Metabolism Study Guide

For any of the reactions in this section you should be able to, at minimum, answer the following three questions:

1. Where the reaction is happening in the cell.
2. What is the state of energy before and after the reaction (i.e. is ATP produced or used, and how much)
3. What goes into a reaction and what comes out of that reaction.

SOME IMPORTANT KEY TERMS

acetyl CoA
aerobic
alcohol fermentation
anaerobic
ATP synthase
beta oxidation
cellular respiration
citric acid cycle
cytochrome
electron transport chain
facultative anaerobic
glycolysis
lactic acid fermentation
NAD+
oxidation
proton-motive force
redox reaction
reduction
substrate-level phosphorylation
beta oxidation
gluconeogenesis
substrate-level phosphorylation
lipoproteins

THE PROCESS OF CELLULAR RESPIRATION

1. Describe the three major stages of cellular respiration and state the region of the eukaryotic cell where each stage occurs.
2. Describe how the carbon skeleton of glucose changes as it proceeds through glycolysis.
3. Explain the physiological importance of the hexokinase reaction.
4. Identify substrate-level phosphorylation and the reduction of NAD+ that occurs in glycolysis.
5. Describe where pyruvate is oxidized to acetyl CoA, what molecules are produced, and how this process links glycolysis to the citric acid cycle.
6. Describe the main purpose and the products of the citric acid cycle. Explain why it is called a cycle.
7. Describe the point at which glucose is completely oxidized during cellular respiration.
8. Distinguish between substrate level phosphorylation and oxidative phosphorylation.
9. In general terms, explain how the exergonic “slide” of electrons down the electron transport chain is coupled to the endergonic production of ATP by chemiosmosis and oxidative phosphorylation.
10. Explain where and how the respiratory electron transport chain creates a proton gradient.
11. Describe the role that oxygen plays in the cellular respiration process.
12. Summarize the net ATP yield from the oxidation of a glucose molecule by constructing an ATP ledger or score card.
13. Describe the differences among carbohydrate respiration vs. amino acids and fatty acids as the energy source. Include the advantages and disadvantages of each.
14. Explain how ATP production is controlled by the cell and describe the role that the enzyme phosphofructokinase plays in the process.

RELATED METABOLIC PROCESSES

15. State the basic function of fermentation.
16. Describe the process of fermentation in humans and the reactants and products.
17. Compare the differences in the processes of fermentation and cellular respiration.
18. Describe in what way certain muscle tissues are different with respect to their tendencies to perform full oxidative cellular respiration vs. fermentation.
19. Describe what ways the liver and kidneys can maintain essential concentrations of glucose in the bloodstream.
20. Explain gluconeogenesis, including what metabolic components can be used for the process.
21. Describe the differences and functions of the lipoproteins, with special attention to where they are created and how their components dictate their physiological functions.