**LESSON 6.**

**Classification, morphology and ultrastructure of fungi**

**LESSON PLAN:**

* Structural features of eukaryotic cells.
* Classification of fungi
* Primitive and higher fungi
* Perfect and imperfect fungi
* Morphology, ultrastructure of fungi.
* Mycelial, yeast, yeast-like, dimorphic fungi.
* Reproductive characteristics of fungi: sexual and asexual reproduction.
* Pathogenic fungi of the types *Zygomycota, Ascomycota, Basidiomycota* and *Deuteromycota*.
* The examination methods of fungi morphology.

***Fungi*** *(Fungi, Mycetes, Mycota)* are plant-based, chlorophyll-free, single- or multi-celled eukaryotic organisms

The branch of microbiology that studies fungi is called mycology

There are pathogenic and non-pathogenic types of fungi

Morphology of fungi

* Mycelial or filamentous fungi
* Yeasts and yeast-like fungi
* Mycelial or filamentous fungi
* They are composed from long filamentous cells of hyphae.
* Hyphae branch out to form mycelium.
* Mycelium may be septate or aseptate.
* In primitive fungi, mycelium is aseptate.
* In most fungi, hyphae are divided into cells by internal cross-walls called "septa“
* Substrate or vegetative mycelium that grows on and into the culture medium and, as the colony matures
* The portion of mycelium that grows upward or outward from the surface of the substrate is called the aerial mycelium or the reproductive mycelium

**Yeasts fungi (Saccharomycetes)**

* True yeasts are round, oval or rod-shaped single-celled fungi. Fungi reproduce both sexually and asexually
* Asexual reproduction occurs through budding.
* Yeast fungi also reproduce by forming ascospores. At this time, 2,4,8 ascospores, etc. are formed inside the sac that called the ascus
* An ascospore is a spore contained in an ascus or that was produced inside an ascus
* Yeast fungi are widely used in baking, dairy production, etc.

**Yeast-like fungi**

* They are morphologically similar to real yeasts.
* They are single-celled, round or oval-shaped fungi reproduce through budding
* Sometimes the buds grow longitudinally without leaving the mother cell and form derivatives called pseudomycelium. For example, Candida fungi.

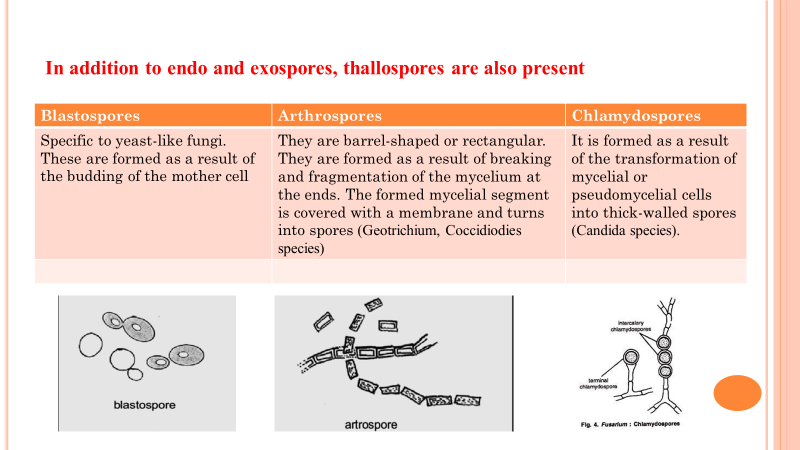
**Dimorphism of fungi**

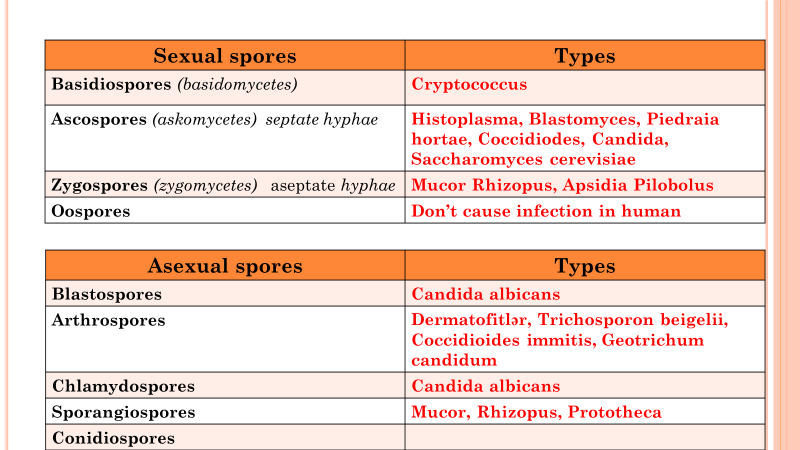
* Dimorphic fungi are fungi that have a yeast (or yeast-like) phase and a mold (filamentous) phase
* Mold form typically exist in the environment and nutrient media and yeast-like form in the human body
* Most causative agents of subcutaneous and systemic mycoses have dimorphism

**Reproduction of fungi**

* Sexual reproduction - the formation of sexual gametes, the formation of sexual spores (zygospores, ascospores, basidospores)
* Asexual reproduction-budding, fragmentation of hyphae, formation of asexual spores (arthroconidia, blastoconidia, chlamydoconidia)
* It is divided into 2 parts depending on whether the fungus has sexual reproduction or not
* Perfect (Reproduced both asexually and sexually)
* Imperfect (Reproduced asexually)

The main reproductive organ of fungi is spores

* If the spore is located inside the mycelium, it is called an endospore
* Endospores are formed within special structures - sporangia. This type of spore formation is characteristic of fungi of the genus Mucor
* Spores that form outside the mycelium are called exospores or conidia



* In the fungi Penicillium and Aspergillus, elongated cells-sterigums are formed at the ends of the reproductive mycelium-conidia. Conidia are arranged in a chain on them.  
  Conidia may be unicellular (microconidia) and multicellular (macroconidia).
* In the modern classification, fungi are divided into types.
* Depending on whether there is sexual reproduction, all fungi are divided into advanced and immature fungi.
* Advanced fungi reproduce not only asexually but also sexually.
* In immature fungi, no sexual reproduction has been detected, but this is a condition, as they are referred to the appropriate types as soon as sexual reproduction is detected in these fungi.

***Classification of fungi***

Zygomycotes (Zyqomycota) - Reproduced sexually and asexually. Sexual reproduction is through zygospores (zygos-mergers), and asexual reproduction is through sporangiospores. Vegetative forms are aseptate. Pathogenic types to humans are Rhizopus, Absidia, Mucor, etc.

Ascomycota - The largest type of fungus. Sexual reproduction is through ascospores (asc-sac), asexual reproduction is through conidia. Vegetative mycelium is septate. It contains about 85% of fungi that are pathogenic to humans.

Blastomyces, Histoplasma, Candida, Trichophyton, Coccidoides, Arthrodernma, Saccharomyces, etc

* + - *Basidiomycotes - sexual reproduction occurs through basidiospores (basidiomycetes). The mycelium is septate.*
    - *Pathogen types for humans - Filobasidiella neoformans, Cryptococcus neoformans, etc.*
* Deuteromycetes (immature fungi - Deiteromtcota, Fungi imperfecti) - this is a conventional type.
* Pathogen types for humans- *Coccidioides immitis, coccidioides posadasii, Sporothrix, Aspergillus, Epidermophyton, Paracoccidioides, Phialophora, etc*.

METHODS OF STUDYING MORPHOLOGY OF FUNGI

* Simple staining, Gram staining, lactophenol staining, etc.  
  The crushed drop method  
  skin scales, hairs, nails, etc. preparations for the detection of fungal elements are performed with an alkaline solution (15-20% KOH)