

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	Eukaryota	Viruses
Size	0.2–10 micrometers	0.2–10 micrometers	1–90 micrometers	0.05–0.3 micrometers
Nucleus	No	No	Yes	No
Genetic information	DNA	DNA	DNA	DNA or RNA
Lipid bilayer	Yes	Modified	Yes	No
Ribosomes	Small, unique	Small, more like eukaryotes	Large	No
Membrane-bound organelles	No	No	Yes	No
RNA polymerase	Simple, 3 subunits	More complex, 8 subunits	Most complex, 12 subunits	Depends on genetic material
Gene within outside body	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
- EN: Halophiles, salt loving; Sulfophiles, sulfur loving; Thermotrophs, heat loving; Lithotrophs, rock loving; methanophilic, 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 //

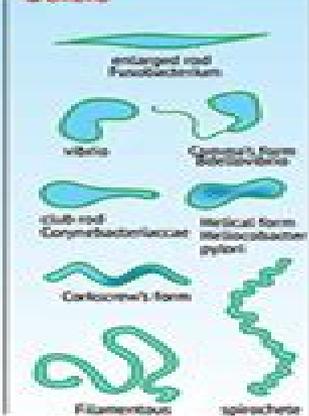
Bacterial & Archeal Cell Shapes & Growth Characteristics

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

Cocci



Others



Bacilli



Budding and appendaged bacteria



- **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

- **Ciliate:** Short cilia used for locomotion and/or feeding
- **Flagellate:** Long flagella used for locomotion; usually there are only one or two per cell
- **Slime mold:** 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 organisms 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 On

Yan Bai



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Table of Contents Microbiology Study Guide On

1. Understanding the eBook Microbiology Study Guide On
 - The Rise of Digital Reading Microbiology Study Guide On
 - Advantages of eBooks Over Traditional Books
2. Identifying Microbiology Study Guide On
 - 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 On
 - User-Friendly Interface
4. Exploring eBook Recommendations from Microbiology Study Guide On

- Personalized Recommendations
- Microbiology Study Guide On User Reviews and Ratings
- Microbiology Study Guide On and Bestseller Lists
- 5. Accessing Microbiology Study Guide On Free and Paid eBooks
 - Microbiology Study Guide On Public Domain eBooks
 - Microbiology Study Guide On eBook Subscription Services
 - Microbiology Study Guide On Budget-Friendly Options
- 6. Navigating Microbiology Study Guide On eBook Formats
 - ePub, PDF, MOBI, and More
 - Microbiology Study Guide On Compatibility with Devices
 - Microbiology Study Guide On Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Microbiology Study Guide On
 - Highlighting and Note-Taking Microbiology Study Guide On
 - Interactive Elements Microbiology Study Guide On
- 8. Staying Engaged with Microbiology Study Guide On
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Microbiology Study Guide On
- 9. Balancing eBooks and Physical Books Microbiology Study Guide On
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Microbiology Study Guide On
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Microbiology Study Guide On
 - Setting Reading Goals Microbiology Study Guide On
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Microbiology Study Guide On

- Fact-Checking eBook Content of Microbiology Study Guide On
 - 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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