

Biology 12

Biological Molecules III

Lipids

Lipids are usually not soluble in _____. Familiar lipids include _____ (for example lard and butter) which are _____ at room temperature. Another group of familiar lipids are the _____ (for example corn oil and canola oil). These are _____ at room temperature. Fats have a number of functions in the body. List three of them below.

- 1.
- 2.
- 3.

A fat or oil forms when three _____ react with one _____ molecule. The synthesis reaction is shown below.

Glycerol has three _____ groups (-OH) which allow the glycerol to react with three _____ to form one triglyceride (fat) and three molecules of _____.

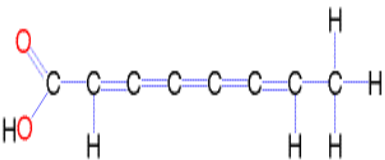
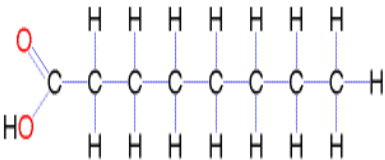
Why is a triglyceride also called a NEUTRAL FAT?

Fatty acids are a _____ chain with the acidic group - _____ on the end. Most fatty acids contain 16 or 18 carbon atoms, but smaller ones do exist.

What is the difference between saturated and unsaturated fatty acids? Choose from the diagrams below and explain the difference.



Molecule	Saturated or Unsaturated	Distinguishing characteristic and examples
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Emulsifiers

Soaps are formed from a _____ plus an _____. A molecule of soap has a polar end and a non polar end. Explain how soap emulsifies fats and oils.

Why would a person without a gallbladder have trouble digesting fatty foods?

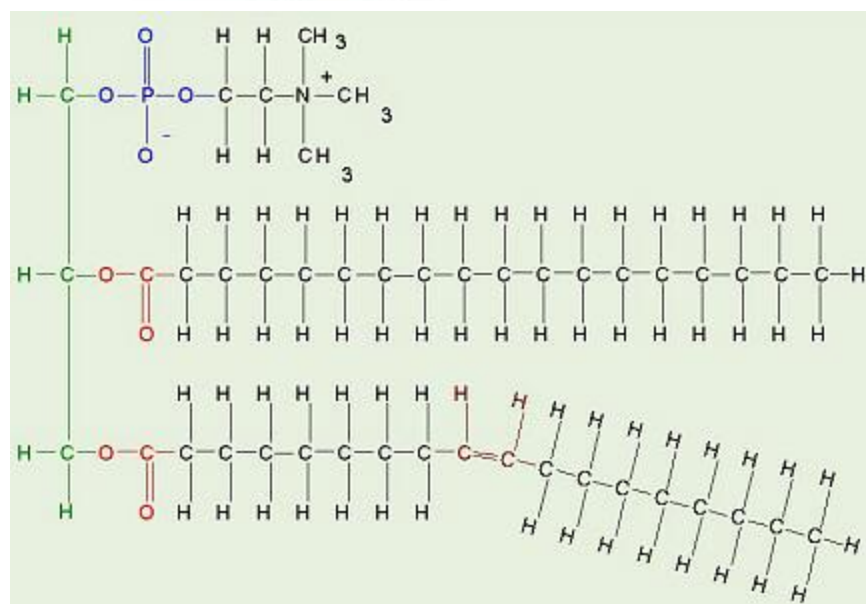
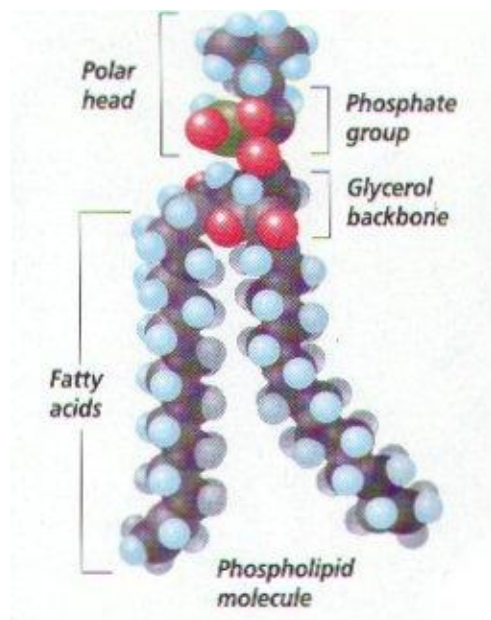
Phospholipids

What possible groups take the place of a third fatty acid in a phospholipids?

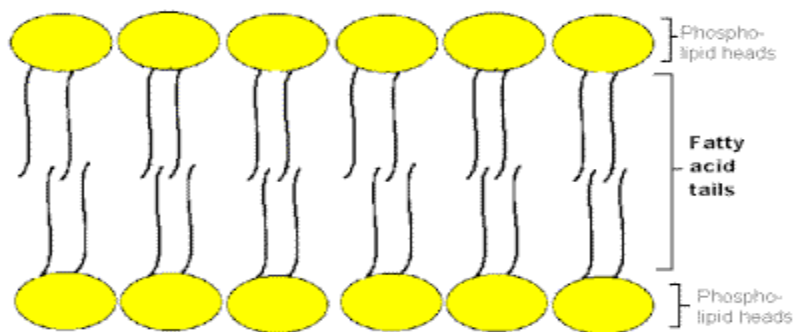
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The following diagrams show different representations of a phospholipids.

Explain why a phospholipids are not electrically neutral.



Phospholipids make up the cell membrane. The polarity of the phospholipids makes a bilayer possible. Label the polar and nonpolar regions of the bilayer.

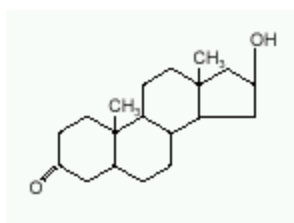


Steroids and Cholesterol

Steroid molecules all have a backbone of _____. They differ according to arrangement of atoms in the rings and the type of _____.

Cholesterol is the precursor to several steroids. Give their functions.

STEROID	FUNCTION
Aldosterone	
Estrogen/Testosterone	



Lipids are organic compounds that are _____ in water. In the body, they serve as _____-term energy storage molecules. Lipids include fats, _____, and _____.

The 3 most important classes of lipids are neutral fats, _____, and _____.

Oil, fat, butter are all composed of lipid molecules called _____ (or _____). Neutral fats are composed of two types of molecules: _____ and _____.

Most fatty acids contain about _____ carbon atoms in a long chain.

Saturated fatty acids have no _____ bonds between carbon atoms, and tend to be solid at room temperature. Unsaturated fatty acids are most often found in vegetable oils, and account for the fact that they are liquid at room temperature.

Butter contains a large proportion of _____ fatty acids. Excess intake of this type of fatty acid is known to cause _____ attacks and strokes.

Soap is a _____ formed when a _____ is reacted with an inorganic base such as _____. Soap allows oils to be mixed with water by _____ the oils.

A **phospholipid** is a lipid made of glycerol, 2 fatty acids, and a phosphate group. It is the primary component of membranes. The phosphate "head" is _____, the tail is _____.

_____ are small lipids containing rings that are all derived from cholesterol. An important function of these compounds are sex _____ like progesterone.

LIPIDS

1. Lipids are a wide variety of compounds, more frequently known by their **common names**, including **fats, oils, waxes**.
2. are all **insoluble** in water.
3. Functions of Lipids include the following:
 1. **Padding** of vital organs
 2. **Insulation** ("blubber")
 3. Long-Term **Energy storage** (fat is excellent for storing energy in the least amount of space, and packs 9.1 calories of energy per gram, versus 4.4 for carbohydrates and proteins).
 4. **Structural** (e.g. **cell membranes**, white matter of brain etc.)
 4. **chemical messengers** (e.g. steroid hormones, prostaglandins).

There are four main types:

- i. **FATTY ACIDS**: a long chain of carbons with hydrogens attached, ending in an acid group (-COOH). There are two main types:
 5. **saturated fatty acids** - **no double bonds** between carbons. All carbons are "saturated" with hydrogens. **Solid** at room temp. These are the "bad" dietary fats (e.g. butter, lard, meat fat), which are known to contribute to heart disease and strokes.
 6. **unsaturated fatty acids** - have one (monounsaturated) or more (polyunsaturated) **double**

bonds between carbons in chain. **Liquid** at room temperature. e.g. vegetable oils, Omega-3 unsaturated fatty acids. Are thought to be better for your heart than saturated fats.

- ii. **NEUTRAL FATS:** (also called **Triglycerides**)
- 7. formed by dehydration synthesis rx. between **glycerol** (a molecule of 3 hydrated carbons and **3 fatty acids**).
- 8. non-charged, non-polar molecules. Do not mix with water unless a soap is added.

Neutral fats are sometimes drawn like this:

- 9. **Soap** is made by combining a **base** and a **fatty acid**.
- 10. soaps are **polar**, will mix with water. Soap molecules surround oil droplets to their polar ends project outwards, causing the oil to **disperse** in water (this process called **EMULSIFICATION**).

- iii. **PHOSPHOLIPIDS:** important components of **cell membranes**

- 11. same basic structure as neutral fats **except** that 1 fatty acid is replaced by a phosphate group with a charged nitrogen attached.
- 12. phospholipids have a Phosphate-containing "**head**" and two long fatty acid **tails**. Head is **hydrophilic** ("water-loving"), tail is **hydrophobic** ("water-fearing")

- iv. **STERIODS:** a different type of lipid

- 13. They are multi-ringed structures, all derived from **CHOLESTEROL**
- 14. You've heard many bad things about cholesterol, but it is actually an **essential molecule** found in every cell in your body (it forms parts of cell membranes, for example).
- 15. The problem is that **dietary cholesterol** helps to form **arterial plaques**, which lead to **strokes** and **heart attacks**. Dietary cholesterol only found in **animal products** (meat, fish, poultry, dairy products). There is **no cholesterol in plant foods**. Your blood cholesterol should be no more than 150 mg/dl
- 16. Steroids can function as **chemical messengers**, and form many important **hormones** (e.g. **testosterone, estrogen, aldosterone, cortisol**) that have a wide variety of affects on cells, tissues, and organs (especially sex characteristics, ion balance, and gluconeogenesis).