CELLS

Objectives for Exam #1:
1. Describe basic cellular structures and functions, including the organelles and plasma membrane.
2. Discuss different cellular shapes and different stages of cellular lives.

Objective for Journal #1:
Begin the biology journals with a warm-up activity and complete a science survey to reflect on background knowledge of anatomy, physiology, disease, and health.

Part I: Cellular Structure and Function

You will have an opportunity to cycle through different stations. You can work independently, or with classmates at each station.

Station A: Cellular Organelles

1. From the display, a _____ is the basic building block of life, the smallest unit of an organism that can carry out functions of life. The structures within cells that carry out specific functions are called _____.

2. Below is a photo of the cell model at your table. Using the display and the *Human Body* textbook (p. 46-47) for assistance, label the following organelles: Nucleus, Mitochondria, Endoplasmic Reticulum (dotted with ribosomes in model), Golgi Complex, Lysosomes (green in model), Vesicles (blue in model).

3. Your GTA has made a prep of cheek cells by scraping a few cells with a toothpick, rubbing the cells onto a microscope slide, adding a drop of stain, and covering the stained cells with a coverslip. Under the microscope, what organelle can you see in these cheek cells?

   _____

4. In the next slide, body cells have been preserved and stained with numerous chemicals. The plasma membrane and nucleus of each cell is stained purple in color. Some of the cells were active and their mitochondria picked up brown stain. Do these cells have few or many mitochondria? _____

Station B: Organelle Functions

1. Using the display and the *Human Body* textbook (p. 46-47) for assistance, match the organelle with its correct function (write the letter next to the function):

A. Nucleus	_____ contains substances the cell produces (like hormones, enzymes, and waste products) and secretes them at the plasma membrane.
B. Mitochondrion	_____ processes proteins and other molecules and directs them to where they need to go.
C. Endoplasmic Reticulum	_____ has enzymes that degrade bacteria, old organelles, and other unwanted substances.
D. Golgi Complex	_____ often called the "powerhouse" of the cell, where respiration produces ATP, an energy-rich substance.
E. Lysosome	_____ often called the "brain" or "control center" of the cell, contains chromosomal DNA and a nucleolus.
F. Vesicle	_____ transports materials, and is the site of attachment for ribosomes, structures involved in building chains of amino acids.

Station C: Plasma Membrane Structure

1. The cell membrane consists of two layers of **phospholipids**. Each phospholipid molecule has two parts, commonly referred to as the "head" and the "tail." The heads are water-soluble and face outward, and the tails are water-insoluble and face inward. Referring to the cell membrane model, loosely sketch the phospholipid bilayer of a portion of a cell's plasma membrane.

2. In the cell membrane model, the water-soluble heads of the phospholipids molecule are _____ in color, and the water-insoluble tails are _____ in color. The blue structure embedded in the membrane represents a _____.

3. The display shows three **transport proteins** embedded in the cell membrane. The protein on the left is **aquaporin**, which is the protein that moves _____ through the cell membrane. The protein in the middle is helping large _____ molecules into the cell, and the protein on the right is using a molecular form of energy abbreviated to _____ to move sodium and potassium from low to high concentration ("against their gradient").

Station D: Plasma Membrane Function

1. Start by dropping one drop of food color into the beaker of clear water. Observe what happens. From the *Cell Membranes* poster, this is an example of _____ diffusion, molecules moving from an area of _____ concentration to an area of _____ concentration. (Empty the cup in the sink, and fill it with water for the next students)
2. From p. 49 of the *Human Body* textbook (and the display), _____ diffusion is when molecules are transported by a particular carrier protein and _____ transport is when ATP energy is required to change a protein into a channel molecules can pass through.

3. From the *Cell Membranes* poster, the membrane of a cell folding inward around a material, taking it into the cell within a vacuole, is called _____. If it takes in a solid, this process is more specifically called _____. When vacuoles fuse with the cell membrane and release materials outside of the cell, this is called _____.

4. Fill in the function of these three proteins found in a cellular membrane:

Protein Type	Function (what they do)
Receptor Proteins	
Marker Proteins	
Transport Proteins	

Station E: Specialized Cells

1. From the display, the human body consists of trillions of cells, including approximately _____ different types of cells that vary greatly in size, shape and function.

2. Although cells are typically drawn as round, there are many different cellular shapes and sizes (p. 48 of *Human Body*). Using the display, for each of the following cells, sketch their general shape and read how it matches the cell's function.

Cell	Function	Sketch
Fertilized Egg	Large egg has adequate organelles and nutrients to support rapid mitosis (cell division) once fertilized by the sperm	
Sperm	Small head contains the DNA, and whip-like tail projects the sperm through fluid as it seeks the egg	
Skeletal Muscle Cell	Long tube-like cells have smaller myofibrils that contract and relax, altering the length of the cells and resulting in movement	

Neuron (nerve cell)	Numerous hair-like dendrites and a long axon connect cells together for intricate communication	
Fat Cell	Cells can swell in size to store additional fat, the nucleus and other organelles are often pushed off to the side	

3. Refer to the large model at the station. This is a high magnification of a bundle of _____ cells (choose from the list above). When you view the model from the side, the muscle cells look long and tubular in shape. When you view the model from above, what shape does each muscle cell seem to have? _____ This difference in appearance from different viewing angles will be important when you start studying the muscular system next week.

4. From *The Structure of Human Cells* poster (right side), which cells in the human body lack a nucleus? _____. Approximately how many white blood cells does a human make in a day? _____ Which cells can be the longest in the human body? _____

Station F: Cellular Life Stages

1. Cells have stages of development, also known as cellular life stages. After the egg is fertilized by sperm, the fertilized egg begins to divide into cells, those cells divide into more cells, and so on. Cellular division is called **mitosis** (p. 53 of *Human Body).* In order for one cell to become two cells, the chromosomes (made of DNA) are _____ so each resulting cell receives equal copies from the original cell. Mitosis is critical for growth, repair of injury, and replacement of older cells. Where in your body are cells currently undergoing high rates of mitosis? _____

2. Once a new cell has been formed by mitosis, it changes to a specific shape and function. This process is called **differentiation**. Most cells in the body will differentiate into a pre-specified shape and function, except for _____ cells, which can become a broader range of cell types (see handout).

3. Cells will typically grow in size over time. This process is called **hypertrophy** and is necessary since many cells are quite small after mitosis. There are cells found throughout the body that can grow quite large if a human consumes an excess of calories. These are _____ (or adipose) cells.

4. Most cells have a finite life span, and are genetically programmed to die at a specific time. This programmed cell death is called **apoptosis**. What might be an advantage of cells having a predetermined life span (think about what may happen to a cell as it ages)?

Station G: Cells and Homeostasis

1. From the display, what is **homeostasis**?

2. **Disease** is a loss of homeostasis. There are many ways to disrupt homeostasis in the human body. If organelles are abnormally formed or become damaged, cells can malfunction or die. From the handout provided, list diseases associated with abnormal/damaged mitochondria and lysosomes.

Cell Structures	Diseases
Mitochondria	
Lysosomes	

Part II: Journal warm-Up and Science Survey (for Journal #1, stamp not required)

Begin the *Biology Journal* by completing the Warm-Up on page #1. Complete the Science Survey pages 2-3 of the journal. These can be done as homework; a stamp is not required.

Journal assignments represent your individual skills.
Do not submit an assignment that is a duplication of any other individual's work
(see syllabus for additional information on academic honesty)