All fatty acids have carboxyl groups with long hydrocarbon tails. Hundreds of different kinds of fatty acids exist. Some have one or more double bonds in their hydrocarbon tail and are said to be unsaturated. Fatty acids with no double bonds are saturated.

This double bond is rigid and creates a kink in the chain. The rest of the chain is free to rotate about the other C–C bonds.

Fatty acids are stored as an energy reserve (fats and oils) through an ester linkage to glycerol to form triacylglycerols.

If free, the carboxyl group of a fatty acid will be ionized. But more often it is linked to other groups to form either esters or amides.

Phospholipids are the major constituents of cell membranes. In phospholipids two of the –OH groups in glycerol are linked to fatty acids, while the third –OH group is linked to phosphoric acid. The phosphate is further linked to one of a variety of small polar groups (alcohols).
LIPID AGGREGATES

Fatty acids have a hydrophilic head and a hydrophobic tail. In water they can form a surface film or form small micelles.

Their derivatives can form larger aggregates held together by hydrophobic forces:

- **Triglycerides** form large spherical fat droplets in the cell cytoplasm.
- **Phospholipids and glycolipids** form self-sealing lipid bilayers that are the basis for all cellular membranes.

POLYSOPRENOIDS

Long-chain polymers of isoprene

OTHER LIPIDS

Lipids are defined as the water-insoluble molecules in cells that are soluble in organic solvents. Two other common types of lipids are steroids and polyisoprenoids. Both are made from isoprene units.

STEROIDS

Steroids have a common multiple-ring structure.

- **Cholesterol**—found in many membranes
- **Testosterone**—male steroid hormone

GLYCOLIPIDS

Like phospholipids, these compounds are composed of a hydrophobic region, containing two long hydrocarbon tails, and a polar region, which, however, contains one or more sugar residues and no phosphate.

- **Galactose**
- **Sugar residue**
- **A simple glycolipid**

- **Dolichol phosphate**—used to carry activated sugars in the membrane-associated synthesis of glycoproteins and some polysaccharides