

Lec.1 Introduction in microbiology

➤ **What is microbiology?**

The study of microorganisms and their activities: Nutrition, multiplication, pathogenicity, control, etc.

➤ **What are microorganisms?**

They are very minute organisms that are too small to be seen with the naked eye. They are also referred to as microbes. They are observed with the aid of a magnifying device called the microscope. "Germ" refers to a rapidly growing cell.

➤ **What is medical microbiology?**

The study of the pathogenic microbes and the role of microbes in human illness. Includes the study of microbial pathogenesis and epidemiology and is related to the study of disease pathology and immunology.

➤ **Evolution & history of microbiology:**

Key to the study of microorganisms was the development of the microscope

- Earliest record of microbes was from the work of **Robert Hooke** in the 1660s
- 1668 **Antony van Leeuwenhoek** began with microscopy
- 1884 **Metchnikoff** described phagocytosis & **Gram** described „Gram staining“
- 1928 **Fleming** penicillin discovered

-1675: **Anthony van Leeuwenhoek**, a Dutch draper, described the “little animals” (animacules) he observed with his crude home made microscope while examining rain water and watery infusions. He was the first man to describe microorganisms.

-In 1668, an Italian scientist, **Francesco Redi**, after many smart experiments, disproved the theory of a biogenesis.

-Louis Pasteur (1822-1895), a French chemist (the father of modern medicine), performed series of brilliant researches and experiments for the wine industry between 1860 and 1890.

- Major contribution of Louis Pasteur

1. Microbial theory of fermentation
2. Principles and practice of sterilization and pasteurization Medical Bacteriology
3. Control of diseases of silk worms
4. Development of vaccines against anthrax and rabies.
5. Discovery of streptococci

-Joseph Lister, Professor of surgery in Glasgow, applied Pasteur's observations to the prevention of wound sepsis.

-In 1867, he discovered the use antiseptic technique to kill bacteria in wound and air with carbolic acid.

-Robert Koch (1843-1910) (father of medical microbiology), a German scientist.

Major achievements of Robert Koch

1. Discovery and use of solid medium in bacteriology
2. Discovery of causative agents of tuberculosis and cholera.
3. Koch's phenomenon
4. Koch's postulates

Koch's postulates includes :

1. The organism must be found in every case of the disease.
2. The organism must not be found in a healthy person.
3. The organism must be isolated and grown in pure culture.
4. Inoculation into a susceptible animal should reproduce the disease and the organism isolated from the animal.
5. Infection should produce circulating antibody specific for the infecting organism.

➤ **Classification of microbiology:**

Microbiology can be also classified based on taxonomy:

- 1- Bacteriology: The study of bacteria.
- 2- Mycology: The study of fungi ,yeasts & moulds.
- 3- parasitology: The study of protozoa ,helminthes & arthropodes.
- 4- algology : The study of algae.
- 5- Immunology: The study of the immune system.
- 6- Virology: The study of the viruses.

➤ **Binomial nomenclature :**

- Organisms are named using binomial nomenclature (viruses are exceptions)
- **Genus** – *Bacillus*, always capitalized
- **species** - *subtilis*, lowercase
- Both italicized or underlined – *Bacillus subtilis* (*B. subtilis*)

❖ **EUKARYOTIC CELL:**

Eu- true Karyote- nucleus--The eukaryotic cell has a true membrane bound nucleus, usually containing multiple chromosomes, a mitotic apparatus, a well defined endoplasmic reticulum and mitochondria.

❖ **PROKARYOTIC CELL:**

Pro- primitive Karyote- nucleus-- The prokaryotic cell possesses naked DNA without associated basic proteins, divides a mitotically by binary fission and bounded by a semi rigid cell wall.

Table - The distinguishing features between Eukaryotic cell and Prokaryotic cell:

Features	Prokaryote cells	Eukaryote cells
Size	1µm	10µm
Nuclear membrane	Absent	Present
Chromosome	Single	Multiple
Nucleolus	Absent	Present
Sexual reproduction	Absent	Present
Cytoplasmic ribosomes	70s	80s
Mitochondria	Absent	Present
Endoplasmic reticulum	Absent	Present
Lysosomes	Absent	Present
Micro filaments and tubules	Absent	Present
Site of photosynthesis	Cell membrane	Chloroplast
Peptidoglycan	Present	Absent
Cell membrane composition	Phospholipids & Proteins	Sterols

➤ **Levels of organisms Classification:**

- Domain
- Kingdom
- Phylum or Division
- Class
- Order
- Family
- *Genus*
- *species*

➤ **Classification of Microorganisms:**

The five kingdom system:

The five kingdom system was first proposed in 1969 five kingdoms include:

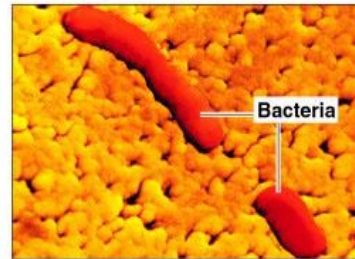
- 1- Plantae (the plants)
- 2- Fungi (the fungi)
- 3- . Animalia (the animals)
- 4- Protista (the unicellular eukaryotes)
- 5- Monera (the prokaryotes)

Domain system : domains proposed later than the Five-kingdom system. The three domains are:

- 1- Bacteria
- 2- Archaea
- 3- Eukarya : includes (Protists , Fungi ,Plants ,Animals)

Bacteria :

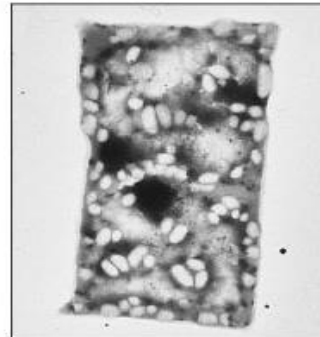
- Prokaryotes
- Peptidoglycan cell walls
- Binary fission
- For energy, use organic chemicals, inorganic chemicals, or photosynthesis



(a)

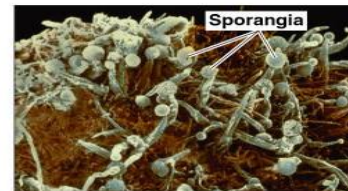
Archaea:

- Prokaryotic
- Lack peptidoglycan
- Live in extreme environments
- Include:
 - Methanogens
 - Extreme halophiles
 - Extreme thermophiles



Fungi

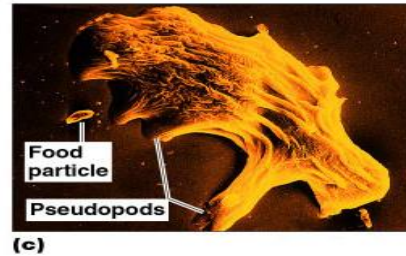
- Eukaryotes
- Chitin cell walls
- Use organic chemicals for energy
- Molds and mushrooms are multicellular consisting of masses of mycelia, which are composed of filaments called hyphae
- Yeasts are unicellular



(b)

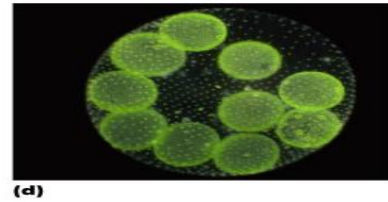
Protozoa

- Eukaryotes
- Absorb or ingest organic chemicals
- May be motile via pseudopods, cilia, or flagella



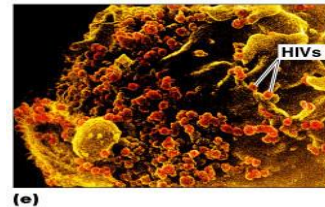
Algae

- Eukaryotes
- Cellulose cell walls
- Use photosynthesis for energy
- Produce molecular oxygen and organic compounds



Viruses

- Acellular
- Consist of DNA *or* RNA core
- Core is surrounded by a protein coat
- Coat may be enclosed in a lipid envelope
- Viruses are replicated only when they are in a living host cell



Multicellular Animal Parasites

- Eukaryote
- Multicellular animals
- Parasitic flatworms and round worms are called helminths.
- Microscopic stages in life cycles.

