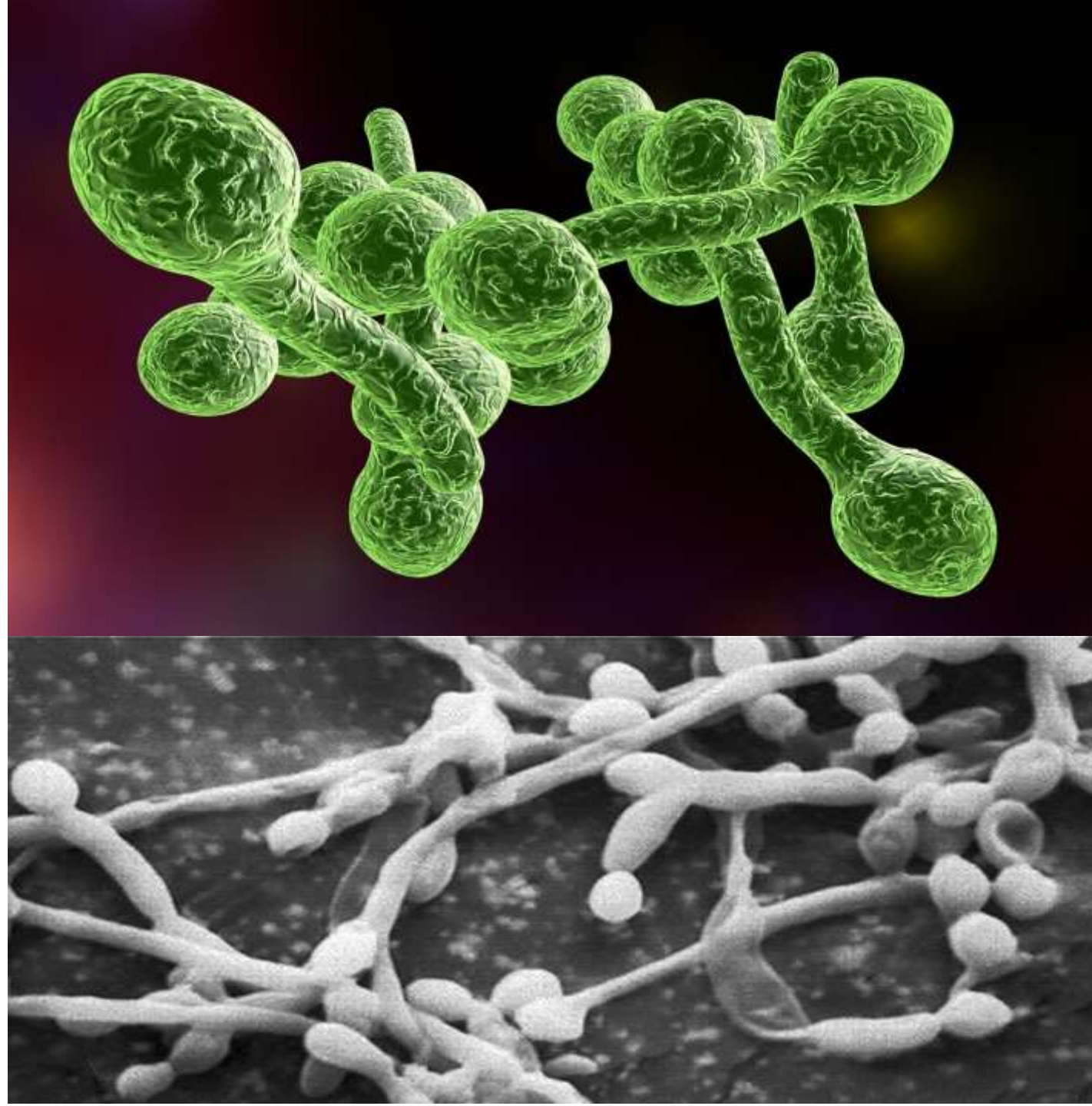


The Fungi of Medical Importance

Dr. Zaid Shaker Naji

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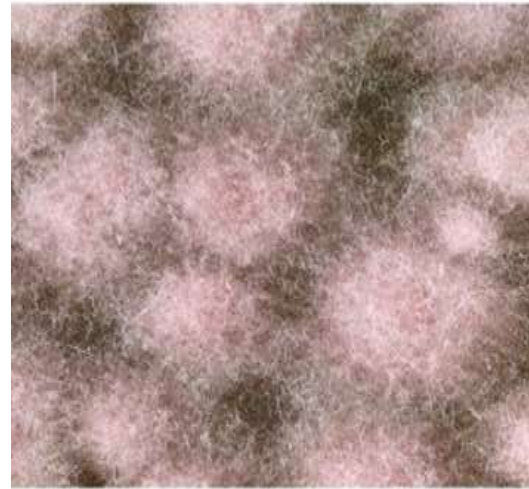
Fungi as Infectious Agents

- Molds and yeasts are widely distributed in air, dust, fomites, and normal flora
- Humans are relatively resistant
- Fungi are relatively nonpathogenic
- Of the 100,000 fungal species, only 300 have been linked to disease in animals
- Fungi are the most common plant pathogens
- Human **mycoses** are caused by true fungal pathogens and opportunistic pathogens

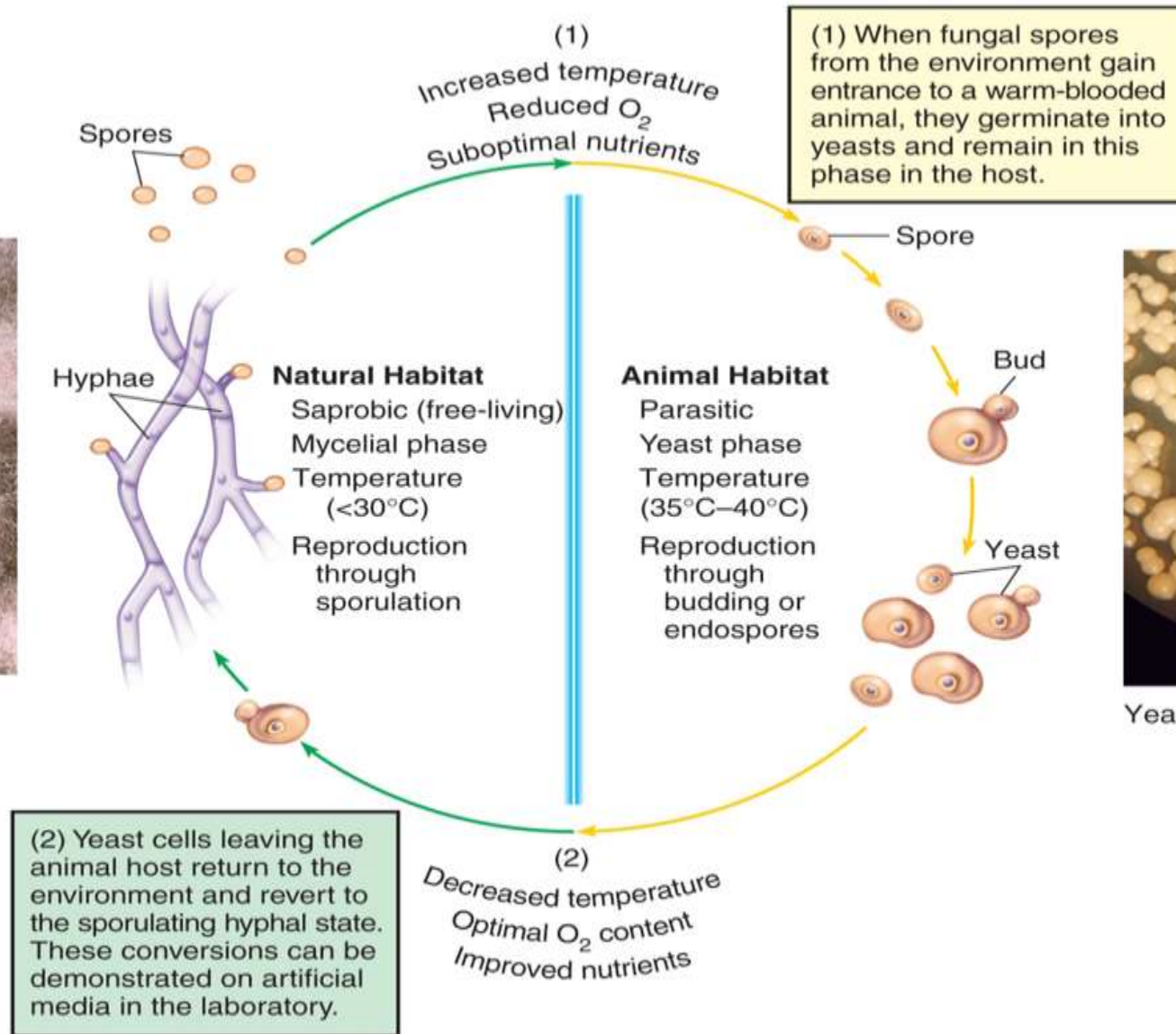
Fungal Pathogens

- **True** or **primary** fungal pathogen can invade and grow in a healthy, noncompromised host
- Most striking adaptation to survival and growth in the human host is the ability to switch from hyphal cells to yeast cells
- **Thermal dimorphism** – grow as molds at 30°C and as yeasts at 37°C

Thermal Dimorphism



Hyphal colonies



Yeast colonies

Epidemiology of the Mycoses

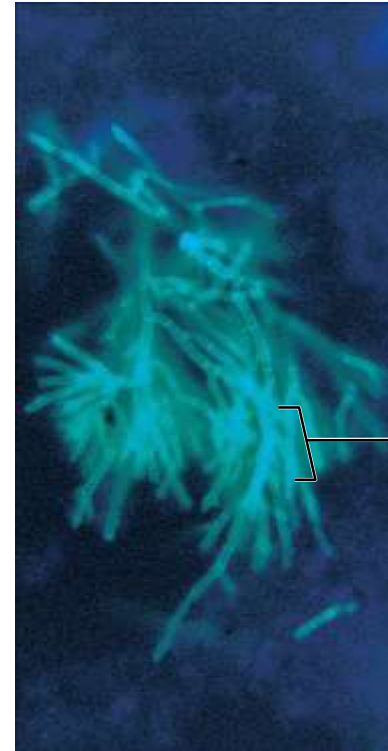
- Most fungal pathogens do not require a host to complete their life cycles and infections are not communicable
- **Dermaphytes** and ***Candida*** sp naturally inhabit human body and are transmissible
- **Dermaphytoses** most prevalent
- Cases go undiagnosed or misdiagnosed

Pathogenesis of the Fungi

- Portal of entry
 - **Primary mycoses** – respiratory portal; inhaled spores
 - **Subcutaneous** – inoculated skin; trauma
 - **Cutaneous and superficial** – contamination of skin surface
- Virulence factors – thermal dimorphism, toxin-like substances, capsules and adhesion factors, hydrolytic enzymes, inflammatory stimulants

Diagnosis of Mycotic Infections

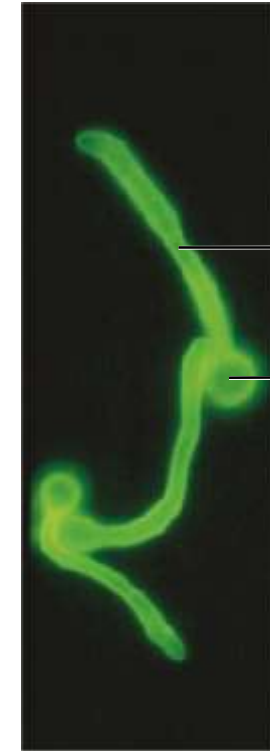
- Diagnosis and identification require microscopic viewing of stained specimens, culturing in selective and enriched media and specific biochemical and serological tests



Branched septate hyphae

© Courtesy Reinhard Ruchel, University Göttingen, Germany

(a)



Young hypha
Germinating yeast

© Mercy Hospital, Toledo, OH/Dr. Brian Harrington/CDC

(b)

Control of Mycotic Infections

- Immunization is not usually effective
- Control involves intravenous amphotericin B, flucytosine, azoles, and nystatin
- In some cases surgical removal of damaged tissues
- Prevention limited to masks and protective clothing to reduce contact with spores

Organization of Fungal Disease

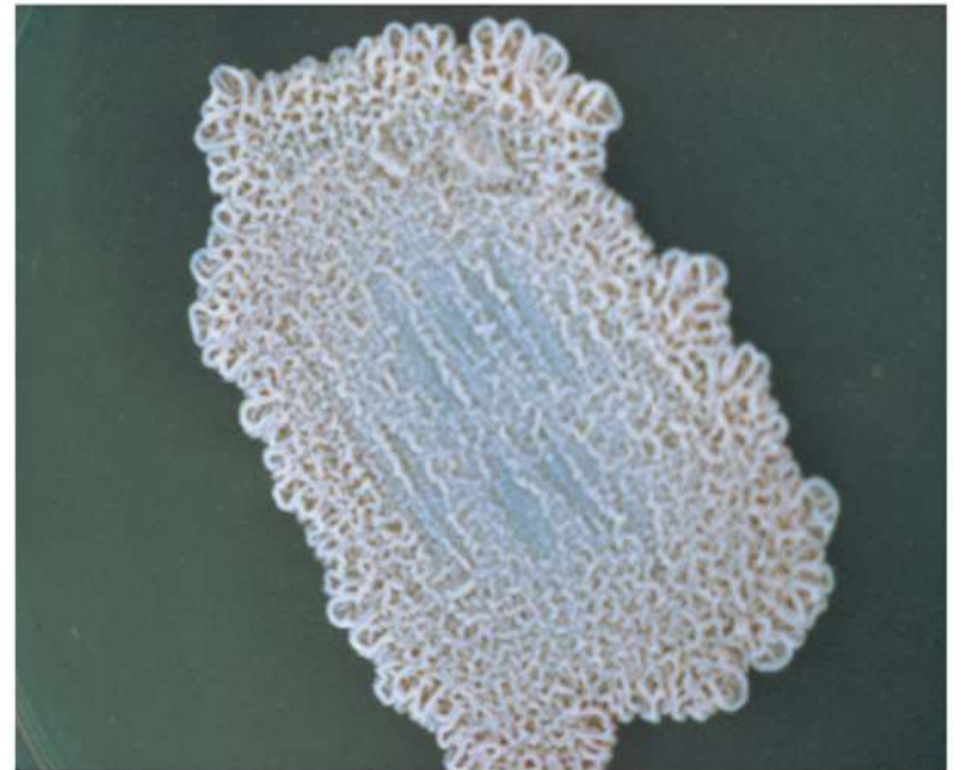
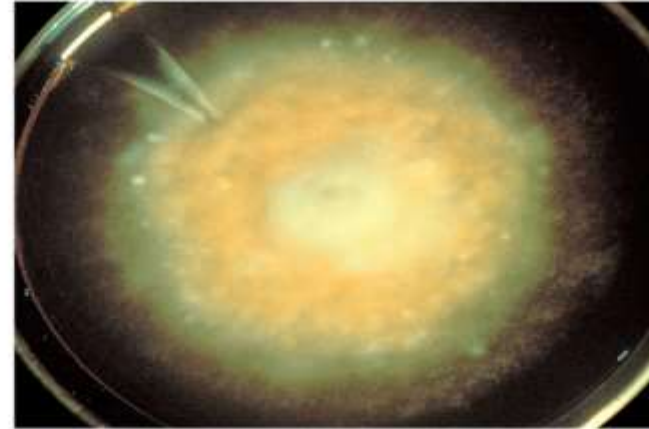
- Mycoses are presented according to type, level of infection, and degree of pathogenicity
 - **True pathogens**: systemic, cutaneous, and superficial mycoses
 - **Opportunistic mycoses**

Systemic Infections by True Pathogens

- Restricted to endemic regions of the world
- Infection occurs when matter containing conidia is disturbed
- Spores germinate in the lungs
- Infection can become systemic
- Spores may be inoculated into the skin

Histoplasmosis: Ohio Valley Fever

- ***Histoplasma capsulatum*** – most common true pathogen; causes **histoplasmosis**
- Typically dimorphic
- Grows in moist soil high in nitrogen content
- Inhaled conidia produce primary pulmonary infection that may progress to systemic involvement of a variety of organs and chronic lung disease
- Amphotericin B, ketoconazole

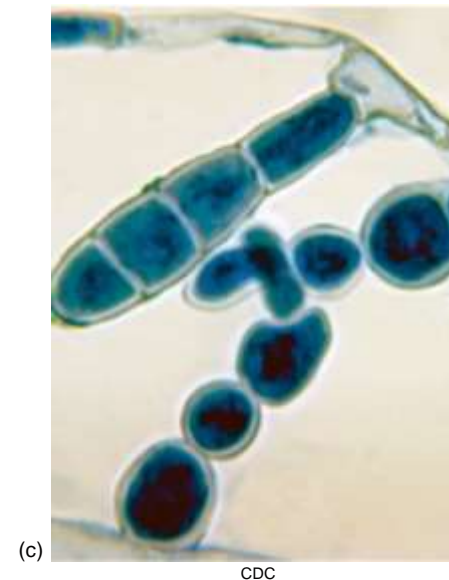


Subcutaneous Mycoses

- **Subcutaneous mycoses:** when fungi are transferred directly into traumatized skin, they can invade
- Most species in this group are greatly inhibited by higher temperatures of the blood and viscera
- Diseases are progressive

Cutaneous Mycoses

- Infections strictly confined to keratinized epidermis (skin, hair, nails) are called **dermatophytoses** – ringworm and tinea
- 39 species in the genera *Trichophyton*, *Microsporum*, *Epidermophyton*
- Closely related and morphologically similar
- Causative agent of ring worm varies case to case



Cutaneous Mycoses

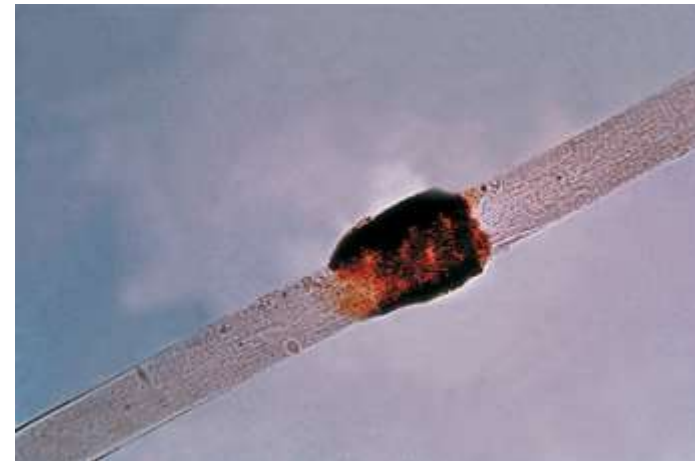
- Natural reservoirs – humans, animals, and soil
- Hardiness of the dermatophyte spores, presence of abraded skin, and intimate contact promote infection
- Long infection period followed by localized inflammation and allergic reactions to fungal proteins

Superficial Mycoses

- **Tinea versicolor** – caused by *Malassezia furfur*; elicits mild, chronic scaling, mottling of skin; also implicated in folliculitis, psoriasis, and seborrheic dermatitis
- **White piedra** – caused by *Trichosporon beigelii*; whitish or colored masses develop scalp, pubic, or axillary hair
- **Black piedra** – caused by *Piedraia hortae*; dark-brown to black gritty nodules, mainly on scalp hairs



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Opportunistic Mycoses

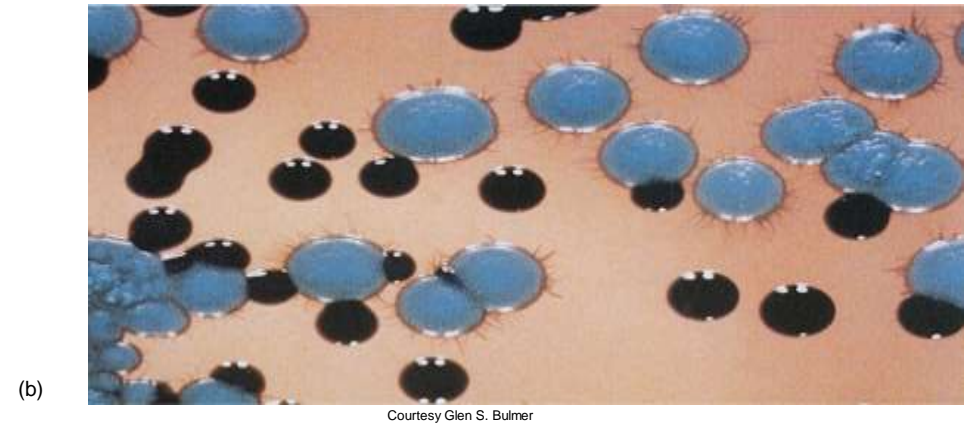
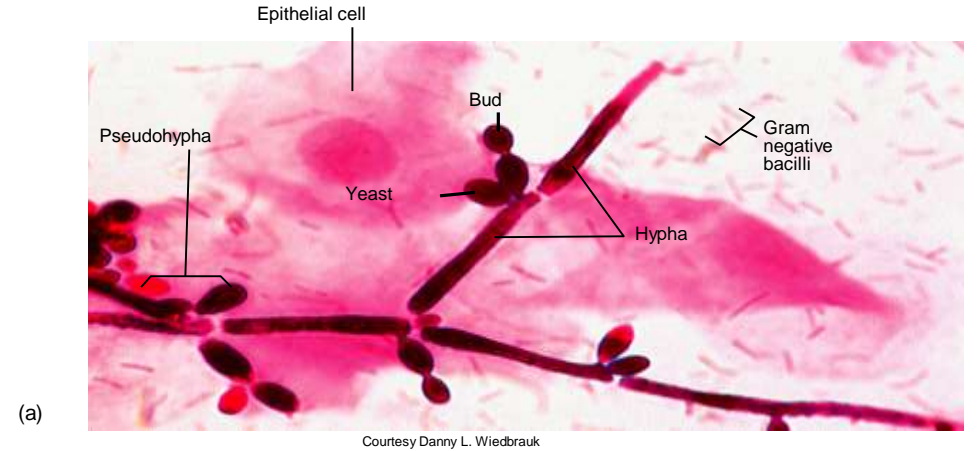
- All have predisposing factors
 - Candida*** – dominant opportunistic pathogen
 - Aspergillus*** – accounts for most lung infections
 - Cryptococcus***
 - Alternaria***
 - Paecilomyces***
 - Fusarium***
 - Rhizopus***

Infections by *Candida*: Candidiasis

- ***Candida albicans***
- Widespread yeast
- Infections can be short-lived, superficial skin irritations to overwhelming, fatal systemic diseases
- Budding cells of varying size that may form both elongate pseudohyphae and true hyphae
- Forms off-white, pasty colony with a yeasty odor

Diagnosis and Treatment

- Presumptive diagnosis made if budding yeast cells and pseudohyphae are found; germ tube
- Growth on selective, differential media differentiates *Candida* species
- Topical antifungals for superficial infections, amphotericin B and fluconazole for systemics



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