Recap

We learnt about the process of semi conservative DNA replication and how it ensures genetic continuity. You now the roles of DNA helicase, ligase and polymerase in this process, as well as the confirmation of this process through Meselson and Stahl's experiment.

1.6 ATP

Structure of ATP

- **All living organisms need energy in order to survive**. Plants and animals obtain energy from the food they eat, particularly glucose, through a process called **respiration**.

- **The energy from glucose is stored as ATP**. During respiration, the chemical energy stored in foods like glucose are converted to a molecule called adenosine triphosphate (ATP), which stores the energy in a readily available form.

- **ATP is made in the mitochondria**. ATP is primarily generated in the mitochondria of plants and animals. This which is where cellular respiration occurs.

- **ATP is a nucleotide derivative**. ATP is made up of the nitrogenous base adenine (the same adenine found in DNA and RNA). ATP also has a ribose sugar, like RNA. What makes ATP unique is that it has 3 phosphate groups.

Key Aims

1. *ATP Structure.*
2. *The use of ATP as an energy source.*
3. *ATP Synthesis.*

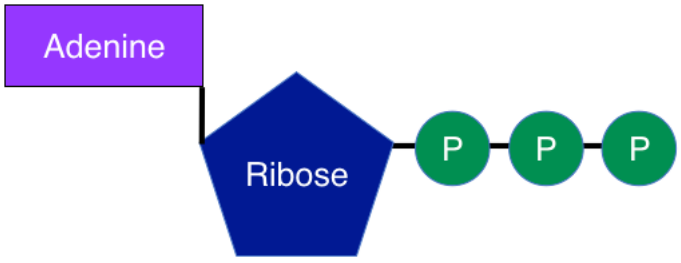

Fig 1. Structure of ATP.

AQA Specification

A single molecule of adenosine triphosphate (ATP) is a nucleotide derivative and forms from a molecule of ribose, a molecule of adenine and three phosphate groups.

Using ATP for Energy

- **Energy is stored in the bonds joining phosphate groups**. The energy in ATP molecules is stored within the **phosphoanhydride bonds** (high energy between the three phosphate groups. In order to release this energy, the bond must be broken.

AQA Specification

Hydrolysis of ATP to adenosine diphosphate (ADP) and an inorganic phosphate group (Pi) is catalysed by the enzyme ATP hydrolase.

- **The phosphate bonds are broken by hydrolysis**. Hydrolysis of ATP forms ADP (adenosine diphosphate) and an inorganic phosphate group (Pi). This hydrolysis is catalysed by the enzyme **ATP hydrolase**. ATP hydrolase can further catalyse ADP into adenosine monophosphate (AMP) and a second inorganic phosphate group.

- **ATP hydrolysis can be coupled with biological processes**. When energy-requiring biological processes occurred, there can be simultaneous ATP hydrolysis to provide the energy required.

- **The released inorganic phosphate can be used in phosphorylation**. The phosphate group can be added to another molecule to make it more reactive. This mechanism is carried out a by a group of enzymes known as **kinases**.

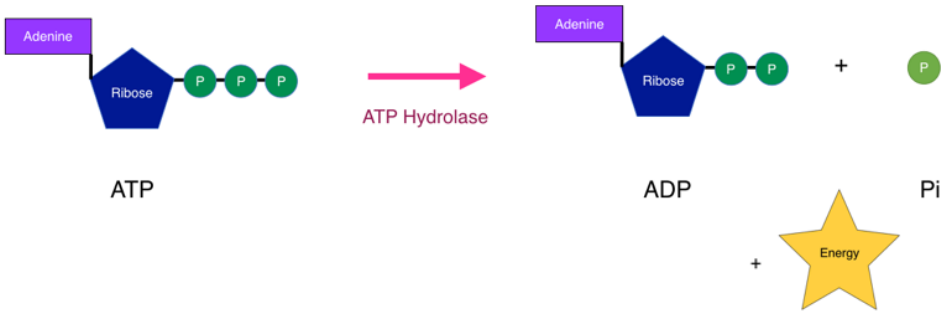

Fig 2. Hydrolysis of ATP.

AQA Specification

ATP is re-synthesised by the condensation of ADP and Pi. This reaction is catalysed by the enzyme ATP synthase during photosynthesis, or during respiration.

ATP Synthesis

- **ATP is synthesised during respiration and photosynthesis**. The majority of ATP in an organism is synthesised during respiration in the mitochondria, and during a process called glycolysis in the cytoplasm. In plants, ATP is also synthesised during photosynthesis in the chloroplasts of plant cells.

- **ATP synthesis involves a condensation reaction**. ATP synthesis is a condensation reaction in which ADP and Pi are covalently linked to form ATP. The enzyme **ATP synthase** catalyses the reaction.