**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Self-Guided Exploration of Cells and Organelles**—23 pts total

This homework assignment is designed to level the playing field with regards to your knowledge about cell biology. Many times throughout this course we will casually mention different aspects about cell biology, especially when we discuss the relevance of the biochemical processes we are studying to pathology and organism physiology. Use these basic concepts about cell biology to tie together main ideas later in the course—this will deepen your understanding of biochemistry, and provide a frame of reference for the molecular processes you will study.

**Part I:**

Familiarize yourself with:

* The differences between prokaryotic and eukaryotic cells
* The functions of different cellular compartments
* The general mechanisms that govern transport between these compartments in mammalian cells

Read through these online resources to refresh (or learn for the first time) your knowledge about bacterial and mammalian cells. The questions you have to answer will guide your web/book searching beyond these sites—but they are a good start.

1. Mol. Biology of the Cell 4th Ed, Chapter 12: Intracellular Compartments http://www.ncbi.nlm.nih.gov/books/NBK26907/
2. The Biology Project, University of Arizona: Prokaryotes, Eukaryotes and Viruses (Only read up to viruses): http://www.biology.arizona.edu/cell\_bio/tutorials/pev/main.html
3. Cells Alive! (A little archaic looking, but good!) http://www.cellsalive.com/cells/cell\_model.htm

**Part II:**

Answer the questions below (9 questions total). Partial credit will be given, but to receive full credit you must completely answer the question and show that you understand the material. Keep your answers as **succinct**, yet complete as possible.

***Please type your answers. This homework assignment is due at the beginning of class on Monday, September 9th. Use full sentences and paragraph form, unless specifically asked bullet point answers and short incomplete sentences will not be graded.***

Questions:

1. List in the space below the major differences between bacterial and mammalian cells. Highlight those features that are unique to each type of cell. (2 pts)
2. What is the function of the nucleus? How is DNA protected there—i.e. what different mechanisms govern nuclear transport? (3 pts)
3. Make a table of the different compartments/organelles in mammalian cells and their unique characteristics/functions. (2 pts)
4. What is the purpose of compartmentalization in mammalian cells? (2 pts)
5. Where are proteins synthesized in mammalian cells? In bacterial cells? (2 pts)
6. Describe the function of the mitochondrion. Discuss the endosymbiotic and autogenous hypotheses for the origin of mitochondria. Which one is more widely accepted by the scientific community? (2 pts)
7. In the disease light chain amyloidosis, misfolding-prone immunoglobulin light chain proteins are overproduced in plasma cells and are secreted extracellularly. AL is systemic—these immunoglobulin light chains circulate, clump together and form pathogenic amyloid plaques in the heart, liver and kidneys, disrupting normal organ function. You are a biochemist who is developing a series of experiments to reduce the secretion of this pathogenic protein. What organelles/cellular functions would you target first? Do a quick web search to find 3 small molecules or genetic mechanisms that could be used to stop the secretion of this aberrant protein. List them, and discuss why and how they would be effective. (5 pts)
8. Newly synthesized proteins are floppy and sticky (lots of hydrophobic patches). There are other proteins in cells called chaperones that greet these nascent proteins and sequester them from the crowded cellular environment. This allows the new proteins to fold in peace, preventing aggregation (proteins clumping together) and maintaining a function cellular environment. Name one type of chaperone/chaperoning system in prokaryotes (e.g. *E. coli*) and how it works to maintain cellular homeostasis. (3 pts)
9. How do cells deal with waste (old proteins, toxic metabolites, even parts of organelles)? Name and describe two processes. (2 pts)