

PLEASE NOTE THAT THE ITEMS IN THE TEXT THAT ARE HIGHLIGHTED IN **YELLOW** ARE THOSE THAT ARE TOUCHED ON IN THE READING ASSIGNMENT (PAGES 90- 99) AND IN THE LECTURE. ESPECIALLY KNOW THIS MATERIAL FOR THE FIRST LECTURE EXAM. THE REMAINDER IS REVIEW USUALLY COVERED IN AN INTRODUCTORY BIOLOGY COURSE.

Chapter 3: Cytology

Cytology is the study of cells. Cells are the basic units of life. We are made up of trillions of cells.

- I. Plasma membrane surrounds all cells
 - A. functions of the plasma (cell) membrane
 1. recognition site
 2. support
 3. permeability (allows movement of materials in and out)
-most are semi-permeable (allows some material in or out, but not all)
 - B. appearance
 1. fluid mosaic model
 - a. phospholipid bilayer contains polar heads and non-polar tails
 - b. heads are hydrophilic (love water and face outward)
 - c. tails are hydrophobic (hate water and face inward)
 2. also contains proteins
 - a. integral protein penetrate all the way through
 - b. peripheral proteins attach to surface
 - c. proteins act as markers, channels, enzymes, structural support, receptors
 - d. if proteins have a sugar molecule attached they are called glycoproteins

3. plasma membrane also contains cholesterol
- a. this helps support and stabilize the membrane and determines the fluid nature of the membrane
- b. cholesterol is found only in animal tissue

II. Nucleus is found in all cells

A. structure and location

1. found in the center of the cell usually
2. is the control center of the cell
3. is surrounded by a nuclear membrane riddled with holes called nuclear pores
4. contains DNA and histone protein (called chromatin before mitosis occurs)
5. has a nucleolus that is important in the manufacture of ribosomes
6. note: a red blood cell will lose its nucleus once it leaves the bone marrow and enters the blood stream

III. Cytoplasm is found in all cells

A. composition

1. cytosol is the fluid portion containing enzymes, ions, and molecules
2. cytoskeleton is the structural support network
 - a. microtubules-made of tubulin protein, important in cell division, centrioles, cilia, flagella
 - b. microfilaments-contractile capability in muscle; actin and myosin protein present
 - c. intermediate filament-mechanical strength inside cells
3. Inclusions
 - a. storage areas for chemicals like hemoglobin, glycogen, melanin, lipochromes (pigment that increases with age)

B. Organelles (little organs)

1. Misc. information
 - a. small structures that have specialized jobs

- b. separated by membranes from other organelles
 - c. nucleus is usually considered to be an organelle
2. Types of organelles
- a. ribosomes-
 - sites of protein synthesis
 - rRNA and protein are assembled in the nucleolus to make the ribosome
 - free ribosomes make proteins for use in the cell
 - attached ribosomes make proteins for use outside the cell
 - b. endoplasmic reticulum
 - network of broad, flattened sacs and tubules
 - interior of sacs contain cisternae
 - rough E.R. contains ribosomes and makes protein for use outside the cell
 - smooth E.R. doesn't have ribosomes and is important in the manufacture of lipid, cholesterol, steroid hormones, and carbohydrate like glycogen
 - smooth E.R. is important in detoxification of chemicals and drugs and helps muscle store calcium
 - c. Golgi Apparatus
 - flattened membranous sacs containing cisternae
 - stacked like pancakes
 - modifies, packages, and distributes protein and lipid materials made in E.R.
 - you can consider them to be the 'mail man of the cell'
 - d. secretory vesicles-pinch off from golgi apparatus and fuse with the plasma membrane to release contents outside the cell in the extracellular fluid
 - e. lysosomes (suicide packets)
 - contain digestive enzymes
 - f. peroxisomes
 - break down hydrogen peroxide
 - g. mitochondria-powerhouse of the cell
 - make ATP

C. Cytoskeleton

1. centrioles
 - a. important in cell division
2. cilia
 - a. short bristle like structures that function in the movement of material over cells
 - b. found in upper respiratory and female fallopian tubes (for example)
3. flagella
 - a. long hair like structure that functions in movement of the cell
 - b. only example in animals is the male sperm cell

IV. Movement through membranes

A. Passive transport doesn't use energy

1. Diffusion-movement of molecules from greater concentration to lesser concentration until equilibrium is reached (think of alka-seltzer diffusing in your glass)
2. Facilitated diffusion-same as regular diffusion except it requires a carrier or channel protein to cross the cell membrane
3. Osmosis-movement of water molecules from greater water concentration to less water concentration
 - a. osmotic pressure is the ability of osmosis to generate enough pressure to 'lift' water
 - b. the greater the concentration of non-permeable solute particles in a solution, the lower the water concentration of that solution and the greater the osmotic pressure
 - c. the osmotic pressure of intracellular and extracellular solutions is about the same, so the situation is **isotonic (equal)**. Fluids move back and forth at the same rate.
 - d. What if you took a blood cell (0.9% saline solution) and placed it in a hypotonic solution? Where salt goes, water follows. A hypotonic solution has less solid than the cell, so the water goes to the salt. In this case, the cell takes on water and could burst.

e. What if you took a blood cell (0.9% saline) and placed it in a hypertonic solution (10% saline). This time there is more salt in the hypertonic solution and less water, so water will leave the cell and enter the hypertonic solution. The cell will shrink.

B. Active Transport-cell uses ATP (energy)

1. Endocytosis- movement into a cell

-includes pinocytosis-cell drinking

-includes phagocytosis-cell eating

2. Exocytosis-movement out of the cell

-rids the cell of waste

-secretion of products made in cell and released to extracellular fluids

3. Receptor mediated endocytosis

-requires a carrier protein

-read purple box in your text about hypercholesterolemia

V. Cell Cycle-look at the pictures in your text as you go over the stages

A. Mitosis-division of body cells resulting in 2 identical daughter cells containing 46 chromosomes each.

B. Cell cycle begins with interphase (doubles all cell contents in preparation for mitosis)

C. Mitosis begins with prophase (chromosomes become visible and the nuclear membrane begins to disappear)

D. Next is metaphase where the chromosomes line up and attach to spindle fibers produced by the centrioles. The spindle fibers catch the centromere, located in the middle of the chromosome.

E. Anaphase is next and the chromosomes separate and move toward

opposite poles. The chromosomes are now single copies again.

F. Last we have telophase in which the nuclear membrane begins to reappear and the chromosomes begin to disappear. A cleavage furrow begins to form, signaling the beginning of cytokinesis (division of the cytoplasm). Cytokinesis completes and you have 2 identical daughter cells.