

## 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; halotrophs, 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 Study Guide

**Lei Huang**

A red circular graphic with a gradient, appearing as a stylized arrow or a partial circle, located to the right of the author's name.

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## **Table of Contents Microbiology Study Guide**

1. Understanding the eBook Microbiology Study Guide
  - The Rise of Digital Reading Microbiology Study Guide
  - Advantages of eBooks Over Traditional Books
2. Identifying Microbiology Study Guide
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Microbiology Study Guide
  - User-Friendly Interface
4. Exploring eBook Recommendations from Microbiology Study Guide
  - Personalized Recommendations
  - Microbiology Study Guide User Reviews and Ratings
  - Microbiology Study Guide and Bestseller Lists
5. Accessing Microbiology Study Guide Free and Paid eBooks
  - Microbiology Study Guide Public Domain eBooks
  - Microbiology Study Guide eBook Subscription Services
  - Microbiology Study Guide Budget-Friendly Options

6. Navigating Microbiology Study Guide eBook Formats
  - ePub, PDF, MOBI, and More
  - Microbiology Study Guide Compatibility with Devices
  - Microbiology Study Guide Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Microbiology Study Guide
  - Highlighting and Note-Taking Microbiology Study Guide
  - Interactive Elements Microbiology Study Guide
8. Staying Engaged with Microbiology Study Guide
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Microbiology Study Guide
9. Balancing eBooks and Physical Books Microbiology Study Guide
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Microbiology Study Guide
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Microbiology Study Guide
  - Setting Reading Goals Microbiology Study Guide
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Microbiology Study Guide
  - Fact-Checking eBook Content of Microbiology Study Guide
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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