Medical Microbiology

Lecture-1-

Introduction & History development of microbiology

Microbiology: is the study of microorganism, a large and diverse group of microscopic organisms that exist a single cell or cell cluster; it also includes viruses which are microscopic but not cellular.

These microscopic forms of life are present in vast numbers in nearly every environment known. They are found in the water, food, soil, and air. Also more than 90% of the cells in human's bodies are microbes. Some of these microorganisms (M.O.) are harmful (disease causing microorganisms), others benefit by association with biological activity of the host.

History development of microbiology

Microbiology has its origin deeply rooted in curiously. At first MOs were thought to be of little practical importance.

Leeuwenhoek (1673) designed and constructed simple microscope, and he made the first accurate descriptions of most major types of single cell MO known today: algae, bacteria, protozoa, and yeasts.

Edward Jenner (1796) discovered the vaccine against cowpox (Vaccinia).

Louis Pasteur (1850) demonstrated the biological functions of MO (fermentation theory) method of sterilization (pasteurization) and development of vaccines against microbial diseases such as anthrax and rabies.

Antiseptic Surgery: when anesthetics were introduced into surgery and obstetrics during the 1840, surgeon performing longer more complex procedures than ever before. Unfortunately, the number of surgical wound infections increased at the same time, often causing the death of patients.

Joseph Lister showed the role of MO in the wound contamination, and developed Lister system which came to be known as Antiseptic Surgery, which includes the heat sterilization of instruments and the application of phenol to wound by means of dressings.

The germ theory of disease

In nineteenth century the concept of contagion the spread of infectious disease performed the proof of the existence of pathogenic agents.

A direct role of MO as agents of disease was given by **Koch in 1876**.

Koch postulates:

1. The suspected causative agent must be found in every case of disease.
2. This MO must be isolated from the infected individual and grown in a culture with no other types of MO.
3. When inoculation into normal healthy susceptible animal a pure culture of the agent must be produce the specific disease.
4. The same MO must be isolated from the experimentally infected host.

Chemotherapy

By 1900 the microbial causes of many important human diseases were known. These included cholera, diphtheria, leprosy, and tetanus. Despite the relative success in uncovering the cause of bacterial disease, advances in treatment were disappointing. The modern era of control treatment began with the use of chemicals that would kill or interfere with the growth of the disease agent without damaging the infected individual. This approach, known as chemotherapy was introduced by **Paul Ehrlich**.

In 1929, Alexander Fleming isolated a mold produced substance that inhibited bacteria but was non toxic to lab animal. He named this antibacterial material Penicillin, which is one type of antibiotics. Up to data, many new approaches and techniques are developing that aid in the isolation, treatment, controlling, and prevention of infectious disease.

Microbial Divisions

The field of microbiology includes the study of bacteria, fungi, protozoa and viruses.

Bacteriology: is the science dealing with the study of bacteria.

Mycology: is the science dealing with the study of fungi.

Protozology: is the science dealing with the study of protozoa.

Virology: is the science dealing with the study of viruses.

Immunology: is the study of host's defense mechanisms against disease, also study the interaction between human and disease agents (pathogenic microbes).

Eukaryotes & Prokaryotes

The size microorganisms (M.O.) were variable; viruses are smallest MO, bacteria (prokaryots), fungi, protozoa and worms (euokaryotes). In genera prokaryotic cells are smaller than eukaryotic cells. The main differences between Eukaryotic cells & Prokaryotic cells can be illustrates in the following table:

Table (1) illustrates the main differences between Eukaryotic cells & Prokaryotic cells

Structure	Eukaryotic cells	Prokaryotic cells
Definite Nucleus	Yes	No
Nuclear membrane	Yes	No
Chromosome	Multiple	Single
Cell envelope	Yes, have flexible cell mem. Except fungi have rigid cell wall with chitin	Yes, have rigid cell wall that contain peptidoglycan
Nucleolus	Yes	No
Organelles (mitocondria, Golgi apparatus,	Yes	No
ribosome	Large 80 S ribosome	Small 70 S ribosome
Replication	By mitosis	By binary fission
Representative organisms	Animals, plant, protozoa, fungi	Bacteria

Shapes and size of bacteria and patterns of arrangement

1. spherical (cocci); A: singular cocci. B: diplococci (pairs of cells).
   C: streptococci (chains). D: staphylococci (clusters or grape like).E: tetrad: four cocci
2. Bacilli (rod like); A: singular bacillus. B: diplobacilli (pairs of cells).
   C: streptobacilli (chains). D: coccobacilli (spherical to rod)
3. Spirochetes: spirilium (spiral). & vibrio (comma).
4. pleomorphic (appear in many shape).

- **Bacterial size**

Most disease causing by bacteria range in size from 0.2 -5 μm in diameter and 0.4-14 μm in length approximately. The bacterial cells are about the size of mitochonderia.

Medical important organism

There are many differences among medical the important organisms; viruses (smallest MO), bacteria, fungi or mycosis, protozoa, and helminthes (Largest organism), therefore, the following table can be illustrates the comparison of medical important organisms.

Table (2) illustrates the comparison of medical important organism

characteristic	Viruses	Bacteria	Fungi	Protozoa	Helminthes
Cells	No cell (particle)	Yes	Yes	Yes	Yes
Diameter(µm)	0.02-0.3 smallest MO	1-0.5	3-10 (yeast)	15-25 trophozoite	multicellular Largest organism
Nucleic acid	Either DNA or RNA	Both	Both	Both	Both
Nature of outer surface proteins	Capsid and lipoprotein envelope	rigid cell wall that contain peptidoglycan	rigid cell wall with chitin	Flexible cell mem.	May be cuticle
ribosome	absent	70 S	80 S	80 S	80 S
Methods of Replication	Produce many copies of Nucleic acid and protein, then, reassemble into multiple progeny viruses. They are replicate only within living cell	By binary fission	Budding or mitosis	mitosis	mitosis
Motility	none	some	none	most	motile

* mem: membrane

Kingdom of organisms

All types of organisms classified in to five kingdom; monera, protista, fungi, plantae, and animalia. The following table illustrates the kingdoms**.**

Table (3) illustrates the kingdom of All types of organisms

Kingdom	Types of cell	Organism
monera	Prokaryotes	Bacteria
protista	Eukaryotes	Protozoa
fungi	Eukaryotes	fungi
plantae	Eukaryotes	plant
animalia	Eukaryotes	Man, animals

Classification of MO

The importance of classification:

1. To establish the criteria for identification.
2. To arrange similar organisms in to groups.
3. To provide information about how organism evolved.
4. To avoid the confusing in the information about different types of organisms.

Scientific name:

The binomial system of published by C. Linnaeus. The genus and species are significant taxonomic uses in binomial nomenclature for each organism. The first name for genus and second name for species. First letter of genus should be written in capital letter, whereas first letter of species, must be write in small. Name of genus and species for any organism must be write in Italic from or place line under each genus and species.

Ex: *Staphylococcus aureus*.

Name of bacteria are derived from

1. The name of disease that caused by bacteria. Ex: *Vibrio cholerae*= causes cholerae.
2. The locality where the bacteria was first isolated. Ex: *Escherichia coli*=from colon.
3. The scientists responsible for isolating bacteria. *Listeria*= Lister.
4. Properties of bacterial morphology and physiology. *Staphylococcus aureus*= cluster.