

## Chapter 3: Structure and Function of the Cell

### I. Functions of the Cell

A. List and describe the main functions of the cell:

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_
4. \_\_\_\_\_  
\_\_\_\_\_
5. \_\_\_\_\_  
\_\_\_\_\_

### II. How We See Cells

- A. Light microscopes allow us to \_\_\_\_\_
- B. Electron microscopes are used to \_\_\_\_\_
- C. What type of electron microscope is used to observe surfaces? \_\_\_\_\_
- D. What type of electron microscope can see through structures? \_\_\_\_\_

### III. Plasma Membrane

A. Outermost Component of a Cell

1. Substances inside the plasma membrane are \_\_\_\_\_
2. What does "intercellular" mean? \_\_\_\_\_
3. Functionally the plasma membrane:
  - a. Encloses and \_\_\_\_\_
  - b. Attaches to \_\_\_\_\_
  - c. Ability to \_\_\_\_\_
  - d. Determines what \_\_\_\_\_
4. Membrane potential or charge difference across the plasma membrane:
  - a. The outside of the cell is: \_\_\_\_\_

- b. The inside of the cell is: \_\_\_\_\_
  - c. Allows cells to function like \_\_\_\_\_
5. Chemical composition of the plasma membrane is:
- a. 45-50% \_\_\_\_\_
  - b. 45-50% \_\_\_\_\_
  - c. 4-8% \_\_\_\_\_
  - d. Carbohydrates and lipids combined form \_\_\_\_\_
  - e. Carbohydrates and proteins combined form \_\_\_\_\_
  - f. The glycocalyx is composed of \_\_\_\_\_

## B. Membrane Lipids

### 1. Phospholipids

- a. Assemble to form a \_\_\_\_\_
- b. Hydrophilic heads are \_\_\_\_\_
- c. Hydrophobic heads are \_\_\_\_\_

### 2. Cholesterol

- a. Interspersed among \_\_\_\_\_ and accounts for \_\_\_\_\_
- b. Amount present determines \_\_\_\_\_

## C. Membrane Proteins

### 1. What does the "fluid-mosaic model" say about the plasma membrane?

\_\_\_\_\_

\_\_\_\_\_

### 2. Integral (intrinsic) proteins are found where? \_\_\_\_\_

### 3. Peripheral (extrinsic) proteins are found where? \_\_\_\_\_

### 4. Marker molecules do what? \_\_\_\_\_

\_\_\_\_\_

### 5. Integrins are involved in \_\_\_\_\_

### 6. Channel Proteins

- a. Integral proteins arranged to form \_\_\_\_\_
- b. Nongated ion channels are always \_\_\_\_\_
- c. What is a ligand? \_\_\_\_\_
- d. List 2 types of gated ion channels: \_\_\_\_\_ and \_\_\_\_\_

7. Receptor Molecules
  - a. Proteins in the plasma membrane that can attach to \_\_\_\_\_
  - b. Receptors can be linked to \_\_\_\_\_ or \_\_\_\_\_
8. What catalyzes chemical reactions on either the inner or outer surface of the plasma membrane? \_\_\_\_\_
9. Carrier proteins function to \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### IV. Movement Through the Plasma Membrane

##### A. Selectively Permeable

1. Means that the membrane allows \_\_\_\_\_
2. Describe the 4 ways that material can pass through the plasma membrane:
  - a. Directly through the phospholipid membrane \_\_\_\_\_  
\_\_\_\_\_
  - b. Membrane channels \_\_\_\_\_  
\_\_\_\_\_
  - c. Carrier molecules \_\_\_\_\_  
\_\_\_\_\_
  - d. Vesicles \_\_\_\_\_  
\_\_\_\_\_

##### B. Diffusion

1. A solute is \_\_\_\_\_
2. A solvent is \_\_\_\_\_
3. Diffusion is the movement of \_\_\_\_\_ from an area of \_\_\_\_\_ to an area of \_\_\_\_\_
4. Diffusion occurs due to the constant \_\_\_\_\_
5. The term "concentration gradient" refers to \_\_\_\_\_  
\_\_\_\_\_

6. The rate of diffusion is influenced by:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

7. Viscosity is a measure of \_\_\_\_\_

C. Osmosis

1. Osmosis is the diffusion of \_\_\_\_\_ across \_\_\_\_\_

a. Water diffuses from \_\_\_\_\_ and into \_\_\_\_\_

2. Osmotic pressure is: \_\_\_\_\_  
\_\_\_\_\_

3. The osmotic pressure provides information about \_\_\_\_\_  
\_\_\_\_\_

4. Isosmotic solutions have \_\_\_\_\_

5. A hyperosmotic solution has \_\_\_\_\_

6. A hyposmotic solution has \_\_\_\_\_

7. What happens to a cell placed in an isotonic solution? \_\_\_\_\_

8. What happens to a cell placed in a hypertonic solution? \_\_\_\_\_

9. What happens to a cell placed in a hypotonic solution? \_\_\_\_\_

10. What does crenation mean? \_\_\_\_\_

11. The process called lysis does what to a cell? \_\_\_\_\_

D. Filtration

1. In filtration, the liquid and small molecules move across the partition from:  
\_\_\_\_\_  
\_\_\_\_\_

E. Mediated Transport Mechanisms

1. Mediated transport mechanisms involve carrier proteins that \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. List and define the three characteristics of mediated transport mechanisms:

a. \_\_\_\_\_  
\_\_\_\_\_

b. \_\_\_\_\_  
\_\_\_\_\_

c. \_\_\_\_\_  
\_\_\_\_\_

3. Facilitated Diffusion

a. Facilitated diffusion moves substances into or out of cells from \_\_\_\_\_  
\_\_\_\_\_

b. Does facilitated diffusion require metabolic energy? \_\_\_\_\_

c. The rate of transport is \_\_\_\_\_

4. Active Transport

a. Does active transport require metabolic energy? \_\_\_\_\_

b. The maximum rate of transport depends on \_\_\_\_\_

c. Active transport is important because it can move substances \_\_\_\_\_  
\_\_\_\_\_

d. Active transport can also move \_\_\_\_\_

e. Some active transport mechanisms \_\_\_\_\_

5. Secondary Active Transport

a. Describe how secondary active transport works: \_\_\_\_\_  
\_\_\_\_\_

b. Cotransport means movement of the molecules is \_\_\_\_\_

c. Countertransport means movement of the molecules is \_\_\_\_\_

6. Endocytosis and Exocytosis

a. Endocytosis refers to the bulk \_\_\_\_\_

b. A vesicle is \_\_\_\_\_

c. Describe how endocytosis works: \_\_\_\_\_  
\_\_\_\_\_

d. Phagocytosis or "cell-eating" applies to \_\_\_\_\_  
\_\_\_\_\_

e. Pinocytosis or "cell-drinking" refers to \_\_\_\_\_  
\_\_\_\_\_

f. What mechanism allows endocytosis to exhibit specificity? \_\_\_\_\_

g. Describe the process of exocytosis and what it is used for: \_\_\_\_\_

## V. Cytoplasm

### A. Cytosol

1. Cytosol consists of \_\_\_\_\_

a. The fluid portion is \_\_\_\_\_

2. Cytoskeleton

a. What are the functions of the cytoskeleton? \_\_\_\_\_

b. Microtubules

1. Hollow tubules composed \_\_\_\_\_

2. Provide \_\_\_\_\_ and \_\_\_\_\_

3. Involved in the process of \_\_\_\_\_, \_\_\_\_\_

\_\_\_\_\_, and form \_\_\_\_\_

c. Actin Filaments or Microfilaments

1. Are small fibrils that form \_\_\_\_\_

2. Provide structure \_\_\_\_\_ and \_\_\_\_\_

3. They support the \_\_\_\_\_ and \_\_\_\_\_

d. Intermediate Filaments

1. They provide \_\_\_\_\_

3. Cytoplasmic Inclusions

a. Cytoplasmic inclusions are \_\_\_\_\_

## VI. Organelles

### A. Centrioles and Spindle Fibers

### 1. Centrioles

- a. What shape is a centriole? \_\_\_\_\_
- b. Two centrioles are normally located \_\_\_\_\_
- c. Wall of centriole is composed of \_\_\_\_\_ evenly spaced, \_\_\_\_\_ oriented, \_\_\_\_\_ units, or \_\_\_\_\_
- d. Each unit is composed of \_\_\_\_\_
- e. The two centrioles double in number \_\_\_\_\_
- f. During cell division the centrioles produce \_\_\_\_\_

### B. Cilia and Flagella

#### 1. Cilia

- a. What does the 9+2 arrangement refer to? \_\_\_\_\_  
\_\_\_\_\_
- b. Movement of cilia is important for? \_\_\_\_\_  
\_\_\_\_\_

#### 2. Flagella

- a. Movement of the flagella accomplishes? \_\_\_\_\_

### C. Microvilli

1. They are cylindrical shaped extensions of the \_\_\_\_\_
2. They function to \_\_\_\_\_

### D. Ribosomes

1. Ribosomes are sites of \_\_\_\_\_
2. They are composed of 2 subunits one \_\_\_\_\_ and one \_\_\_\_\_
3. Chemically the subunits are composed of \_\_\_\_\_
4. Free ribosomes synthesize proteins \_\_\_\_\_
5. Endoplasmic reticulum ribosomes produce proteins \_\_\_\_\_

### E. Endoplasmic Reticulum

1. The endoplasmic reticulum consists of \_\_\_\_\_  
\_\_\_\_\_
2. The interior spaces are called \_\_\_\_\_
3. Rough endoplasmic reticulum has attached \_\_\_\_\_
  - a. The ribosomes of the rough ER are \_\_\_\_\_

4. Smooth endoplasmic reticulum is without \_\_\_\_\_
  - a. Functions to manufacture \_\_\_\_\_
  - b. Smooth ER also participates in \_\_\_\_\_
  - c. In skeletal muscle cells the smooth ER \_\_\_\_\_

#### F. Golgi Apparatus

1. The Golgi apparatus is composed of \_\_\_\_\_
2. Thought of as a \_\_\_\_\_ and \_\_\_\_\_ because it \_\_\_\_\_
3. The Golgi apparatus receives vesicles from the \_\_\_\_\_
4. Forms glycoproteins by \_\_\_\_\_
5. Forms lipoproteins by \_\_\_\_\_
6. What are the proteins packaged into? \_\_\_\_\_
7. How does material leave the Golgi apparatus? \_\_\_\_\_

#### G. Secretory Vesicles

1. Pinch off from the Golgi apparatus and \_\_\_\_\_
2. Contents leave the cell by the process of \_\_\_\_\_

#### H. Lysosomes

1. Formed by the Golgi apparatus and contain \_\_\_\_\_ that function \_\_\_\_\_
2. List and describe 3 ways that lysosomes function:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_

#### I. Peroxisomes

1. Peroxisomes are \_\_\_\_\_ than lysosomes.
2. Peroxisomes contain enzymes that \_\_\_\_\_
3. What does catalase do? \_\_\_\_\_

#### J. Proteasomes

1. Proteasomes consist of \_\_\_\_\_
2. Proteasomes function to \_\_\_\_\_



## K. Mitochondria

1. Mitochondria provide \_\_\_\_\_
2. Constantly change shape from \_\_\_\_\_
3. They are the major sites of \_\_\_\_\_
4. Each mitochondrion has a \_\_\_\_\_ outer membrane and a \_\_\_\_\_ inner membrane.
  - a. Infoldings that project into the interior of the mitochondria are \_\_\_\_\_
5. Where is the matrix found? \_\_\_\_\_
6. Enzymes of the citric acid (Kreb's) cycle are located in \_\_\_\_\_
7. Enzymes of the electron transport chain are \_\_\_\_\_

## VII. Nucleus

### A. Structure

1. The nucleus contains \_\_\_\_\_
2. It is described as a large \_\_\_\_\_  
\_\_\_\_\_
3. The nucleus consists of \_\_\_\_\_
  - a. The nuclear envelope is composed of \_\_\_\_\_
    1. How are nuclear pores formed? \_\_\_\_\_
    2. What do nuclear pores do? \_\_\_\_\_

### B. Deoxyribonucleic Acid (DNA)

1. The proteins associated with DNA are \_\_\_\_\_
2. Since the DNA and protein can be stained they are called \_\_\_\_\_
3. When is the chromatin more functional? \_\_\_\_\_
4. Chromosomes form during \_\_\_\_\_ when chromatin \_\_\_\_\_
5. DNA ultimately determines \_\_\_\_\_
6. DNA functions by means of an intermediate called \_\_\_\_\_

### C. Nucleolus

1. A nucleolus is described as \_\_\_\_\_
2. How many nucleoli per cell? \_\_\_\_\_

3. What happens in the nucleolus? \_\_\_\_\_  
\_\_\_\_\_

## VIII. Overview of Cell Metabolism

### A. Cell Metabolism

1. Cell metabolism is the sum of \_\_\_\_\_
2. Energy is released by \_\_\_\_\_
3. Released energy is used to \_\_\_\_\_
4. What is used to drive other processes? \_\_\_\_\_
5. Where in the cell does ATP production occur? \_\_\_\_\_
6. The conversion of glucose to pyruvic acid occurs in \_\_\_\_\_
  - a. The chemical reactions are collectively called \_\_\_\_\_

### B. Aerobic Respiration

1. This process requires \_\_\_\_\_ to occur.
2. The pyruvic acid molecules enter \_\_\_\_\_
3. The pyruvic acid molecules are converted to \_\_\_\_\_ and \_\_\_\_\_
  - a. What 2 series of reactions are responsible for the conversion?
    1. \_\_\_\_\_
    2. \_\_\_\_\_
4. How many ATP molecules can be produced by aerobic respiration? \_\_\_\_\_
5. What is the oxygen we breathe in used for? \_\_\_\_\_
6. Where does the carbon dioxide we breathe out come from? \_\_\_\_\_

### C. Anaerobic Respiration

1. Occurs when there is no \_\_\_\_\_
2. The process includes the conversion of \_\_\_\_\_ to \_\_\_\_\_
3. How many ATP's are produced by anaerobic respiration? \_\_\_\_\_

## IX. Protein Synthesis

### A. General

1. DNA information for one amino acid is contained in a \_\_\_\_\_
2. A gene is \_\_\_\_\_

3. Transcription is the copying of DNA information to \_\_\_\_\_
  - a. The copy is called: \_\_\_\_\_
  - b. This process occurs in the \_\_\_\_\_
4. Translation uses the information in the copy to make \_\_\_\_\_
  - a. The amino acids are transported by \_\_\_\_\_
  - b. This process occurs in the \_\_\_\_\_

#### B. Transcription

1. Synthesis of mRNA based on the sequence of \_\_\_\_\_
2. Occurs when DNA double strands \_\_\_\_\_
3. One of the strands serves as a \_\_\_\_\_
4. Nucleotides “complementarily base pair” how?
  - a. DNA adenine pairs with RNA \_\_\_\_\_
  - b. DNA thymine pairs with RNA \_\_\_\_\_
  - c. DNA guanine pairs with RNA \_\_\_\_\_
  - d. DNA cytosine pairs with RNA \_\_\_\_\_
5. RNA polymerase enzymes form a long mRNA by joining together nucleotides through \_\_\_\_\_
6. The mRNA contains \_\_\_\_\_
7. The “genetic code” is carried in:
  - a. Three nucleotides in the DNA called: \_\_\_\_\_
  - b. Three nucleotides in the mRNA called \_\_\_\_\_
8. The region of DNA between a start code and a stop code is called a \_\_\_\_\_

#### C. Translation

1. List the three types of RNA involved in the process:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  1. All three types are produced in \_\_\_\_\_ by \_\_\_\_\_
2. Each kind of tRNA combines with a specific \_\_\_\_\_
3. Each tRNA has a three-nucleotide message called \_\_\_\_\_
4. During the process of translation the tRNA \_\_\_\_\_ must combine with the mRNA \_\_\_\_\_ based on pairing relationships.

5. During the process of matching up \_\_\_\_\_ align the tRNA and mRNA.
6. As the amino acids join together \_\_\_\_\_
7. Several ribosomes may attach to the same mRNA called a \_\_\_\_\_
8. Each ribosome attached to the mRNA produces \_\_\_\_\_

#### D. Regulation of Protein Synthesis

1. If all cells of the body have the same DNA why is a muscle cell different from a bone cell or a neuron? \_\_\_\_\_  
\_\_\_\_\_

## X. Cell Life Cycle

### A. Interphase

1. This is the phase between \_\_\_\_\_
2. What is the cell doing during interphase?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
3. The preparation for cell division includes:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_

### B. DNA Replication

1. During replication the two strands of each DNA molecule \_\_\_\_\_
2. Each strand then functions as \_\_\_\_\_
3. New nucleotides \_\_\_\_\_ with existing nucleotides
4. The process is catalyzed by \_\_\_\_\_
5. The process produces \_\_\_\_\_ DNA molecules
5. Each new DNA molecule has one strand from \_\_\_\_\_  
and one strand \_\_\_\_\_

### C. Cell Division

1. Involves division of the \_\_\_\_\_ and \_\_\_\_\_
2. Nuclear division is called \_\_\_\_\_
3. Cytoplasmic division is called \_\_\_\_\_

**D. Mitosis**

1. Each nucleus produced by mitosis has \_\_\_\_\_
2. Chromosomes are \_\_\_\_\_
3. A somatic cell is \_\_\_\_\_
4. A somatic cell contains \_\_\_\_\_ chromosomes and is \_\_\_\_\_
5. The chromosomes of a somatic cell are organized into \_\_\_\_\_
  - a. One member of each pair comes from a person's \_\_\_\_\_
  - b. The other member of each pair comes from a person's \_\_\_\_\_
6. Females have \_\_\_\_\_ sex chromosomes that look alike
7. Males have one \_\_\_\_\_ and one \_\_\_\_\_
  - a. Which is smaller? \_\_\_\_\_

**E. Cytokinesis**

1. Refers to division of \_\_\_\_\_
2. When does cytokinesis begin? \_\_\_\_\_
3. When does cytokinesis end? \_\_\_\_\_
4. The first sign is formation of a \_\_\_\_\_
5. Actin filaments form a \_\_\_\_\_ that pulls plasma membrane inward.

**XI. Meiosis****A. Gamete Formation**

1. Meiosis produces \_\_\_\_\_
2. In meiosis the nucleus undergoes \_\_\_\_\_
  - a. The resulting nuclei contain \_\_\_\_\_
3. The male gamete is called \_\_\_\_\_
4. The female gamete is called \_\_\_\_\_
5. A gamete contains 23 chromosomes, which is the \_\_\_\_\_ number
6. In prophase I, the four homologous chromatids join together or \_\_\_\_\_
  - a. This joining together forms a \_\_\_\_\_
  - b. While in this form chromatids can exchange pieces of DNA referred to as \_\_\_\_\_

## **XII. Cellular Aspects of Aging**

A. List and describe five major theories of cell aging:

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_
4. \_\_\_\_\_  
\_\_\_\_\_
5. \_\_\_\_\_  
\_\_\_\_\_