Human** : dogs , cats , horses & live stock animals
3. **Environment** → **Human** : soil but it's rarely ( note that this disease is found in less hygienic area )



### Characteristics of Dermatophytes :

- Imperfect fungi ; have unknown sexual stage ( mold fungi + moniliaceous ) produced spores asexually
- Produced light-colored colonies on culture ( white colony )
- Produced alkaline material in the medium in which they grow ( alkaline PH medium )
- Are senitive to < 20 ug/ml **Griseofuluim** , but resistant to 500 ug/ml of **Cyclohexamide** so it can grow on Mycobiotic medium ( ☼ **MCQ** )
- Have special hyphal structure ; Racquet hyphae , they are mold fungi ; septate , have nodular bodies ; pictivate coils = spirals " shandear"
- There natural Habitant :
  - In dermatologus clinics
  - Infected animals
  - Soils ( rarely )

**Epidemiologically we can divide them into 3 group :**

### **1. Anthrophilic Dermatophytes**

- Live in humans
- Cause more chronic disease ; more sever infection
- Need longer time for treatment
- Examples : T.mentagrophytes
  - T.rubrum
  - T.violaceum
  - M.audouini
  - E.floccosum

### **2. Zoophilic Dermatophytes**

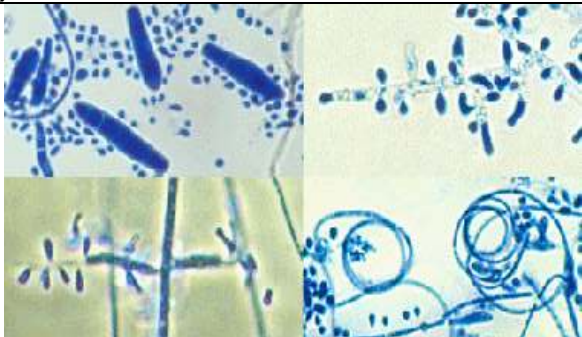
- Live in animals
- Cause more serious but less chronic diseases
- Need early treatment , take short time in treatment
- Examples : M.canis
  - Trichophyton verrucosum → zoophilic found in cow


### **3. Geophilic Dermatophytes**

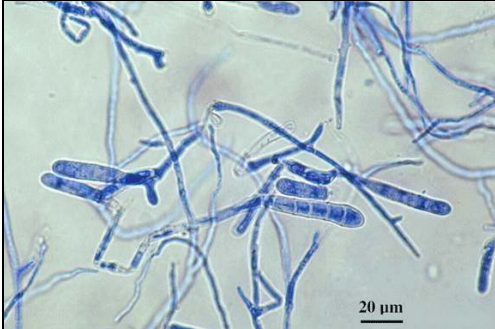
- Live in soil
- Examples : M.gypseum

➤ In general these group of fungi are **Keratinophilic** utilize keratin in the skin & soils

❖ **They are in 3 genera :**

<b>A. Trichophyton</b>	
About 20 species	
Cause hair , skin , nail infection	
Zoophilic : T.mentagrophytes → Dog & live stock animals T. verrucosum → Cows	
Anthrophilic : T.violeceum T.rubram	
There are 4 types in K.S.A (☀ <b>MCQ</b> )	
Contain large & small conidia Macro & Micro anellospores Elongated pencil-shaped cells with long tips multicellualr Only single	

<b>B. Microsporum</b>	
About 18 species	
Cause skin & hair infection . No nail infection ( ☀ <b>MCQ</b> )	
Zoophilic : M.canis → Cats	
Most common cause of T.capitis in K.S.A ( ☀ <b>MCQ</b> )	
There are 3 types	
Anthrophilic : M.audouinii	
Geophilic : M.gypseum ( hair & nail infection )	
<p>Large &amp; small conidia</p> <p>Macro &amp; Micro anellospores</p> <p>Spindle-shaped cells with pointed ends ( American football )</p> <p>Only single</p>	

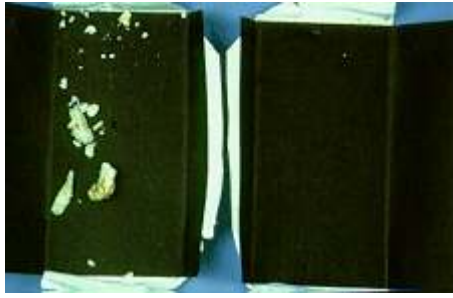
<b>C. Epidermophyton</b>	
Affect nail & skin only	
Anthrophilic : M.floccosum	
One type , one species found in K.S.A ( ☀ <b>MCQ</b> )	
	<p>Large conidia with chlamydospores</p> <p>Macroanellospores only</p> <p>Club-shaped : with smooth wall &amp; round tip</p> <p>Arranged in groups</p> <p>Multi cellular</p> <p>Single or double</p>

### ❖ Laboratory Diagnosis :

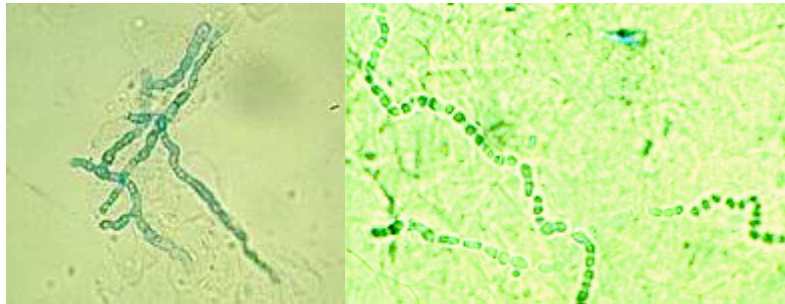
#### A. specimens

- Skin scraping from the lesion
- Infect hair & nail clipping
- KOH test : the specimen is placed in 10% or 20% of KOH which has 2 advantages
  1. Destroys the epithelial cells
  2. Doesn't affect the fungi

+ve results indicated by the presence of spores , septate hyphae or both



Black collection cards showing a suitable amount of nail material for a good sample.



KOH mount of infected skin scales (left) and nail material (right) showing typical dermatophyte hyphae breaking up into arthroconidia.

## B. Cultures ; in 3 media

### 1. SDA ( Sabouraud's Agar ) :

- A medium for isolation & cultivation of fungi
- No antifungal agents are present
- Can be identify according to the shape & spores that produced

- Specimens should be inoculated onto primary isolation media, like Sabouraud's dextrose agar containing cycloheximide (actidione) and incubated at 26-28C for 4 weeks. The growth of any dermatophyte is significant.

- Mixed culture of *T. violaceum* and *T. tonsurans* from a case of endothrix Tinea capitis in an Australian Aborigine



## 2. Mycobiotic medium contain :

- 500 ug/ml Cycloheximide which kills the other fungi rather than dermatophytes (☼ **MCQ**)
- Chloramphenicol which inhibits bacteria → the only micro-organisms developing in the mycobiotic medium is dermatophytes since it resistant to cycloheximide & chloramphenicol
- At room temperature of 26°c → grow after days , if not grow in 4 weeks → -ve culture

## 3. DHT ( dermatophytes testing media ) :



(DTM) (Dermatophyte Test Medium) A selective and differential medium for isolation of pathogenic fungi from cutaneous sources. Contains pH indicator. 10pk

- Contains antifungal & antibacterial agent + special dye called Phenol Red (amphoteric drug)
- Detected the presence of Dermatophytes
- In alkaline media , phenol red is red in color
- If Dermatophytes grow → alkaline medium → this dye is red in color → +ve DMT
- If the color does not change → not a Dermatophytes
- The natural color of DTM is yellow & it's PH is Acidic . But the Alkaline product from the Dermatophytes will produce Red color

### What does the DTM contain ? (☼ **MCQ**)

1. Antibacterial
2. Antifungal agent ( cyclohexamide ) → so selective medium
3. Amphotenic Dye ( yellowish )

- +ve DTM → Dermatophytes

It is a good test 90% specific for Dermatophytes although little or very little species will produce the test & they are not Dermatophytes → false +ve result

### Note

DTM do not used as isolated medium . not advisable in Dermatophytes clinic because it will inhibit the other bacteria that can cause the infection or inhibit the other fungi

❖ **Drugs in Treatment**

1. Gniseoglarin

Topically or Systemically + A20 le drugs like :

- Miconazole (Dktrin) -clotrimazole- Ereonezole as topically ointment or cream
- The zoophilic → after 8 weeks , the response will be good
- The anthrophilic → 10 weeks

2. Allylamins , like :

- Terberuphine
- Naphtiphine
- Lamnicine ( common name ) , cream or tablet

3. Toluaftate like : 1% solution

- The most common treatment is Grise Flavin ( as table systemically )
  - + one of the Azole Drugs :
    - Micromazole
    - Toluaftate
    - Econazole , clotrimazole

*" Many of life's failures are people who did not realize how close they were to success when they gave up ! "*



# Subcutaneous Mycosis

## ❖ First: Mycetoma

A chronic granulomatous infection of the subcutaneous & deep tissue.

It's also called Madura's Foot, because it was first recognized in (Madura-India) where it usually affected feet. (☼ **MCQ**)

Common sites of infection : feet (most common) , hands , legs , arms , thighs , shoulders & head

**Caused by:** higher bacteria or true fungi.



## ❖ **General characteristic:**

1. Mostly chronic. (☼ **MCQ**)
  - takes 2-3 years to develop
  - takes 7-9 years to treat
2. May confuse with secondary skin infections due to systemic fungi.
3. Tumefaction: swelling of the affected side, cause formation of trauma .
4. Sinuses draining pus from the abscess to the surface of the lesion.
5. Grains in the infected tissue & in the pus. These grains are colonies (granules) of the causative organism. The grains differ in size & color according to the organism.
6. Multiple subcutaneous abscesses which are drained by sinuses.
7. Localized lesions do not progress to the visceral tissue eg. Lung but they may progress to the bones. (☼ **MCQ**)
8. Usually acquired following trauma to the skin, non contagious.  
(☼ **MCQ**)
  - causative agents in → the soil  
→ plant materials & vegetation debris → Trauma → entry to the body
9. progression of infection :
  - early → cold painless swelling , patient does not seek medical care
  - late → the bones is involved , painful , patient seeks for medical care
10. May confused with systemic infection with fungal symptoms of skin.
11. Traumatic ( mycosis of implantation).
12. Primary infection of subcutaneous.
13. Leukocytosis or eosinophilic response leading to cyst formation or granuloma.
14. Common in tropical & subtropical regions ( southern KSA, Sudan, Yemen & Somalia).





Advanced Mycetoma of the foot. Note the swelling, deformity and sinuses



Actinomycetoma with complete destruction of the forefoot

❖ **Clinical types of Mycetoma:**

- Eumycotic Mycetoma (Eumycetoma) : the agent is fungi.
- Actinomycotic Mycetoma ( Actinomycetoma) : the agent is filamentous higher bacteria
- Botryomycosis : the agent is true bacteria ( eg. Staph.aureus , Streptococci & E.coli )

Actinomycetoma	Eumycetoma
 <p style="text-align: center;">B</p> <ul style="list-style-type: none"> <li>- Bacterial agent</li> <li>- More aggressive</li> <li>- Margins of lesions not well defined</li> <li>- Larger number of sinuses</li> <li>- Good response to treatment</li> </ul>	 <ul style="list-style-type: none"> <li>- Fungal agent</li> <li>- Less aggressive</li> <li>- Margins are well defined</li> <li>- Less number of sinuses</li> <li>- Poor response &amp; difficult treatment</li> <li>- Great chance of relapse</li> <li>- Faster involvement of bone</li> </ul>

- Pathologic change in Mycetoma : Local , chronic → skin subcutaneous tissue → may spread to bones

## A. Eumycotic Mycetoma

The color of grains is **mostly black**, but it can be brown, yellow or white.

- They cause about 50% of all mycetomas.
  - There are about 16 species.
  - The most common are:
    1. *Madura mycetomatis*.
    2. *Madura grisea*.
- } Most common in K.S.A  
( ☀ **MCQ** )

Both have the following characteristics:

- Cause black gray mycetomas.
- Are imperfect fungi (deuteromycetes) by formation of conidia
- Dematiaceous fungi (dark colored fungi which grow slowly).
- Produce phialides & phialoconidia in cultures.

### 3. *Pseudoallescheria boydii*:

- Perfect moniliform fungus which reproduces sexually forming ascospores & produces white grains.

### 4. *Scedosporium apiosporum*:

- imperfect moniliform fungus which reproduce asexually forming anellospores.
- moniliaceous fungi → quick growing , light colored fungi

## B. Actinomycotic Mycetoma :

- Caused by actinomycetes (mainly aerobic, gram+ve filamentous bacteria)
- The color of the grains is usually yellow, but may be brown, red, green, white or pink.
- Represents the other 50% of mycetomas.
- They have 8 species.
- The commonest are:

### 1. *Streptomyces Somaliensis*:

The most common in KSA. ( ☀ **MCQ** ) They produce yellow, brown or white grains.

### 2. *Actinomyces madurae* : pink, yellow, white grains.

### 3. *Actinomyces Pellicularis*: pink, red grains.

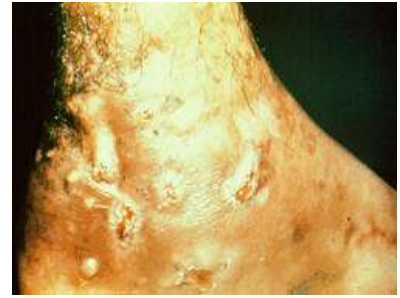
### 4. *Nocardia Brasiliensis*:

Can cause systemic infection. They produce yellow or white grains. It's a +ve AFB (acid fast) using ZN stain. They may cause Nocardiosis (*Nocardia asteroides*), brain & pulmonary abscesses "all the previous are aerobic".

### 5. *Actinomycosis Israelii*:

It's the only one which is anaerobic. Cause pulmonary & brain abscesses. They produce yellow, white grains (sulfur granules).

- Mycetoma showing numerous draining sinuses.  
There is destruction of bone, distortion of the foot, and hyperplasia at the openings of the sinus tracts.



### C. Botryomycetoma :

- It's very rare
- Similar to actinomycetoma , except that the causative organisms are :
  - true bacteria
  - producing white or yellow grains
  - very responsive to treatment

**Note:** the color of the grains is important to identify the agent :

- If the grains are **black**: fungal mycetoma.
- If they are **pink** : bacterial mycetoma.
- If they are **white or yellow** : either any of the three

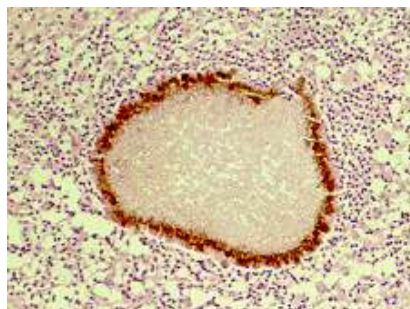
### ❖ Laboratory Diagnosis :

#### 1. Specimen:

- Grains which are visible to naked eye are the main specimen.
- Tissue biopsy.
- Currentings from the sinus.
- Exudated pus.
- Blood for serology.



Excised mycetoma showing a draining sinus  
(cut open in this preparation) containing black grains



H&E stained tissue section showing blacked grained eumycotic mycetoma caused by *Madurella mycetomatis*.

## 2. Direct histological sections:

- Stained by gram stain, ziehl-neelsen stain, acid-fast stain, H&E stain, KOH, PAS stain.
- After fungal staining :
  - if large broad septate black hyphae with clamidospore  
→ fungal mycetoma.
  - if thin yellow filaments → actinomycetoma, → gramstain  
→ Z-N → AFB  
in nocardia.

## 3. Culture :

- Blood agar: 30°C aerobically.
  - 37°C anaerobically.
  - BHIA ( blood – heart infusion agar).
  - SDA.
- Fungi : take time to grow ( almost 10 days )
- Bacteria : grow faster

## 4. Serology :

- The serum of the patient is tested with a known antigen for each etiological agent
- Agglutination & Precipitation :
  - I.D.T ( immunodiffusion Test )
  - C.I.E ( counter Immunoelectrophoresis )

## ❖ Treatment:

### 1. Actinomycotic mycetoma:

Respond well to treatment as long as the bone is not infected.

( ☀ **MCQ** ) Treatment also lasts for a shorter duration.

- cotrimoxazole ( TMP-SMX).
- dapson + streptomycin sulphate.

### 2. Eumycetoma:

treatment is prolonged.

- ketoconazole.
- itraconazole.

- Actinomycetoma responds better & requires less time to treat than Eumycetoma if bones are not involved
- Botryomycosis is the most responsive

## Note

if there is bone involvement, treatment will be by amputation.

## ❖ Second: Rhinosporidiosis

Mucocutaneous fungal infection of the nose ( most common ) , mouth, conjunctive, palate & epiglottis.

The main lesions are in the form of polyps, papillomas ( wart like lesions), nasal polyps.

Primarily is the nasal polyps

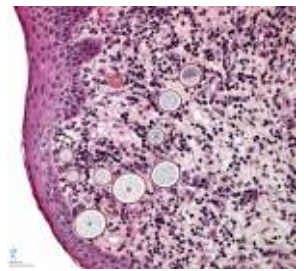
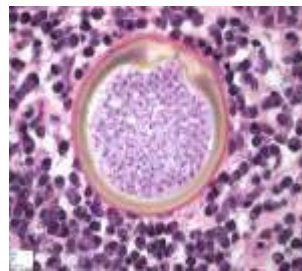


### **Causative agent:**

- Rhinosporidium seeberi.
- It's an obligatory parasite.
- Does not grow in SDA or mycobiotic agar but can grow in tissue culture.
- Gives false –ve results on SDA & mycobiotic agar.

### ❖ **Laboratory Diagnosis:**

- KOH + grind the tissue.
- Examination under the microscope shows spherules with endospores.
- It is believed that the hyphochytrid mycelium does not grow on artificial media but has been cultured in some tissue culture



### ❖ **Treatment:**

1. Surgical excision
2. Relapse is common.

## ❖ Third: Lobomycosis



Cutaneous & subcutaneous infection.

The main lesion is primarily **cuoloidal verrucoid nodules** (☼ **MCQ** ).

It is chronic & localized infection.

Common sites : face, ear, arms, legs.

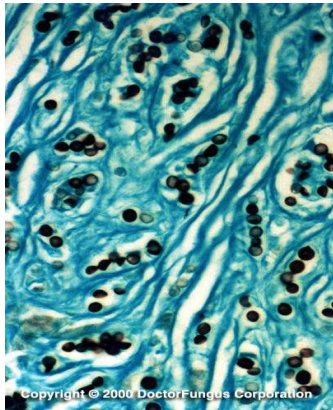
### **Causative organism:**

- Loboia loboia ( locazia loboia ).
- An obligatory parasite.
- Does not grow on SDA or mycobiotic agar ( false –ve), but grows on tissue culture



❖ **Laboratory Diagnosis:**

- KOH.
- Microscopic examination reveals chains of cells.
- Diagnosed depend only on microscopic examination ( histopathology ) this infection do not disseminate to other sites although they spread locally (☼ **MCQ** )



GMS stain of tissue infected with Lacazia loboi

❖ **Treatment:**

1. Surgical excision.
2. Relapse is common.

❖ **Fourth: Zygomycosis**

These are the fungal infections caused by the zygomycetes fungi of the order Mucorales, Entomophthorales.

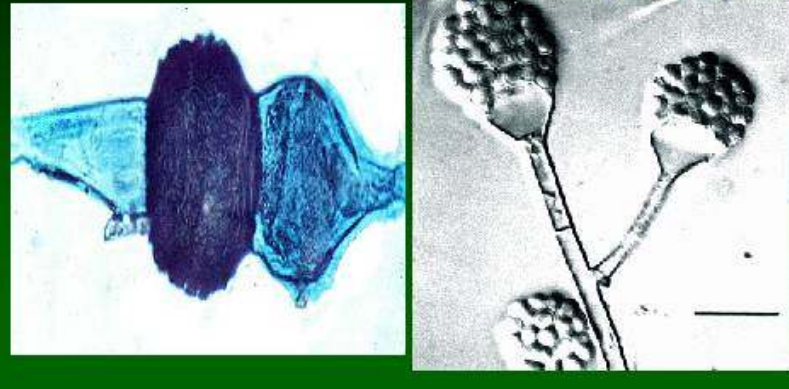
**General characteristics:**

- The old name is Phcomycosis.
- Perfect fungi: reproduce by producing spores sexually & asexually:
  - sexual spores are zygospores.
  - Asexual spores are sporangia ( candida).
- All zygomycete fungi have non-septate hyphae " molds".
- The infections are systemic or subcutaneous.
- The systemic infections are usually opportunistic.
- The subcutaneous infections are usually non-opportunistic.



*" The art of being wise is knowing what to overlook"*

**Zygomycota**— sexual spores are thick walled resting spores called zygospores --asexual spores are borne internally in a sporangium



#### Clinical types:

1. Subcutaneous.
2. Rhinocerebral.
3. Pulmonary.
4. GIT zygomycosis.

#### 1. Subcutaneous:

- These are infections caused by zygomycete of the order Entomophthorales ( entomophthoromycosis ).
- They are chronic localized subcutaneous infections(non-opportunistic), **do not** disseminate.
- The commonly affected sites:
  - rhinofacial area ( nasal & paranasal ) primarily.
  - other sites: arm, thigh, shoulder, leg ( to lesser extent ).
- The lesion is usually firm, swollen& distorted, with intact skin, no sinuses, no fissures, no abscesses ( cellulites ).  
( ☼ **MCQ** )
- The spores enter through :
  - nasal mucosa.
  - insect bites.
  - contaminated debris.
- The pathological pattern is:
  - inflammatory or granulomatous.

### ❖ The etiological agents:



1. *Candida albicans* (sporangia conidia) which usually cause rhinofacial infection (sexual reproduction).

2. *Blastomyces dermatitidis* (zygospores), which usually cause the other sites infection (sexual reproduction).

- but the *Candida albicans* may cause other sites infection.
- vice versa, the *Blastomyces dermatitidis* may cause the other sites infection.



### ❖ Laboratory Diagnosis:

- specimen: tissue biopsy.
- microscopic: broad non-septate hyphae, with accumulation of eosinophils around the hyphae.
- culture: on SDA with out antifungal agents.

### ❖ Treatment:

1. KI orally: respond well after prolonged treatment for about 6 months.

It is the drug of choice with a good response. **No need** for surgery only drug.

2. if the infection is severe & not responding to KI → KI combined with amphotericin B or septrin.

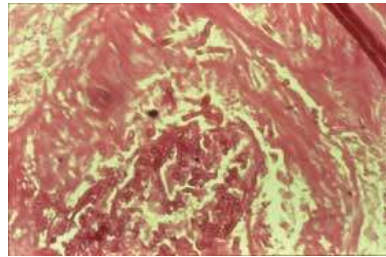
*" A leader is one who knows the way, goes the way, and shows the way. "*

2. **Rhinocerebral**: common, mucoromycosis.

3. **Pulmonary** : uncommon, mucoromycosis.



Patient with Diabetes Mellitus and Rhinocerebral zygomycosis



Pulmonary artery filled with broad, irregular non-septate hyphae indicative of invasive zygomycosis (Hematoxylin and Eosin stain).

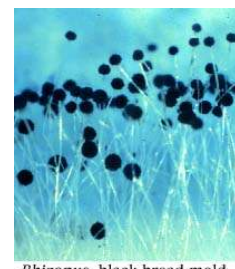
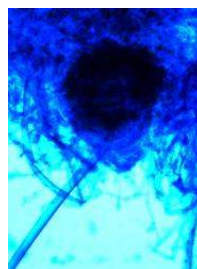
Both are :

- Are opportunistic diseases that start subcutaneous then systemic.
- Are caused by the order mucorals.
- More dangerous & more frequently seen( **fatal if diagnosed late**).
- Acute disease affect compromised patient (opportunistic)
- e.g: diabetic ketoacidosis.
- Can disseminate to the cerebrum state in rhinofacial (paranasal sinus) , spread to the orbit of the eye, cranium & brain along the optic nerve, damage cerebral vessels leading to bleeding then death. ( ☼ **MCQ** )
- Clinical presentation is sinusitis-orbital cellulites.
- No or poor respond to treatment. ( ☼ **MCQ** )

❖ **The etiological agents :**

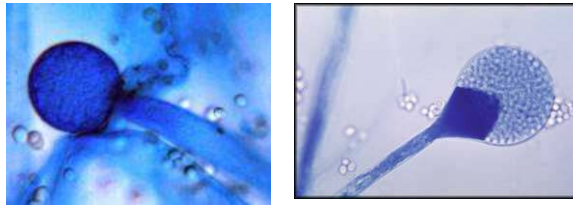
Zygospores ( sexually), sporangiospores in sporangia (asexually). The commonest are:

1. rhizopus.

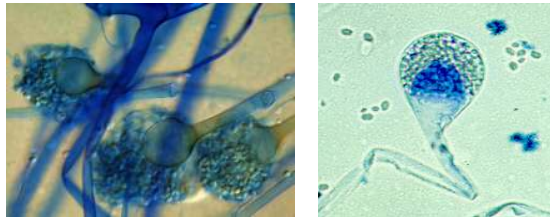


Rhizopus -black bread mold

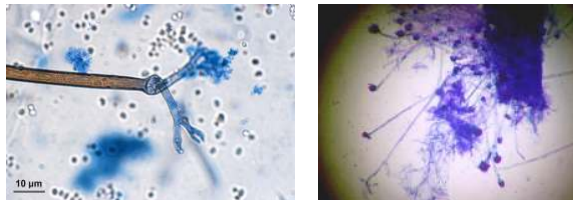
## 2. mucor.



## 3. absidia.



## 4. rhizomucor e.g. rorhizus.



### ❖ Laboratory Diagnosis:

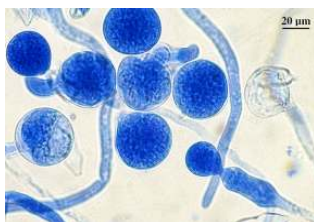
- specimen: biopsy from nasal area, cheek, lung.
- microscope: broad non-septate hyphae, but **with out** accumulation of eosinophils around the hyphae.
- culture: on SDA with out cyclohexamide, **fast growing**.

### ❖ Treatment:

If diagnosis is made as zygomycosis by direct microscopy, start amphotercin B then wait for culture:

1. if sub cutaneous: start KI & stop amphotercin B.
2. if rhinocerebral: increase amphotercin B + surgical removal

## 4. GIT zygomycosis:



- Chronic infection responds to treatment.
- Affects GIT specially liver causing abcess masses.
- Treated by intraconazole.
- Caused by basidobolus ranarum.





### ❖ Fifth: Phaeohyphomycosis

- Primary chronic subcutaneous fungal infection, or chronic cerebral fungal infection.
- Lesions may be subcutaneous abscess or cerebral abscess.
- It is caused by **dematiaceous fungi**, have brown septate hyphae.
- Abscesses, ulceration, neurotropic, cerebral→ many species.



Phaeohyphomycosis lesion in an immunologically compromised patient due to *Exophiala spinifera* mold.



Subcutaneous phaeohyphomycosis caused by *Exophiala jeanselmei*.

### Causative organism:

(*Ramichloridium miskinsies*) found in the middle east. (☀ **MCQ**)

❖ **Treatment:** clean excision

### ❖ Sixth: Chromoblastomycosis

- Cutaneous & subcutaneous infection.
- Chronic, local, painless but itching.
- Verrucous, pedunculus, violaceous, cauliflower-like, hyperkeratosis, ulceration, autochthonous.
- Muriform: sclerotic bodies brown in color.
- Causative organism present in woody plants.





**Causative organism:**

- phialophora verrucosa ( **slowly growing**).
- F. pedrasoi.
- exophiala.
- cladosporium.

❖ **Treatment:**

clean excision, amphotericin B, S.fluor(S-FC), azoles.

❖ **Seventh: Sporotrichosis**

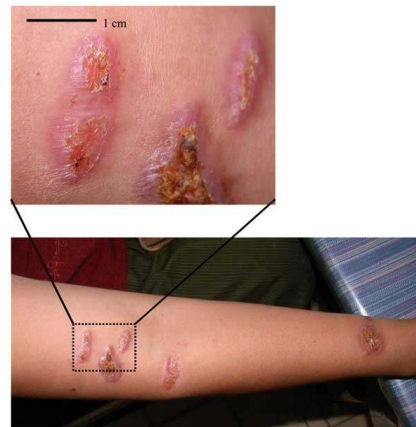


- Chronic.
- Affect lymphatic system, lymph cutaneous.
- Usually asymptomatic nodular, ulcers, lymphatics+ subcutaneous.
- Granulomatous, suppurative, ulcerates subcutaneous.

**Causative agent:** Sporothrix schenckii.

❖ **Treatment:**

1. KI.
2. Itraconazol.



*" Success is never final.  
Failure is never fatal.  
Courage is what counts. "*

## *Non Opportunistic Systemic Primary Systemic Mycosis*

Fungal infection in which there is significant penetration or dissemination to **Internal Organ**

Not common in K.S.A But are common in U.S.A & Western (☀ **MCQ**)  
Not Communicable , affect Both compromised & non-compromised , it affect any person

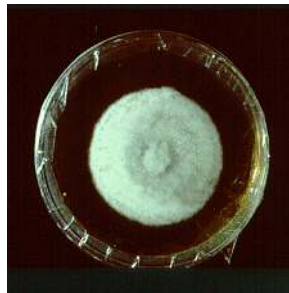
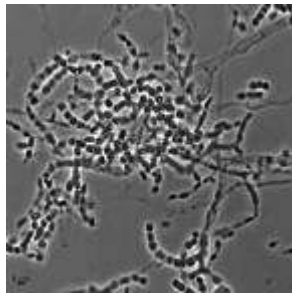
Also know as **Fungal fevers** , because common presentation is **Fever** (☀ **MCQ**)

Infection start in respiratory (may remain) → Systemic → Disseminated  
Contracted by inhalation of fungal elements in Dust  
Flue Symptomes → Fever , Chest pain

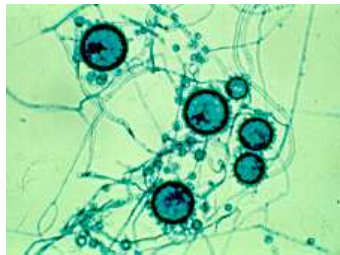
### **Note**

4 common Systemic Fungal Pathogens ( Imperfect ) :

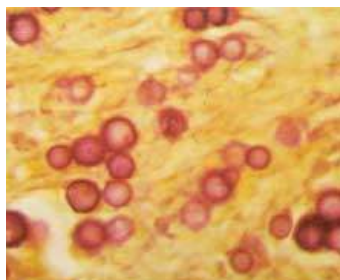
1. *Coccidioides immitis*



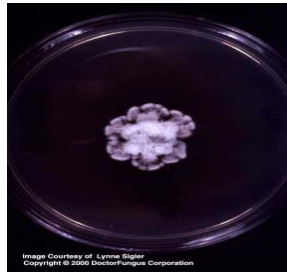
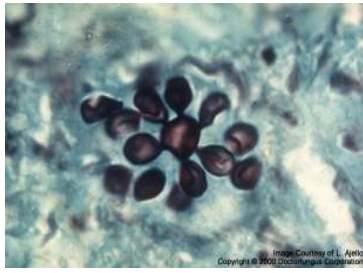
2. *Histoplasma capsulatum*



3. *Blastomyces dermatitidis*



#### 4. Paracoccidioidis brasiliensis



##### ❖ Etiology of the fungus

- Dimorphic fungi : in nature present in restricted habitats in soil , vegetation debris , excreta of birds & animals
- Moniliaceous
- Imperfect fungi
- Disease progressively worsens with time , defective cell-mediated immunity

*" The real contest is always  
between what you've done  
and what you're capable of doing. You  
measure yourself against yourself and  
nobody else. "*

# Systemic Mycosis

## ❖ 4 Major Types :

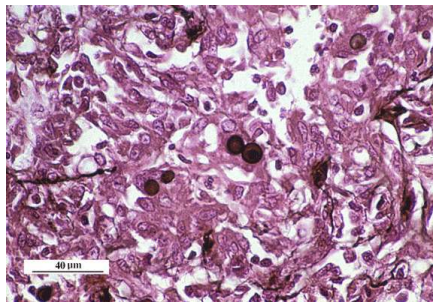
### 1. Blastomycosis ( North American Blastomycosis ) ( ☼ MCQ )

- Begins as mild respiratory infection eg. Dry cough , Little fever , Chest pain , Flue symptoms
- Then , the Cough → reproduced  
Fever → elevated  
→ sweating , weight loss , weakness
- It is **Not Self limiting** , if Not treated , infection will disseminates to skin ( ☼ MCQ )
- Mostly in ♂ & children , few cases in K.S.A , it occur between 40-60 yrs
- Affect : bones , may disseminate to Genital area



#### Etiological Agent :

- Is Blastomyces Dermatitidis
- Imperfect organism
- Dimorphic fungi :
  - In human body & culture at 37°C → it grows as Yeast
  - At room temperature 22-25°C → it grow as Mold
- Moniliaceaus ( whit-light-colored fungus )
- Yeast cells growing fast
- Budding with broad bas attachment is diagnostic feature



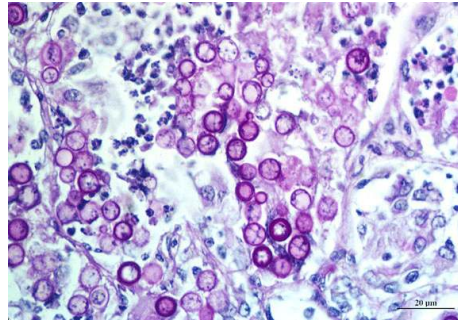
#### N.B

In Yeast form , buds are attached to mother cell by **Broad base** (B.B) ( ☼ MCQ )

Green septate hyphae with candida on sides

#### Specimens :

- Usually from respiratory system ( septum + lung biopsy + BAL )  
& some time bone biopsy , skin biopsy , blood



- Tissue sections showing large, broad-base, unipolar budding yeast-like cells of *Blastomyces dermatitidis*, 8-15mm in diameter. Note: tissue sections need to be stained by Grocott's methenamine silver method to clearly see the yeast-like cells, which are often difficult to observe in Haematoxylin and eosin (H&E) stained preparations

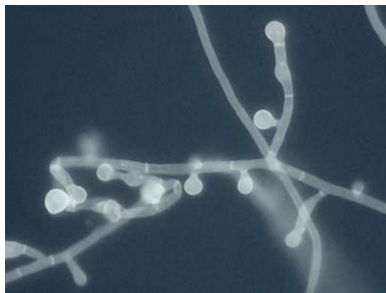
#### **Culture :**

- SDA
- Brain Heart Infusion Agar (BHIA)
- B.A



#### **Clinical Diagnosis :**

- According to :
1. Morphology
  2. Convertible from Mold to Yeast or from Yeast to Mold



- Calcofluor white stain of mould phase growth at 30°C. Septate hyphae bearing round or pear-shaped terminal conidia attached to conidiophores of varying lengths or directly on the hyphae are observed

#### **Serology :**

Look for Ag (antigen) by Ab (antibody) against known Ag

- I.D.T Immunodiffusion test
- C.I.F Counter-Immunoelectrophoresis
- C.F Complement fixation

#### **Treatment ( option for Blastomycosis ):**

1. Asymptomatic Patients → No treatment
2. Mild , Primary Pulmonary Infection , progressive lung lesions → Itraconazole
3. Disseminated disease Life-Threaten disease → Amphotericin B



## 2. Histoplasmosis – Cave Disease – Darling Disease (☼ MCQ)

- Rare in K.S.A (☼ MCQ)
- May be progressive or Self-limiting
- Is intracellular infection of R.E.S (reticuloendothelial system) → inside the Macrophage → involve spleen , bone marrow , liver
- **Start in lung** as Blastomycosis , But it disseminates spontaneously
- Commonly found : birds & bat dropping
- Also its symptoms resemble T.B & in X-ray it is as T.B

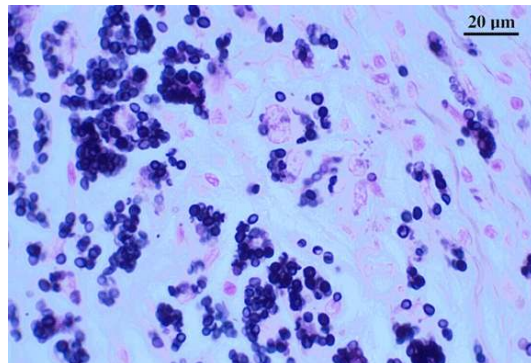


- If there is a patient with T.B signs But don't responded to T.B treatment → may have Histomycosis (☼ MCQ)

### Etiologic Agent :

Histoplasma Capsulatum ( two variety ) :

1. Histoplasma Capsulatum Variety ( H.C.V) Capsulatum found in most of the world → Classic Histoplasmosis
2. Histoplasma Capsulatum Variety DuboisII in African Histoplasmosis

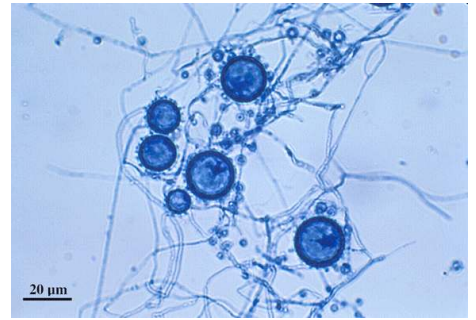


- In room temperature , they are Moniliaceous & in Mold Phase (they have same mold phase )
- They produce two types of conidia :
  1. Tuberculated macroconidium : which is diagnostic feature of Histoplasmosis Capsulatum in cultured room temperature
  2. microconidium
- Molds in room temperature :
  - they live commonly in Cave Soil in Bat
  - common in U.S.A & Europe (☼ MCQ )more endemic in Americans → can be introduced to other countries even K.S.A (☼ MCQ )

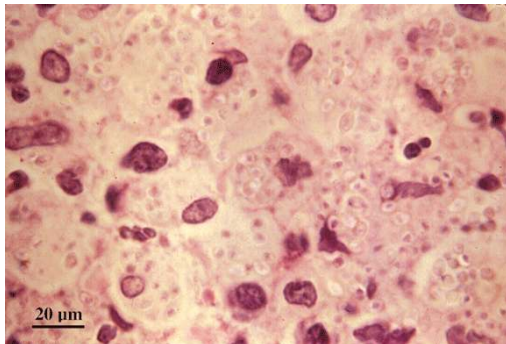


### Clinical Diagnosis :

- Microscopic : inside macrophage  
**(look for it inside macrophage)**
  - liver → kupffer cell
  - bone marrow → histocyte macrophage
  - blood → monocyte reticular endothelial system
- Culture : for 8-10 weeks BH-I & B.A
- Serology : serum is tested against Histoplasmin Antigen (**esp. in Urin**) (☼ **MCQ**)  
Complement Fixation Test is the best test for serology



- Skin & Serologic test because they **lack specificity**
- Generally lab. Diagnosis is the same as Blastomycosis



- Tissue section stained with haematoxylin and eosin from a biopsy of the mouth lesion shown in the previous slide. Note macrophages containing numerous yeast cells of Histoplasma capsulatum. The basophilic cytoplasm of the fungal cells is retracted from the poorly stained cell wall, giving the false impression of a capsule

### Treatment :

1. Asymptomatic Mild-Primary Pulmonary Infection → No treatment
2. Progressive Lung lesions → Oral Itraconazole
3. Disseminated disease → Amphotericin B

### 3. Coccidioidomycosis ( Valley Fever ) ( ☼ **MCQ** )

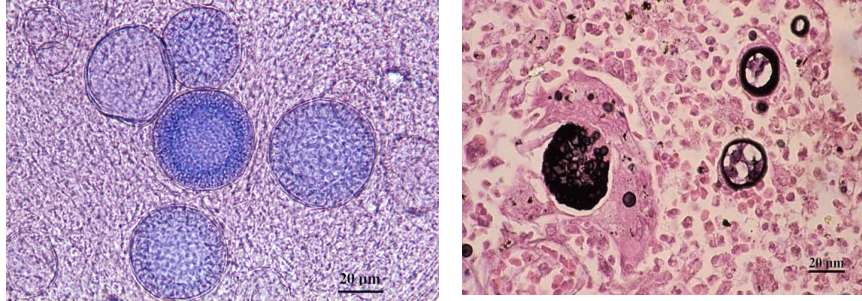
- Endemic in Desert of California & Arizona in U.S.A

#### Etiologic Agent :

- Coccidioides Immitis
- Imperfect dimorphic + momiliceous
- Structure (in modified converse medium) :
  1. as spherules (**not yeast**) producing endospores-at maturity
  2. molds in culture at room temperature , molds producing Arthrospores separated by disjunct cell



- At cultivation in room temperature :
  - fast growing molds producing septate hyphae → when hypha mature → produce **Arthrospores alternate with disjunct cell** (diagnostic feature )



- Common affected site **Foot-Areas** , But require trauma to develop  
3 species of 40 :
  1. Cladosporium : C. Cladosporens, C. Bantianum
  2. Exophiala
  3. Wangiella

#### Clinical Diagnosis :

- Microscopic
- Culture
- Serum against Coccidioidin Antigen
- Method as others



#### Treatment :

1. Asymptomatic Mild-Primary Pulmonary infection → No treatment
2. Persistent Lung Disease Disseminated → Amphotericin B
3. drug of choice for C. immitis , meningitis → Fluconazole

#### 4. Paracoccidioidomycosis (southe American Blatormycosis) (☼ MCQ )

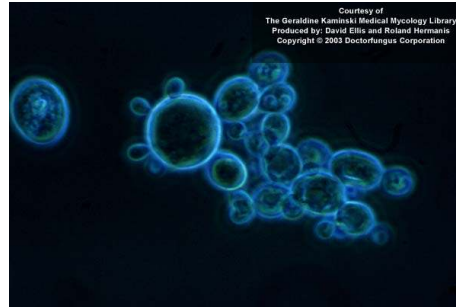


- Common in South America (☼ MCQ )
- Symptoms as others But main feature is :
  1. presence of ulcer in Buccal mucosa which connected to skin  
→ Teeth may fall down (☼ MCQ )
  2. Also ,Lymphangitis

#### Etiologic Agent :

- Paracoccidioides Brasiliensis
- Yeast at 37°C have **multiple buds** on surface → **Micky-Mouse cell** (diagnostic feature in tissue & culture at 37°C ) (☼ MCQ )

- Moniliaceous , Dimorphic :
  - Mold → not characteristic
  - Yeast → is characteristic
- Have a **Pilot-wheel** appearance (☀ **MCQ**)



### General for the Systemic Mycosis :

- All are Dimorphic fungi
- Habitat : soil with guano & excreta of birds , animals , vegetation debris
- Transmitted by Inhalation of spores
- Start in Lung
- Septate hyphae
- All have Yeast phase **except coccidioides immitis Spherules** (☀ **MCQ**)

### Treatment :

All by :

1. Amphotericine B
2. Sulphonamide , some mild cases of paracoccidiosis respond to it
3. Caspofungin , treat Yeast & Mold with no side effect
4. Isoniazid preparation could be considered
5. Itraconazole , Vorticonazole , Voriconazole

### 5. Ramiclonidium Mackinneyi (☀ **MCQ**)

Discovered by **Prof. Al Hodaithy** in 1983 in KKUH when he exposed them to UV rays , to produce spores (UV rays **kill fungi** But when they are **endangered they produce spores**)

### Characteristics Feature :

- Limited to Middle East (☀ **MCQ**)
- **Black** colonies
- **Fatal brain Abscess** (☀ **MCQ**)
- Aspirated puss is examined if +ve Brown septate Hyphae → Appear after 24 hrs



Ramichioedium Mackinyesi  
Chladosporium Bantianum

The two are Neutropic (like the brain)  
cause Brain Abscess (☀ **MCQ**)

- Ramichioedium Mackinyesi → mainly cause Brain abscess  
**Most common in K.S.A (☀ MCQ)**
- Chladosporium Bantianum → Common in K.S.A (☀ **MCQ**)  
Present in Woody Plant  
Cause Fatal infection



**Laboratory Diagnosis :**

- Specimen Aspirated Pus ( put KOH) do DME - **Brown Septate Hyphae ; PheoHyphae (☀ MCQ)**
- Imperfect fungi
- On culture , **grow very slowly** on SDA or Mycobiotic Culture

*" What we have done for ourselves alone  
dies with us; what we have done for others  
and the world remains and is immortal. "*



# Major Opportunistic Disease

## 1. Candidiasis

### ❖ Introduction

They are also called Candidosis or Moniliasis

These are Fungal infection caused by any species of candida

Usually opportunistic → affecting the compromised patient

Can be Acute or Chronic

Can occur at any part of the body

Their Yeast infections **Not** Mold (☀ **MCQ**)

The most clinically important species of candida → Albicans (☀ **MCQ**)

### ➤ Develop candida **Typically** :

- vaginal candidiasis
- oral thrush

But **do Not** develop **Systemic**

### ❖ Clinical Types

#### 1. Mucocutaneous

##### A. Oral thrush :

- Involves the mucous membrane of the mouth ( tongue - soft palat )
- The commonest site for Superficial Candida → **Oral mucosa** (☀ **MCQ**)
- Appears as white patches or gray membranous on the oral mucosa & other oral mucosa membrane
- Primary affecting :
  1. Newborns ; they though its milk accumulation , the baby start crying inability to suck milk
  2. compromised ( lead to AIDS discovery) (☀ **MCQ**)
  3. children → it appears white patches
  4. Old-aged people
- The patches are made of Pseudohyphae & the Yeast cells of the fungus
- The thrush are :
  - Discrete
  - Confluent



##### B. Diaper (Napkin) (☀ **MCQ**) :

- Affecting the children using diapers , under hygienic condition
- The infection is self-limited by correcting the hygienic condition (☀ **MCQ**)
- Appears as Erythematous skin rash in Groin Area
- If Not treated → could be transferred to the face & eyes by the baby's hand

### C. Mycotic Vulvovaginitis :

- Infection of the Vagina & Vulva in :
  - pregnant Ladies
  - woman taking contraceptive pills
  - diabetic woman
  - virgin girls , common in K.S.A ( ☼ **MCQ** )
- Appears as white patches on the Vaginal mucosa , made up of the fungal elements (colonies) , **Not tissue**
- The main symptom is **Pruritic itch** & there is Vaginal discharge of thick yellowish white pus (similar to gonorrhea , but **Not** sexually transmitted) ( ☼ **MCQ** ) , part of normal flora No require for sexual in intercourse
- Her husband may develop Balanitis ; infection of penis ( may go when treat wife)



### D. Cutaneous (intertriginous) candidiasis :

- Infection of the **skin folds** (umbilicus , axilla , buttox , toe webs)
- Appears as erythematous dry scaly or moist & spreading
- More often in: diabetics , over weight people ( especially in summer)

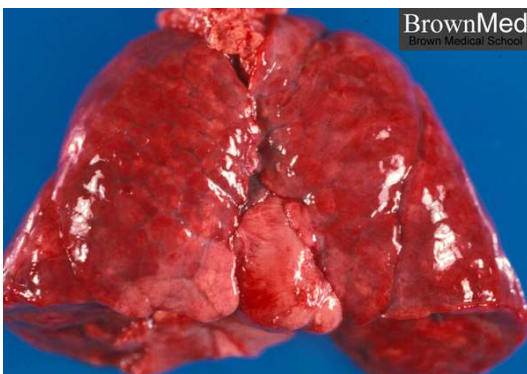


### E. Paronychia :

- Infection in the area “ paronychia area “ distal to finger nail which become swollen
- If not treated → onychomycosis , nail finger infection
- More in children beating finger ( ☼ **MCQ** )
- Restaurant dishwasher repeated immersion of hands in water → help predispose



## 2. Bronchopulmonary



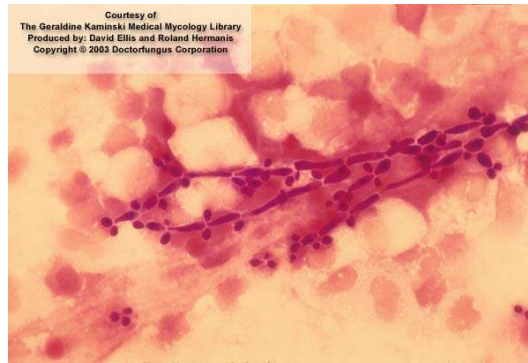
- Affect the lungs & bronchus
- Present as : chronic bronchitis , pneumonia ( especially in children )
- Affects primarily the debilitated patients (especially ICU pt, ICP, cancer pt )
- It is difficult to diagnose this type of candidiasis , cause candida is part of normal flora of the Respiratory tract → usually diagnosed by excluding other infections ( ☼ **MCQ** )



### 3. Systemic Candidiasis

#### A. Urinary tract infections :

- The most common systemic candidiasis (☼ **MCQ**)
- Candida is a normal flora of the urinary tract , But the number of the organism is > or equal 10<sup>5</sup>/ml in midstream urine specimen , it causes → infection (☼ **MCQ**)



- Direct smear of urine from a patient with candidiasis of the kidney showing C. albicans in mycelial or tissue phase with blastoconidia budding from the pseudohyphae

#### B. Septicemia → Fever

- Known as candidaemia or fungeumia
- Candida may be running in the blood transiently just passing from one organ to another , if one culture is +ve
- If 3 or more culture are +ve → candidaemia
- There is a signs of infection continuously ↑ temperature if culture grown candida in more than 2 bottles → infection
- If one culture is +ve & other is -ve → likely transient **Not** infection

#### C. Meningitis : in immunocompromised patient

- Very rare , clear CSF & normal composition of CSF

#### D. Cardiac

- Endocarditis
- Myocarditis
- Pericarditis

#### Note :

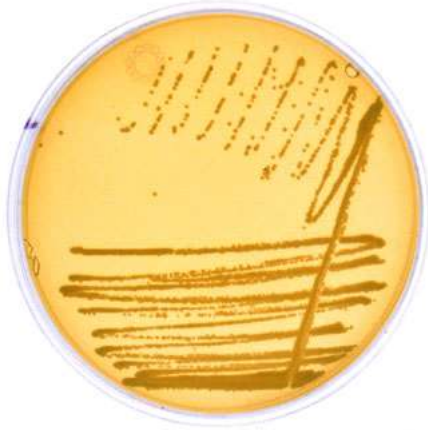
Infection is aquired endogenly , Not contagious (☼ **MCQ**)



- Generalized candidiasis in a young infant secondary to seborrhoeic dermatitis caused by C. albicans. Note the particular involvement of body creases, e.g. groin, axillae, neck, cubital fossae and multiple small satellite lesions

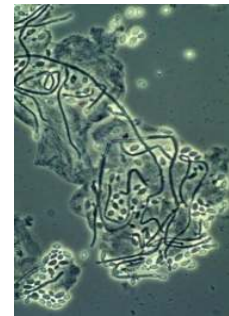
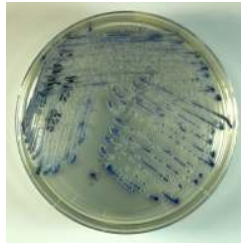
### ❖ Etiology

- Any species of the genus candida can cause candidiasis
- These are imperfect yeast fungi “unicellular” **growing fast 24-42 hrs**
- They are present in skin , GIT , UT , RT , Vagina & mouth , as normal flora (☀ **MCQ**)
- Also in environmental e.g soil
- They produce budding yeast cell , pseudohyphae & blastospores



### Species

1. Candida Albicans , the most pathogen (☀ **MCQ**)  
the most common → cause 80-85% of all yeast infection in human  
belong to normal flora
2. C.Tropicalis , has an invasive properties

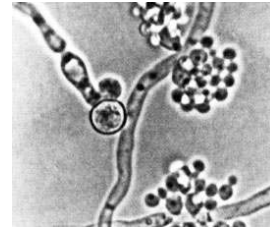


3. C.Stellatiod , chlamydospores germ tube
4. C. krusei



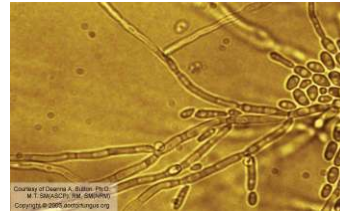
### **C.Albicans**

- Esophagitis
- Mucosal ulceration
- Perforation & abdominal surgery



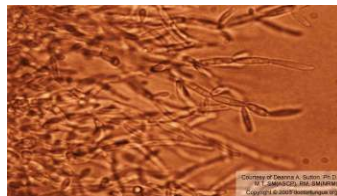
### **C. Tropicalis**

- Cancer
- Leukemic patient with long granulocytopenia
- (due to chemotherapy)



### **C.Parapsilosis**

- Prolonged total parenteral Nutrition

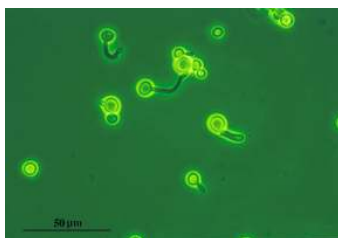
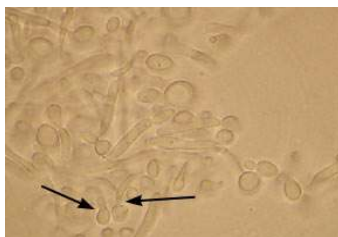


#### **❖ Laboratory Identification of C.Albicans :**

- Usually produce typical budding yeast cells under most conditions & most temperatures
- They produce pseudohyphae or hyphae

#### **1<sup>st</sup> Germ Tub Test :**

Takes 1-2hrs , very rapid , we start with this test if C.Albicans they produce an elongated growth called : germ tube from yeast cells at 37°C (body temperature)



- Candida albicans incubated in rabbit serum at 37° (germ tube test). Germ tubes are indicated by arrows and are the beginnings of true hyphae: no constriction is at the origin of the germ tube and the parent cell

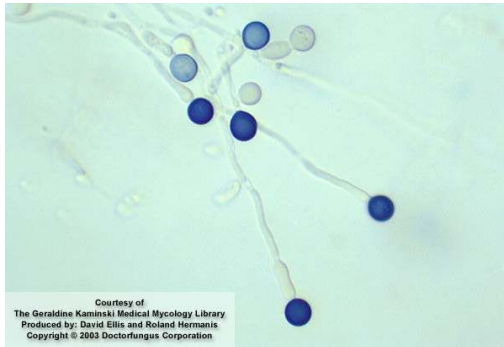
## 2<sup>nd</sup> Corn Meal Agar :

C.Albicans can produce terminal thick walled chlamydospores from the pseudohypha under certain conditions on CMA 1-2days , if doesn't produce → Not C.Albicans



## 3<sup>rd</sup> Resistant to 500Mg/ml Cyclohexamide (☀ MCQ )

Others are sensitive , C.Albican grow on Microbiotic medium

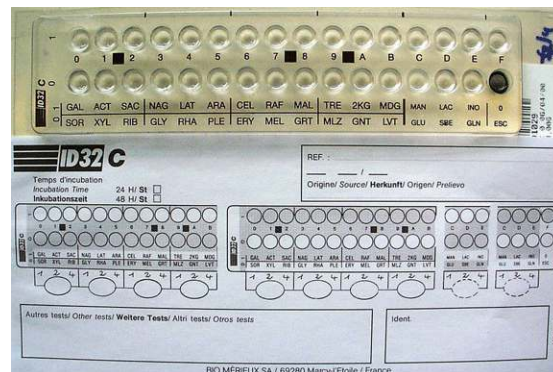


- Confirmatory test for C. albicans. Production of large round, thick-walled vesicles (often incorrectly referred to as chlamydoconidia) on Difco chlamydo-spore agar. Trypan blue in the medium is absorbed strongly by these terminal vesicles. Numerous small blastoconidia and pseudohyphae are also present

## 4<sup>th</sup> Carbohydrate (sugar) Assimilation Test AP120C :

The most specific to identify any yeast , including C.Albicans

- They produce blastospores
- They don't produce arthrospores



- API ID32C yeast identification strip showing the identification of Candida.

## Another Rapid Test , Latex Agglutination Test :

Takes less than one minute & is good especially in **Meningitis**

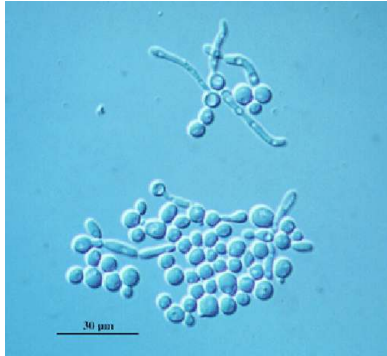
## Note :

Some rare strains of C.Stellatoid can produce Germ tubes & Chlamydospores

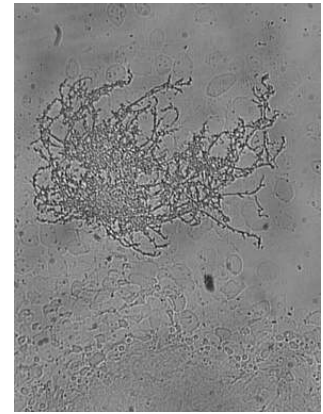


## ❖ Diagnosis

- A. Specimen : according to the site of infection :
- Microscopy : By KOH you see Budding yeast cell (oval yeast) single or multiple or pseudohyphae in tissue (usually Not done for non sterile specimen)



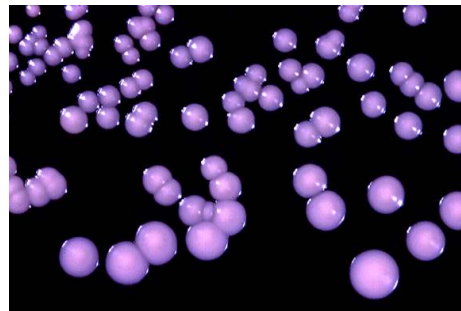
- Microscopic morphology of *C. albicans* showing budding spherical to ovoid blastoconidia



- Culture : All **yeast are fast growing** 24-48 hrs on SDA , Blood agar



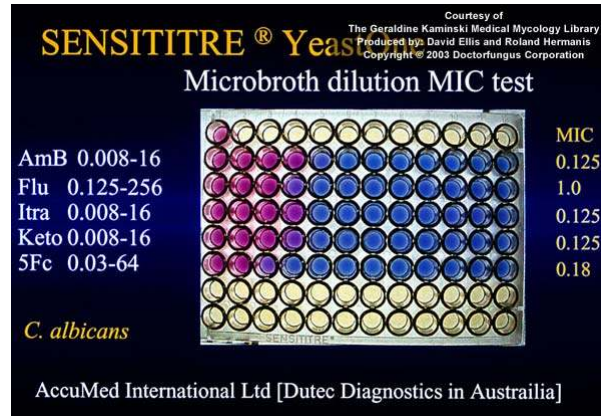
- *albicans* on Sabouraud's dextrose agar showing typical cream coloured, smooth surfaced, waxy colonies



- Serology : patient serum is tested against known antigen for candida
- The Ag is more specific than Ab ( ☼ **MCQ** )
- In serum or CSF : Ag → always + in infected person Ab → may be +ve or -ve in infected person
- Selective : Mannan Ag indicates invasive *C. Albicans* ( ☼ **MCQ** )

The **2 serological techniques** are :

1. I.D → immunodiffusion
  2. C.I.E → Counter immunoelectrophoresis
- Ag: Mannan Ag in cell wall
  - Endlase in cytoplasm
  - C.Aspartry protienase in Cytoplasm
  - All present in invasive (systemic) candidias “one of them or all”

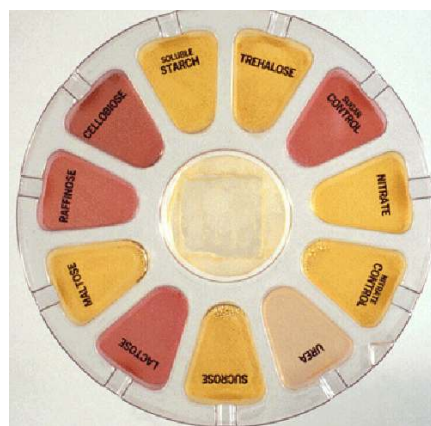


- Sensititre YeastOne antifungal microbroth dilution plate showing MIC's to *Candida albicans* for Amphotericin B (0.125 ug/ml), Fluconazole (1.0 ug/ml), Itraconazole (0.125 ug/ml), Ketoconazole (0.125 ug/ml) and 5-Fluorocytosine (0.18 ug/ml).

#### B. Skin test :

+ve immunocompetent → Hypersensitivity response

-ve immunocompromised → deficient cell mediated immunity



- Uni-Yeast-Tek plate showing common assimilation tests and Dalmau plate culture used for the identification of yeasts. Note morphological studies are essential for the satisfactory identification of yeasts. Also note the negative urease test indicating the ascomycetous nature of *Candida albicans*, the test organism

#### Note :

##### Meningeal Disease

- Clinical presentation is meningitis in immunocompromised individual or compromised & host especially AIDS patient
- This disease Kill the patient also common in Systemic mucosa
- Can be Pulmonary disease
- More common in immunocompromised unlike skin *Cryptococcus* affect normal patient



### Clinical Manifestation of cryptococcal meningitis :

Slow onset symptoms including :

- frontal – temporal headache
- mental status changes
- nuchal rigidity
- focal neurological deficits
- mild fever
- can occur in immunocompetent

#### ❖ Treatment

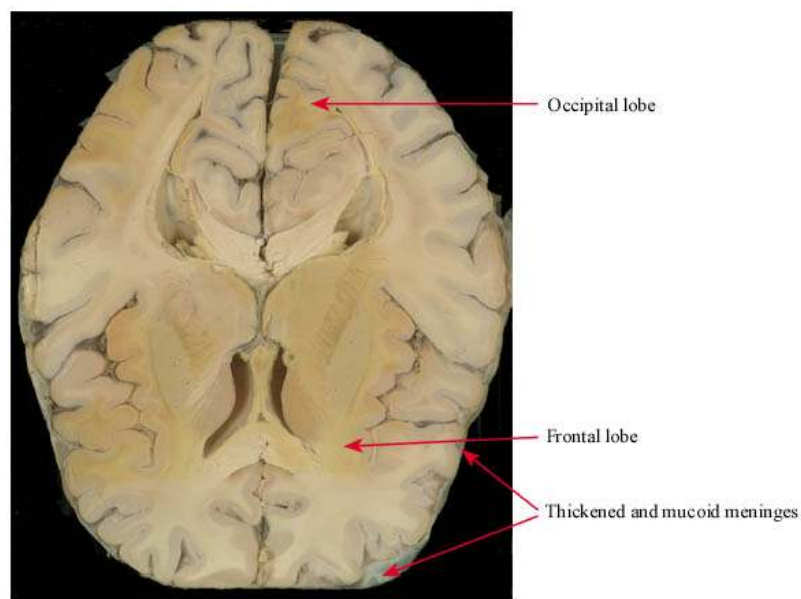
A. For cutaneous & mucocutaneous candidiasis :

1. cotrimazole → for skin infection
2. miconazole → for vaginal infection ( cream )
3. nystatin → for oral infection (can be used topically or orally)

B. For systemic candidiasis :

1. amphotericin B (**drug of choice but there is side effect**)
2. fluconazole : orally more safe , no side effect

➤ Caspofungin & voriconazole ; very good drugs



Cryptococcal meningitis - A horizontal section of the brain

V.54

*"Success is how high you bounce when you hit bottom ! "*

## 2. *Aspergillus*

### ( Chronic Fungal Infection )

#### ❖ General Characteristic:

- 1- It belongs to the **opportunistic infection**; i.e. it affects :
  - Immunodeficient leukemic
  - Lymphomic patient ( **in this case most common type is Pulmonary aspergillosis** )
- But occasionally non-opportunistic → affecting immunocompetent person.

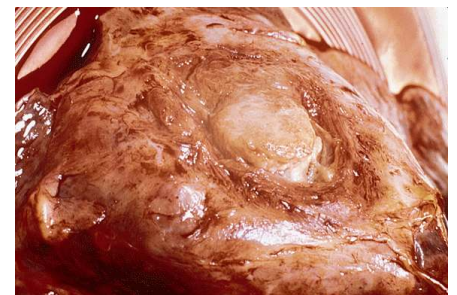


- 2- They produce conidia ( asexual spores )
- 3- The spores are **ubiquitous** → very common in environment.
- 4- Their habitat is the soil and dust.
- 5- They are moniliaceous mold fungi → the filaments produce septate hyphae .
- 6- The spores are formed in **chains of conidia** ( ☼ **MCQ** ).
- 7- **Fast** growing.

#### ❖ Clinical type:

##### A. Allergic Aspergillosis

- The **commonest clinical type** ( ☼ **MCQ** ).
- Infection occur by inhalation of spores
- Two clinical forme:
  1. Extrinsic Asthma (**Type I**):  
Manifested with the usual symptoms ( sneezing, cough and malaise).
  2. Allergic bronco-pulmonary(**Typell**),(ABPA):
    - Affects the compromised patient mostly.
    - The symptoms: sneezing, cough and malaise.
    - The fungal growth may block(plug) the bronchus.
    - It is of increase IgE hypersensitivity type → ↑ IgE may be associated with ↑ IgG level.



## B. Cutaneous Aspergillosis

- Also known as **nail and skin infection** (☀ **MCQ**).
- Skin infections appearing as **nodules covered by thick epidermis**.
- May affect the non-compromised people.
- Caused by *Aspergillus Nigar* and **treated easily**.
- Produce Toxicosis symptoms (Diarrhea – Vomiting – Fever).



## C. Disseminated Aspergillosis

- **Rare** affecting the severely compromised (debilitated) patients.
- Then later on → disseminate to involve other organs as Brain, Kidney, Heart ....etc.

## D. Colonizing Aspergillosis

- Also called: **Pulmonary Aspergillosis or Aspergillus fungal ball** (☀ **MCQ**).
- *Aspergillus* colonies cavities or space are already present then grows in this cavity & form ball like accumulation. therefore we called *Aspergillus* fungus spore or Aspergilloma.



- The fungus spore sometimes is big & the most commonest colonizing is pulmonary Aspergilloma
  - Can originate from the allergic aspergillosis especially the broncho-pulmonary, if not treated.
  - Occur at the surface of the lung which previously diseased, e.g.: the cavity of old T.B, bronchiectasis or sarcoidosis. & this can happen in compromised & non-compromised patient.
  - Spores germinate to form the fungal ball (contain hyphae, remain localized, oval or round in shape).
- CXR shows:  
Single like mass rounded or oval mass (fungal ball) → uniform opacity (not dense) = (Radiolucent) crescent (**Monad's sign; Gxalot**) (☀ **MCQ**)

- The fungus has an affinity to affect the upper portions of the lungs.
- **More common in the left than the right lung.**
- Symptoms:  
recurrent cough , with or without intermitted fever (variable grade) and hemoptysis .

### E. Nasal-Orbital Aspergillosis

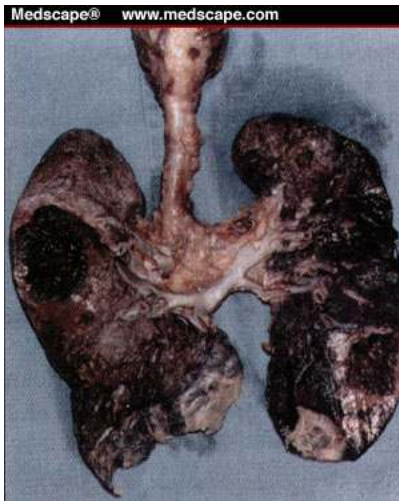
- Also called **Rhinocerebral Aspergillosis** or **Aspergillus sinusitis** .
- Very serious and fatal condition( ☼ **MCQ** ).
- May be considered as a type colonizing Aspergillus.
- May affect the non-compromised persons → therefore, it is considered as **very disting infection**( ☼ **MCQ** ).
- We call it depending on the extend of the infection but more often it is the form of sinusitis.
- Colonized the maxillary sinuses, usually this is clear by washing sinus by ENT doctor, but if the sinus mucosa is penetrated by fungal hyphae the \*\*\*\*\* of fungus will communicate to the sphenoid sinus at the ethmoid sinus & develop **Rhinocerebral aspergillosis**.
- It **begin as nasal polyps or sinusitis** then it involve the orbit of the eye & spread into the cranium & produce brain infection( ☼ **MCQ** ).
- Aspergillus affect the brain by produce **hard masses in the brain** which is difficult to remove by surgery.
- The sinusitis polyps will handled easily especially when it is discover early.
- Before 20 years it was difficult to treated but not washing sinuses & antifungal drug will treat it at the sinus stage.
- It is chronic.
- More common in **children & teen** .
- Starts by involving the paranasal sinuses, forming fungal mass → may spread to the eyes and brain (difficult to cure) → DEATH ( ☼ **MCQ** ).
- Common in **tropical region**.



#### Two clinical forms:

1. Nasal polyps.
  2. Sinusitis.
- The most common etiology is Aspergillus Fervus in K.S.A ( ☼ **MCQ** ).
  - sinusitis not limited to fungus, bacteria may cause also.

## F. Invasive pulmonary Aspergillosis



- It can occur **anywhere in the body**, but more **common in the lungs**.
  - More severe and advanced infection( ☼ **MCQ** ).
  - May develop from the allergic type or from the growth of Aspergilloma.
  - Affecting **mostly** the compromised patients.
- 
- The hyphae fungi themselves can invade lung tissue by one of the two following:
    1. Invade lung parenchyma only:
      - Invasion in this tissue situation is diffused (not local).
      - Specimen from respiratory tract is –ve for hyphae (sputum).
      - You should taken lung biopsy.
      - This type is rare.
    2. Invade (bronchial tree + lung parenchyma):
      - More common
      - Specimen from bronchial tree → +ve for hyphae .
- 
- Symptom: Pneumonia , Leukocytosis, Chronic cough, Fever and hemoptysis.
  - CXR shows multiple patches radiating and infiltrating surroundings → picture of **Pneumonia**.
  - The invasive may grow in color so the fungi would grow the hyphae & the hyphae can grow into lung tissue, or may developed by itself after contracted the organisms.
  - Laboratory investigation may be –ve . e.g. Blood is –ve ( no Ab for aspergillosis ) but the surgical specimen show +ve results.
  - Lab investigation may be –ve especially if the specimen is non invasive.

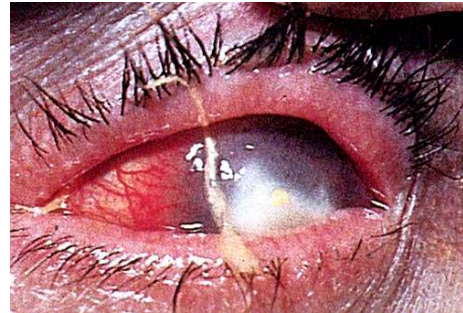
*" You can't build a reputation on what you are going to do. "*



## G. Other infections

### 1. Eye infections:

- Cause primary corneal ulcer (treatable) also Endophthalmitis (**rare**).
- Causes by *Aspergillus Fumigatus* , *Aspergillus Flavus*.



### 2. Ear infections:

- dry – no pus – but if found with bacteria there is Pus ( ☼ **MCQ** ).
- Causes otitis externa mostly (very painful and otitis media rarely ).
- Causes by *Aspergillus Nigar* commonly.

### 3. Toxicosis :

- Some aspergillus species produce Aflatoxin (in food )
- Ear food contaminated with toxin (which produced by the person ) will develop Toxicosis.

### 4. Mycetoma:

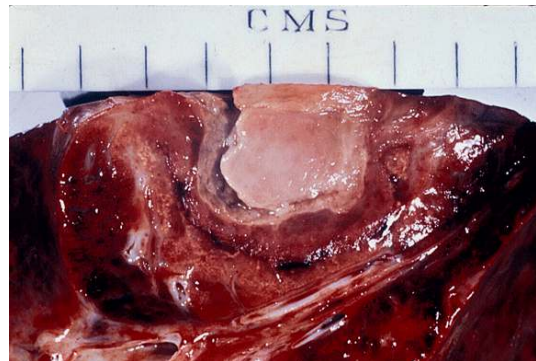
## ❖ Diagnosis

- The specimen like *Candida* **depend on site of infection** .

**A. Specimens :** ( from site of infection e.g. nail , skin .....etc. ) according to the type of Aspergillosis.

e.g : - Sputum , by bronchial wash or lavage (BAL) bronchioalveolar lavage ( ☼ **MCQ** )

- Biopsy from affecting site.
- Skin scraping from skin lesion.
- Ear or eye swab or smear.
- Mass of the organism when removed ( surgically removed of Aspergilloma ).
- respiratory specimen in case of pulmonary type.
- Bronchoscope.



**B. Culture :** on SDA ( no cyclohexamide ) → **Fast growing** .

## N.B

- If the specimen is non-sterile, because *Aspergillus* is common we must rule out of contamination possibility **by taken repeated specimen.** ( ☼ **MCQ** )
- If the specimen is sterile (e.g. tissue biopsy, blood ), if we find *Aspergillus* → very diagnostic , **no need to rule out contamination possibility because its sterile specimen.**

### 1. Direct microscopy ( KOH ) :

- We can use direct KOH or we can make histologic section and stain them with fungal stain.

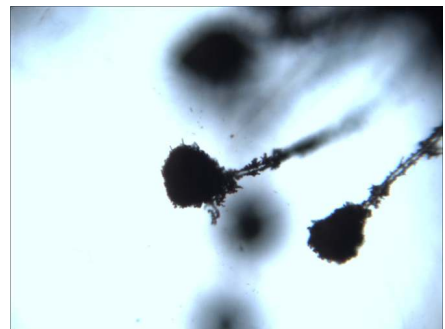
- The **commonly** used stain are :
  - P.A.S : (Periodic Acid-Schiff ) stain.
  - G.M.S ( Gomori Methenamine Silver nitrate ) stain. If it is +ve for aspergillosis we see septate hyphae.
  - Giemsa Stain : if the specimen is +ve → it will show septate bronchial hyphae (Dichotomous branching of hyphae ) without conidia, since they are **not** produced in vivo .
- try to exclude contamination by repeating the specimens obtaining.

**Note:**

microscopy for aspergillosis is present of hyaline septate hyphae and we may or may not see dicotmous branching.

**2. Culture :**

- on SDA, at the room temperature for 1-4 days because grows fast growing organism and observe the colony growth, after it grow it start producing chonydia , then we can identify it.
- Chloramphenicol is added as an antibacterial in the contaminated specimen ( ☼ **MCQ** )
- No Cyclohexamide is added ( will inhibit the aspergillus from growing) ( ☼ **MCQ** )
- In invasive pulmonary aspergillosis . the result may become –ve → so repeated isolation.
- 25-37°C **fast growing**.



- If the specimen is sputum +ve by direct microscope for hyphae, And also by culture for aspergillus, this may not mean infection, this is may be result as contamination therefore we should repeat the specimen to conform that it is coming from patient **not** as contaminated.
- Rule out contamination possibility. Is getting repeat specimen if the specimen is contaminated e.g. sputum.
- Biopsy tissue when it is +ve it mean +ve ( **no need for repeating** ).

*" Rule your mind or it will rule you ! "*

### 3. Serology:

- We test for presence of antibody using known antigen ( **not very conformation** ). And the specimen is blood.

Antigen are:

- A. terreus.
- A. polyvalent antigen.
- A. nidus = A. nidulas.
- Precipitating Abs to aspergillosis Ags by:
  - Counter Current Immuno Electrophoresis ( CIE)
  - ImmunoDiffusion (ID)
  - Solid Phase RadioimmunoAssay (SPRIA). ( most sensitive, then CIE then ID )
- If pulmonary Aspergillosis occur → more lines are formed → multi-band identity lines ( if not found → **no Ab** → go to more sensitive tests ( CIE, SPRIA ) e.g. **low in invasive pulmonary Aspergillosis.**
- ELISA tests for Ag is being developed by **French**.
- If the patient having Aspergilloma fungus spore we do ID plate for serology there will be multi band identity lines.
- If the patient having invasive pulmonary aspergillosis there will be one line form or may be no lines form in case of pulmonary aspergillosis.
- ID test may be -ve for pulmonary aspergillosis because it is not sensitive then we have to use RIA.
- For Aspergilloma there will be multi band forming in the ID plate in the serologic diagnosis.
- Latex agglutination available for Aspergilloma but it is not specific. ( ☼ **MCQ** )
- If the specimen is sputum it would be false +ve or false -ve :
  - False +ve : contamination . to avoid repeated the test.
  - False -ve : invadement of **lung parenchyma Only** ( lung biopsy )

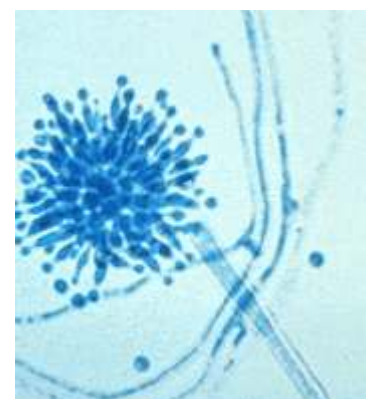
### **N.B**

in serology :

- Aspergilloma : Ab higher than Ag.
- Invasive aspergillosis : Ag higher than Ab.
- Immunodiffusion can be -ve if the specimen is sputum.

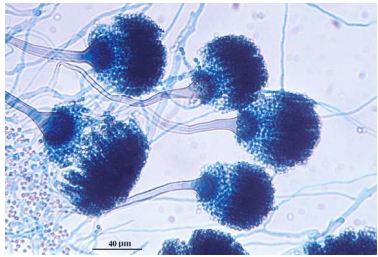
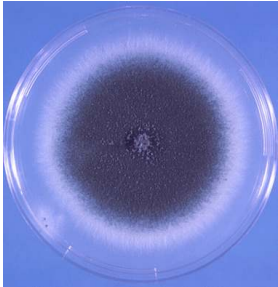
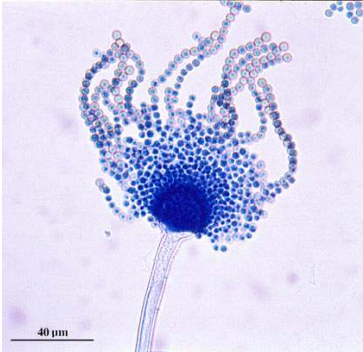
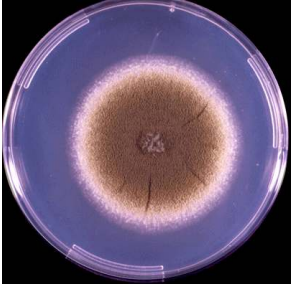
### ❖ **Etiology**

- Any species of aspergillus is differentiated on basis of:
  - 1- Morphology.
  - 2- Color of colony, when it grow in the plate.


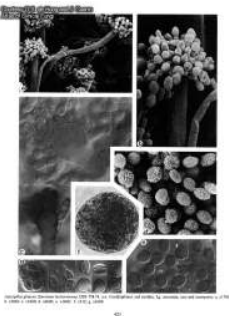
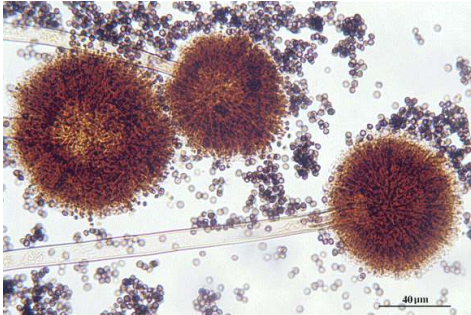
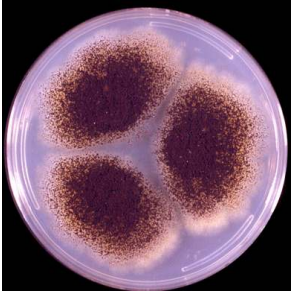
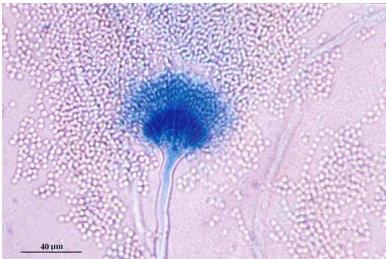
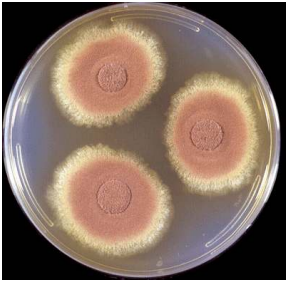


- The common (aspergillus Fumigatus-blue, **the MOST common**, Aspergillus Falvus-yellow green, Aspergillus Nigar- Black, Aspergillus terrus-brown like soil) (☀ **MCQ**)
- Other less incidence → aspergillus glaucus & others.
- Eurotium species Ascomycete.
- Etiology in regard of the causative organism of Aspergillus, any species of aspergillus can cause this infection.
- Aspergillus is monilecious having septate hyphae (white in color then it produce chonyologoforsa that carry chain of chonydia to the spherical structure of the conidum)
- General feature of monilecious:
  - Imperfect , mold fungi , fast growing, septate hyphae , **chain of conida form.**
  - Found every where in air, soil , dust , school, building, street , houses .....etc.
- Aspergillus has vary species, however, the main species that cause aspergillas are:
  1. Flavus
  2. A. nigar
  3. A. terreus.

Aspergillus species ( about 150)

Name of species	Colony color	Characters
- Asp. Fumigatus 	- Dark green 	- Most pathogenic
- Asp. Flavus 	- Yellow green 	- <b>Most common in K.S.A</b> (☀ <b>MCQ</b> ) - Naso-orbital asp. - Produce aflatoxin - No.1 cause of infection - Lung, eye mainly



<p>- Asp. Glaucus</p>  <p><small>Courtesy of Deanna A. Sutton Jasperoff.com/aspergillus</small></p>	<p>- Black</p> 	<p>- Most eat infection agent</p>
<p>- Asp. Nigar</p>  <p><small>40 µm</small></p>	<p>- Black</p> 	<p>- Skin infection</p>
<p>- Asp. Terreus</p>  <p><small>40 µm</small></p>	<p>- Brown like soil</p> 	<p>- Most serious</p>

### ❖ Treatment

- The best is medical and surgical (segmental lobotomy) treatment together.
- The primary treatment is medical (Antifungal):
  1. Amphotericin B → drug of choice ( if there is pain we can add fluky to sine)
  2. Flucytocine
  3. Itraconazole (new drug)



**N.B**

if the patient can not tolerate Amphotericin B due to its toxicity use alternative Itraconazole. (☀ **MCQ**)

- Acute allergic asp. AAA → **Anti-Allergic agent AAA** (trick)
- Invasive Asp. → I.V Amphotericin B
- Amphotericin B **less or no side effects**. (☀ **MCQ**)
- if there is side effect we use liposomal Amphotericin B or Itraconazole or ( caspofungin or voriconazole ); alternative drug.
- **Dosaconazole not yet available.**

*" Attach yourself to your passion, but not to  
your pain.  
Adversity is your best friend on the path to  
success. "*

## Other Yeast Infection

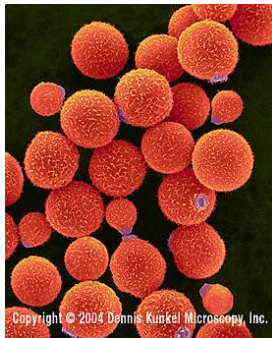
### ❖ First: Cryptococcosis

It is as opportunistic yeast infection  
Its main type is **Cryptococcal meningitis** or **Lung infection**

- The etiological agent is *Cryptococcus Neoformans* (☼ **MCQ**)
- Perfect stage of this organism (filobasidella) it is BasidioMycete
- it is :
  - true yeast ( has no hyphae or psedohyphae ) unlke candida
  - has a polypeptide capsule (☼ **MCQ**)
  - pigen habitats , inhalation of aerosolized soil enriched with

#### **Pigeon dropping**

- produce an enzyme called **Phenole oxidase**
- when grow it on a medium containing phenole compound known as Cephalic acid or Birdseed agar, it produce **chocolate color** (☼ **MCQ**)

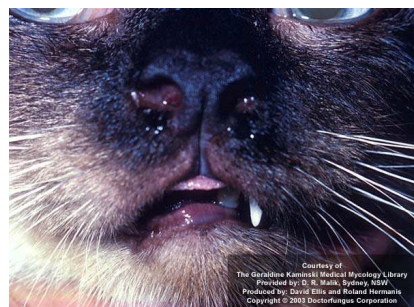


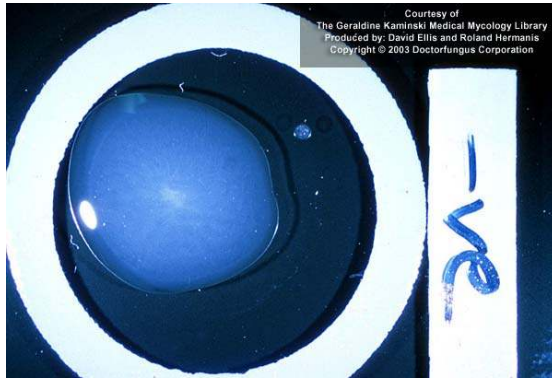
- 4 sites of infection by *C. Neoformans*:

1. meninges
2. lungs
3. skin
4. bones

### **Diagnosis :**

- Specimen :
  - CSF , ↑ opening pressure , ↑ proteins & ↓ glucose lymphocytosis
  - respiratory
  - blood ( very bad if +ve ) , usually got capture before being in blood
  - biopsy tissue
- Indian ink → clear space around yeast cell , Polysaccharide encapsulated resist India ink , -ve for the capsule (☼ **MCQ**)  
white capsule , yeast cell dark inside , **very specific But not sensitive** (☼ **MCQ**)
- Direct microscopy : Lunar or Crescent cells
- Culture : SDA , BHIA
- Serologic test : agglutination ( **highly sensitive But not specific** ) Not good test (☼ **MCQ**)





- Negative cryptococcal antigen latex test.



- When we put the Fungus + Medium contains Phenolic substance → enzyme in medium oxidize it & Burn it
- Cryptococcuse + Caffeic Acid ( phenolic compound ) → Organism release compound → chocolate

#### Treatment :

1. Resolve without treatment
2. Amphotericin B
3. Flucytosin

#### ❖ Second: Pneumocytosis (SPCP) (☼ MCQ)

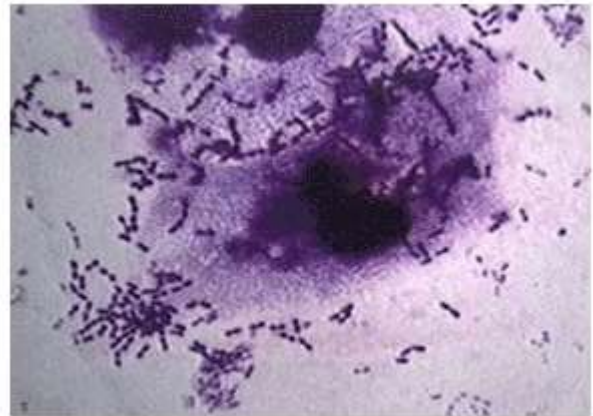
- Opportunistic fungal respiratory disease , charchterized by :
  - dyspnea
  - pneumonia
  - cyanosis
- Affect **compromised people**
- Common in all patient with AIDS(☼ MCQ)

#### Etiology :

- PCP Pneumocytosis Cranii Pneumonia
- Obligatory parasite , were considered as **Parasite protozoa** But RNA studies proved it to be a **Fungus**
- **Chitinase enzyme** attacks the wall of fungal cusy which is made up of chitin
- Doesn't grow or culture ( always -ve ) (☼ MCQ)
- Affect children ( childhood disease ) (☼ MCQ)

**Host / Habitat :**

- Found in :
  - rodent
  - goat
  - humans
- It is **normal flora** of humans body acquired during childhood causes infection , Only if immunity is distracted ( ☼ **MCQ** )



**Pneumococos (bactérias arredondadas)**

**Diagnosis :**

Respiratory specimen

Organism are clear in deep BAL

Sputum maybe false –ve

1. Microscopy : silver stain GMS show cyst organism in the form of **Hats-creasent commas** ( ☼ **MCQ** )

Approach the size of Yeast 4-5 µm

2. Serology : Ag detection

Detect Ag in patient serum using known Ab

3. Culture → -ve always Obligatory Organism ( ☼ **MCQ** )

**Treatment :**

Trimethoprim + Sulphamethaxazole = Co.Tricoxazole ( septrin )

❖ **Third: Trichosporonosis**

Opportunistic infection , usually Pulmonary But can cause Skin infection

**Etiology** : Trichosporum Beigelii

**Diagnosis :**

- Yeast / PseudoHyphae ( **not true Yeast** ) ( ☼ **MCQ** )
- Arthrospores
- Blastospores
- **NOT** chlamydospores
- Urase +ve
- Clinical specimen : Budding yeast cell , Pseudohyphae

**Treatment** : Amphotericin B

❖ **Fourth: Geotricosis**

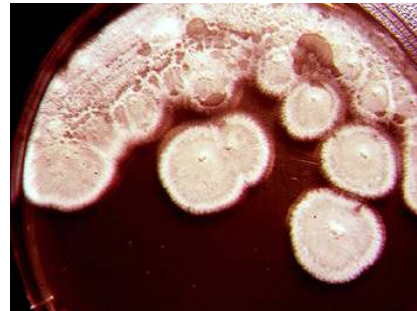
Opportunistic infection , usually pulmonary infection

**Etiology :** Geotrichum Condium ,  
G.Candidiosis

**Diagnosis :**

- Pseudohyphae ( **Not true yeast** ) + Hyphae
- Arthrospores ( **Not** basidiospores )  
( ☼ **MCQ** )
- Clinical specimen : Pseudohyphae  
Budding yeast

**Treatment :** Amphotericin B ( **for all yeast infection** )



*" To achieve the impossible, one must think the absurd; to look where everyone else has looked, but to see what no else has seen. "*

*„ The End „*