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**Lecture-1**

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**Introduction**

**Medical microbiology:** the field of microbiology that deal with study of pathogenic microorganisms and their interactions with human as causative agents of infectious diseases, with the prevention, diagnosis and treatment of these diseases.

It covers the branches of bacteriology, virology, mycology, parasitology and immunology.

**Microorganisms/microbes:** are microscopic living organisms which are very diverse and invisible by naked eye. They can be found in nearly every environment. The life in our planet is impossible without microbes due to their important role in generation of energy.

**Types of microbial pathogens :**

The pathogenic organisms of infectious diseases can be classified into four major groups of organisms : viruses, bacteria , fungi and parasites. Differences between these groups are listed in table number (1).

**Normal microbial flora:** are permanent residents of certain body sites, especially skin, mouth, nose, colon and vagina, without causing any disease.

It includes various non-pathogenic bacteria and yeasts, while all viruses and most parasites are usually not considered as members of normal flora, although they present in asymptomatic individuals.

The members of normal flora vary in both number and kind from one site to another; although it is extensively populates many areas in the body, the internal organs are sterile.

Normal flora should be differentiated from carrier state and colonization:

**Carrier state:** an individual who harbors a potential pathogen, and can be a source of infection to others; whether it is asymptomatic infection or a person recovered from a disease and continue to carry and shed the organism for a long period.

**Colonization:** an acquisition of a new organism, that may cause an infectious disease or may be eliminated by the immune system.

The normal flora has 3 roles in the body:

1. They can cause disease, especially in immunocompromised individuals or when it changes its anatomical location.
2. Constitute a protective host defense mechanism, as it prevent colonization of pathogenic organisms and produce inhibitory substances.
3. They may serve a nutritional function, as the intestinal bacterial flora produce many vitamins B and vitamin K.

**Prokaryotes Vs. Eukaryotes:**

All types of cells can be divided into two different types according to the nucleus: Prokaryote and Eukaryote . The differences between them are :

1. The eukaryotic cell has a true nucleus with multiple chromosomes surrounded by a nuclear membrane. The prokaryotic cell has not true nucleus but has single circular loosely chromosome in cytoplasm lacking nuclear membrane.

2. All types of cells contain both types of nucleic acid (DNA and RNA) , except viruses contain one type of nucleic acid, either DNA or RNA.

3. The prokaryotic organisms are only unicellular, whereas eukaryotic organisms either unicellular or multicellular.

4. Eukaryotic cells contain cellular organelles (such as mitochondria, lysosome, large 80s ribosome, Golgi apparatus and others), whereas prokaryotic cells contain no organelles except small 70s ribosome .

5. Most prokaryotes have rigid cell wall that contain peptidoglycan, whereas eukaryotes not contain peptidoglycan but have flexible cell membrane, except fungi and plant cells have cell wall.

6. The prokaryotic cell (eg; bacteria) replicate by binary fission, whereas most eukaryotic cells replicate by mitosis. During which one parent cell divided to make two progeny cells. In contrast, viruses produce many copies of nucleic acid and protein , then reassemble into multiple progeny viruses.

**Scientific nomenclature:**

Scientific nomenclature for organisms as illustrated by **Carolus Linnaeus,** consist of two parts**:** genus and species.

First name for genus and second name for species. First letter of genus must be written in capital, whereas first letter of species must be written in small form .

The Latinized name of genus and species for any organism must be written in **Italic form** or place line under each genus and species.

Example: *Staphylococcus aureus* or Staphylococcus aureus

*Bacillus anthracis* or Bacillus anthracis

**Table (1):** Comparison between main groups of major pathogens.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Virus** | **Bacteria** | **Fungi** | **Parasite** |
| **Size** | smallest infectious agents (20 nm-300 nm) | larger and more complex than viruses | larger than bacteria | larger than bacteria |
| **Cell type** | particle | prokaryote | Eukaryote | Eukaryote |
| **No. of cell** | acellular | unicellular | Uni-/multicellular | Uni-/multicellular |
| **Cell wall** | - | + | + | - |
| **Type of Nucleic acid** | DNA or RNA | DNA and RNA | DNA and RNA | DNA and RNA |
| **Nuclear membrane** | - | +  No true nucleus | +  true nucleus | +  true nucleus |
| **Organelles** | - | Only small ribosomes | + | + |
| **Replication** | Replicate only within living cells | Binary fission | budding or mitosis | mitosis |