Lipids - nonpolar hydrophobic - don't dissolve in H2O

Isoprene

\[ \text{H}_2\text{C} = \text{C} - \text{CH}_3 \]

\[ \text{H} - \text{C} = \text{C} - \text{H}_2 \]

Fatty Acid

\[ \text{H}_2\text{C} - \text{C} = \text{O} \text{ carboxyl group} \]

Hydrocarbon tail

Hydrocarbons - contain hydrogen + carbon. Non polar

\[ \text{H}_2\text{C} - \text{H} - \text{C} - \text{H}_2 \]

\[ \text{O} - \text{C} - \text{C} = \text{O} - \text{C} = \text{O} \]

FAT

× Lipids do not dissolve in H2O b/c they have hydrocarbons

× Unlike amino acids, nucleotides + monosaccharides, lipids are characterized by a physical property - their solubility. Instead of a shared chemical structure. The structure of lipids varies widely.

Most important Lipids: Fats, Steroids + Phospholipids
Fats: Glycerol + 3 fatty acids joined by ester linkage (previous page)

Steroids: 4 rings, hydrocarbon tail + R group
  Identity + properties of steroid determined by identity + properties of R-group(s)

Phospholipids: Glycerol - phosphate - hydrocarbons

- Polar/charged group
- Phosphate
- Glycerol
- Fatty acid

Bac + Euk have fatty acid tails
Archaea have isoprene tails.

- Membrane forming lipids have a polar hydrophilic region in addition to the non-polar, hydrophobic region found in all lipids.

- The charge + polar bonds in the head region interact with water when a phospho lipid is in solution. In contrast, long isoprene or fatty acid tails of a phospho lipid are non-polar, hydrophobic.
Amphipathic: "dual sympathy" both hydrophilic +ophobic.

6.2. Phospholipid bilayers.

Molecules - tiny droplets formed by phospholipids.

Phospholipid bilayers - two sheets align. Heads face water, tails face in.

Lipid bilayers are more stable than independent molecules in H₂O.

Liposomes are artificial membranes bound vesicles used by researchers to test permeability.

Permeability - tendency to allow a substance to pass through.

Selectivity.

* Lipid bilayers are selective.

* Selective permeability: Small, non-polar molecules move across bilayers quickly. In contrast, large + charged molecules do not (slowly or not at all).
Correlation between structure and function.

Hydrocarbon chains are said to be saturated. But if a chain contains one or more double bonds, it is said to be unsaturated, C=H have more free energy than C=C. If dieting, don't eat saturated fats!
Bond Saturation + Chain Length

- When hydrophobic tails are packed into a lipid bilayer, the kinks created by double bonds produce spaces among the tightly packed tails. These spaces reduce the strength of hydrophobic interactions between tails. These interactions are stronger among saturated hydrocarbon tails.
- Hydrophobic interactions also become stronger as saturated hydrocarbon tails increase in length.

Butter = Saturated lipid

Honey = Saturated lipid w/long hydrocarbon tail

Safflower oil = Unsaturated lipid

No unsaturated phospholipids in bilayer = Low permeability + Less fluid

Lots of unsaturated phospholipids in bilayer = High permeability + more fluid.

Cholesterol reduces membrane permeability.
Expt: Does adding cholesterol to membrane affect permeability?

Conclusion: Adding cholesterol decreases permeability.

Temperature

°C 25° - membranes are fluid

\[ \frac{1}{T} = \frac{1}{\text{fluidity}} = \frac{1}{\text{permeability}} \]

These experiments on lipid + ion movement demonstrate that membranes are dynamic.

How quickly molecules move within and across membranes is a function of T and structure of hydrocarbon tails in bilayer.