

Data & Disease

- There needs to be a clear causal connection before a correlation can be proven.
- **When looking at data critically, consider the following questions:**
 - Has the right factor been measured and have the correct questions been asked?
 - How was the data gathered, were the methods reliable and was the right apparatus used?
 - Do those collecting the data have a vested interest in the outcome of the research?
 - Has the study been repeated, with the same results and conclusions, by other people?
 - Are there still unanswered questions?
- **Misleading Statistics:** The media may only focus on a single figure. The impression given is that the figure applies to everyone, this is often far from the case.
- **Factors that can increase the risk of cancer:**
 - Genetics, smoking, diet, obesity, lack of exercise and sunlight.

Digestion

- **Digestive system:** an interface with the environment
- **Digestion:** the process in which large molecules are hydrolysed by enzymes to produce smaller molecules that can be absorbed and assimilated.
- **Oesophagus:** a thick muscular wall that transports food from the mouth to the stomach.
- **Stomach:** a muscular sac that stores and digests food, especially proteins. The inner layer produces enzymes. To prevent the stomach from digesting itself, other glands in the wall produce mucus.
- **Small Intestine:** a long muscular tube that further digests food by enzymes produced there. The inner walls are folded into villi for an increased surface area.
- **Large Intestine:** absorbs water so food becomes drier and thicker in consistency to form faeces.
- **Rectum:** the final section where faeces are stored before removal by the anus during the process of egestion.
- **Salivary glands:** they are near the mouth and pass secretions via the duct in the mouth. These secretions contain the enzyme amylase.
- **Pancreas:** a large gland below the stomach. The secretion (pancreatic juice) contains proteases to digest proteins, lipase to digest lipids and amylase to digest starch.
- **Physical breakdown:** food is broken down by structures such as the teeth to increase the surface area for chemical breakdown. Food is also churned by the stomach muscles.
- **Chemical breakdown:** breaks down large, insoluble molecules into smaller ones through means of hydrolysis carried out by enzymes.
- Molecules incorporated into the body tissues may be used in other processes: **assimilation**.

Carbohydrates

- Polysaccharides are large molecules that are insoluble.
- They are suitable for storage and some (e.g. Cellulose) are used to give structural support to plant cells.
- **Starch** is a polysaccharide found in many parts of plants in the form of small granules or grains.
- It is formed by the linking of between 200-100,000 glucose molecules.
- **Test for Starch (Iodine test):**
 1. Place 2cm³ of the sample to a test tube.
 2. Add two drops of iodine solution and shake/stir.
- **A positive result is shown by a blue/black colouration.**

Protein Structures

- **Primary structure:** the sequence of amino acids in polypeptide bonds.
- The shape determines the function.
- **Secondary structure:** hydrogen bonds form between the positive H of the $-NH$ group and the negative O of the $-C=O$ group.
- The polypeptide chain therefore twists into either a α -helix or β -pleated sheet.
- **Tertiary structure:** the structure twists and folds to more to give a complex and often unique 3-D structure which is maintained by different bonds.
- **Disulfide bonds:** fairly strong and not easily broken.
- **Ionic bonds:** formed between any carboxyl and amino group not involved in forming peptide bonds. Broken by pH changes.
- **Hydrogen bonds:** numerous but easily broken.
- **Quaternary structure:** large proteins contain a number of polypeptide chains and non-protein (prosthetic) groups.

Factors Affecting Enzyme Action

- **Effect of pH:**

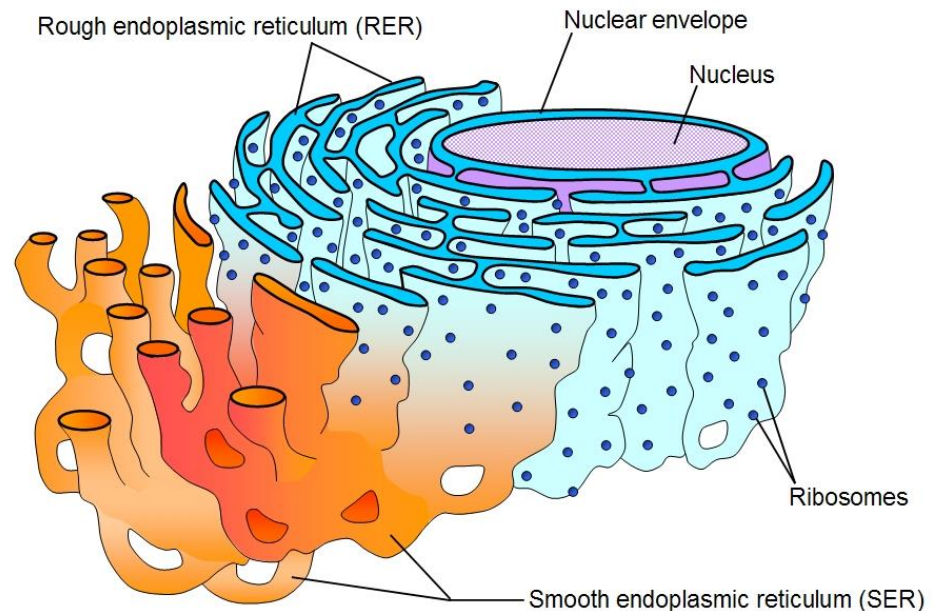
- Each enzyme has an optimum pH (measure of H^+ concentration).
- A change in pH reduces effectiveness and can cause denaturing of the enzyme.
- Even small changes can change active site arrangement (determined by hydrogen and ionic bonds).
- pH changes can alter the charges on amino acids and break the bonds in the tertiary structure.

- **Effect of substrate concentration:**

- Low substrate concentration: too few molecules to occupy all active sites.
- Intermediate substrate concentration: all active sites may be occupied at one time. Rate of reaction is at its maximum.
- High substrate concentration: addition of further molecules has no effect as all active sites are occupied. No increase in rate of reaction.

Structure of an Epithelial Cell

- **Endoplasmic Reticulum:**
- A system of sheet-like membranes that enclose flattened sacs called cisternae.
- **Rough ER:** has ribosomes on outer surface. Provides large surface area for synthesis of proteins and glycoproteins and is the pathway for transport of materials.
- **Smooth ER:** more tubular in appearance: synthesises, stores and transports lipids and carbohydrates.



Lipids

- **Lipids are insoluble in water but soluble in organic solvents.**
- **Roles:** cell membrane, energy source, waterproofing, insulation and protection.
- At R.T.P fats are solids and oils are liquids.
- **Triglyceride:** three fatty acids and one glycerol.
- The glycerol molecule is always the same, different properties come from variations in the fatty acids (over 70 fatty acids).
- **No C=C bonds: saturated.**
- **Single C=C bonds: monounsaturated.**
- **More than one C=C bonds: saturated.**
- **Phospholipids:** two fatty acids, one glycerol and one phosphate.
- **Hydrophilic 'head'** from the phosphate (attracts water, repels fat).
- **Hydrophobic 'tail'** from the fatty acids (repels water, mixes with fat).
- Polar molecule as the two ends behave differently.

Test for Lipids

- **Emulsion Test:**

1. Take completely dry and grease-free tube.
2. To 2cm³ of sample, add 5cm³ of ethanol.
3. Shake tube to dissolve lipid.
4. Add 5cm³ of water and shake gently.
5. **A cloudy-white colour indicates presence of a lipid.**
6. As a control, repeat using water, final solution should be clear.

- The cloudy colour is due to the lipid being finely dispersed in water to form an emulsion. Light passing through is refracted as it passes from oil droplets to water droplets.

The Cardiac Cycle

- Cardiac muscle is **myogenic** – initiated by its own muscle.
- **Pacemaker cells:** create the electrical impulse that causes the heart to beat – from the cells in the sinoatrial node (SAN) in the wall of the right atrium.
- Wave of electrical activity spreads from SAN across both atria – causes contraction.
- A layer of non-conductive tissue in the atrioventricular septum prevents wave crossing straight to the ventricles.
- Wave passes through a second cell group called the atrioventricular node (AVN) that lie between the atria.
- AVN, after a short delay, conveys a wave between ventricles along a series of specialised muscle fibres called the bundle of His.
- The bundle branches into smaller fibres – wave of electrical activity is released from the fibres and the ventricle contracts from apex upwards.
- **Closed circulatory system:** blood confined to the vessels – pressure maintained and regulated.

Cardiac Output

- **Cardiac output:** the volume of blood pumped by one ventricle of the heart in one minute.
- Measured in dm^3/min .
- **Stroke volume:** volume of blood pumped out at each beat.
- **Cardiac output = heart rate X stroke volume**