

# MICROBIOLOGY

Discover the science of microorganisms

## Organisms & Evolution //

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

- The four 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	1–90 micrometers	0.02–0.3 micrometers
Nucleus	No	No	Yes	No
Genetic information	DNA	DNA	DNA	DNA or RNA
Lipid bilayer	Yes	Modified	Yes	Sometimes
Ribosomes	Small, unique	Small, more like eukaryotes	Large	No
Membrane-bound organelles	No	No	Yes	No
RNA polymerase	Single, 3 subunits	More complex, 8 subunits	Most complex, 12 subunits	Depends on genetic material
Grow without outside help	Yes	Yes	Yes	No
Maximum number of cells	1	1	Many	Non-cellular
Cell wall	Peptidoglycan	Several different forms	Cellulose, sometimes none	None

### 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/in them than human cells
- Incredibly 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)
- Combine some features of prokaryotes and eukaryotes
- Often known as extremophiles and will grow when other organisms cannot
  - ECG: 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 amoebas) or multicellular (e.g., fungi, plants, and animals)
  - Contain membrane-bound subcompartments that separate specific functions, particularly the nucleus
  - Division includes microscopic 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 & Archeal Cell Shapes & Growth Characteristics

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



- Diplo-:** Prefix meaning two; a diplococcus is two cocci that have grown together
- Tetrad:** Four cocci that grow together in a plane
- Sarcinae:** Eight cocci that grow together in a cube
- Strepto-:** Prefix meaning chain; a streptococcus is cocci that have grown together in a chain
- Staphylo-:** 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 two per cell
- Slime molds:** Single cells living in a damp environment (e.g., under leaves in a forest) that come together during replication



- Amoeba:** Free-form cell that can change its shape and engulf its prey
- Protist:** Non-plant, non-fungi organism (e.g., ciliates and flagellates)
- Algae:** Photosynthetic organism with a nuclei and chloroplasts. Many are single cells, others are multicellular, but many forms are still microscopic (i.e., volvox)
- Diatoms:** Photosynthetic eukaryote with a silicate cell wall often with a complex symmetrical pattern
- Yeast:** Eukaryotic, single-celled, round fungi
- Mush:** Multicellular fungus which forms hair-like projections (hyphae) that may contain crosswalls (septate) or not (non-septate)

### Viral Shapes

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

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**George A. Wistreich**



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