AP Biology – Fall 2017 Edward R. Murrow High School
Exam 3 Review Sheet Mr. Sprague

Format:

Section I 27 multiple choice questions
Section II 1 essay question and 3 short free response questions

Reading: Hillis chapters 5 and 6 (and all previous readings)

Concepts to Review:

- EVERYTHING FROM EXAMS 1 AND 2

- Membranes and Cell Transport
  - Be able to describe the structure of the plasma membrane and explain the roles of *phospholipids*, *channel proteins*, *glycoproteins*, and *cholesterol*.
  - Be able to correctly use the terms *hypotonic*, *hypertonic*, *isotonic*, and *concentration gradient*.
  - Be able to compare the processes of *simple diffusion*, *facilitated diffusion*, and *active transport*.

- Intercellular Signal Transduction
  - Be able to describe the sequence of events involved in a signal transduction pathway.
  - Be able to explain the roles of *ligands*, *receptors*, *second messengers*, *kinases*, *phosphorylation*, and *transcription* (*gene expression*) in cell signaling.

- Respiration and Photosynthesis
  - Understand how and why exergonic and endergonic reactions are coupled in cells.
  - Be able to explain the purpose of *chemiosmosis*, how the process occurs, and the role of *ATP synthase*.
  - Be able to identify the roles of the following coenzymes: ADP/ATP, NAD^+/NADH, FAD/$FADH_2$, and $NADP^+$/NADPH.
  - Be able to explain the terms *substrate-level phosphorylation*, *oxidative phosphorylation* and *photophosphorylation*.
  - Understand the differences between *anaerobic respiration* and *aerobic respiration*.
  - Be able to summarize the processes of cellular respiration (*glycolysis*, *pyruvate oxidation*, *Krebs cycle*, *electron transport chain*) and photosynthesis (*light-dependent reactions* and *Cavlin cycle*).
  - Be able to explain the role of oxygen (O_2) in the electron transport chain of respiration.
  - Be able to explain the purpose of *fermentation* in anaerobic respiration.
  - Be able to explain the role of water (H_2O) in the light-dependent reactions of photosynthesis.
  - Know the structure of a *mitochondrion* and where each step of respiration takes place.
  - Know the structure of a *chloroplast* and where each step of photosynthesis takes place.

- Labs
  - Be able to graph data, including labeling both axes with units.
  - Be prepared to discuss the following labs: *Osmosis*, *Water Potential*, *Cell Respiration*, and *Chromatography*.
  - Understand the meaning of *water potential* and be able to calculate the water potential of a solution.

Overarching Questions to Consider:

Suggestion: Answer all of these questions in writing, then compare answers with a classmate. I promise that taking the time to do so will be well worth it and much more useful then memorizing facts and definitions.

1. How do the size and polarity of molecules affect their ability to permeate the plasma membrane?
2. Why do molecules naturally diffuse along a concentration gradient? Why does active transport require ATP?
3. Why does temperature affect the rate of diffusion?
4. What happens to a cell in a hypotonic solution? Why? What happens to a cell in a hypertonic solution? Why?

[continue on back…]

5. What does water potential represent? Why is the value negative?
6. How were we able to determine the sucrose concentration of the potato in lab? Why does this method work?
7. Why are second messengers necessary for the amplification of a signaling transduction pathway?
8. What does it mean when we say a cell signaling pathway results in a gene being "expressed"?
9. Why does it matter for a cell whether a vital chemical reaction is endergonic or exergonic?
10. How are the three methods of ATP synthesis we have explored—substrate-level phosphorylation, oxidative phosphorylation, and photophosphorylation—different?
11. How does each step in cell respiration (glycolysis, pyruvate oxidation, Krebs cycle, electron transport) contribute to the synthesis of ATP? How does each step in photosynthesis (electron transport, Calvin cycle) contribute to the synthesis of carbohydrates?
12. Why must oxygen be reduced during aerobic respiration? Why must water be oxidized during the light reactions of photosynthesis? What is the role of carbon dioxide in the Calvin cycle?
13. Why is glycolysis enough for prokaryotes to survive on, but not capable of sustaining most eukaryotes?
14. If the purpose of photosynthesis is to make carbohydrates, why must ATP be synthesized in the process?

Practice Exam Questions:

Visit the course website and click on the "Multiple Choice Practice" link. Complete all practice questions for the relevant chapters and check your work against the answer key. Note: these items are password protected.

Essay Question Sneak Peak:

Figures 1–5 are not shown.

1. Cellular mechanisms for respiration and photosynthesis both involve a pathway of complex, multi-step reactions. In cellular respiration, ATP is synthesized from the oxidation of carbohydrates and other metabolites. In photosynthesis, carbohydrates are synthesized from carbon dioxide using energy captured from sunlight. Figures 1, 2, and 3 represent models for the metabolic pathways of glycolysis, the Krebs cycle, and the electron transport chain in respiration, respectively. Figures 4 and 5 represent models for the metabolic pathways of the electron transport chain and the Calvin cycle in photosynthesis, respectively.

   (a) Using the models, **describe** ONE contribution of each of the following in ATP synthesis.
   - Catabolism of glucose in glycolysis and pyruvate oxidation
   - Oxidation of intermediates in the Krebs cycle
   - Formation of a proton gradient by the electron transport chain

   (b) Using the models, **describe** ONE contribution of each of the following in carbohydrate synthesis.
   - Synthesis of ATP and NADPH in the electron transport chain
   - Fixation of carbon dioxide in the Calvin cycle

   (c) Use each of the following observations to **justify** the claim that glycolysis first occurred in a common ancestor of all living organisms.
   - Glycolysis occurs under anaerobic conditions.
   - Glycolysis occurs only in the cytosol.

   (d) **Describe** TWO features of a model that represents how natural selection resulted in the spread of glycolysis from a common ancestor to nearly all existing organisms.

   (e) A prairie grass species has been infected with a virus that disrupts one of the electron transport proteins in the chloroplasts of infected cells. **Predict** ONE effect on the production of a specific molecule in the cells of an infected plant. **Justify** your prediction.

   (f) Not all of the energy in glucose is successfully converted into ATP. In most organisms, the efficiency of glucose metabolism is less than 50 percent. **Describe** what happens to the excess energy released from the metabolism of glucose that is not used to synthesize ATP.