

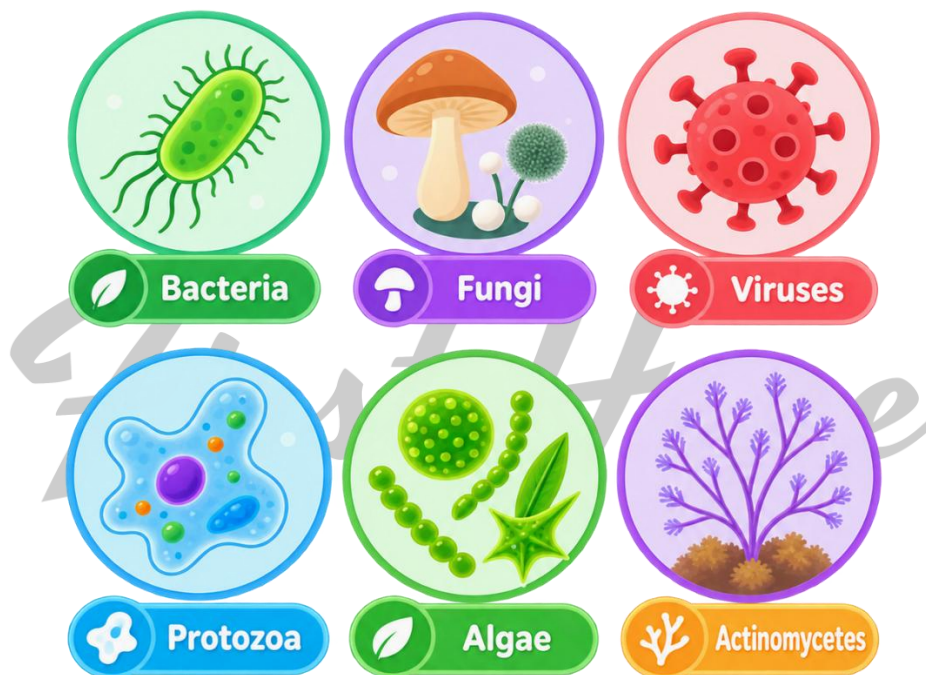
Microbiology

Introduction to Microbiology

Definition of Microbiology

- **Microbiology** is the branch of biology that studies **microorganisms** (microbes), which are very small living organisms not visible to the naked eye.
- They can only be seen using a microscope.
- It includes studying their structure, growth, functions, reproduction, and role in nature and disease.

What are Microorganisms?



1. Bacteria

- Single-celled prokaryotic organisms.
- Found in soil, water, air, and inside living organisms.

2. Fungi

- Includes yeasts, molds, and mushrooms.
- Can be unicellular or multicellular.

3. Viruses

- Acellular particles.
- Need a host cell to reproduce.

4. Protozoa

- Single-celled eukaryotic organisms.

- Often found in water and may cause diseases.

5. Algae

- Photosynthetic microorganisms.
- Produce oxygen and serve as primary producers.

6. Actinomycetes

- Filamentous bacteria with fungus-like growth.
- Important in antibiotic production.

Branches of Microbiology

A. Bacteriology

- Study of bacteria.
- Covers bacterial structure, metabolism, genetics, and diseases.

B. Mycology

- Studying fungi.
- Includes beneficial and harmful fungi.

C. Virology

- Study of viruses.
- Focuses on viral structure, replication, and diseases.

D. Parasitology

- Study of parasites such as protozoa and worms.

E. Immunology

- Study of immune responses against microorganisms.

F. Microbial Genetics

- Study of heredity and gene transfer in microbes.

G. Industrial Microbiology

- Use of microbes in industries for antibiotics, enzymes, and fermentation.

Importance of Microbiology

1. Medical Importance

- Help understand infectious diseases.
- Used in diagnosis, prevention, and treatment.
- Antibiotics and vaccines are products of microbiology.

2. Environmental Importance

- Microbes recycle nutrients.
- Decompose dead organic matter.
- Help in sewage treatment and bioremediation.

3. Agricultural Importance

- Nitrogen-fixing bacteria improves soil fertility.
- Used as biofertilizers and biopesticides.

4. Industrial Importance

- **Used in the production of:**
 - Alcohol
 - Yogurt
 - Cheese
 - Antibiotics
 - Enzymes

History and Development of Microbiology

Antonie van Leeuwenhoek

- Father of Microbiology.
- First observed microorganisms using a simple microscope.



Antonie van Leeuwenhoek

First microbes



Louis Pasteur

- Proved microbes cause fermentation.
- Developed pasteurization.
- Disproved spontaneous generation.



Louis Pasteur

Fermentation & pasteurization



Robert Koch

Germ theory



Robert Koch

- Established **Germ Theory of Disease.**
- Developed Koch's postulates.



Joseph Lister

Antiseptic surgery



Joseph Lister

- Introduced antiseptic surgery.

Alexander Fleming

- Discovered penicillin.



Alexander Fleming

Penicillin



Scope of Microbiology

- Food microbiology
- Medical microbiology
- Agricultural microbiology
- Environmental microbiology
- Pharmaceutical microbiology
- Biotechnology

Prokaryotes

Prokaryotes

- Primitive and simple cells.
- Lack a true nucleus.
- DNA lies freely in cytoplasm.

Examples

- Bacteria
- Cyanobacteria
- Archaea

Characteristics of Prokaryotic Cells

Cell Structure

- No membrane-bound nucleus.
- DNA present as circular chromosome.
- No membrane-bound organelles.

Cell Wall

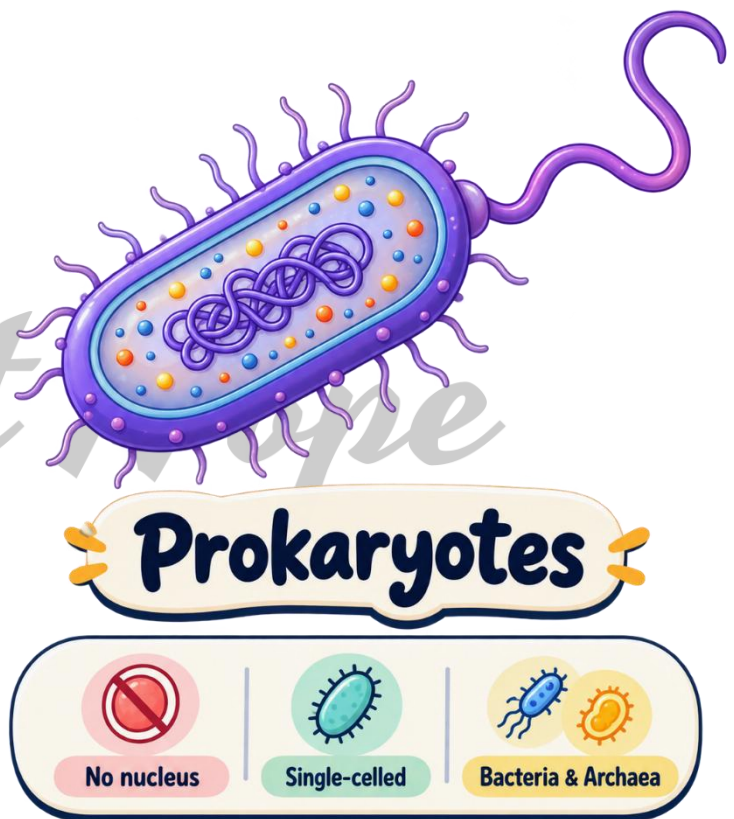
- Usually present.
- In bacteria made of peptidoglycan.

Size

- Very small (1–10 μm).

Reproduction

- Mainly by binary fission.



Ribosomes

- 70S ribosomes.

Eukaryotes

Eukaryotes

- More advanced and complex cells.
- Have a true nucleus enclosed by nuclear membrane.

Examples

- Fungi
- Protozoa
- Algae
- Plants
- Animals

Characteristics of Eukaryotic Cells

1. Nucleus

- Well-defined nucleus.
- Contains linear chromosomes.

2. Organelles Present

- Mitochondria
- Endoplasmic reticulum
- Golgi apparatus
- Lysosomes

3. Size

- Larger (10–100 μm)

4. Ribosomes

- 80S ribosomes.

5. Reproduction

- Mitosis and meiosis.
- Sexual and asexual reproduction possible.



Difference Between Prokaryotes and Eukaryotes



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