MYCOLOGY

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INTRODUCTION

- Mycology is the study of fungi, which are eukaryotic organisms

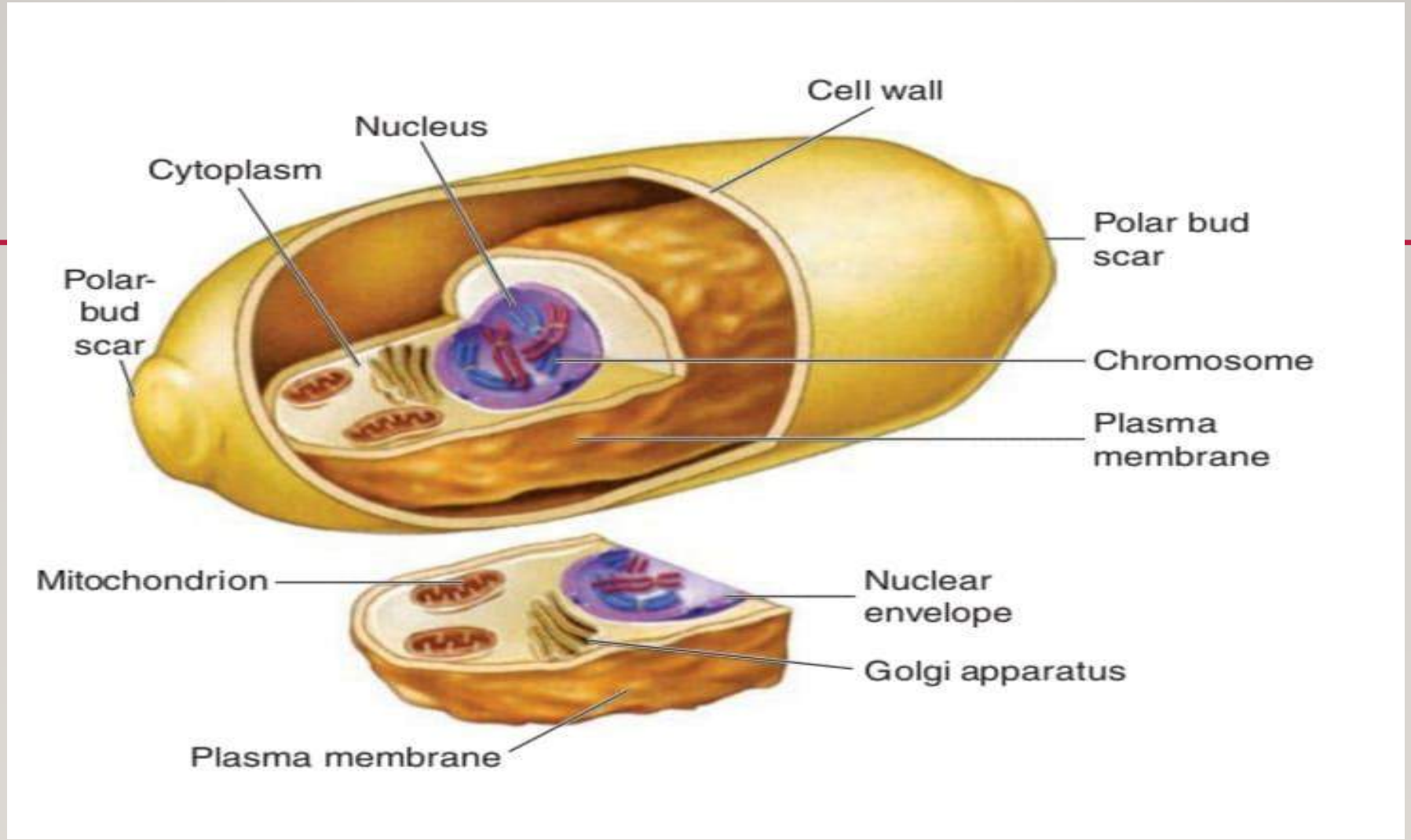
Fungi are eukaryotes with a higher level of biologic complexity than bacteria. They are:-

- spore-bearing, reproducing both sexually and asexually. Fungi may be unicellular or may
- differentiate and become multicellular by the development of long, branching filaments.

- unlike animals most fungi are nonmotile and possess a rigid cell wall. Unlike plants, fungi are nonphotosynthetic.

STRUCTURE

- The fungal cell has many typical eukaryotic features, including a nucleus with a nucleolus, nuclear membrane, and linear chromosomes .The cytoplasm contains a cytoskeleton with actin microfilaments and tubulin-containing microtubules. Ribosomes and organelles, such as mitochondria, endoplasmic reticulum, and the Golgi apparatus, are also present.


Cell wall
Nucleus
Cytoplasm
Polar bud scar
Polar-bud scar
Chromosome
Plasma membrane
Mitochondrion
Nuclear envelope
Golgi apparatus
Plasma membrane

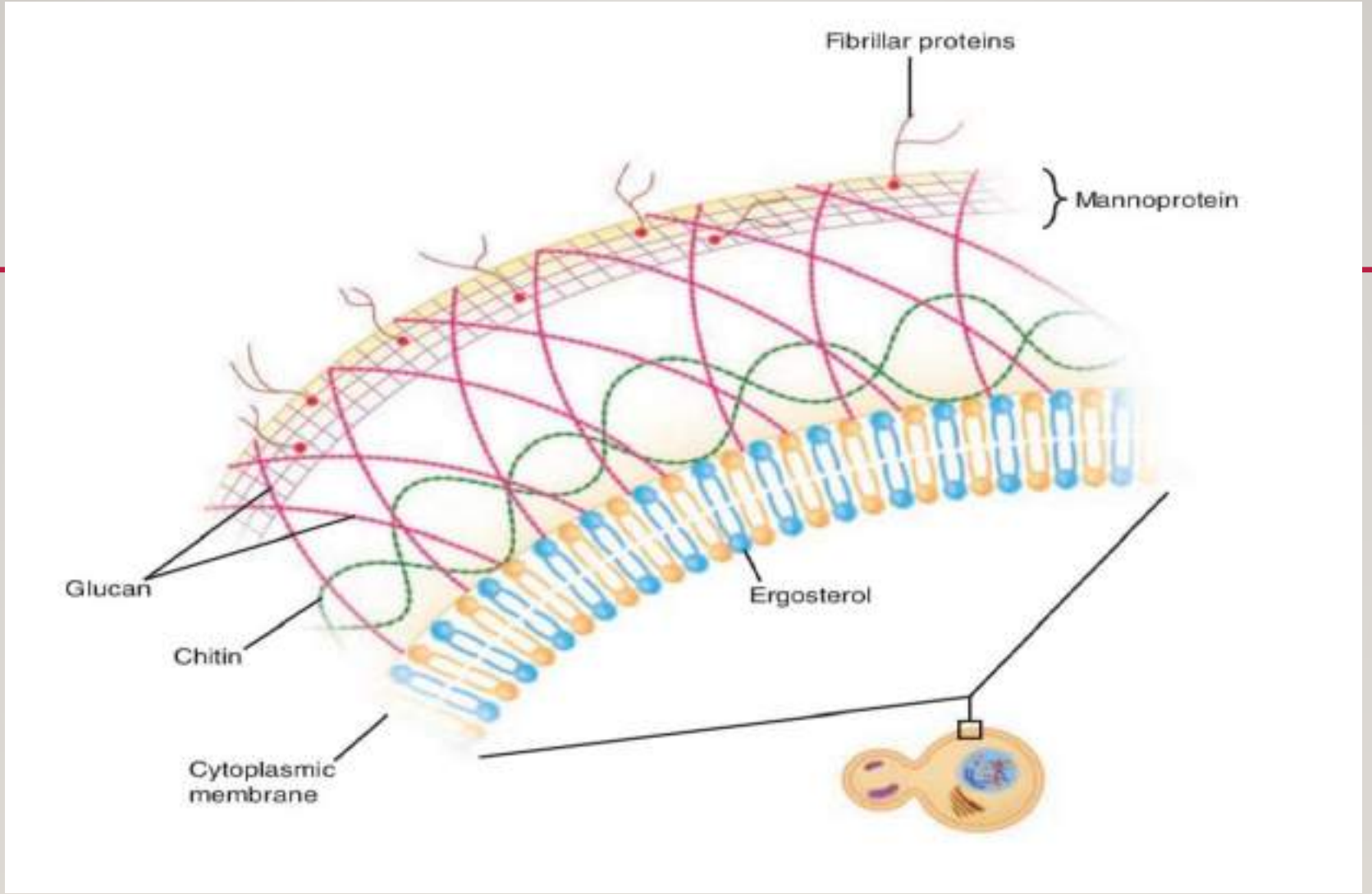
STRUCTURE

- **Cell wall**

Fungal cells have a rigid cell wall external to the cytoplasmic membrane, which differs in its chemical composition from the cell walls of bacteria and plants. In addition to the cell wall, another important difference from mammalian cells is the sterol makeup of the cytoplasmic membrane. In mammalian cells, the dominant membrane sterol is cholesterol; in fungi, it is ergosterol.

CELL WALL

- The chemical structure of the cell wall in fungi is markedly different from that of **bacterial cells** in that it does not contain peptidoglycan, glycerol, teichoic acids, or lipopolysaccharide. In their place are complex polysaccharides such as mannans, glucans, and chitins in close association with each other and with structural proteins


Fibrillar proteins
Mannoprotein
Glucan
Chitin
Ergosterol
Cytoplasmic membrane

REPRODUCTION

- Fungi may reproduce by either asexual or sexual process.
- **The asexual** form is called the anamorph, and its reproductive elements are termed **conidia**.
- **The sexual** form is called the teleomorph, and its reproductive structures are called **spores.**

TYPES OF CONIDIA (ASEXUAL SPORES)

- **Arthroconidia** (arthrospores): Conidia that result from the fragmentation of hyphal cells
- **Blastoconidia** (blastospores): Conidia that are produced by budding (eg, yeasts).
- **Chlamydoconidia** (Chlamydospores): Large, thick-walled, usually spherical conidia produced from terminal or intercalary hyphal cells.

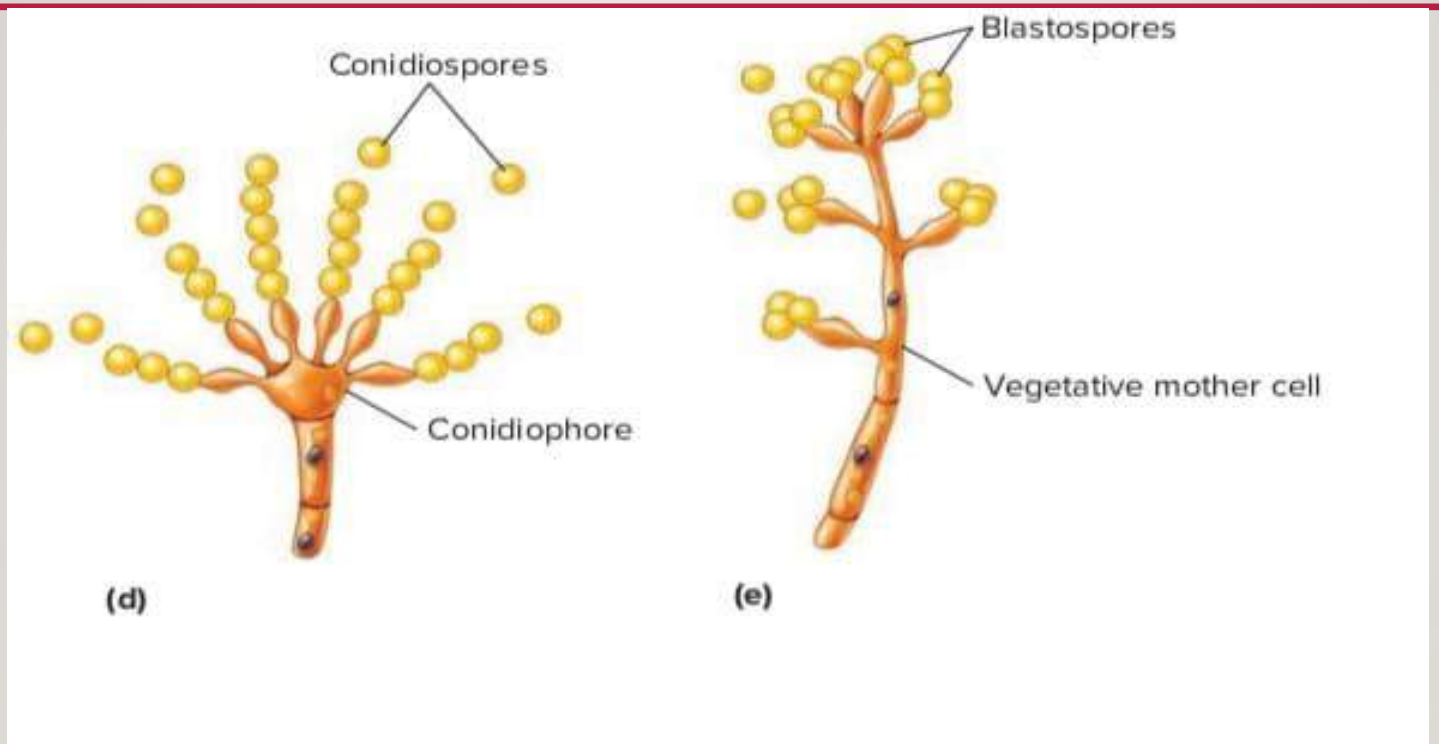
TYPES OF CONIDIA (ASEXUAL SPORES)

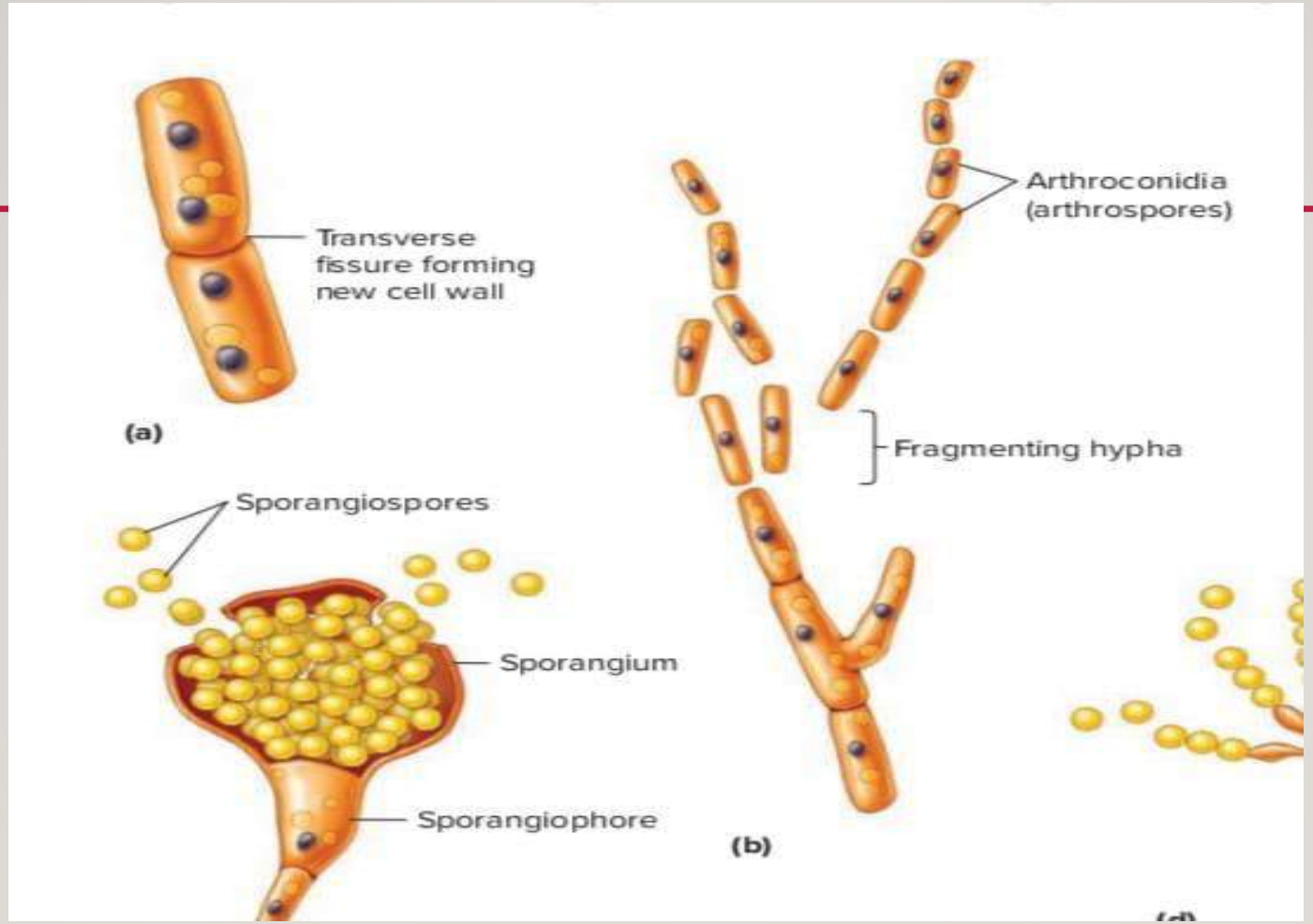
- **Phialoconidia**: Conidia that are produced by a "vaseshaped" conidiogenous cell termed a phialide (eg, *Aspergillus fumigatus*).

- **Sporangiospores**: Asexual structures characteristic of the Order *Mucorales*; they are mitotic spores produced within an enclosed sporangium, often supported by one sporangiophore.

SEXUAL SPORES

- **Ascospores**: In the Phylum Ascomycota, following meiosis, four to eight meiospores form within an ascus.
- **Basidiospores**: In the Phylum Basidiomycota, following meiosis, four meiospores usually form on the surface of a specialized structure, a club-shaped basidium.
- **Zygospores**: In the Order Mucorales, following meiosis, a large, thick-walled zygospore develops.


Conidiospores
Conidiophore
(d)
Blastospores
Vegetative mother cell
(e)


Transverse fissure forming new cell wall
(a)
Sporangiospores
Sporangium
Sporangiophore
Arthroconidia (arthrospores)
Fragmenting hypha
(b)


Ascomycota
Basidiomycota

IMPORTANT TERMS

- **Yeasts** are fungi that primarily grow in a round cellular form.
- **Molds** are fungi that primarily grow as filamentous, tube-like structures called hyphae
- **Dimorphic fungi**: Fungi that have two growth forms, such as a mold and a yeast, which develop under different growth conditions (eg, Blastomyces dermatitidis forms hyphae in vitro and yeasts in tissue).

IMPORTANT TERMS

- **Hyphae:** Tubular**,** branching filaments of fungal cells, the mold form of growth. Most hyphal cells are separated by porous cross-walls or **septa**
- **Pseudohyphae**: Chains of elongated buds or blastoconidia; the septations between cells are constricted
- **Mycelium**: Mass or mat of hyphae, mold colony.

IMPORTANT TERMS

- **Mycoses** :diseases caused by fungi in animals .
- **Dematiaceous fungi**: Fungi whose cell walls contain melanin, which imparts a brown to black pigment.

SUPERFICIAL MYCOSES

- **1- Malassezia infections** These yeasts can be isolated from **normal** skin and scalp and are considered part of the cutaneous mycobiota. Thus, infections are likely caused by **endogenous strains**.

Pityriasis versicolor is a highly prevalent, chronic superficial infection of the stratum corneum caused by species of the lipophilic yeast, Malassezia

SPECIES

There are 14 currently recognized species of Malassezia, but the vast majority of cases of pityriasis versicolor are caused by

- *Malassezia globosa,*
- *Malassezia furfur, or*
- *Malassezia sympodialis*

CLINICAL FINGINGS

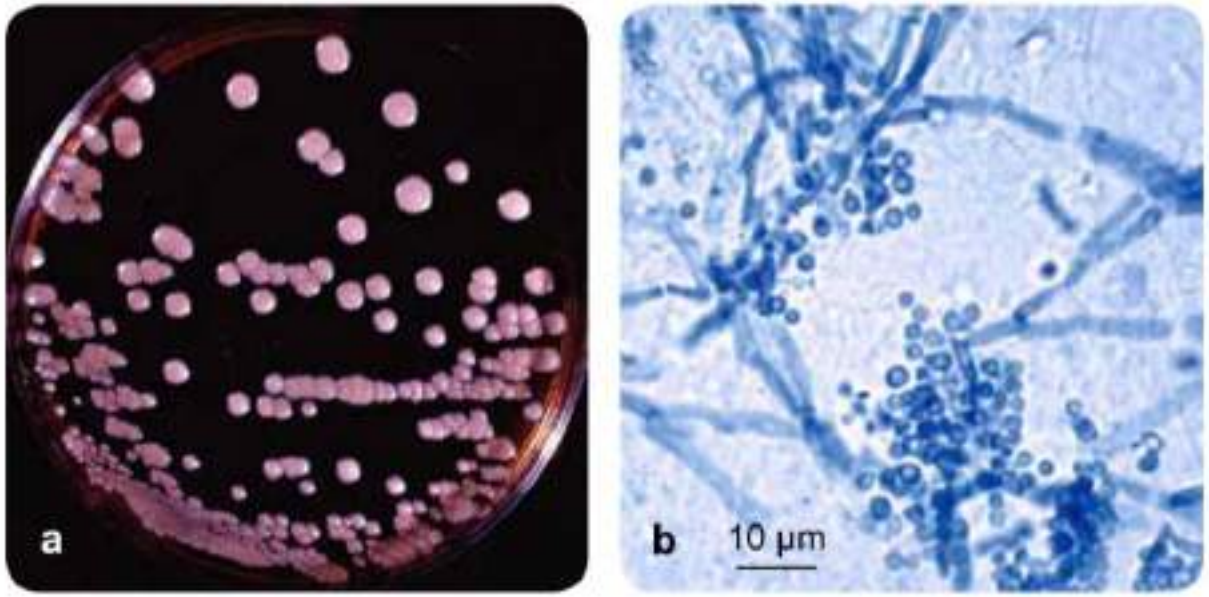
- The infection is characterized by discrete, serpentine, hyper-, or hypopigmented maculae that develop on the skin, usually on the chest, upper back, arms, or abdomen. These patches of discolored skin may enlarge and coalesce, but scaling, inflammation, and irritation are minimal.

PREDISPOSING CONDITIONS

- the immune status of the patient,
- genetic factors, and
- elevated temperature and humidity

THE DIAGNOSIS

- is confirmed by direct KOH microscopic examination of scrapings of infected skin. Short unbranched, nonpigmented hyphae and spherical cells are observed.



Malassezia furfur (a) culture on modified Dixon's agar and (b) direct microscopy of skin scrapings showing characteristic clusters of thick-walled round, budding yeast-like cells and short angular hyphal forms (the so called "spaghetti and meatballs" appearance) typically seen in pityriasis versicolor.

TREATMENT

- Daily applications of selenium sulfide.
- Topical or oral azoles are also effective.

NOTE :The goal of treatment is not to eradicate Malassezia from the skin but to reduce the cutaneous population to commensal levels.

SUPERFICIAL MYCOSES

2-Tinea Nigra (or tinea nigra palmaris) is a superficial chronic and asymptomatic infection of the stratum corneum caused by the dematiaceous fungus *Hortaea (Exophiala) werneckii*. This condition is more prevalent in warm coastal regions and among young women

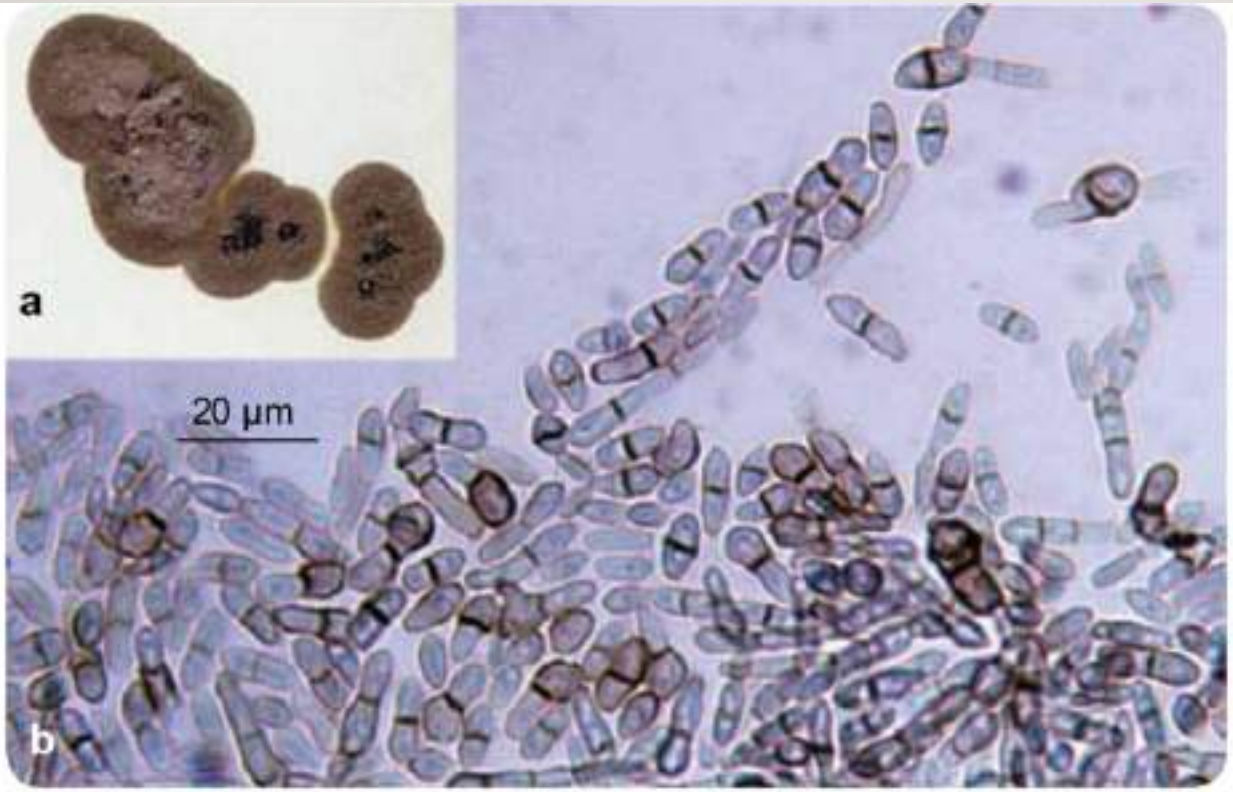
CLINICAL FINDINGS

- The lesions appear as a dark (brown to black) discoloration, often on the **palm**

DIAGNOSIS AND TREATMENT

- Microscopic examination of skin scrapings from the periphery of the lesion will reveal branched, septate hyphae and budding yeast cells with melanized cell walls.

- Tinea nigra will respond to treatment with keratolytic solutions, salicylic acid, or azole antifungal drugs.



Hortaea werneckii (a) culture and (b) conidia.

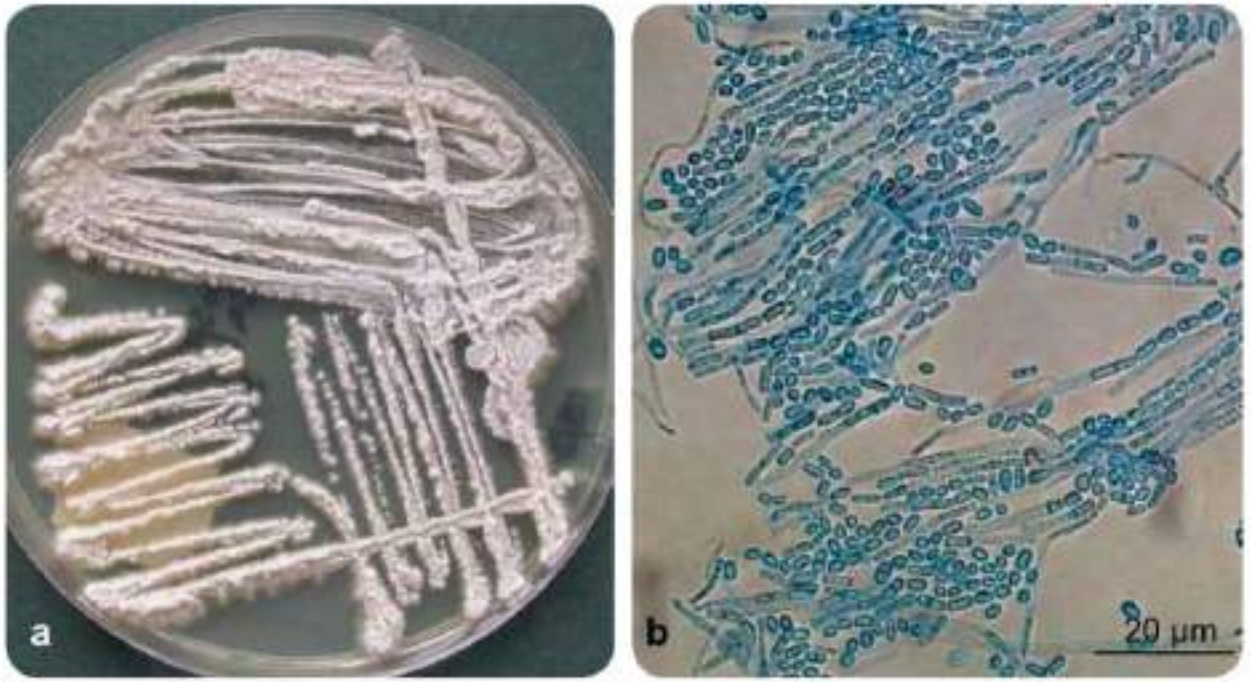
SUPERFICIAL MYCOSES

- **3-Piedra**

A. **Black piedra** is a nodular infection of the hair shaft caused by *Piedraia hortae*.

B. **White piedra,** due to infection with *Trichosporon* species, presents as larger, softer, yellowish nodules on the hairs

Hair of the axilla, genitalia, beard, and scalp hair may be infected



Trichosporon asahii (a) culture and (b) hyphae and arthroconidia.

TREATMENT

- Treatment for both types consists of removal of the infected hair and application of a topical antifungal agent.

- Piedra is endemic in tropical countries.

REFERENCES

- Jawetz Medical microbiology 2019
- Sherries medical microbiology 2018
- Prescott's Microbiology (2023)
- Descriptions of medical fungi 2016