The Evolution of Microorganisms and Microbiology Cheat Sheet

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The Importance of Microorganisms

Who are the members of the microbial world?

- Cellular and acellular microorganisms too small to be clearly seen by the unaided eye
- Organisms with no highly differentiated tissues
- Relatively simple in their constructions

What are the types of microorganisms

1. Cellular - Includes Fungi, Protists, Bacteria and Archaea
2. Acellular (Not made up of cells/divided into cells) - Includes Virus, Viroids, Satellites and Prions

Describe prokaryotic cells

Their contents are not divided into compartments by membranes

Describe eukaryotic cells

- Have a membrane-enclosed organelles
- More complex morphologically
- Usually larger than prokaryotes

What are the three domain systems?

- Bacteria
- Archaea
- Eukaryotes

Describe the domain bacteria

- Usually single-celled organism
- Contain peptidoglycan in their cell wall
- Most lack membrane bounded nucleus
- Ubiquitous and some live in extreme environments

Describe the domain archaea

- Distinguished from bacteria by unique rRNA sequences
- Have unique membrane lipids
- Lack peptidoglycan in their cell walls
- Many live in extreme environments

Describe the domain eukarya

- Include plants, animals, protists and fungi
- Protists are generally larger than bacteria and archaea
- Fungi have metabolic capabilities

What are the differences between organisms' rRNA?

- Archaea SSU rRNA are more similar to eukaryotes compared to bacteria
- Prokaryotes have tRNA on their rRNA
- Prokaryotes have longer rRNA compared to eukaryotes

The Importance of Microorganisms (cont)

Describe viruses

- Smallest of all microbes
- Require host cell to infect
- Consist of nucleic acid and protein

Describe viroids and satellites

Composed of RNA only but some have DNA

Describe prions

- Infectious proteins
- Lack nucleic acid

How did the methods used to classify microbes changed?

Before
- Organisms were classified into five kingdoms (Monera, Protista, Fungi, Animalia, Plantae)
- All organisms with prokaryotic cell structures are under Monera
- Prokaryotes are too diverse to be grouped together in a single kingdom so this is invalid

After
- Recent discoveries on rRNA lead to classification into three domains (Bacteria, Archaea, Eukaryotes)

Different characteristic that distinguish microorganisms from the other

- Bacteria: Contain peptidoglycan in their cell walls
- Archaea: Have unique membrane lipid
- Protists: Usually larger than bacteria and archaea
- Fungi: Have metabolic capabilities
- Viruses: Composed of nucleic acid and proteins
- Viroids: Composed of RNA only
- Satellites: Composed of RNA/DNA
- Prions: Composed of infectious protein only

Microbiology and Its Origins

Explain the endosymbiotic hypothesis

Over time the bacterial endosymbiont of ancestral cell in the eukaryotic lineage lost its ability to live independently, becoming either a mitochondrion if it used aerobic respirations or chloroplasts if it was a photosynthetic bacterium

What are the evidences to support endosymbiotic hypothesis?

- Mitochondria and chloroplasts have similar SSU rRNA with bacteria:Mitochondria - proteobacteria while chloroplast and green algae - cyanobacterium
- Peptidoglycan found in chloroplasts
- Mitochondria and chloroplast have similar DNA and ribosomes with Bacteria's

Microbiology and Its Origins (cont)

Explain the hyrogen hypothesis

- The endosymbiont was an anaerobic bacterium that produces hydrogen and carbon dioxide as end products of its metabolism
-Over time, the host become dependent to the hydrogen produced by the endosymbiont thus it evolved into several organelles
- Perform aerobic respiration: Mitochondria
- Produce ATP through fermentation: Hydrogenosome

Describe Koch's Postulates

1. The microorganism must be present in every case of the disease but absent from healthy organisms
2. The suspected microorganism must be isolated and grown in a pure culture
3. The same disease must result when the microorganism is inoculated into a healthy host
4. The same microorganism must be isolated from the infected host

What is a pure culture?

A medium used to isolated suspected bacterial pathogens

Why are pure cultures important to Koch's postulates?

- To isolate suspected bacterial pathogens
- Agar is not broken down by most bacteria
- Agar will not melt until it reach 100c and will only solidify if it reach 50c