Chapter 1 Humans and the Microbial World

Summary Outline

1.1 The origin of microorganisms
- A. Theory of Spontaneous Generation
  - 1 Pasteur's experiments
  - 2 Tyndall and Cohn experiments
- B. The first microorganisms—probably grew in the absence of air and at very high temperatures

1.2 Microbiology: A human perspective
- A. **Vital activities** of microorganisms
  - 1 Necessary for the survival of all other organisms
  - 2 Bacteria fix nitrogen; microorganisms replenish the oxygen on earth
  - 3 Microorganisms degrade organic waste materials
- B. **Economic applications** of microbiology
  - 1 Production of bread, wine, beer and cheeses
  - 2 Bacteria degrade dangerous toxic pollutants
  - 3 Bacteria synthesize a variety of different products
- C. **Genetic engineering**
  - 1 Genes from one organism are introduced into related or unrelated organisms resulting in new properties
  - 2 Expands the capabilities of microorganisms enormously
  - 3 Microorganisms produce medically important products including vaccines
  - 4 Genes can be transferred into plants by microorganisms
- D. **Genomics**
  - 1 The science that deals with the DNA sequences of organisms
  - 2 Genomics will enable scientists to better understand the relationships between organisms and with their environments.
- E. **Medical microbiology**
  - 1 Microorganisms cause diseases such as smallpox, bubonic plague and influenza
  - 2 Emerging diseases are arising in developed countries
  - 3 Other diseases that were declining have begun to reemerge
  - 4 Chronic diseases such as ulcers and heart disease may be caused by bacteria
  - 5 Bacteria use the body as an ecological niche
- F. Microorganisms as **subjects for study**
  - 1 Excellent model organisms to study
  - 2 Grow rapidly and follow the same genetic, metabolic and biochemical principles as higher organisms

1.3 The Microbial World
- A. Two major cell types
  - 1 The simple **prokaryotic**
  - 2 The complex **eukaryotic**
- B. **Three domains**—based on the chemical composition and cell structures
  - 1 **The Bacteria**—single-celled prokaryotes with peptidoglycan in their cell wall
  - 2 **The Archaea**—single-celled prokaryotes; do not have peptidoglycan in their cell wall; grow in extreme environments
  - 3 **The Eucarya**—have eukaryotic cell structure: single cells or multicellular
  - 4 Microbial members of the Eucarya are
  - 5 **Algae**—single-celled or multicellular; can use sunlight as a source of energy

6 **Fungi**—single-celled yeasts or multicellular molds and mushrooms; use organic compounds as food
7 **Protozoa**—single-celled organisms
a) Motile by a variety of means
b) Use organic compounds as food

C. Nomenclature
1 **Binomial system**
2 ***Genus*** and a ***species*** name written in Italics

1.4 **Viruses, viroids and prions**

A. Non-living members of the microbial
B. Not composed of cells
C. **Obligate intracellular parasites**
D. **Prions** consist only of protein without any nucleic acid

1.5 **Size** in the microbial world—**varies greatly**