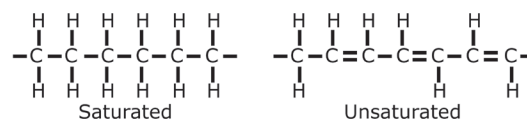


Figure 3.21.2**Saturated and Unsaturated Fatty Acids**

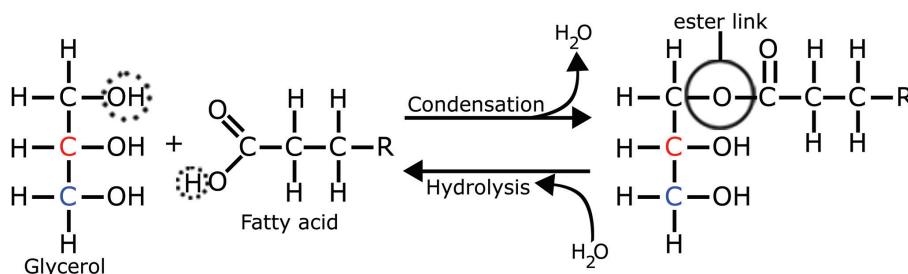
Fatty acids are classified as either saturated or unsaturated, depending on whether or not there are double bonds between the carbon atoms of the carbon backbone. If there are no double bonds between carbon atoms, that allows more hydrogen atoms to bond to the carbon. This means that the carbon backbone is saturated with hydrogen atoms and is called a saturated fatty acid. If there are double bonds between the carbon atoms, this allows for fewer hydrogen atoms to bond to carbon, meaning the fat is not as saturated with hydrogen. These fatty acids are called unsaturated fatty acids.

**3.22 GLYCEROL BACKBONE AND ESTER BONDS**

The backbone of the lipid molecule is called **glycerol**. Glycerol is a three-carbon molecule with one hydroxide group (OH^-) on each carbon. An individual fat molecule is formed by linking between one and three fatty acid molecules to one glycerol molecule. This occurs via a dehydration synthesis reaction which removes one H^+ ion from one of the carbon atoms on the glycerol molecule, and then removes one OH^- ion from the carboxylic acid group of the fatty acid molecule to form the lipid and a water molecule. This type of bond is called an **ester bond**. Note that the ester bond is similar to the glycosidic bond. It is essentially an oxygen bridge between a carbon of the glycerol and a carbon on the fatty acid chain. Depending on the molecule the organism needs, a fatty acid can be linked to one, two, or all three carbon atoms of the glycerol.

Figure 3.22.1**Synthesis of a Fat Molecule**

The making of a fat molecule begins with a glycerol molecule and a fatty acid molecule. Look at Figure 3.21.1 if needed to see the structure of a fatty acid. The "R" corresponds to the rest of the fatty molecule, as in Figure 3.21.2. The R group may be saturated or unsaturated. **The condensation synthesis reaction removes the OH group from the carboxyl end of the fatty acid and a H from the glycerol to bond the two together.** The oxygen from the fatty acid links the carbon from the glycerol to the carbon of the fatty acid. The molecule shown on the right has had one fatty acid linked to the glycerol. This is called a monoglyceride. If another fatty acid is linked to the red carbon by an ester bond, there would be two fatty acids linked to the glycerol. This is called a diglyceride. If a third fatty acid is linked to the blue carbon, it is called a triglyceride.

**Figure 3.22.2****Triglyceride Structure**

This molecule is a triglyceride. Three fatty acids have been linked to the three carbon glycerol molecule through three ester bonds. If there were only one fatty acid attached to the glycerol, the molecule would be a mono-glyceride. If there were two fatty acids attached, the molecule would be a diglyceride. The fat molecule is named depending on the number of fatty acids attached to the glycerol backbone and how long the fatty acid chains are. The fatty acid chains correspond to the "R" on the molecule shown to the right.

