Chapter 1 Humans and the Microbial World

What is microbiology?

study of life too small to be seen by unaided eye (microbial world)

How did people figure out that there were microbes?

Development of the microscope.

Define Domain

The highest level in biological classification. There are 3 domains: **Bacteria, Archaea, & Eukarya.**

Define Eukaryote

Organism composed of 1 or more eukaryotic cells; members of the domain **Eukarya & eukaryotes.**

Define Eukaryotic Cell

Cell type characterized by a membrane--bound nucleus

Define Prion

An acellular infectious agent consisting only of protein.

Define prokaryote

single-celled organism consisting of a prokaryotic cell; members of the domains Bacteria & Archaea are prokaryotes.

Define prokaryotic cell

Cell type characterized by the lack of membrane-bound nucleus.

Define Viroid

An acellular infectious agent consisting only of RNA

Define Virus

An acellular infectious agent consisting of nucleic acid surrounded by a protein coat.

Define Spontaneous Generation

Life arose from non-living matter

Chapter 1 Humans and the Microbial World (cont)

In 1749, **John Needham** produced results that ____ spontaneous generation when he showed that broths that had been boiled & then sealed with a cork ____.

support; could still give rise to microorganisms.

Lazzaro Spallanzani's experiment of 1776 showed that flasks of broths that had been boiled for long periods of time & sealed tight ____.

remained free of microorganisms.

Francesco Redi first disproved the theory of spontaneous generation by showing that ___.

worms only appear on decaying meat has been exposed to flies.

Tyndall & Cohn's experiments in the 1870s showed of a heat-resistant form of bacteria called a(n)

endospore

The Golden Age of Microbiology is the period in which...

many disease-causing microorganisms were discovered.

The principle that microorganisms cause certain diseases is called the ___ Theory.

Germ

The property of endospores that led to confusion in the experiments on spontaneous generation is their ___.

heat resistance

If all prokaryotes were eliminated from the planet,

all animals would die

All of the following are emerging infectious disease except...

smallpox

All of the following are biological domains except...

Chapter 1 Humans and the Microbial World (cont)

Prokaryota

Which name is written correctly?

Staphylococcus epidermidis

Members of which pairing are most similar in appearance to each other?

Archaea & Bacteria

Viruses...

contain both protein and nucleic acid

Antonie van Leeuwenhoek could not have observed...

viruses

The Scientific Method

Scientific Method includes **(1)** observing occurrence & asking a question about that situation; **(2)** developing a *hypothesis* that explains the occurrence & devising an experiment that tests the hypothesis; **(3)** doing the experiment, collecting the data, & drawing conclusions; & **(4)** communicating the results, methods, & conclusions.

What is a scientific theory?

An explanation supported by a vast body of experimental evidence.

Define Biogenesis

The production of living things, as opposed to spontaneous generation.

Early Experiments

The experiments of **John Needham** supported the idea of spontaneous generation, while those of **Lazzaro Spallanzani** did not.

Experiments of Pasteur

Pasteur disproved spontaneous generation & supported what is now known as the theory of **biogenesis**.

Experiments of Tyndall

Chapter 1 Humans and the Microbial World (cont)

John Tyndall showed that some microbial forms are not killed by boiling. He & **Ferdinand Cohn** discovered *endospores*, the heat-resistant forms of some bacteria.

Commercial Benefits of Microorganisms

Microorganisms are used in the production of bread, wine, beer, & cheeses. They are also used to degrade toxic pollutants and to synthesize a variety of different useful products. *Biotechnology* depends on members of the microbial world.

Define Biotechnology

The use of microbiological & biochemical techniques to solve practical problems & produce valuable products.

Microbes as Research Tools

Microorganisms are wonderful model organisms to study because they have the same fundamental metabolic & genetic properties as higher life-forms, & they grow rapidly on simple, inexpensive growth media.

Define Bacteria

Bacteria are single-celled prokaryotes that have peptidoglycan in their cell walls.

Define Coccus

sphere-shaped bacterial cell.

Define Rods

Cylinder-shaped bacterium; also called a bacillus

Define vibrio

short, curved, rod-shaped bacterial cell

Define spirillum

curved rod-shaped bacterial cell that is long enough to form spirals

Define Spirochetes

Long, helical bacteria that have flexible cell wall & endoflagella

Chapter 1 Humans and the Microbial World (cont)

Define Archaea

single-celled prokaryotes

Define Fungi

single-celled yeasts & multicellular molds & mushrooms; they use organic compounds as food

Define Algae

single-celled or multicellular, & use sunlight as an energy source

Define Protozoa

typically motile single-celled organisms that use organic compounds as food.

Chapter 3 Cells & Methods to Observe Them

Define Capsule

a distinct, thick gelatinous material that surrounds some microorganisms

Define chemotaxis

movement of a cell toward or away from a certain chemical in the environment

Define Cytoplasmic Membrane

A phospholipid bilayer embedded with proteins that surrounds the cytoplasm & defines the boundary of the cell

Define Endospore

An extraordinary resistant dormant cell produced by some types of bacteria

Define Flagellum

A type of structure used for cell movement

Define Gram-Negative Bacteria

Bacteria that have a cell wall characterized by a thin layer of peptidoglycan surrounded by an outer membrane; when Gram stained, these cells are **pink**

Define Gram-Positive Bacteria

Bacteria that have a cell wall characterized by a thick layer of peptidoglycan; when Gram stained, these cells are **purple**

Chapter 3 Cells & Methods to Observe Them (cont)

Define Lipopolysaccharide (LPS)

Molecule that makes up the outer layer of the outer membrane of Gram-negative bacteria

Define Peptidoglycan

a macromolecule that provides strength to the cell wall; it is found only in bacteria

Periplasm

the gel-like material that fills the region between the cytoplasmic membrane & the outer membrane of Gram-negative bacteria & the cytoplasmic membrane & peptidoglycan layer of at least some Gram-positive bacteria

Define Pili

cell surface structures that allow cells to adhere to certain material; some types are involved in a mechanism of DNA transfer

Define Plasmid

Extrachromosomal DNA molecule that replicates independently of the chromosome

Define ribosome

structure involved in protein synthesis

Transport systems

Mechanisms cells use to transport nutrients and other small molecules across the cytoplasmic membrane

Which bacterial cell component provides the best barrier for preventing most molecules from passing through it?

Cytoplasmic membrane

Endotoxin is associated with...

Gram-negative bacteria

The "O157" in the name *E. coli* O157:H7 refers to the type of O antigen. From this information you know that *E. coli*

Is Gram-negative

Chapter 3 Cells & Methods to Observe Them (cont)

Eliminating which structure is *always* deadly to cells?

Cytoplasmic membrane

If you interfered with the ability of a *Bacillus* species to form endospores, what would be the result? The bacterium would no longer be...

able to withstand boiling water

If a virus mimics a ligand that normally participates in receptor-mediated endocytosis, the virus might..

be take up by the cell

The antibiotic erythromycin prevents protein synthesis in bacterial cells. Based on this information, which of the following might be targeted by the drug?

Chapter 3 Cells & Methods to Observe Them Cont.

The antibiotic erythromycin prevents protein synthesis in bacterial cells. Based on this information, which of the following might be targeted by the drug? 2. 70s ribosomes, 4. 50s ribosomal subunit

2, 4

If a eukaryotic cell were treated with a chemical that destroys tubulin, all of the following would be directly affected *except*

actin

Which of the following is most likely to be used in atypical microbiology laboratory?

Bright-field microscope

When a medical technologist wants to determine if a clinical specimen contains a *Myobacterium* species, which should be used?

Acid-fast stain

Chapter 4 Dynamics of Microbial Growth

Define Biofilm

Polymer-encased community of microorganisms

Define Chemically Defined Medium

A culture medium of exact chemical composition; generally used only for specific experiments when nutrients must be precisely controlled

Define Complex Medium

A culture medium that contains protein digests, extracts, or other ingredients that vary in their chemical composition

Define Differential Medium

A culture medium with an ingredient that certain microorganisms change in a recognizable way; used to differentiate microbes based on their metabolic traits

Define Exponential (Log) Phase

Stage in the growth curve during which cells divide at a constant rate; generation time is measured during this period of active.