SBI4U – Metabolic Processes – Anaerobic Respiration

Curriculum Expectations:

Overall Expectations

C3. demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes.

Specific Expectations

C1.2 assess the relevance, to their personal lives and to the community, of an understanding of cell biology and related technologies (e.g., knowledge of metabolic processes is relevant to personal choices about exercise, diet, and the use of pharmacological substances; knowledge of cellular processes aids in our understanding and treatment of mitochondrial diseases [a group of neuromuscular diseases]) [AI, C]

C2.2 conduct a laboratory investigation into the process of cellular respiration to identify the products of the process, interpret the qualitative observations, and display them in an appropriate format [PR, AI, C]

C3.1 explain the chemical changes and energy conversions associated with the processes of aerobic and anaerobic cellular respiration (e.g., in aerobic cellular respiration, glucose and oxygen react to produce carbon dioxide, water, and energy in the form of heat and ATP; in anaerobic cellular respiration, yeast reacts with glucose in the absence of oxygen to produce carbon dioxide and ethanol)

C3.4 describe, compare, and illustrate (e.g., using flow charts) the matter and energy transformations that occur during the processes of cellular respiration (aerobic and anaerobic) and photosynthesis, including the roles of oxygen and organelles such as mitochondria and chloroplasts

Learning Goals – Students will…

1) Create a flow chart explaining the process for anaerobic respiration
2) Differentiate between anaerobic and aerobic respiration
3) Identify the metabolic processes in anaerobic respiration
4) Relate to how aerobic and anaerobic respiration occurs in day to day life

Glossary

Adenosine triphosphate (ATP): a nucleoside triphosphate used in cells as a coenzyme. ATP transports chemical energy within cells for metabolism.

Aerobic respiration: form of cellular respiration that uses oxygen and produces large amounts of ATP. Aerobic cellular respiration occurs in two stages, glycolysis and oxidative respiration. Glycolysis is a series of 10 enzyme-catalyzed reactions, occurring in the cytoplasm, that essentially breaks one molecule of glucose into two molecules of pyruvate. Oxidative respiration is a series of reactions occurring in the mitochondria that uses oxygen to convert pyruvate into carbon dioxide, water, and ATP.

Anaerobic respiration: form of cellular respiration that does not use oxygen and produces small amounts of ATP. This is accomplished through a series of reactions called fermentation (ethanol and lactic acid). Ethanol fermentation occurs in yeast cells and lactate fermentation occurs in human muscle cells during periods of strenuous exercise.

Cellular respiration: metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into adenosine triphosphate (ATP), and then release waste products.

<table>
<tr><td colspan="2">Glucose: simple monosaccharide sugar that is an important carbohydrate that cells use as a primary source of energy
Mitochondria: membrane-enclosed organelle found in most eukaryotic cells, described as the “cellular power points” because they generate most of the cell’s supply of ATP.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Assessment Evidence:
Recapping concepts of aerobic and anaerobic respiration
Simulation of anaerobic muscle fatigue
Class discussion of activity’s purpose</td><td>Evaluation:
Lab questions to be submitted at end of class
Concepts on unit test</td></tr>
<tr><td colspan="2">Learning Plan:
Review concept of aerobic and anaerobic respiration (short PowerPoint)
Explain key difference in anaerobic respiration (video)
Students conduct clothespin activity to experience anaerobic muscle fatigue
Discuss purpose of activity and how it relates to anaerobic respiration
Students will graph their results and complete the questions
Class clothespin muscle fatigue competition</td></tr>
<tr><td colspan="2">References:

http://kisdwebs.katyisd.org/campuses/BDJH/teacherweb/washingtons/Lists/Calendar/Attachments/316/Lab_MuscleFatigue%20academic.pdf – unmodified version of the clothespin lab

http://www.youtube.com/watch?feature=player_embedded&v=mgH_-spn-ew – short video of anaerobic respiration

http://www.youtube.com/watch?feature=player_embedded&v=uTILYY-NxxE – short video of anaerobic respiration</td></tr>
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