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**Unit 3: Photosynthesis and Cell Respiration**

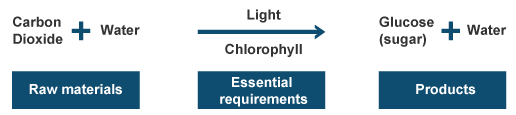
* Chemical Energy
  + All carbon-based molecules in food store chemical energy in their bonds.
  + Carbohydrates and lipids are the most important energy sources
    - Energy is only available once the molecules are broken down
* Adenosine Triphosphate (ATP)
* Molecule that transfers energy from the breakdown of food to cell processes
* Function
  + - Building molecules
    - Moving materials by active transport
* Energy in ATP
* Energy is released when a phosphate group is removed from the molecule
* The bond holding the third phosphate is unstable and easily broken to form ADP
* ATP in Food
* Food that we eat does not contain ATP that our cells can use
* The food must be digested and broken into smaller molecules.
* Different foods provide different amounts of ATP
* Photosynthesis
* Conversion of light energy into chemical energy (carbohydrates = sucrose and starch) inside the **chloroplast**
* Light-dependent reaction (needs light) and light-independent reaction (doesn’t need light)
* Chlorophyll
* A green pigment molecule in the chloroplast that absorbs the light energy
* Two types: chlorophyll *a* and chlorophyll *b*
  + - Absorb mainly red and blue light
* Rate of Photosynthesis
* Measured by production/release of oxygen or uptake of carbon dioxide or increase of biomass
* Light- Dependent Reaction
* Takes place within thylakoid membrane
* Water and sunlight are needed
* Light- Dependent Reaction Process

1. Chlorophyll absorbs energy form sunlight.
2. Energy transferred along thylakoid membrane.
3. H2O molecules broken down. O2 released.
4. Energy carried along thylakoid membrane transferred to ATP.

* Light- Independent Reaction
* Uses energy from the light-dependent reaction to make sugars(carbohydrates = glucose)
* Occur in the stroma of chloroplasts
* CO2 is needed
* Light-Independent Reaction Process

1. CO2 is needed to build larger molecules. Energy is needed from the light-dependent reaction.
2. A molecule of simple sugar is formed, usually glucose (C6H12O6), to store some of the energy that was captured from sunlight.

* Photosynthesis Reaction



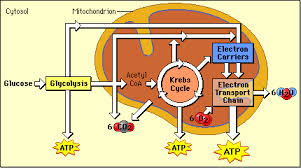
* Purpose
* Plants make their own food.
  + - Through PHOTOSYNTHESIS
    - Inside the chloroplast
* Eukaryotes break down molecules from food to produce energy, or ATP
  + - Through CELLULAR RESPIRATION
    - Inside the mitochondria
* Photosynthesis and Cellular Respiration
* Photosynthesis:

6CO2 + 6H2O + light energy -> C6H12O6 + 6O2

* Cellular Respiration:

C6H12O6 + 602 -> 6H2O + 6C02

* Energy form Food
* Mitochondria cannot directly make ATP from food.
* Foods are broken down into smaller molecules like glucose (C6H12O6)
* Three Main Steps
  + Glycolysis- 2 ATP made
  + Krebs cycle- 2 ATP made
  + Electron transport chain (ETC)- 32 ATP
* Glycolysis
  + Splits glucose into two three-carbon molecules and makes 2 ATP
  + Takes place in cell’s cytoplasm
  + Anaerobic: Doesn’t need Oxygen
* Is Oxygen Present?
  + Yes (Aerobic)? CELLULAR RESPIRATION
  + No (Anaerobic)? FERMENTATION
* Cellular Respiration
  + Releases chemical energy from sugars and other carbon-based molecules to make ATP when oxygen is present
  + Aerobic process  
     -Needs Oxygen to take place
  + Occurs in mitochondria
* Krebs Cycle
  + 3-carbon molecule from glycolysis are broken down
  + Occurs in matrix of mitochondria
  + 2 ATPs are made, Energy- carrying molecules transferred to Electron Transport Chain
* Electron Transport Chain
  + Energy-Carrying molecules from Krebs Cycle used to create ATP
  + 32 ATP created
  + Occurs in inner mitochondrial membrane
* Cellular Respiration Overview



* Anaerobic Respiration  
  + No Oxygen
  + Only 2 ATP (From Glycolysis)
  + Glycolysis and then fermentation
  + Fermentations is just a way to get rid of the 3-carbon molecule
  + End products vary
  + Takes place in the cytoplasm
* Lactic Acid Fermentation
  + Used by bacteria and our muscles!
  + Turn the 3-carbon molecule into lactic acid
  + NO NEW ENERGY
  + Makes cheese and Yogurt!!
  + Reason why our muscles get tired when we use them a long time
  + Oxygen Debt- we owe our body oxygen to get rid of the lactic acid
* Ethanol Fermentation
  + Used by yeast
  + Turns pyruvate into ethanol and Carbon
  + NO NEW ENERGY
  + Used to make wine, beer and bread!!
* Which would you rather do?
  + Aerobic makes 36 ATP
  + Anaerobic makes ATP
  + As long as oxygen is around, you will always choose Aerobic. Anaerobic is only there so we organisms can survive if that are in an environment without oxygen ( or muscles can keep working when they run out of oxygen)