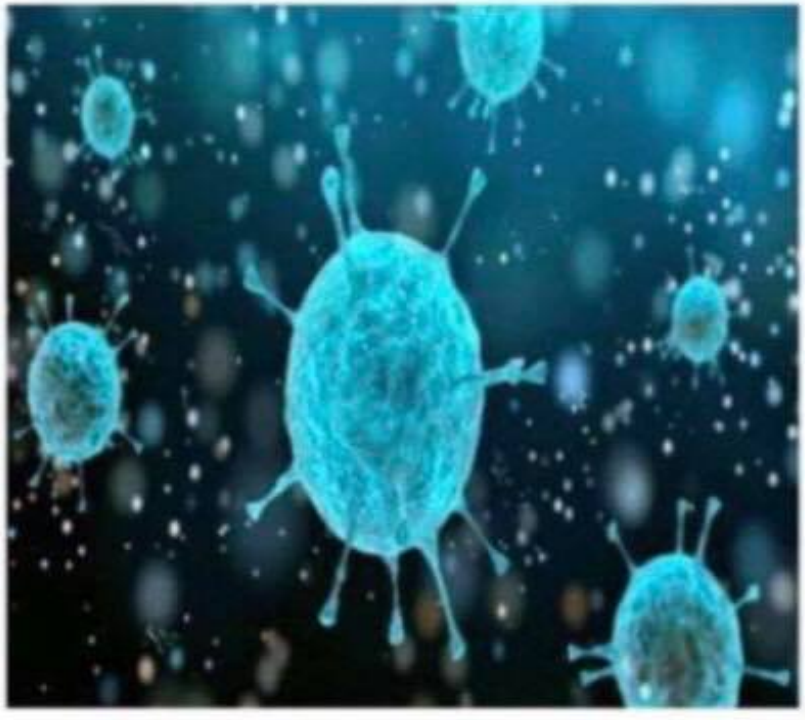
Lecture 8

Passion Batch



MICROBIOLOGY

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Moulds

Moulds are the fungi often seen in water and soil and on food it is mainly composed of hypae.

They grow in the form of cytoplasmic filaments or hyphae that make up the mycelium of the mould

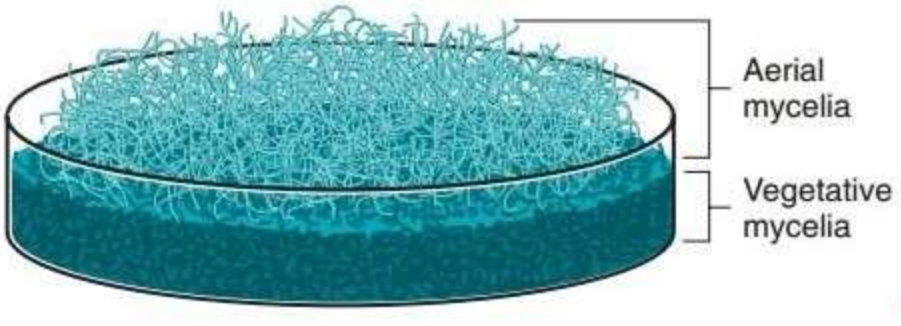
We can classify moulds in two ways:

A. Septation:
   1.septate.
   2.aseptate.

B. Site of growth related to media surface:
   ABOVE (aerial) or BENEATH (vegetative).

Aerial hyphae = extend above the surface

Vegetative hyphae = beneath the surface



The hypae of the mould make up the mycelium which we can observe on surfaces of pickles and vinegars and this type is not toxic.

Many antibiotics are produced by moulds. = *Penicillium and Acremonium*

And it is an important characteristic of fungi and that is why we can call it (pharmacy 2")

Some moulds produce = large quantities of enzymes (such as amylase, which converts starch to glucose), citric acid, and other organic acids that are used commercially.

They are of the most expensive types of food involved in fungi modification like color of flavor.

The flavor of cheeses such as bleu cheese and limburger is the result of moulds that grow in them.

Almost 60% of Antibiotics are produced by these organisms from the microbial soil, it has a major contribution in pharmaceutical industries.

Fleshy Fungi

Mushrooms, toadstools, puffballs, and bracket fungi (collectively referred to as fleshy fungi) are examples of fungi that are not microorganisms.

Some types of them are very nutritious and we can call these types “poor people’s meat”.

Many mushrooms are delicious to eat, but others are extremely toxic and may cause permanent liver and brain damage or death

A variety of yeasts and moulds cause human infections (known as mycoses).

Some moulds and fleshy fungi produce mycotoxins, which can cause human diseases called microbial intoxications.

Many diseases of crop plants, grains, corn, and potatoes are caused by moulds.

From previous slide:

We have two types of fungi diseases mycoses:

1. One is related to immune system impairment as in pregnant women, AIDS patients, and patients under chemotherapy, these people have weak immune system, so yeasts can overcome it and cause a disease like: A. Oral thrush. B. Vaginitis. C. Skin infections. D. Local infections.
2. Second one is related to blood stream infections or “Fungimia” and the danger in this type lies in the ability of fungi to reach any organ (Systemic infection).

Fungal Infections of Humans

Fungal infections are known as **mycoses**

Superficial, cutaneous, subcutaneous, or systemic mycoses.

Superficial mycoses = hair, fingernails, toenails, and the dead, outermost layers of the skin (the epidermis).

Cutaneous mycoses = fungal infections of the living layers of skin (the dermis)

Dermatophytes cause = tinea infections, which are often referred to as “ringworm” infections

C. albicans lives harmlessly on the skin and mucous membranes of the mouth, gastrointestinal tract, and genitourinary tract.

Reduction in the number of indigenous bacteria at these anatomic locations, *C. Albicans* flourishes, leading to yeast infections of the mouth (thrush), skin, and vagina (yeast vaginitis).

This type of local infection may invade the bloodstream to become a generalized or systemic infection in many internal areas of the body.

Subcutaneous mycoses are fungal infections of the dermis and underlying tissues

Madura foot (a type of eukaryotic mycetoma), in which the patient's foot becomes covered with large, unsightly, fungus-containing bumps

Systemic mycoses are fungal infections of internal organs of the body (e.g., simultaneous infection of the respiratory system and the bloodstream, or simultaneous infection of the respiratory tract and the central nervous system).

It could be inhaled to the lung and could be disseminated to blood stream and cuase a systemic infection “Fungimia”.

Spores of some pathogenic fungi may be inhaled with dust from contaminated soil or dried bird and bat feces (guano), or they may enter through wounds of the hands

Inhalation of spores of bread moulds like *Rhizopus and Mucor spp. by an* immunosuppressed patient can lead to a respiratory disease called zygomycosis or mucormycosis.

The mould can then become disseminated throughout the patient’s body and can lead to death

Also, spores could cause allergy (sensitive).

In the mycology laboratory, yeasts are identified (speciated) by determining which substrates they are able to use as nutrients.

Yeasts are identified (speciated) by inoculating them into a series of biochemical tests.

Moulds are identified by a combination of macroscopic and microscopic observations and the speed at which they grow.

In the previous slide:

How to diagnose yeast and moulds?

- Yeasts look like bacteria, we can culture it on 37 degrees in the encubator and staining it, then we can observe the germ tube or the budding (it is easy to differentiate between bacteria and yeast).
- Moulds could be speciated either microscopic by observation the septation of hypae or macroscopic as in bread mould.
- Moulds encubation temprature is 25 degrees (room temp.).

Dimorphic Fungi

Dimorphic fungi can live either as yeasts or as moulds, depending on growth conditions.

The most dangerous type of fungi and they are the main pathogen to humans.

Dimorphic fungi that cause human diseases include:

Histoplasma capsulatum = histoplasmosis

Sporothrix schenckii = sporotrichosis

Coccidioides immitis = *coccidioidomycosis*

Blastomyces dermatitidis = blastomycosis

Lichens

lichen is a combination of two organisms: an alga (or a cyanobacterium) and a fungus.

Lichens are classified as protists.

They are not associated with human disease,

Some substances produced by lichens have been shown to have antibacterial properties

Slime Moulds

Slime moulds, which are found in soil and on rotting logs, have both fungal and protozoal characteristics and very interesting life cycles

Some taxonomists classify slime moulds as fungi, whereas others classify them as protists.

They are not known to cause human disease

Element and atoms

- Four elements comprise over 98% of all living material (C, H, O, N)
- Two elements comprised 1% (P, S)

  Bacteria needs the above six elements in order to live.
- Elements are composed of atoms
- Atoms are composed of electrons (negatively charged), neutrons (positively charged) and protons (not charged)

Formation of molecules

- Chemical bonds
- Molecule is two or more atoms held together by chemical bonds
- The atom is most stable when its outermost shell is filled with electrons
- If the outermost shell is unfilled, atoms tend to acquire electrons by bonding to nearby atoms to fill this shell and achieve maximum stability

We care about bonds that exist in microbes nutrient molecules.

Covalent bonds

- Formed when atoms share electrons and create strong bond
- All covalent bonds are strong, the stronger the bond, the more difficult it is to break
- Covalent bonds break when exposed to strong chemicals or are supplied with large amounts of heat
- Non-polar covalent bond: covalent bond between identical atoms such as H-H, the electrons is shared equally. Non-polar covalent bonds exist between different atoms i.e C-H

Covalent bonds

- Polar covalent bond: An atom has a much greater attraction for electrons than the other, the electrons are shared unequally, one part of the molecule has a positive charge and another part has a negative charge i.e H_2O

The difference between types of bonds is the ability of holding atoms together.

Ionic bonds

- Formed by the loss and gain of electrons
- If electrons of one atom are attracted very strongly by a nearby atom, the electrons completely leave the first atom and become a part of the outer shell of the second atom
- The atom that gains the electrons becomes negatively charged and the atom that gives up the electrons becomes positively charged

Ionic bonds

- Charged atoms termed ions
- Most common in inorganic molecules
- Important in biology because they hold the ions, atoms among the weak forces of solutions i.e water

Hydrogen bonds

- Attraction of a positively charged hydrogen atom to different negatively charged atoms
- Weak but biologically very important

Important:
نوع السكر في كل حمض نووي:
DNA : Deoxy ribose.
RNA : Ribose.

- Hydrogen bond is responsible for some important properties of many molecules of biological importance, such as DNA and proteins.

Nucleic acids generally.

- Hydrogen bonds are made and broken at room temperature

Although it is very weak but is one of the most important bonds.

Important molecules of life

- Small molecules Micromolecules.
- Small molecules in the cell include inorganic and organic compounds
- Water is the most important molecule in the world
- Over 90% of cell weight is composed of water
- 1% of the total dry weight of a cell is composed of inorganic ions i.e Na+, K+, Mg++, Ca++, Fe++, Cl-, PO-3, SO+4

Important molecules of life

- Organic compounds are those that contain at least one carbon atom covalently bonded to another carbon or hydrogen atom. These compounds are biologically the most important molecules

- Organic compounds can be grouped based on distinctive groups of atoms they contain

Organic compounds are characterized by distinctive chemical group { hydroxyl, amine, carboxyl}.

Some compounds contain more than one of these groups like: amino acids.

- Some of the distinctive groups are the hydroxyl, amino, and carboxyl groups

- Some molecules contain several distinctive groups i.e amino acid has both amino (NH_2), carboxy (COOH) group.

Large molecules in the cell

- Macromolecular synthesis involves two steps
- The synthesis of subunits Composed of monomers.
- Joining them together

- Joining the subunits involves the removal of H2O molecule, termed dehydration synthesis Loss of water.

- Hydrolysis is the reverse reaction where the macromolecule is broken down into subunits and H2O molecules is added back Gain of water.

We study macromolecules because they are very important nutrients for bacterial growth or as a part of their structure.

Protein synthesis

- Twenty amino acids (shared certain features) joined together to form protein

- Shared features are:

1. carboxyl (acidic [COOH]) group at one end and
2. an amino (basic [NH2) group bonded to the same carbon atom, this carbon atom is also bonded to a side chain which is characteristic for each amino acid.

- The twenty amino acids in proteins are held together by peptide bonds (covalent linkage formed when the carboxyl group of one amino acid react with the amino group of another amino acid, with the release of water (dehydration)

Protein synthesis

- Polypeptide chain: the chain of amino acids formed when a large number of amino acids are joined together by peptide bonds

*Bacteria can't benefit out of proteins unless they are well synthesized.
*The more complex the protein is, the more antinogenic sites exist, which is an inducer for the immune system (strong antigen).

Levels of protein structure

- Primary structure: the sequence of amino acids in protein, the substitution of one amino acid for another in a protein may destroy the protein's function

- Secondary structure: a string of certain amino acids will often form a helix, and another group of amino acids will form sheets

- Tertiary structure: the final three-dimensional shape of protein

- Most proteins are globular and some are fibrous

Protein denaturation

- The protein shape is flexible and it changes if the temperature, acidity of the solution changes
- The protein must have a specific shape in order to carry out its function

1.
- If the temperature is raised or the solution becomes
2. very acidic or basic weak bonds will be broken and the molecule will lose its proper shape in a process termed denaturation

3. When it face a salty environment.

Polysaccharides

- Carbohydrates are compounds containing principally carbon, hydrogen, and oxygen atoms in a ration of approximately 1:2:1

  Bacteria always search for the most simple sugars.

- Polysaccharides: Polymers of monosaccharide subunits

  The main nutrient for bacteria is glucose.

- The term sugar is often applied to monosaccharides and disaccharides