

Chapter 26 Notes: Prokaryotes

I. Learning Objectives

- A. Describe the basic differences between prokaryotes and eukaryotes.
- B. Describe the nitrogen cycle and the essential roles played by prokaryotes.
- C. Describe the diversity of prokaryotic metabolic strategies in terms of obtaining carbon, energy, and oxygen requirements.
- D. Outline the phylogeny of the major groups of prokaryotes.
- E. Describe how prokaryotes impact human health.

II. Prokaryotes

- A. Small
- B. Abundant in all habitats
- C. Metabolically diverse
- D. Essential to all life on Earth
- E. Huge impact on human health
- F. Basic structure:
 - 1. Plasma Membrane
 - 2. Cytoplasm
 - 3. Chromosomal DNA
 - a. Circular chromosomes
 - b. Bacteria often have small circles of additional DNA call **plasmids**
 - 4. Cell Wall
 - 5. Flagellum

- a. Helps the prokaryote move- this makes them structurally different from eukaryotes.

6. Ribosomes

III. Gram Stains

- A. A positive gram stain means the cell stained well.
- B. A negative gram stain means the cell stained poorly.
- C. Usually, gram-negative cells have an additional cell wall that block the absorption of the stain.

IV. Reproduction

- A. Prokaryotes reproduce asexually.
- B. Genetic diversity arises from mutation.
- C. Mutation occurs in three ways:
 - 1. **Conjugation:** DNA, usually plasmids, forms a donor cell and is transferred through a pilus into the recipient cell.
 - 2. **Transformation:** DNA is released into the environment by a dead cell and is taken up by a recipient cell.
 - 3. **Transduction:** DNA is transferred from a donor cell to a recipient cell by a virus.

V. Prokaryotic Metabolism

- A. Prokaryotes are able to use sources of energy not available to Eukaryotes.
- B. Prokaryotes species vary in their need (and tolerance) of O₂

VI. Oxygenic vs. Anoxygenic

- A. Oxygenic Photosynthesis:



B. Anoxygenic Photosynthesis:



C. Anaerobic Respiration:



D. Aerobic Respiration



VII. Prokaryotes and Their Importance to Biology

- A. Prokaryotes play important roles in all the major biochemical cycles
- B. They are essential for sulfur and nitrogen cycles
- C. Only bacteria can fixate nitrogen into useable forms such as nitrate and ammonia.
- D. Many prokaryotes have not been grown in cultures
- E. They are only known from their DNA sequences.
- F. Common groups of Bacteria:
 - 1. Firmicutes
 - 2. Actinobacteria
 - 3. Y-proteobacteria
 - 4. Cyanobacteria

VIII. Cyanobacteria

- A. Photosynthetic
- B. They can be single cell or multi-cell
- C. They form common green substances, like pond scum.