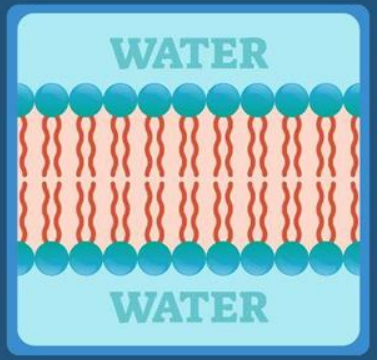
LIPIDS

MISSION MBBS | NEET 2024

BIOMOLECULES-L3



ZOOLOGY | CLASS 11

PUSHPENDU SIR

MISSION MBBS

MONDAY TO FRIDAY
4 PM - 8 PM

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ZOOLOGY	ZOOLOGY	CHEMISTRY	BOTANY	PHYSICS

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Registration Date
8th June
Onwards

Exam Dates and Time
3rd & 10th July
2:00 to 5:20 PM

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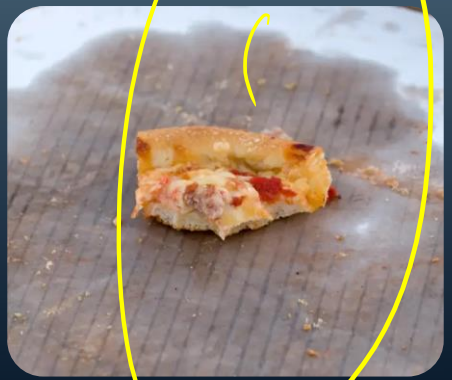
Drool Check!

Aldehyde group

Have You Noticed?

Fats / Oils

Translucent



Have You Noticed?

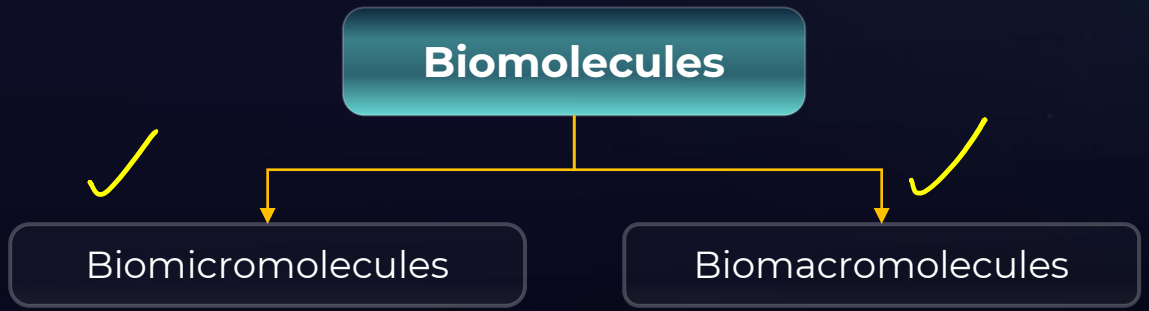
Aldehyde group

When we add a drop of oil in water

It is insoluble in water

Lipids

Recall! Biomolecules



- Small sized
- Low mol wt.
- 18 - 800 Daltons
- Found in the acid soluble pool
- E.g: Simple sugars, amino acids, nucleotides

- Large sized
- High mol wt.
- >1000 Daltons
- Found in the acid insoluble pool
- E.g: Complex carbohydrate, lipid, protein, nucleic acids

Note!

Aldehyde group

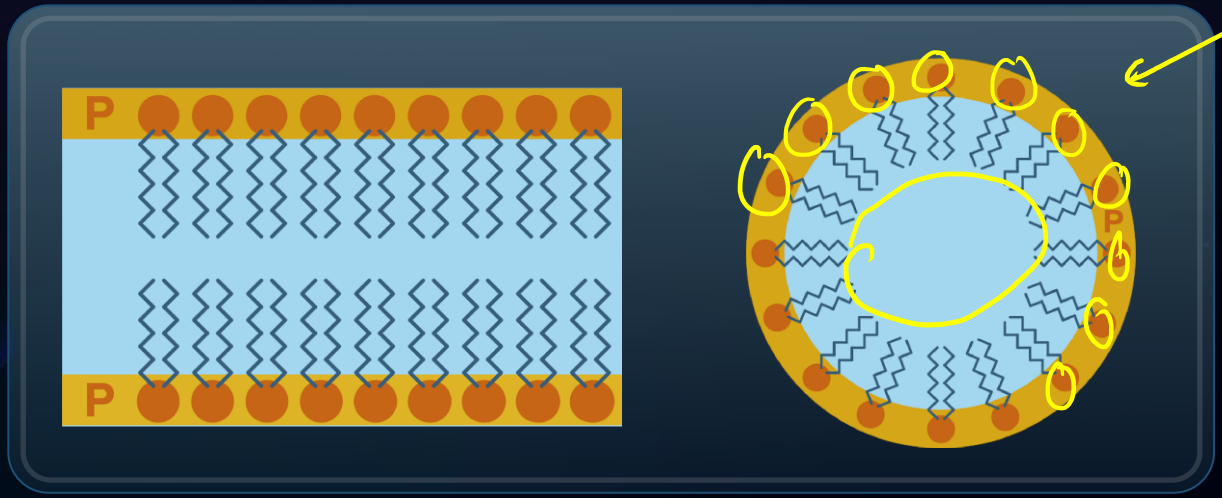
Lipids weigh less than 800 Daltons.

But still are present in acid insoluble pool!!

Why Are lipids found in acid insoluble pool?

Why Are Lipids Found in Insoluble Pool?

- Lipids, when disintegrated, form **vesicles**
- Vesicles are **insoluble in acid**
- Joins the acid insoluble fraction/macromolecule fraction



What are Lipids?

What are Lipids?

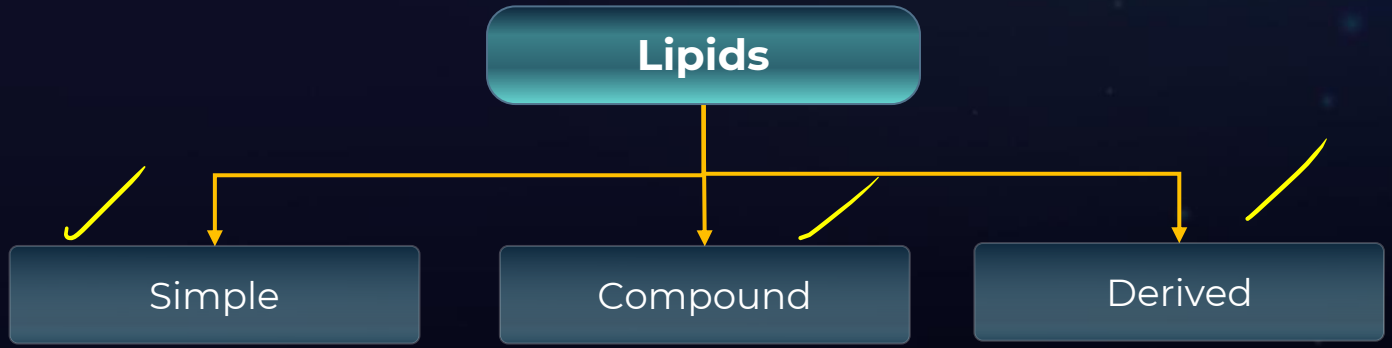
- Organic compounds
- Consists of **carbon, hydrogen** and **oxygen**
- Molecular weight **less than 800 daltons**

What are Lipids?

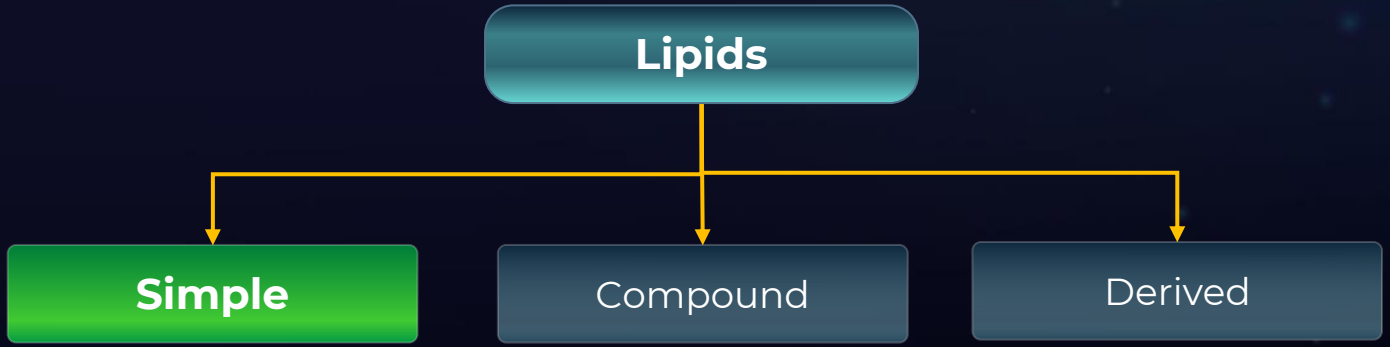
- **Insoluble** in water
- Not polymeric

Classification of Lipids

Classification of Lipids



Classification of Lipids



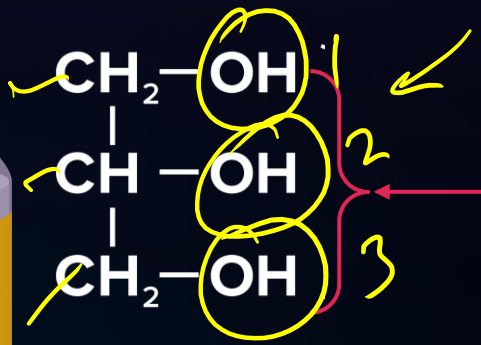
Simple Lipids

Simple Lipids

- **Esters** of **fatty acid** with **alcohol**
- In most lipids, the alcohol is **glycerol**
- Classified based on the **type of alcohol** they contain

Glycerol

- Alcohol with **three carbons, five hydrogens, and three hydroxyl (OH) groups**
- Also called **trihydroxy propane**
- Colourless, viscous and sweet

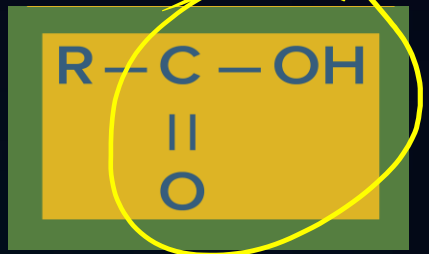


Glycerol

3 hydroxy groups

Fatty Acids

- Carboxylic acid with an **R group attached**
- R groups can be:
  - Methyl (-CH3)
  - Ethyl (-C2H5)
  - 1- 19 (-CH2) groups

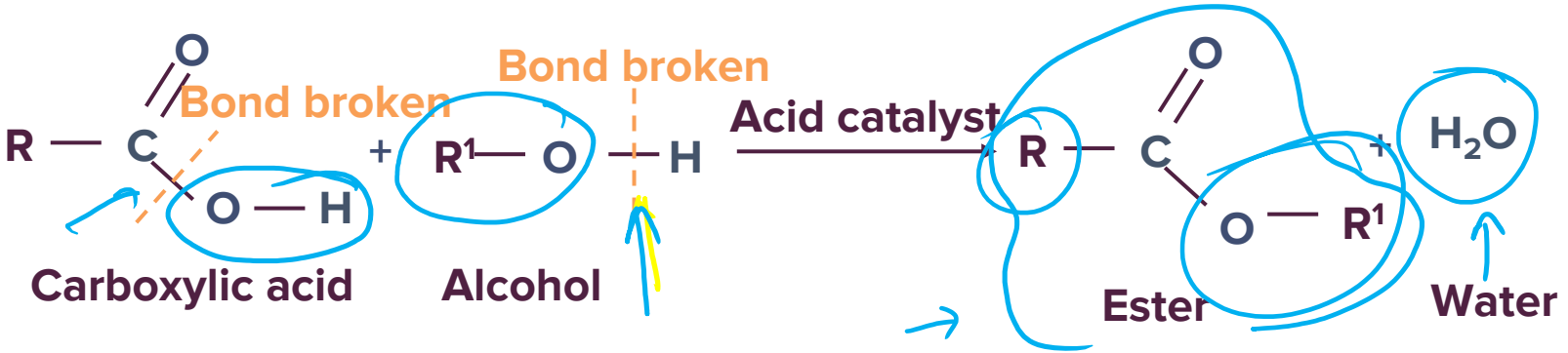


Fatty acid structure

- Carboxyl group (COOH): acid part
- 'R' group: Hydrocarbon chain

How are Glycerol and Fatty Acids attached?

Esterification



Formed when carboxylic acids condense with alcohol

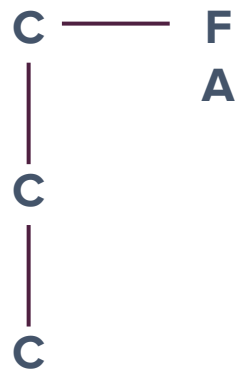
The esters formed from glycerol and fatty acids are called..

Glycerides

Monoglyceride	Diglyceride	Triglyceride
Formed by the condensation of **one fatty acid and glycerol**	Formed by the condensation of **two fatty acids and glycerol**	Formed by the condensation of **three fatty acids and glycerol**

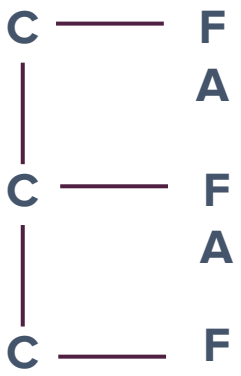
Glycerides

Monoglyceride

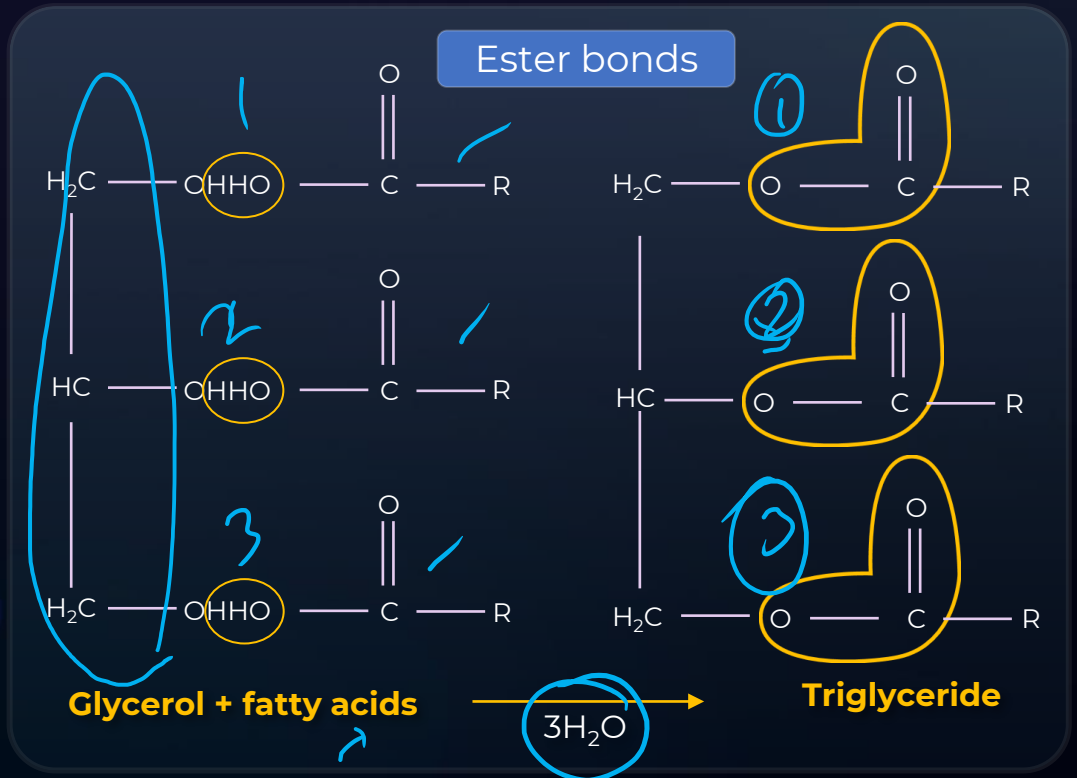


Diglyceride

Triglyceride



Formation of Triglyceride



Let’s test for the presence of lipids/triglycerides

Sudan Test

Sudan Test

Objective: To test for the presence of lipids/triglycerides

Sudan Test

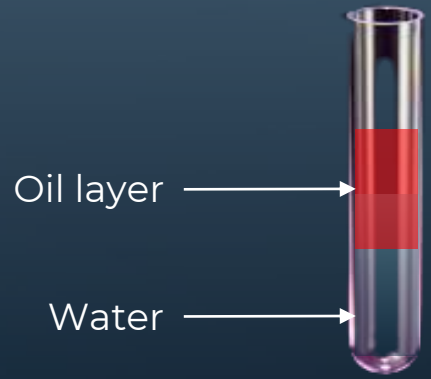
Experiment

Add equal amounts of sample and water to the test tube

Add 3-4 drops of Sudan III reagent, and shake the test tube

Sudan Test

Result

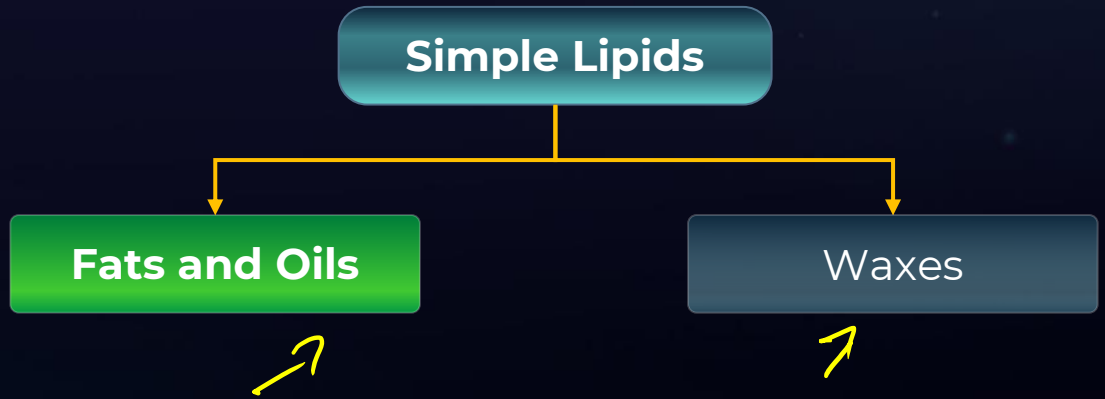


When Sudan III is added, the upper fat-containing layer turns orangish-red indicating the presence of fats.

Red → insoluble in water.
Soluble in fats.
Hydrophobic.

Classification of Simple Lipids

Based on alcohol present



Simple Lipids: Fats and Oils

- **Esters of fatty acids** with **glycerol**
- Majority of **fats and oils** are **triglycerides**

Ghee

Mustard oil

Have You Noticed?

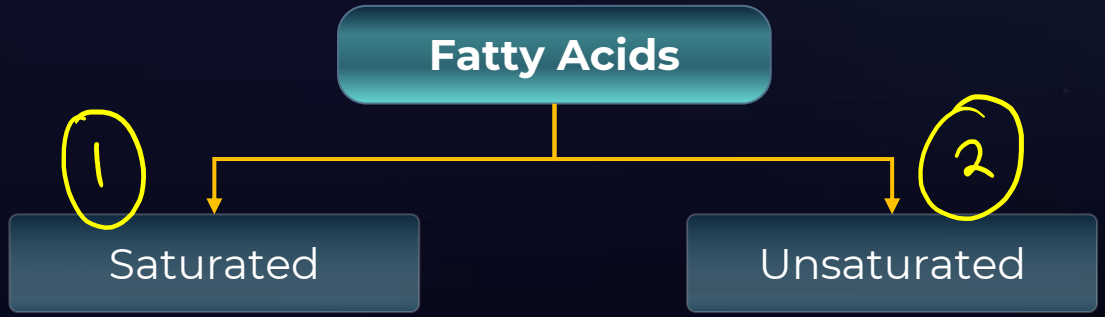
Ghee solidifies during winters

Have You Noticed?

Cooking oils like mustard oil, sesame oil do not solidify during winters

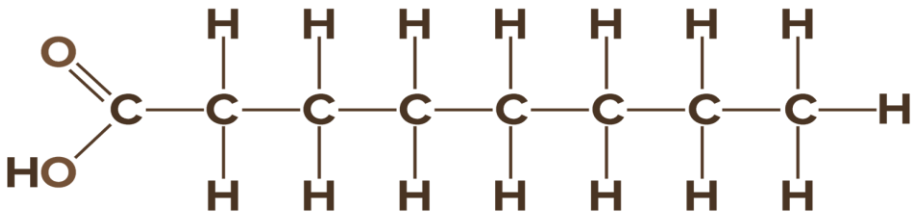
To understand this we need to learn the two classifications of fatty acids

Classification of Fatty Acids



Saturated Fatty Acids

- Have **single bond** between the carbon atoms
- Mostly **solid** at room temperature
- E.g. **Butter, ghee**



Saturated

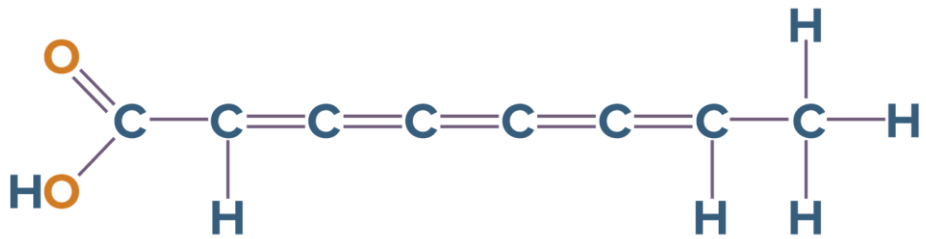
Saturated Fatty Acids

Examples	No. of C
Palmitic acid	16
Stearic acid	18

Palmitic acid

Unsaturated Fatty Acids

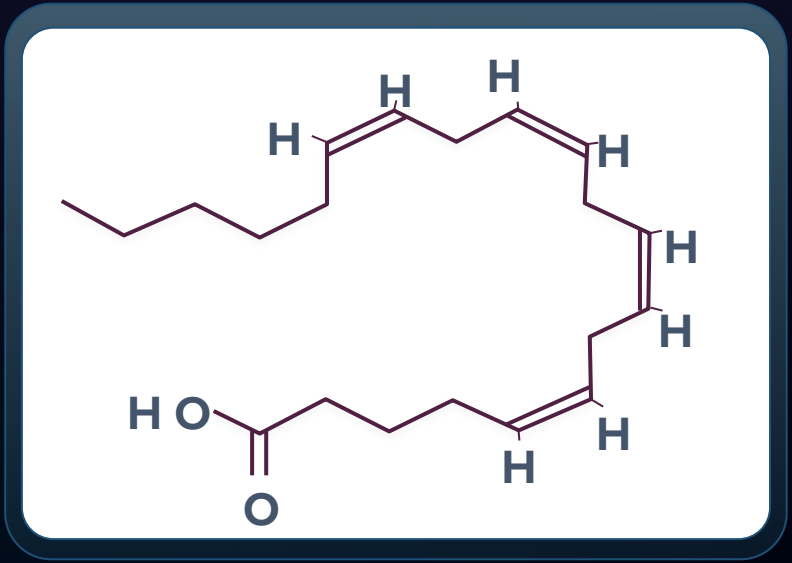
- Have **double bond** between the carbon atoms
- **Lower** melting point
- Mostly **liquid** at room temperature
- E.g. Sunflower oil



Unsaturated

Unsaturated Fatty Acids

- **Arachidonic acid:** Fatty acid with 20 carbons (including carboxyl carbon)



Unsaturated Fatty Acids

Examples	No. of double bonds
Oleic acid	1
Linoleic acid	2
Linolenic acid	3
Arachidonic acid	4

MUFA: Monounsaturated fatty acid

PUFA: Polyunsaturated fatty acid

Have You Wondered Why Olive Oil is so Popular?

High amount of unsaturated fatty acids

Extra Virgin Olive Oil

Nutrition Facts

Serving Size 1 tablespoon (14ml)

Amount Per Serving	
Calories 120	Calories from Fat 120
	% Daily Values*
Total Fat 14g	**22%**
Saturated Fat 2g	**10%**
Trans Fat 0g	
Polyunsaturated Fat 2g	
Monounsaturated Fat 10g	
Cholesterol 0mg	**0%**
Sodium 0mg	**0%**
Total Carbohydrate 0g	**0%**
Dietary Fiber 0g	**0%**
Sugars 0g	
Protein 0g	**0%**

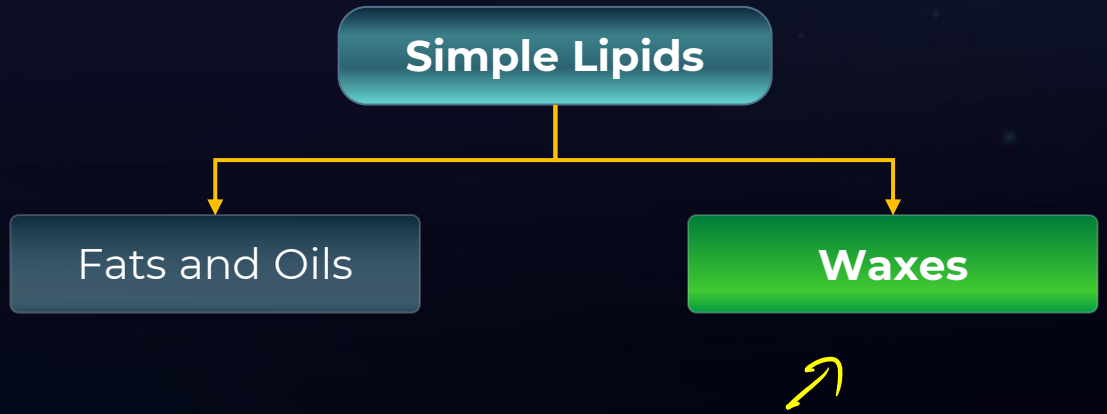
*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2400mg	2400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Omega 3-
Omega 6.
Brain & cell growth.
Cholesterol.

Classification of Simple Lipids

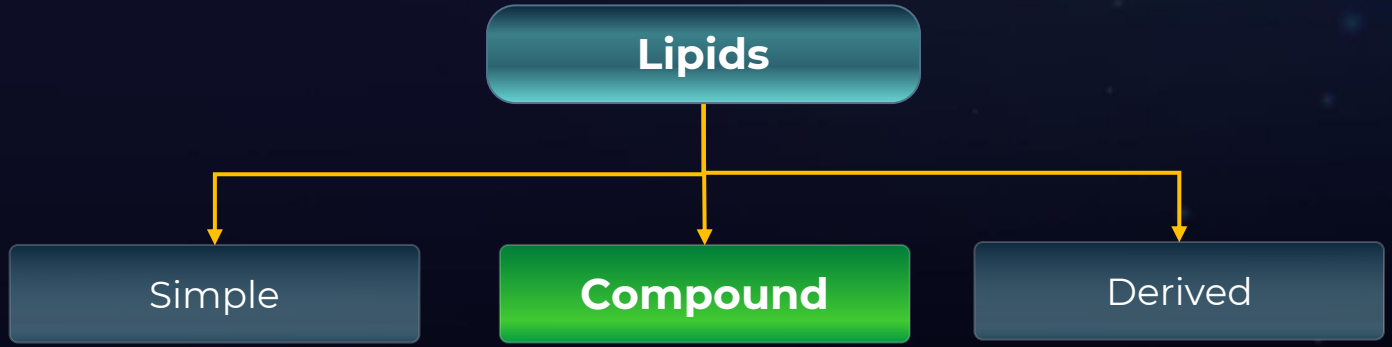
Based on alcohol present



Waxes

- **Esters** of long chain fatty acids and long chain alcohol
- Form **water insoluble coating**
  - On hair & skin in animals
  - On stem, leaves and fruits in plants
- E.g. **Bee wax, Cerumen or ear wax**

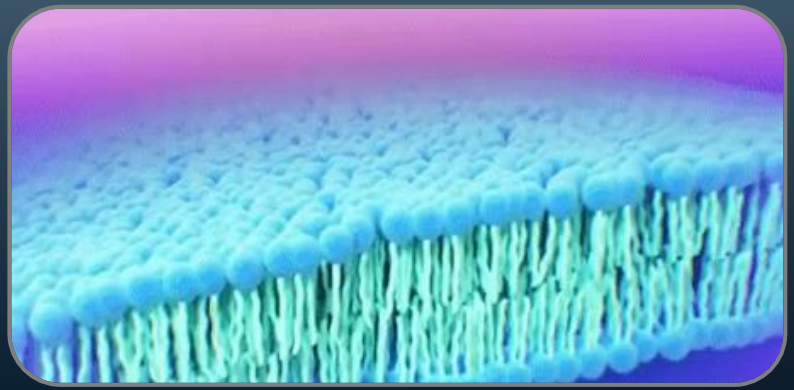
Classification of Lipids



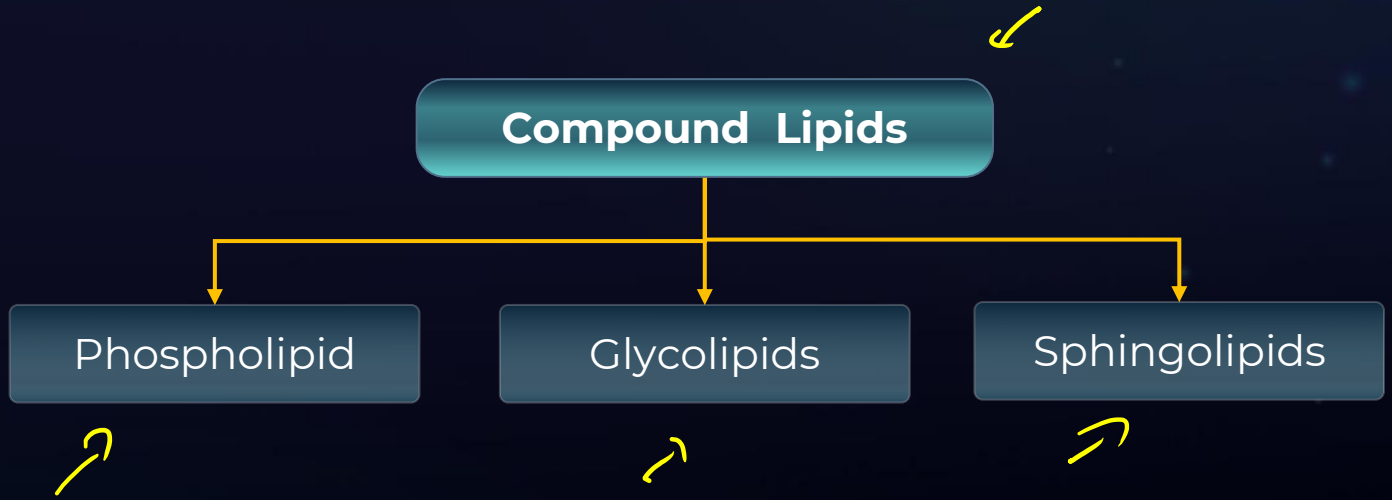
Compound Lipids

Compound Lipids

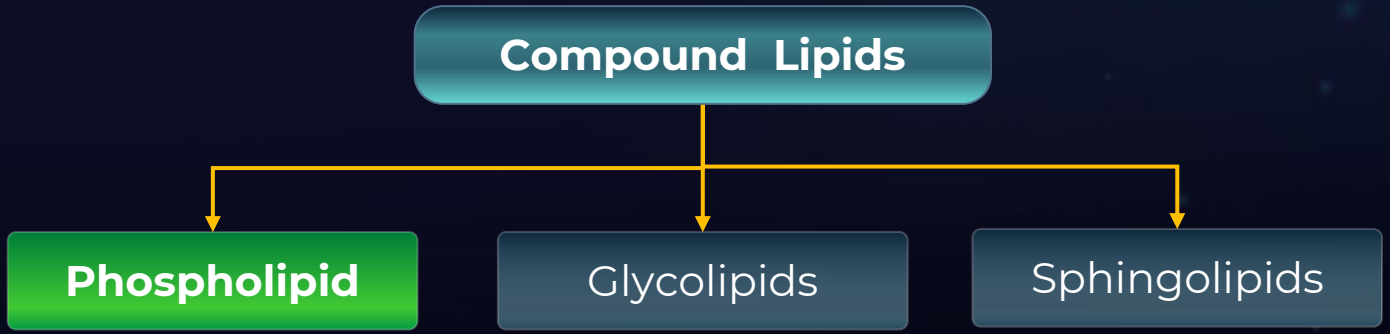
- Esters of **fatty acids and alcohol** along with additional groups
- Additional groups: **Phosphorus, proteins or sugar**
- Usually found in cell membrane



Classification of Lipids

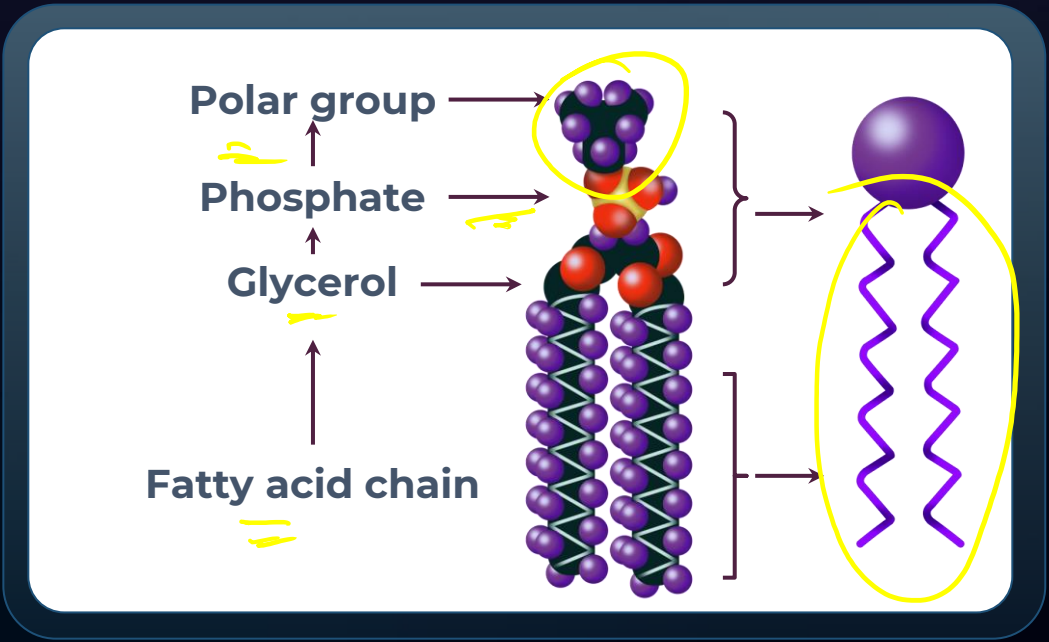


Compound Lipids

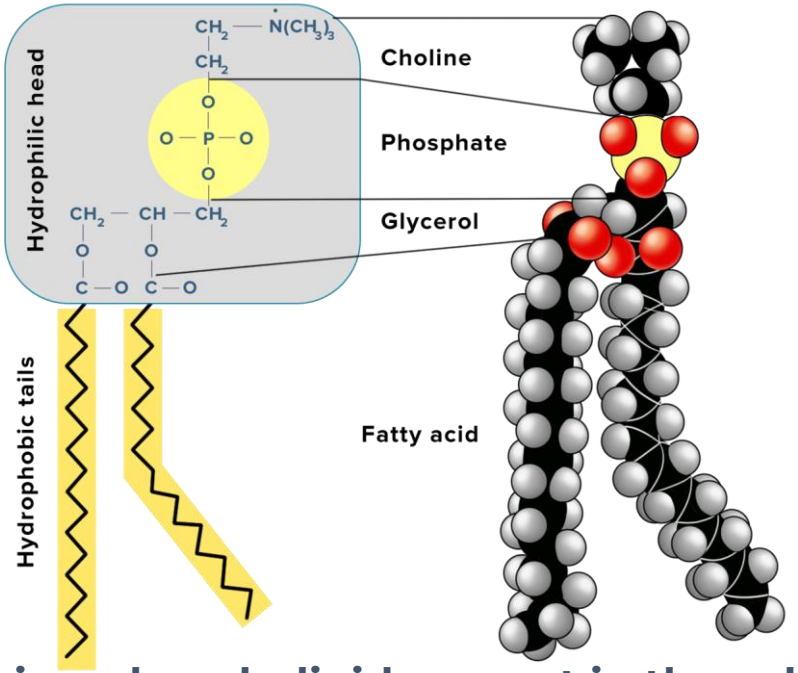


Compound Lipids: Phospholipids

- Phospholipid = **Fatty acids + glycerol + phosphate group**
- Major component of cell membranes

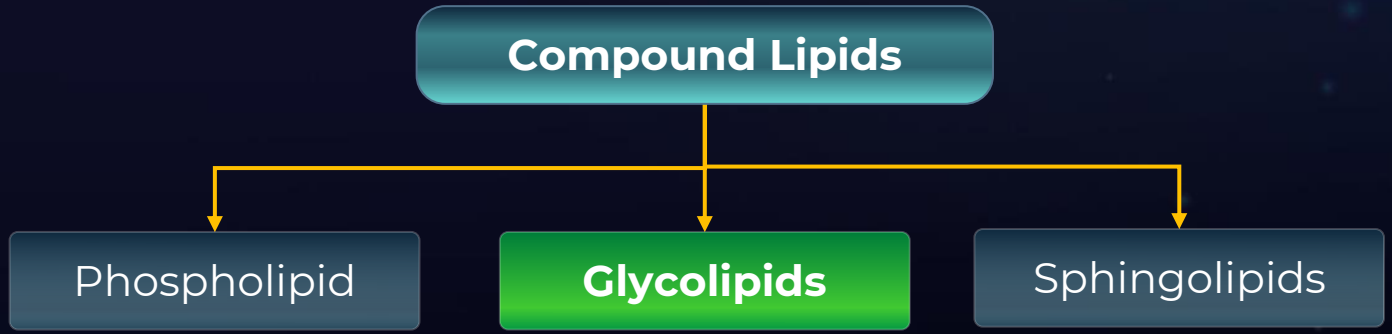


Compound Lipids: Phospholipids



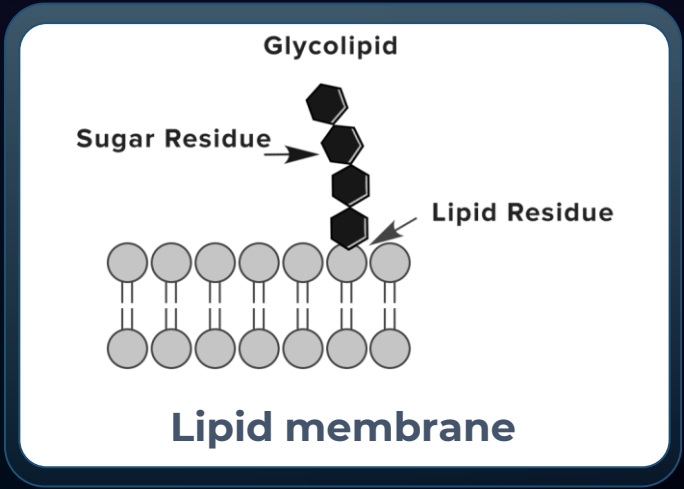
Lecithin is a phospholipid present in the cell membrane

Compound Lipids



Compound Lipids: Glycolipids

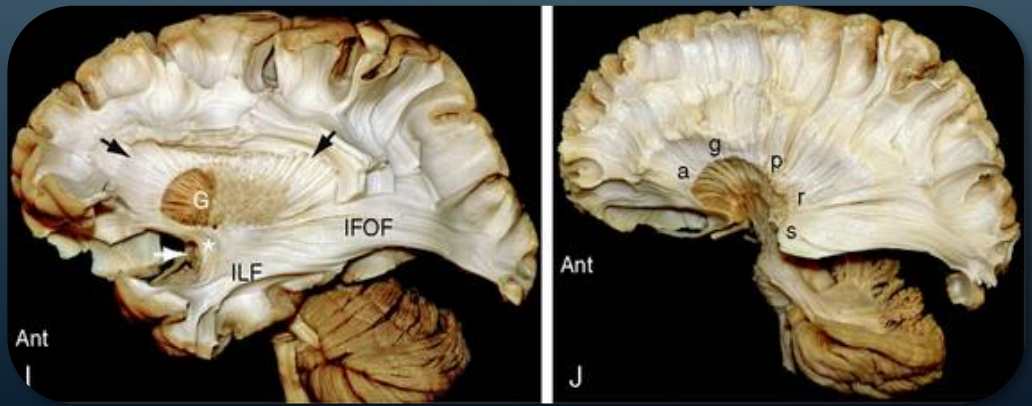
- **'Glyco'** - related to sugar
- Glycolipid = Fatty acid + Glycerol + Carbohydrate group
- Found on the cell membrane surface
- Helps in **cell recognition**



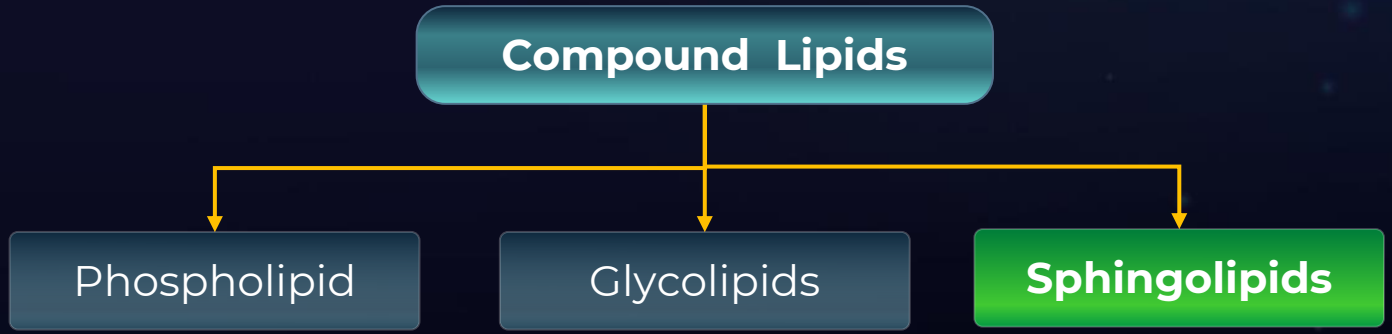
Did You Know?

Glycolipid - Galactocerebroside

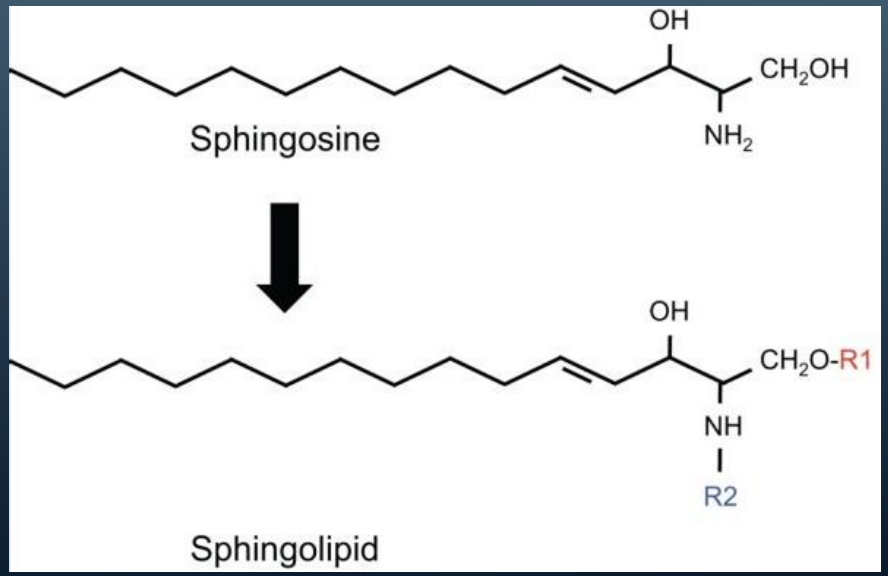
- The white matter of brain is called so because of its whitish fatty appearance due to myelin.
- Main lipid found in myelin, is a glycolipid called **galactocerebroside**



Compound Lipids

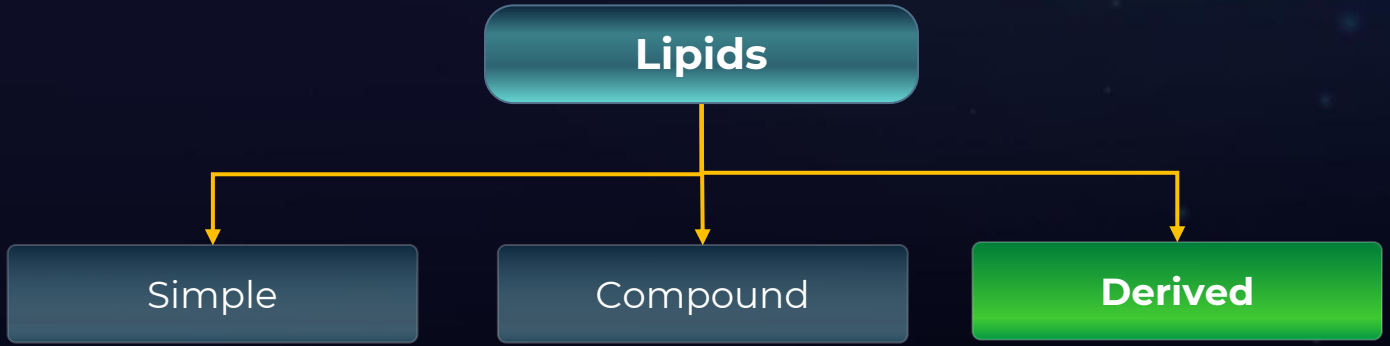


Sphingolipids



Class of lipids containing a **backbone of sphingoid bases,** a set of aliphatic amino alcohols that includes sphingosine

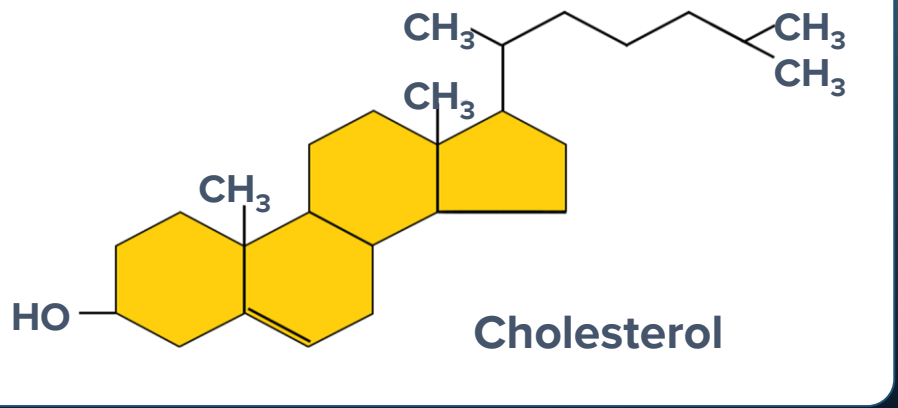
Classification of Lipids



Derived Lipids

Derived Lipids

- **Lipids derived from** simple or conjugated lipids
- **Complex** in structure
- Eg: **Cholesterol**



Cholesterol

Functions of Lipids

Functions of Lipids

- **Long term energy storage**
- Protection against heat loss (insulation)
- Protection against physical shock
- Protection against water loss
- Chemical messengers (hormones)
- Major component of membranes

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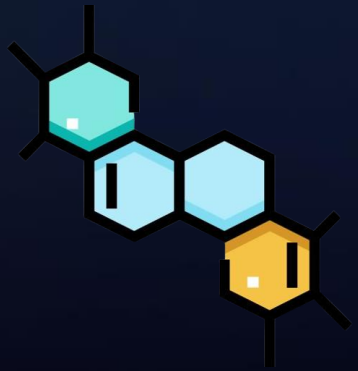
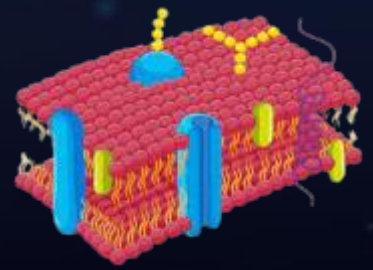


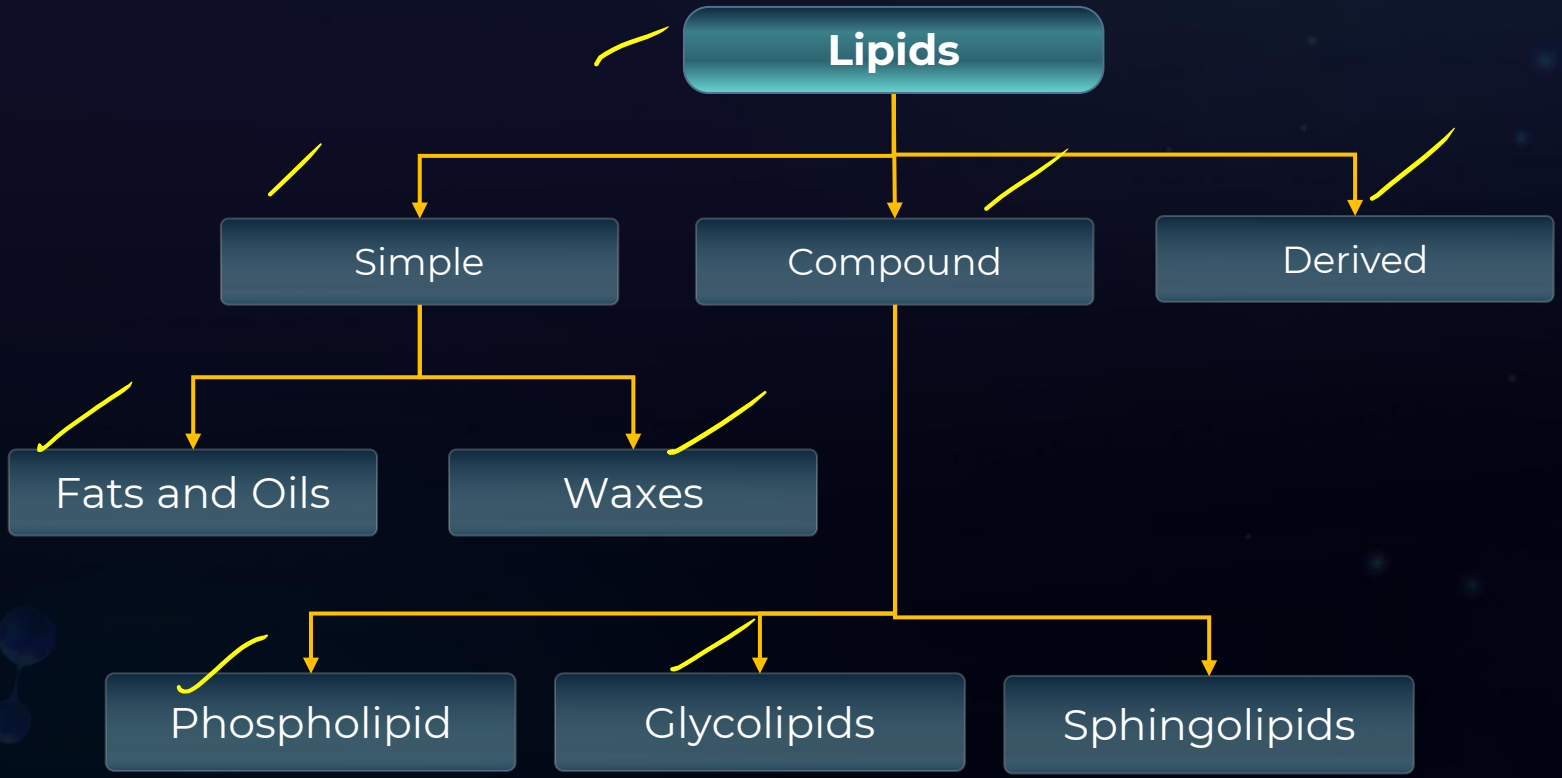
Functions of Lipids

- Long term energy storage
- Protection against heat loss (insulation)
- Protection against physical shock
- Protection against water loss
- Chemical messengers (hormones)
- **Major component of membranes**



Summary

Summary


Lipids
Simple
Compound
Derived
Fats and Oils
Waxes
Phospholipid
Glycolipids
Sphingolipids

Summary

	Fats	Oils
Similarities	Triglycerides	Triglycerides
Differences	Solid at room temperature	Liquid at room temperature
	Mainly from animal sources	Mainly from plant sources
	Relatively more saturated	Relatively more unsaturated
	High melting point Eg: Ghee	Low melting point Eg: Oil

Past Year Questions

A typical fat molecule is made up of:

(NEET-2017)

A. 1 glycerol and 3 fatty acid molecules

B. 1 glycerol and 1 fatty acid molecule

C. 3 glycerol and 3 fatty acid molecules

D. 3 glycerol molecule and 1 fatty acid molecule

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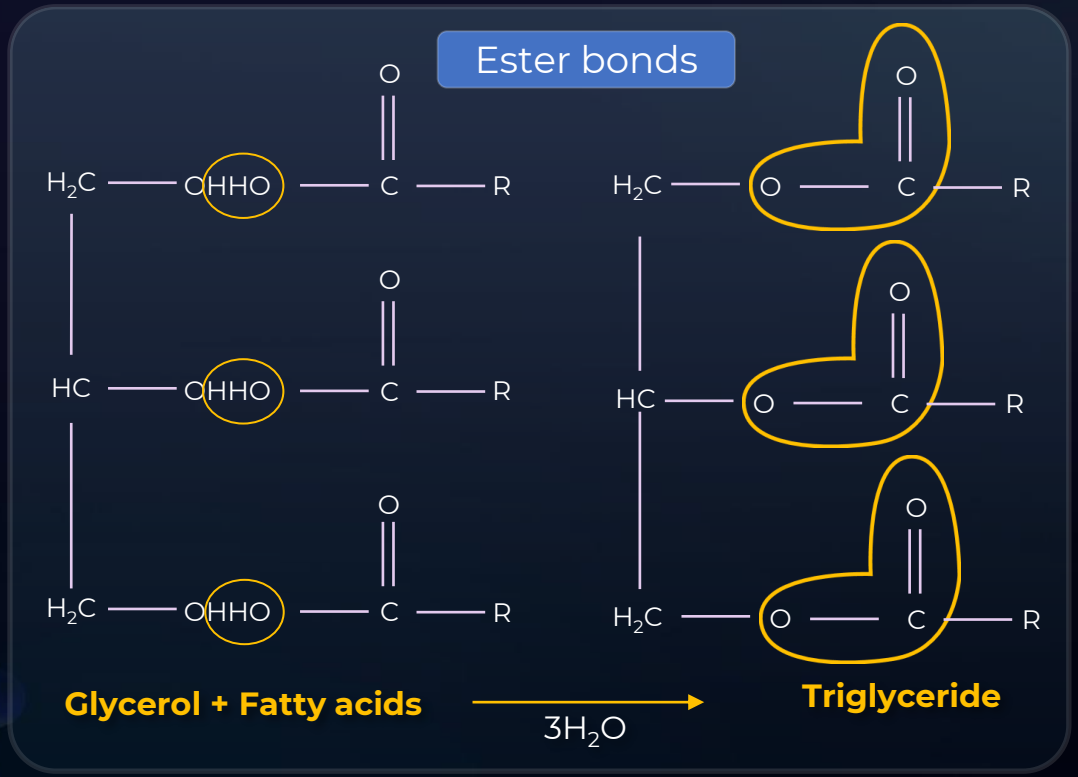


- **Triglycerides** are typical fat molecules
- They are **esters of fatty acids and glycerol**, in which **the carboxylate part of 3 fatty acids** are linked to the **hydroxyl group of the glycerol** by means of ester bonds

A phosphoglyceride is always made up of:

(NEET-2013)

A A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate is also attached

B A saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule

C Only a saturated fatty acid, esterified to a glycerol molecule to which a phosphate group is attached

D Only an unsaturated fatty acid esterified to a glycerol to which a phosphate group is also attached

A phosphoglyceride is always made up of

(NEET-2013)

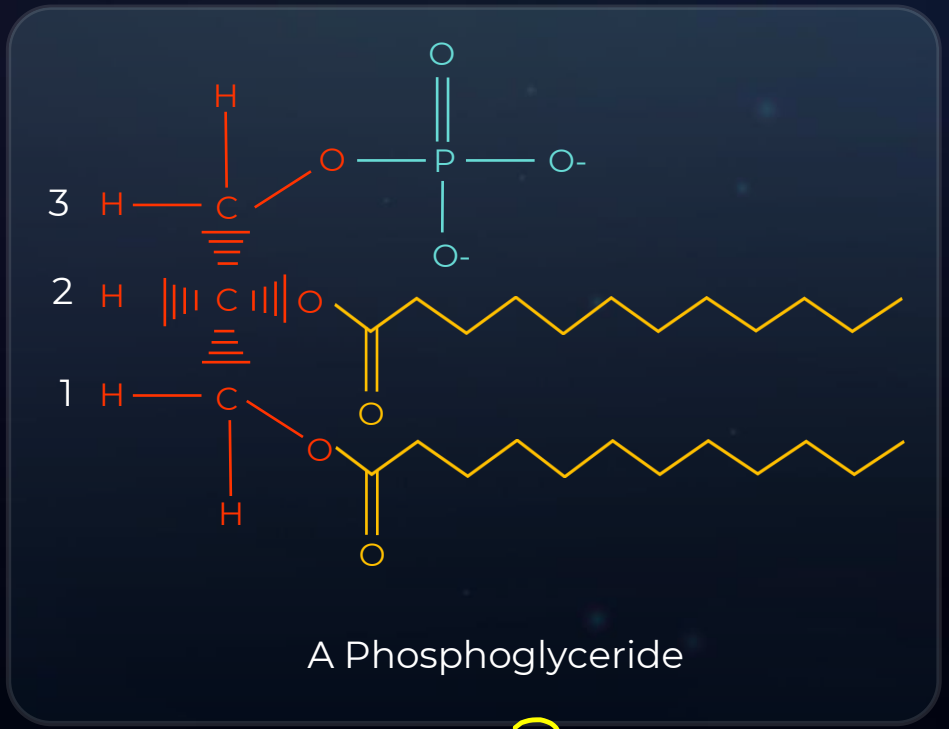
A. A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate is also attached

B. A saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule

C. Only a saturated fatty acid, esterified to a glycerol molecule to which a phosphate group is attached

D. Only an unsaturated fatty acid esterified to a glycerol to which a phosphate group is also attached

- The phosphoglycerides have a phosphate attached to one of the carbons of the Glycerol rest two carbons are attached to fatty acid chain, and an alcohol group attached with phosphate group.
- These fatty acid chains can either be saturated or unsaturated.



A Phosphoglyceride

Following are a few statements with reference to lipids, choose the correct answer from the option given below. (NEET-2021)

a. Lipids having only one bond are called unsaturated fatty acids

b. Lecithin is a phospholipid

c. Trihydroxy propane is glycerol

d. Palmitic acid has 20 carbon atom including the carboxyl carbon

e. Arachidonic acid has 16 carbon atom

A b and c only

B b and e only

C a and b only

D c and d only

Following are a few statements with reference to lipids, choose the correct answer from the option given below

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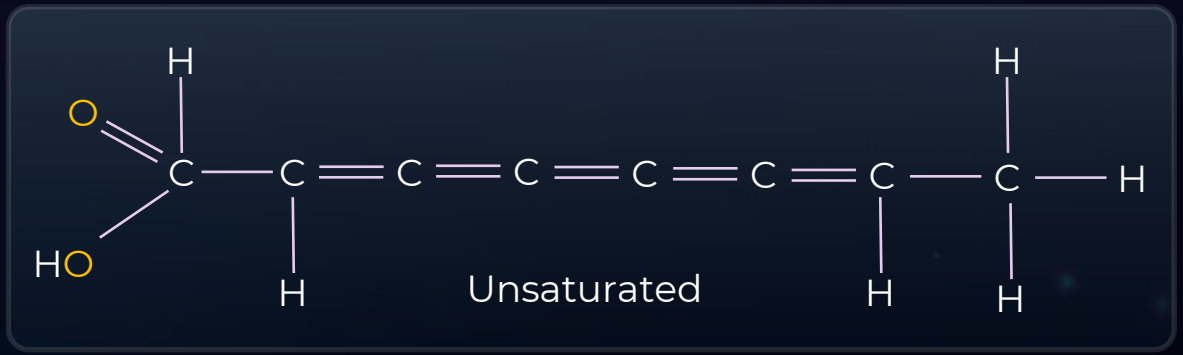
C. a and b only

D. c and d only

Lipids having only one bond are called unsaturated fatty acids

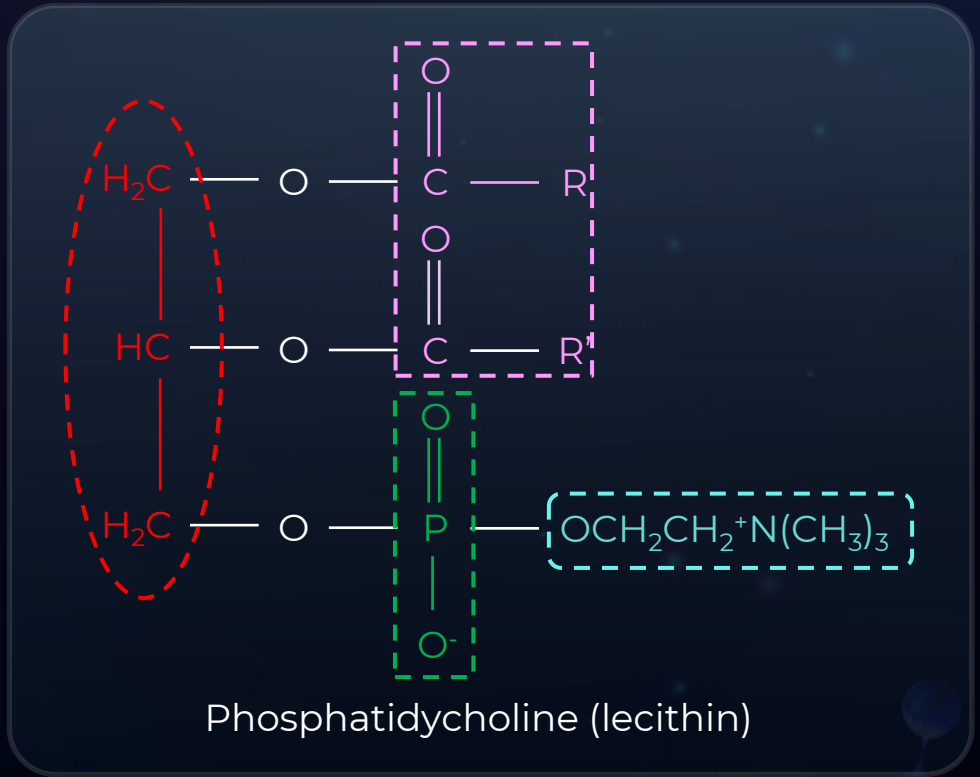
- Lipids that contain unsaturated fatty acid chains, can have one or more than one double and triple bonds



Lecithin is a phospholipid

Lecithin is a compound lipid that has four components

a. Glycerol
b. 2 fatty acids
c. Phosphate group
d. Choline - an alcohol



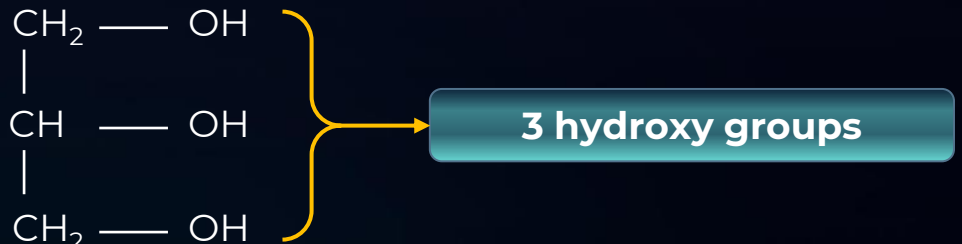
Phosphatidycholine (lecithin)

Trihydroxy propane is glycerol

Simple lipids

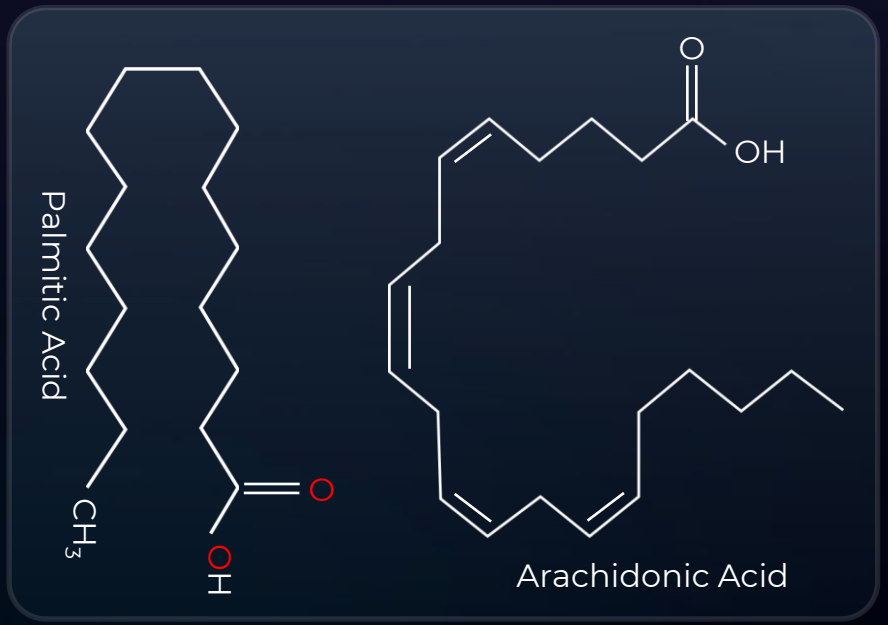
- Glycerol
- Fatty acids
- Glycerides

- It is also called trihydroxy propane



Glycerol

Palmitic acid has 20 carbon atom including carboxyl carbon
Arachidonic acid has 16 Carbon atom



- Palmitic acid is a saturated fatty acid that is made up of 16 carbon atoms
- Arachidonic acid is an unsaturated fatty acid. It has 20 carbon atoms


Keep
Learning!