Review: Communication, Metabolism

AP Biology

*SIGNAL TRANSDUCTION*

1. Name and describe the structures involved when one cell signals another. Where is each component found? What forms might the signal take? Use the vocabulary to distinguish between signaling between cells that are near versus far.
2. What changes might a received signal cause? What energy molecule might facilitate these changes? How?
3. Name the part of the signal pathway that relays the message intracellularly. What term describes when the message is moved between different molecules? Discuss the role of cAMP, kinases, and amplification in this stage.
4. Relate the effector to the response. Provide an example.

*FEEDBACK*

1. Compare and contrast positive and negative feedback. Explain an example of each.

*NERVOUS SYSTEM*

1. What type of cell is found in the nervous system? Identify the cell parts. In which direction does a stimulus move through these cells? What speeds the transmission of an impulse along these cells? What slows the message?
2. Differentiate between these cells based on location, function, and direction of impulse movement.
3. Explain the role of the action potential, Ca2+, vesicles, neurotransmitters, diffusion, and transmembrane receptors in moving the message from one nerve cell to another.
4. Differentiate between resting potential and action potential. How does the voltage across the neuron membrane change when an action potential is initiated? Why does it change? How is a resting potential reestablished?
5. Differentiate between leak channels, gated channels, and pumps. What is the role of each in the process of conducting a nerve impulse?

*METABOLISM*

1. How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems? How is energy conserved, and yet always needed to ‘flow’ into biological systems?
2. What are the primary molecules of energy in organisms? Describe each.
3. What are the primary reactions of energy in organisms? State each. Describe each using the vocabulary of energetics.
4. What is the role of ATP in coupling the cell’s anabolic and catabolic processes?

*ENZYMES*

1. What are the role of enzymes in metabolism? Describe the ‘anatomy’ of the enzyme-substrate complex. How does the specificity of an enzyme depend on its structure?
2. How do enzymes regulate the rate of chemical reactions? In what ways is the activity of an enzyme regulated?
3. Predict the effect of each of the following on reaction rate: cooling, boiling, changes in pH, increased enzyme, increased substrate.
4. Explain the enzyme-facilitated reaction of the lab. Relate the terms peroxide, peroxidase, catalase, catalyst, enzyme, substrate.

*RESPIRATION*

1. What is the energy-releasing pathway used by all organisms? What are the reactants & products of the rxn? At what stage in the pathway is each used or produced?
2. How do cells generate ATP in the absence of oxygen? How efficient are these pathways? How do they limit organisms?
3. In respiration, what are the roles of glucose and oxygen, respectively? What is the role of NADH and FADH2?
4. Describe the journey of a single carbon atom from glucose in respiration. Describe the journey of a single hydrogen atom from glucose in respiration.
5. Yeast facilitate the conversion of grape juice to wine. These facultative anaerobes use both fermentation and respiration to do so, producing CO2 in each case. Which process will these facultative anaerobes undergo first, and why? How can an enologist determine when they have switched strategies?
6. An experiment to measure the rate of respiration in crickets and mice at 10oC and 25o C was performed using a respirometer, an apparatus that measures changes in gas volume. Respiration was measured in mL of O2 consumed per gram of organism over several five-minute trials and the following data were obtained.



1. Which organism at which temperature had the fastest metabolic rate (produced the most ATP) during its trials? Explain how you know.
2. According to the data, the mice at 10oC demonstrated greater oxygen consumption per gram of tissue than did the mice at 25oC. Propose an explanation for why this is.
3. Under laboratory conditions, muscle cells were broken up and separated into fractions of mitochondria and cytoplasm in an attempt to learn more about cellular respiration. Each fraction was incubated with glucose or pyruvate. Tests were carried out during incubation for the presence of either carbon dioxide or lactic acid. The results are shown below:



1. What does the presence of lactic acid in a sample indicate about the process occurring in each cell fraction?
2. Explain why lactic acid was produced by the cytoplasm fraction incubated with glucose, but not the mitochondrial fraction.
3. Why was no carbon dioxide produced by either fraction incubated with glucose?
4. Why did the cytoplasm fraction produce lactic acid in the presence of both glucose and pyruvate?
5. Why did the mitochondria produce carbon dioxide in the presence of pyruvate but not in the presence of glucose?