**Review Questions**

**Suggestions for Study:**

* **Pay attention to the need to know boxes and the tips from the authors and their students in your Holtzclaw study book.**
* **FRQs are theme oriented – there will ALWAYS be parts you can answer so don’t skip any of them.**
* **Use Bozeman videos to help in areas where you need help.**
* **Do the Holtzclaw exam and use that information to direct you to areas of study.**
* **See my webpage to links for calculating and interpreting standard error of the mean (SEM)**

**Directions: The following are four synthesis questions for you to answer. These are due, in the front of your class notebook, on Monday, May 11th. These count as a test grade.**

1. Proteins are the main worker and structural molecules of the cell and are coded for by genes. Describe how protein synthesis is turned on, how it occurs, and how it is regulated. Describe each structural level of a protein and the types of bonds that support it. Describe the effects of the three types of point mutations and their potential effects on the behavior of the protein.
2. Frequent mutations in human immunodeficiency virus (HIV) have produced constantly changing viral surface proteins that have made it difficult for the human immune system to adequately respond to the virus. Developing a vaccine for HIV has been similarly difficult. Now, scientists are focusing on an HIV surface protein called gp120 that has not changed significantly over the past 30 years. The gp120 protein plays an important role in HIV infection by binding to the CD4 receptor on human T cells and allowing the HIV to enter the cell and replicate. Researchers have found that any HIV with a mutation that changes the shape of a specific crucial region of gp120 is unable to invade a host cell. This region seems unusually exposed on the surface and appears to be vulnerable to b12, a powerful antibody. The b12 antibody inhibits many different strains of HIV and was first isolated from an HIV patient whose immune system was unusually successful at slowing the progress of the virus.

(a) Using your understanding of natural selection, explain how the development of vaccines has been unsuccessful in preventing infection by HIV.

(b) Explain how it is possible that there has been little change in the gp120 protein despite frequent mutation of other proteins in HIV.

(c) Predict how the b12 antibody will impact the variation within the HIV population if it is used to treat patients infected with HIV. Justify your prediction.

(d) Predict how HIV will **most likely** change if the b12 antibody is used for many years to treat patients infected with HIV. Justify your prediction.

1. Until recently, most scientists hypothesized that organisms obtain free energy from either sunlight or from organic molecules. This hypothesis changed when thriving ecosystems of unusual and diverse organisms were discovered at hydrothermal vents on the ocean floor. Hydrothermal vents are typically found in volcanically active areas along the ocean floor at depths of up to 2.5 kilometers (8,200 feet). Sunlight does not penetrate the ocean at this depth and life is usually very sparse. Active hydrothermal vents, however, are teeming with life and continuously spew superheated water that contains many compounds, including hydrogen sulfide and iron sulfide, into the surrounding near-freezing ocean water. Most of the bacteria found around the hydrothermal vents are chemoautotrophs that utilize the free energy in hydrogen sulfide, which is toxic to most organisms. These bacteria are found living in and around other organisms around the hydrothermal vent, including limpets, mussels, crabs, clams, and giant tube worms. Giant tube worms can grow to up to 2.5 meters (8 feet) in length. As larvae, tube worms have primitive mouths and digestive tracts and consume chemoautotrophic bacteria. The mouth and digestive tract disappear in adult tube worms, but the chemoautotrophic bacteria remain inside the worms’ bodies. Each adult worm has a specialized organ that exchanges compounds such as oxygen, carbon dioxide, and hydrogen sulfide with the environment. Some bacteria found at hydrothermal vents live in environments where no oxygen is present. These anaerobic chemoautotrophs use compounds other than oxygen to carry out the biochemical pathways necessary for life. Photoautotrophs, on the other hand, live at or near the surface and use oxygen in the processes used to capture free energy from the environment and obtain free energy from organic compounds. There are similarities and differences in the processes used by photoautotrophs and anaerobic chemoautotrophs to capture and obtain free energy.

(a) Explain the process used by photoautotrophs to capture free energy from the environment, and explain the role of oxygen in the process. Be sure to include the source of free energy in your explanation.

(b) Describe the process that photoautotrophs use to obtain free energy from organic compounds, and explain the role of oxygen in the process.

(c) Explain the process used by anaerobic chemoautotrophs to obtain free energy, and explain one similarity between the processes used by photoautotrophs and anaerobic chemoautotrophs to obtain free energy.

(d) Explain how adult tube worms are able to survive and grow around hydrothermal vents since they do not have mouths or digestive tracts with which to obtain free energy. Include a justification of the importance of the adult tube worms’ ability to exchange compounds with the environment

1. Write your own synthesis question and answer it. Make it legit!!