

The Prokaryotes

- Simplest organisms
- All unicellular
- Lack nuclei
- Lack organelles
- Peptidoglycan (cell wall)
- Multiply by binary fission
- Diverse metabolism (eat about anything)
- Diverse habitats

Bacteria vs. Archaea

- Two different forms of prokaryotes
- Two separate domains
- Very different
- Ancient split

Prokaryote Shapes

- Bacilli
- Cocci
- Spiral

Pleomorphic bacteria can assume several shapes.

Range in size from 2-8 μm long and 0.2-2 μm in diameter.

(1 μm = 1/1,000,000 m)

Some are pathogenic (disease causing), but most are harmless.

Exotoxins and Endotoxins

Prokaryotic Nutrition:

How organisms obtain carbon and energy:

Autotrophs

 Photoautotrophs

 Chemoautotrophs

Heterotrophs

 Photoheterotrophs

 Chemoheterotrophs

Oxygen Requirements:

Obligate aerobes

Facultative anaerobes

Obligate anaerobes

Aerotolerant anaerobes

Microaerophiles

Many prokaryotes thrive in hostile environments (Archaea).

acidophiles, thermophiles, basophiles, halophiles

Modifications for Survival

1) prokaryotic flagellum

2) pili

3) endospores

4) actinomycetes (fungus like)

Special Prokaryotes

Cyanobacteria

- photosynthetic bacteria
- blue-green
- blooms

Nitrifying Bacteria

- convert ammonia and nitrite into nitrate
- agriculture

Nitrogen Fixing Bacteria

- fix nitrogen gas into ammonia
- root nodules of legumes

Sulfur Reducing Bacteria

- deep sea vents
- may represent earliest forms of life

The Prokaryotic Cell

I. Structures external to cell wall

A. Glycocalyx

- Gelatinous glycoprotein covering
- Includes capsules and slime layers
- Functions:
 1. Protect from phagocytosis
 2. Adherence
 3. Prevent desiccation
 4. Feeding

B. Flagella

- Solid, unsheathed, protein
- Filament, hook, basal body

C. Axial Filaments

D. Fimbriae and Pili

II. The Cell Wall

- Rigid structure surrounds plasma membrane
- Consists of peptidoglycan
- Two different types based on structure
 - 1) Gram +
 - 2) Gram –
- Porins

III. Structures internal to cell wall

A. The plasma membrane

- Phospholipid Bilayer with interspersed proteins
- Encloses the cytoplasm
- Mesosomes = irregular infoldings of the membrane

B. Cytoplasm

- Fluid component of cell
- Mostly water with soluble material

C. The nuclear area (nucleoid region)

- Region contains bacterial chromosome
- Plasmids

D. Ribosomes

- 70S (as opposed to 80S in eukaryotes)
- Sites of protein synthesis
- Damaged by some antibiotics

E. Inclusions