

# MICROBIOLOGY

Discover the science of microorganisms

## Organisms & Evolution //

**Microbiology:** The study of living things too small to see with the naked eye.

- The five main divisions of life are Bacteria, archaea, eukaryotes, and viruses.
- Each division's DNA is more similar to its own than to any of the other three.



Characteristic	Bacteria	Archaea	Eukaryotes	Viruses
Size	0.2—5 micrometers	0.2—5 micrometers	1—100 micrometers	100—1000 micrometers
Nucleus	No	No	Yes	No
Genetic Information	DNA	DNA	DNA or RNA	
Lipid Bilayer	No	Substituted	No	Substituted
Polysaccharides	None, unique	None, more like eukaryotes	Large	No
Mitochondria	No	No	No	No
RNA Polymerase	Simple, 3 subunits	More complex, 8 subunits	More complex, 12 subunits	Depend on protein: bacterial
Gene without membrane	No	No	No	No
Membrane	None	None	Cellulose, non-cellulose, none	None
Cell wall	Peptidoglycan	Surfactant, stiffness, toxins	Cellulose, non-cellulose, none	No

### Bacteria

- Were the first cells on Earth.
- Contain over 50 different phyla (major groupings).
  - Are the most abundant form of life.
  - People have more bacteria growing on them than human cells.
- Extremely diverse.
  - There are thousands of different species in one gram of soil.
  - Live in most environments, including the deep sea, underground, and terrestrial.

### Archaea

- Relatively uncommon with fewer known species.
- Most common in extreme environments (e.g., deep-sea vents and high salinity lakes).
- Contain some features of prokaryotes and eukaryotes.
- Often known as extremophiles and will grow when other organisms cannot.
- Ex: Halophiles, salt loving; sulfophiles, sulfur loving; thermotrophs, heat loving; lithotrophs, rock loving; methanophiles, methane loving (ruminant guts).

### Eukaryotes

- May be single cells (e.g., yeast, algae, and amoebae) or multicellular (e.g., fungi, plants, and animals).
  - Contain membrane-bound subcompartments that separate specific functions, particularly the nucleus.
  - Divisions includes microeukaryotic organisms previously belonging to the Monera kingdom.

### Viruses

- Many feel viruses are not alive as they are obligate parasites and cannot replicate without other cells.
- Different viruses target all three domains.
- Viruses may use DNA or RNA as genetic material and use molecules from the host cell to make more virus particles, ultimately killing the host.

## Shapes & Types //

### Bacterial & Archival Cell Shapes & Growth Characteristics

- Cocci: Spherical
- Bacilli: Rod-shaped
- Spirilli: Spiral-shaped
- Pleomorphic: Multiple shapes are possible



- Diplococci: Prefix meaning two; a diplococcus is two cocci that have grown together.
- Tetrads: Four cocci that grow together in a cube.
- Sarcinae: Eight cocci that grow together in a cube.
- Streptococci: Prefix meaning chain; a streptococcus is cocci that have grown together in a chain.
- Staphylococci: Prefix meaning cluster; a staphylococcus is cocci that have grown together in a cluster.

### Eukaryotic Types

- Ciliates: Short-cilia used for locomotion and/or feeding.
- Flagellates: Long flagella used for locomotion; usually there are only one or three per cell.
- Slime molds: Single cells living in a damp environment (e.g., under leaves in a forest) that come together during replication.



- Amoebae: Free-living cell that can change its shape and engulf its prey.
- Flagellates: Nonplant, non-fungi organisms (e.g., ciliates and flagellates).
- Algae: Photosynthetic organisms with a nucleus and chloroplasts. Many are single cells, others are multicellular, but many forms are still microscopic (e.g., yeasts).
- Slime molds: Photosynthetic eukaryotes with a eukaryotic cell wall often with a complex, symmetrical pattern.
- Yeasts: Eukaryotic, single-celled, round fungi.
- Molds: Multicellular fungi which form hair-like projections (hyphae) that may contain asexually (conidia) or not (conidia).

### Viral Shapes

- Helical: Spiral arrangement of protein capsid molecules that can appear rod-shaped.

# Microbiology 233 Study Guide

**Cindy H. Nakatsu, Robert V.  
Miller, Suresh D. Pillai**

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