

Respiration

- Respiration is the process by which energy is produced from food.
- Main food used for energy - glucose.
- Respiration is a chemical process that takes place in cells.
- AKA cellular respiration, internal respiration, tissue respiration.
- Cell division - create more cells, repair damaged cells, replace worn cells, produce reproductive cells.
- Growth - formation of new cells, permanent increase in cell size.
- Conduction of electrical impulses by nerve cells.

Aerobic Respiration:

- Chemical reactions in cells that use oxygen to break down nutrient molecules to release energy.
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38ATP$
(or)
 $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 2830kJ$
(for every mole of glucose)
- Process of oxygen combining with food is oxidation and food is said to be oxidised.
- C is oxidised to CO_2
- H is oxidised to H_2O
- At the same time energy is released as ATP.
- Energy is not released all at once.
- Oxidation takes place in a series of small steps which require their own enzymes and release a little energy.
- Glucose (6 carbon molecule) is converted to pyruvate (3 carbon molecule) by glycolysis.
- Pyruvate is converted to acetyl coenzyme A (2 carbon molecules)
- Some energy is in the form of heat and retained in the body.

Uses of energy:

- Contraction of muscle cells - movement, peristalsis, childbirth.
- Building up proteins.
- Maintaining constant body temperature - maintain rate of chemical reactions.
- Active transport - villi.

Mitochondria and ATP:

- ATP production takes place in the mitochondrial matrix within the inner membrane.
- Role of mitochondria - ATP production.
- ATP molecule - adenosine tri phosphate is converted to ADP and then AMP.
- Release of phosphate and electrons is used as energy.
- ATP is not a stored form of energy, it is an energy currency which is used immediately after it is produced.
- Made and utilised in some metabolic reaction.

Heat release in plants and poikilotherms:

- In cold blooded animals, heat may be built about for a time, allowing the animal to move quickly.
- In plants, all heat is immediately lost to surroundings.

Anaerobic respiration:

- Chemical reactions in cells that break down nutrient molecules to release energy without using oxygen.
- In absence or lack of oxygen.
- Yeast respire anaerobically and converts sugar to carbon dioxide.
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 118kJ$ (for every mole of glucose)
or
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 2ATP$

Respiration

Fermentation:

- Alcohol fermentation:
$$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + 2\text{ATP}$$

or

$$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + 118 \text{ kJ}$$
- Less energy is produced because sugar is not completely broken down.
- Lactic acid fermentation: glucose \rightarrow lactic acid + 2ATP (bacteria in milk, humans)

Muscular activity:

- Muscles have the highest number of mitochondria, highest ATP production and consumption.
- During exercise, muscles respire rapidly and oxygen cannot be delivered fast enough.
- Muscles start respiring anaerobically, less energy is produced
- Pyruvate is converted to lactic acid instead resulting in the formation of an 'oxygen debt'
- Lactic acid diffuses into the bloodstream.
- Build up of lactic acid causes muscle fatigue and cramps and can restrict functioning of important muscles.
- Heart beats faster to remove lactic acid to the liver.
- In the liver, lactic acid is combined with oxygen forming CO_2 and H_2O . This is called repaying the oxygen debt.
- Oxygen is obtained through deep breathing even after exercise has stopped.