


MICROBIOLOGY

Friend or Foe


Microbes

- Organisms that are too small to be seen with the naked eye
- The four types include
 - ▣ Bacteria
 - ▣ Virus
 - ▣ Fungi
 - ▣ Parasites (some)



The First Microbiologist

- Anton van Leeuwenhoek was the first person to look at microbes under the microscope
- He observed pond water and called what he saw animalcules



What Does a Microbiologist Do?

- They study the effect of microbes on humans
- Work in almost every industry
 - ▣ Food, agriculture and pollution control, biotechnology, pharmaceuticals and health, government agencies and labs, in education as teachers and researchers

Bacteria Are Ideal Microbes

- Reproduce asexually via binary fission
- Can divide every 20-30 minutes so research can be done in a fraction of the time of eukaryotic cells

Generation	Number of Bacteria
1	1
5	16
10	512
15	16384
20	524288
50	562949953421312

- The oldest living things on Earth
- Microbial genomes (10 million bases) are small in size as compared to human genomes (3 billion bases)
- They live in every environment on planet Earth (ice, boiling water, deep ocean, hot springs)
- There are more bacteria cells in your body than human cells
- Bacteria produce almost half of the air we breathe

Fascinating Facts

Project Description

- In groups of 4-5, research one of the seven subfields of microbiology on iPad's and make a Google Presentation
- Include a general description of this field of microbiology
- Explain the role of microbes in research and development
- Highlight 2 careers in this field including average salary
- Explain at least one current area of research (the latest breakthroughs)

SUPPLEMENTAL SLIDES

Food Microbiology

- Microorganisms are involved in producing many foods and beverages
- Lactobacillus and other bacteria turn milk into buttermilk, sour cream, yogurt, and cheeses.
- Other bacteria turn apple cider into vinegar, and cucumbers into pickles.
- Microbes can help control food spoilage
- Fermentation
 - Microorganisms convert simple sugars into alcohol and carbon dioxide
- Food borne illness
 - Eating spoiled foods or foods containing harmful microbes or their products

Industrial Microbiology

- Fermentation
- Production of several industrial products
 - Enzymes, vitamins, pharmaceuticals
- Treatment of water and wastewaters
- Disposal and cleanup of biological wastes
- Treatment of mine drainage
- Pesticides and agricultural products

Industrial Microbiology

- Alternative Fuels
 - Some microbes produce carbohydrates used as fuels
 - Other microbes convert biomass into renewable fuels

Fuel Production

- Alternative Fuels
 - Some microbes produce carbohydrates used as fuels
 - Other microbes convert biomass into renewable fuels
- Archaeobacteria produce methane gas, which makes up 20% of the world's natural gas used for fuel.

Environmental Microbiology

- Studies microbes in their own environment
 - Evolution and adaptation
- Important to the cycling of chemical elements
- Using bacteria to break down toxic chemicals into environmentally friendly chemicals
- Role of microbes in soil production

Digestive Health

- Many bacteria, such as human *E. coli*, live a warm and cozy life in your intestines. They help digest your food and make vitamins, such as Vitamin K (which is necessary for blood clotting).
- Beneficial bacteria, such as *Lactobacillus*, keep the "bad" bacteria in check, by competing with them for nutrients.

Digestive Health Cont.

- Microbes living in the rumen of the cow are responsible for the breakdown of the carbohydrate cellulose of plants.
- The cow lacks the enzymes to break down carbohydrates.
- Without microbes and their enzymes, ruminants would not be able to derive any energy or nutrients from a diet of grass.

Medicines

- The pharmaceutical industry uses some forms of bacteria to make vitamins and antibiotics.
- Other bacteria can be used to produce insulin, which can be collected and given to people with diabetes.

Biological Warfare & Bioterrorism

- Microbes can be turned into biological weapons
 - Bioterrorism: Can harm humans (smallpox, anthrax, plague, botulism)
 - Agroterrorism: Destroying food supply