



Medical Analysis Department

Faculty of Science



Medical Mycology

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Lec. 1

4th Grade – Spring Semester 2021-2022

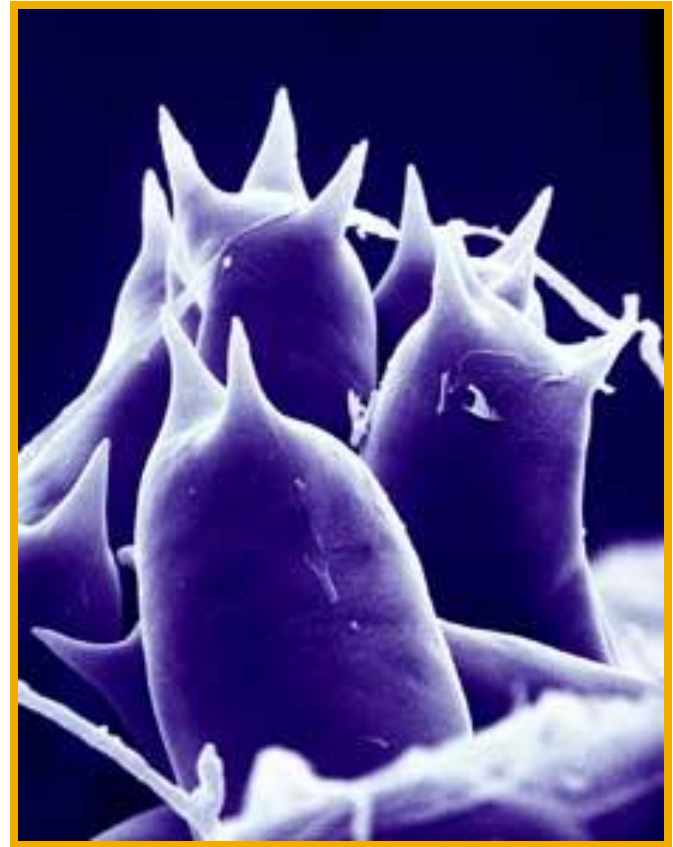
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10/02/2021

Mycology

- Study of fungi
- Fungi found every where



Fungi (fungus)

- Fungi first appeared approximately 1.5 billion years ago
- 100, 000 known fungal species
- Estimated number 1 to 10 million fungal species
- 1000 to 1500 new species every year







Fungal mycelium



Fungi and disease

- The vast majority of fungi are not associated with disease, and many are saprophytic
- Around 500 species are associated with human and animal infections
- Plant fungal pathogens both destroy crops and generate mycotoxins

Fungal infections are becoming more important!!

- Human fungal diseases became a serious problem only during the 20th and 21st centuries
 - Increased efficiency in treating bacterial infections
 - Growth in the number immunodeficient patients
 - Increasing use of indwelling medical devices

Most important

- The most common human fungal pathogens are:
 - *Candida albicans*
 - *Cryptococcus neoformans*
 - *Aspergillus fumigatus*

Where are fungi?

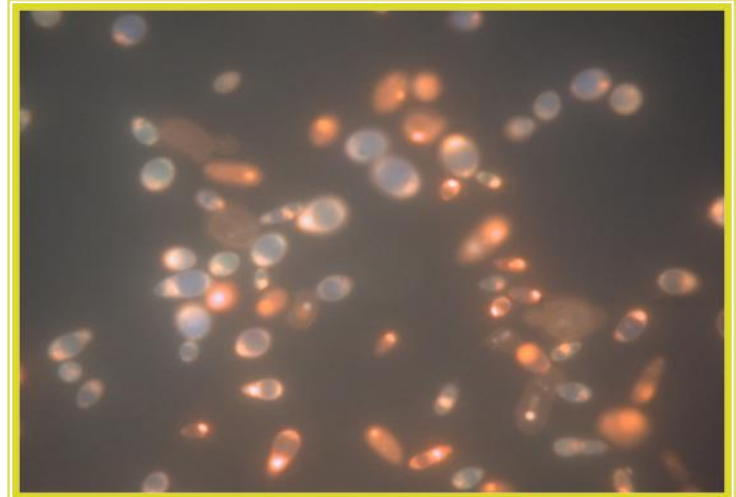
- The 5 Kingdoms or Phyla system
 - Bacteria (heterophilic)
 - Protista (unicellular)
 - Animalia
 - Fungi (heterophilic)
 - Plantae (photosynthesis)

Main characteristics of fungi

- DNA in nucleus, chromosomes
- Mitosis and meiosis
- Mitochondria
- Chitin and glucan in cell wall
- In sensitive to antibiotics

Morphology of fungi?

- Fungi can exist as single cells (yeast)
- Or chains of cells (hyphae)

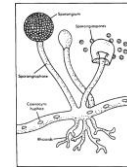


Morphology

- Filamentous
- Yeast
- Dimorphic

Physiology

- Temperature
- Nutrition
- Respiration
- Reproduction





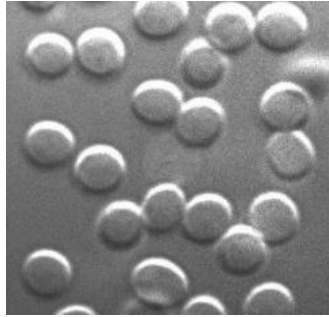
Filamentous culture



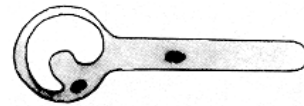
Multicellular filamentous mould

Genus *Aspergillus*

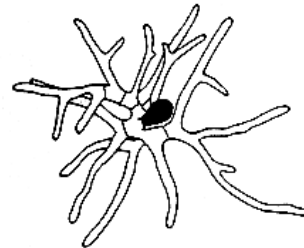




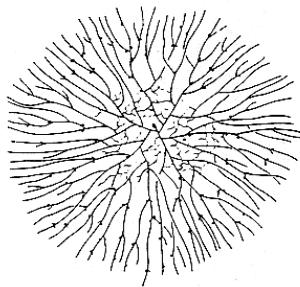
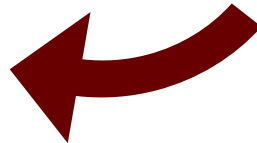
Spores inhaled



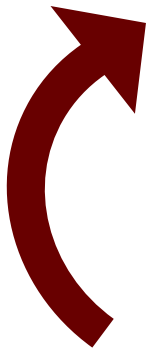
Germination



Hyphal elongation and branching

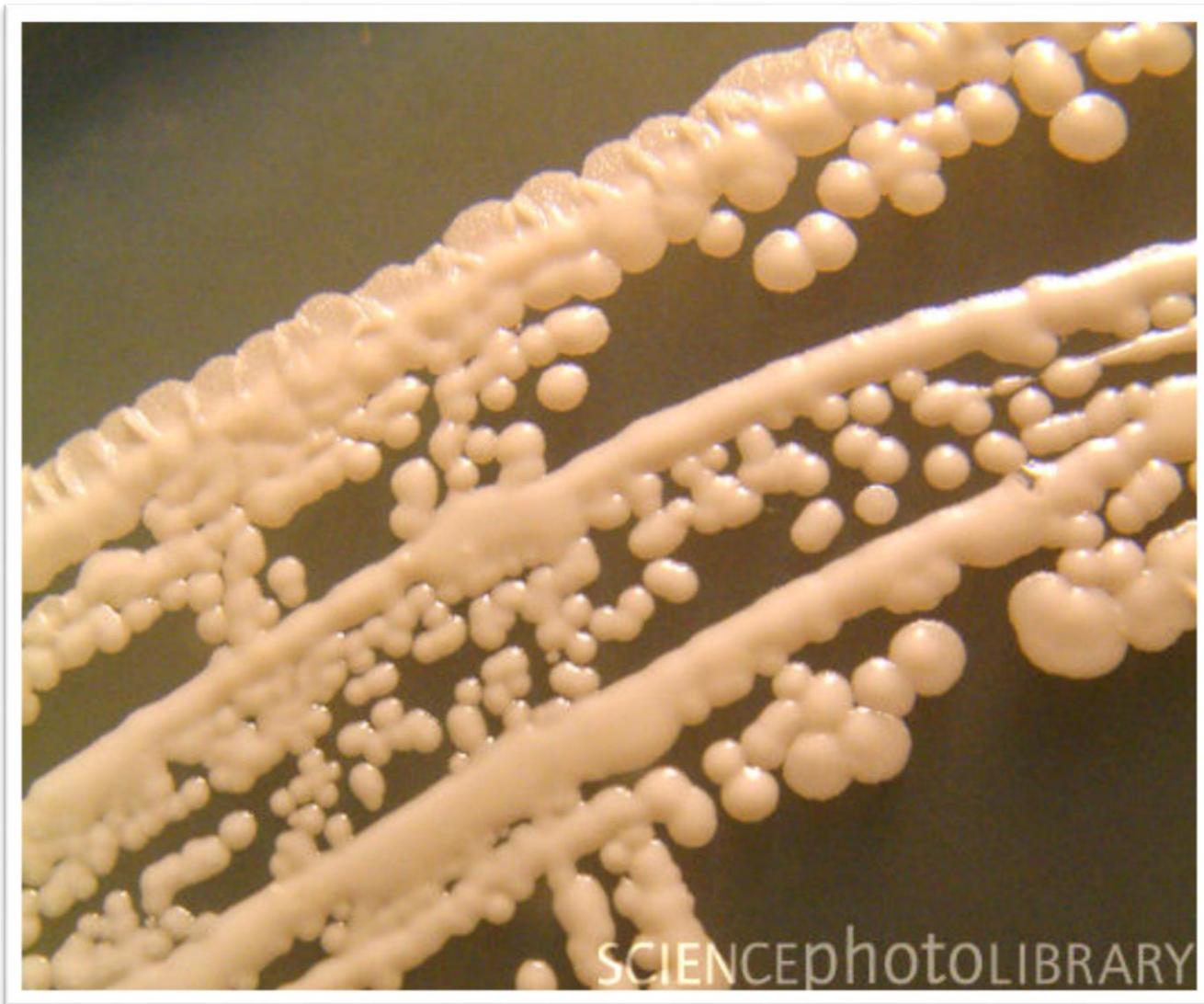


Mass of hyphae

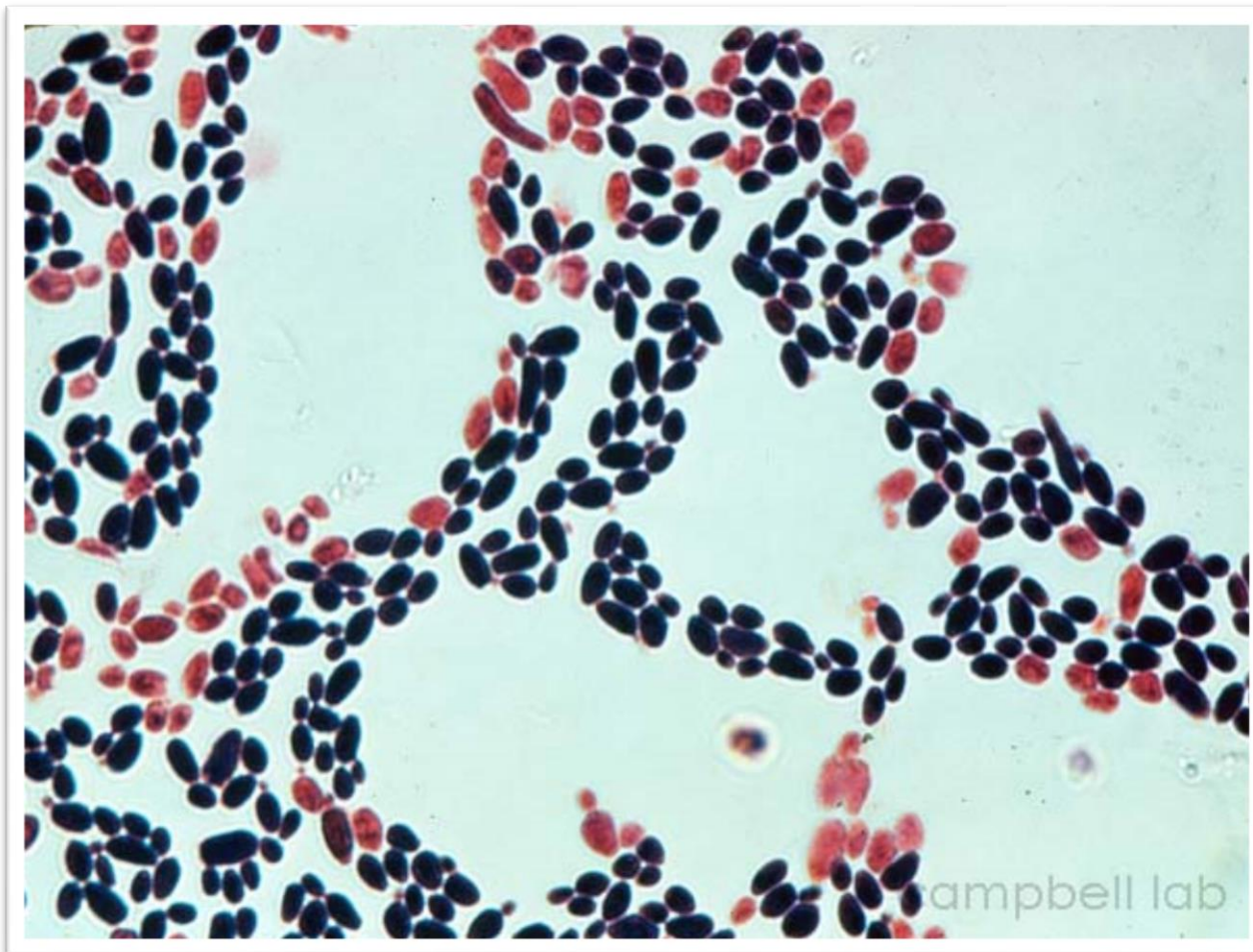


Aspergillus species

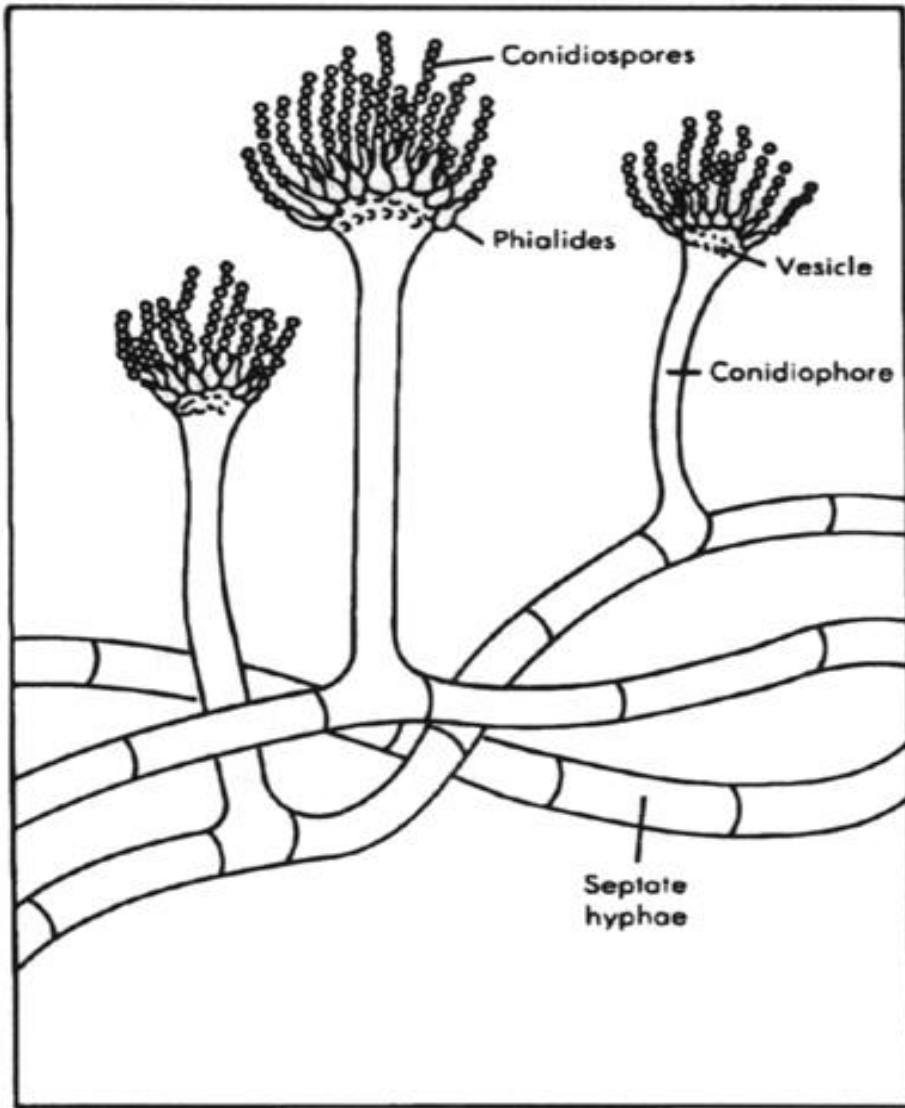
- *Aspergillus fumigatus*
- *Aspergillus flavus*
- *Aspergillus niger*
- *Aspergillus nidulans*
- *Aspergillus terreus*



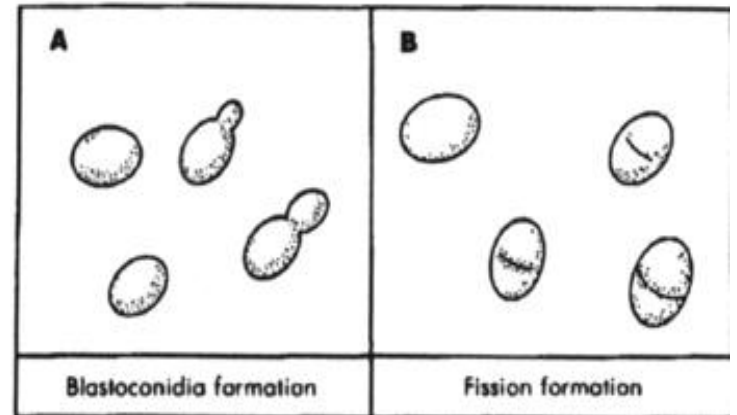
Culture of Candida yeast



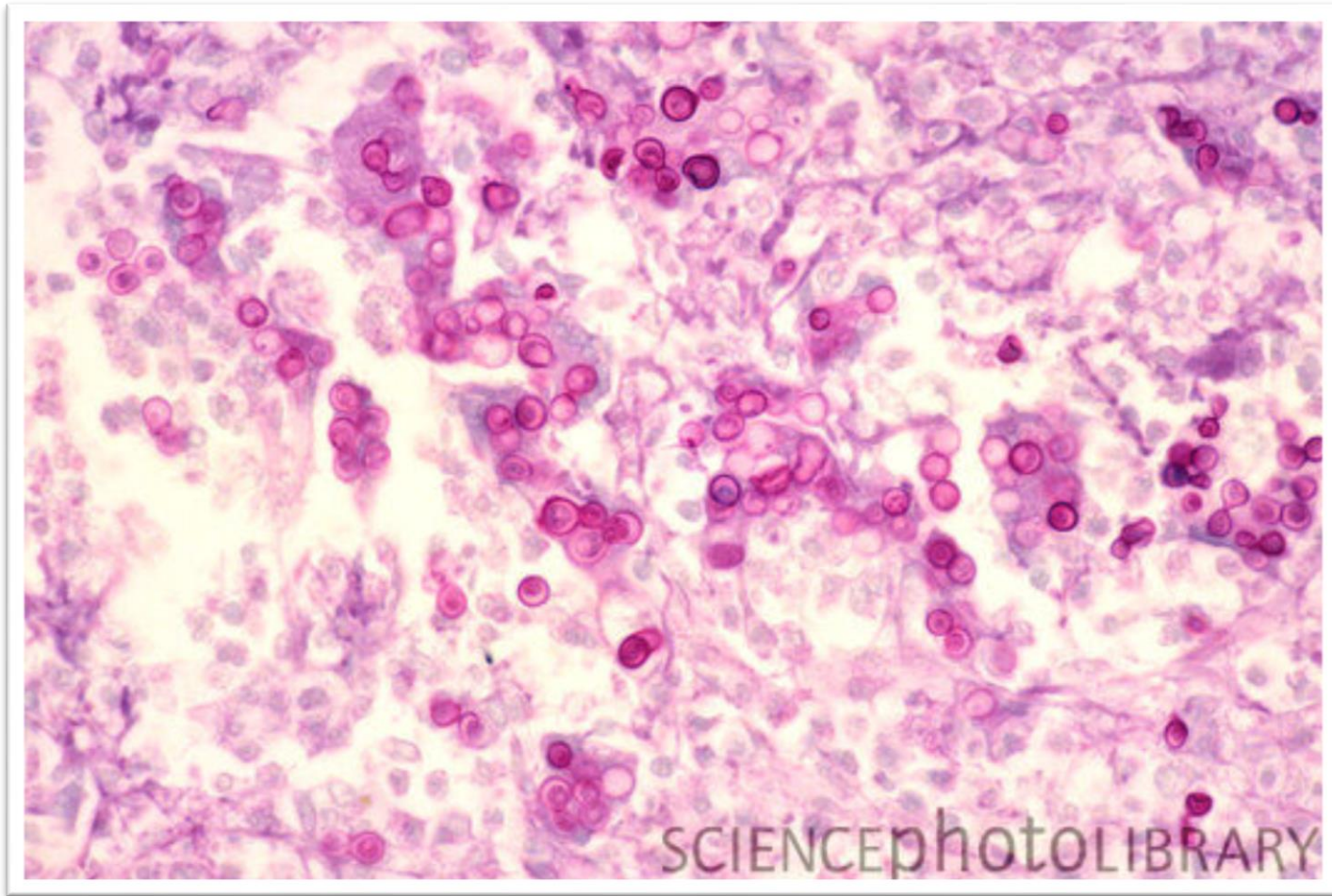
Yeast gram stain



Filamentous fungus



Yeast fungus



Dimorphic fungus in brain tissue

Where do fungi live?





Image Courtesy of M. McGinnis
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Helpful fungi: In every day life

- Nitrogen and Carbon
- Mushrooms and Quorn
- *Saccharomyces cerevisiae*
- *Aspergillus oryzae* and *Aspergillus niger*
- Flavours and vitamins
- Penicillin and cyclosporine
- Molecular cloning and cancer research

Section two

FUNGI OF MEDICAL IMPORTANCE

Fungal infections

- Caused by only \approx 500 species out of 100,000
- Primary infections
- Opportunistic infections
- Myco-toxins
- Allergy

Mycoses

- Superficial and cutaneous
- Subcutaneous
- Deep (systemic)

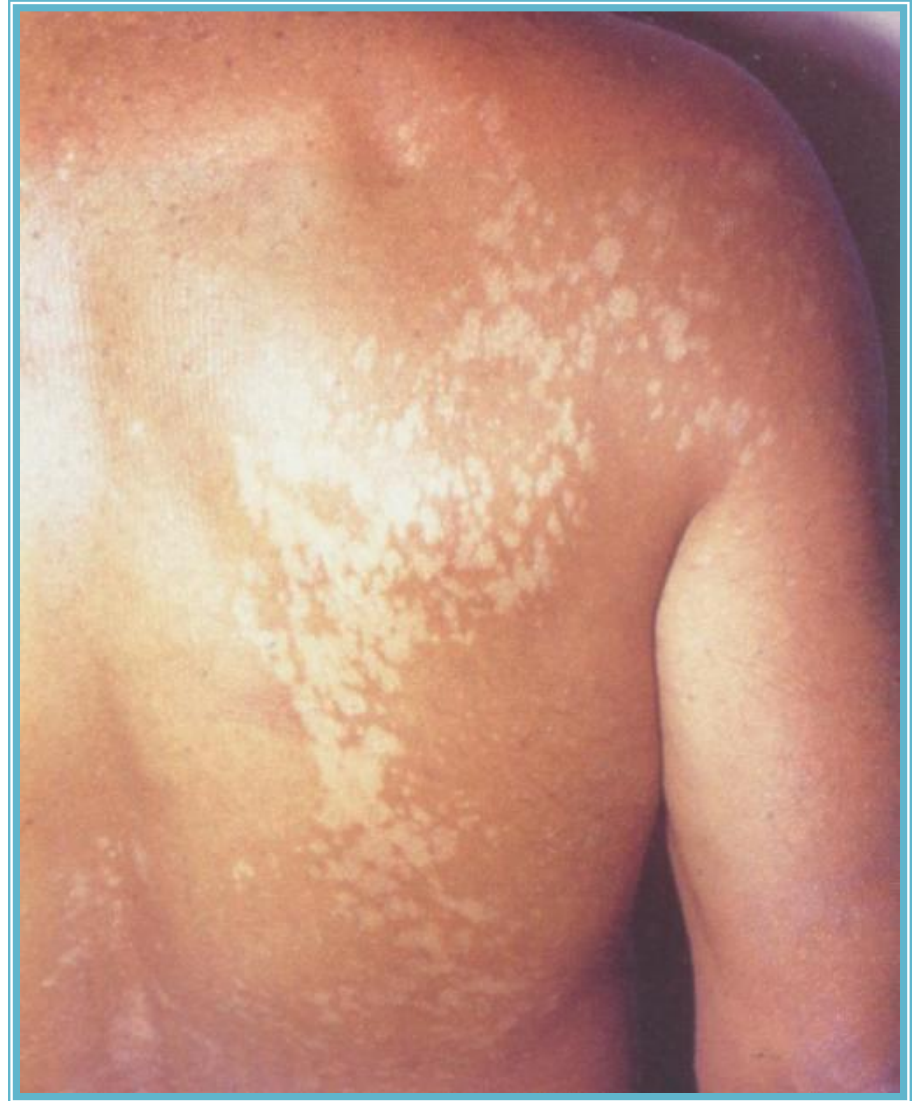
Examples of yeast of medical importance

- *Candida species*
 - *Germ tube test*
 - *Cycloheximide susceptibility*
 - *Growth at 45° C*
- *Cryptococcus neoformans*
 - *Capsulated yeast → India Ink staining*
- *Malassezia species*
 - *Lipophilic → media supplemented with lipids*

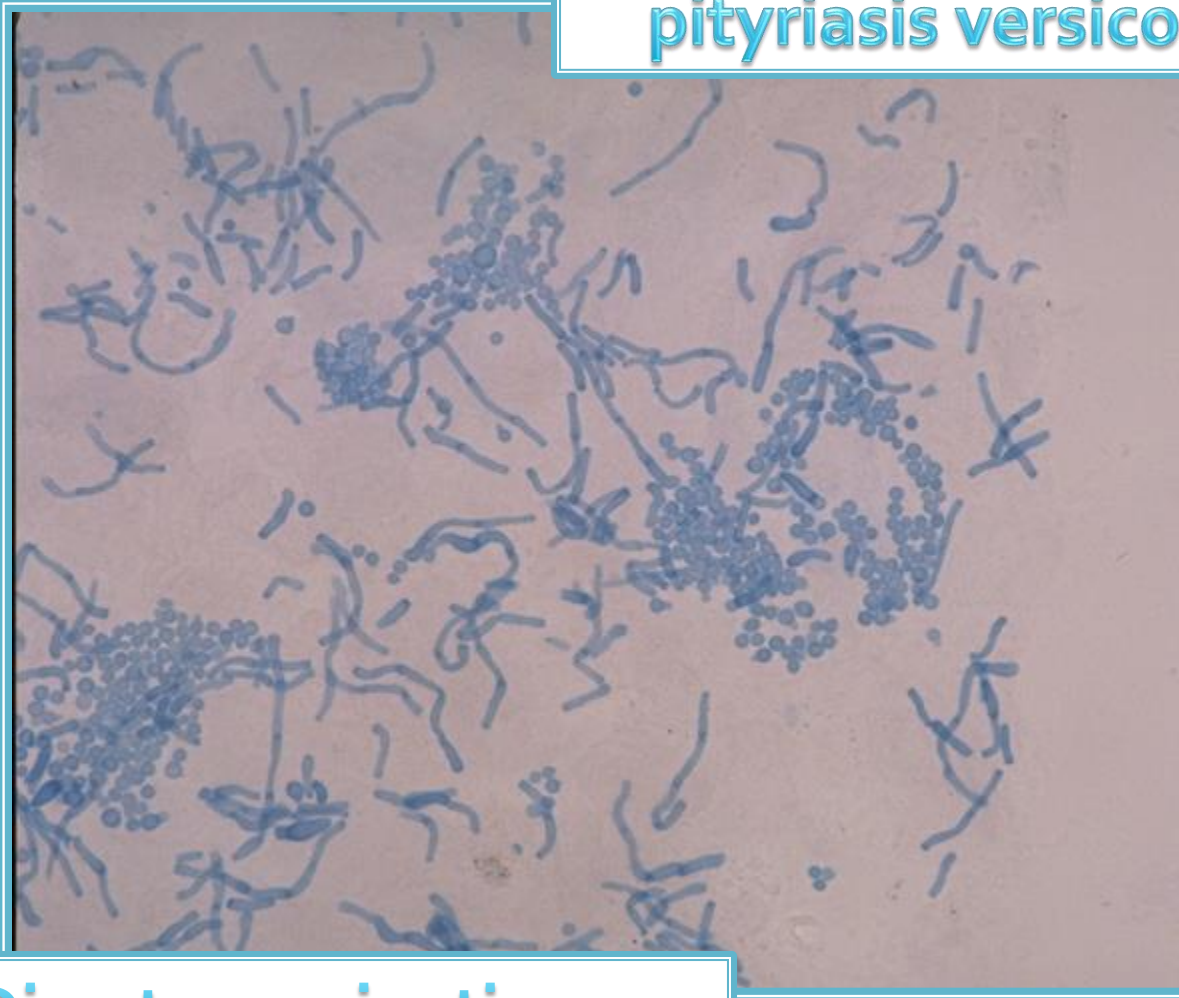
Identification of yeast

- Morphology
- Mode of sporulation
 - Sexual (ascospores and basidiospores)
 - Asexual (blastocidia, pseudo-hyphae, true-hyphae, arthrospores, ...etc)
- Physiological tests

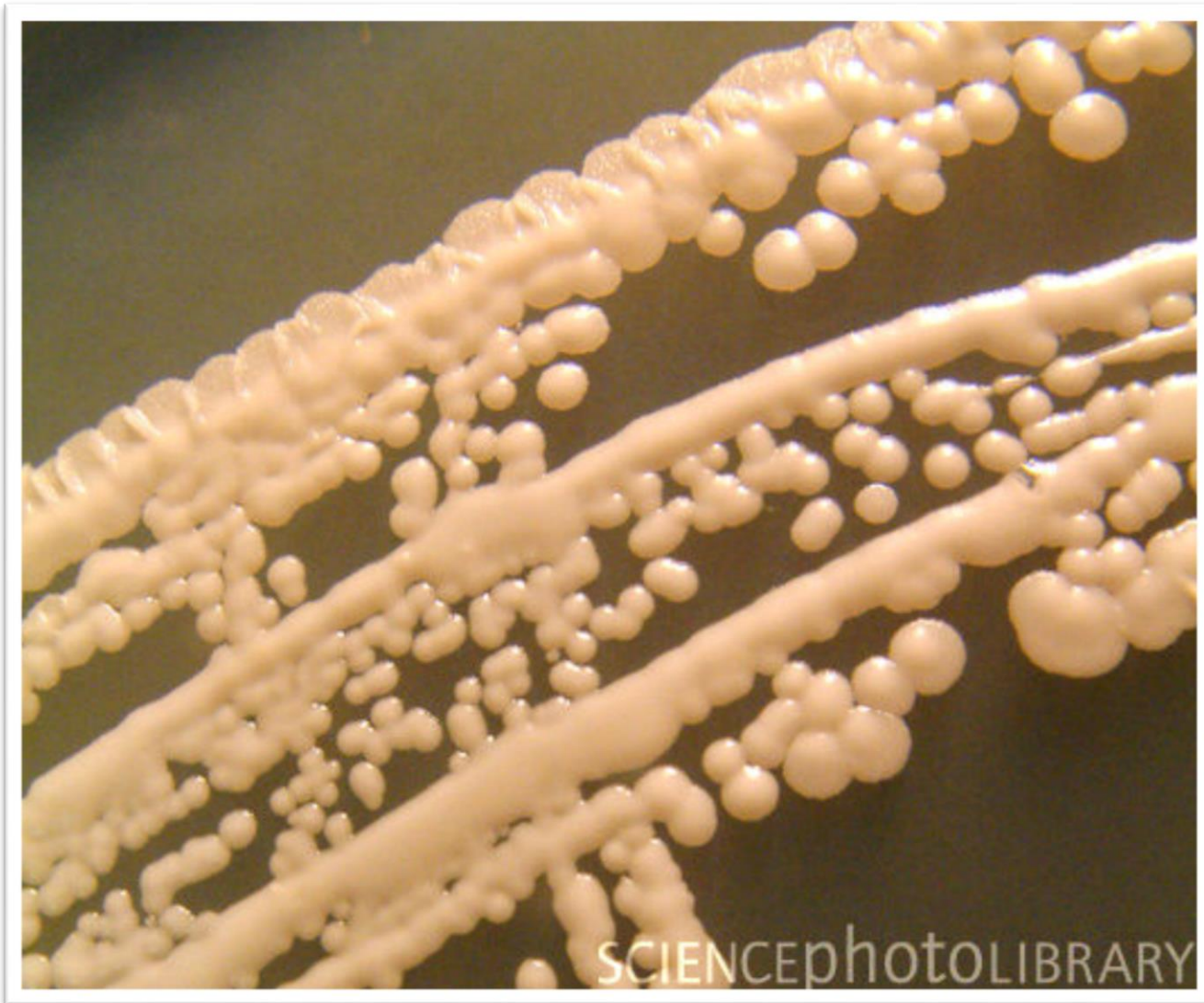
pityriasis versicolor caused
by *Malassezia* species



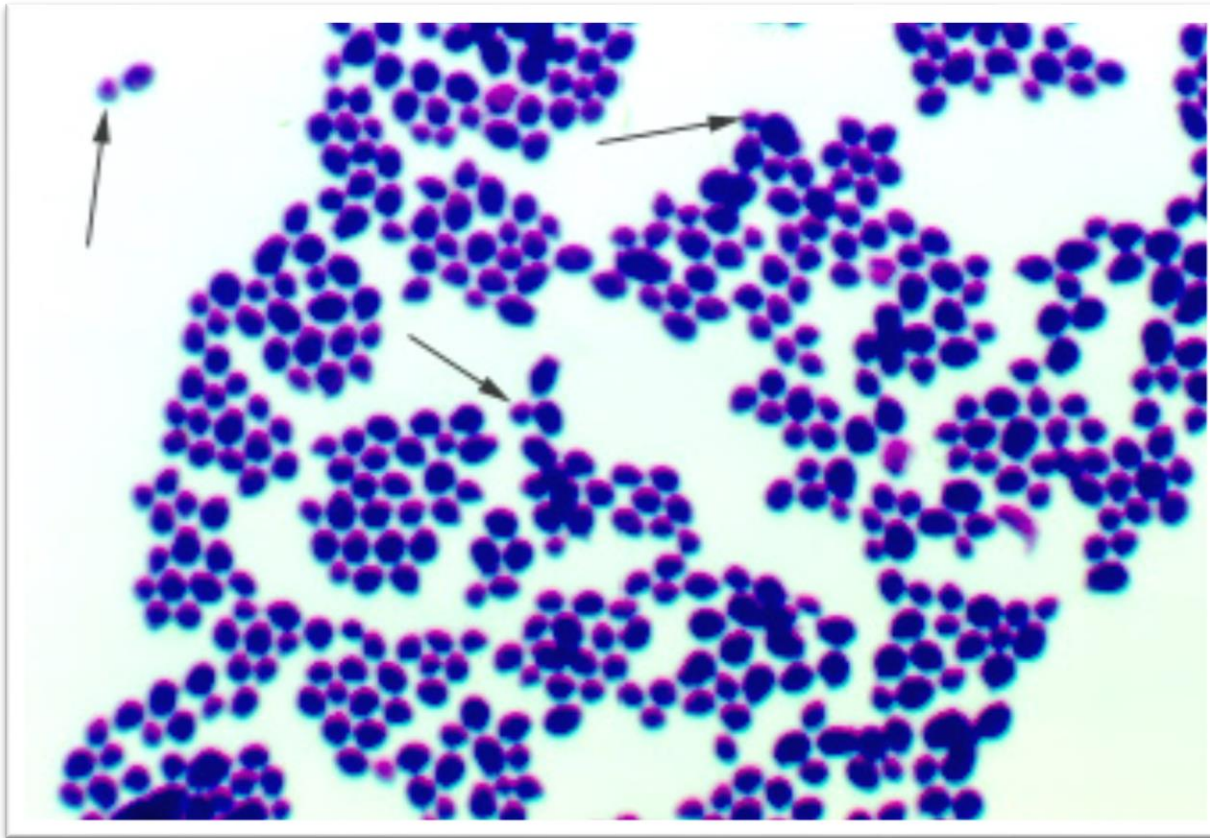
pityriasis versicolor



Direct examination



Culture of Candida yeast



Candida albicans "methylene blue stain"

Candida species

- *C. albicans* (50-60 % of all yeast infections)
- *C. glabrata*
- *C. tropicalis*
- *C. parapsilosis*

Examples of moulds of medical importance

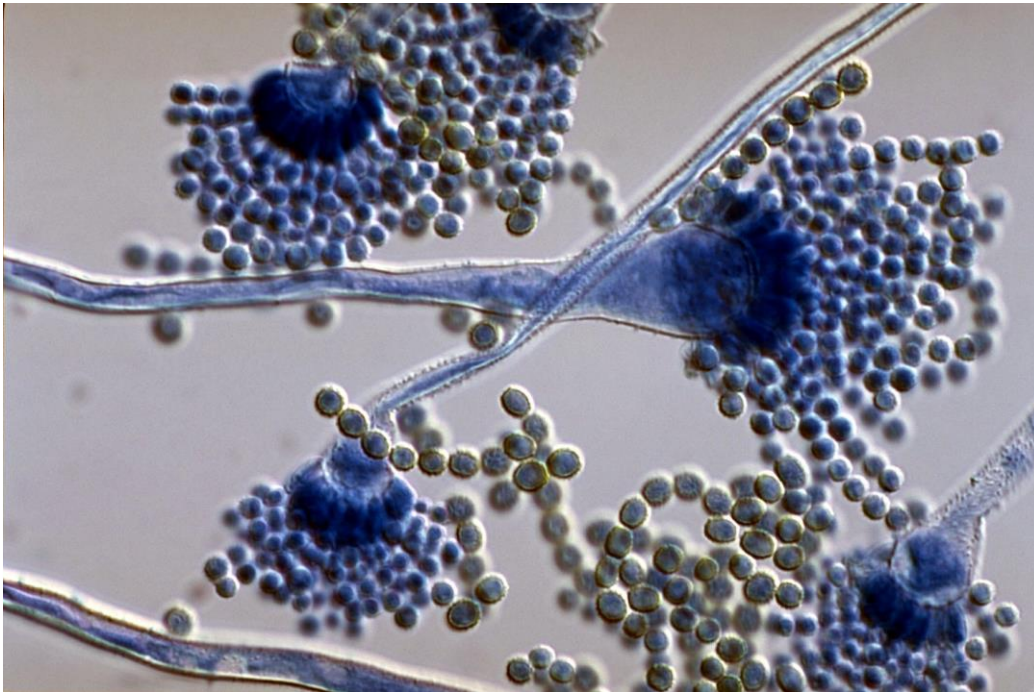
- Dermatophytes
- *Aspergillus* species
- *Zygomycetes*



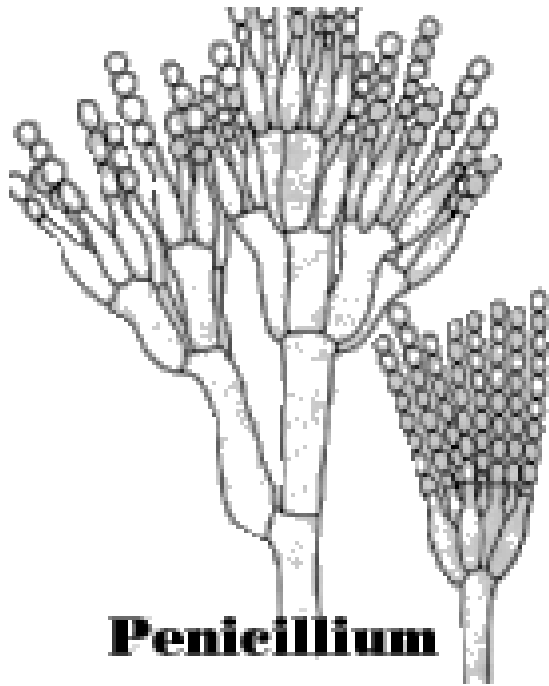
Identification of moulds

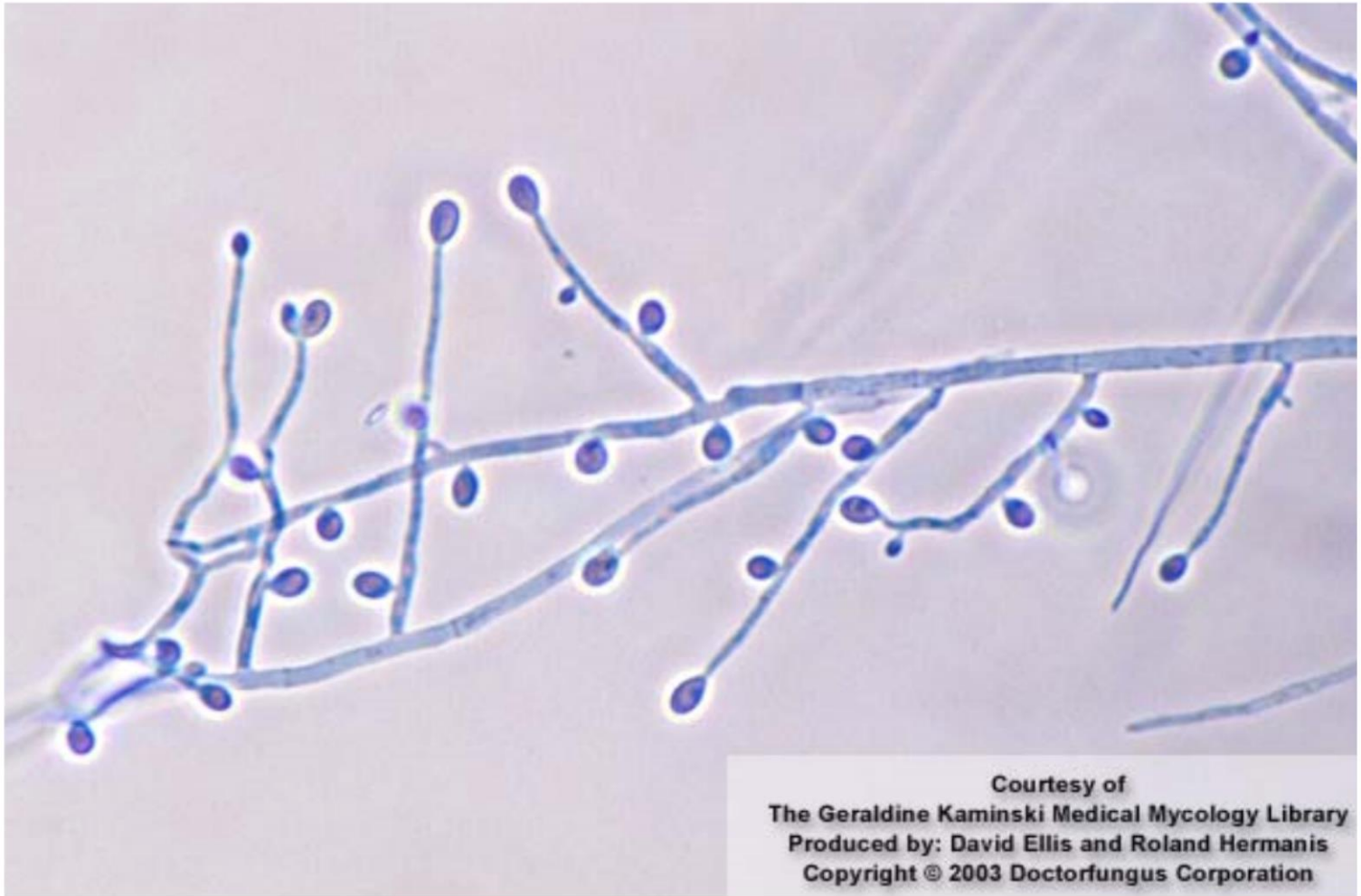
- Hyphae Septation
 - Zygomycetes
 - Ascomycetes or basidiomycetes
- Rate of growth
- Color of hyphae
- Mode of sporulation
 - Sexual (ascospores, basidiospores, or zygospores)
 - Asexual (conidia, micro or macro-conidia, sporangiospores, arthrospores, ...etc)

Aspergillus species



Penicillium species





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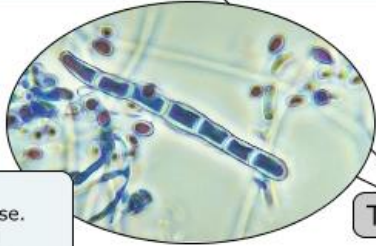
Scedosporium apiospermum

Dermatophytes

Trichophyton

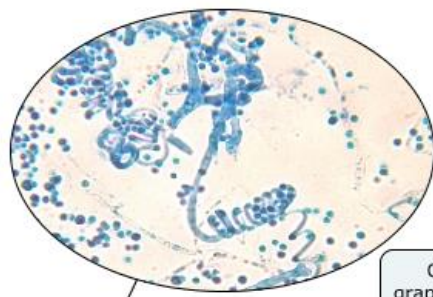
T. rubrum

Colony with white center and red periphery and red reverse. Macroconidia with parallel sides that may break into arthroconidia, microconidia with 'bird on wire' appearance, no fluorescence, hair perforation test negative, urea negative.



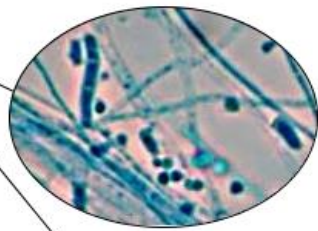
T. mentagrophytes

Cigar-shaped macroconidia, grape-like clusters of microconidia, spiral hyphae, no fluorescence, hair perforation test positive, urea positive at 5 days.



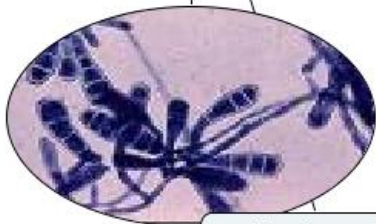
T. tonsurans

Rare, irregular macroconidia, numerous microconidia in various shapes, intercalary and terminal conidia, no fluorescence, hair perforation test positive at 14 days, requires thiamine.



Epidermophyton

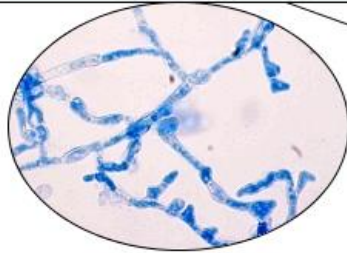
No microconidia
Macroconidia beaver tail
No special structures



Microsporum

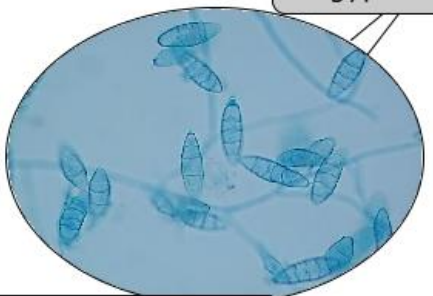
M. audouinii

Ringworm.
Colony off-white with salmon reverse. Pectinate hyphae, poorly shaped macroconidia called spindle, rare microconidia, hair perforation test negative, yellow-green fluorescence.

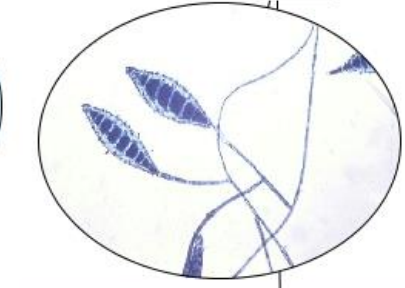


M. gypseum

Symmetric macroconidia with somewhat rounded ends and no more than 6 compartments, microconidia are club-shaped, no fluorescence, hair perforation test positive, urea positive.



M. canis



Colony with white center ringed with yellow. Spindle macrospores, bud-like microspores, yellow-green fluorescence, hair perforation test positive, urea positive, yellow pigment when grown on rice.

Dermatophytes



Tinea corporis



Tinea corporis caused by *M. canis* following contact with infectious cat

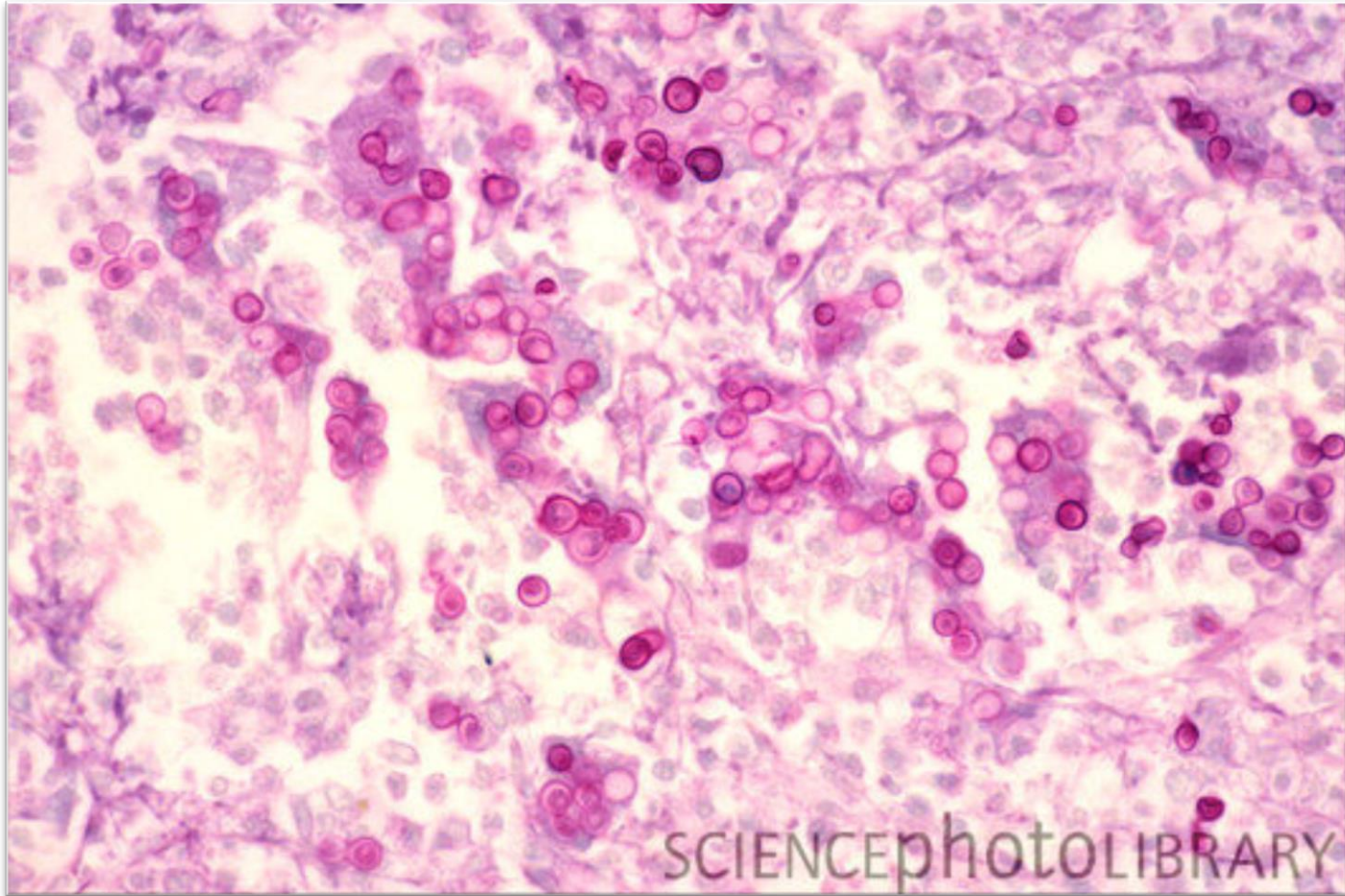
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Hyphae in skin scraping

Examples of dimorphic fungi of medical importance

- *Blastomyces dermatitidis*
- *Histoplasma* species
- *Coccidioides immitis*
- *Paracoccidioides brasiliensis*



Blastomycosis in the brain