

Chapter Ten: Cellular Respiration

Lesson 10.1: Cellular Respiration: An Overview

When you are hungry, you feel sluggish, dizzy, and weak. You are weak because your body is telling you that you need food as energy.

calorie: amount of energy needed to raise the temperature of 1 gram of water 1 degree Celsius.

- The Calorie (capital C) is what we see on food labels is equal to 1000 calories or 1 kilocalorie
- The energy stored in the macromolecules (also called biomolecules) are what your cells use.
 - Proteins, carbohydrates, and fats

Nutrition Facts	
4 servings per container	
Serving size	1 cup (227g)
Amount per serving	
Calories	280
% Daily Value*	
Total Fat 9g	12%
Saturated Fat 4.5g	23%
Trans Fat 0g	
Cholesterol 35mg	12%
Sodium 850mg	37%
Total Carbohydrate 34g	12%
Dietary Fiber 4g	14%
Total Sugars 6g	
Includes 0g Added Sugars	0%
Protein 15g	
Vitamin D 0mcg	0%
Calcium 320mg	25%
Iron 1.6mg	8%
Potassium 510mg	10%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

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- 1 gram of sugar releases 3811 calories of heat energy
- 1 gram of fat in beef releases 8893 calories of heat energy
- Converting food Calories into energy
 - 1 Calorie (Cal) = 1000 calories (cal)
 - 1 Calorie (Cal) = 1 kilocalorie (kcal)

- 1 kilocalorie (kcal) = 4184 Joules (J) = 4.184 kilojoules (kJ)
- 1 banana = 110 Calories = 460.24 kJ
- 4 oz. chicken breast = 187 Calories = 782.408 kJ
- 1 cup spaghetti cooked = 221 Calories = 924.664 kJ
- 1 gallon of gasoline = 126,858 kJ
- 1 gram of uranium = ~20,000,000 kJ

cellular respiration: a process of energy conversion that releases energy from food in the presence of oxygen

- oxygen + glucose (sugar) → carbon dioxide + water + energy
- $6 \text{ O}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 6 \text{ CO}_2 + 6 \text{ H}_2\text{O} + \text{Energy}$
- Photosynthesis is the exact opposite
 - carbon dioxide + water + energy (Sun) → oxygen + food (sugar)
 - The process of photosynthesis is where plants convert energy from the sun into food for the plant and release oxygen into the atmosphere
- Some of the energy from food gets “lost” into heat for the body.

Stages of cellular respiration:

1. Glycolysis

- a. Food enters this process where 10% of energy is captured to make ATP
 - i. ATP = Adenosine Triphosphate
 - ii. One of the most important compounds in cells that stores energy

2. The Krebs cycle

- a. Second stage where a little more energy is captured

3. Electron transport chain

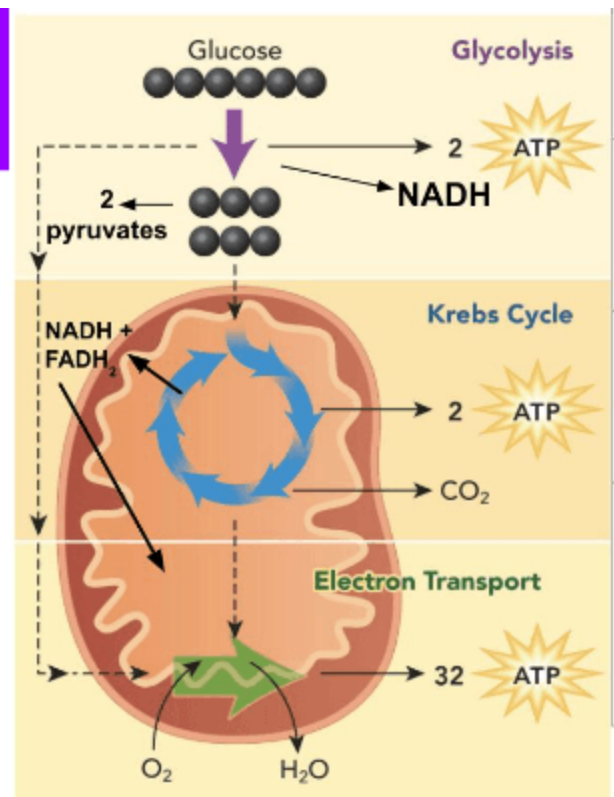
- a. Most of the energy necessary for the cell is captured in this final stage
- b. Uses oxygen to capture the energy
 - i. Anytime a cell's demand for energy increases, its use of oxygen increases as well
 - ii. Most of the energy releasing pathways within cells require oxygen and this is the reason why we need to breathe
 - iii. Cyanide poisoning disrupts this part of cellular respiration

3 STAGES OF CELLULAR RESPIRATION

Cellular respiration captures energy from food in 3 main stages that all work together in order:

1. Glycolysis
2. Krebs Cycle
3. Electron Transport Chain

Cells can use almost any food molecule for energy, but we will focus on the simple sugar **GLUCOSE**



aerobic: requires oxygen

- The Krebs cycle and electron transport chain
 - Occurs in mitochondria
 - The Krebs cycle doesn't directly require oxygen but it cannot run without the electron transport chain

anaerobic: doesn't require oxygen

- Glycolysis
 - occurs in the cytoplasm

Photosynthesis and cellular respiration

- Earth's savings account
 - Photosynthesis deposits energy
 - taking in carbon dioxide and water to make sugar and oxygen
 - Cellular respiration withdraws energy
 - taking in sugar and oxygen to produce carbon dioxide and water

