Advanced Biology Cell and Membrane Structure and Function

Learning Objectives:

- To Study cells, biologists use microscopes and tools of biochemistry.
- Eukaryotic cells have internal membranes that compartmentalize their functions.
- Cellular membranes are fluid mosaics of lipids and proteins.
- Passive transport is diffusion of a substance across a membrane with no energy investment.
- Active transport uses energy to move solutes against their gradients.Bulk transport across the membrane occurs by exocytosis and endocytosis.

Major Terms:

Apoptpsos
Cell
Cell theory
Cell wall
Central vacuole
Centriole
Chloroplast
Chromatin
Chromosome
Cilia
Cristae
Cytoplasm
Cytoskeleton
ER
Eukaryotic
Flagellum
Golgi apparatus
Granum
Lysosome
Matrix
Micro tubule
Mitochondrion
Nuclear envelope
Nuclear pore
Nucleolus
Nucleoplasm
Nucleus
Organelle
Peroxisone
Plasma membrane
Prokaryotic
Ribosome
Stroma
Surface-area-to-volume ratio
Thylakoid
Vacuole
Vesicle
Active transport
Adhesion junction
Carrier protein
Concentration gradient
Diffusion
Endocytosis
Exocytosis
Facilitated transport
Fluid-mosaic model
Gap junction
Glycolipid
Glycoprotein
Hypertonic
Hypotonic
Isotonic
Osmosis
Osmotic pressure
Phagocytosis
Phospholipid bilayer
Pinocytosis
Plasmodesmata
Plasmolysis
Receptor protein
Sodium-potassium pump
Solute
Solution
Solvent
Tight junction
Turgor pressure

Read: Chapters 4 and 5

Lecture:

I. Basic Microscopy

A. _____: The degree of enlargement in size.

B. _____: The minimum distance allowing the distinction of two objects.

C. Light Microscopy
1. Resolution to ~ 0.2µm, Magnification _____
2. Bright field (may be stained or unstained, fixed or live specimens).
3. Phase Contrast—usually live specimens.
4. Darkfield and Darkfield Interference — especially useful to visualize chromosomes, various organelles

D. Electron Microscopy:
1. Resolution to ~ 0.0001µm, Magnification _____. Uses beams of electrons in place of beams of visible light. Specimens are killed, fixed with electron-dense heavy metal salts. The specimen may be sectioned or freeze-fractured.
2. Transmission Electron Microscopy
3. Scanning Electron Microscopy - Provides a 3-D view

II. Cell Theory - A, B, C's

A. _____living organisms are composed of cells.

B. _____ - the cell is the structural and functional unit of all organisms.

C. _____come only from pre-existing cells.

III. Cells are small - needs a large _____ to rid of wastes

IV. Differences between Prokaryotes and Eukaryotes

	Prokaryotes	Eukaryotes
Cell Wall	Peptidoglycan or Protein	Cellulose or Chitin
Nucleus		Histone Proteins, DNA + Protein make **Chromatin**
Plasma Membrane		
Cytoskeleton		
Membrane Bound Organelles		Minimizes competing interactions and increases SA
Mitochondria /Chloroplasts		
Ribosomes		
Size		

V. Differences between Plant and Animal Cells

	Plant Cells	Animal Cells
Cell Wall		
Plasma membrane		
Flagella/Cilia		
Phagocytic Activity		
Centrioles		
Chloroplasts		

VI. Cellular Organelles

A. Nucleus
   1. Found in _____
   2. Nuclear envelope surrounds nucleoplasm (liquid) and _____(DNA and Protein)
   3. Genetic information storage, Location of the Chromosomes

B. Nucleolus
   1. Found in Eukaryotes
   2. Chromatin and RNA
   3. Dark spot in nucleus where _____.

C. Ribosomes
   1. Found in all cells Different structure in Pro and Eukaryotes
   2. Made of _____. In Two parts
   3. _____ (translation)

D. Endoplasmic Reticulum
   1. Eukaryotes
   2. _____
   3. Rough ER
      a. Studded with _____
      b. _____
   4. Smooth ER
      a. _____
      b. Carbohydrate synthesis, lipid synthesis, chemical conversions, vesicle formation

E. Golgi Apparatus (Golgi Bodies, Golgi Complex)
   1. Eukaryotes
   2. _____
   3. Formation of vesicles, processing, packaging, and delivery of modified proteins

F. Lysosome
   1. Animal cells
   2. Membranous sac that contains _____
   3. Intracellular Digestion, _____

G. Microbodies
   1. Eukaryotes
   2. Membraneous sac that contains _____.
   3. Two types
      a. _____
      b. Glyoxysome

H. Vacuoles/Vesicles
   1. Eukaryotes
   2. _____
   3. Storage of _____, pigments, intracellular digestion
   4. Large Central Vacuole of water is common characteristic in plant cells

I. Mitochondria
   1. Eukaryotes
   2. Two membranes

a. _____ (inner membrane) responsible for energy production

b. Outer membrane

c. _____ is the solution inside, has enzymes

3. Has some DNA
4. Organelle is inherited from _____

5. Produces _____ (cellular energy) through Cellular Respiration

J. Chloroplast
1. _____
2. Two membranes
a. Inner membranes form _____ (discs), stack of thylakoids is a granna, Chlorophylls bounded on membrane

b. _____is liquid surrounding

3. _____

K. Cytoskeleton
1. Eukaryotes
2. Microtublules, microfilaments, actin and intermediate filaments

3. _____

L. Centrioles
1. Animal cells
2. 9+0 microtubule pattern
3. Organization of microtubules, miotic spindle

M. Cilia
1. Eukaryotes
2. 9+2 pattern, small hairs

3. _____

N. Flagella
1. All, rare only a few in plants
2. 9+2 microtubule pattern in eukaryotes, long whip

3. _____

O. Cell Wall
1. _____
2. Bacterial: Peptidoglycan
3. Plant: Carbohydrate (cellulose)

4. _____

P. Plasma Membrane
1. All cells
2. Phospholipids with two _____fatty acid chains within the bilayer. Phosphate head is _____ and faces outer or inner environment.
3. Lipid Bilayer: Proteins on <u>one side</u> or <u>embedded within</u>.
4. Boundary, selective transport of molecules or ions into or out of the cell

VII. The Fluid-Mosaic Model

A. _____ are hydrophilic and face both the outside and the inside of the cell.

B. The _____ are hydrophobic and form the interior of the bilayer.
C. Peripheral proteins are loosely bound to the surface.
D. Intergral proteins are those embedded in the membrane. Can be:

1. On inner - may be anchored to the cell cytoskeleton
2. outer
3. transmembrane. (through) -
    a. The hydrophopic portions of the protein are within the membrane while the hydrophilic portions are facing either outside or inside the cell (Structure Determines Function)
    b. The outer and transmembrane proteins are often _____ (have carbohydrate parts on them).
    c. The glycosylation is often related to cell-cell recognition (immune response) and to cell-cell communication.

E. Functions of Proteins

1. _____
2. _____
3. _____
4. _____
5. _____

VIII. Cellular Transport Mechanisms: membrane is semi-, differentially, or selectively permeable

A. Passive Transport: No Energy Required

1. _____
    a. No energy, Toward _____
    b. Water, lipid soluble molecules (non-polar), O_2
2. Osmosis -
3. _____
    a. Need a specific carrier or channel, An example are aquaporins
    b. Toward _____concentration
    c. Non-polar amino acids, glucose, water
    d. Channel Proteins allow the free passage of certain molecules or ions. Cystic fibrosis is caused by a defective Cl- channel.
    e. Carrier proteins are selective.
4. These processes are _____.

B. Active Transport: _____ (ATP: free energy)

1. Need a carrier or pump
2. _____the concentration gradient: towards higher concentration
3. Polar amino acids, sugars, ions
4. Types
    a. _____**:** 1 substance transported
    b. _____: 2 substances transported
    c. _____: move substances in the same direction
    d. _____: move substances in the opposite direction
5. Active Transport: The Na+/K+ Pump
6. _____

a. Formation of vesicle
b. From inside going to outside, fusing with plasma membrane
c. Macromolecules are sent out of cells

7. _____
   a. Formation of vesicle
   b. From outside going to inside, Formation of a vacuole
   c. Types
      i. _____ – cells, cell debris, food
      ii. _____– Macromolecules
      iii. _____– water

IX. Origin of the Mitochondria and Chloroplasts

A. Serial _____hypothesis: Both organelles may have originated as independent prokaryotes and at some point were phagocytized by ancient organisms. They eventually evolved to become endosymbionts.
   · Evidence in favor: Mitochondria and Chloroplasts arise only from pre-existing organelles. Both contain _____, Both are susceptible to DNA-affecting agents that do not affect eukaryotic DNA

B. _____ hypothesis: Endocytic vesicles evolved specialized functions. These specialized organelles gave a selective advantage to those organisms possessing them.

X. Cell Junctions

A. _____: Pores lines with proteins that allow movement of materials between animal cells

B. _____: "Clamp" Proteins that seal the borders between cells.

C. _____: fasten adjacent cells together

D. _____: Strands of cytoplasm (desmotubules) that extrude through pores into adjacent plant cells.

Do Practice : Reviewing the chapter pg 81 and 99

Terms: Concentration gradient, Solution, Solute, solvent , Osmotic pressure, Isotonic, Hypotonic, Hypertonic, Equillibrium, Turgor pressure, Plasmolysis, Diffusion, Osmosis