

Fungal infections

Dr. Nadisha Badanasinghe
Dept. of Microbiology
Faculty of medicine
Ragama

Objectives

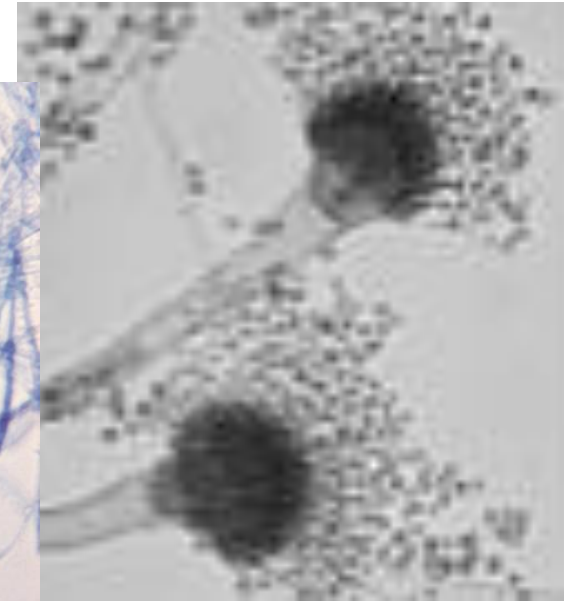
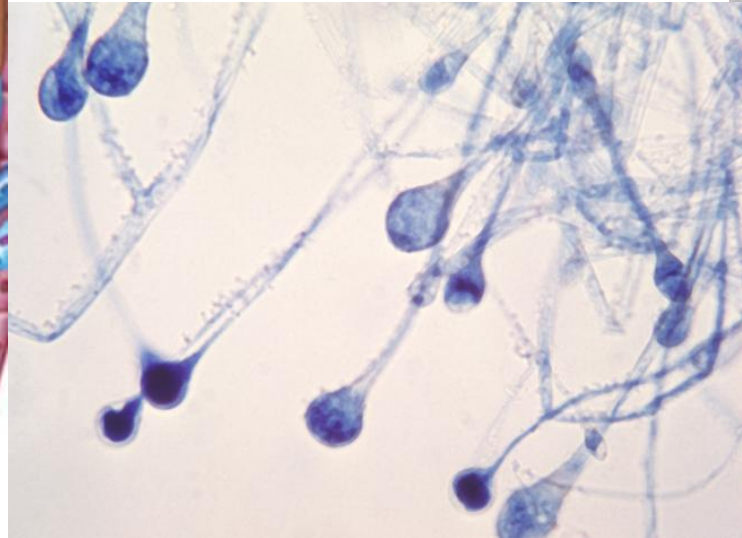
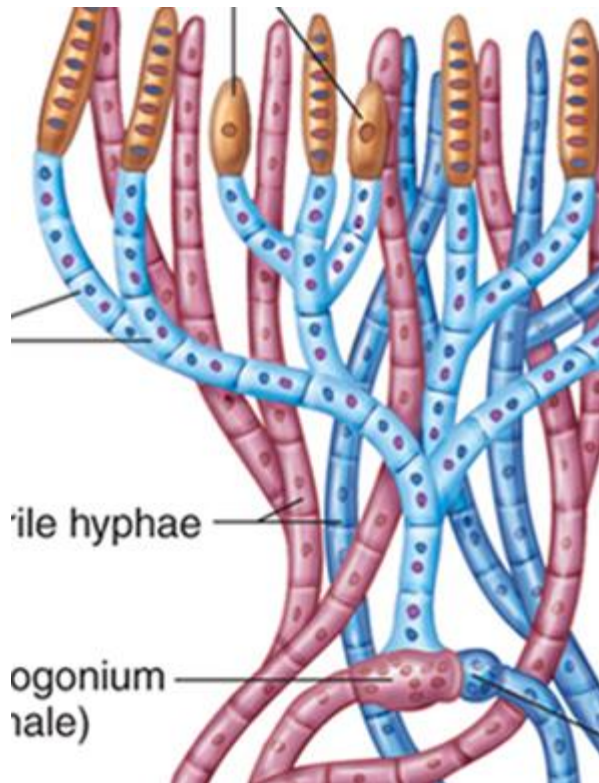
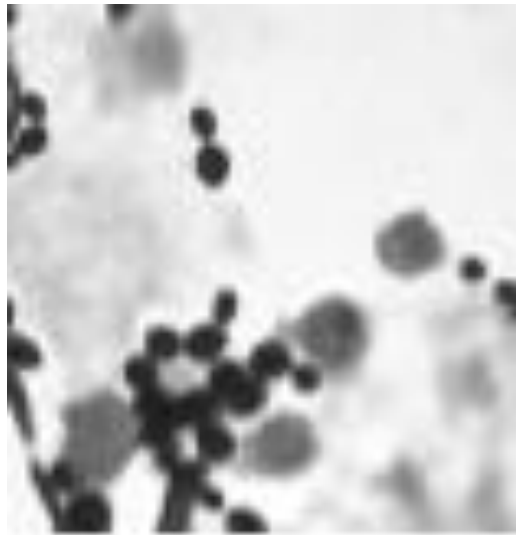
- Classification and properties of fungi
- Types of infections
- Presentation
- Sample collection
- Laboratory diagnosis
- Treatment

Fungi

- Eukaryotes
- More evolutionarily advanced
- Fungi may be unicellular or multicellular
- Have a rigid cell wall composed of chitin and glucan
- Reproduce by means of spores – Sexual/ Asexual
- Fungal taxonomy relies heavily on morphology and mode of spore production
- Saprophytic/ parasitic

Classification of Fungi

- According to basic morphology
 1. Yeast – Ovoid/ spherical
 - reproduces by budding formation of sexual spores
 - do not form mycelium
 2. Yeast like - intermediate
 - may elongate to form sausage-like pseudohyphae
 3. Moulds – form branching filaments (hyphae)
 - form mesh-like structure (mycelium)
 4. Dimorphic – exist in both forms
 - Yeast form in infected lesions
 - Mycelium in environment



Types of Fungal Infections

- Superficial
 1. Pityriasis versicolor (Alu hung)
 2. Dermatomycoses (Tenia infections- Dermatophytes)
 3. Candidiasis
 4. Tenia nigra
- Sub-cutaneous tissues
 1. Mycetoma
 2. Chromoblastomycosis
 3. Rhinoporioidosis
- Systemic
 1. Aspergillosis
 2. Cryptococcus
 3. *Pneumocystis carinii*
 4. Endemic mycoses

Types of Fungal Infections

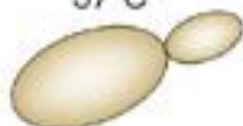
- Infections in normal immuno-competent host
 - Pityriasis versicolor (Alu hung)
 - Dermatomycoses (Tenia infections- Dermatophytes)
 - Candidiasis
 - Mycetoma
 - Chromoblastomycosis
 - Rhinoporioidosis
 - Endemic fungi
- Infections in immuno-compromised host (oppotunistic)
 - Aspergillus
 - Cryptococcus
 - Penicillium
 - Candida

Dimorphic fungi

25°C

37°C

Blastomyces dermatitidis



Coccidioides immitis



Histoplasma capsulatum

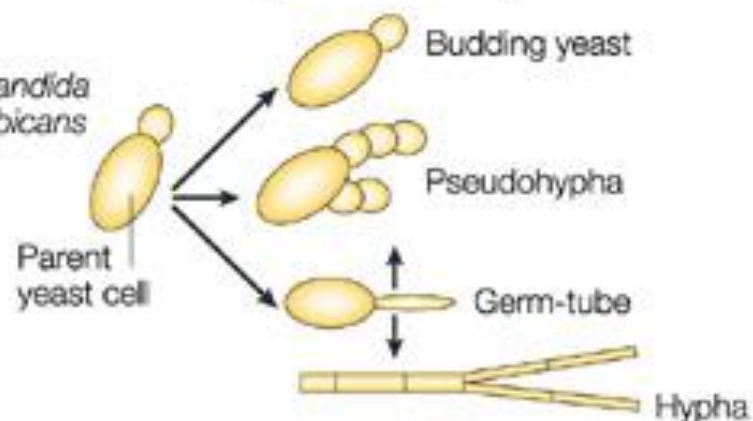


Paracoccidioides brasiliensis



Opportunistic fungi

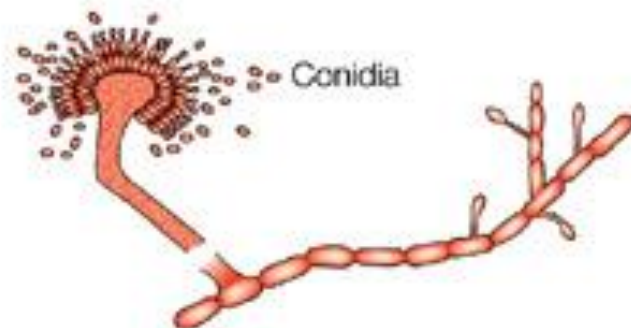
Candida albicans



Cryptococcus neoformans



Aspergillus umigatus



Factors influencing superficial and subcutaneous mycoses

- Immune status of Host
 - Immunocompetent
 - Immunocompromised
- Age – infants, elderly, young children
- Occupational exposure
- Geographical distribution of fungi

Superficial Fungal infections

- These affect the outer layers of the skin, nails and hair
- Affects the dead cornified layers of the epidermis
- generally cause benign and self-limiting diseases
- The organisms involved in these infections are morphologically diverse
- spread by contact
- Transmitted to man from
 - other humans
 - Animals
 - soil

1. Pityriasis versicolor (Alu hung)

- Commonest fungal skin infection in SL
- Characterized by well-demarcated white, pink, fawn or brownish lesions, often coalescing
- Hypo/ hyper pigmented
- Causative agent – *Malassezia furfur*
 - involves only the superficial keratin layer
 - Lipophylic oval yeast
 - Budding on broad base
 - Short stout filaments



Treatment

- Topical – Azoles eg; miconazole ,
ketoconazole, clotrimazole

Selenium sulphide 2.5%

Sodiumthiosulphate

Zinc pyrithion

- oral – ketaconazole
 itraconazole
 fluconazole

2. Dermatophytes (Ring Worm)

- A group of filamentous fungi
- Infect only skin, hair and nails
- Causative organisms- 3 genera
 - *Trichophyton*
 - *Microsporum*
 - *Epidermophyton*
- Anthropophilic - acquired from other humans
- Geophilic - acquired from soil
- Zoophilic - acquired from animals

Dermatophytes (Tinea infection)

type	site	Clinical features
Tinea corporis	body	Circular itchy spreading lesions with a raised edge and central healing May have vesicles and pustules
Tinea pedis (athlete's foot)	Soles and toe webs, nails	Thickened white skin, itchy, peeling with offensive smell , blisters
Tinea cruris	groin	Similar to Tinea corporis
Tinea capitis	Scalp and hair	Scaling, erythema, Kerion (large, tender lesions) Itching, hair loss
Tinea unguium	Nails	Yellow, brittle, thickened, powdery subs. under nail
Tinea barbae	Beard	superficial circular patches, scarring hair loss

Tinea corporis



Medscape®

<http://www.medscape.com>

Tinea pedis



Tinea cruris



Tinea capitis



ectothrix



endothrix



Tinea unguium



Tinea barbae



Treatment - ring worm

- Mild disease – topical miconazole/ clotrimazole/
econazole
(cream/ nail solutions)
- Extensive /poor response to topical therapy/ nail/ scalp
-oral antifungal
eg; Griseofulvin
Itraconazole

3.Candidiasis (Intertrigo)

- Candida
 - Yeast
 - *C. albicans* is the commonest
 - Others- *C. tropicalis*, *C. glabrata*, *C. krusei*
 - Normal flora – on skin, *GI*, *vagina*
 - Predisposing factors for infection
 - Ex. Steroids, DM, pregnancy, neutropenia, AIDs, malignancies antibiotics, frequent handling of water, obesity dentures

Candida infections

- Superficial
 - Skin
 - at moist and macerated areas (Groins, axillae, intermammary, interdigital, gluteal and perineum)
 - Intensely red, macerated, moist, itchy, glistening rash with scaling on the edges (weepy lesions)
 - Nails – onychomycosis, paronychia
 - Mucosa
 - Mouth, GIT, vagina
- Systemic
 - Cystitis, pyelonephritis
 - Endocarditis
 - Sepsis
 - Lung
- Occular- endophthalmitis



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Candidal Paronychia



onychomycosis



Oral thrush



vaginitis



Treatment

- Topical antifungals
 - Ex: Nystatin, miconazole, clotrimazole
- Oral antifungals
 - Flucanazole, itraconazole, flucytosin, voriconazole
- IV antifungals
 - Flucanazole, amphotericin B, voriconazole, caspofungin

Samples for Dx of superficial mycoses

- **Skin scrapings**
- **Nail clipping**
- **Hair clippings**

Lab diagnosis

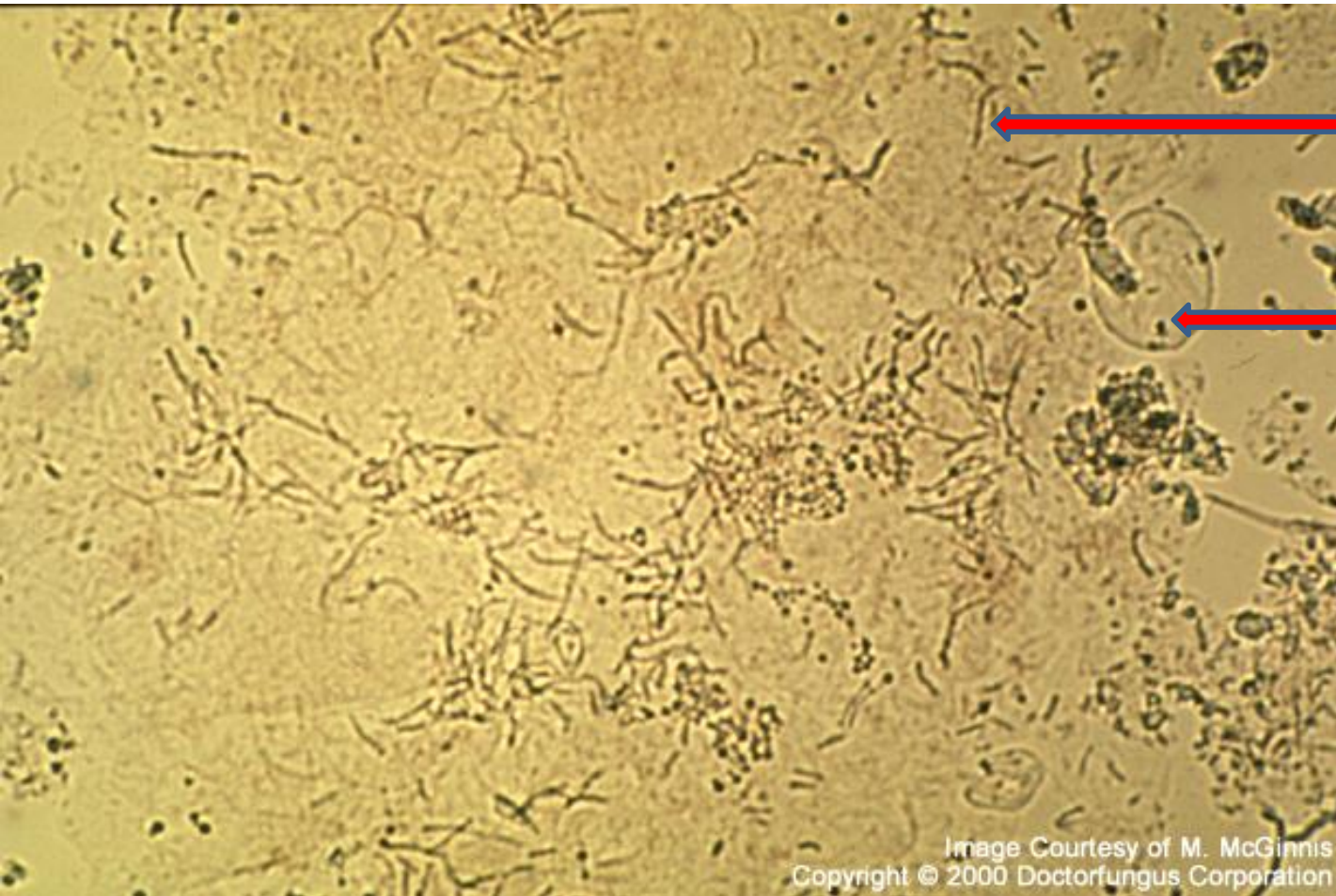
1. Direct smear – in 10% KOH

- Leave the specimen few minutes in a drop of KOH to digest keratin
- Observe under microscope for branching/ short hyphae or yeast

2. Culture – in Sabourod's Dextrose Agar

- Dermatophytes, Candida
- Not done for *Malassezia furfur*
- Identified by - Colony morphology, needle mount with Lactophenol cotton blue and /or slide culture
- Other tests for candida – Rice agar plate, sugar assimilation

Pityriasis versicolor (Alu hung) – KOH mount

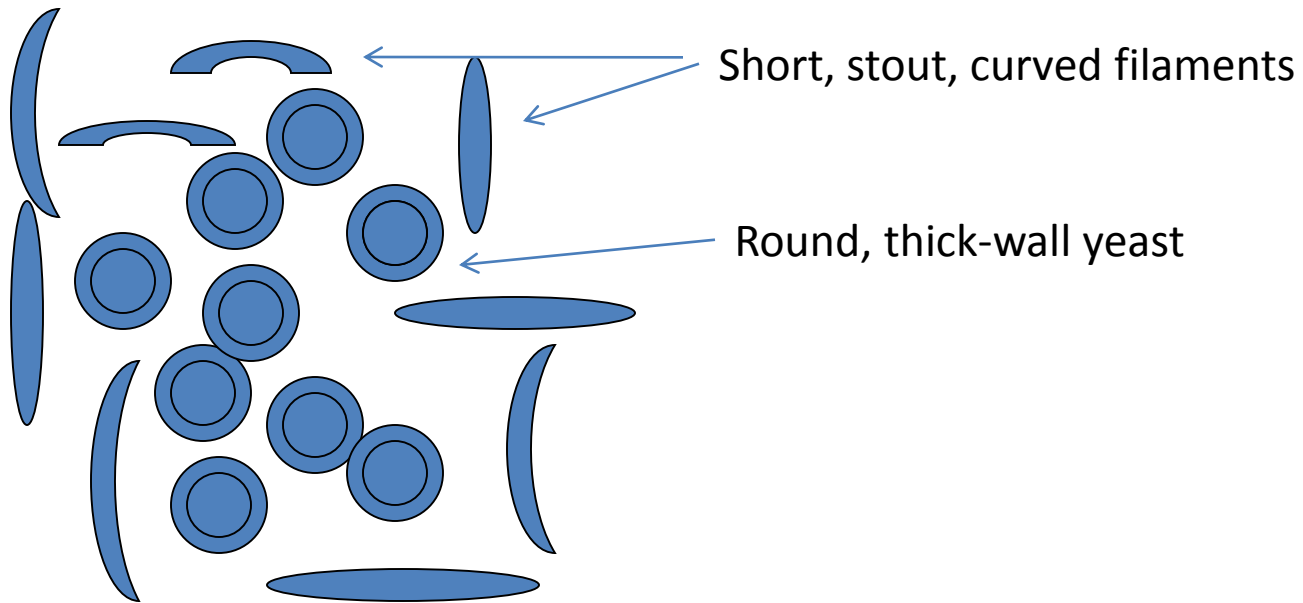


Short, stout, curved
filaments

Round, thick-wall
yeast

Image Courtesy of M. McGinnis
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Pityriasis versicolor (Alu hung) – Parker's stain



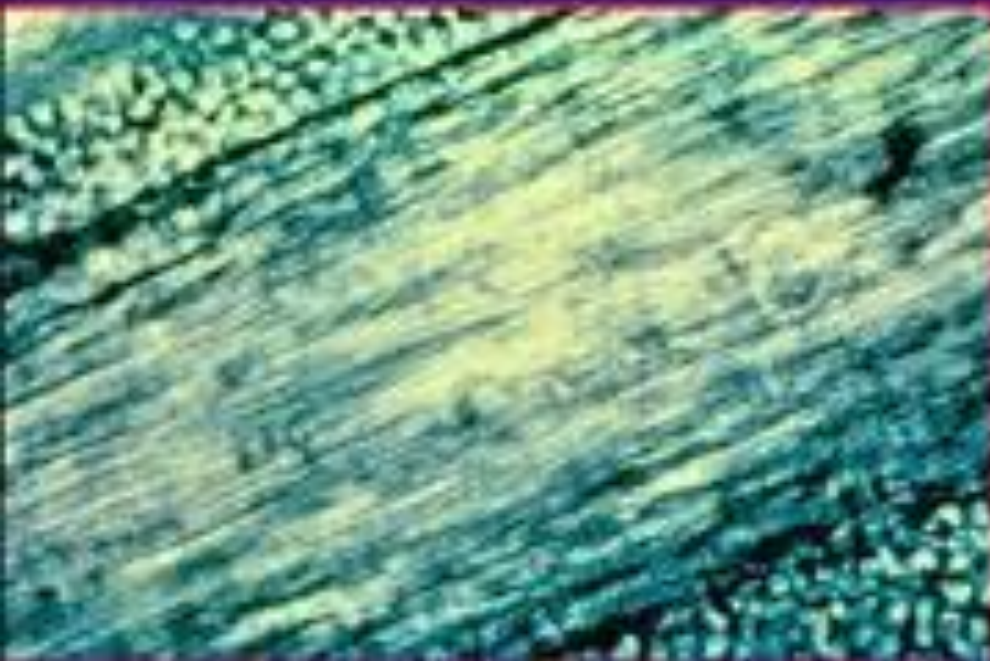
“spaghetti and meat balls appearance”

Dermatophytes in KOH



Branching, septate
hyphae

Ectothrix



Arthrospores are outside the hair shaft

Endothrix



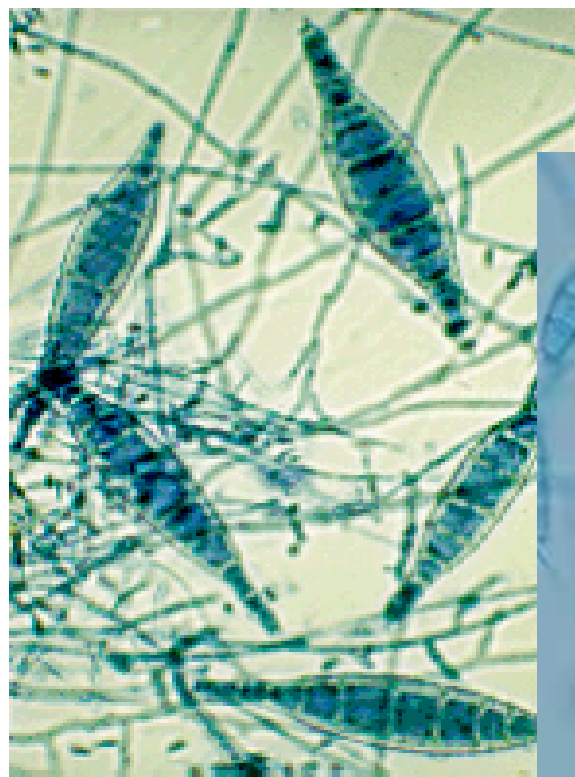
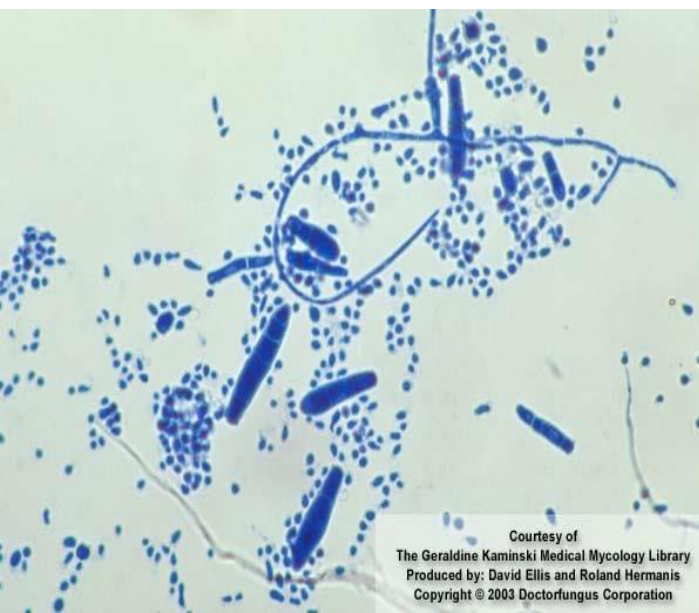
Arthrospores are inside the hair shaft

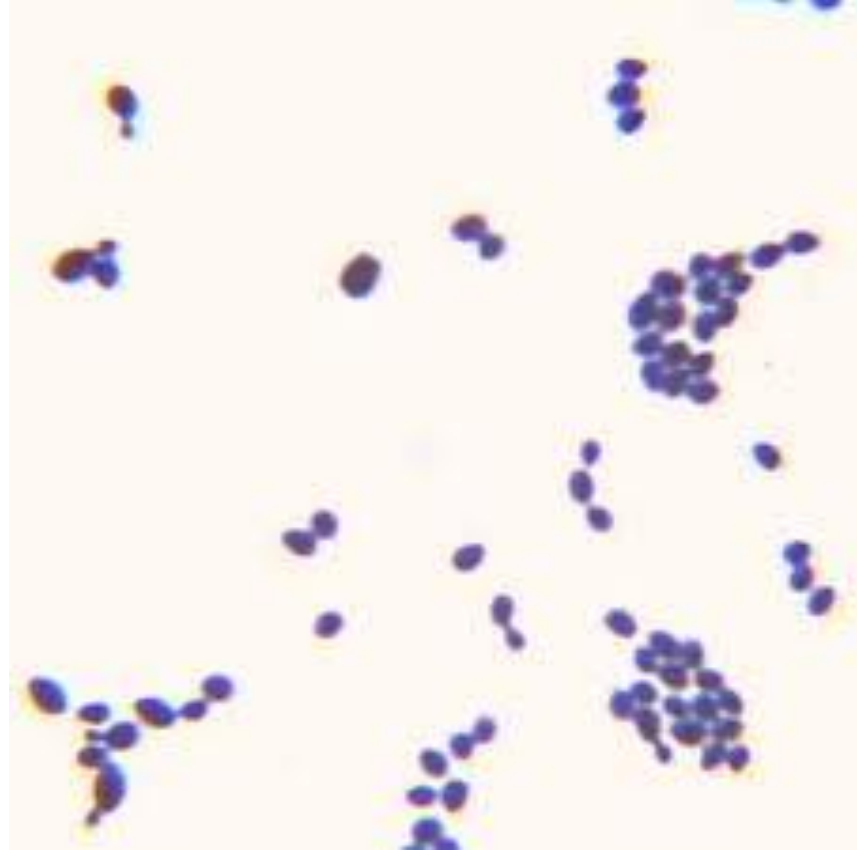


M. canis

T. Mentagrophytes

M. gypseum





Sub-cutaneous Fungal Infections

- involve fungal infections of deeper skin layers
- Transmitted through inoculation by prick injuries
- Chronic infection

Sub-cutaneous Fungal Infections

1. Mycetoma – chronic granulomatous infection

papule of the skin → fixed nodule →

Abscess with pus containing granules →

Ulceration → spread inwards to muscles and bones

→ sinus formation → Destruction of tissues

Causative organisms – filamentous fungi (*Madurella* spp)

Tx – inoculation through skin by penetrating injury

Rx – Ketoconazole/ Itraconazole/ surgery



Fungal Sub-cutaneous Infections

2. Chromoblastomycosis – chronic warty mycosis of skin and s/c tissues

→ Innoculating injury → painless papule/ nodule
→ warty growth with abscesses and crusting →
satellite lesions spread along lymphatic →
progress slowly

Causative organisms - filamentous fungi

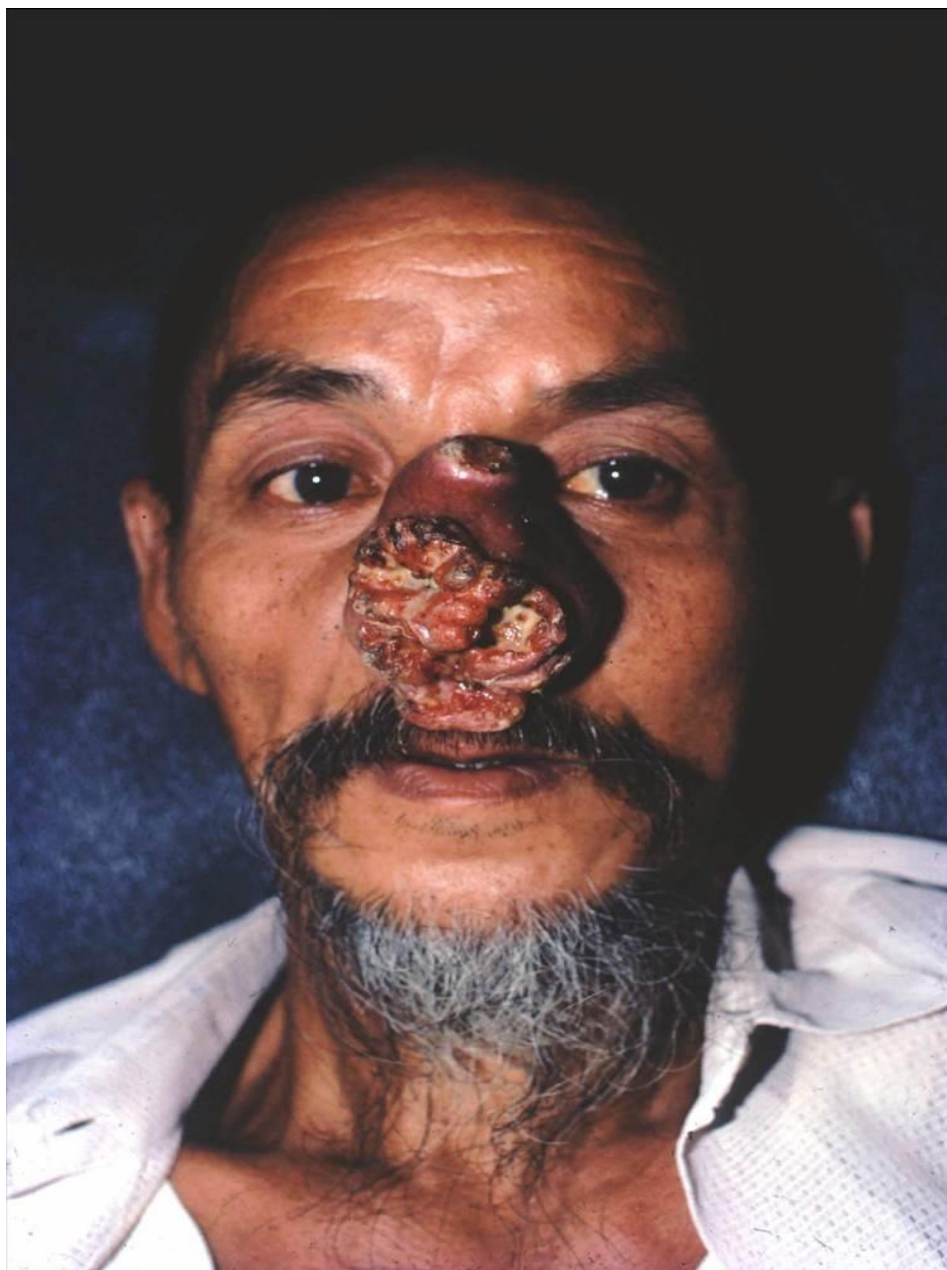
Rx - Itraconazole, terbinafine



Fungal Sub-cutaneous Infections

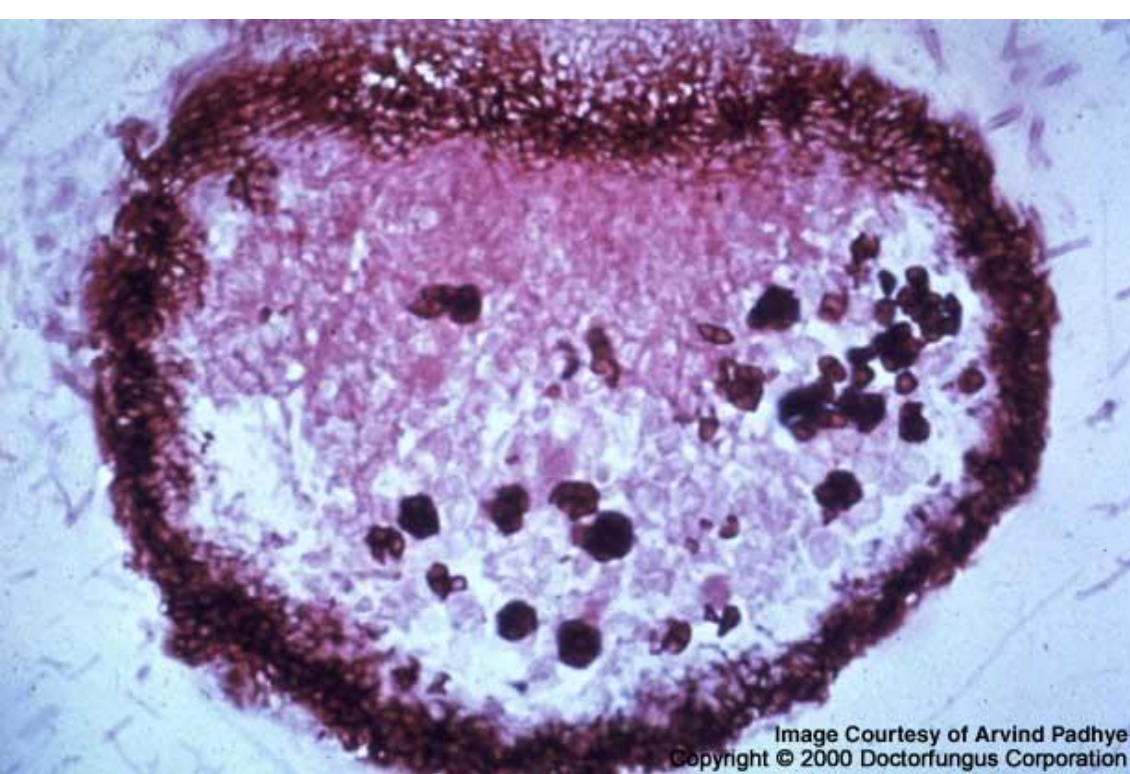
3. Rhinoporioidosis-

- chronic granulomatous infection with polyp formation in mucous membranes (nasal,nasopharynx, eye)
- Endemic in India and SL
- Causative organism- *Rhinosporidium seeberi*

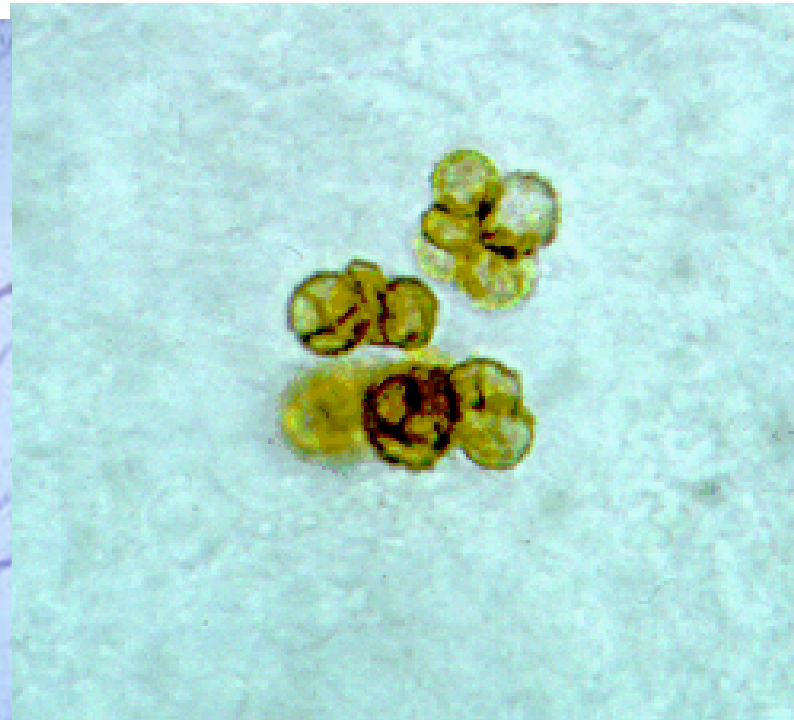


Lab diagnosis

- Specimens- Biopsy / exudate/ pus with grains
- Direct mic. – crushed grains / exudate
- Histology
- Culture in SDA and identification



Mycetoma Grain shown in skin biopsy



Copper penny appearance
Of chromoblastomycosis in
direct smear

Treatment for S/C infections

- Radical surgery
- Systemic antifungals
 - Itracanazole, amphotericin B

Systemic Fungal infections

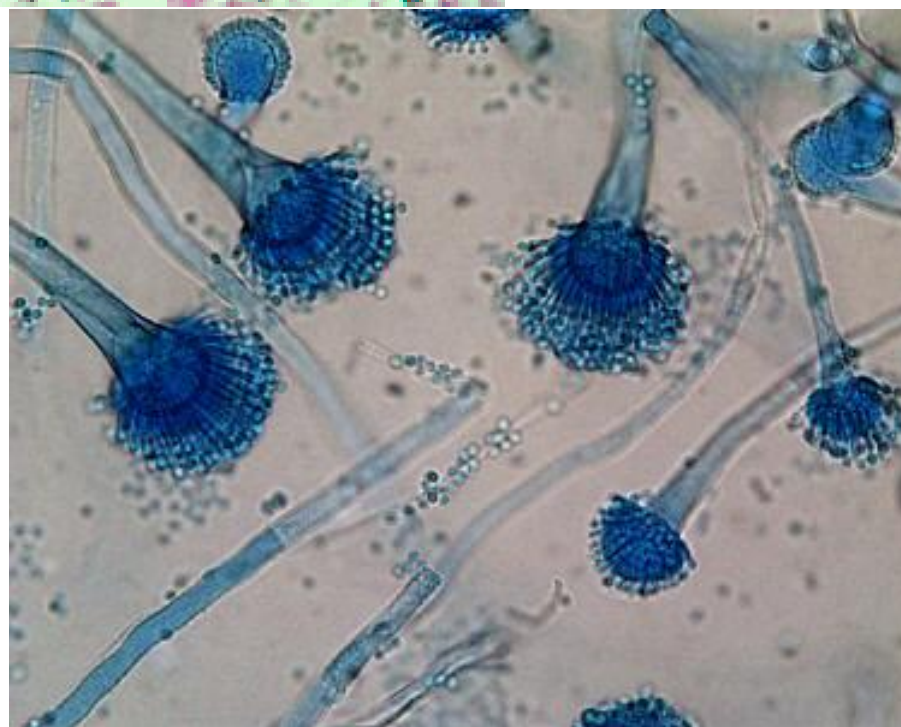
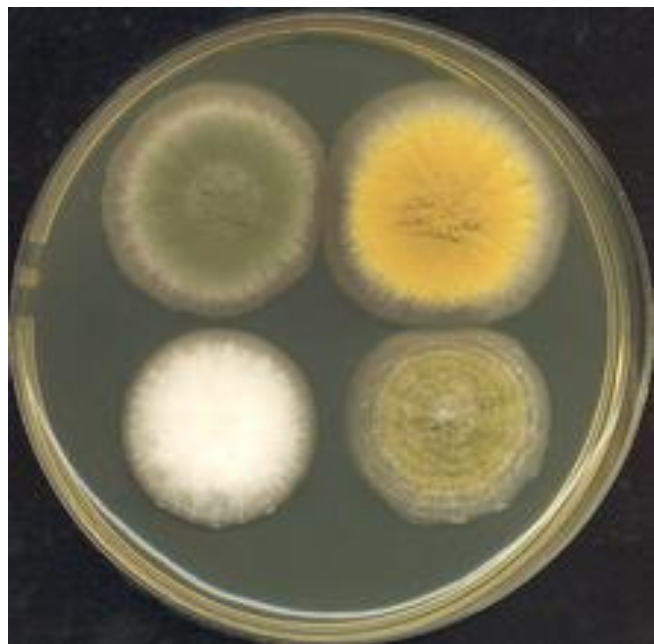
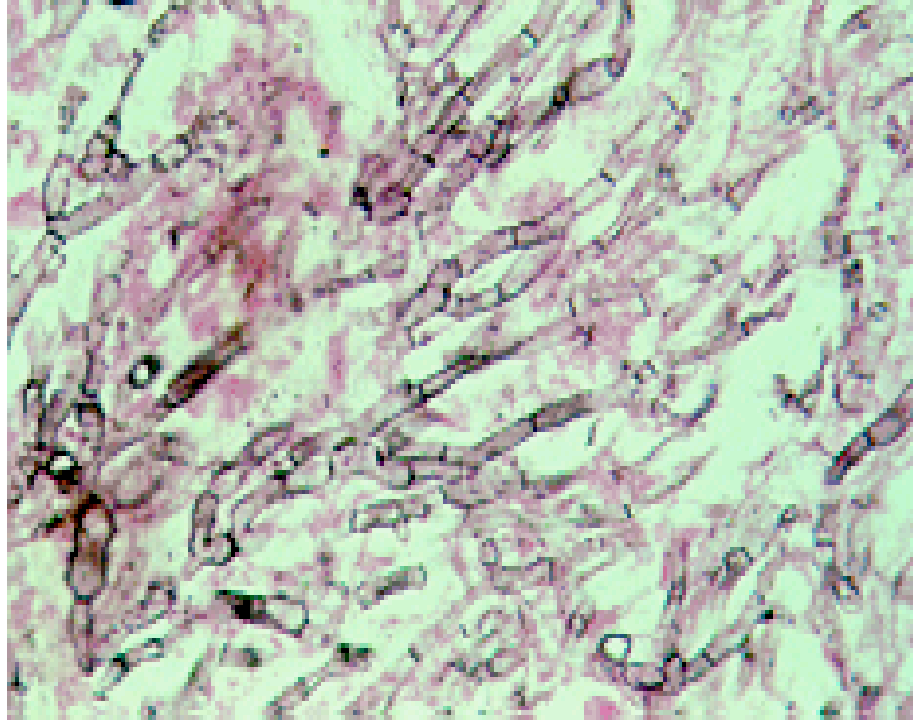
- Aspergillosis – *Aspergillus fumigatus*, *A. niger*
- *Cryptococcus neoformans*
- *Pneumocystis carinii*
- Endemic mycoses
 - Histoplasma
 - Blastomyces
 - coccidioidomycosis

Aspergillosis

- Opportunistic
- Lungs
 - Pneumonia -Chronic nodular pneumonia (“microgranulomatous aspergillosis”) or “mucor pneumonia” (life threatening)
 - ABPA –Acute Bronchopulmonary Aspergillosis
- Others
 - Osteomyelitis
 - CNS – brain abscess
 - skin (erythematous papules or macules with progressive central necrosis)
 - endophthalmitis

Diagnosis of IA

- Visualization of hyphae in tissue / Isolation in culture
 - BAL, percutaneous/ open lung biopsy
- Imaging
 - HRCT
 - CXR
- Detection of *Aspergillus galactomannan Ab*
 - Serum/ BAL –
 - may have low sensitivity compared to other immunocompromised populations
- Real-time (PCR) - pan-*Aspergillus PCR*
 - Serum/ BAL/ tissues



Cryptococcus neoformans

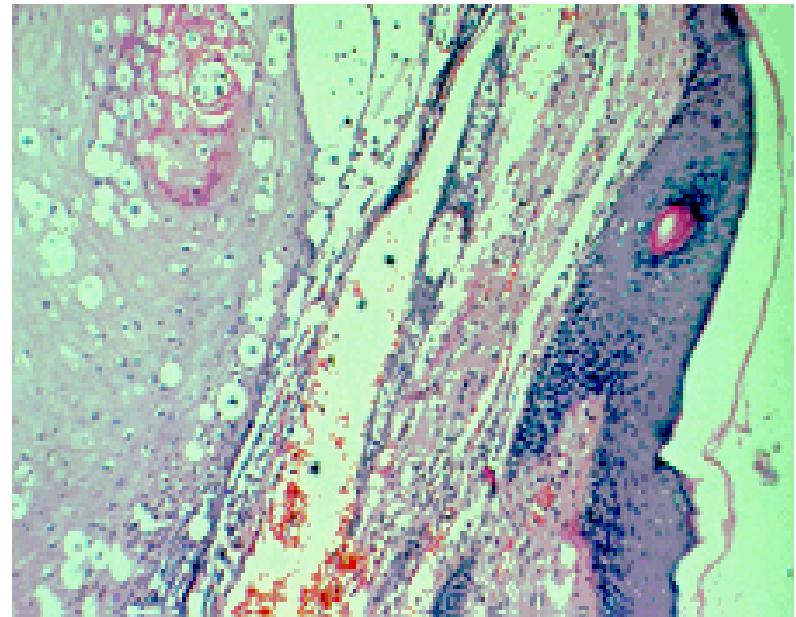
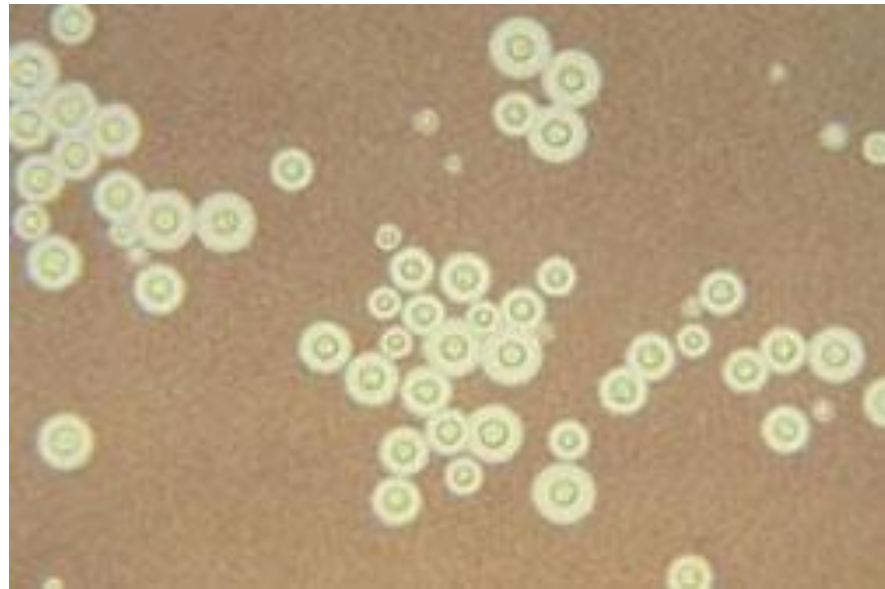
- Acquired by inhalation
- Pulmonary infections have no diagnostic symptoms and are usually subclinical
- Shows a predilection for the central nervous system

Clinical presentations

- Pulmonary
 - Asymptomatic initially
 - fever, dry cough and dyspnoea that can progress to acute respiratory distress syndrome (ARDS)
- CNS
 - meningitis, meningoencephalitis or expanding cryptococcoma
 - Symptoms usually develop slowly over several months, and initially include headache, followed by drowsiness, dizziness, irritability, confusion, nausea, vomiting, neck stiffness and focal neurological defects
 - Cryptococcoma is characterized by localized, solid, tumor-like masses, usually found in the cerebral hemispheres or cerebellum

Diagnosis

- Microscopy/ Isolation
 - CSF, BAL, blood
- Cryptococcal antigen (capsular PS) test (latex agg)
 - Meningitis, Disseminated but not in isolated pulmonary infection
 - CSF, serum – high sensitivity and specificity



Pneumocystis carinii

- Seen in immune deficient patients
- Initially misidentified as a protozoa
- Life threatening opportunistic fungal infection

Clinical presentation

- Pulmonary
 - Typically presents in a subacute manner with progressive dyspnea, nonproductive cough, and low-grade fever, chills and LOW, tachypnoea, tachycardia, ARDS
- Extra-pulmonary
 - Central nervous system
 - Bone marrow (may have necrosis with resultant pancytopenia)
 - Lymphadenopathy
 - Eyes (may have retinal cotton-wool spots)
 - Thyroid (may present as a rapidly enlarging thyroid mass)
 - Gastrointestinal tract

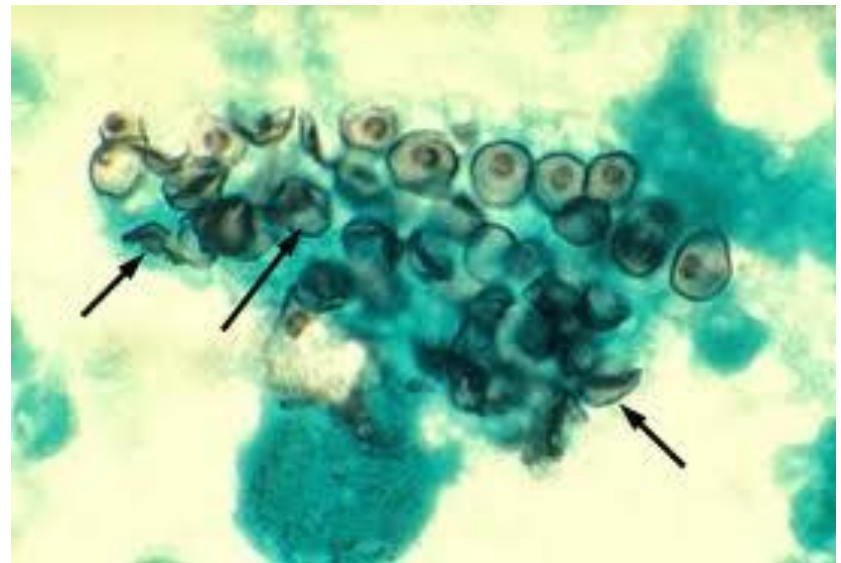
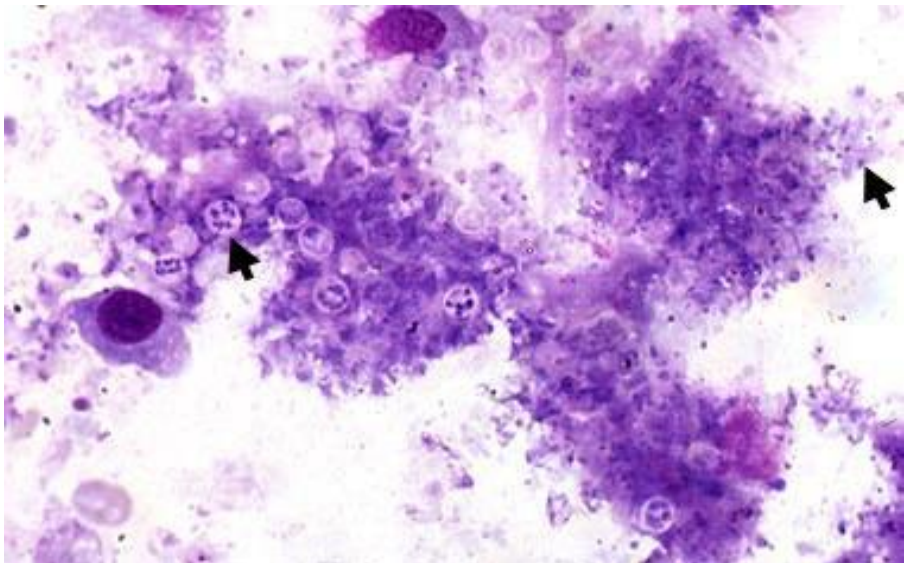
Diagnosis

- Chest imaging
 - Can be normal early in the disease
 - Diffuse bilateral infiltrates extending from the perihilar region
 - Less commonly patchy asymmetric infiltrates pneumatoceles and pleural effusions



Diagnosis

- Microscopy of stained specimens (Cresyl violet, Giemsa, Diff-Quik, Methylamine silver, toluidine blue)
 - Induced sputum, BAL, lung biopsy



Thank you