

MICROBIOLOGY

Quick Science Revision

Classification & Evolution of



Domain	Characteristics	Examples
Bacteria	Prokaryotic, unicellular, lack nucleus and membrane-bound organelles. Cell wall made of peptidoglycan.	Escherichia coli, Bacillus subtilis, Streptococcus pneumoniae
Eukarya	Eukaryotic, can be unicellular or multicellular. Have a nucleus and membrane-bound organelles. Cell wall (if present) is made of cellulose or chitin.	Humans, plants, fungi, protists
Archaea	Prokaryotic, unicellular. Often live in extreme environments (halophiles, thermophiles). Cell wall made of pseudopeptidoglycan.	Halobacterium salinarum, Pyrodicticum ferrireducens

Evolution

- Life on Earth began as simple organic molecules.
- First life forms were simple prokaryotes.
- Over time, more complex organisms evolved.
- Evolution is driven by natural selection.
- Genetic variation is essential for evolution.
- Speciation occurs when populations become reproductively isolated.

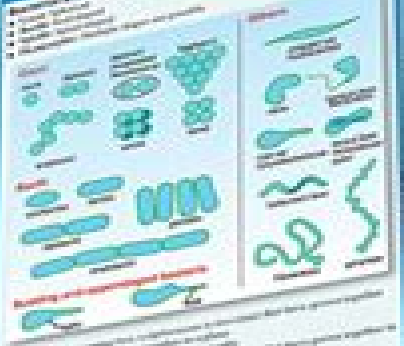
Microscopy

- Light microscope: can see cells and some organelles.
- Electron microscope: can see detailed structure of cells and organelles.
- Fluorescence microscope: can see specific molecules in cells.
- Phase-contrast microscope: can see live cells.

Stains

- Gram stain: differentiates bacteria into Gram-positive and Gram-negative.
- Acid-fast stain: identifies Mycobacterium species.
- Endospore stain: identifies bacteria that form spores.
- Flagellar stain: identifies bacteria with flagella.

Structure & Types of



Cell Structure

- Prokaryotic cells:** lack nucleus and membrane-bound organelles. DNA is in the nucleoid.
- Eukaryotic cells:** have a nucleus and membrane-bound organelles. DNA is in the nucleus.
- Plant cells:** have a cell wall, large central vacuole, and chloroplasts.
- Animal cells:** lack cell wall and large central vacuole.
- Fungal cells:** have a cell wall made of chitin.

Microbial Growth

- Binary fission:** a cell divides into two daughter cells.
- Budding:** a new cell grows out of the parent cell.
- Spore formation:** some bacteria form spores to survive harsh conditions.
- Conjugation:** two bacteria exchange genetic material.

Microbial Metabolism

- Autotrophs:** can produce their own food from inorganic substances.
- Heterotrophs:** obtain energy from organic substances.
- Photosynthesis:** converts light energy into chemical energy.
- Respiration:** converts chemical energy into ATP.

Microbial Interactions

- Symbiosis:** close relationship between two species.
- Mutualism:** both species benefit.
- Commensalism:** one species benefits, the other is unaffected.
- Parasitism:** one species benefits at the expense of the other.

Microbial Control

- Antisepsis:** reduces the number of microorganisms on a surface.
- Disinfection:** destroys most microorganisms on a surface.
- Sterilization:** destroys all microorganisms.
- Antibiotics:** substances that kill or inhibit the growth of bacteria.



Cell Membrane

- Phospholipid bilayer: hydrophilic heads, hydrophobic tails.
- Fluid mosaic model: proteins are embedded in the lipid bilayer.
- Transport mechanisms: diffusion, osmosis, active transport.

Osmosis

- Movement of water across a semi-permeable membrane from high to low water potential.
- Isotonic:** equal water potential on both sides.
- Hypotonic:** higher water potential outside the cell.
- Hypertonic:** lower water potential outside the cell.

Cell Wall

- Provides structural support and protection.
- Prevents the cell from bursting or shrinking.
- Contains peptidoglycan in bacteria.
- Contains cellulose in plants.
- Contains chitin in fungi.

Cell Division

- Mitosis:** produces two identical daughter cells.
- Meiosis:** produces four genetically diverse daughter cells.
- Binary fission:** a cell divides into two.
- Budding:** a new cell grows out of the parent cell.

Microbial Growth Curves

- Lag phase:** initial period of adjustment.
- Exponential phase:** rapid growth.
- Stationary phase:** growth rate equals death rate.
- Death phase:** number of cells decreases.

Microbial Control Methods

- Heat:** pasteurization, autoclaving.
- Cold:** refrigeration, freezing.
- Drying:** removal of water.
- Antibiotics:** kill or inhibit bacteria.
- Antifungals:** kill or inhibit fungi.

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AN Whitehead



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