Chapter

Opportunistic fungi

-- These fungi **usually cannot cause disease in normal humans** but **invade immunocmpromised persons**.

-- Four genera are important: ***Candida, Cryptococcus, Aspergillus,*** and ***Rhizopus*****.**

Candida

-- ***C. albicans*** causes **thrush, vaginitis, diaper rash** and **chronic mucocutaneous candidiasis**.

-- It also causes **disseminated infections** such as **right sided endocarditis** (esp. in iv drug users), **bloodstream infections** (**candidemia**) and **endophthalmitis**.

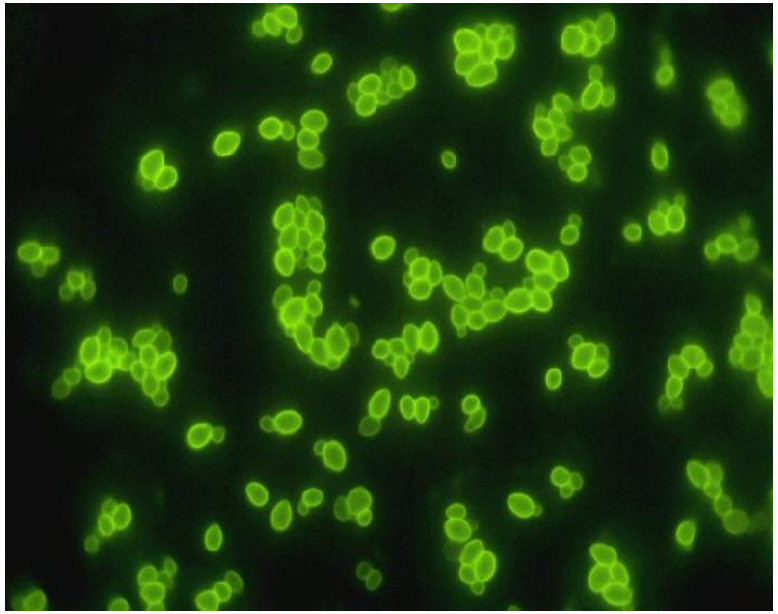
-- Infections related to **indwelling intravenous** and **urinary catheters** are also important.

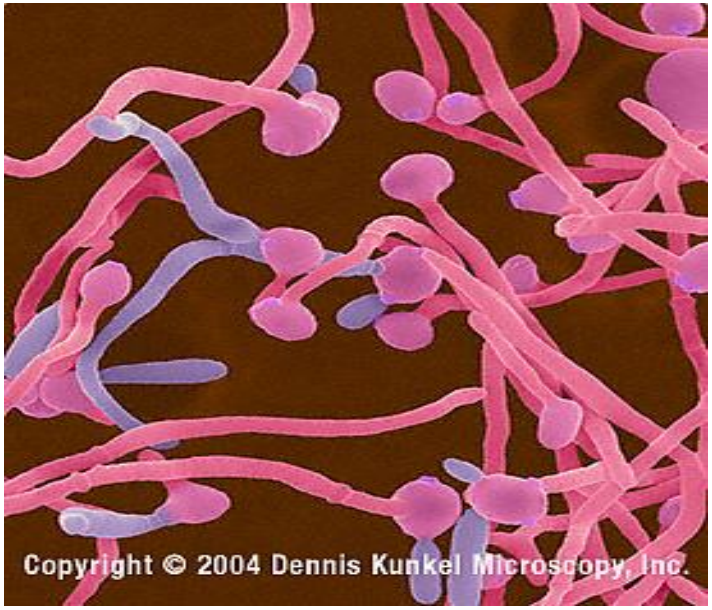
Properties

C. albicans is an oval **yeast** with a **single bud**.

It is **part of normal flora of mucous membranes** of the upper respiratory, gastrointestinal, and female genital tracts.

In **tissues** it may appear as **yeasts** or as **pseudohyphae**.





-- **True hyphae** are also formed when ***C. albicans*** **invades tissues**.

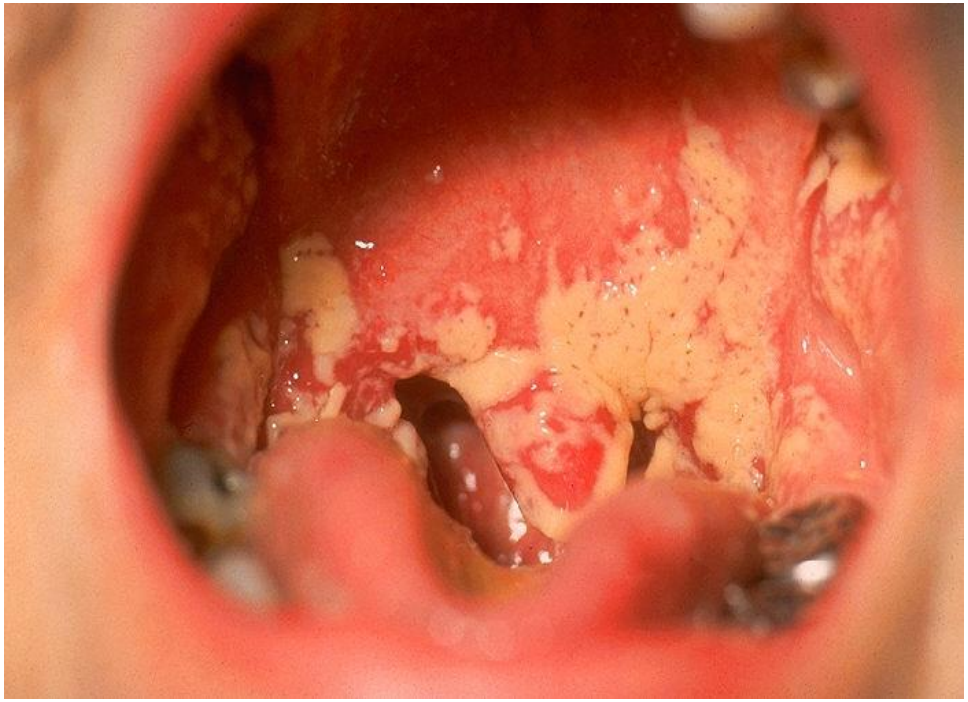
-- Carbohydrate fermentation reactions differentiate them from other ***Candida*****.**

-- They penetrate through **needles** and **indwelling catheters**.

Pathogenesis and Clinical findings

Overgrowth of ***C. albicans*** **in mouth** produces **white patches called thrush** which is actually a **pseudomembrane**.

Vaginitis can also occur due to **high pH, diabetes** or **use of antibiotics** (suppression of ***Lactobacilli***).



-- **Skin infection** is in **warm, moist areas** which become red.

-- **Fingers** and **nails** become involved on **repeated water contact**.

-- **Diaper rashes** in children may occur.

-- In **immunosuppressed** persons, ***Candida*** **may disseminate to many organs** or cause **mucocutaneous candidiasis (CMC).**

-- **CMC is a prolonged infection** of the skin, oral and genital mucosa, and nails in persons with deficient CMI especially with **mutated gene for IL17**.

-- Intravenous drug abuse, indwelling iv catheter and hyperalimentation also predispose to disseminated candidiasis, especially **right sided endocarditis** and **endophthalmitis** (infection within the eye).

-- ***Candida*** **eosophagitis** often accompanied by involvement of the stomach and small intestine is seen in patients with **leukemia** and **lymphoma.**

-- **Subcutaneous nodules** are often seen in **neutropenic patients** with disseminated disease.

-- ***Can. tropicalis*** and ***Can. parapsilosis*** are important pathogens also.

Laboratory Diagnosis

-- In **exudates** or **tissues**, **budding yeasts** and **pseudohyphae** appear **Gram positive** and can also be visualized by using **calcofluor-white staining.**

-- **Serology is not important.**

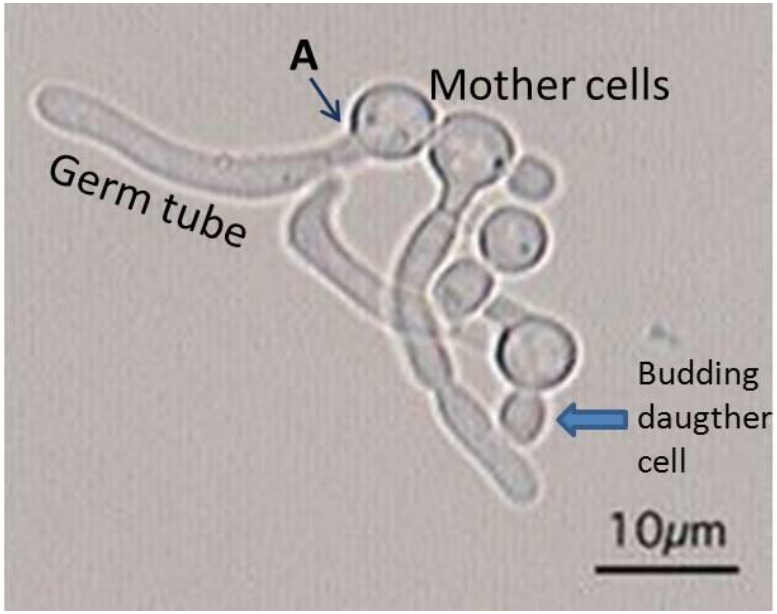
-- Skin tests are **positive in normal infected persons** and are an indication of healthy CMI.

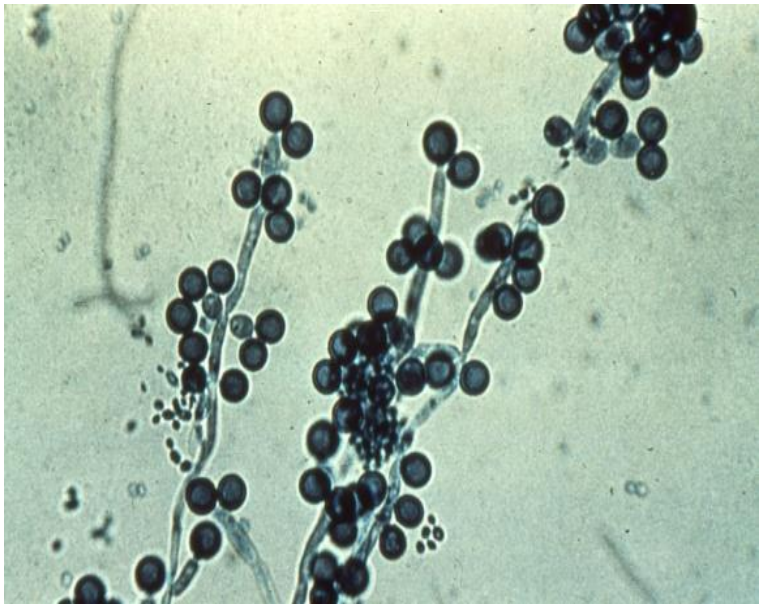
-- Those who have infection but show negative skin test are called **anergic**.

In **culture**, typical yeast colonies are formed which **resemble large staphylococcal colonies**.

C. albicans **uniquely forms germ tubes in serum** which differentiates it from other *Canidida*.

C. albicans also **uniquely form chalmydospores**.





Treatment

-- The drug of choice for oropharyngeal or esophageal **thrush** is **fluconazole**.

-- **Capsofungin** or **micafungin** can also be used.

-- **Skin infections** are treated with **topical antifungal drugs** such as **clotrimazole** or **nystatin**.

-- **Disseminated candidiasis** is treated with **amphotericin B** or **fluconazole.**

-- Mouth washes containing **clotrimazole, miconazole** or **nystatin** can **prevent thrush**.

-- **Fluconazole** is useful in preventing infection in **high risk patients** such as those undergoing bone marrow transplantation and premature infants.

-- **There is no vaccine.**

Cryptococcus

-- ***C. neoformans*** causes **cryptococcis**, especially **cryptococcal meningitis**.

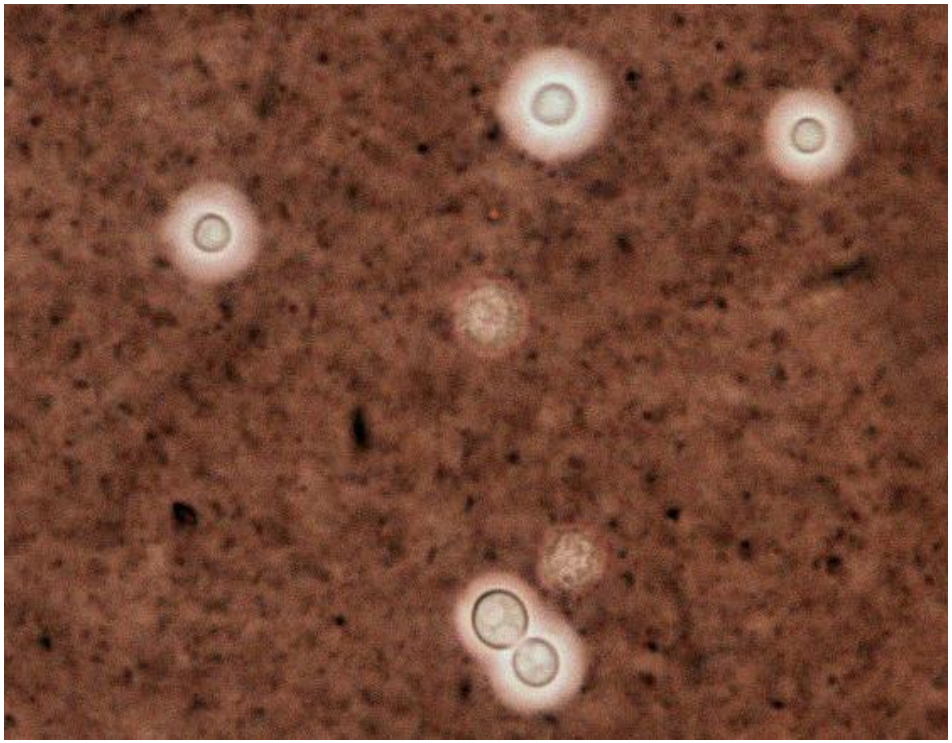
-- **It is the most common life threatening fungal disease in AIDS patients.**

-- ***C. gattii*** cause human disease **less frequently** but **infect normal persons more easily**.

C. neoformans is an **oval budding yeast** surrounded by a **wide polysaccharide capsule**.

It is **not dimorphic**.

It forms a **narrow based bud** in contrast to ***B. dermatidis*** which forms a **broad-based bud**.



-- It occurs **widely in nature** and grows abundantly in soil containing **bird (esp. pigeon) droppings**.

-- Birds are not infected.

-- Human infection is by **inhalation**.

-- There is **no human to human** transmission.

-- ***C. gattii*** is found associated with **eucalyptus trees**.

Pathogenesis and Clinical findings

-- Lung infection is often **asymptomatic** or may produce **pneumonia**.

-- Disease by ***C. neoformans*** is usually in persons with **reduced CMI** in the form of **meningitis.**

-- Other organs may also be affected.

-- **Subcutaneous nodules** may be seen.

-- ***C. gattii*** causes **cryptococcomas (granulomas).**

Laboratory Diagnosis

In CSF mixed with India ink, the yeast cell is seen microscopically surrounded by a **wide unstained capsule.**

Gram stain is not effective and special stains need to be used.

Culture of CSF yields **highly mucoid colonies** due to **large polysaccharide capsule**.

Treatment and Prevention

-- Combined treatment with **amphotericin B** and **flucytosine** is used in **meningitis** and **other disseminated diseases.**

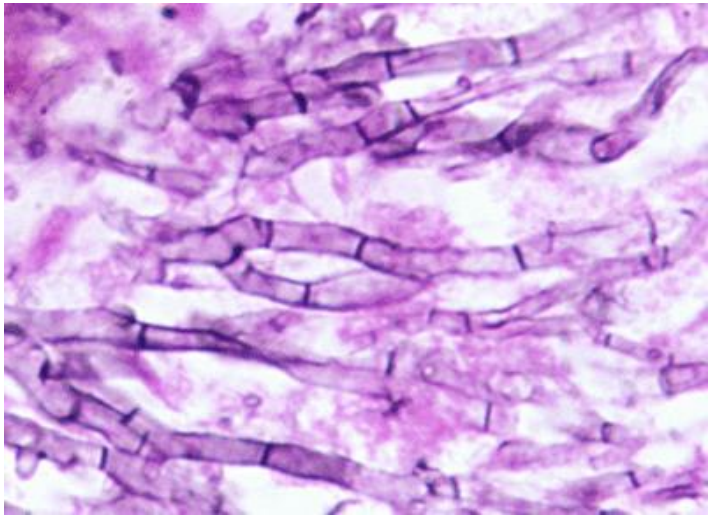
-- **Fluconazole is used in AIDS patients.**

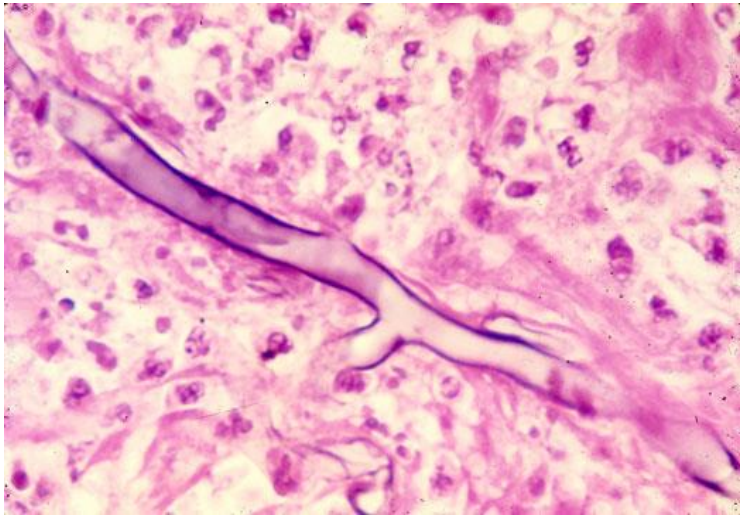
Aspergillus

Aspergillus species, esp. ***A. fumigatus*** causes infections of **skin, eyes, ears and other organs**; **"fungus ball" in lungs**, and **allergic bronchopulmonary aspergillosis**.

Aspergillus species **exist only as molds**.

They have **septate hyphae that form V-shaped (dichotomous) branches** in contrast to ***Mucor*** which produce **non-septate hyphae**.

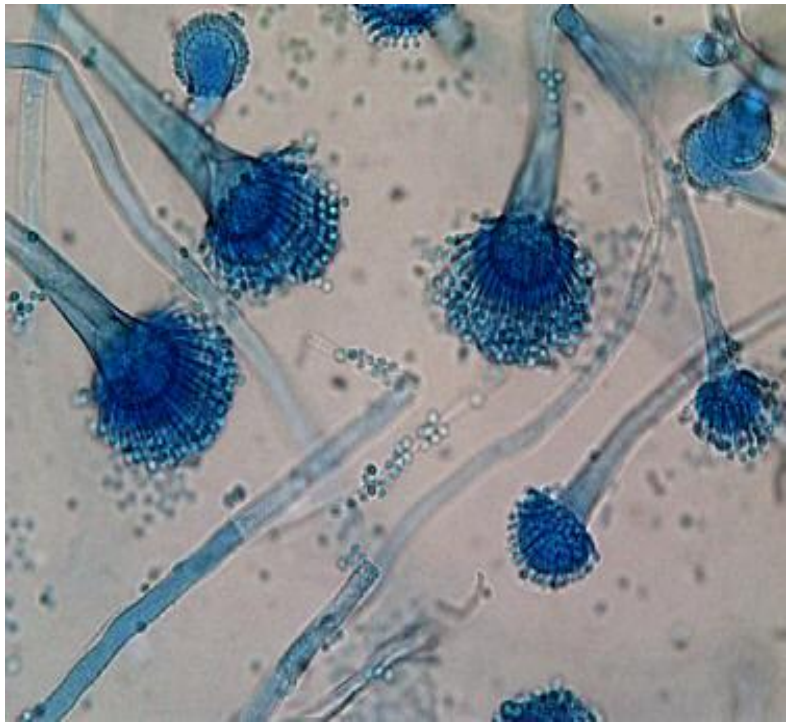




Conidia of *Aspergillus* form radiating chains, in contrast to those of ***Mucor*** and ***Rhizopus*** which are **enclosed in a sporangium.**

They are widely distributed in nature.

Transmission is by **airborne conidia**.



Pathogenesis and clinical findings

-- ***A. fumigatus*** can **colonize** and later invade **abraded skin, wounds, burns, the cornea, the external ear, or paranasal sinuses.**

-- It is the **most common cause of fungal sinusitis.**

-- In persons with **neutropenia**, it can invade the **lungs and other organs** producing **hemoptysis** and **granulomas**.

-- These patients are also **susceptible** to infection by **iv catheterization**.

-- ***Aspergillus*** can easily grow in **cavities within the lungs**, especially those **caused by tuberculosis**.

-- Within the cavities they produce an **aspergilloma (fungus ball)** which can be seen on chest X-ray as radioopaque structure that **changes its position** when patients lie down.

-- **Allergic bronchopulmonary aspergillosis (ABPA)** is an infection of the bronchi by ***Aspergillus*** species.

-- Patients have **asthmatic symptoms** and a **high IgE titer** against ***Aspergillus*** antigens, and they expectorate **brownish bronchial plugs containing hyphae**.

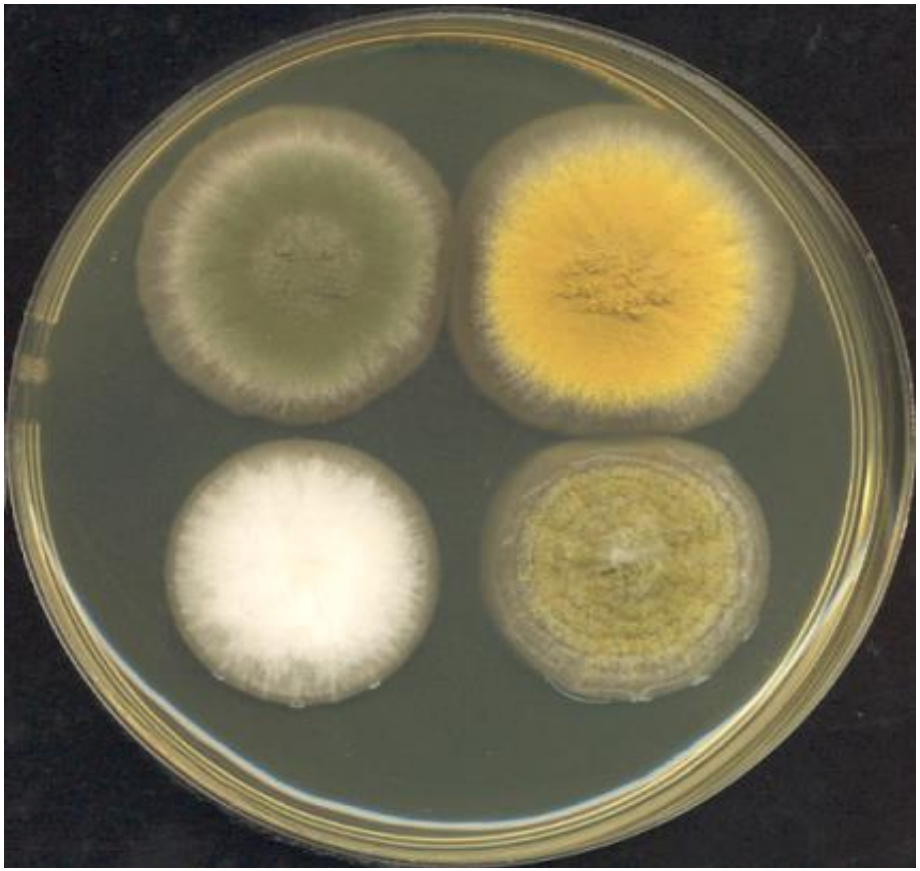
-- Inhaled **airborne conidia** may also cause **asthma**.

-- ***A. flavus*** growing on **cereals or nuts** produces **aflatoxins** that may be **carcinogenic or acutely toxic**.

Laboratory diagnosis

Biopsy specimens show **septate, branching hyphae** invading tissues.

Cultures show **colonies with characteristic radiating chains of conidia**.



-- Positive culture **does not prove disease** as colonization is common.

-- In persons with disease, there are **high levels of galactomannam antigen** in serum.

-- Patients with **ABPA** have **high levels of IgE specific for *Aspergillus* antigens** and prominent **eosinophilia.**

-- **IgG precipitins** are also present.

Mucor and Rhizopus

-- **Mucomycosis (zygomycosis, phycomycosis)** is a disease caused by **saprophytic molds** such as ***Mucor***, ***Rhizopus*** and ***Absidia*** which are found widely in environment.

-- They are **not dimorphic**.

-- Transmission is by **airborne asexual spores** and they **invade patients with reduced immunity**.

They proliferate in the **walls of blood vessels** of **paranasal sinuses, lungs**, or **gut** and cause **infarction and necrosis of tissue distal to the blocked vessel.**

Patients with **diabetic ketoacidosis**, **burns** and **leukemias** are particularly susceptible.

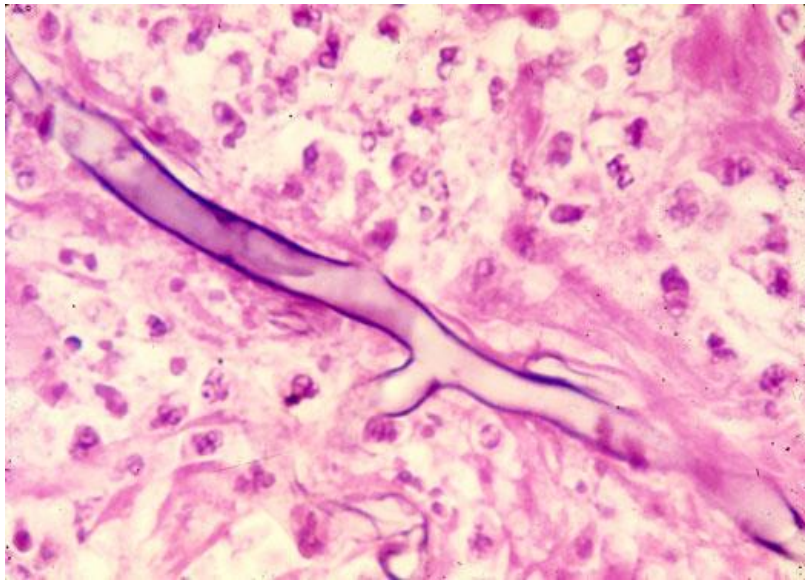
Diabetics are also susceptible to **rhinocerebral mucormycosis** in which mold spores in the sinuses **germinate to form hyphae** that **invade blood vessels that supply the brain**.

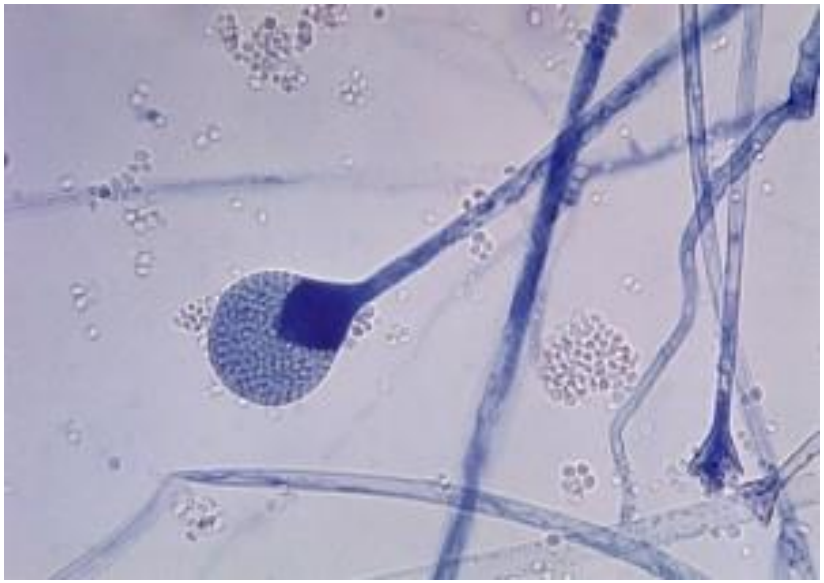
Rhizopus oryzae is responsible for **60% cases of mucormycosis**.

In **biopsy specimens** they appear as **non septate hyphae** with broad irregular walls and branches that form almost at right angles.

Colonies show spores within a sporangium.

In case of early diagnosis, treatment with **amphotericn B** and **surgical removal of necrotic infected tissue** may be helpful.






Thank You!