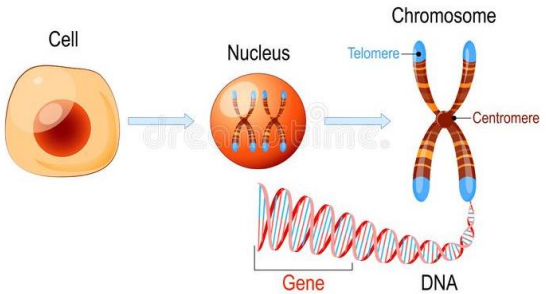
B1.2 What happens inside cells?

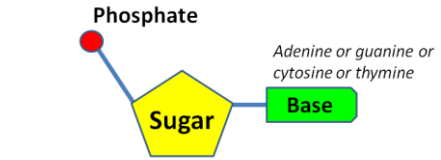
Key words

Chromosome- a molecule of DNA
Gene- a short section of DNA which codes for a characteristic.
Nucleotides- Units which make up DNA.
Complimentary base pairing- the bases A and T always bond together and the bases C and G always bond together.
mRNA- a single stranded copy of the bases on gene used to carry the code out of the nucleus.
Transcription- the process of producing mRNA from the DNA code.
Translation- The process of creating a protein from mRNA.
Enzyme-a biological catalyst.
Active site- where the substrate binds to the enzyme.
Substrate-The molecule which binds to the active site on the enzyme.
Lock and Key hypothesis- The way that scientists think that enzymes and substrates work to make enzymes specific.
Denatured- When the shape of the active site of an enzyme is changed by heat or pH.

B1.2.1 What happens inside cells, the structure of DNA.

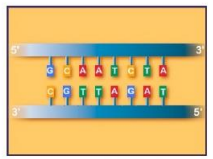
DNA is made up from units called nucleotides. These are; a phosphate, a sugar and a base. There are four different bases A-adenine, T -thymine, C-cytosine,
G-guanine. The nucleotides join together to make a polymer strand of DNA. The bases bond together A and T, C and G to form a double stranded polymer of DNA. Called a double helix.



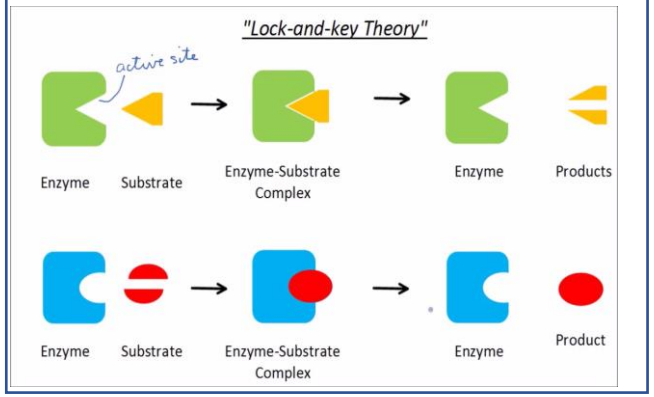


- Base pairing rules
  - Adenine pairs with Thymine (A – T)
  - Cytosine pairs with Guanine (C – G)

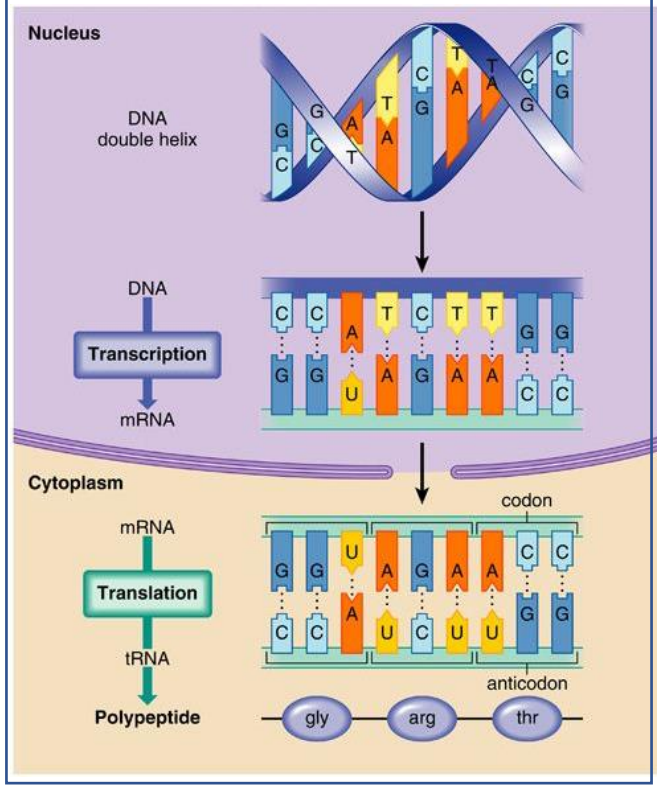

DNA helix


unwind DNA

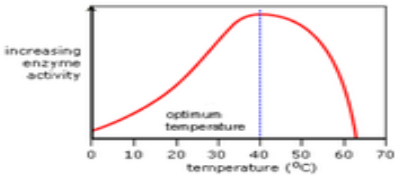
B1.2.3 Enzymes proteins which speed up reactions. Enzymes are specific.

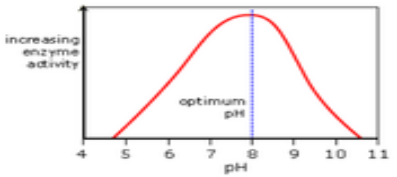


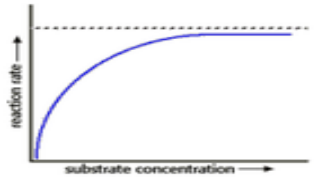
B1.2.2 transcription and translation



B1.2.4 Enzyme reactions







Factors affecting enzyme reactions:

Temperature- as the temperature increases the enzyme and substrate move faster as they have more kinetic energy and therefore they collide more often. When the temperature becomes too high the amino acid chains in the protein start to unravel and the active site changes. The substrate no longer fits the active site. The enzyme is denatured.

pH- each enzyme works at an optimum pH. A change in Ph may make the enzyme unfold and the enzyme is denatured.

Enzyme concentration- the higher the enzyme concentration the faster the reaction until all the substrate is used up.

Substrate concentration-The higher the substrate concentration the faster the reaction until all the enzyme molecules are bound to substrate molecules.

B1.3 Respiration

Key words

Metabolic rate-the rate at which the body uses up energy

Aerobic respiration-the process of transferring energy from glucose and oxygen.

Exothermic reaction-a chemical reaction in which oxygen is transferred from the reacting mixture to the surroundings.

Anaerobic respiration-the process of transferring energy from glucose in the absence of oxygen.

Fermentation-Anaerobic respiration process that produces ethanol and carbon dioxide.

Oxygen debt-The quantity of oxygen required to break down the lactic acid produced during anaerobic respiration.

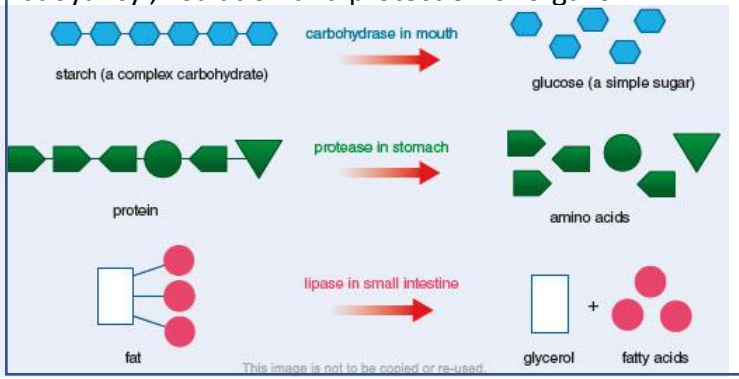
ATP- Adenosine triphosphate. A chemical energy store

B.1.3.1 Carbohydrates, proteins and lipids.

Carbohydrates-some are polymers made from sugars like glucose, sucrose, lactose. Starch is a carbohydrate polymer used as an energy store in plants.

Proteins-polymers made from amino acids. There are 20 amino acids. The order of amino acids determines the type of protein. Proteins used for growth and repair.

Lipids-Not polymers. They include fats and oils. Made from three fatty acid molecules and a glycerol Used for buoyancy ,insulation and protection of organs.



B1.3.2 Aerobic respiration

The body continually transfers energy from the food you eat to allow you to move, to grow and to keep warm. In order to transfer energy glucose reacts with oxygen in a series of chemical reactions., this process is called aerobic respiration. All living cells respire.

Glucose + Oxygen ⟶ Carbon Dioxide + Water + Energy

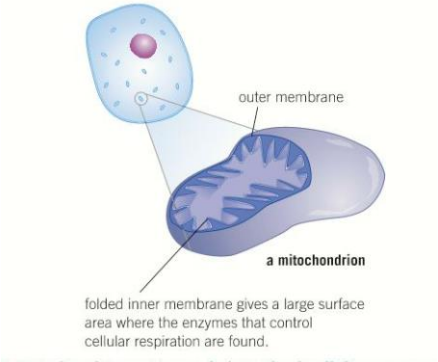
$C_6H_6O_6 + O_2 \longrightarrow 6CO_2 + 6H_2O +$ Energy

The reaction transfers chemical energy in glucose to another energy store called **ATP** (adenosine triphosphate). During this process heat is transferred to the surroundings. Respiration is an **exothermic** reaction.

The ATP produced is used:

- **To synthesise larger molecules** from smaller ones to make new cell material. For example; plants make amino acids from nitrates and then build these up into proteins.
- **For movement**-animals use ATP to make muscle cells contract allowing movement.
- **To stay warm.-**When the surroundings are colder than the animal, cells increase the rate of respiration.

Where does respiration occur?



Aerobic Respiration occurs all the time in plant and animal cells. It takes place in the mitochondria of a cell as a series of chemical reactions, each of which is controlled by a specific enzyme. Active cells contain more mitochondria than less active cells. Muscle cells and liver cells contain many mitochondria.

1.3.3 Anaerobic respiration

During exercise your heart and breathing rate increase to deliver enough glucose and oxygen to your cells for respiration. In strenuous exercise your heart rate cannot increase enough to meet the demand for oxygen and glucose. Your body transfers energy from its chemical store without the need for oxygen. This is called anaerobic respiration and it can only occur for short periods of time. Glucose is not completely broken down and toxic lactic acid is formed.

glucose → lactic acid (+ energy)

Why do we normally respire aerobically?

- Aerobic respiration produces more ATP per glucose molecule than anaerobic respiration. The yield is greater because the glucose is fully broken down.
- The lactic acid produced in anaerobic respiration can cause cramps when it builds up in muscle cells. It causes pain and the muscles stop contracting. Known as fatigue.

Oxygen debt-When anaerobic respiration ends you keep on breathing deeply. The extra oxygen inhaled reacts with the lactic acid to break it down. This is called the oxygen debt.

Fermentation-anaerobic respiration can take place in plants and some microbes.

Glucose → ethanol + carbon dioxide + energy

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

The ethanol produced when yeast ferments can be used to make beer and wine. The CO_2 is used to make bread.