

Respiration and Gas exchange

Aerobic and anaerobic respiration

AEROBIC RESPIRATION

Mammals and birds need energy to maintain a constant body temperature. Energy is also needed for the following life processes:

- growth
- cell division
- muscle contraction
- **protein synthesis**
- **active transport**
- nerve impulses

Respiration involves chemical reactions that break down nutrient molecules in living cells to release energy.

Aerobic respiration needs oxygen. It is the release of a relatively large amount of energy in cells by the breakdown of food substances in the presence of oxygen:



Aerobic respiration happens all the time in animals and plants. Note that respiration is different to breathing (ventilation). Most of the reactions in aerobic respiration happen inside **mitochondria** in cells.

ANAEROBIC RESPIRATION

Anaerobic respiration happens in muscles during hard exercise:



Glucose is not completely broken down, so much less energy is released than during aerobic respiration.

There is a build-up of **lactic acid** in the muscles during vigorous exercise. The lactic acid needs to be **oxidised** to carbon dioxide and water later.

This causes an **oxygen debt** - known as excess post-exercise oxygen consumption (EPOC) - that needs to be 'repaid' after the exercise stops. This is why we keep on breathing deeply for a few minutes after we have finished exercising.

Anaerobic respiration also happens in plant cells and some microorganisms. Anaerobic respiration in yeast is used during brewing and bread-making:



Ethanol is the alcohol found in alcoholic drinks like beer and wine. In bread-making, bubbles of carbon dioxide gas expand the dough and help the bread rise.

AEROBIC VS ANAEROBIC

	AEROBIC	ANAEROBIC
Oxygen	Needed	Not Needed
Glucose break down	Complete	Incomplete
End product(s)	Carbon dioxide and water	Animal cells: lactic acid. Plant cells and yeast: carbon dioxide and ethanol
Energy Released	Relatively large amount	Relatively small amount