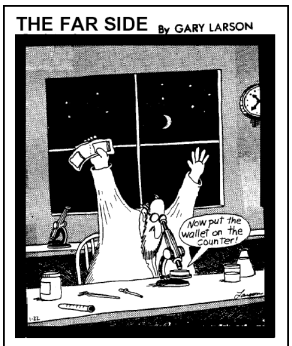
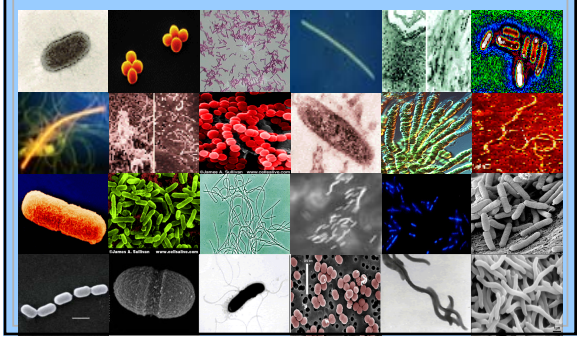


Working alone, Professor Dawson stumbles into a bad section of the petri dish.

The microbial world



Outline

- classification of microorganisms
- viruses
- bacteria

Microorganisms:

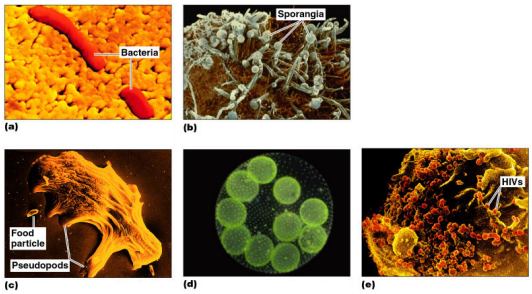


Figure 1.1

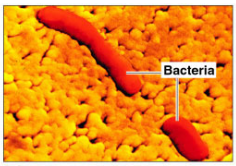
Scientific names

- *Staphylococcus aureus*
  - Describes the clustered arrangement of the cells (staphylo-) and the golden color of the colonies.
- *Escherichia coli*
  - Honors the discoverer, Theodor Eshcerich, and describes the bacterium's habitat, the large intestine or colon.
- *S. aureus*
- *E. Coli*

Classification of Microorganisms

- Three domains
  - Bacteria
  - Archaea
  - Eukarya
    - Protists
    - Fungi
    - Plants
    - Animals
- Viruses

Bacteria



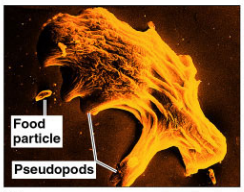
(a)

Figure 1.1a

Archaea

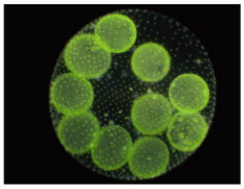
Figure 4.5b

(Eukaryote) Protists



(c)

- Protozoa

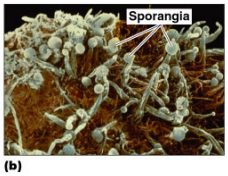

(d)

- Algae

Figure 1.1c

(Eukaryote) Fungi

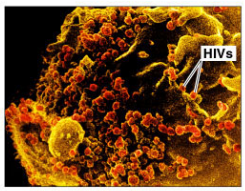
- Molds
- Yeasts



(b)

Figure 1.1b

Viruses



(e)

- Acellular.

Figure 1.1e

Multicellular Animal Parasites

- Microscopic stages in life cycles.

Figure 12.28

The Theory of Biogenesis

- Pasteur's S-shaped flask kept microbes out but let air in.

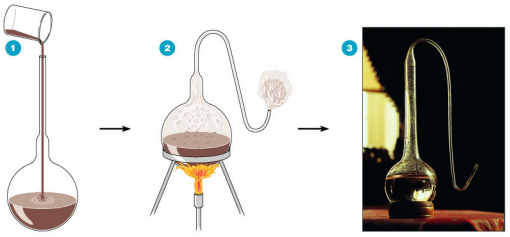


Figure 1.3

The Golden Age of Microbiology

- Beginning with Pasteur's work, discoveries included the relationship between microbes and disease, immunity, and antimicrobial drugs

Pasteurization

- Pasteur demonstrated that these spoilage bacteria could be killed by heat that was not hot enough to evaporate the alcohol in wine. This application of a high heat for a short time is called pasteurization.

Figure 1.4

Disease and vaccination

Koch's postulates are used to identify disease-causing bacteria

- In 1876, Robert Koch discovered rod-shaped bacteria in the blood of cattle suffering from anthrax

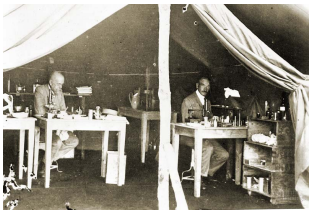


Figure 16.15A

The Birth of Modern Chemotherapy

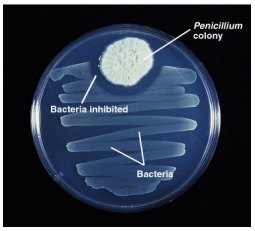


Figure 1.5

Modern Developments in Microbiology

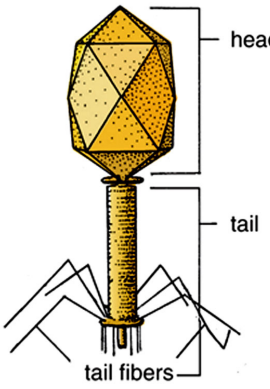
Selected Nobel Prizes in Physiology or Medicine

1901*	von Behring	Diphtheria antitoxin
1902	Ross	Malaria transmission
1905	Koch	TB bacterium
1908	Metchnikoff	Phagocytes
1945	Fleming, Chain, Florey	Penicillin
1952	Waksman	Streptomycin
1969	Delbrück, Hershey, Luria	Viral replication
1987	Tonegawa	Antibody genetics
1997	Prusiner	Prions

* The first Nobel Prize in Physiology or Medicine.

VIRUSES

Bacteriophage

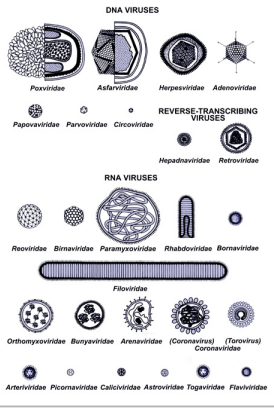


A.

Virus shapes

Sizes:

20-400 nm



Lytic infection

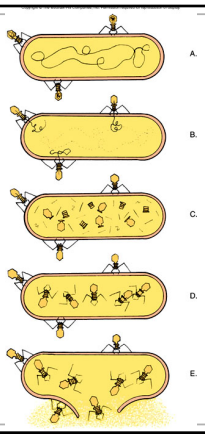
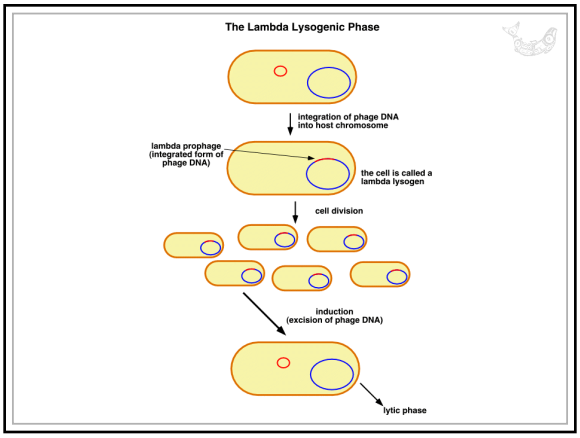
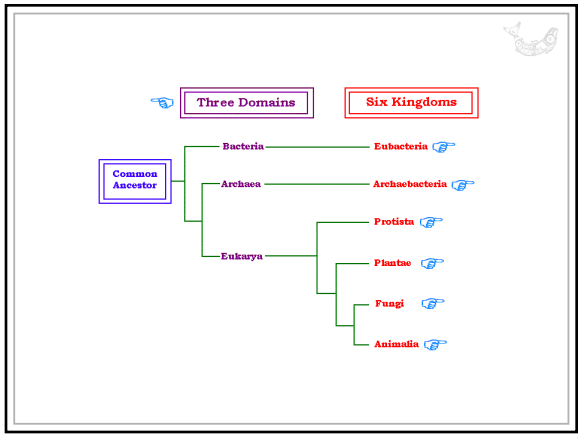
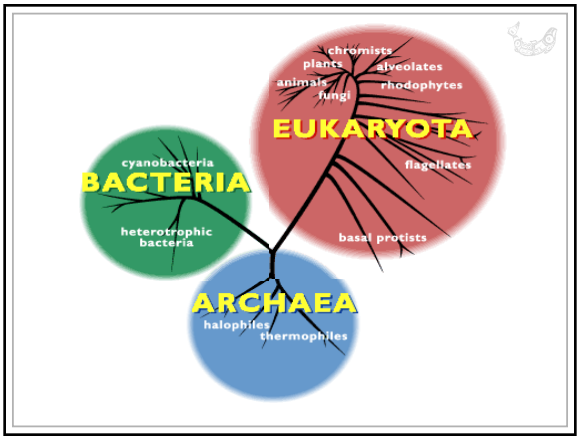


Fig. 17.18







Ancient Bacteria Changed the World

Fossilized

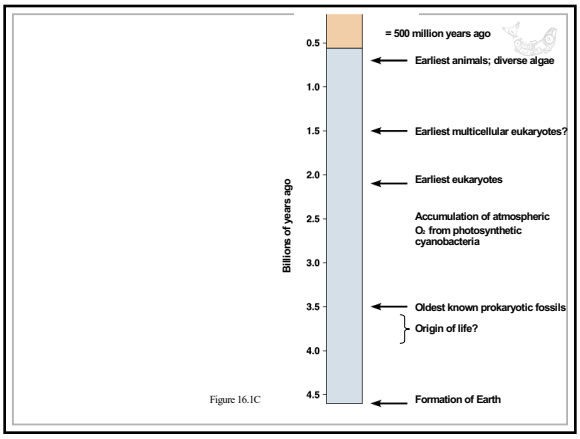
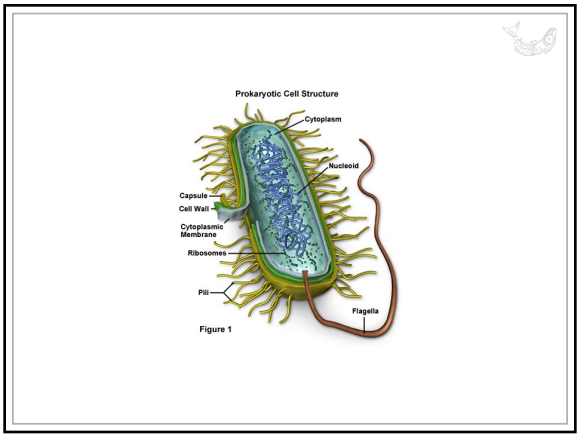


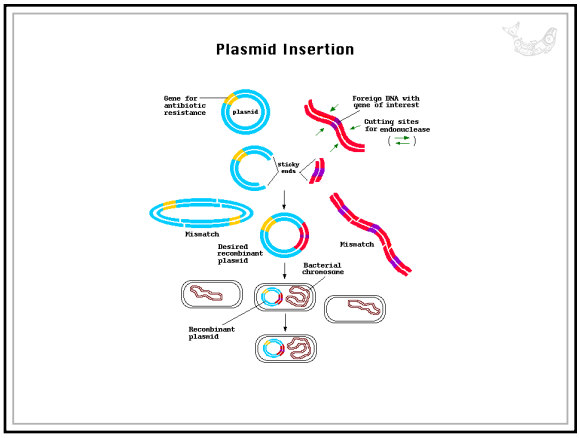
Figure 16.1C

DIFFERENCES BETWEEN BACTERIA AND ARCHAEA

Main Features	Bacteria	Archaea
rRNA sequences	Some unique to bacteria	Some unique to archaea; some match eukaryotic ones
RNA polymerase	One kind; relatively small and simple	Several kinds; complex; similar to eukaryotic
Introns (noncoding parts of genes)	Absent	Present in some genes
Antibiotic sensitivity (to streptomycin, chloramphenicol)	Inhibited	Not inhibited
Peptidoglycan in cell wall	Present	Absent
Membrane lipids	Carbon chains unbranched	Some carbon chains branched

Table 16.8





Shapes

- Spheres (cocci) are the most common
- Rods (bacilli)
- Curves or spirals

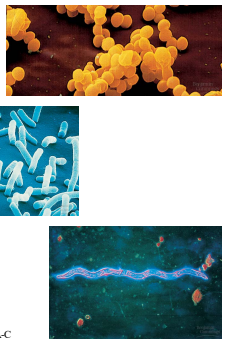
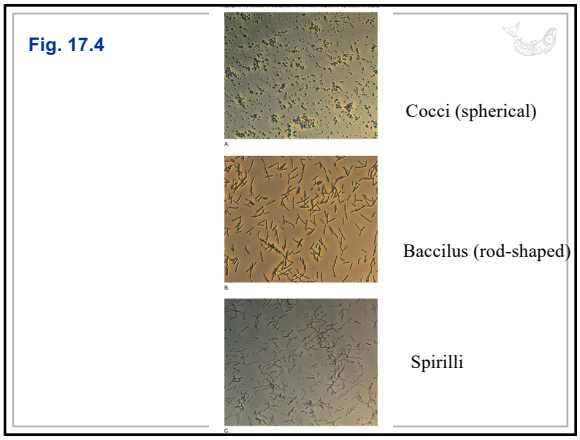
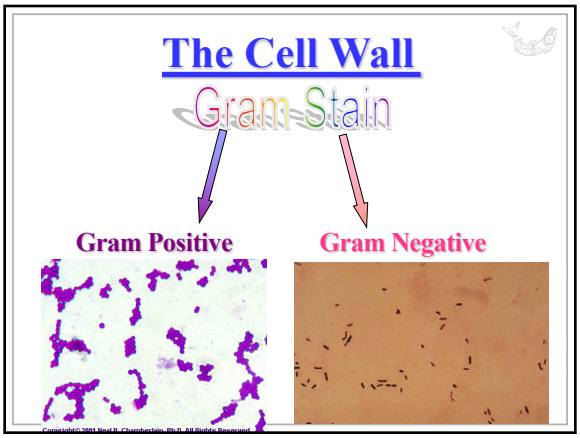


Figure 16.9A-C





Diverse structural features help prokaryotes thrive almost everywhere

- Rotating flagella aid in locomotion

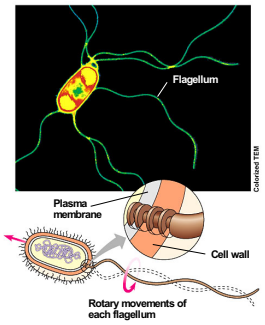


Figure 16.12A

- Pili help cells cling to surfaces

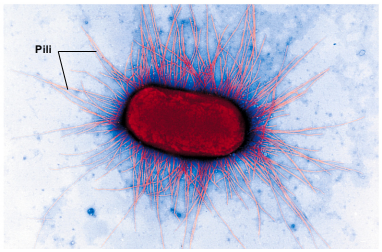
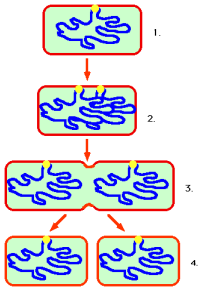


Figure 16.12B

Binary fission



- Many prokaryotes grow in linear filaments

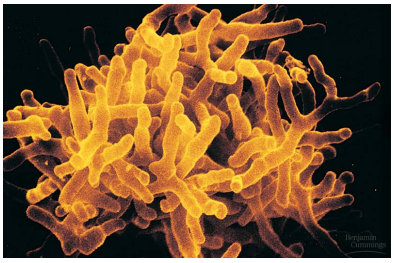
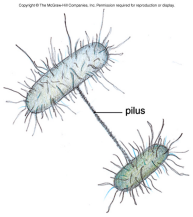
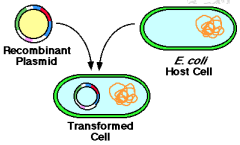


Figure 16.12D

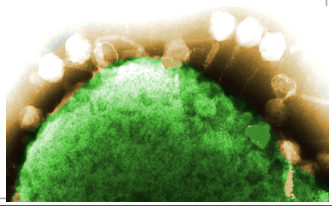
Conjugation



Transformation



Transduction



- Endospores allow certain bacteria to survive environmental extremes in a resting stage

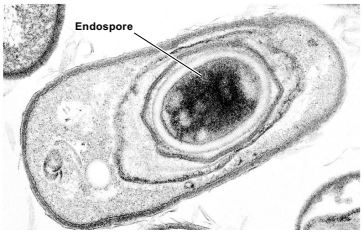


Figure 16.12C

NUTRITIONAL CLASSIFICATION OF ORGANISMS

Nutritional Type	Energy Source	Carbon Source
Photoautotroph (photosynthesizers)	Sunlight	CO_2
Chemoautotroph	Inorganic chemicals	CO_2
Photoheterotroph	Sunlight	Organic compounds
Chemoheterotroph	Organic compounds	Organic compounds

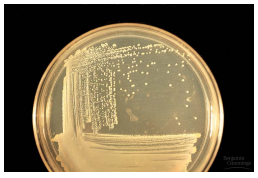


Table 16.10

Archaea

- Archaea live in
  - anaerobic swamps
  - salt lakes
  - acidic hot springs
  - deep-sea hydrothermal vents
  - animal digestive systems

Figure 16.11A, B

- Eubacteria
  - Actinomycetes
  - Chemoautotrophic
  - Cyanobacteria
  - Nitrogen-fixing bacteria

Cyanobacteria

- These bacteria photosynthesize in a plant-like way
  - They often "bloom" in polluted water

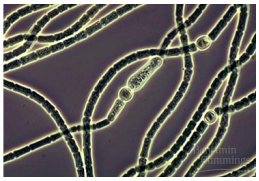


Figure 16.13A, B

Ecosystem roles

- Cycling nutrients
- Decomposers
- Autotrophic bacteria

Symbiotic bacteria

- Symbiosis
- Mutualism
- Commensalism
- Parasitism

Some bacteria cause disease

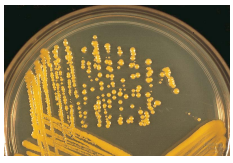


Figure 16.14A, B

- Digest organic waste

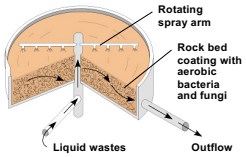


Figure 16.17A

- Clean up oil spills

Figure 16.17B

Bacteria can be used as biological weapons

- The species that causes anthrax can be used as a biological weapon in war or in acts of terrorism

Figure 16.16