MCB2004 Exam 1 Review Guide

15% of human cancer cases are caused by viruses.

Unaided eye resolution is 0.4mm

Microbes- organisms that are too small to be seen with the unaided eye.

6 major groups of microbes studied by microbiologists:

1. Bacteria
    a. **Prokaryotes**-single cell
    b. **Peptidoglycan cell wall**
    c. **Binary fission**- asexual cell division
    d. For energy, use organic chemicals, inorganic chemicals, or photosynthesis
2. Archaea
    a. Prokaryotes
    b. **Lack peptidoglycan**
    c. Commonly live in extreme environments
    d. Includes: methanogens, extreme halophiles (high concentration of salt), and extreme thermophiles
3. Fungi
    a. **Eukaryotes**- cell contains a nucleus
    b. **Chitin cell walls**
    c. Use organic chemicals for energy
    d. **Yeasts are unicellular, molds and mushrooms are multicellular**
4. Protozoa
    a. Eukaryotes
    b. Absorb or ingest organic chemicals
    c. My be motile via pseudopods, cilia, or flagella
5. Algae
    a. Eukaryotes
    b. **Cellulose cell walls**
    c. Use photosynthesis for energy
    d. Produce molecular oxygen and organic compounds
6. Viruses
    a. **Acellular**
    b. DNA or RNA genome

i. Genome surrounded by protein coat called a **capsid.**
ii. Coat may be enclosed in a lipid envelope.

c. Replicated only when they are living in a host cell.

What is a microbe?

Microbes are **living** creatures, **except viruses!**

Have proteins, nucleic acids, lipids, and sugars (same as us chemically).

Metabolize, grow, reproduce, and respond to environment.

Microbial **genomes** (many are sequenced).

Genome- organism's total genetic content.

-First draft of human genome was published in 2000.

Microbes have the greatest diversity of genomes. Studying them is important for studying evolution.

Uses for microorganisms:

1. Produce fermented foods such as bread and cheese.
2. Produce industrial chemicals such as ethanol and acetone.
3. Produce medicine, vaccines, and products used in manufacturing (e.g. cellulase)
4. Widely used as tools in biomedical research
5. Decompose organic waste (sewage treatment, bioremediation)
6. Producers in the ecosystem by photosynthesis
7. Some are **pathogenic** (disease causing)

To Decrease Growth of Microbes	To Increase Growth of Microbes
Prevent food spoilage	Make fermented food
Prevent disease occurrence (public health, personal hygiene, anti-microbial drugs, vaccine)	Make medicine, industrial products
Prevent contamination in medicine and in microbiology laboratories	Recycle waste
	Biological control (BT as pesticide)

Less than 1% of microorganisms are culturable and studied.

Eukarya= protists, fungi, plants, and animals

Robert Hooke, **1665**, reported living things are composed of "little boxes" (cells)

Cell theory: all living things are composed of cells and come from preexisting cells

Aton von Leeuwenhoek, **1673-1723**, described live microorganisms

Where do microbes come from?

1. **Spontaneous generation**-all living organisms arise from nonliving matter
2. **Biogenesis**- living organisms arise from preexisting life

Francesco Redi's experiment on maggots: sealed jars→no maggots, open jars→maggots appeared

John Needham put boiled nutrient broth into covered flasks. When the nutrient broth was heated and placed in a sealed flask, it led to microbial growth.

Lazzaro Spallanzani boiled nutrient solutions in flasks. The flask was heated and sealed, however, led to no microbial growth.

Pasteur:

Poured beef broth into a long necked flask (microorganisms were present in the broth) →heated the neck of the flask and bent it into an "s" shape, boiled the broth for several minutes (microorganisms not present in broth after boiling)→microorganisms did not appear in the cooled solution, even after long periods (bend prevented microbes from entering flask)

Pasteur showed that microbes are responsible for **fermentation**- the conversion of sugar to alcohol. Bacteria can also spoil food by using alcohol and turning it into acetic acid.

Pasteur→spoilage bacteria could be killed by heat that was not hot enough to evaporate the alcohol in wine

Pasteurization-application of high heat for a short amount of time

The Germ Theory of Disease:

1860s- Applying Pasteur's work showing microbes are in the air, can spoil food, and cause animal diseases, **Joseph Lister** used a chemical disinfectant to prevent surgical wound infections.

1876- Robert Koch proved that a bacterium causes anthrax and provided the experimental steps, **Koch's postulates** that prove a specific microbe causes a specific disease.