

# Highlights

1. Cysteine proteases use a mechanism similar to serine proteases. In these enzymes, histidine extracts a proton from the sulfhydryl group of cysteine to create a negatively charged sulfur that attacks the peptide bond, stimulating its breakage.
2. Coenzymes are non-amino acid molecules that help an enzyme to perform catalysis. Common ones include biotin (used in carboxylation reactions) and NAD (used in oxidation/reduction reactions). Many coenzymes are also vitamins.

# Highlights Lipids/Membranes

1. Lipids are cellular compounds that have at least some part of them that is very hydrophobic. The category includes fatty acids, triacylglycerols, sphingolipids, glycerophospholipids, steroids, and others.
2. Fatty acids are amphipathic compounds (part polar, part non-polar), consisting of a long non-polar carbon chain at one end and a polar carboxyl group at the other end.
3. Fatty acids can have all single bonds (saturated), one double bond (unsaturated) or more than one double bond (polyunsaturated). Double bonds of biological origin are almost all *cis* in nature. I didn't say this in class, but *trans* double bonds arise from hydrogenation of fats (typically in partially hydrogenated vegetable oil).
4. Fats (and oils) consist of glycerol esterified to three fatty acids. The resulting compound is very non-polar. Fats are the primary energy storage forms of animals. The difference between a fat and an oil is simply that a fat is solid at room temperature, whereas an oil is liquid at room temperature. Oils will tend to have shorter fatty acids and/or less saturated fatty acids, since these features favor lowering of the melting point.
5. Enzymes that release fatty acids from fats are called lipases.
6. Fats/oils can have any combination of common saturated and unsaturated fatty acids in them.
7. Essential fatty acids are those that an organism cannot synthesize and must be in the diet.
8. Phosphoacylglycerols (glycerophospholipids) are important components of cellular membranes (part of the lipid bilayer). They differ from fats in having a phosphate replace one of the fatty acids on the end carbon of glycerol. Addition of only a phosphate creates phosphatidic acid. In fact, phosphatidic acid is a branch point in the synthesis of fats and glycerophospholipids.
9. When a compound is esterified to the phosphate it creates a phosphatidyl compound. Example compounds attached to the phosphate on phosphatidic acid are ethanolamine (creating phosphatidylethanolamine), choline (creating phosphatidylcholine), serine (creating phosphatidylserine), and others.
10. Sphingolipids are derived from sphingosine. Cerebrosides and gangliosides are sphingolipids that are common in the membranes of brain tissue. Sphingomyelin is a sphingolipid common in the membranes of nerve tissue. Cerebrosides are sphingolipids that have only a simple sugar (usually glucose) attached to them. Gangliosides are sphingolipids that have more complex sugars attached to them.