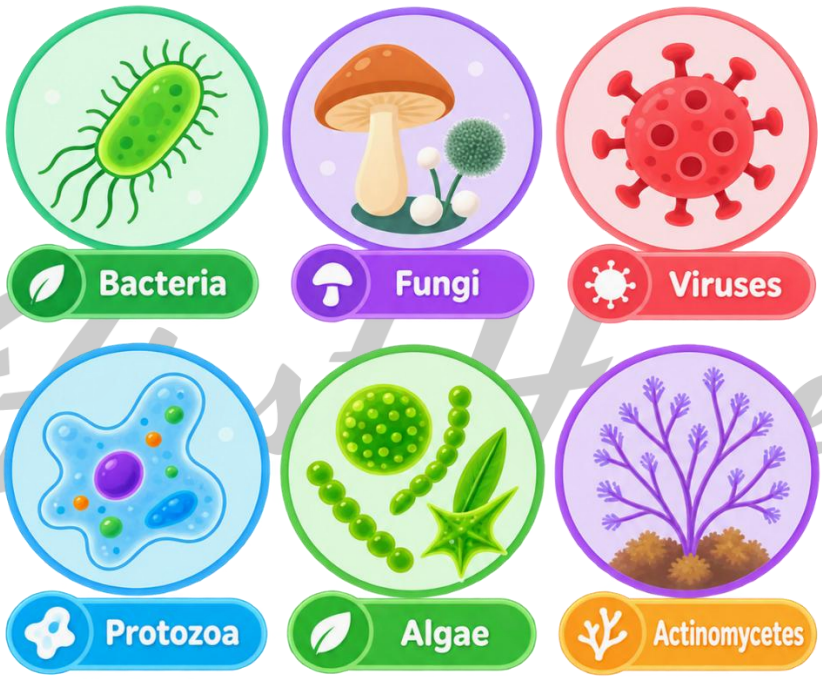
Microbiology

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.

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- 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.

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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.

Louis Pasteur

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

Robert Koch

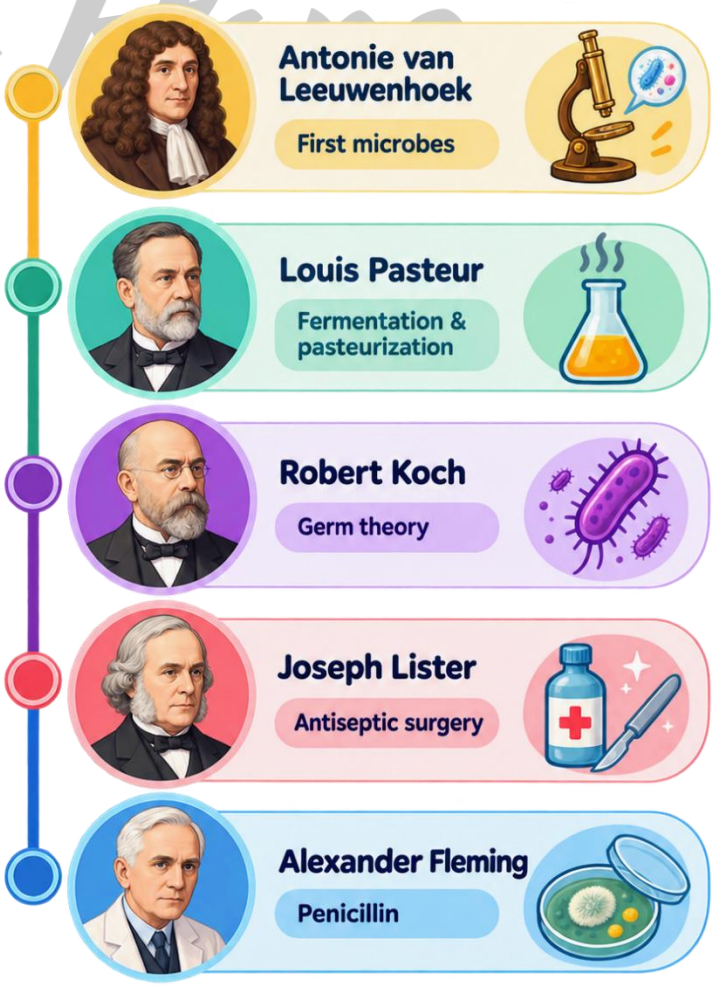
- Established **Germ Theory of Disease.**
- Developed Koch's postulates.

Joseph Lister

- Introduced antiseptic surgery.

Alexander Fleming

- Discovered penicillin.



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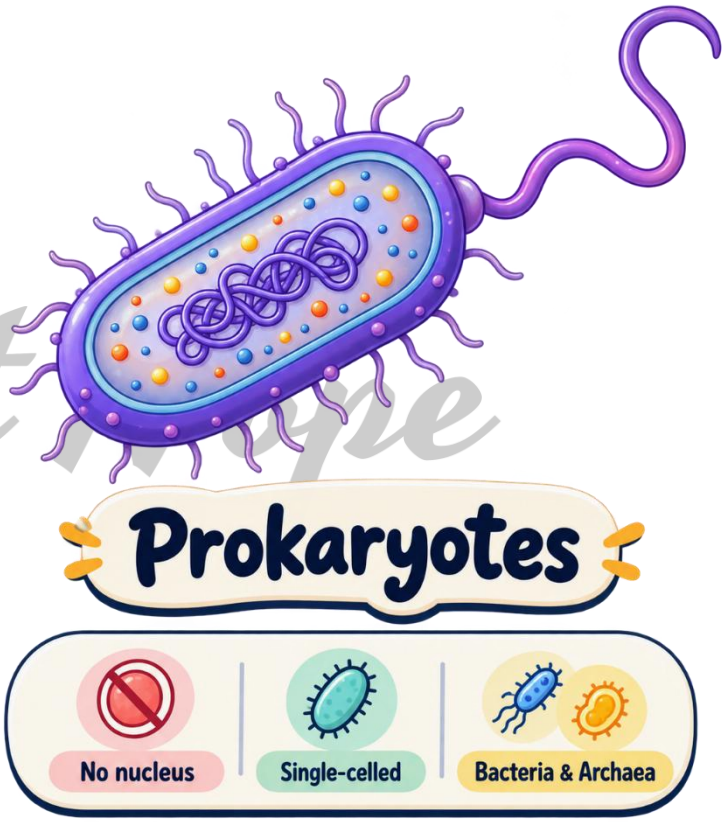
Scope of Microbiology

- 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.

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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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