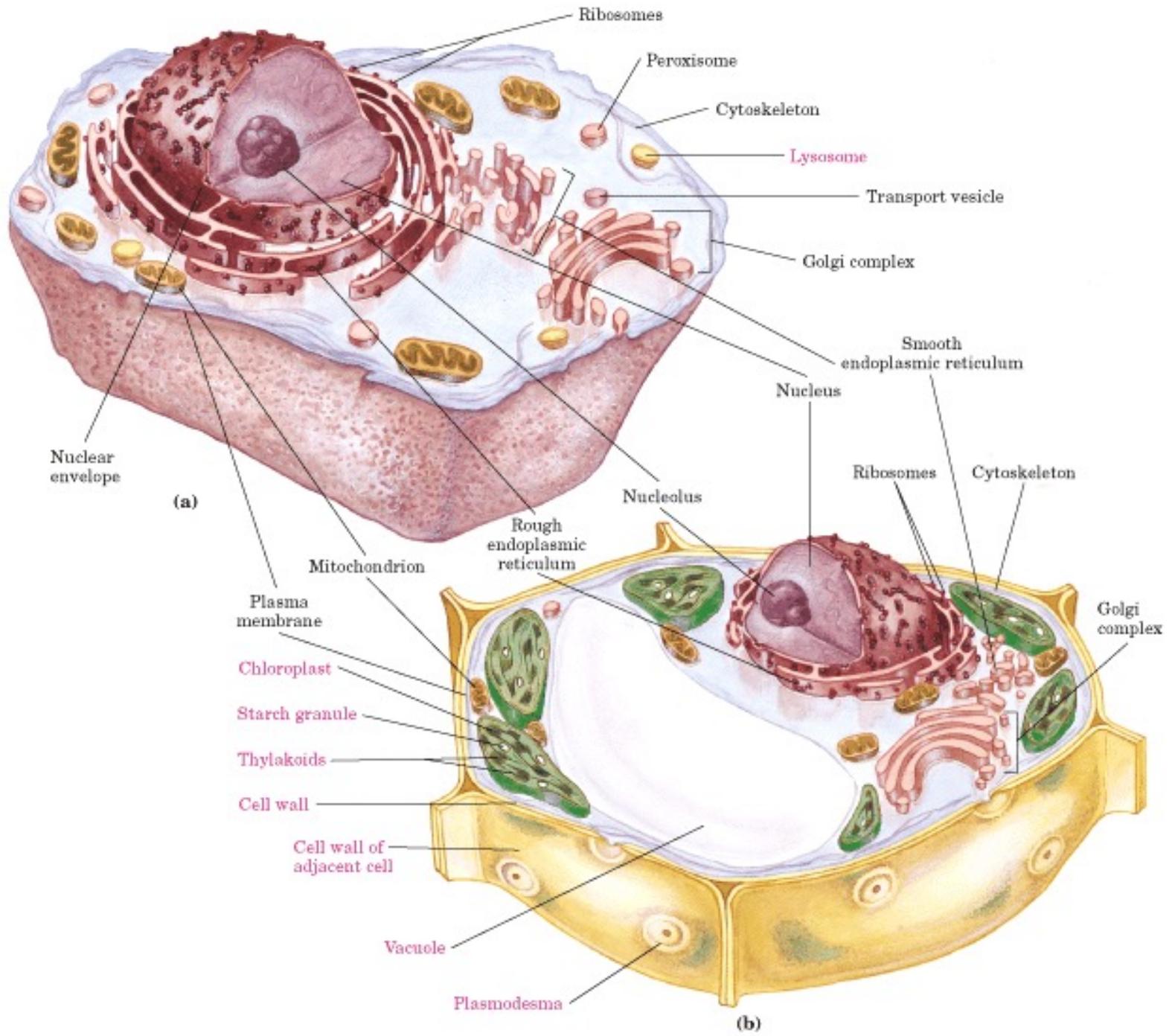


CÉLULAS

- Toda células tem **uma membrana** celular
- Células eucarióticas também apresenta organelas separadas **por membranas**
- **As membranas** separam as células do meio externo e desempenha um papel importante no transporte e no controle do fluxo de informação entre as células e o meio externo
- Diversas enzimas encontram-se **nas membranas** e dependem deste ambiente para o desenvolvimento de suas funções



Nuclear envelope

(a)

Ribosomes

Peroxisome

Cytoskeleton

Lysosome

Transport vesicle

Golgi complex

Smooth endoplasmic reticulum

Nucleus

Smooth endoplasmic reticulum

Nucleolus

Ribosomes

Cytoskeleton

Golgi complex

Mitochondrion

Rough endoplasmic reticulum

Plasma membrane

Chloroplast

Starch granule

Thylakoids

Cell wall

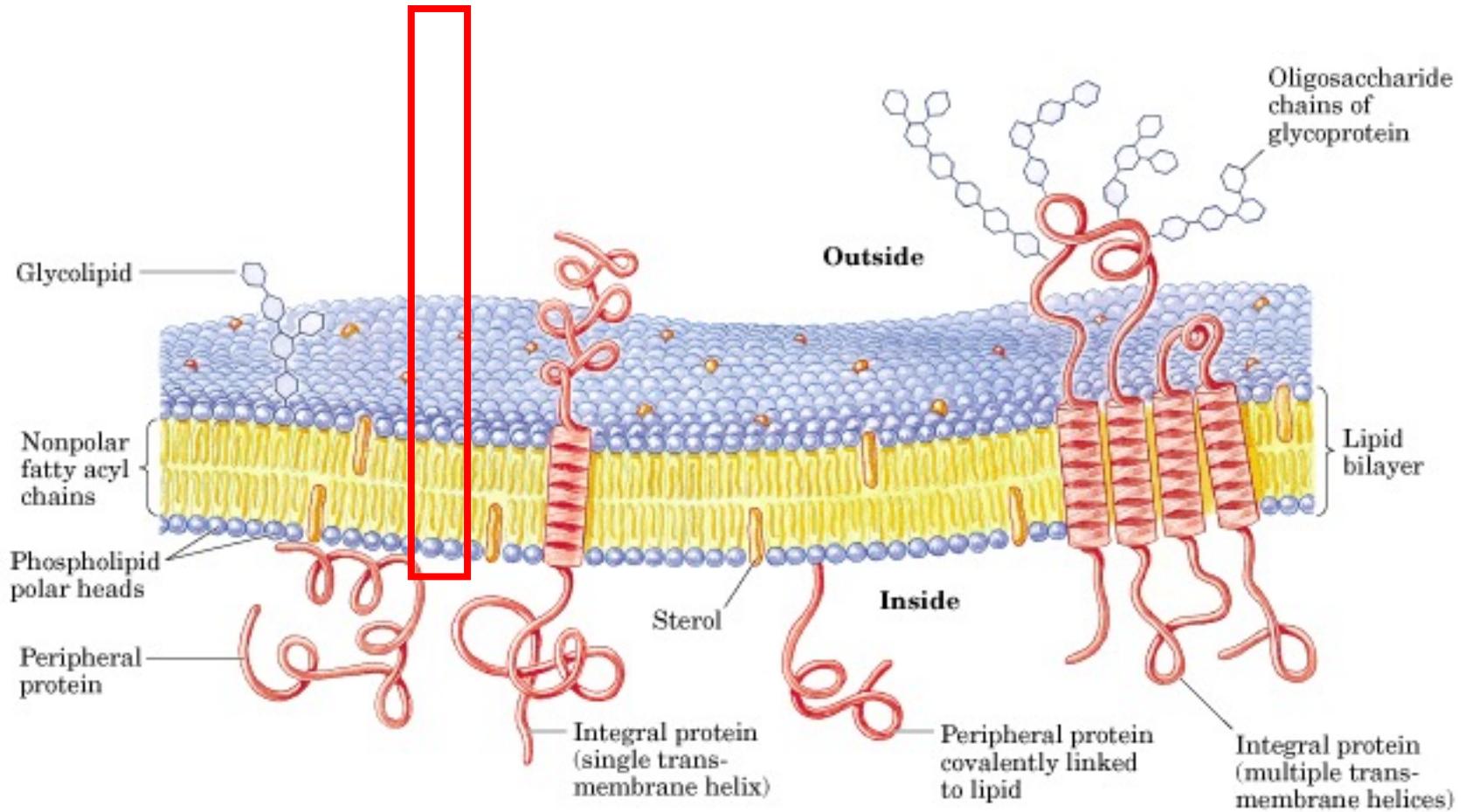
Cell wall of adjacent cell

Vacuole

Plasmodesma

(b)

LIPÍDIOS / MEMBRANAS



LIPÍDIOS

- Compostos biológicos “solúveis” somente em **solventes apolares**
- **Ácidos Graxos**, são os blocos fundamentais de muitos lipídios
- A **cadeia de hidrocarbonetos** tem pouca afinidade com a água
- A **parte polar** associa-se com a água
- As **membranas de células animais** contém proporções significativas de esfingolipídios e colesterol (hidrofóbico)

Lipídeos

Lipídeos (Estrutura e Classificação)

Lipoproteínas (Transporte)

Membranas Biológicas

Onde encontramos os lipídeos??

Óleos e gorduras



Lipídios nos Alimentos

http://www.bungealimentos.com.br - BUNGE ALIMENTO...

Óleo de Milho Salada

Porção de 13ml (1 colher de sopa)

Quantidade por porção		%VD*
Valor energético	108kcal = 454kJ	5%
Carboidratos	0g	0%
Proteínas	0g	0%
Gorduras totais	12g	22%
Gorduras saturadas	1,8g	8%
Gorduras <i>trans</i>	Não contém	**
Gorduras monoinsaturadas	4,4g	**
Gorduras poliinsaturadas	5,8g	**
Colesterol	0mg	0%
Fibra alimentar	0g	0%
Sódio	0mg	0%

*% Valores Diários de referência com base em uma dieta de 2.000kcal ou 8.400kJ. Seus valores diários podem ser maiores ou menores dependendo de suas necessidades energéticas.

**% VD não estabelecidos.

Concluído Internet

Lipídeos

- **Classificados pela solubilidade (não estrutura).**
- **Lipídios (grego “lipos”, gordura): compostos solúveis em solventes orgânicos (metanol, clorofórmio, etc).**
- **São moléculas apolares insolúveis em água. Algumas são anfipáticas.**

Lipídios: Funções Principais

Ácidos Graxos → Unidades que compõe os triacilgliceróis e fosfolipídios
→ Produção de energia
→ Precursores de eicosanóides

Triacilgliceróis → Estoque de energia

Fosfolipídios → Principal componente das membranas celulares

Esteróis
(Colesterol/
Esteres de Colesterol) → Componente de membrana celular
→ Precursor de ácidos biliares, vitamina D
→ Precursores de hormônios esteroidais

Vitaminas Lipossolúveis

- **Vitamina A** – visão (retinal + opsin = rhodopsina)
- **Vitamina D** – metabolismo do cálcio
- **Vitamin E** – antioxidante que protege as membranas
- **Vitamina K** – importante para a coagulação.

Ácidos Graxos

Triacilgliceróis

Fosfolipídios

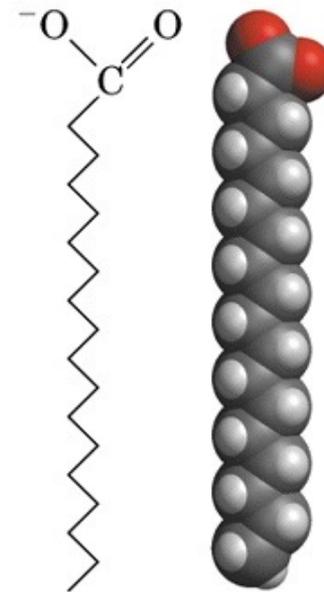
Esteróis

(Colesterol/

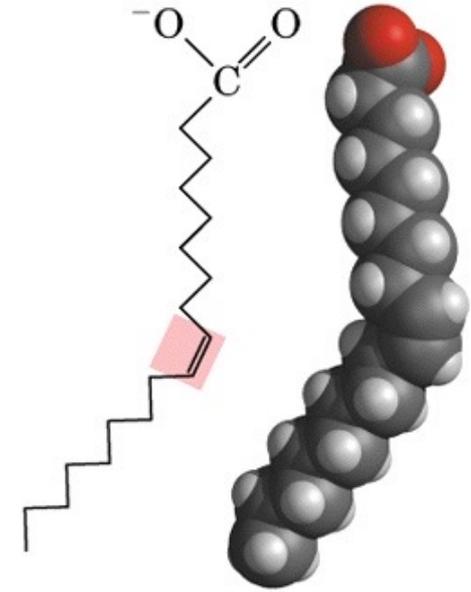
Esteres de Colesterol)

Carboxyl
group

Hydrocarbon
chain



(a)



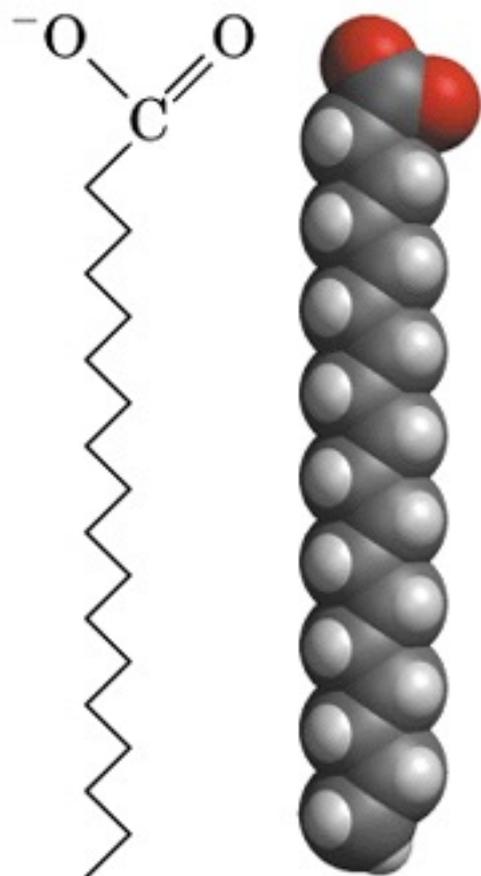
(b)

✓ São ácidos carboxílicos com grupos laterais de hidrocarbonetos de cadeia longa

✓ Encontram-se normalmente na forma esterificada

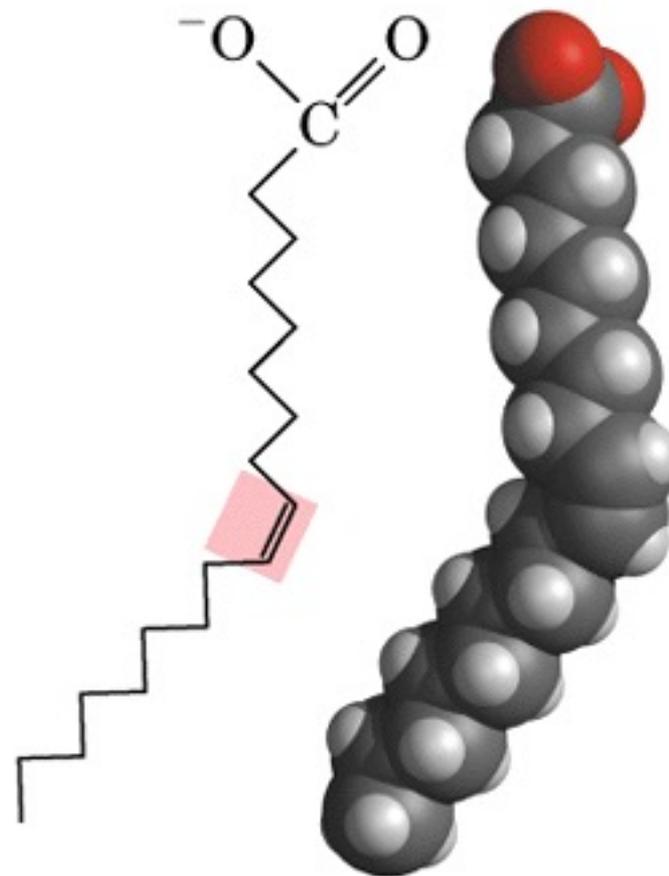
✓ A maioria dos ac.graxos possui número par de carbonos.

Carboxyl
group



Hydrocarbon
chain

(a)

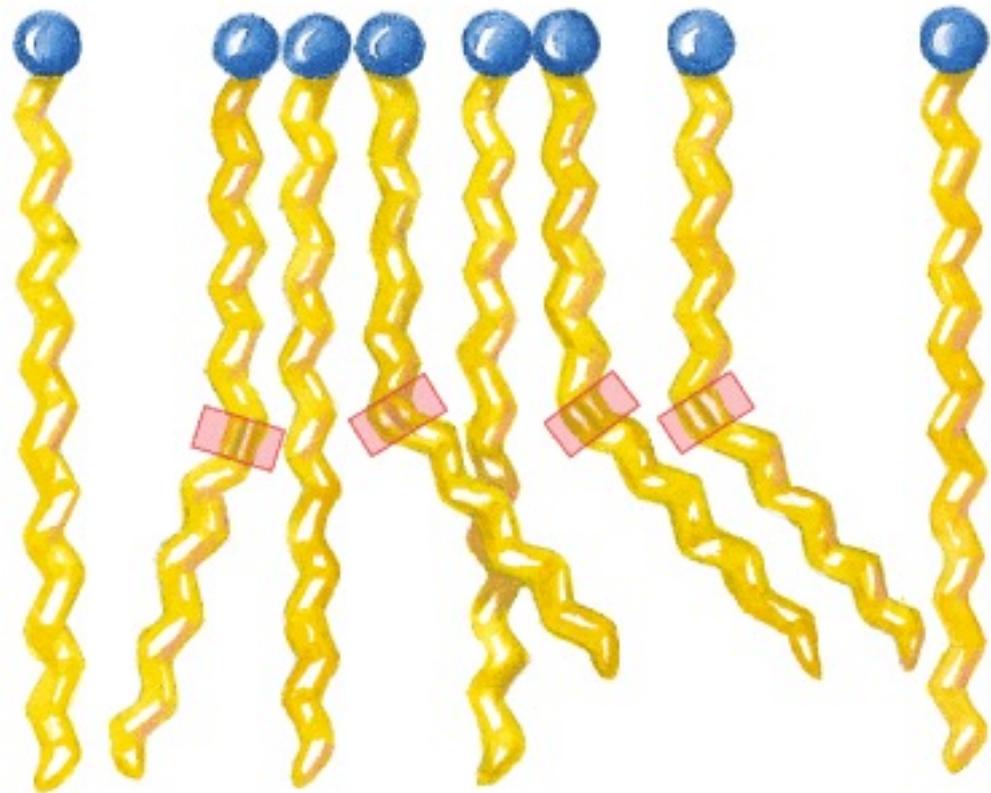


cis *versus* **trans**
(b)



Saturated
fatty acids

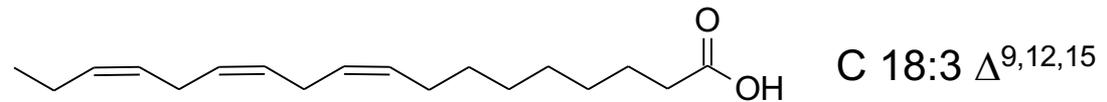
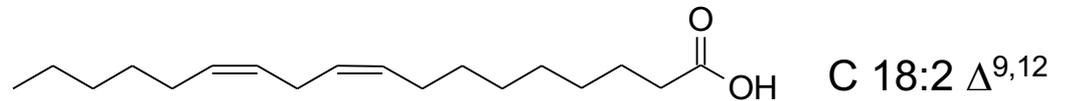
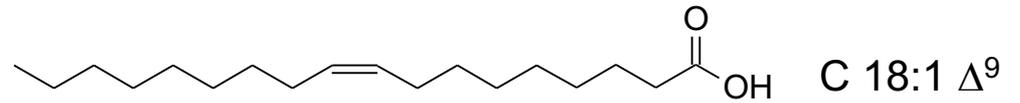
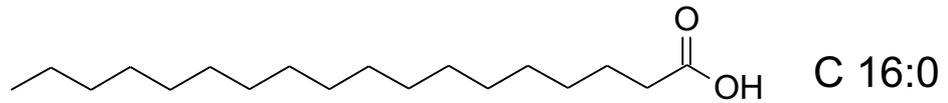
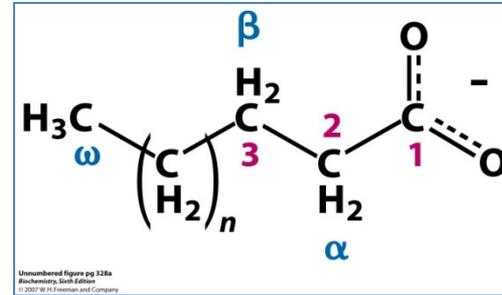
(c)

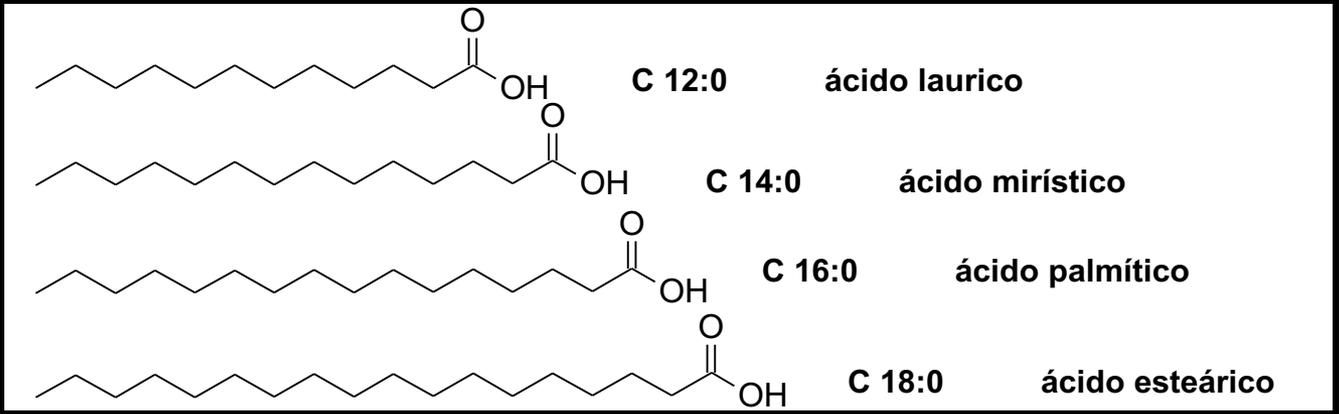


Mixture of saturated and
unsaturated fatty acids

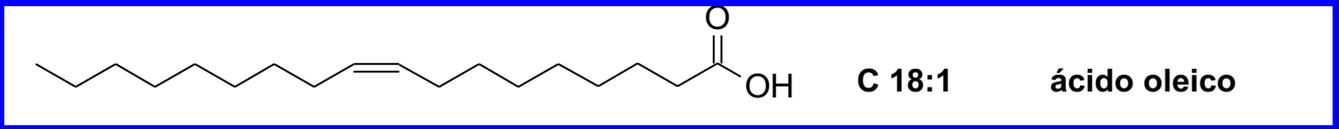
(d)

Ácidos Graxos

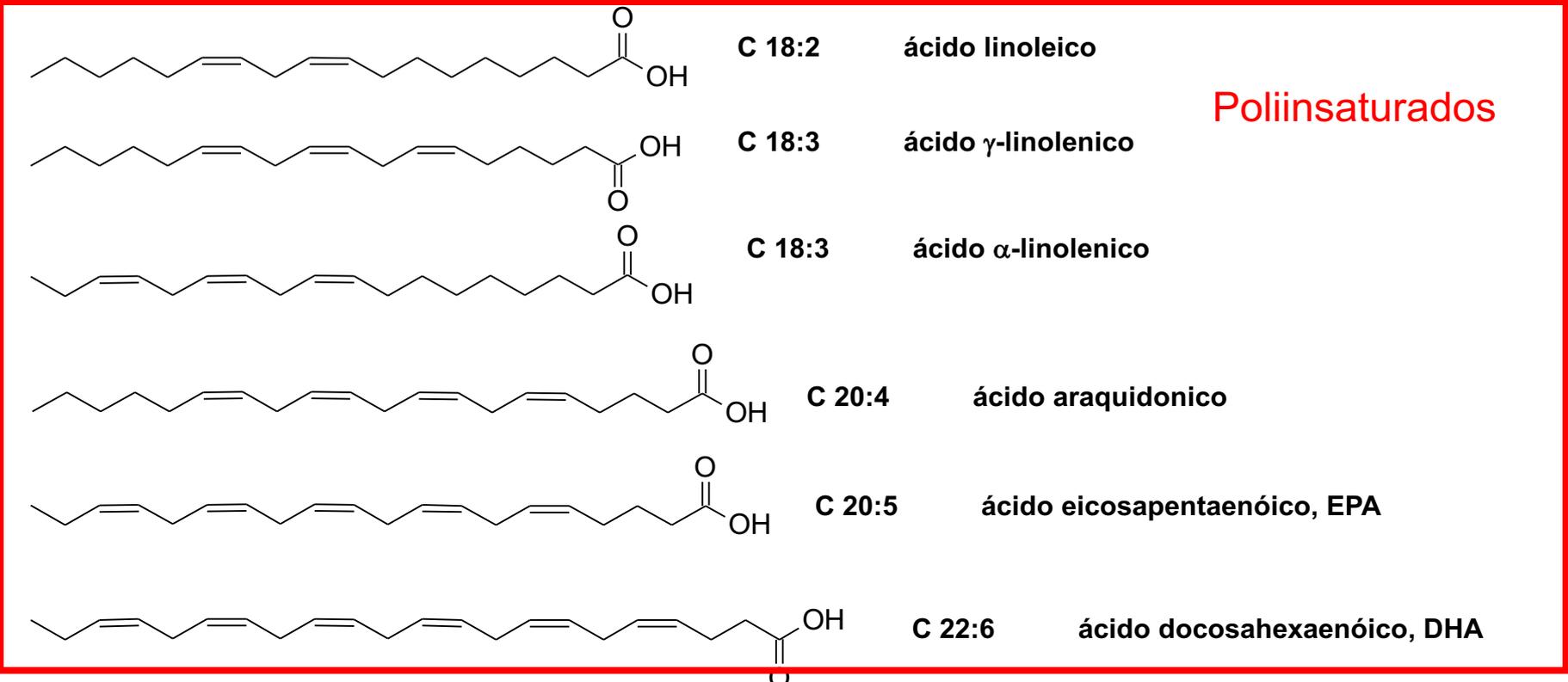




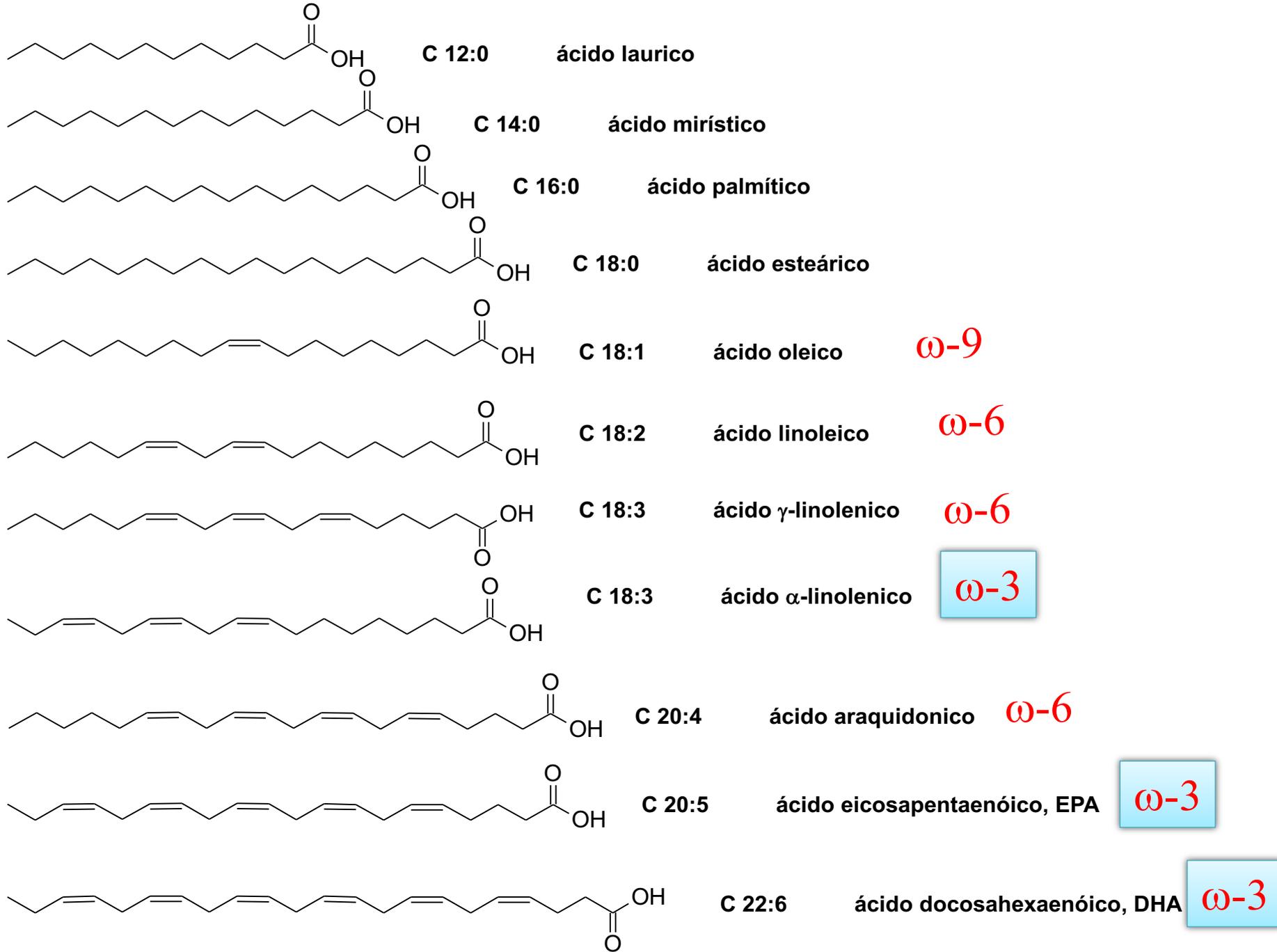
Saturados

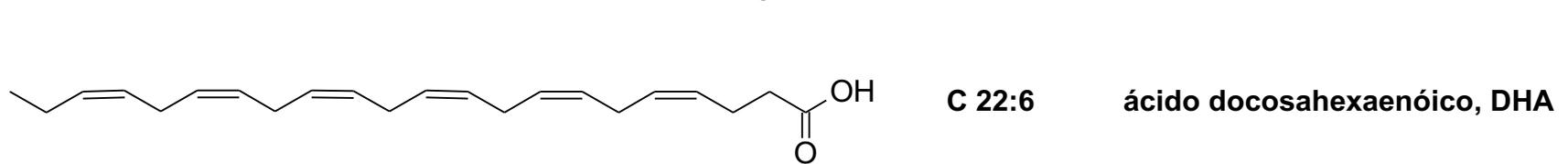
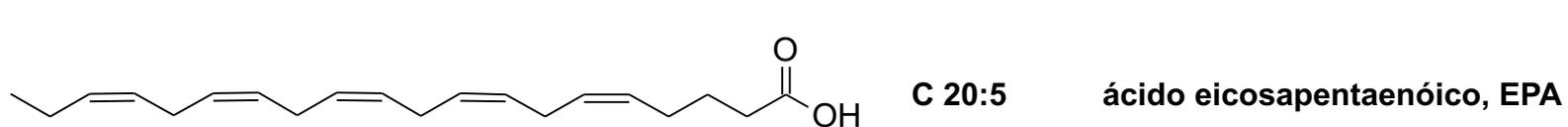
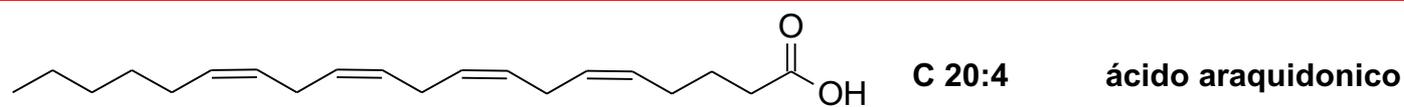
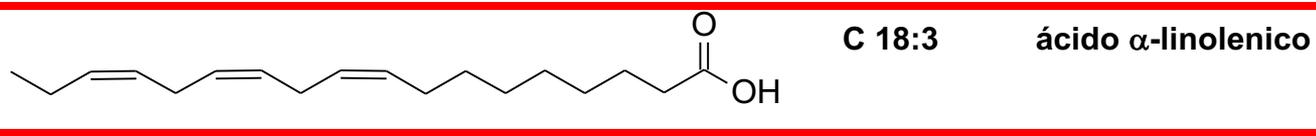
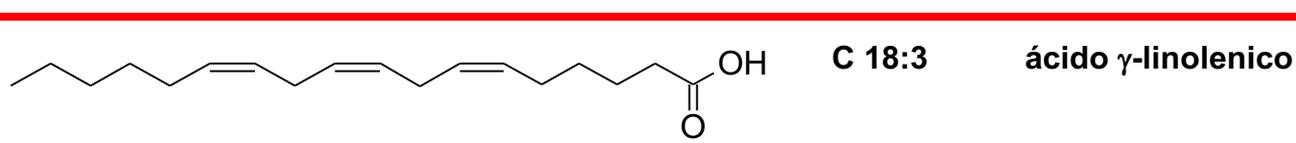
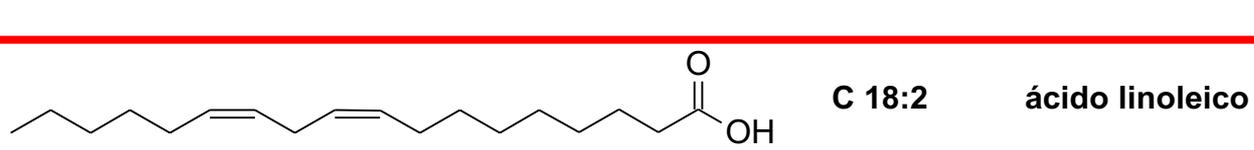
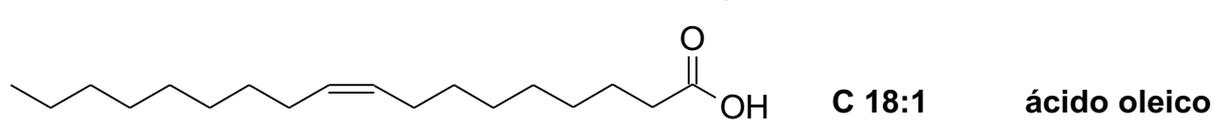
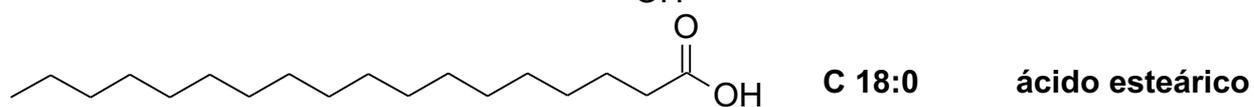
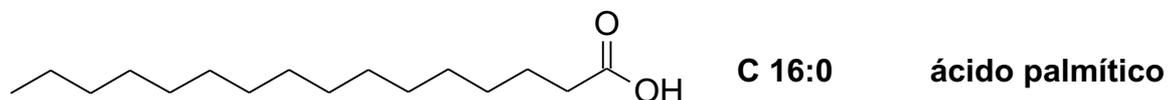
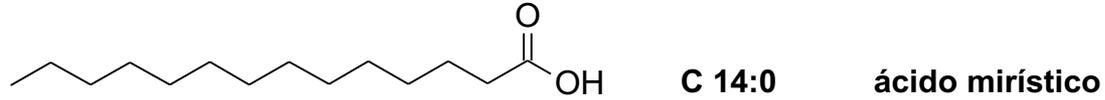
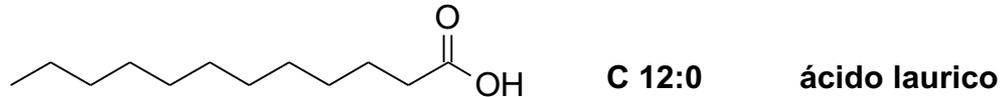


Monoinsaturados



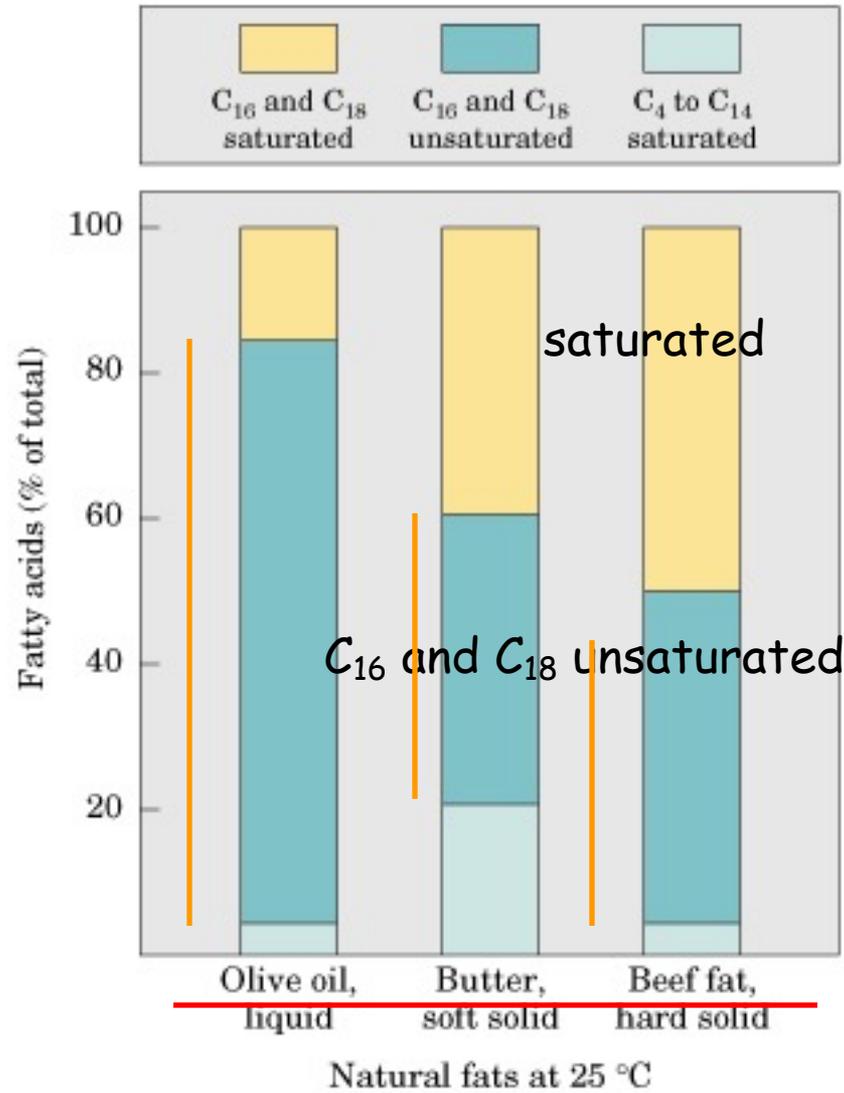
Poliinsaturados





Ac Graxos
Essenciais!!

Fatty acid composition of three food fats



Ácidos Graxos

“TG são excelentes reservas de energia”

- São menos oxidadas do que Carboidratos e Proteínas
- São estocadas de forma “anidra”

Triacilgliceróis

Fosfolipídios

Esteróis

(Colesterol/

Esteres de Colesterol)

Ácidos Graxos

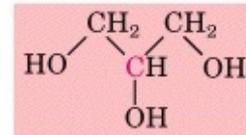
Triacilgliceróis

Fosfolipídios

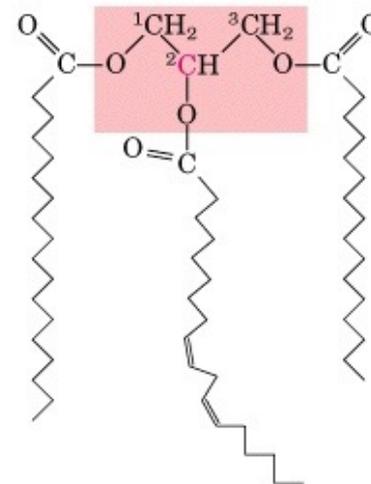
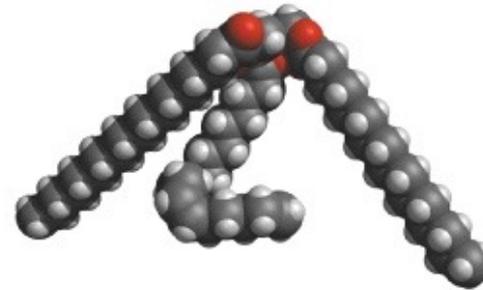
Esteróis

(Colesterol/

Esteres de Colesterol)

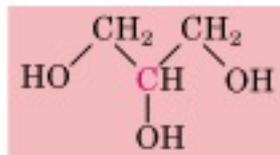


Glycerol



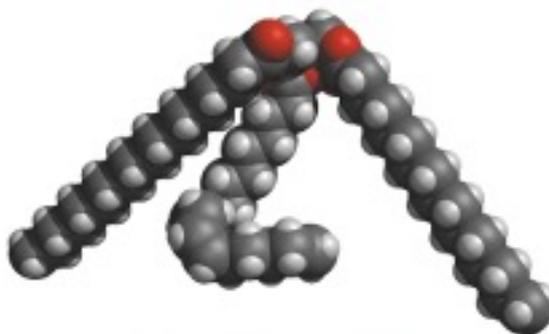
1-Stearoyl, 2-linoleoyl, 3-palmitoyl glycerol,
a mixed triacylglycerol

Lipídios de armazenamento (neutros)



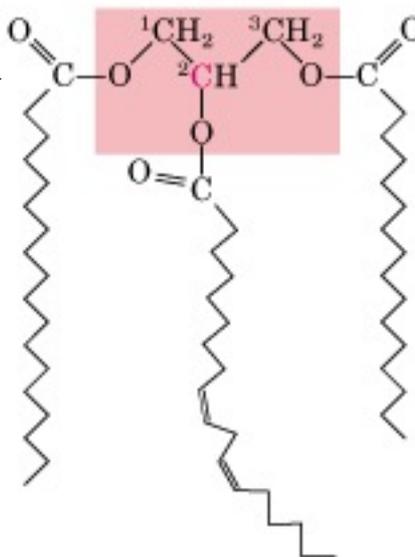
Glycerol

Glicerol



Triacilgliceróis

Glicerol esterificado



Ácido graxo

1-Stearoyl, 2-linoleoyl, 3-palmitoyl glycerol,
a mixed triacylglycerol

Ácido Graxo Ponto de Fusão

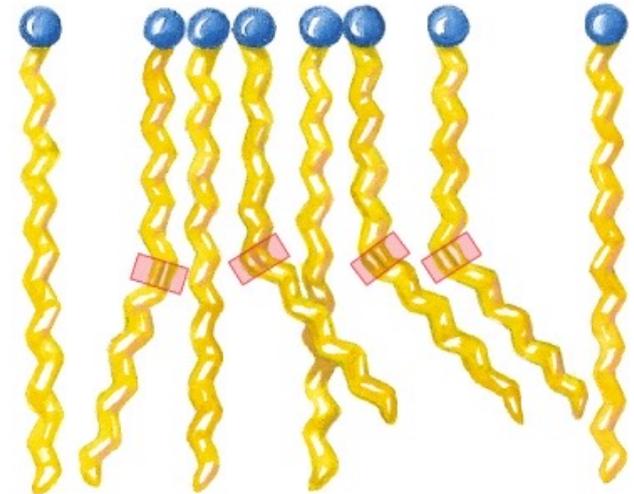
C4:0	-7.9
C6:0	-1.0
C8:0	16.0
C12:0	48
C14:0	58
C16:0	64
C16:1	0.5
C18:0	69.6
C18:1(cis) (oleic)	14
C18:1(trans) (elaidic)	43.7
C18:2	-5.0
C18:3	-11.0

Saturado x Insaturado



Saturated fatty acids

(c)

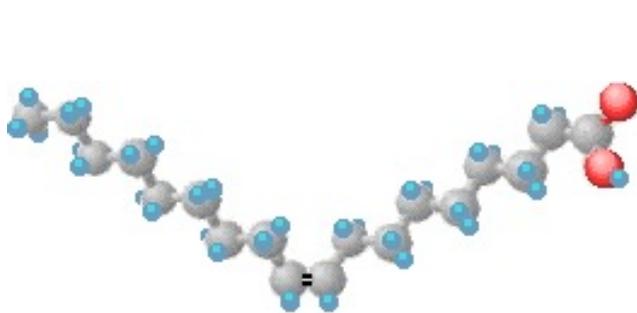


Mixture of saturated and unsaturated fatty acids

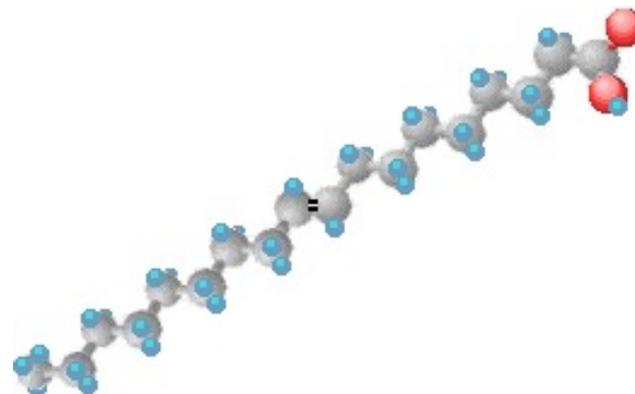
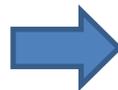
(d)

Ácido Graxo	Ponto de Fusão
C4:0	-7.9
C6:0	-1.0
C8:0	16.0
C12:0	48
C14:0	58
C16:0	64
C16:1	0.5
C18:0	69.6
C18:1(cis) (oleic)	14
C18:1(trans) (elaidic)	43.7
C18:2	-5.0
C18:3	-11.0

Ácidos Graxos Trans adquire características similares à sua forma saturada....



Cis-9-octadecenoic acid
(Oleic acid)



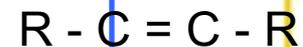
Trans-9-octadecenoic acid
(Elaidic acid)

Alguns ácidos graxos de ocorrência natural

table 11-1

Carbon skeleton	Structure*	Systematic name†	Common name (derivation)	Melting point (°C)	Solubility at 30 °C (mg/g solvent)	
					Water	Benzene
12:0	$\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$	<i>n</i> -Dodecanoic acid	Lauric acid (Latin <i>laurus</i> , "laurel plant")	44.2	0.063	2,600
14:0	$\text{CH}_3(\text{CH}_2)_{12}\text{COOH}$	<i>n</i> -Tetradecanoic acid	Myristic acid (Latin <i>Myristica</i> , nutmeg genus)	53.9	0.024	874
16:0	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$	<i>n</i> -Hexadecanoic acid	Palmitic acid (Latin <i>palma</i> , "palm tree")	63.1	0.0083	348
18:0	$\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$	<i>n</i> -Octadecanoic acid	Stearic acid (Greek <i>stear</i> , "hard fat")	69.6	0.0034	124
20:0	$\text{CH}_3(\text{CH}_2)_{18}\text{COOH}$	<i>n</i> -Eicosanoic acid	Arachidic acid (Latin <i>Arachis</i> , legume genus)	76.5		
24:0	$\text{CH}_3(\text{CH}_2)_{22}\text{COOH}$	<i>n</i> -Tetracosanoic acid	Lignoceric acid (Latin <i>lignum</i> , "wood" + <i>cera</i> , "wax")	86.0		
16:1(Δ ⁹)	$\text{CH}_3(\text{CH}_2)_5\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	<i>cis</i> -9-Hexadecenoic acid	Palmitoleic acid	-0.5		
18:1(Δ ⁹)	$\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	<i>cis</i> -9-Octadecenoic acid	Oleic acid (Latin <i>oleum</i> , "oil")	13.4		
18:2(Δ ^{9,12})	$\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	<i>cis</i> -, <i>cis</i> -9,12-Octadecadienoic acid	Linoleic acid (Greek <i>linon</i> , "flax")	-5		
18:3(Δ ^{9,12,15})	$\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	<i>cis</i> -, <i>cis</i> -, <i>cis</i> -9,12,15-Octadecatrienoic acid	α-Linolenic acid	-11		
20:4(Δ ^{5,8,11,14})	$\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_3\text{COOH}$	<i>cis</i> -, <i>cis</i> -, <i>cis</i> -, <i>cis</i> -5,8,11,14-Icosatetraenoic acid	Arachidonic acid	-49.5		

Iterações hidrofóbicas
Arranjos quase cristalinos



*All acids are shown in their nonionized form. At pH 7, all free fatty acids have an ionized carboxylate. Note that numbering of carbon atoms begins at the carboxyl carbon.

†The prefix *n*- indicates the "normal" unbranched structure. For instance, "dodecanoic" simply indicates 12 carbon atoms, which could be arranged in a variety of branched forms; "*n*-dodecanoic" specifies the linear, unbranched form. For unsaturated fatty acids, the configuration of each double bond is indicated; in biological fatty acids the configuration is almost always *cis*.

Ácidos Graxos

Triacilgliceróis

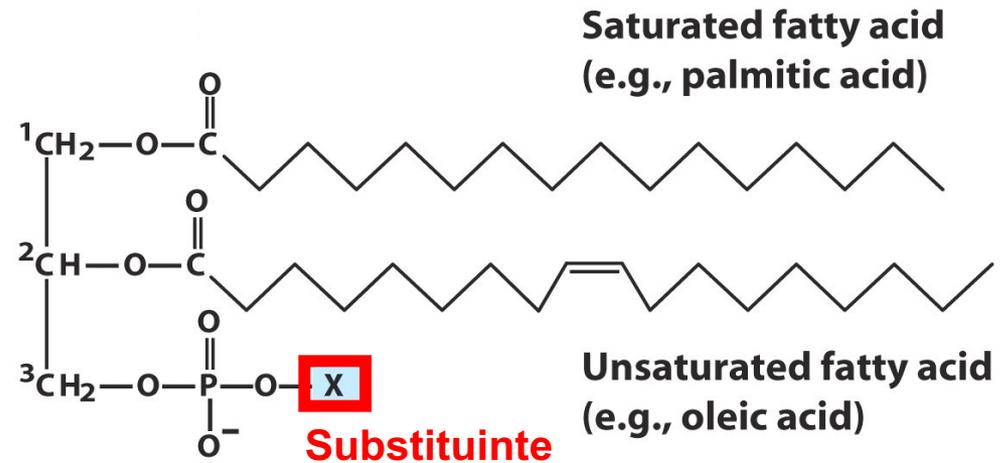
Fosfolípidos

Glicerofosfolípidos

Esteróis

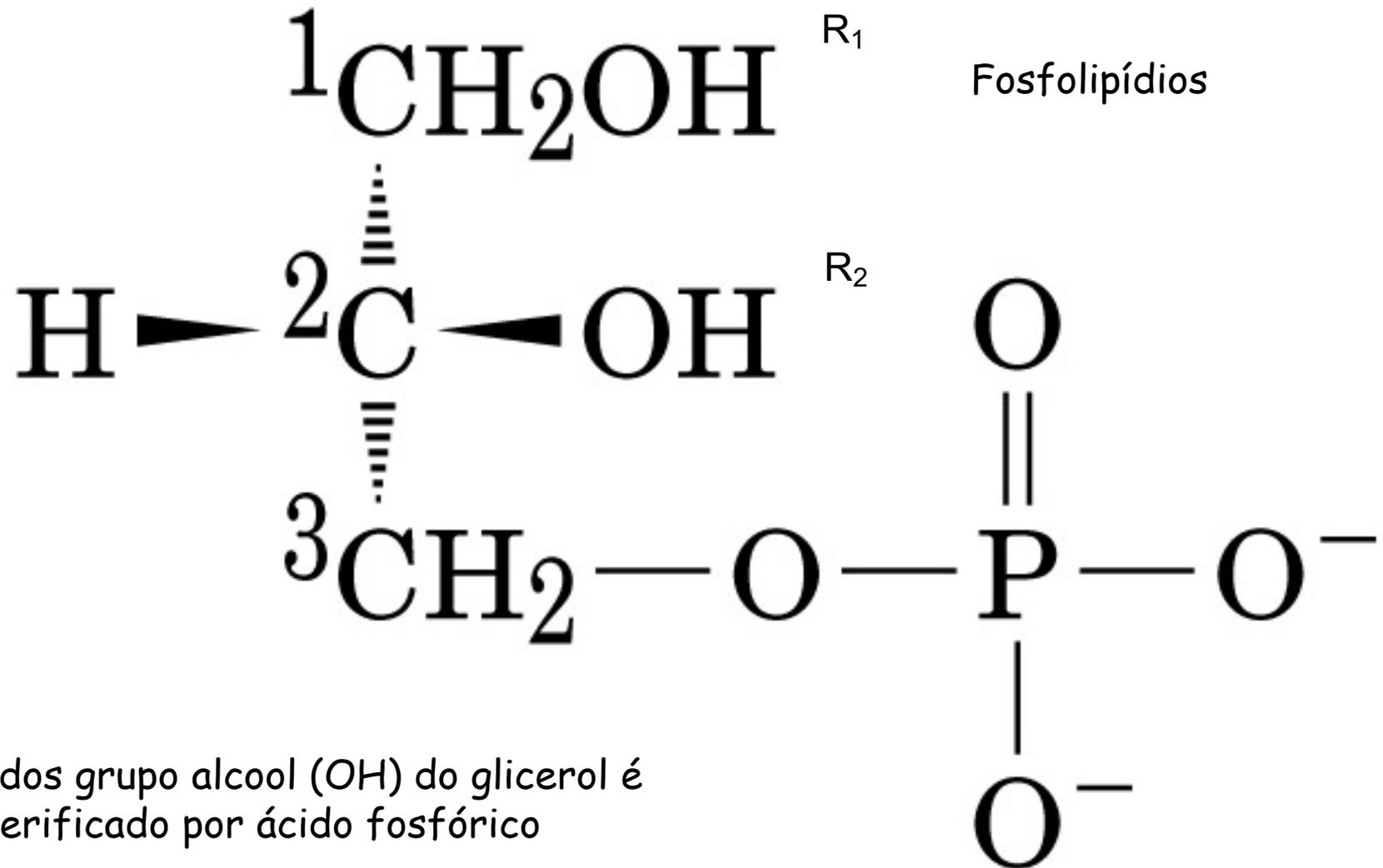
(Colesterol/

Esteres de Colesterol)

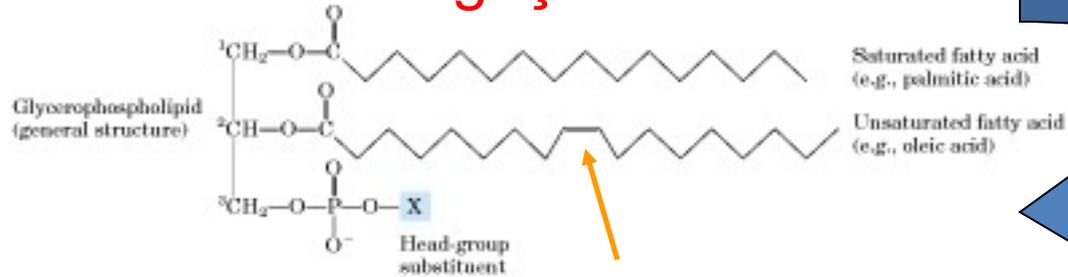


Name of glycerophospholipid	Name of X	Formula of X	Net charge (at pH 7)
Phosphatidic acid	—	— H	- 1
Phosphatidylethanolamine	Ethanolamine	— CH ₂ —CH ₂ —NH ₃ ⁺	0
Phosphatidylcholine	Choline	— CH ₂ —CH ₂ —N ⁺ (CH ₃) ₃	0
Phosphatidylserine	Serine	— CH ₂ —CH—NH ₃ ⁺ COO ⁻	- 1
Phosphatidylglycerol	Glycerol	— CH ₂ —CH—CH ₂ —OH OH	- 1
Phosphatidylinositol 4,5-bisphosphate	<i>myo</i> -Inositol 4,5-bisphosphate		- 4
Cardiolipin	Phosphatidyl-glycerol	— CH ₂ CHOH CH ₂ —O—P(=O)(O ⁻)—O—CH ₂ CH—O—C(=O)—R ¹ CH ₂ —O—C(=O)—R ²	- 2

L-Glycerol 3-phosphate, the backbone of phospholipids



Os glicerofosfolípidios são diacilgliceróis unidos a grupos cabeças alcoólicos através de **ligação fosfodiéster**



Name of glycerophospholipid	Name of X	Formula of X	Net charge (at pH 7)
Phosphatidic acid	—	—H	-1
Phosphatidylethanolamine	Ethanolamine	—CH ₂ —CH ₂ —NH ₃ ⁺	0
Phosphatidylcholine	Choline	—CH ₂ —CH ₂ —N ⁺ (CH ₃) ₃	0
Phosphatidylserine	Serine	—CH ₂ —CH(NH ₃ ⁺)—COO ⁻	-1
Phosphatidylglycerol	Glycerol	—CH ₂ —CH(OH)—CH ₂ —OH	-1
Phosphatidylinositol 4,5-bisphosphate	<i>myo</i> -Inositol 4,5-bisphosphate		-4
Cardiolipin	Phosphatidylglycerol	$ \begin{array}{c} \text{—CH}_2\text{—} \\ \\ \text{CHOH} \\ \\ \text{CH}_2\text{—O—P(=O)(O}^-\text{)—O—CH}_2\text{—} \\ \\ \text{CH—O—C(=O)—R}^1 \\ \\ \text{CH}_2\text{—O—C(=O)—R}^2 \end{array} $	-2

Ácidos Graxos

Triacilgliceróis

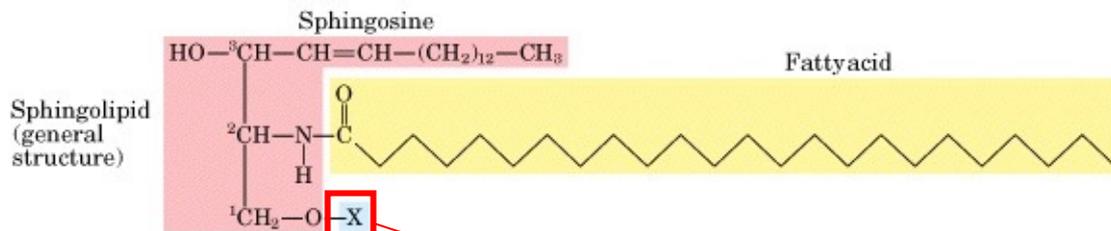
Fosfolipídeos

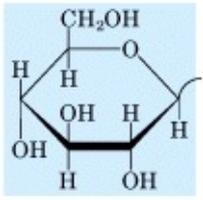
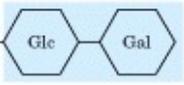
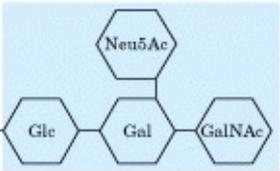
Esfingolipídeos

Esteróis

(Colesterol/

Esteres de Colesterol)



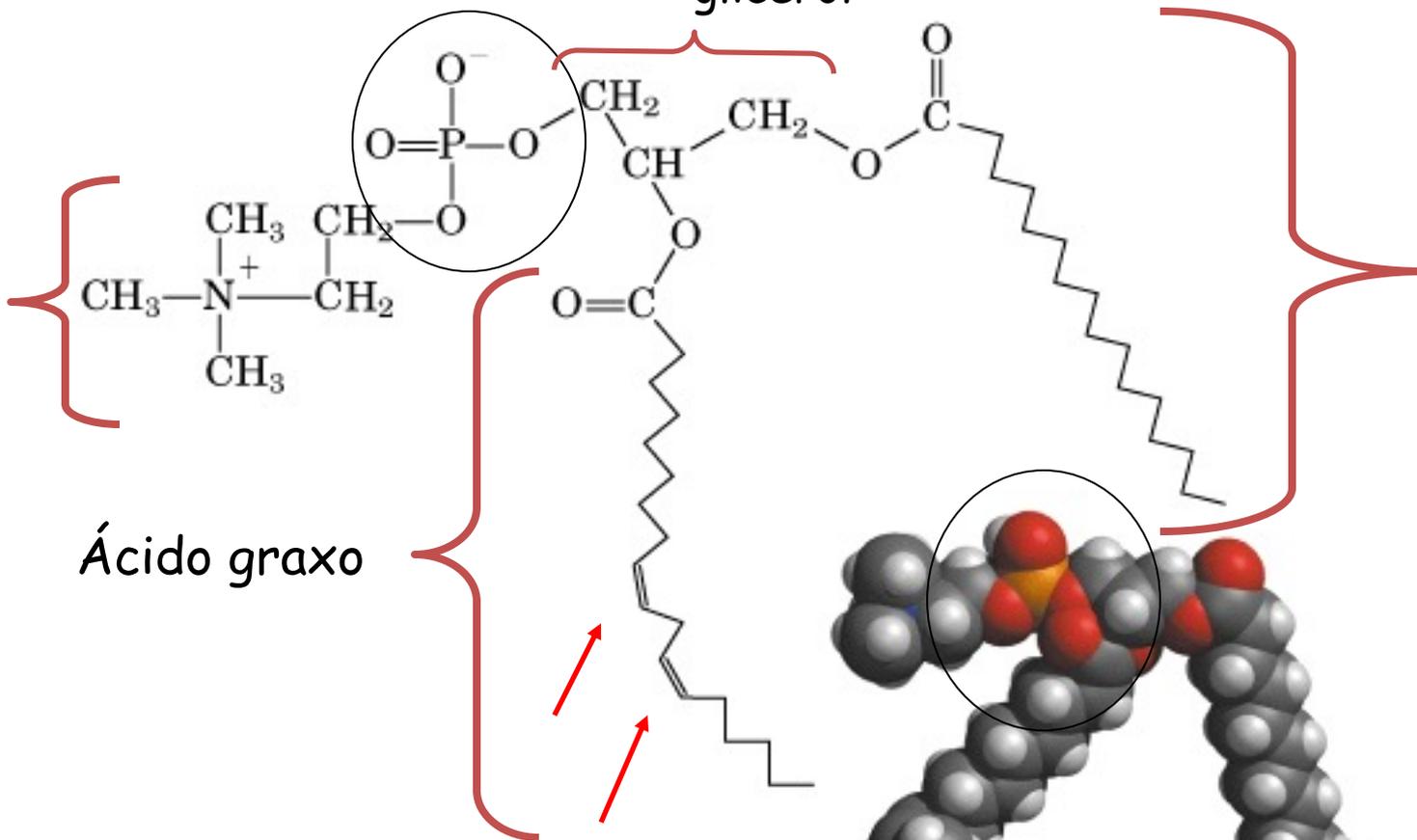
Name of sphingolipid	Name of X	Formula of X
Ceramide	—	— H
Sphingomyelin	Phosphocholine	$-\text{P}(=\text{O})(\text{O}^-)-\text{O}-\text{CH}_2-\text{CH}_2-\text{N}^+(\text{CH}_3)_3$
Neutral glycolipids Glucosylcerebroside Cerebrosídeos	Glucose	
Lactosylceramide (a globoside)	Di-, tri-, or tetrasaccharide	
Ganglioside GM2 Gangliosídeos	Complex oligosaccharide	

Glicolipídeos

Fosfatidilcolina

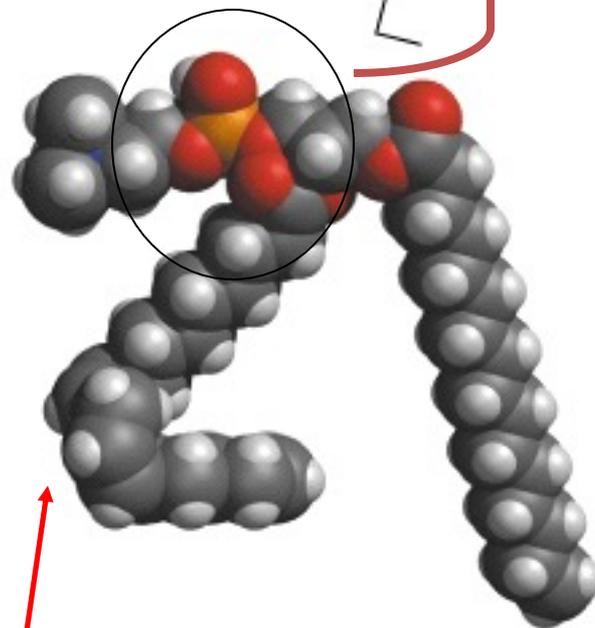
glicerol

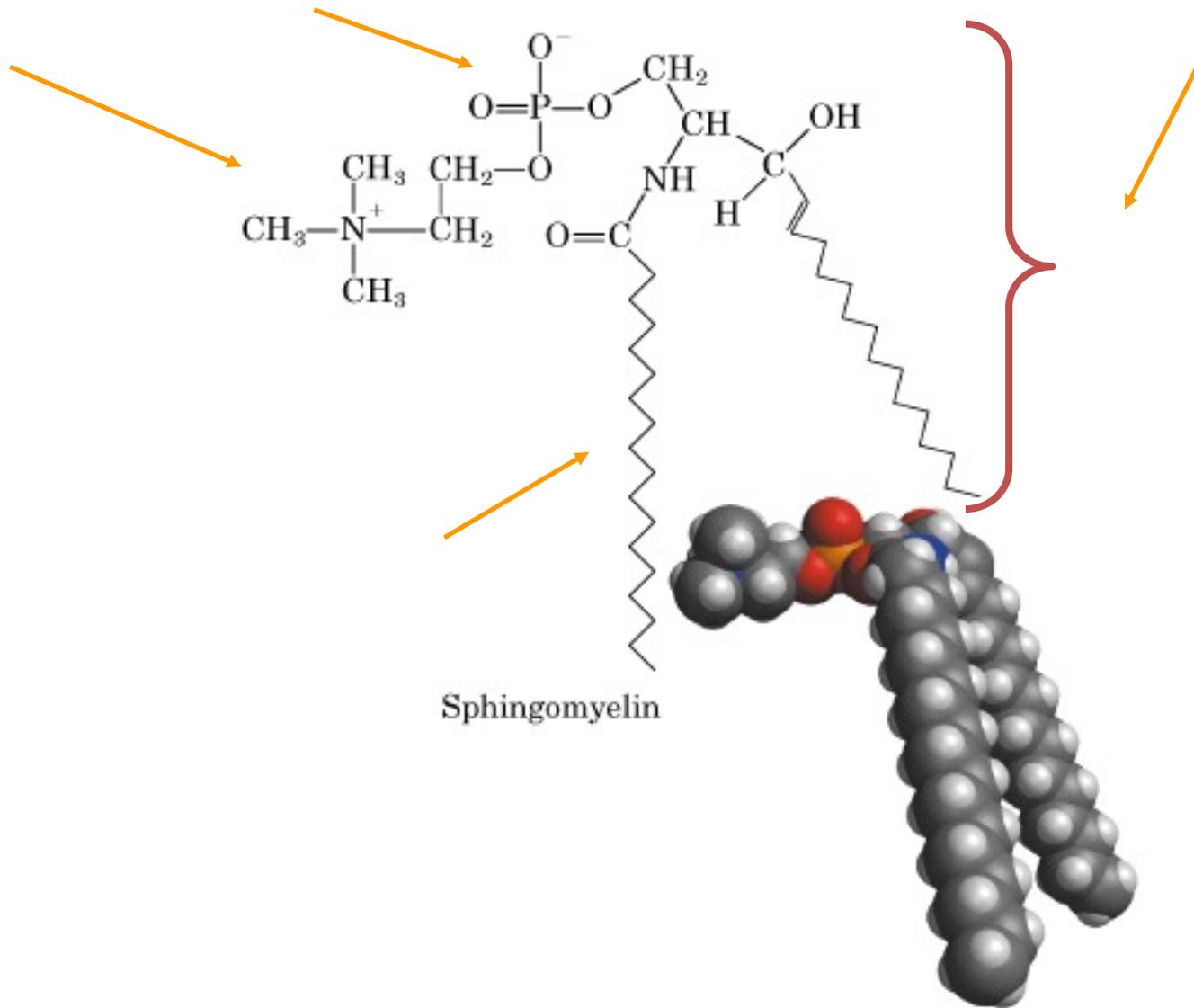
colina



Ácido graxo

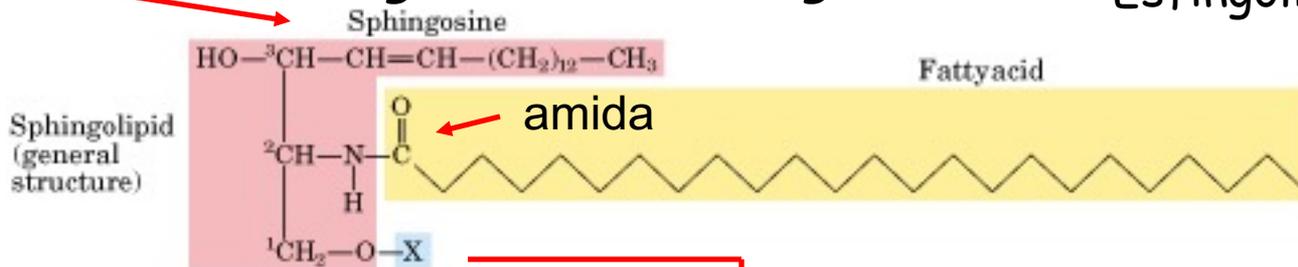
Phosphatidylcholine





Esfingosina + Ácido graxo

Esfingolipídios



Não contem Glicerol em sua molécula

! Membranas de Celulas nervosas

Name of sphingolipid	Name of X	Formula of X
Ceramide	—	— H
Sphingomyelin	Phosphocholine	$\begin{array}{c} \text{O} \\ \\ \text{P}-\text{O}-\text{CH}_2-\text{CH}_2-\text{N}^+(\text{CH}_3)_3 \\ \\ \text{O}^- \end{array}$
Neutral glycolipids Glucosylcerebroside	Glucose	
Lactosylceramide (a globoside)	Di-, tri-, or tetrasaccharide	
Ganglioside GM2	Complex oligosaccharide	

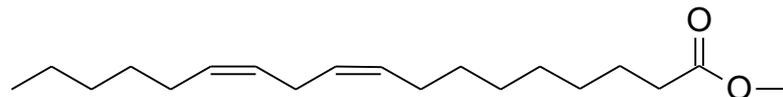
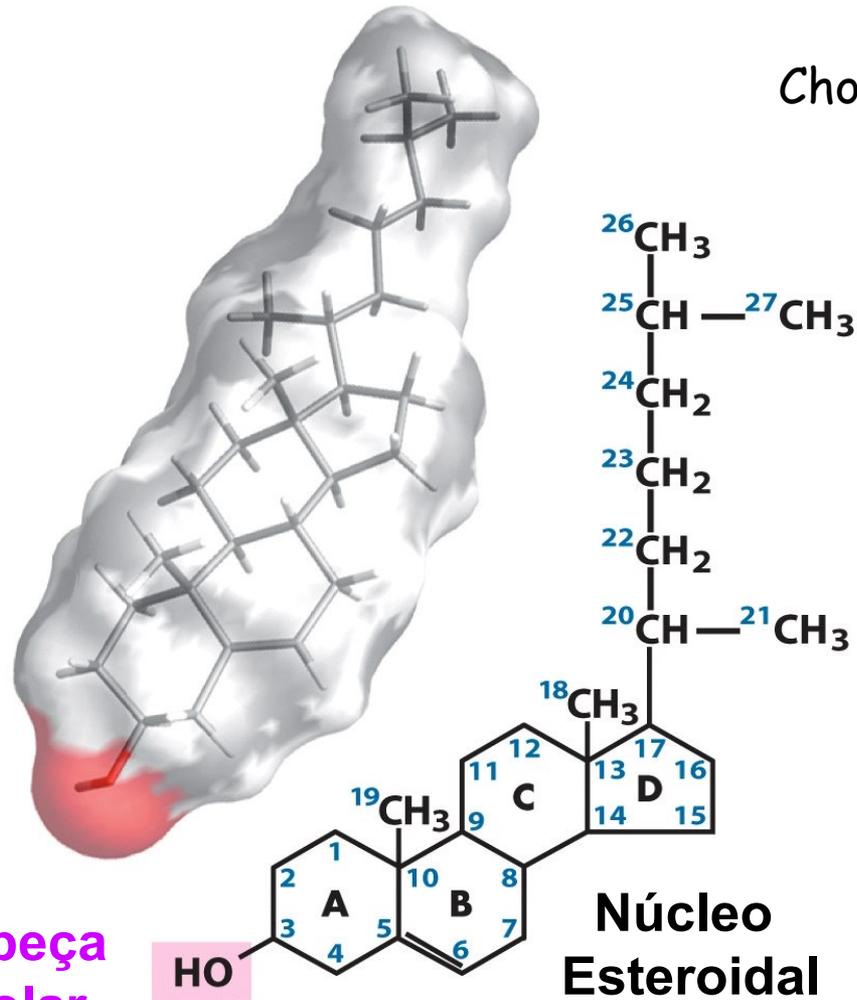
Cholesterol

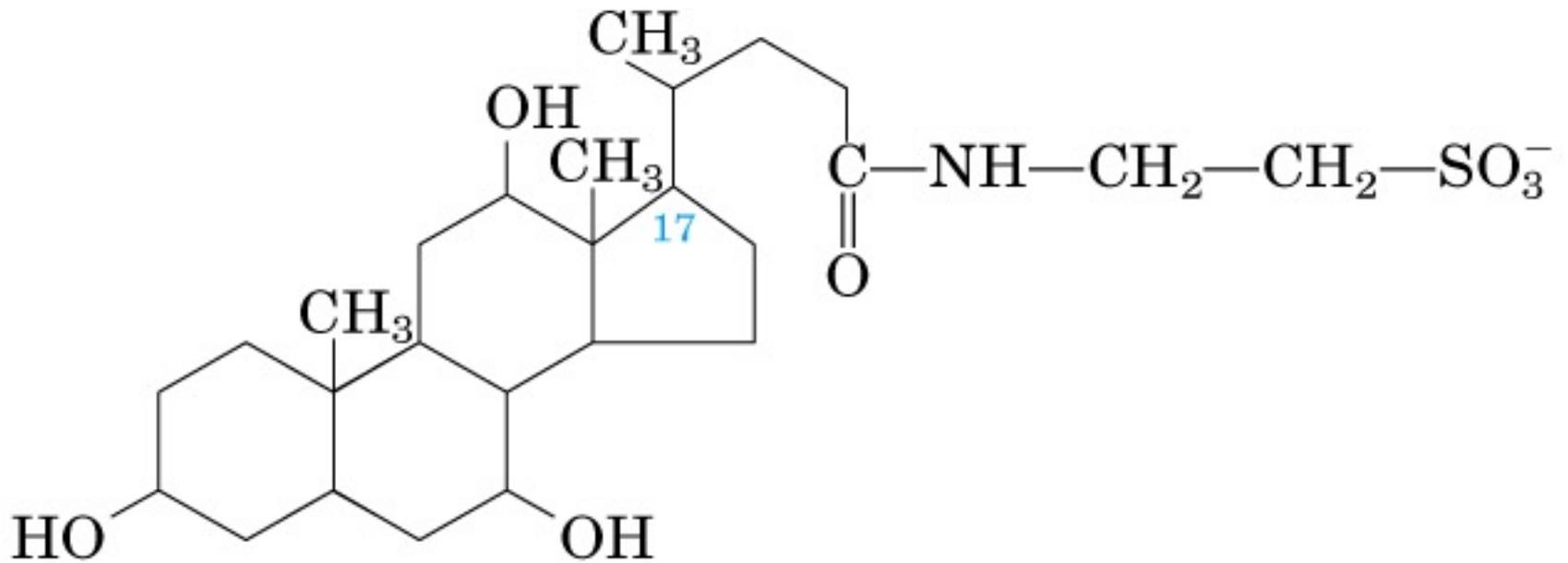
Ácidos Graxos

Triacilgliceróis

Fosfolipídios

**Esteróis
(Colesterol/
Esteres de Colesterol)**

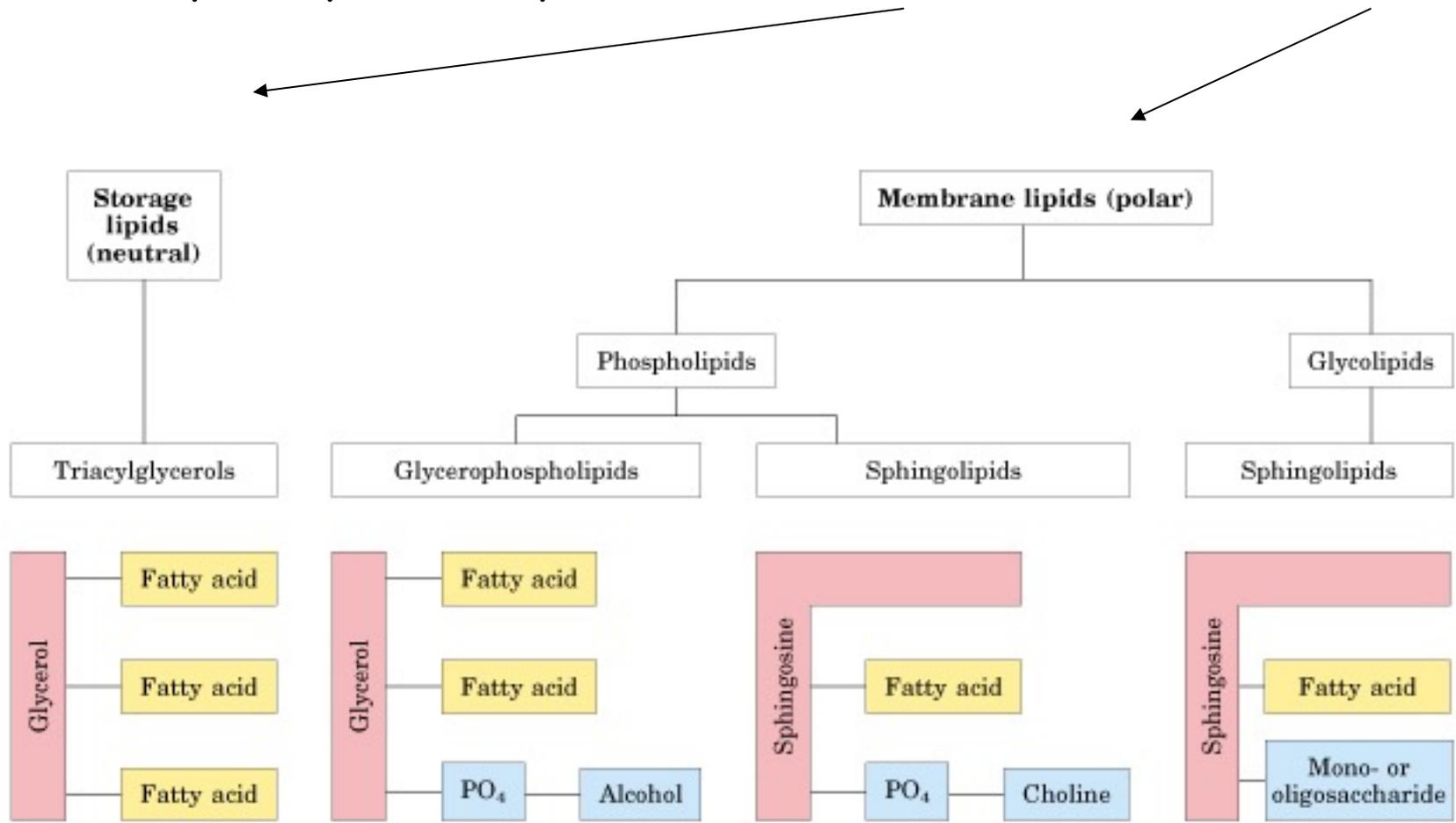




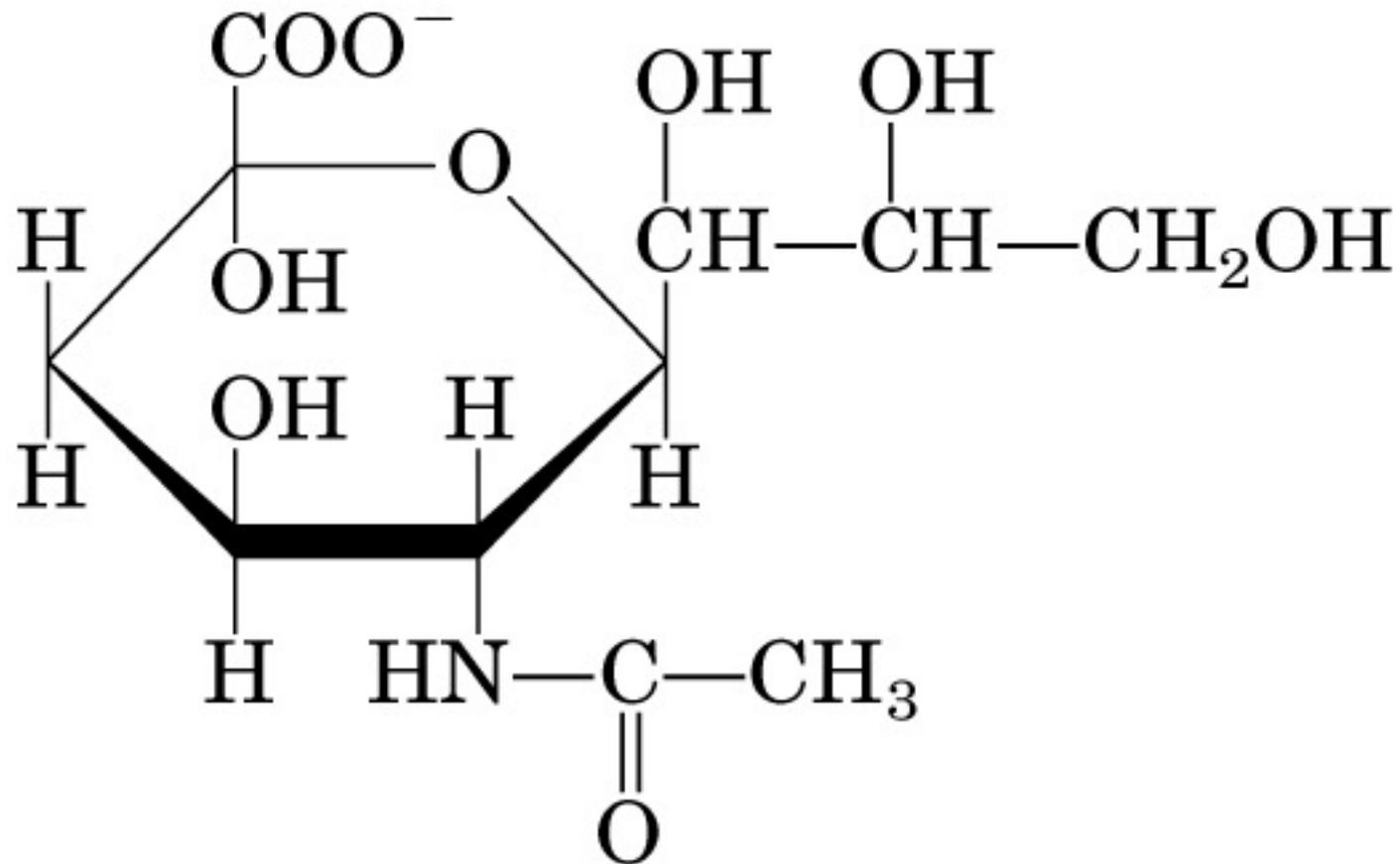
Taurocholic acid
(a bile acid)

Act as detergents in the intestine, emulsifying dietary fats

As classes principais de lipídios de armazenamento e de membrana



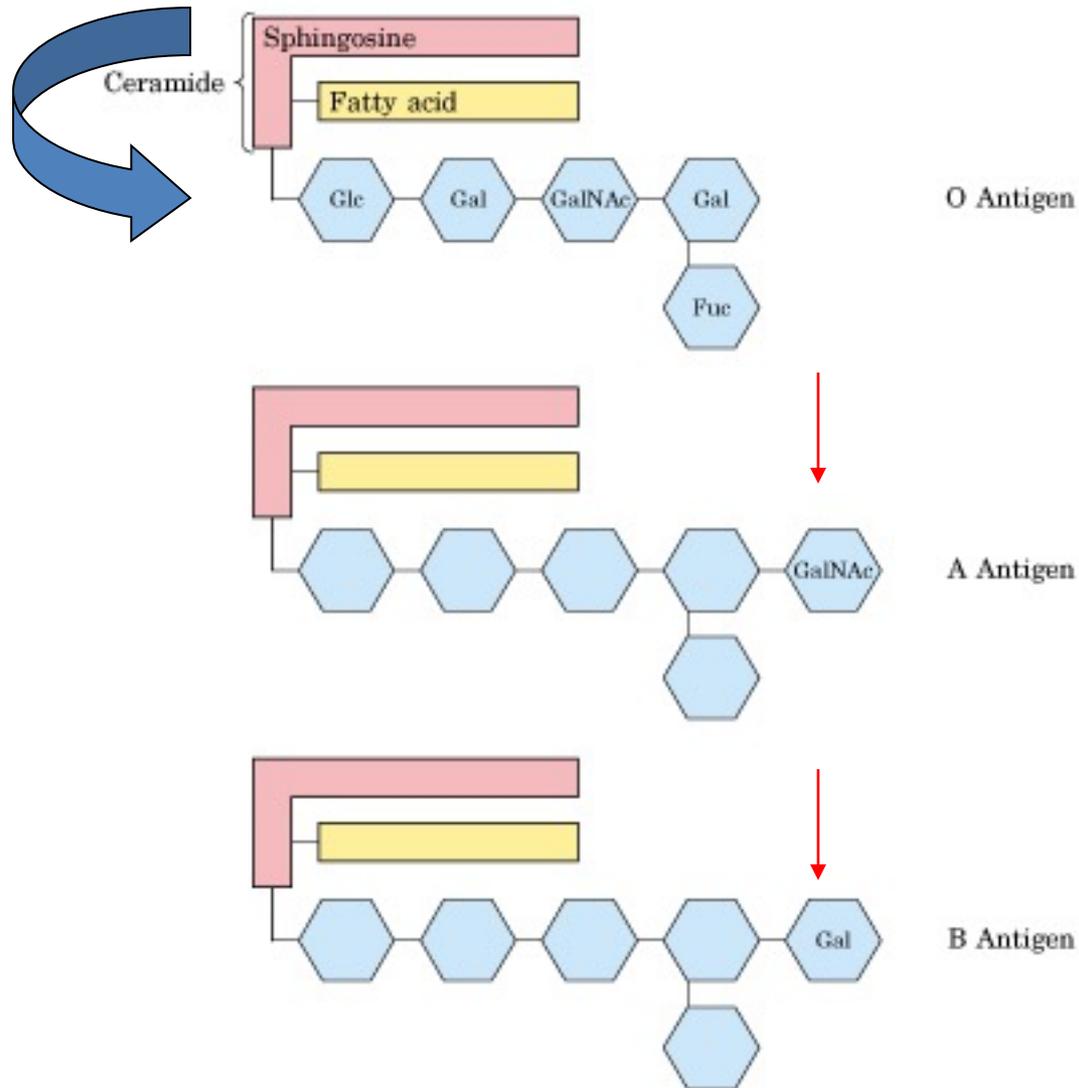
Gangliosides = complex sphingolipids



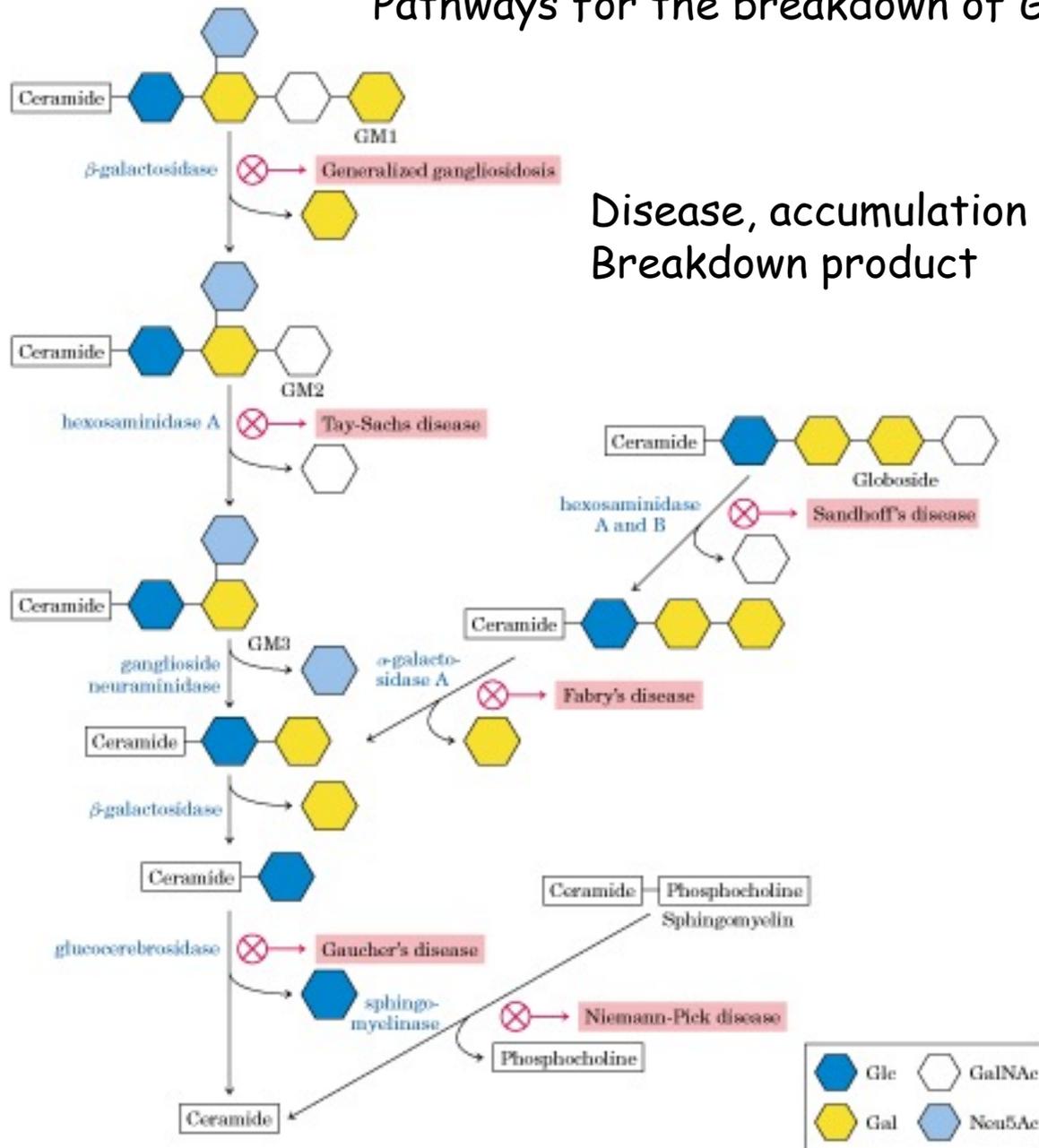
N-Acetylneuraminic acid (sialic acid)
(Neu5Ac)

Glicoesfingolipídios

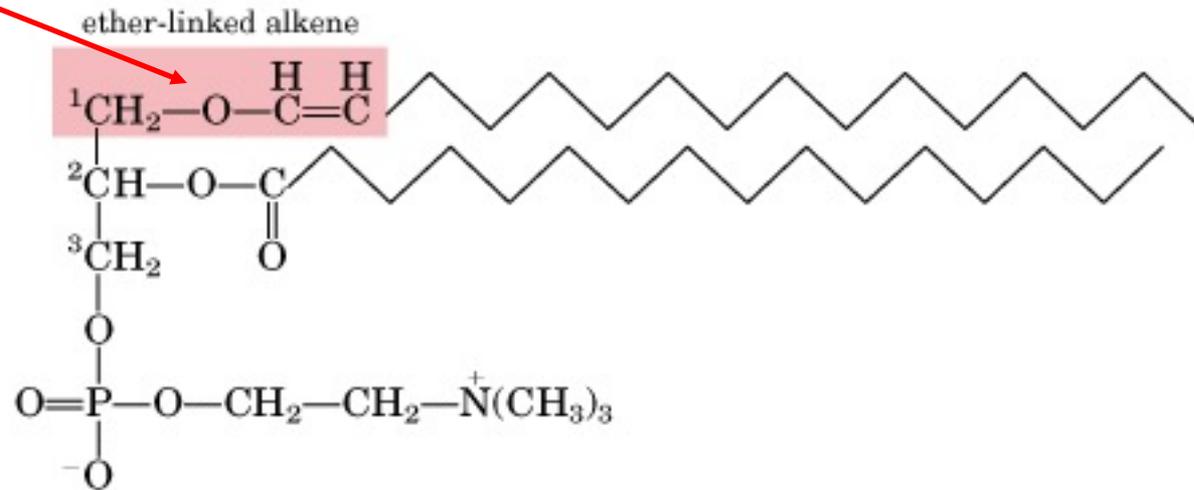
Os grupos sanguíneos humanos O, A, B são, em parte, determinados
Pela composição em açúcares dos grupos cabeça polares destes Glicoesfingolipídios



Pathways for the breakdown of GM1



Disease, accumulation of the partial Breakdown product



Plasmalogen



Platelet-activating factor

Phosphatidylinositols act as intracellular signals

