

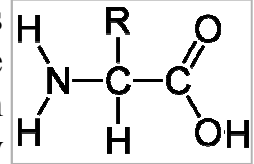
# Biology Top-Up

## Biochemistry

There are three groups of biological molecules: proteins, carbohydrates and lipids. Each of these molecules has different properties, making them suitable for different purposes within the body.

### Proteins

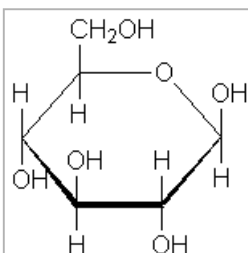
These are long chains made up of amino acids. All amino acids have a similar structure, with only the R group changing (it can be one of 20 chemical groups). The amino acids with a protein molecule are held together by covalent bonds, which are very strong. It is the order of amino acids in a protein which determine its function.



Protein structure can be organised into four levels:

- The primary structure is the order in which the amino acids are arranged and joined by peptide bonds
- The secondary structure is either a coil ( $\alpha$ -helix) or a flat sheet ( $\beta$ -pleated sheet)
- The tertiary structure is the way that bonds (hydrogen bonds or disulfide bridges) form along the chain to give the molecule a specific shape

Occasionally a protein will have a quaternary structure. This is when multiple proteins interact (e.g haemoglobin)



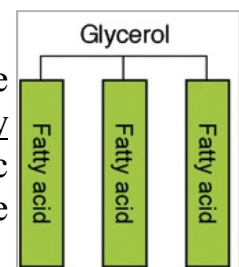
### Carbohydrates

There are three elements present in carbohydrates: carbon, hydrogen and oxygen. Sugars are simple carbohydrates, and are grouped into monosaccharides (single carbon rings) and disaccharides (2 monosaccharides that join by a condensation reaction - a water molecule is produced). Glucose and fructose are monosaccharides, maltose (2 glucose molecules) and sucrose (glucose + fructose) are disaccharides.

Starch and cellulose are polysaccharides that are found in plant cells. Both are insoluble molecules made up of  $\alpha$ -glucose, but starch is a storage molecule and cellulose is structural. Starch molecules are branched, consisting of two polysaccharides: amylose and amylopectin. Cellulose forms microfibrils, which are long polysaccharide chains that are held together by hydrogen bonds.

### Lipids

These are fats and oils. Most lipids found in plants and animals are triglycerides, made up of one molecule of glycerol with three fatty acid chains. Fatty acids are long chain molecules with a carboxylic acid (-COOH) group at one end. If the chain has one or more double bonds between carbon atoms, it is unsaturated.



Phospholipids are a particular type of lipid present in cell membranes. In these molecules, one of the fatty acid chains is replaced with a phosphate group.