

Microbiology Study Guide

Cellular vs. Acellular Microorganisms

- Cellular microorganisms have a cell membrane, while acellular microorganisms do not.
- All living organisms have a cell membrane.
- Cellular microorganisms can be divided into prokaryotes (bacteria and archaea) and eukaryotes (fungi, protists, etc.).
- Prokaryotes lack a true nucleus, while eukaryotes have a nucleus.

Domains of Life

- The three domains of life are Bacteria, Archaea, and Eukarya.
- Bacteria and Archaea are both prokaryotes, while Eukarya are eukaryotes.
- The tree of life is based on the sequence of the 16S rRNA (prokaryotes) and 18S rRNA (eukaryotes) in the small subunit of the ribosome.

Acellular Microorganisms

- **Viruses:** Consist of nucleic acid (DNA or RNA) and a protein coat, but no cell membrane.
- **Viroids:** Consist of only single-stranded circular RNA, no protein coat.
- **Prions:** Consist of only misfolded proteins, no nucleic acid.

Evolution of Microorganisms

- Mutations can lead to positive, negative, or neutral changes.
- Horizontal gene transfer allows bacteria and archaea to share genetic information, leading to adaptation and evolution.
- Strains are slightly different variants of the same species, which can differ in biochemistry, morphology, or surface antigens.

Endosymbiosis

- Mitochondria and chloroplasts are believed to have originated from endosymbiotic relationships with bacteria.
- Mitochondria provide energy to the cell, while chloroplasts are responsible for photosynthesis in eukaryotic cells.

Key Concepts

- Microbes are found everywhere on Earth, and they play crucial roles in recycling elements and supporting life.
- Only about 3% of microbes are pathogens, while the majority are beneficial or neutral.
- Caution is needed when using absolute terms like "always" and "never" in science, as exceptions often exist.
- Microbes can evolve rapidly through mechanisms like horizontal gene transfer, posing challenges for disease treatment and prevention.

Cellular Microorganisms

- **Prokaryotes (Bacteria and Archaea):**
- Lack a true nucleus
- Transcription and translation occur in the same location (the cytoplasm)
- **Eukaryotes:**
- Have a true nucleus
- Transcription occurs in the nucleus, while translation occurs in the cytoplasm

Strains and Species

- Strains are slightly different variants of the same species
- Differences can be in:
- Biochemical properties (biobars)
- Morphology (morphobars)
- Surface antigens (serobars)
- Type strain is the first identified strain of a species

Exam Question Example

Q: Which of the following is true? A. Viruses are part of the acellular domain. B. Bacteria and archaea are both prokaryotes. C. All eukaryotes are multicellular. D. Prokaryotes are unicellular. E. All of the above are true.

The correct answer is B. Bacteria and archaea are both prokaryotes.

Microbiology 233 Study Guide

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