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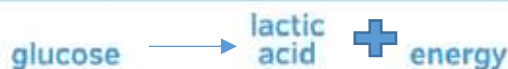
Respiration

Respiration is the chemical reaction which occurs inside the mitochondria of all living cells to release energy for living functions and processes, e.g. movement, warmth and building larger molecules for growth and repair. The reaction is **exothermic**, meaning that energy is released to the surroundings.

Respiration can be either **aerobic** (using oxygen) or **anaerobic** (without using oxygen).



In anaerobic respiration, the glucose is not completely oxidised. This means that there is less energy released than in aerobic respiration.



In plants and yeast, anaerobic respiration makes some different products. The reaction is also called fermentation and is used in bread-making and beer-brewing.



Effect of Exercise

When a person exercises, their body (specifically their **muscles**) need much more energy. To release more energy, the amount of respiration reactions occurring has to increase.

The **heart** pumps faster and the **breathing** rate and breath volume all increase to supply more **oxygen** to the muscles via the bloodstream.

If the muscles are not receiving enough oxygen to keep up the demand needed by the respiration reactions, then **anaerobic** respiration begins to occur. This incomplete oxidation of the glucose produces **lactic acid**, which can build up in the muscles and results in an **oxygen debt**.

After long periods of exercise, the muscles can become fatigued and stop contracting. You might experience a pain commonly called a **stitch**.

Metabolism

Metabolism is the combination of all the reactions in a cell or in the body.

Energy released during respiration is used during metabolic processes to synthesise new molecules:

- Glucose is converted to starch, glycogen and cellulose.
- Glycerol and three fatty acids are joined to form a lipid molecule.
- Glucose and nitrate ions are joined to form amino acids.
- Amino acids are joined to form proteins.
- Excess proteins are broken down and released as urea during excretion.

Respiration itself is also a process which is included in metabolism.

	Aerobic	Anaerobic
Presence of oxygen	Present.	Absent or in short supply.
Oxidation of glucose	Complete	Incomplete. The products of respiration still contain energy.
Products of respiration	Carbon dioxide and water. The products do not contain stored chemical energy.	Mammalian muscle: lactic acid. Yeast: ethanol and carbon dioxide. Some plants: ethanol and carbon dioxide. The products still contain stored chemical energy.
Amount of energy released	Relatively large amount.	Small amount, but quickly.