

TOPIC 2.8: CELL RESPIRATION

Cell Respiration

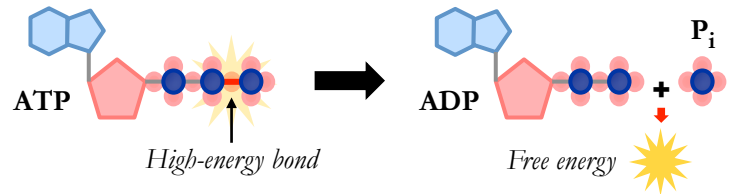
Cell respiration is the controlled release of energy from organic compounds to produce ATP

The main organic compounds used are carbohydrates (i.e. glucose), but lipids or proteins may also be used

- Different organic compounds will have distinct breakdown pathways and so have varied ATP yields

ATP

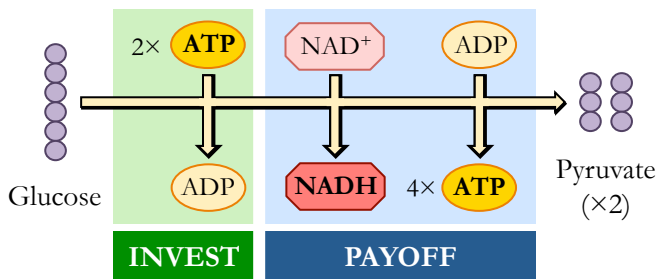
ATP (adenosine triphosphate) is a molecule that functions as an immediate source of energy when hydrolysed (to form ADP)



Glycolysis

Cell respiration begins with the break down of glucose via a process called glycolysis (occurs in the cytosol)

- Glucose is broken down into pyruvate ($\times 2$)
- There is a small ATP yield (net gain = 2 ATP)
- Requires the reduction of NAD^+ (to form NADH)



Anaerobic versus Aerobic Respiration

Pyruvate (from glycolysis) will follow one of two pathways:

Anaerobic Respiration

- Occurs in the cytosol and does not require oxygen
- Results in a small energy yield (2 ATP from glycolysis)
- Forms lactic acid (*animals*) or ethanol and CO_2 (*plants / yeast*)
- Also known as fermentation and is reversible

Aerobic Respiration

- Occurs in the mitochondria and requires oxygen
- Results in a large energy yield (~ 36 ATP per glucose)
- Forms carbon dioxide and water
- Uses hydrogen carriers to make ATP (*oxidative phosphorylation*)

Fermentation

Fermentation is a reversible anaerobic process that allows ATP production to continue in the absence of oxygen

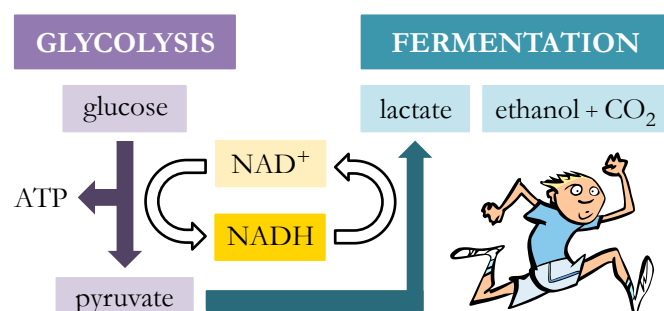
Fermentation restores NAD^+ stocks (needed in glycolysis) to ensure a continued production of ATP (by glycolysis)

Fermentation in animals produces lactic acid, and is used to maximise muscle contractions when oxygen is limited

- This reaction can be reversed when oxygen is restored

Fermentation in plants and yeast produce ethanol and CO_2 gas which can be used in baking (leavening dough)

- Also for the production of alcohol, yogurts and cheese



Respirometry

A respirometer determines an organism's respiration rate by measuring either carbon dioxide production or oxygen uptake

- Commonly used for invertebrates or germinating seeds

A simple respirometer may involve the use of a manometer:

- An organism is sealed in a container with a CO_2 absorbant
- Oxygen uptake creates a pressure change which displaces the fluid in the manometer (allowing for quantitation)

