

Lipids – Summary

A. Triglycerides

Macromolecules, not polymers

Assembled via dehydration synthesis:

- Glycerol
 - Alcohol with 3 carbons, each bearing a hydroxyl group
- Fatty acid
 - Long carbon skeleton (16 – 18 atoms in length)
 - –COOH at one end
 - non-polar C-H bonds – hence fatty acids and fats are hydrophobic

1 Glycerol + 3 Fatty Acids = 1 Triacylglycerol

- Ester linkages

Saturated Fats	Unsaturated Fats
Saturated fatty acids	Unsaturated fatty acids
NO C=C in the hydrocarbon skeleton	One or more cis double bonds (a kink for each)
Solid at r.t.p. (E.g. lard and butter)	Liquid at r.t.p. (e.g. Oils)
Most animal fats	Most plant and fish fats
	Synthetic hydrogenation – converts unsaturated fats to saturated fats. (e.g. hydrogenated vegetable oils, peanut butter, margarine)
Causes atherosclerosis	Hydrogenation produces not only saturated fats but also unsaturated fats with trans double bond, which may contribute more to atherosclerosis than saturated fats

Function:

- Energy in 1g of fat = more than twice energy in 1g of polysaccharide
 - Long hydrocarbon skeletons broken down into two-carbon units
- Starch for immobile plants. Oils for seeds.

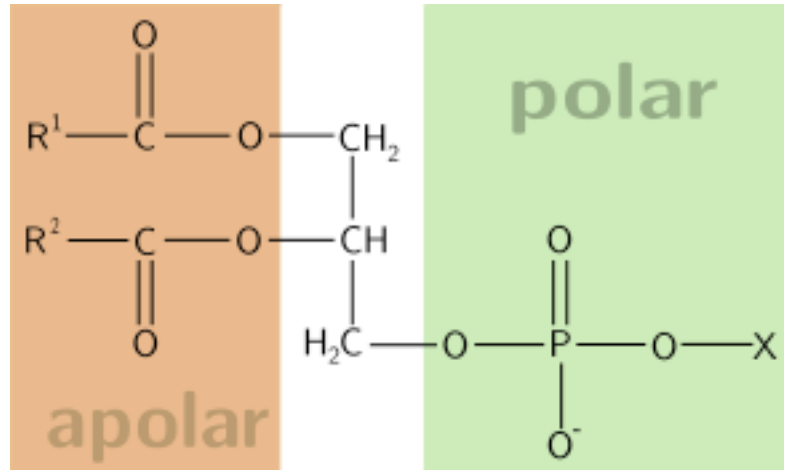
- Fat for mobile animals (stored in adipose cells)
- Cushioning – vital organs e.g. kidneys
- Insulation e.g. blubber
- Source of water – metabolic water e.g kangaroo rat, birds and crocodiles in eggs.

B. Phospholipids

Two fatty acids + Glycerol + Phosphate group (phosphate group has –ve charge)

Ambivalent in water:

- Hydrophilic phosphate head
- Hydrophobic non-polar tails
- Micelles
- Phospholipid bilayer



Function:

- Major component of all cell membranes
- Forms boundary between cell and external environment

C. Steroids

Little in common with other lipids

Insoluble in water, soluble in organic solvents

Carbon skeleton - four interconnected rings

Examples: cholesterol, vitamin D, bile acids, testosterone

Function (cholesterol):

- Maintains mechanical stability of plasma membrane
- Hydroxyl groups of cholesterol close to polar lipid heads
- High concentrations in the membrane
- Prevents hydrocarbons from crystallizing
- Inhibits phase transitions (i.e. freezing)
- Decreases permeability of membrane to small water-soluble molecules

D. Waxes

*not in syllabus

E. Ethanol emulsion test

Method:

(For solution)

1. Add 2cm^3 of ethanol to two drops of test sample in a test tube. Mix well.
2. Decant the ethanol into another test tube containing 2cm^3 of water.
3. Shake vigorously and observe

(For solid)

1. Add 2cm^3 of ethanol to grounded test sample in a test tube.
2. Mix well to dissolve any lipids if present
3. Decant the ethanol into another test tube containing 2cm^3 of water.

Observations	Conclusion
A homogeneous solution is first formed. Remained homogeneous when water was added	Lipids absent
A homogeneous solution is first formed. Emulsion formed when water was added	Lipids present