Module 2

Chapter 4 – Anatomy of the Cell

The Prokaryotic and Eukaryotic Cells

- **Prokaryotic** cells and **eukaryotic** cells _____
  - Composed of carbohydrates, proteins, nucleic acids, lipids
  - Perform _____ of chemical reactions
- Differences are primarily in internal, external _____

Shapes

- Average size: _____
- Most bacteria are _____
  - Maintain _____ throughout lifetime
- A few are _____
  - Adopt _____
  - More difficult to _____ based on shape alone
- Three basic shapes
  - _____
  - _____
  - _____

Coccus

- _____
  - _____
- _____

Bacillus

- _____
- Bacillus → _____
- *Bacillus* → _____

Spiral

- Have _____ twists
  - Vibrio
    - _____
  - Spirilla
    - Helical, _____ shape
    - Rigid bodies
  - Spirochetes
    - Helical, _____

Other shapes include:

- Star shaped
- Rectangular, flat

Structures external to the cell wall

Glycocalyx

- A "_____"
  - _____ polymer of _____
  - _____
- _____ cell wall
- Two general types of glycocalyx
  - Capsule – _____
  - Slime layer – _____
- Can be important in contributing to _____ (ability to cause disease)
  - _____ allows cell to attach - _____
  - Capsules prevent _____

Flagellum, flagella

- Long appendage(s) that _____
- Allows for _____
  - Ability to _____
- Outside of _____
- Made of _____
- Arrangement of flagella
  - Peritrichous
  - Monotrichous
  - Lophotrichous
  - Amphitrichous
  - Atrichous

- Taxis – movement _____ from environment
- Positive taxis – _____ environment
  - Environment called _____
- Negative taxis – _____ from environment
  - Environment called _____
- Environment includes chemicals, light
  - Movement towards light – _____ _____taxis
  - Movement away from chemical – _____ _____taxis

Axial filaments

- Bundles of _____ that _____ cell
- AKA _____
- Uniquely in _____
- _____ cause cell to move in _____

Fimbria, fimbriae

- _____ appendages
  - Not used _____

- Fimbriae allow for _____
  - *Neisseria gonorrhoeae* sticks to _____
  - No _____, no _____

Pilus, pili
- Used to _____ between bacteria
  - Process called _____
- Also can be used for _____
  - _____
  - _____

The Cell Wall
- Surrounds _____
  - _____
  - _____
- Bacterial cell wall made of _____

Peptidoglycan
- Polymer of _____ (NAM or NAG), forms _____ backbone
- Linked by _____
- Arrangement of peptidoglycan used to classify bacteria into 2 groups
  - _____ bacteria
  - _____ bacteria

Gram-positive cell walls
- _____; _____ layers of peptidoglycan next to cell membrane
- _____ acids - only in Gram-positive cell wall
  - _____ acid links to _____
  - _____ teichoic acid links to _____

Gram-negative cell walls
- _____ layer of peptidoglycan _____ membranes
  - In _____ between outer and inner (_____) membranes
- Outer membrane contains _____ (LPS)
- Protection from _____, immune system _____
- Provides _____ to _____
- _____ is an _____
- _____ form _____ through outer membrane

Atypical cell walls
- Acid-fast cell walls
  - Like _____
  - _____ bound to peptidoglycan _____
    - _____ from immune system
  - Found in _____
- Archaea
  - _____

- Wall of _____ (lack _____)
- Mycoplasmas
  - Lack _____
  - _____ in plasma membrane, provide _____

The plasma membrane

- Thin layer, encloses _____ of cell
- Consists primarily of _____
- Arranged in _____ parallel rows called _____
  - _____ "heads" on two _____ surfaces of membrane
  - _____ "tails" in _____ of membrane
- Membrane is as viscous as _____
- _____ within membrane perform various functions
  - Channels, structure, transport
- Phospholipids and proteins are _____
  - Referred to as fluid mosaic model

Functions of membrane:

- _____ barrier for materials into and out of cell
- _____ – _____ molecules can pass barrier
  - _____ pass – too big to squeeze through
  - _____ pass – _____ on phospholipids repel ions
  - _____ molecules (ie oxygen, carbon dioxide,) _____ pass
- _____ passes through _____ channels (_____)
- _____ proteins allow specific molecules to pass

The movement of materials across membranes

- In order to generate energy, food must cross membrane
  - Most resources are _____ to cross membrane
- _____ processes
  - Molecules move from an area of _____ concentration to area of _____ concentration
    - _____ the concentration gradient
  - Requires _____
- _____ processes
  - Molecules move from an area of _____ concentration to area of _____ concentration
    - _____ the concentration gradient
  - Requires _____
- Passive processes – 3 mechanisms:
  - Simple diffusion
  - Facilitated diffusion
  - Osmosis
- Active Processes (1 mechanism)
  - Active Transport

Simple diffusion

- Net overall movement of molecules from an area of _____ concentration to area of _____ concentration
- Equilibrium – the point when _____
- Simple diffusion across plasma membrane important for small molecules like _____, _____

Facilitated diffusion

- Similar to simple diffusion, ie _____ the concentration gradient
- Uses _____ to cross the membrane
    - Molecules cannot cross membrane _____

Osmosis

- Movement of _____ across a _____ membrane from an are of _____ concentration to and are of _____ concentration
- Osmotic pressure – the pressure needed _____ across the membrane
    - Important for cell to balance osmotic pressure
- Tonicity - measure of _____ concentration in a solution relative to a membrane
    - Solute concentration of _____ (_____) compared to inside of _____ (across the _____)
    - Measured as _____
    - Affects transport of _____ (_____ can't cross membranes)
- Isotonic solution - solute concentration of a solution is _____ to the solute concentration in a cell
    -
    -
    -
- Hypotonic solution - solute concentration of a solution is _____ than the solute concentration in a cell
    -
    -
    -
        -
        -
- Hypertonic solution - solute concentration of a solution is _____ than the solute concentration in a cell
    -
    -
    -
        -
- Active Processes
    - Sometimes cell needs to move molecules _____
    - Cell uses _____
    - Requires _____

Inside the prokaryotic cell

- The Cytoplasm is the substance of _____ the plasma membrane
- Contains:
    - _____ - fluid and dissolved portion of cytoplasm
    - _____, organic molecules, inorganic ions
    - Specialized structures
        - _____

Nucleoid

- The area that contains the _____
    - Called the _____
- Takes up _____ inside the cell

The prokaryotic ribosome

- Responsible for _____
- Ribosomes are composed of proteins and _____ (rRNA)
- Bacterial ribosomes (_____) consist of two subunits:
    - Small subunit; _____ subunit
    - Large subunit; _____ subunit
    - "S" a reference to size

Inclusions

- _____ used for various purposes
- Can include stores of _____, provide various _____
- Endospores
    - _____ cells
    - Resistant to desiccation (_____), heat, _____
    - _____ - endospore formation
    - _____ - return to vegetative (growing) state

The Eukaryotic cell

- Typically _____, structurally more _____ than prokaryotic cells

The plasma (cytoplasmic) membrane

- _____ to prokaryotic membrane
    - Composed of a _____ bilayer
    - Includes _____ embedded in the bilayer
- Eukaryotic plasma membrane contains _____
    - Not found in prokaryotic cells (exception: Sterols are found in which prokaryote?)

The cell wall and glycocalyx

- Cell wall is generally _____ than prokaryotic cell walls
    - _____, not peptidoglycan
    - Plants, algae have _____ cell wall
    - Fungi have _____ cell wall
- Many eukaryotes have _____ cell walls
- Some eukaryotes have _____
    - Help strengthen cell surface, attach cells together

Cytoplasm
- Everything _____, outside of _____
- _____: _____ portion of cytoplasm
- Major differences:
  - Presence of _____
    - Provides support, shape, movement
  - _____ (ie, metabolism) that are found in _____

Organelles
- Structures with specialized functions
- Not found in prokaryotic cells
- **Nucleus**: Storage of DNA
- **Ribosomes:** 80S (40S + 60S); different size compared to bacteria; same function
- **Endoplasmic Reticulum (ER)**: Synthesis of molecules
- **Golgi complex**: Transport of molecules
- **Lysosome**: Degradation & recycling of molecules
- **Vacuole**: Storage of molecules
- **Mitochondrion**: ATP generation
- **Chloroplast**: Photosynthesis
- **Peroxisome**: Degradation of toxins

Chemotherapy
- Use of _____ to _____ (kill or stop growth of) _____
  - _____
  - _____
- Antimicrobial drugs display _____ - acts within _____ without _____
- _____ – substance produced by _____ that inhibits growth of other microbes
- _____ spectrum
  - Affects _____
- _____ spectrum
  - Affects _____
- _____ cells harder to inhibit
  - Protected by _____
  - Drugs must be _____ and _____ to pass through _____

Penicillins (Beta-lactams)
- _____ with similar mechanism
  - Penicillin (ns), ampicillin (bs), oxacillin (bs)
- Prevent synthesis of _____
  - Weakens _____; cell _____ (_____)
- Affects only _____ cells

Polypeptide antibiotics
- **Bacitracin**
  - Inhibits _____ bacteria

    - _____ only
- **Vancomycin**
    - Very narrow (*Staphylococcus*)
    - Last effective antibiotic against _____ – Methicillin resistant _____
    - Appearance of vancomycin resistant _____ (VRE) a concern

Antimycobacterial antibiotics

- _____ layer _____ most chemicals
- **Isoniazid** inhibits _____ of mycolic acid
- Used in _____ with other drugs

Protein Synthesis Inhibitors

- Prokaryotic ribosome _____ from eukaryotic ribosomes
    - _____ (30S + 50S) vs _____ (40S + 60S)
    - _____ antibacterial target
- **Chloramphenicol** binds to _____ – inhibits activity
    - _____ (bs), simple to make (cheap)
    - _____ – used only when necessary
- **Tetracyclines** prevent tRNA binding to _____
    - _____ (very bs)
    - Can _____ and inhibit intracellular pathogens
- **Neomycin** changes _____
    - Shows serious side effects, so only _____