

Funzioni dei **lipidi**:

1. Riserva energetica
2. Componenti delle membrane cellulari
3. Altro (ormoni, vitamine, prostaglandine etc.)

Struttura generale dei **lipidi**:

Testa polare, idrofilica

Coda apolare, idrofobica

**Storage
lipids
(neutral)**

Triacylglycerols

Glycerol

Fatty acid

Fatty acid

Fatty acid

Membrane lipids (polar)

Phospholipids

Glycerophospholipids

Glycerol

Fatty acid

Fatty acid

PO₄

Alcohol

Sphingolipids

Sphingosine

Fatty acid

PO₄

Choline

Glycolipids

Sphingolipids

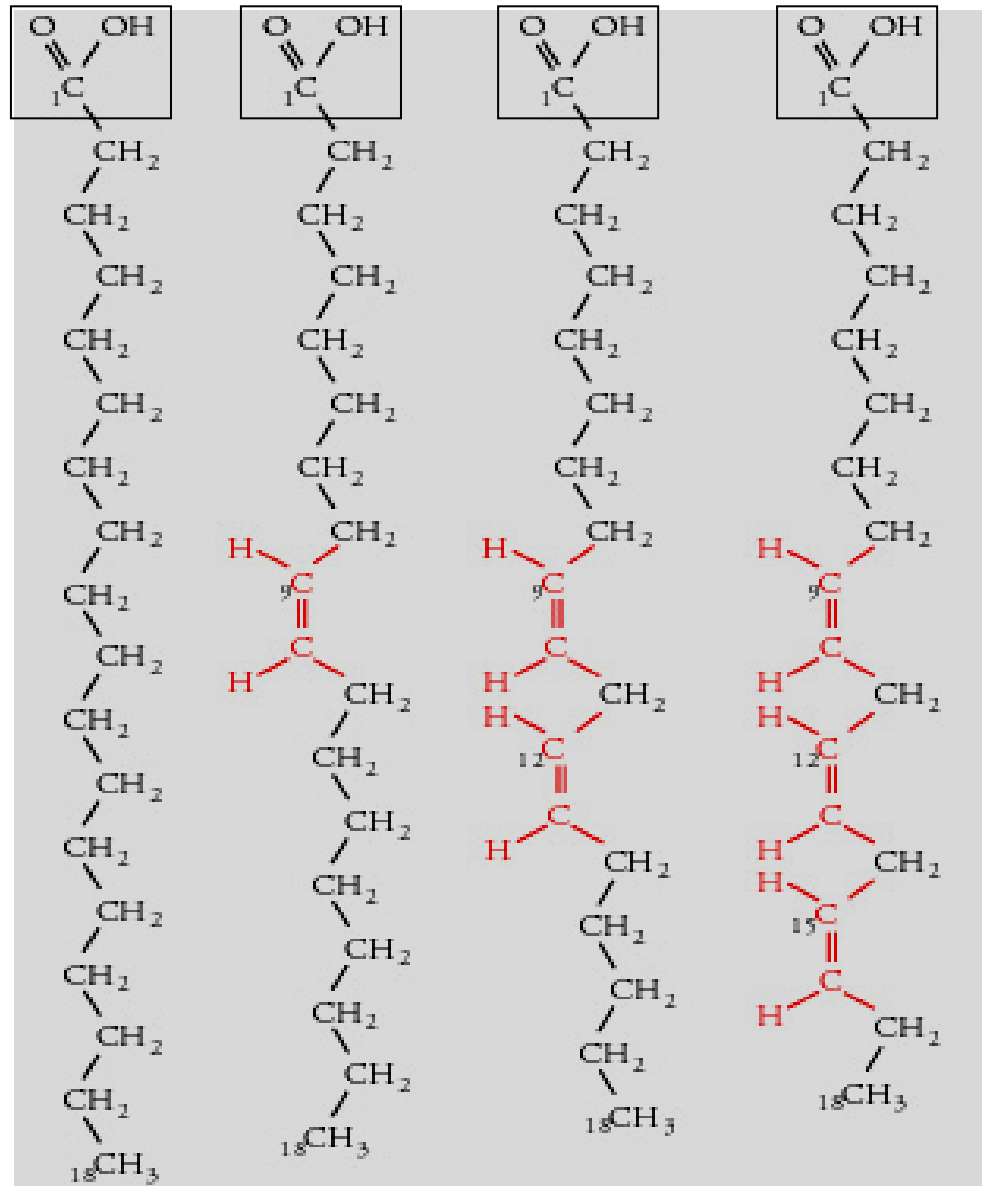
Sphingosine

Fatty acid

Mono- or
oligosaccharide

A: Acidi grassi

La > parte ha n°
di atomi C pari



Stearico

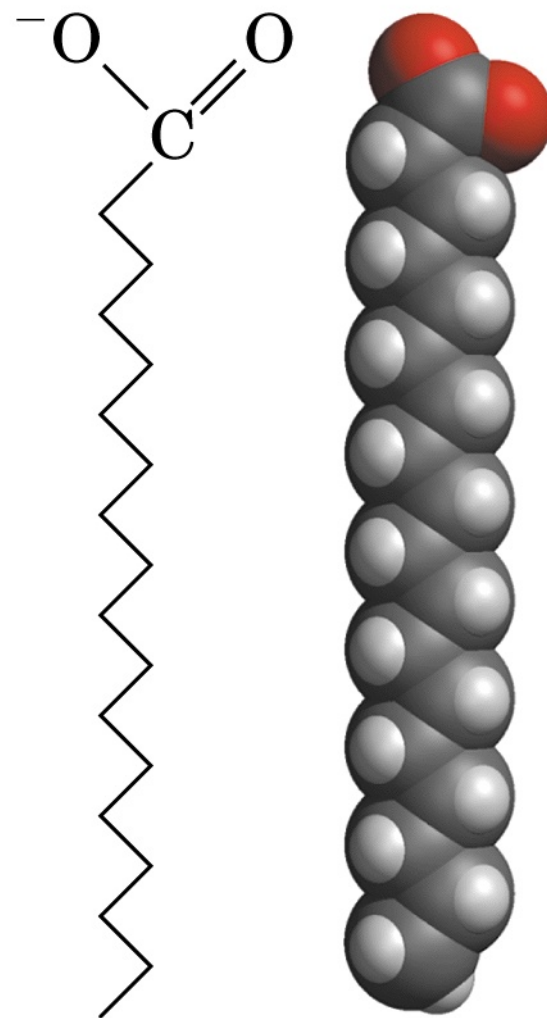
oleico

linoleico

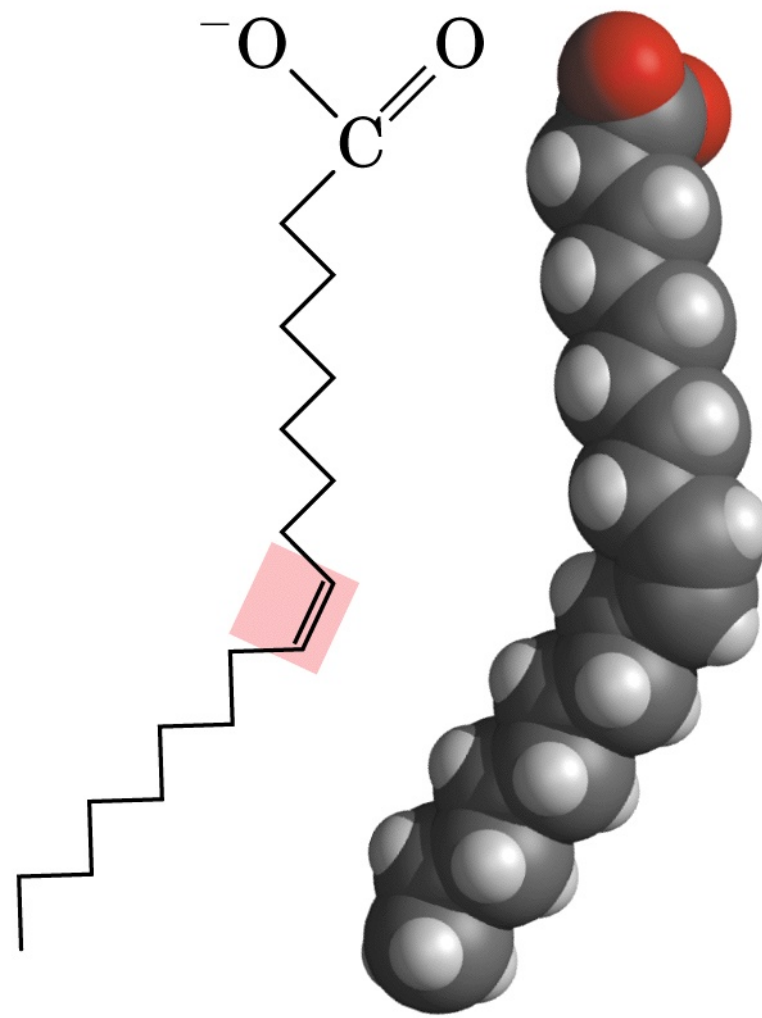
α-linoleico

Carboxyl
group

Hydrocarbon
chain



(a) Stearato



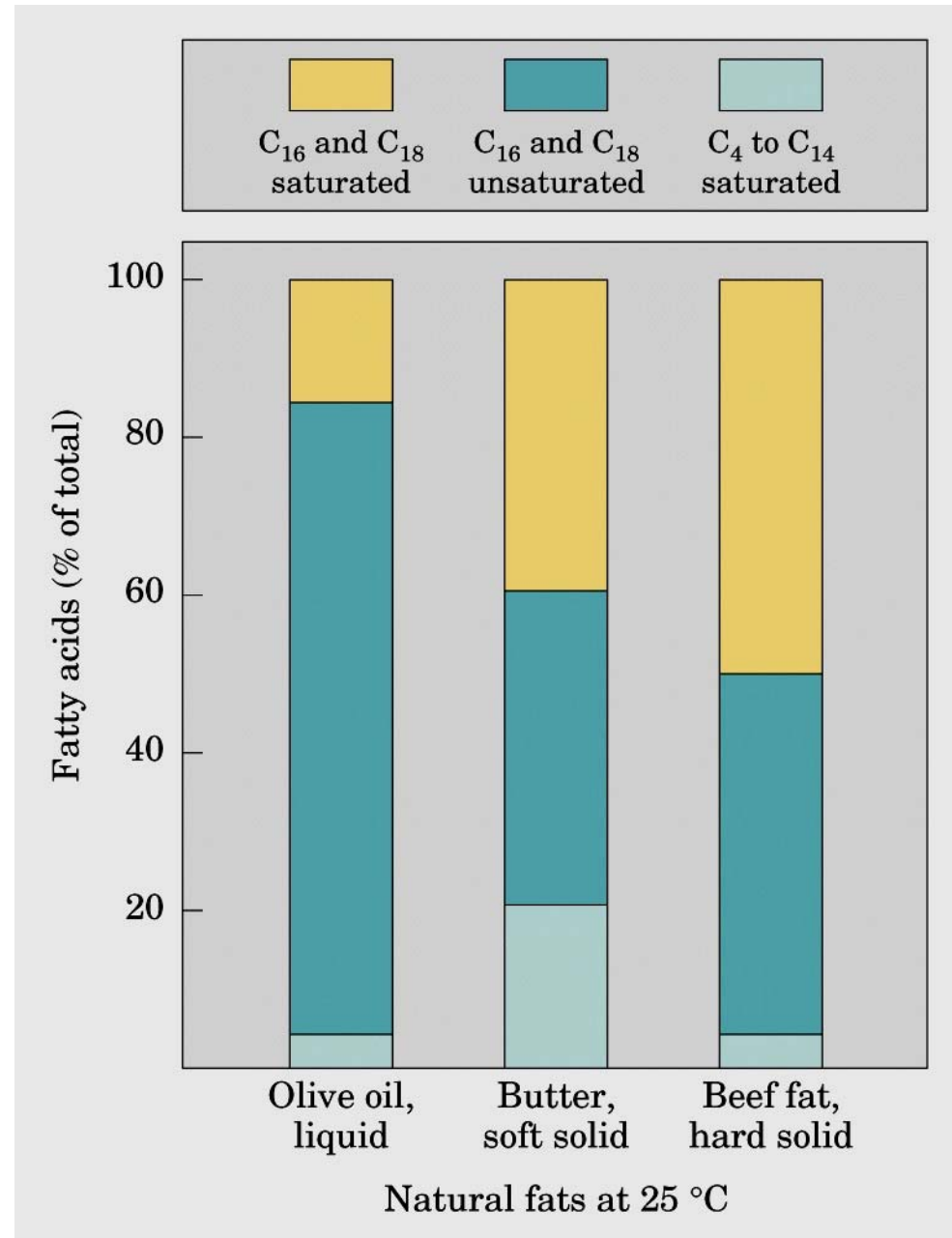
(b) Oleato

Formula generale : $\text{CH}_3(\text{CH}_2)_n\text{COOH}$

Tabella 9.1. Gli acidi grassi più comuni nel mondo biologico

<i>Simbolo</i> ¹	<i>Nome comune</i>	<i>Nome sistematico</i>	<i>Punto di fusione (°C)</i>
<i>Acidi grassi saturi</i>			
12:0	Acido laurico	Acido dodecanoico	44,2
14:0	Acido miristico	Acido tetradecanoico	52
16:0	Acido palmitico	Acido esadecanoico	63,1
18:0	Acido stearico	Acido ottadecanoico	69,1
20:0	Acido arachidico	Acido eicosanoico	75,4
22:0	Acido beenico	Acido docosanoico	81
24:0	Acido lignoceric	Acido tetracosanoico	84,2
<i>Acidi grassi insaturi (tutti i doppi legami sono cis)</i>			
16:1	Acido palmitoleico	Acido 9-esadecenoico	-0,5
18:1	Acido oleico	Acido 9-ottadecenoico	13,2
18:2	Acido linoleico	Acido 9,12-ottadecadienoico	-9
18:3	Acido α-linolenico	Acido 9,12,15-ottadecatrienoico	-17
18:3	Acido γ-linolenico	Acido 6, 9,12-ottadecatrienoico	
20:4	Acido arachidonico	Acido 5,8,11,14-eicosatetraenoico	-49,5
20:5	EPA	Acido 5,8,11,14,17-eicosapentenoico	-54
24:1	Acido nervonico	Acido 15-tetracosenoico	39

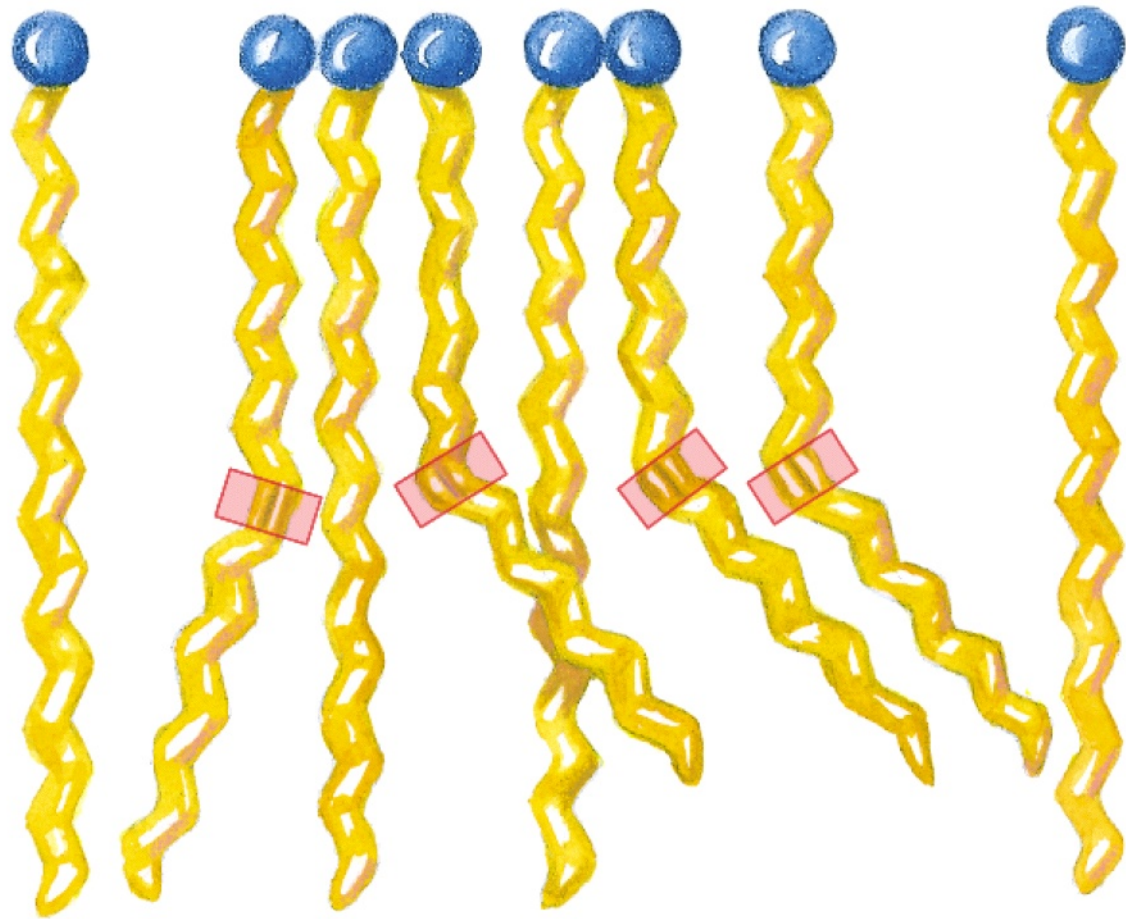
1. Numero degli atomi di carbonio : Numero dei doppi legami.





Saturated
fatty acids

(c)

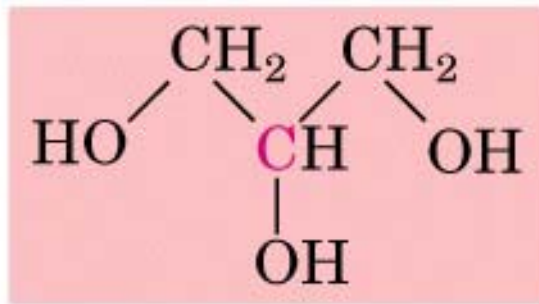


Mixture of saturated and
unsaturated fatty acids

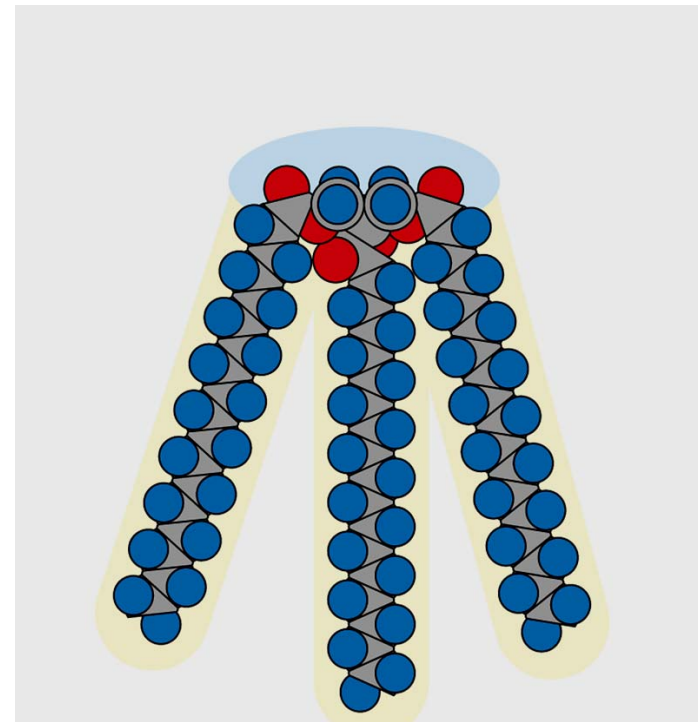
(d)

B: Triacilgliceroli

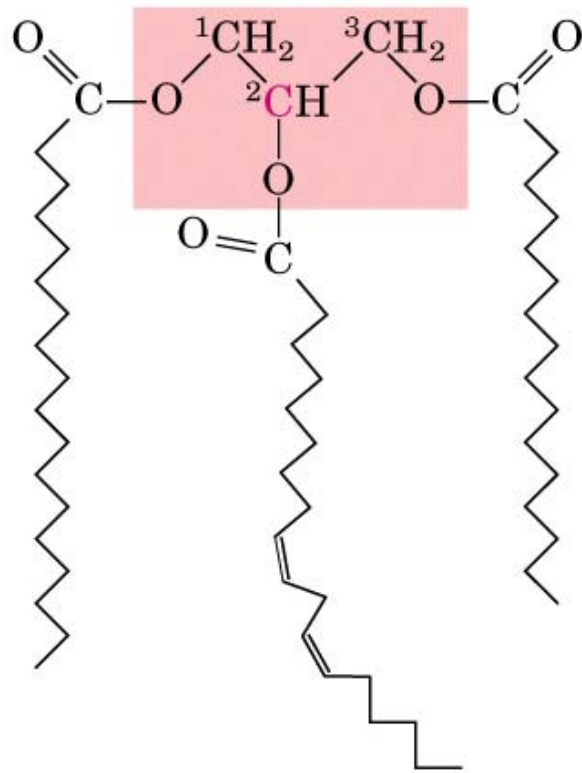
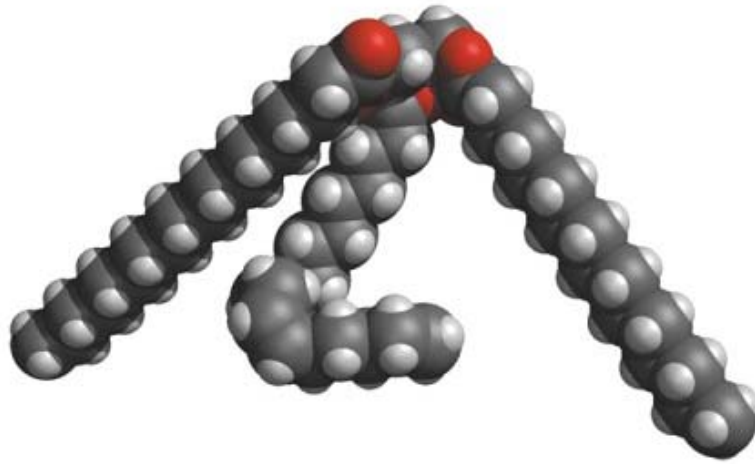
Sono **triesteri** degli acidi grassi e del glicerolo



Glycerol



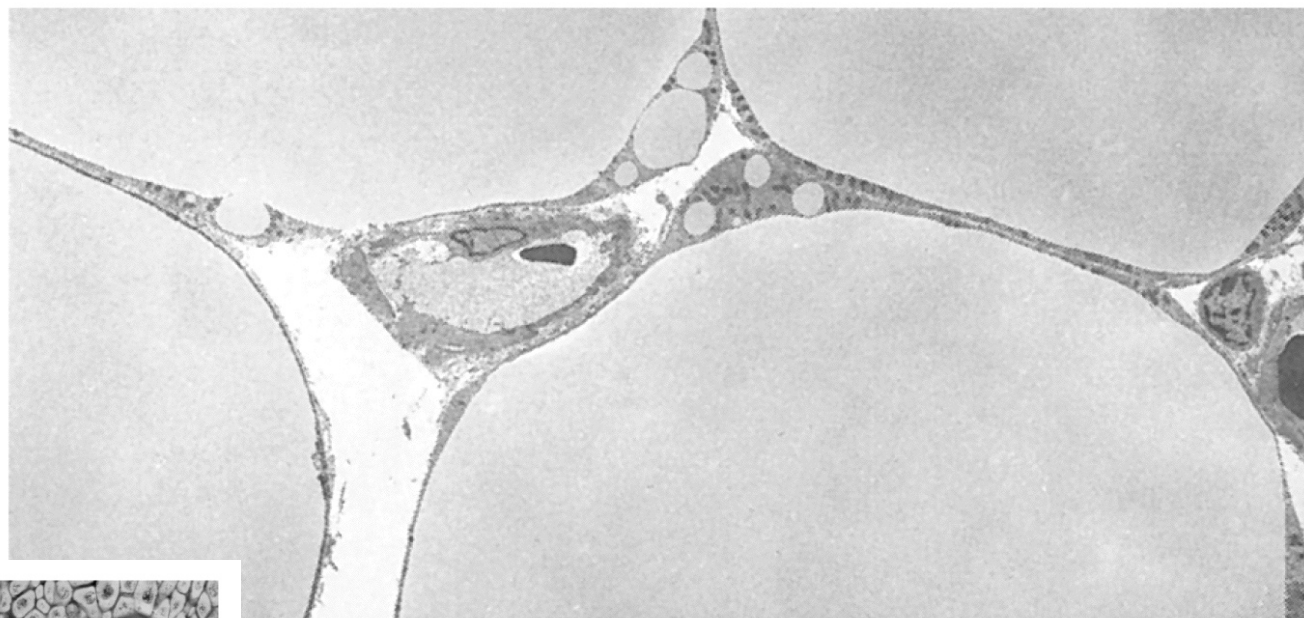
Tristearina, un trigliceride
semplice (catene uguali)



1-palmitoleil-2-linoleil-
3-stearil-glicerolo, un trigliceride
misto (catene diverse)

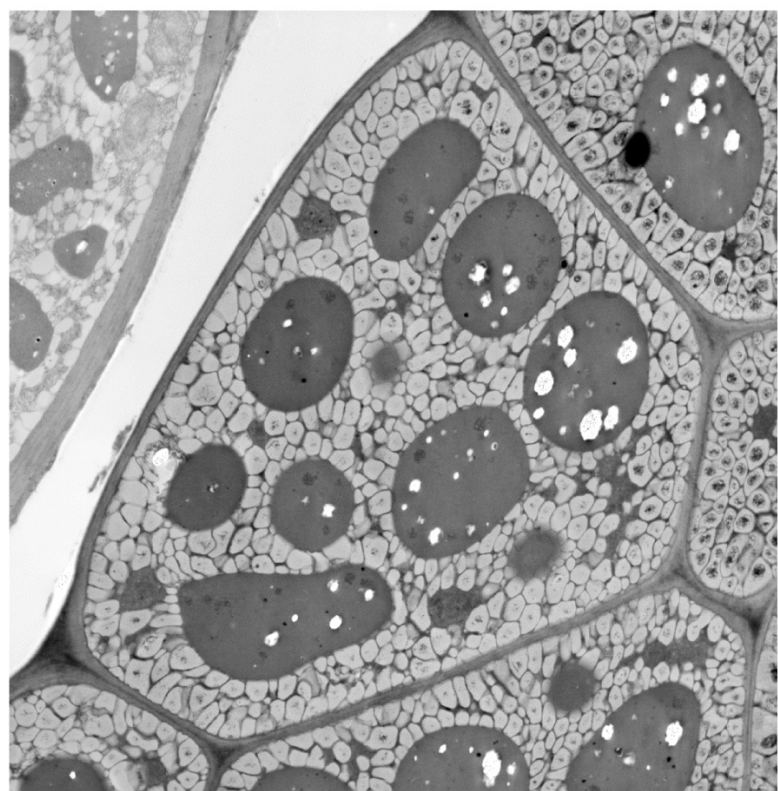
I trigliceridi hanno funzione di **riserva** per

1. Produzione di energia
2. Produzione di calore (grasso bruno)
3. Isolamento (pannicolo adiposo, grasso di balena)



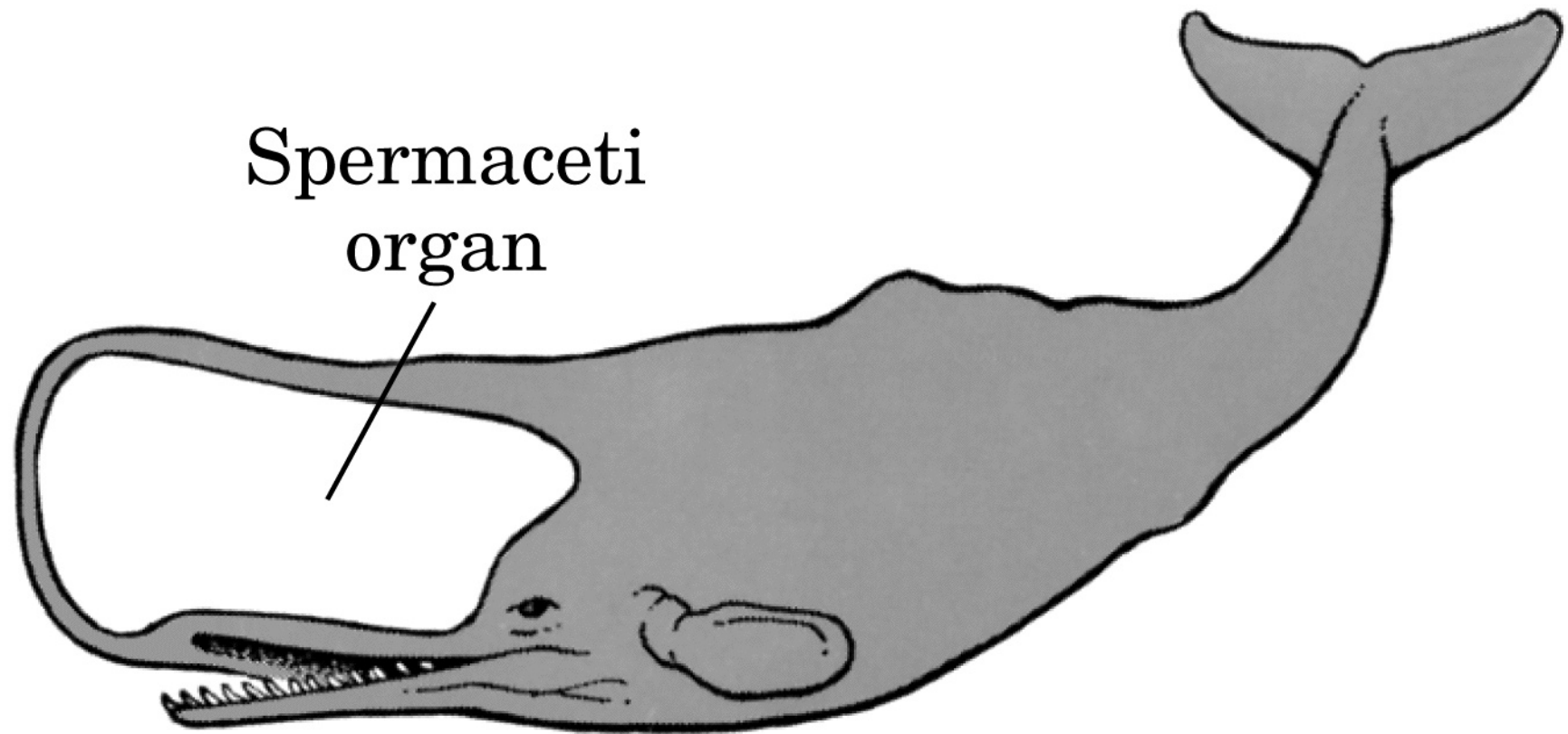
(a)

8 μ m



(b)

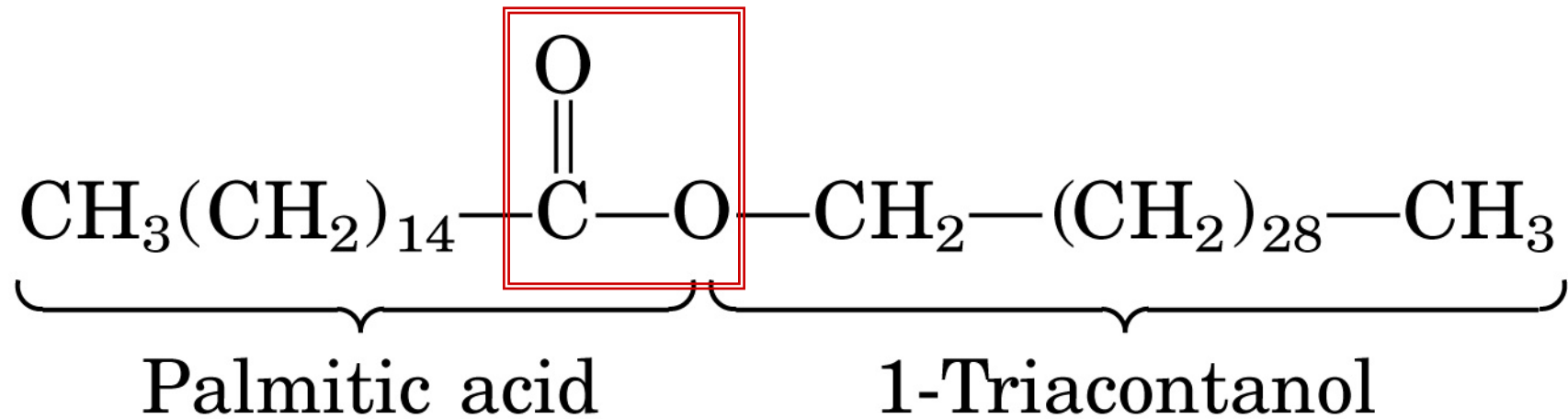
3 μ m



Spermaceti
organ

Le **cere**:

esteri di acidi grassi a lunga catena (14-36 C)
e alcoli alunga catena (16-30 C)

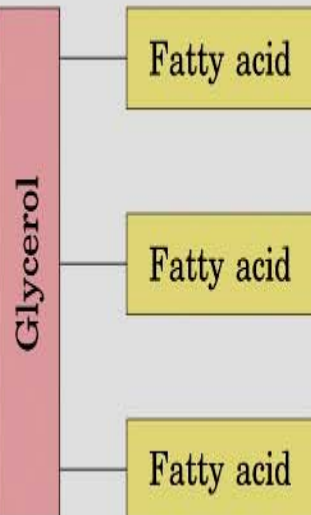


(a) tricontanilpalmitato

La **testa polare** è estremamente
ridotta → le cere sono idrorepellenti
ed insolubili in acqua

**Storage
lipids
(neutral)**

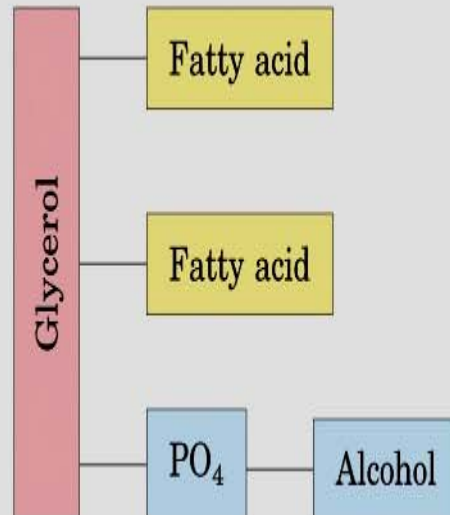
Triacylglycerols



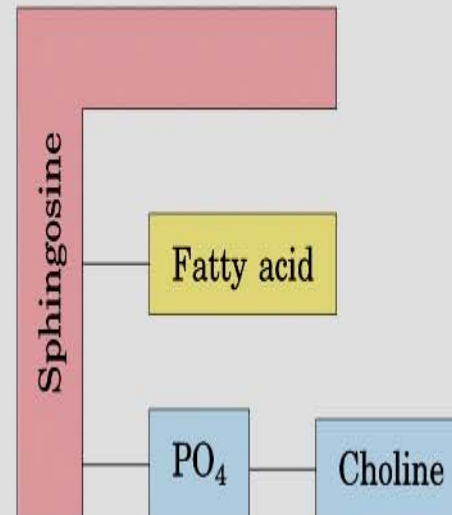
Membrane lipids (polar)

Phospholipids

Glycerophospholipids

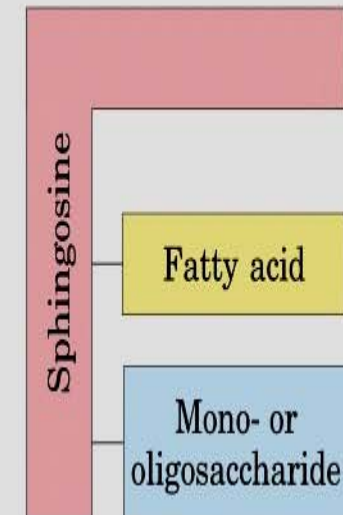


Sphingolipids

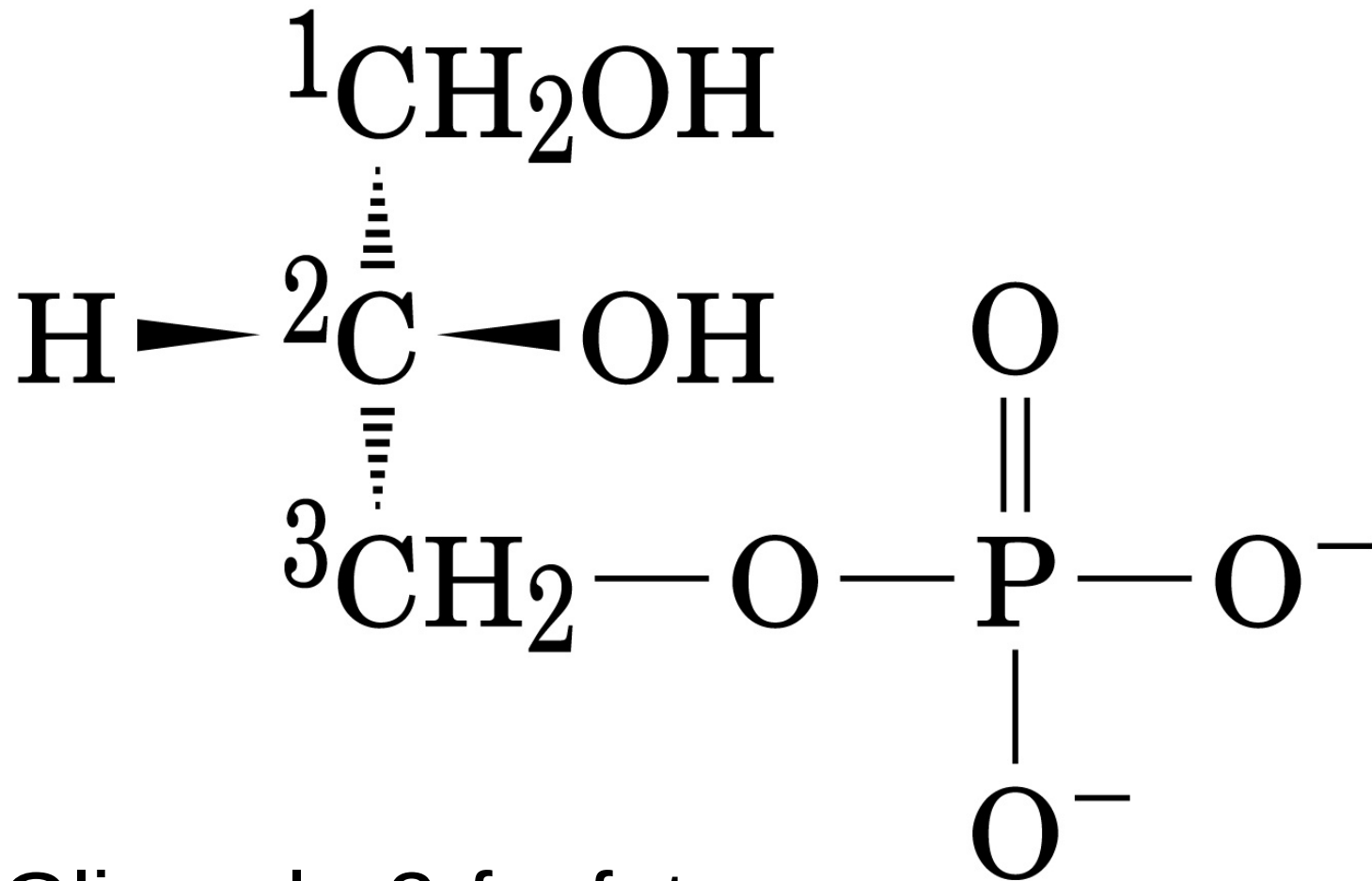


Glycolipids

Sphingolipids

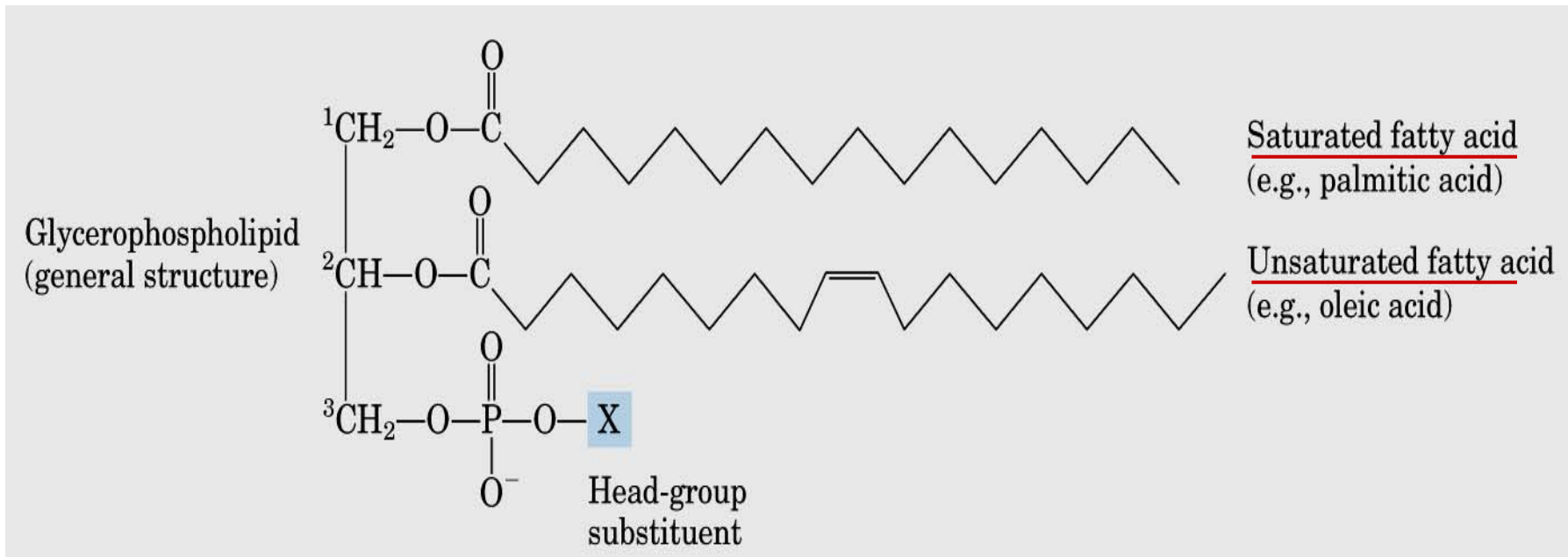


Fosfolipidi : A. glicerofosfolipidi

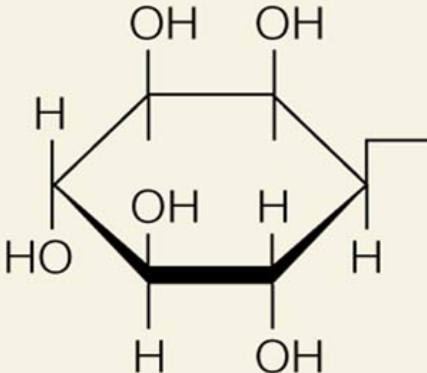


Glicerolo-3-fosfato

Fosfolipidi : A. glicerofosfolipidi

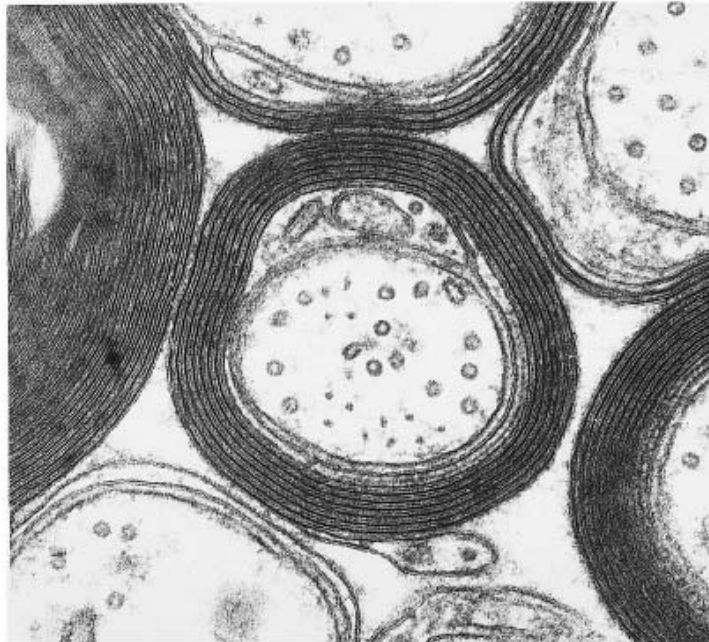


Gli R_3 possono essere molto diversi
→ diverse proprietà

Nome dei glicerofosfolipidi	R ₃ (Figura 10.6)
Acido fosfatidico	H— (ionizzato a pH neutro)
Fosfatidiletanolamina	$\text{H}_3\text{N}^+ - \text{CH}_2 - \text{CH}_2 -$
Fosfatidilcolina	$(\text{CH}_3)_3\text{N}^+ - \text{CH}_2 - \text{CH}_2 -$
Fosfatidilserina	$\begin{array}{c} \text{H}_3\text{N}^+ - \text{CH} - \text{CH}_2 - \\ \\ \text{COO}^- \end{array}$
Fosfatidil inositolo	

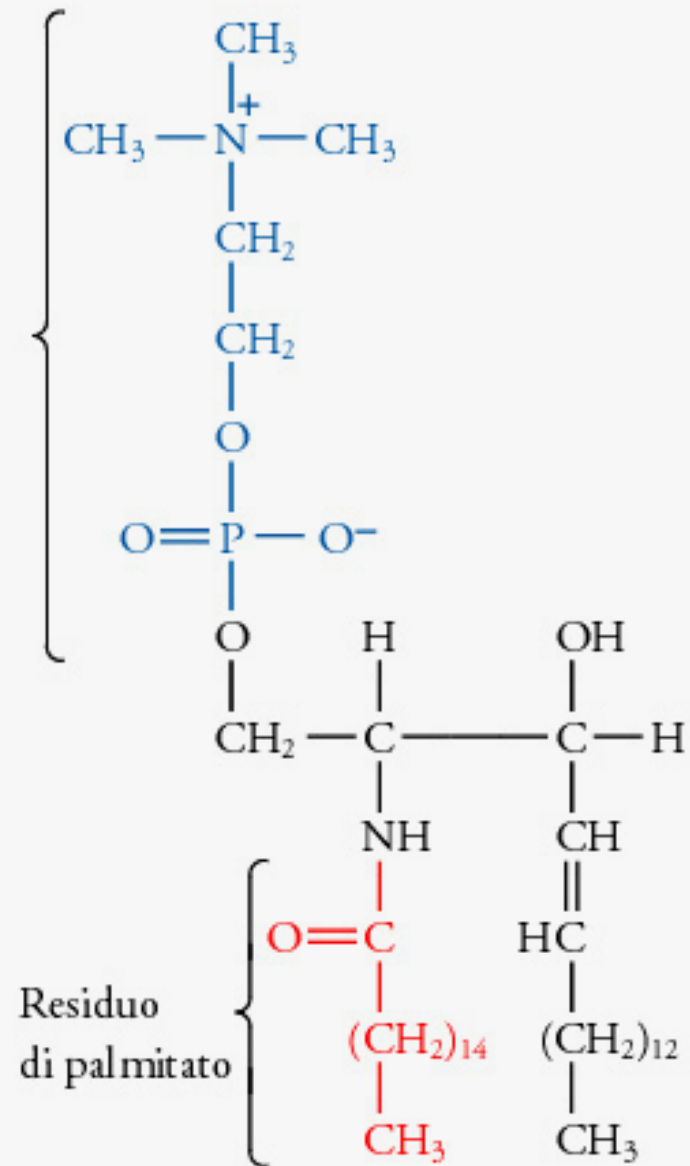
SE: solo un acido grasso è legato con legame amidico al gruppo $-NH_2$ della sfingosina
→ **ceramide**





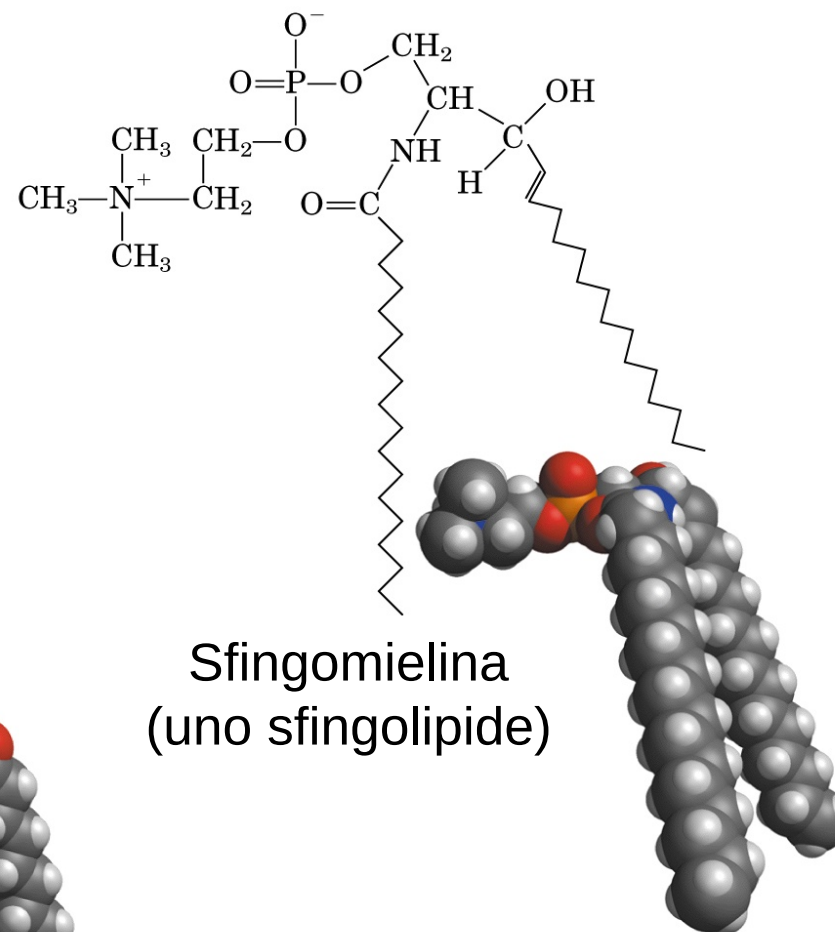
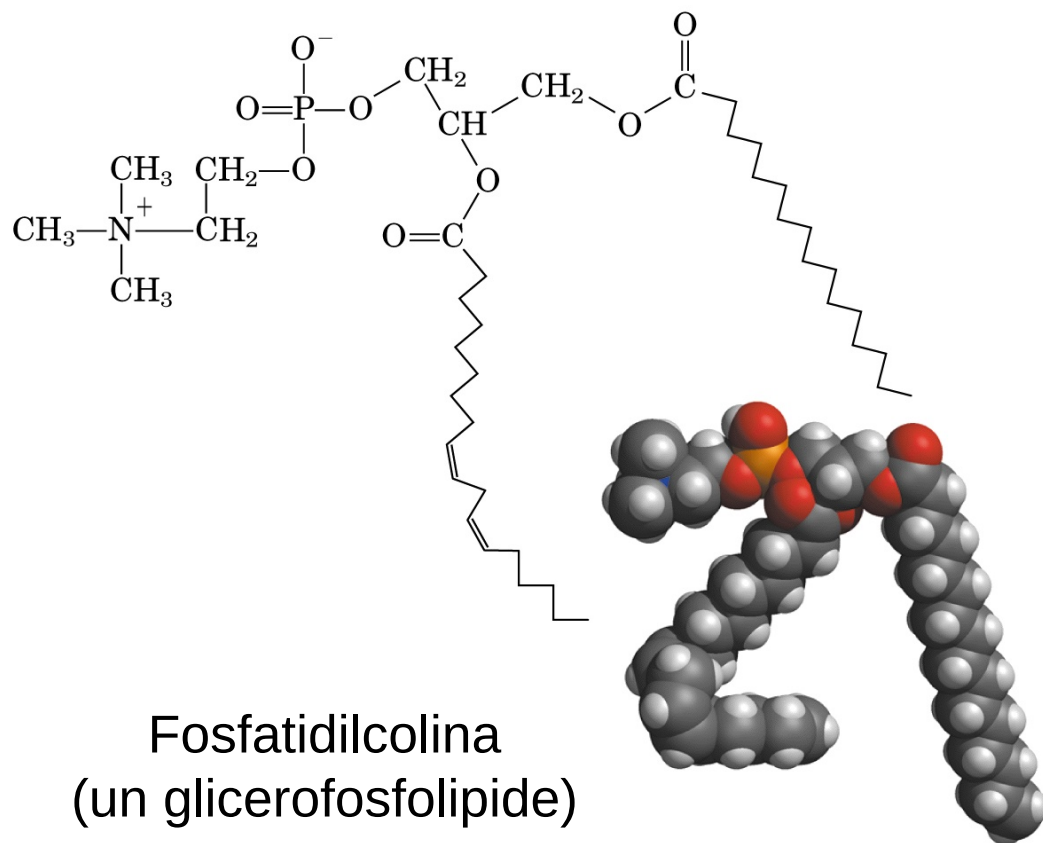
(a)

Fosfocolina,
testa polare



Residuo
di palmitato

Una sfingomielina



**Storage
lipids
(neutral)**

Triacylglycerols

Glycerol

Fatty acid

Fatty acid

Fatty acid

Membrane lipids (polar)

Phospholipids

Glycerophospholipids

Glycerol

Fatty acid

Fatty acid

PO₄

Alcohol

Sphingolipids

Sphingosine

Fatty acid

PO₄

Choline

Glycolipids

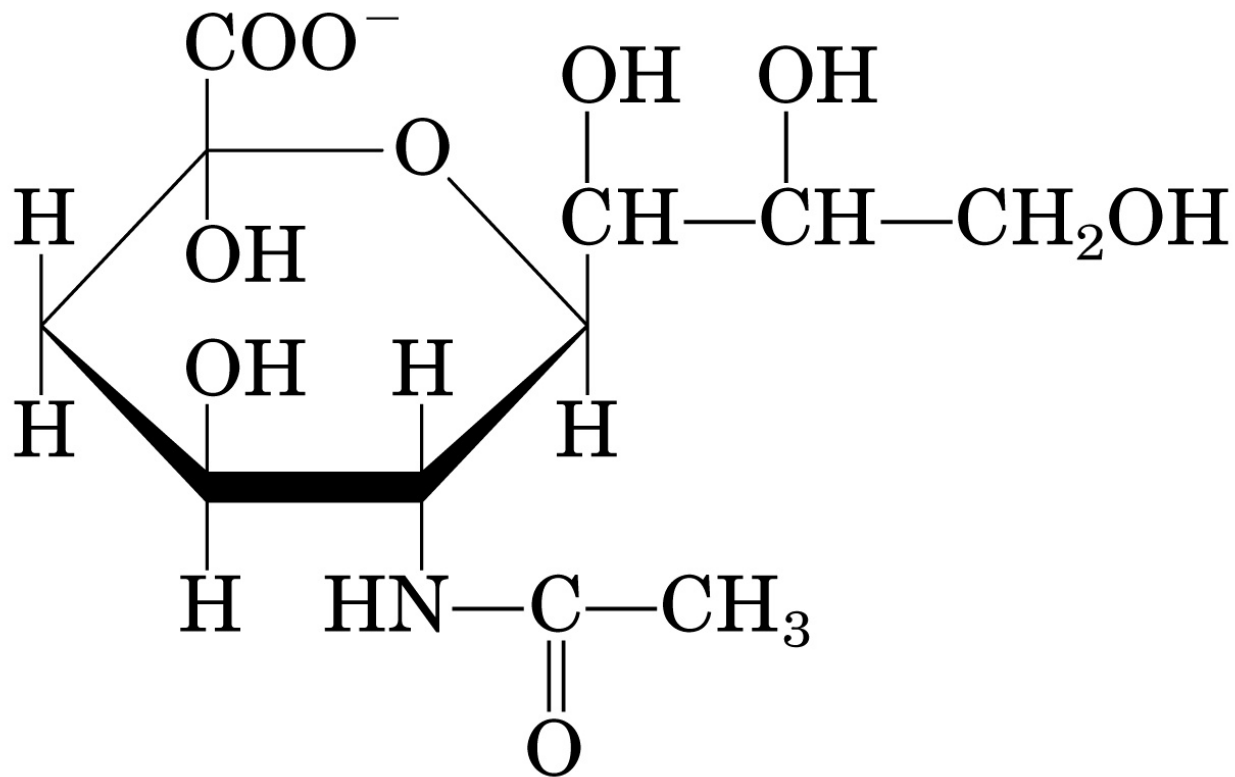
Sphingolipids

Sphingosine

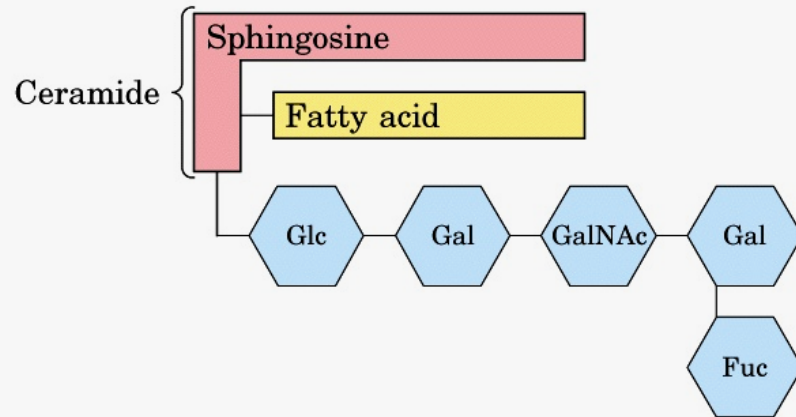
Fatty acid

Mono- or
oligosaccharide

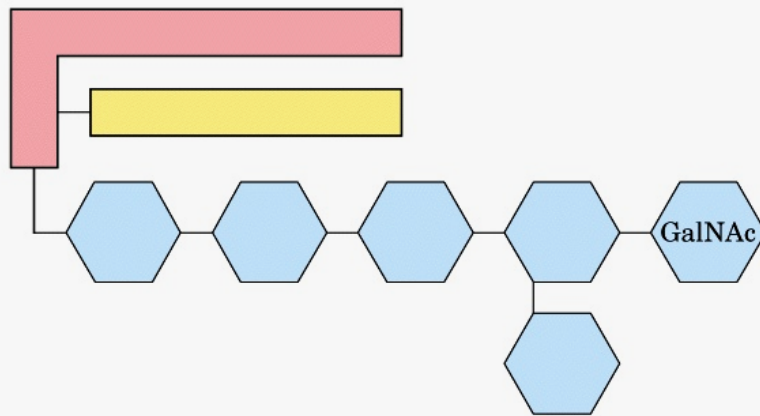
In alcuni **glicosfingolipidi** è presente l'acido sialico



N-Acetylneuraminic acid (sialic acid)
(Neu5Ac)

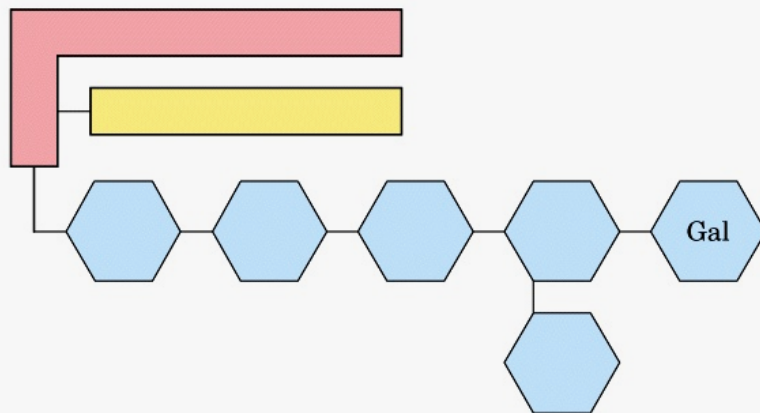


Antigene 0



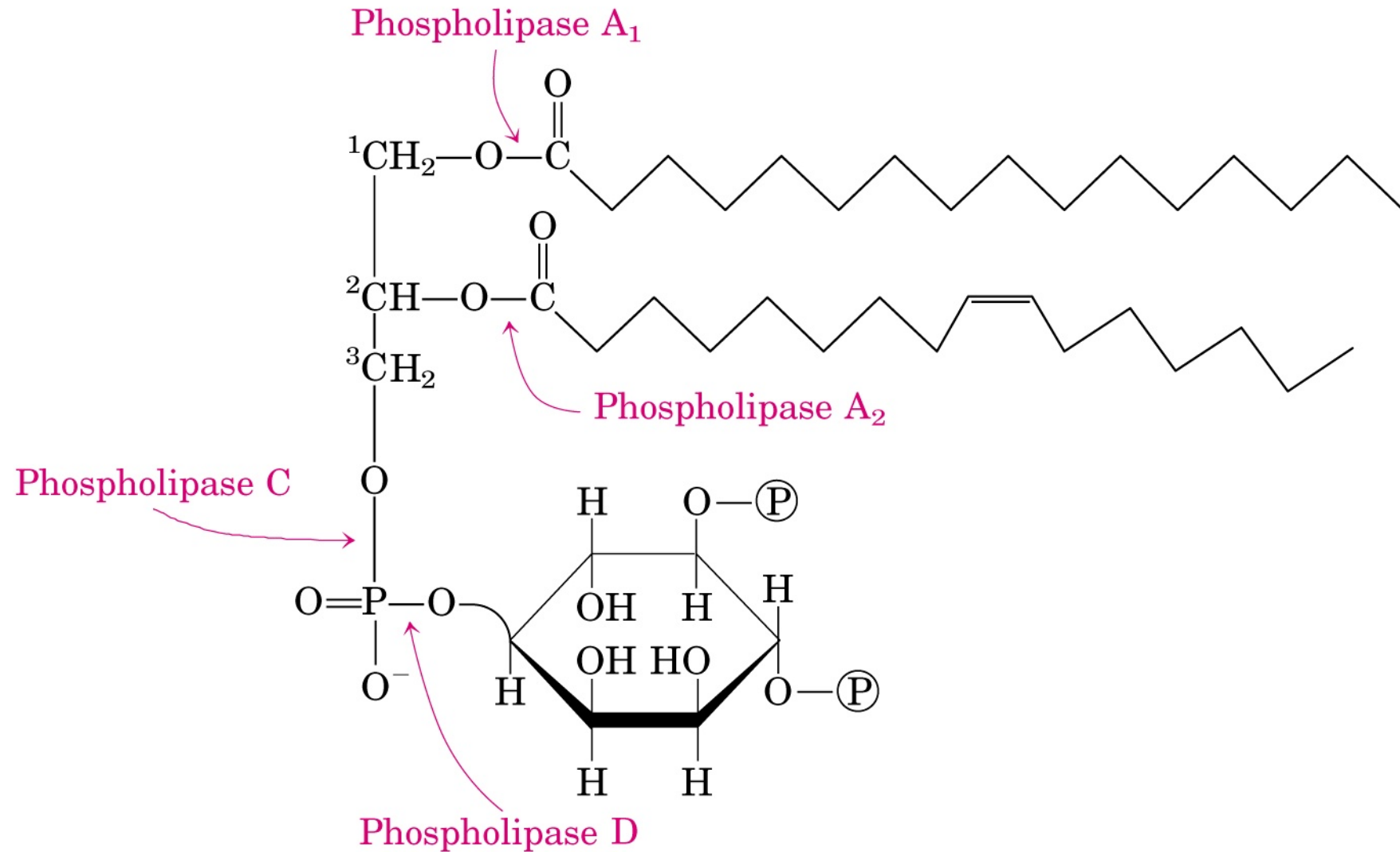
I gruppi sanguigni del sistema ABO dipendono da **glicosfingolipidi**

Antigene A

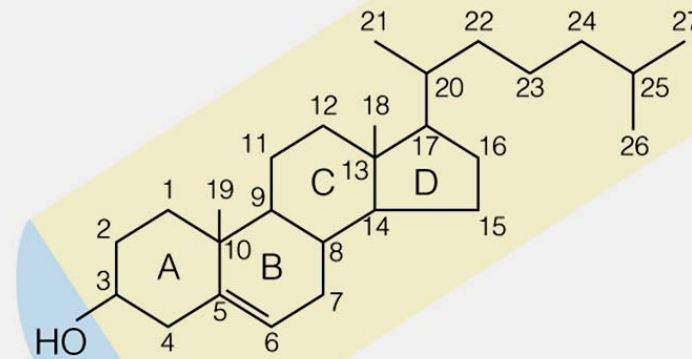


Antigene B

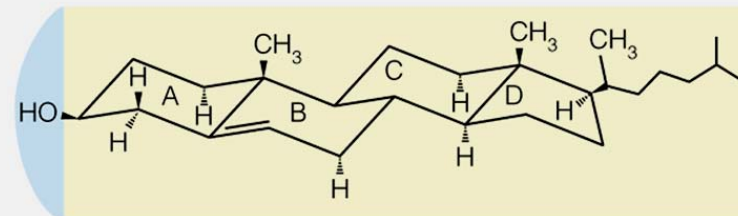
Le **fosfolipasi** sono enzimi in grado di demolire i fosfolipidi



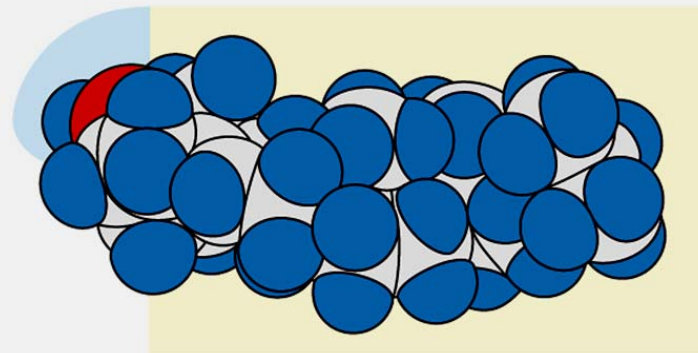
Il **colesterolo** è un importante lipide di membrana



(a)

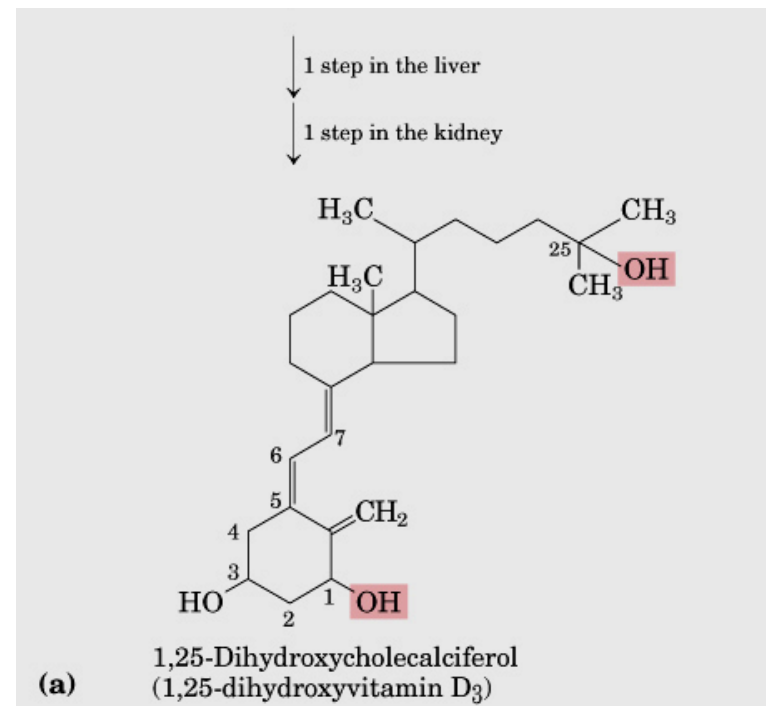
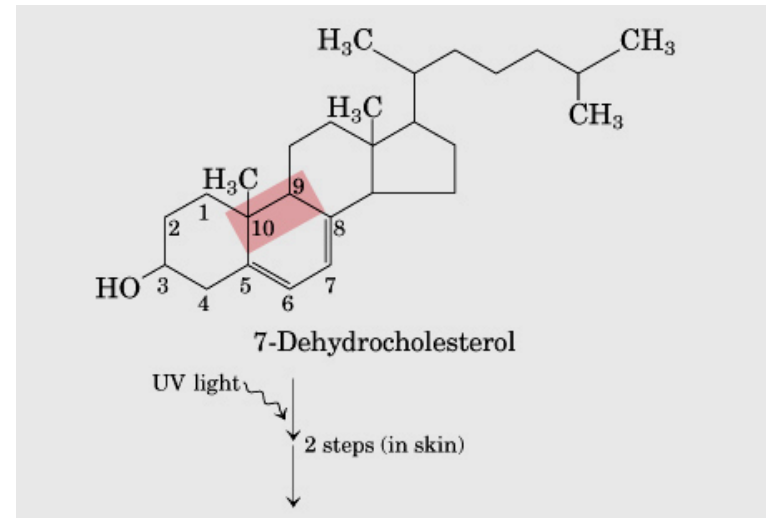


(b)

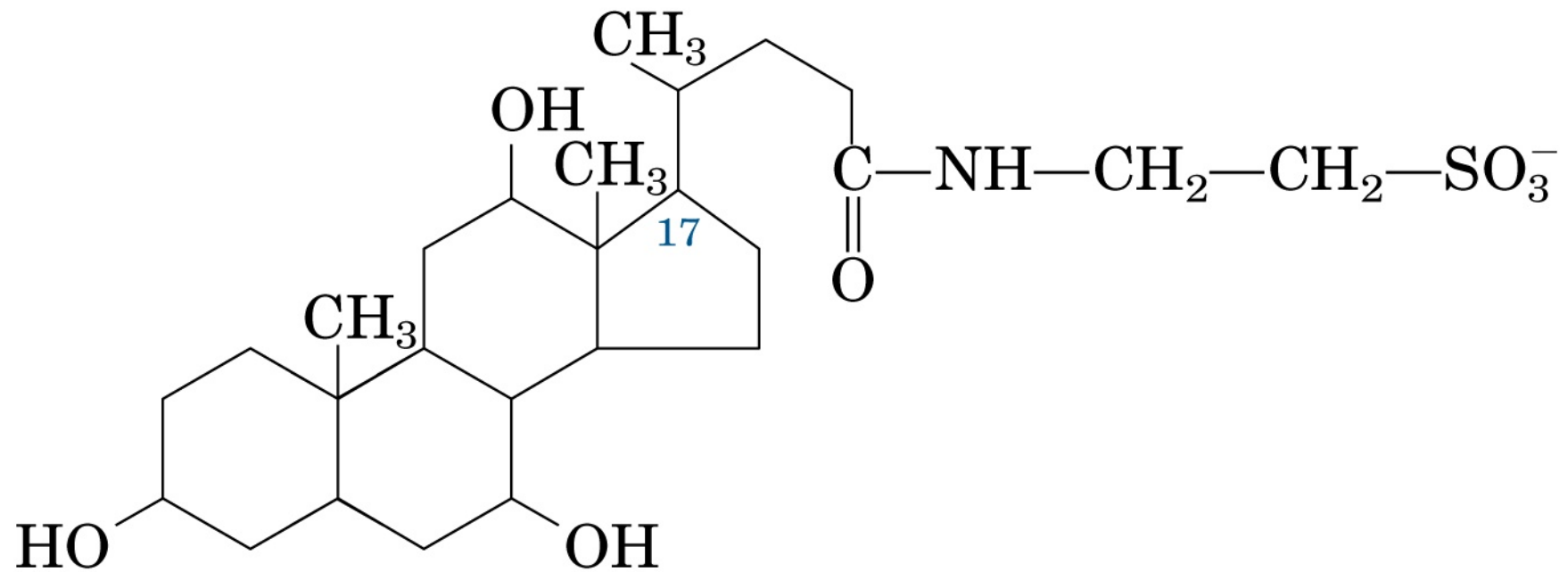


(c)

La Vitamina D è un derivato di un intermedio della sintesi del colesterolo

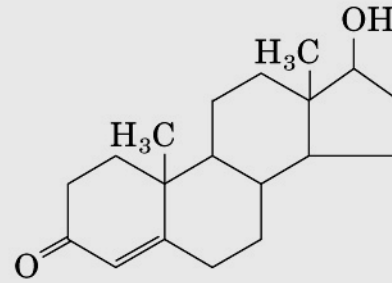


Altri steroidi : acidi biliari

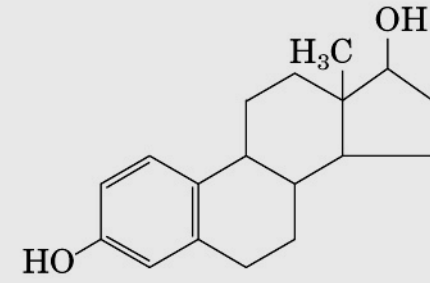


Taurocholic acid
(a bile acid)

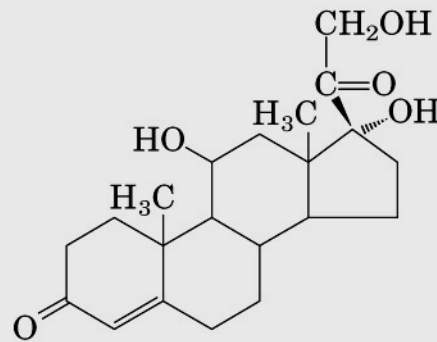
Altri steroidi : ormoni steroidei



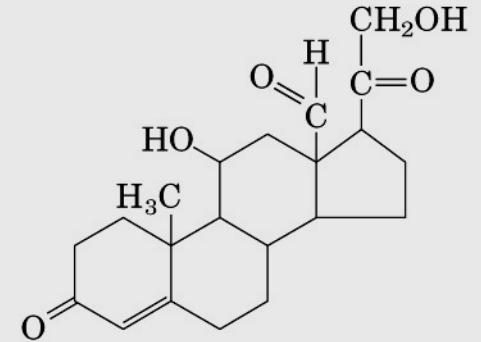
Testosterone



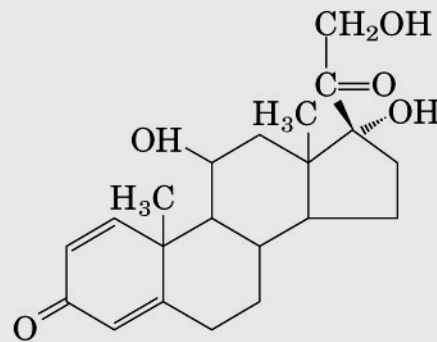
Estradiol



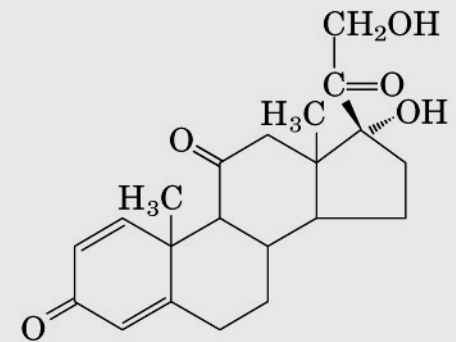
Cortisol



Aldosterone



Prednisolone



Prednisone

Un altro fosfolipide
importante: il **fosfatidil-
inositolo**

