

# Cellular Respiration (CR or RESP)

CELLULAR RESPIRATION:

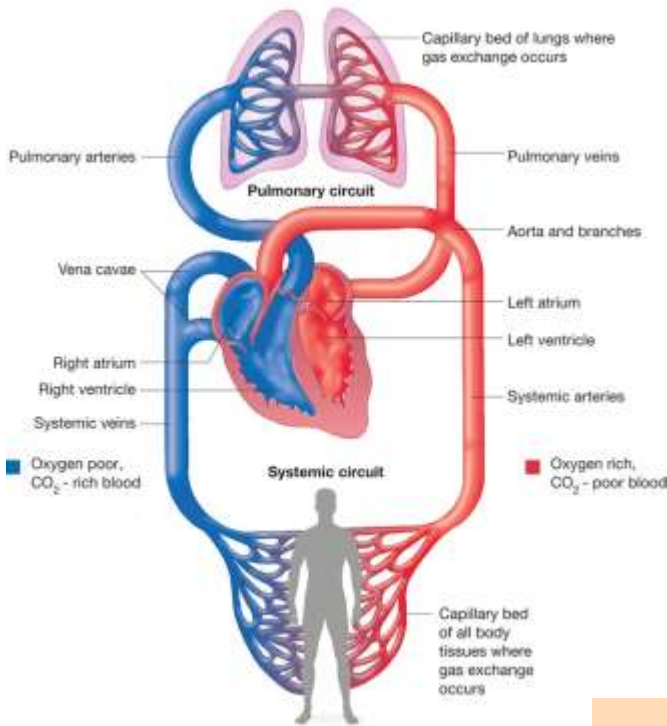


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THE CIRCULATORY SYSTEM (cardiovascular system): circulates and delivers reactants AND products of cellular respiration to AND from ALL cells in the body.

Veins are vessels for blood to go TO the heart. Arteries are vessels from blood to go AWAY from the heart.

Ventricles are the bottom parts of the heart that push blood with force so it goes to the lungs and the rest of the body. Atria are the top part of the heart that collect the blood as it comes back from the lungs or the body.



Cells that are more active (like brain cells or muscle cells) have...

- Have more blood flow (more glucose and O<sub>2</sub> in; more CO<sub>2</sub> and H<sub>2</sub>O out)
- More mitochondria
- Make more energy AND heat!

Brain cells are the most active cells in your body. Your brain uses 20% of all oxygen and glucose you intake (despite being only 2% of your total bodyweight). This is why when you are hungry or when you are holding your breath too long you get a headache. Your muscles use the second most glucose and oxygen in your body. Every time they contract they use thousands of ATP molecules.

**CELLULAR RESPIRATION:** releases energy stored in the chemical bonds of glucose Has 3 steps:

**1. GLYCOLYSIS - “splitting sugar”:**

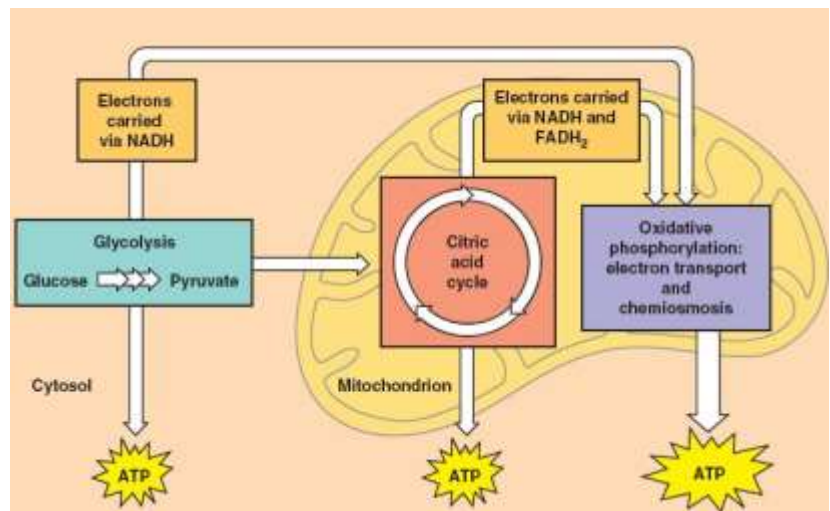
*The breakdown of glucose by enzymes, releasing energy (2 ATP) and pyruvic acid. NOTE: no O<sub>2</sub> is required*

**2. KREBS CYCLE aka THE CITRIC ACID CYCLE aka TCA CYCLE:**

*this cycle releases four carbon dioxide molecules and produces two ATP molecules. NOTE: no O<sub>2</sub> is required*

**3. ELECTRON TRANSPORT CHAIN (ETC):**

*The electron transport chain is responsible for producing: water (with the help of oxygen we breathe) and up to 34 ATP*



The KREBS CYCLE and the ETC occur in the mitochondria and yield 34 more ATP molecules. Your cells can only get these extra 34 ATP molecules if they have **oxygen!** This means if you are exercising and can deliver O<sub>2</sub> steadily to your cells, you get 38 ATP for every glucose burned. With CR (not just glycolysis), you can exercise longer and get more energy from glucose than if you didn't have O<sub>2</sub> (2 ATP molecules vs. 34 ATP molecules).

WHAT IF YOU DO NOT HAVE ENOUGH O<sub>2</sub>?

- You still do glycolysis in the cell cytoplasm and get 2 ATPs for each glucose burned
- Next, you do FERMENTATION (anaerobic = no O<sub>2</sub>)
- You make LACTIC ACID, which may make muscles cramp, burn, and work less efficiently.
- You create an “oxygen debt”. You will break down lactic acid with O<sub>2</sub> eventually, and get energy.
- You will hurt later (lactic acid build up) - If you move, you'll get blood flow to the area, delivering O<sub>2</sub> to pay your “oxygen debt” - movement helps ease soreness

