’Mycology

Lecture 1

Introduction:

MYCOLOGY: Is the study of fungi and their multiple functions in nature.

• Mykes(Greek word) : Mushroom • Fungi are eukaryotic organisms differ from bacteria and other prokaryotes.

Characters of the fungi:

1.They have cell walls containing chitin (rigidity & support), mannan& other polysaccharides .

2. Cytoplasmic membrane contains ergosterols .

3. Possess true nuclei with nuclear membrane & paired chromosomes.

4. Divide asexually, sexually or by both.

5. Unicellular and Multicellular.

Taxonomy:

Kingdom Characteristic Examples:

Monera: Prokaryocyte Bacteria E. coli

Protista: Eukaryocyte Protozoa E.histolytica

Fungi: Eukaryocyte Fungi Mushroom , Candida sp.

Plants: Eukaryocyte Plants

Animals: Eukaryocyte Arthropods , Mammals ,Man**.**

WHAT ARE FUNGI?

Fungi are not plants. Fungi form a separate group of higher organisms, distinct from both plants and animals, which differ from other groups of organisms in several major aspects :-

First:

Fungal cells are encased within a rigid cell wall, mostly composed of chitin and **glucan**. These features contrast with animals, which have no cell walls, and plants, which have **cellulose** as the major cell wall component.

Chitin:

Is a long-chain polymer of a **N- acetyl glucosamine**, a derivative of glucose, and is found in many places throughout the natural world.

glucan molecule:-

Is a polysaccharide of D-glucose monomers, linked by glycosidic bonds.. Many beta-glucans are medically important. They represent a drug target for antifungal medications.

Second:

Fungi **are heterotrophic**. This means that they are lacking in chlorophyll and cannot make their organic food as plants can, through photosynthesis. Fungi live embedded in a food source or medium, and obtain their nourishment **by secreting enzymes for external digestion** and by **absorbing the nutrients that are released from the medium.**

Third:

Fungi are simpler in structure than plants or animals. **There is no division of cells into organs or tissues.** The basic structural unit of fungi is either a **chain of tubular, filament-like cells, termed a hypha** or hyphae (plural) or **an independent single cell.**

Fourth:

Fungi reproduce by means of **microscopic propagules called spores**. Many fungi produce spores that result from an asexual process. Many fungi are also capable of sexual reproduction. Some species are **homothallic** and able to form sexual structures within individual colonies.

General properties of fungi:

1. They **are eukaryotic**; cells contain membrane bound cell organelles including nuclei, mitochondria, golgi apparatus, endoplasmic reticulum, lysosomes etc. They also exhibit mitosis.

2. **Have ergosterols** in their membranes and possesses 80S ribosomes.

3. **Have a rigid cell wall** and are therefore non-motile, a feature that separates them from animals. All fungi possess cell wall made of chitin.

4. Are **chemoheterotrophs (**require organic compounds for both carbon and energy sources) and **fungi lack chlorophyll** and are therefore **not autotrophic.**

5. Fungi are **osmiotrophic;** they obtain their nutrients by absorption.

6. They obtain nutrients as **saprophytes** (live off of decaying matter) or **as parasites** (live of living matter).

7. All fungi require water and oxygen and there are **no obligate anaerobes.**

8**. Typically reproduce asexually and/or sexually by producing spores.**

9. They grow either reproductively **by budding or non-reproductively by hyphal tip elongation.**

10. Food storage is generally **in the form of lipids and glycogen**.

Many fungal pathogens of humans and animals **change their growth form** during the process of tissue invasion. These **dimorphic pathogens usually change from a multicellular hyphal form in the natural environment to a budding, single-celled form in tissue**.

- In most multicellular fungi the **vegetative stage** consists of a mass of branching hyphae, **termed a mycelium**.

- Each individual hypha has a rigid cell wall and increases in length as a result of apical growth.

- In the more primitive fungi, the hyphae remain **aseptate** (without cross-walls).

- In the more advanced groups, however, the hyphae are septate

<u>Beneficial Effects of Fungi:</u>

1. Decomposition of nutrient and carbon recycling.

2. Biosynthetic factories. The **fermentation property** is used for the industrial production of alcohols, fats, citric, oxalic and gluconic acids.

3. Important **sources of antibiotics**, such as Penicillin.

4. Model organisms **for biochemical and genetic studies**. Eg: Neurosporacrassa

5. Saccharomyces cerviciaeis extensively **used in recombinant DNA technology,** which includes the Hepatitis B Vaccine.

6. Some fungi are used as food **(mushrooms).**

7. Yeasts provide nutritional supplements such as **vitamins and cofactors**.

8. Penicillium is used to flavor Roquef and Camembert cheeses.

9. Ergot produced by Clavicepspurpurea contains **medically important alkaloids** that help in inducing uterine contractions, controlling bleeding and treating migraine.

10. Fungi (Leptolegnia caudate and Aphanomyceslaevis) are **used to trap mosquito larvae** in paddy(ابلشلا) fields and thus help in malaria control.

Harmful Effects of Fungi:

1. Destruction of food, lumber, paper, and clothes.

2. Animal and human diseases, including allergies.

3. Toxins produced by poisonous mushrooms and within food (Mycetism and Mycotoxicosis).

4. Plant diseases.

5. Spoilage(فـلاذ) of agriculture produce such as vegetables and cereals in the godown.

6. Damage the products such as magnetic tapes and disks, glass lenses, marble statues, bones and wax.

The differences between bacteria and fungi:

1. Fungi are **eukaryotes** while bacteria are prokaryotes.

2. Bacteria **are single celled** whereas most fungi **are multicellular except for yeast.**

3. The compositions within their cell walls are different.

4. Fungi **are heterotrophs** while Bacteria can **be autotrophs or heterotrophs.**

5. Bacteria have 3 distinct shapes while fungi have various shapes.

6. Bacteria reproduce **asexually via binary fission** whereas fungi are capable of reproducing **both sexually or asexually.**

7. Bacteria affected by **antibiotics** but fungi are not affected.

EPIDEMIOLOGY OF MYCOLOGY:

Fungi are ubiquitous in nature and human beings are constantly exposed to them. Most mycotic agents are soil saprophytes and mycotic diseases are generally not communicable from person-to-person (occasional exceptions Candida and some dermatophytes).

Outbreaks of fungal disease may occur, but these are due to a common environmental exposure, not communicability.

The establishment of a **mycotic infection** usually depends on the size of the inoculum and on the resistance of the host.

The severity of the disease seems to depend mostly on **the immunologic status of the host.** Thus, the demonstration of fungi, for example, in blood drawn from an intravenous catheter can correspond to colonization of the catheter, to transient fungemia (i.e., transitory dissemination of fungi through the blood stream without disease), or to a true infection. The physician must decide which is the clinical status of the patient based on clinical parameters, general status of the patient,

laboratory results, etc. The decision is not trivial, since treatment of systemic fungal infections requires the aggressive use of drugs with various degrees of toxicity.