

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
 - 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

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

Microbiology 233 Study Guide

**Michigan State University. Dept. of
Bacteriology and Public
Health, Michigan Agricultural College.
Department of Bacteriology and
Hygiene**

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