Lecture 6

Lipids

1. How to differentiate between saturated and unsaturated fatty acids. Discuss with suitable examples.

Answer: Saturated fatty acids are long-chain carboxylic acids that usually have between 12 and 24 carbon atoms and have no double bonds. Thus, saturated fatty acids are saturated with hydrogen (since double bonds reduce the number of hydrogens on each carbon). Because saturated fatty acids have only single bonds, each carbon atom within the chain has 2 hydrogen atoms (except for the omega carbon at the end that has 3 hydrogen's).

Unsaturated fatty acids resemble saturated fatty acids, except that the chain has one or more double-bonds. The two carbon atoms in the chain that are bound next to either side of the double bond can occur in a *cis* or *trans* configuration.

2. Distinguish between triacyl glycerols and glycerol phospho lipids?

Answer: Triacylglycerol, TAG or triacylglyceride is an ester composed of a glycerol bound to three fatty acids. The glycerol molecule has three hydroxyl (OH-) groups. Each fatty acid has a carboxyl group (COOH-). In triglycerides, the hydroxyl groups of the glycerol join the carboxyl groups of the fatty acid to form ester bonds. It is the main constituent of vegetable oil and animal fats.

Glycerophospholipids or phosphoglycerides are glycerol-based phospholipids. The term glycerophospholipid signifies any derivative of sn-glycero-3-phosphoric acid that contains at least one O-acyl, or O-alkyl, or O-alk-1'-enyl residue attached to the glycerol moiety and a polar head made of a nitrogenous base, a glycerol or an inositol unit.

It contains a glycerol core with fatty acids. They can be the same or different subunits of fatty acids.

- Carbon 1 (tail, apolar) contains a fatty acid, typically *saturated*
- Carbon 2 (tail, apolar) contains a fatty acid, typically *unsaturated* and in the cis conformation, thus appearing "bent"
- Carbon 3 (head, polar) contains a phosphate group or an alcohol attached to a phosphate group

They are the main component of biological membranes.

3. Distinguish between steroids and cholesterol.

Answer: A steroid is a type of organic compound that contains a specific arrangement of four rings that are joined to each other. The sterane core of steroids is composed of seventeen carbon atoms bonded together to form four fused rings: three cyclohexane rings (designated as rings A, B, and C in the figure to the right) and one cyclopentane ring (the D ring). The steroids vary by the functional groups attached to these rings and by the oxidation state of the rings. Sterols are special forms of steroids, with a hydroxyl group at position-3 and a skeleton derived from cholestane.

Cholesterol is a type of steroid that found in the cell membranes and transported in the blood plasma of all animals.

4. What is mesosome?

Answer: In some locations, the cell membrane forms internal folds in the cytoplasm called mesosomes.

Mesosomes presumably increase the internal surface area available for membrane activities. It has been proposed that mesosomes function in cell wall synthesis and to guide the duplicated bacterial chromosomes into the two daughter cells during cell division.

5. How to differentiate cis– and trans- form of fatty acid chain?

Answer: The two carbon atoms in the chain that are bound next to either side of the double bond can occur in a *cis* or *trans* configuration.

A *cis* configuration means that adjacent hydrogen atoms are on the same side of the double bond. The rigidity of the double bond freezes its conformation and, in the case of the *cis* isomer, causes the chain to bend and restricts the conformational freedom of the fatty acid. The more double bonds the chain has in the *cis* configuration, the less flexibility it has.

A *trans* configuration, by contrast, means that the next two hydrogen atoms are bound to *opposite* sides of the double bond. As a result, they do not cause the chain to bend much, and their shape is similar to straight saturated fatty acids.