Prokaryotes: Bacteria & Achaea
BI 101 General Biology

Announcements

Homework:
- Read article “Ultimate social network”
- (check email)
- Write a 1 page reflection on what you learned
- Extra credit questions at end
- Due Wed
- Reach Ch
Microorganisms

- Single-celled organisms that are too small to be seen without a microscope
- Bacteria are the smallest living organisms
- Viruses are smaller but not made up of cells

Kingdoms and Domains

The three-domain system
- Bacteria
- Archaea
- Eukarya

The six-kingdom system
- Bacteria
- Archaea
- Protista
- Plantae
- Fungi
- Animalia

The traditional five-kingdom system
- Monera
- Protista
- Plantae
- Fungi
- Animalia
Bacteria

- Microscopic
- Unicellular
- Live in every habitat on the planet & fill every possible niche
- There are more bacterial cells on each of our bodies than there are our cells of our own
  - important in skin, mouth, intestinal tract

Ecological Importance of Bacteria

- Decomposition
- Nitrogen fixation
- Mutualistic relationships
- Parasitic relationships
- Commercial uses

Treponema pallidum, a spiral-shaped bacteria which causes Syphilis in humans
Ecological Importance: Bioremediation

*Alcanivorax borkumensis* can break down oil from oil spill in Gulf of Mexico

Cyanobacteria

- Nitrogen fixers
- Photosynthesis with chlorophyll

Also known as Bluegreen algae
Cyanobacteria

- Nitrogen fixers
- Photosynthesis with chlorophyll
- **Stromatolites**

Also known as Bluegreen algae

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Cyanobacteria

- Nitrogen fixers
- Photosynthesis with chlorophyll
- Stromatolites
- **Biological soil crust**
Nitrogen fixation

Bacterial Metabolic Diversity

- Photoautotrophic
  - Aerobic (Cyanobacteria)
  - Anaerobic (Green bacteria)
- Chemoautotrophic
  - Important in nitrogen cycle
- Chemoheterotrophic
  - Largest group
Commercial importance

- Bacteria, often in combination with yeasts and molds, are used in the preparation of fermented foods such as:
  - cheese, pickles, soy sauce, sauerkraut, vinegar, wine, and yogurt.

Industrial importance

- Bacteria are also important to industrial processes,
  - wastewater treatment
  - industrial production of antibiotics and other chemicals.
Medical importance

- Some bacteria act as pathogens
  - tetanus, typhoid fever, pneumonia, syphilis, cholera, food-borne illness, leprosy, and tuberculosis (TB).
  - In plants, bacteria cause leaf spot, fireblight, and wilts.
  - The mode of infection includes contact, air, food, water, and insect-borne microorganisms.
Why don’t antibiotics work for colds and flu?

Why don’t they destroy your body’s cells?

➔ Discuss with a partner

Hint: Antibiotics often work by disrupting the bacteria cell wall.

**Cell wall of peptidoglycan**

(a) Structure of peptidoglycan in gram-positive bacteria

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The Threat of Drug-Resistance

In a population of pathogens, drug-resistant individuals survive and reproduce

- About half the known strains of *Streptococcus pneumoniae* are penicillin resistant
- Many strains of HIV are now resistant to the antiviral drugs used to fight them

![Graph showing resistance to Vancomycin over time](image-url)
What can we do to solve the problem?

→ discuss with a partner
Archaea

- Single celled prokaryotes
- Extreme habitats & niches!
  1. Methanogens
  2. Extreme halophiles
  3. Extreme thermophiles

*Methanobacterium ruminantium* lives in cow digestive tract
Extreme Halophiles

*Halobacterium halobium* lives in salty areas like the Great Salt Lake

Extreme Thermophiles