PEER Life Science Cells Are Us Meeting Cells’ Energy Needs Notes Outline Key

**Why It Matters**

* Energy is the capacity to do work.
* Energy can be stored as potential energy, or as energy of motion, known as kinetic energy.
  + Name two other forms of energy:
    - Chemical energy
    - Sound energy
    - Mechanical energy
    - Thermal/heat energy
    - Nuclear energy
* Molecules are held together by chemical bonds with an energy force that is released when these bonds are broken.
* The most readily available form of energy in the body is glucose.
* Mitochondria are organelles that allow the energy in glucose to be released and captured in a usable form in a process called cellular respiration.

**What We Know**

* Mitochondria use oxygen to liberate the chemical energy of food and trap it in storage compounds that cells can use.
* This process is called cellular respiration. The net chemical equation for it is:
  + C6H12O6 + 6O2 à 6CO2 + 6H2O + energy (stored in ATP)
* The first step of cellular respiration is called glycolysis, and is where glucose is split and transformed into a molecule called pyruvic acid. This process does/does not require oxygen, or is anaerobic.
* The next step is the Krebs/Citric Acid Cycle which only occurs in aerobic conditions (oxygen is present).
* The last step of cellular respiration is the electron transport chain.
  + This step transforms adenosine diphosphate (ADP) to adenosine triphosphate (ATP). The third phosphate bond stores the energy released by the breakdown of glucose.

**How We Know**

* A mitochondrion is an oval bag filled with membranes. They are so small that they are only visible with electron microscopes.
* The large number of membrane folds in mitochondria allow for more surface area for chemical reactions to occur.
* Mitochondria can be separated from broken up cells by centrifugation (spinning at high speed) which separates parts of the cell by size and weight.
* Mitochondria have DNA that is different from the DNA found in the nucleus, and this DNA is only inherited from your mother.
* As mitochondria produce energy, they also produce a toxic by-product called free-radicals. These highly reactive substances can damage nearby mitochondrial RNA and DNA.
* In addition to creating energy for the cell to use, mitochondria also produce heat.

**Common Hazards**

* Mitochondrial toxins can act in three ways. They can:
  + Inhibit electron transport which interferes with the transport of electrons through the chain of proteins in the electron transport system.
  + Uncouple phosphate bonding which prevents the creation of ATP without affecting electron transport.
  + Have mixed action where they inhibit electron transport at high doses and uncouple phosphate bonding at low doses.