

Lípidos

Características generales

- Grupo muy heterogéneo
- Insolubles en soluciones acuosas
- Solubles en solventes no-polares
- No forman polímeros
- En general se forman por condensación de moléculas de acetato

Funciones

- Reserva energética
- Estructural
- Aislante térmico
- Hormonal
- Formación de membranas

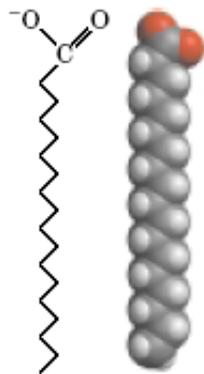
table 11-1

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($\Delta^{9,12}$)	$\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	<i>cis</i> -, <i>cis</i> -9,12-Octadecadienoic acid	Linoleic acid (Greek <i>linon</i> , "flax")	-5		
18:3($\Delta^{9,12,15}$)	$\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$	<i>cis</i> -, <i>cis</i> -, <i>cis</i> -9,12,15-Octadecatrienoic acid	α -Linolenic acid	-11		
20:4($\Delta^{5,8,11,14}$)	$\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_3\text{COOH}$	<i>cis</i> -, <i>cis</i> -, <i>cis</i> -, <i>cis</i> -5,8,11,14-Icosatetraenoic acid	Arachidonic acid	-49.5		

Propiedades fisicoquímicas

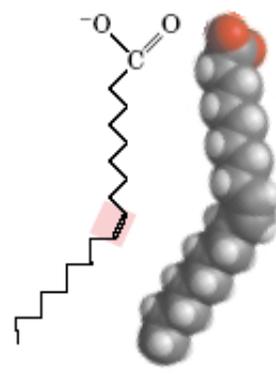
- C3-C4 son líquidos solubles en agua y volátiles
- c1 se denomina alfa, el resto, beta, gamma, etc.
- Son ácidos débiles
- C6 en adelante insolubles en agua
- C10 en adelante sólidos
- saturados o insaturados
- En general configuración *cis*
- La temperatura de fusión aumenta con el número de átomos de C.
- La temperatura de fusión disminuye con el número de insaturaciones
- La solubilidad en agua disminuye con el aumento del número de átomos de C y la disminución de las insaturaciones.
- Solubles en soluciones alcalinas (jabones)

Carboxyl group

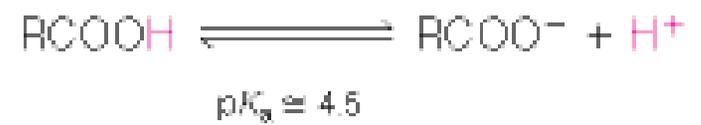


Hydrocarbon chain

(a)

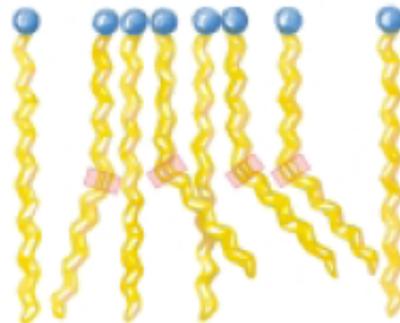


(b)



Saturated fatty acids

(c)



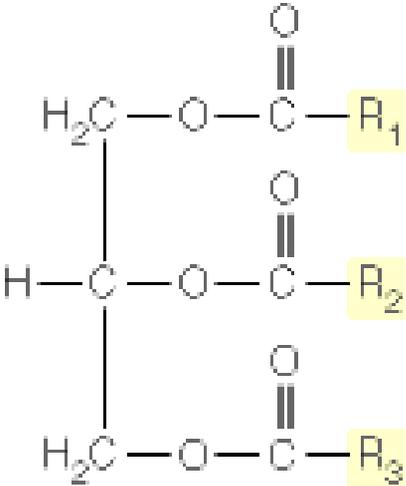
Mixture of saturated and unsaturated fatty acids

(d)

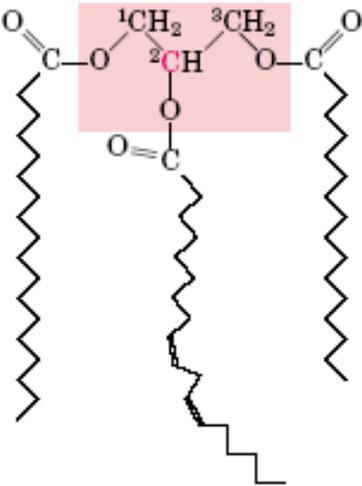
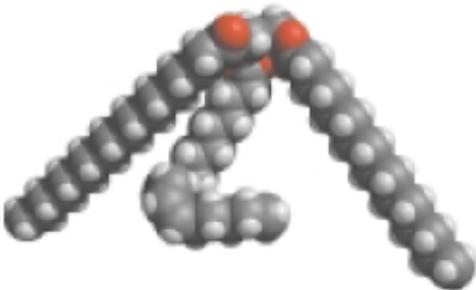
Triacilgliceroles



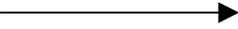
Glycerol



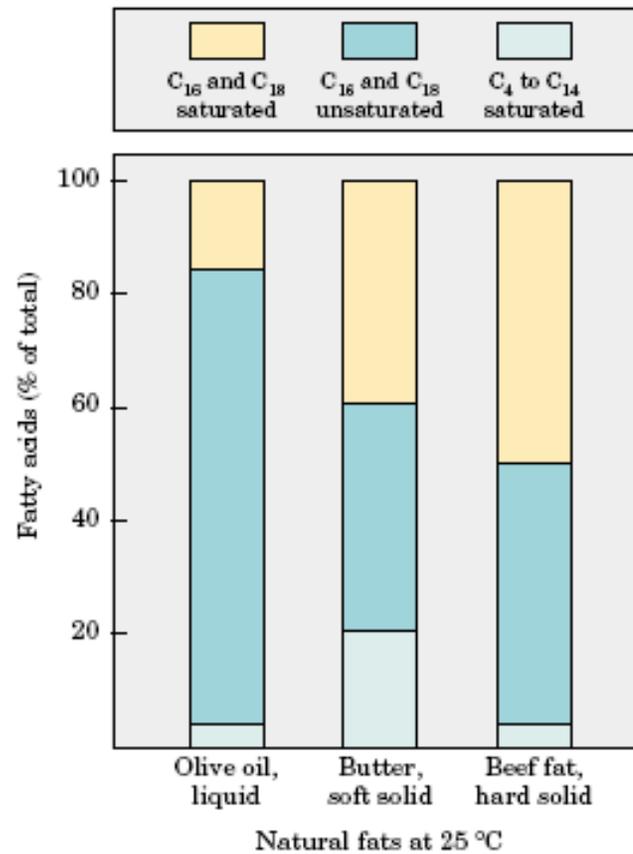
Triacylglycerol

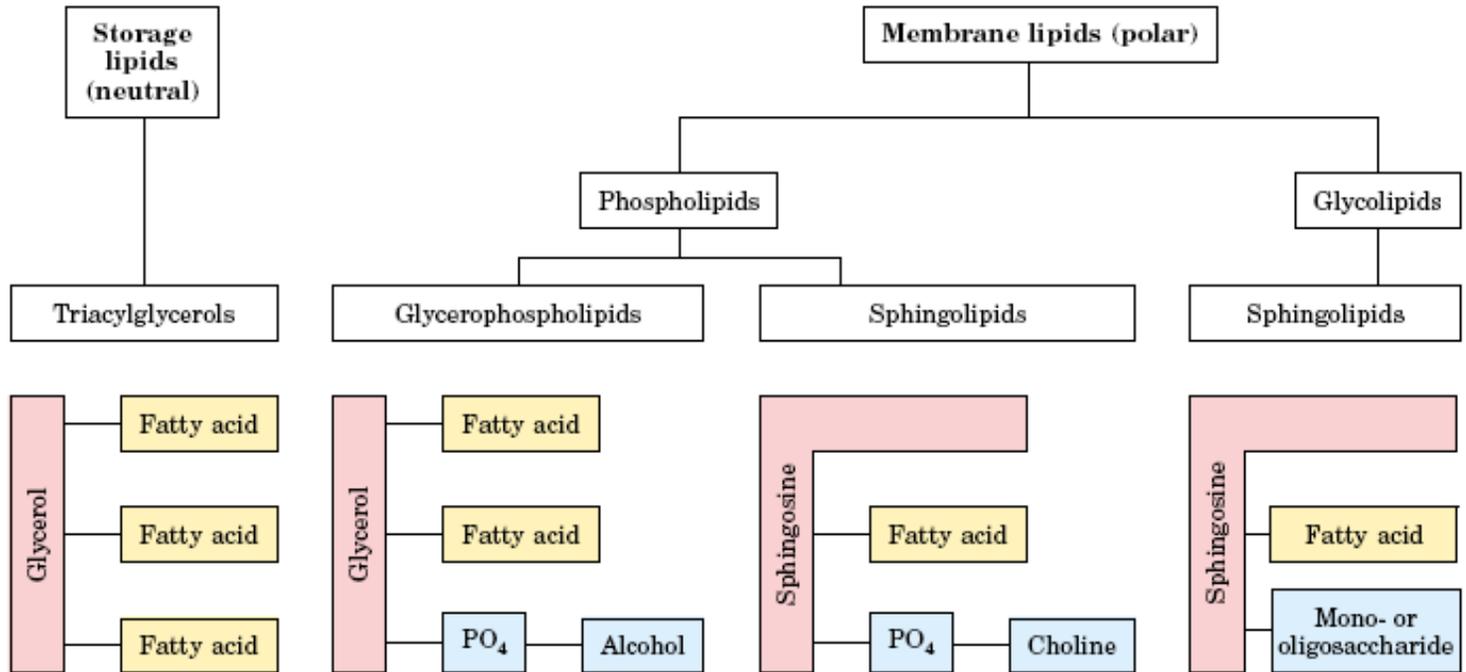


nomenclatura

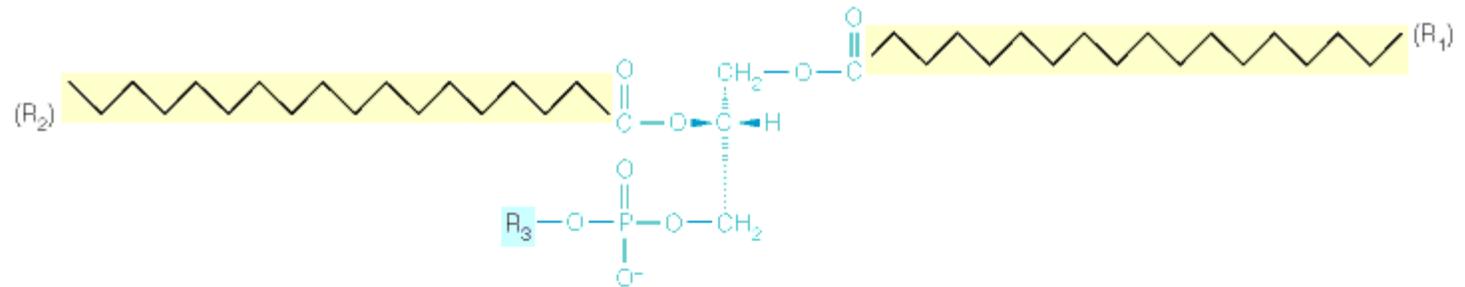


1-Stearoyl, 2-linoleoyl, 3-palmitoyl glycerol,
a mixed triacylglycerol

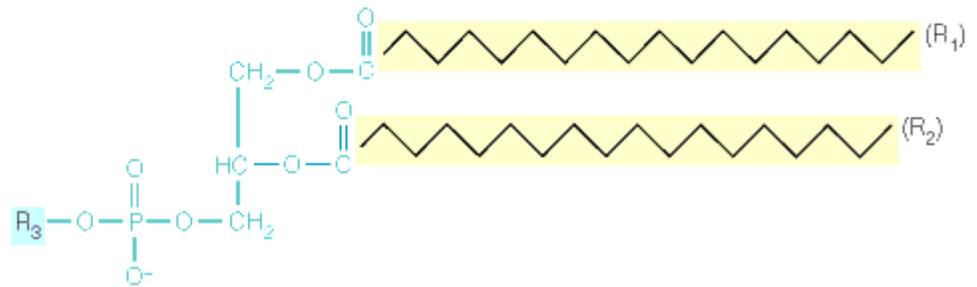




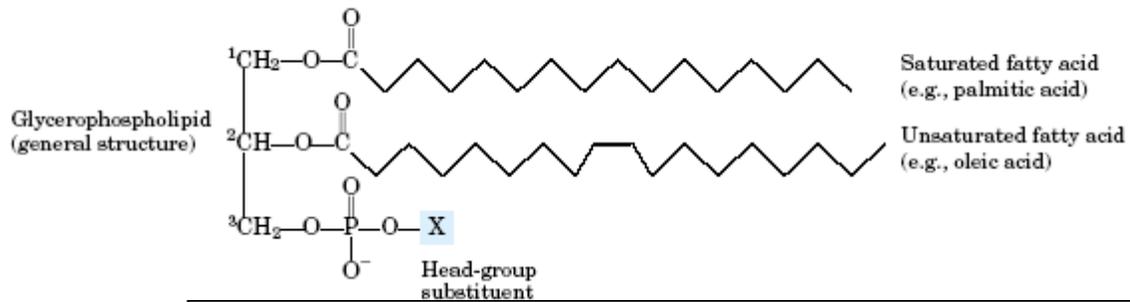
Fosfolípidos



(a)



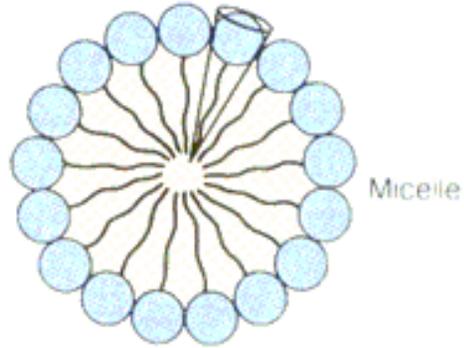
(b)



Molécula
asimétrica
(isómeros L y D)



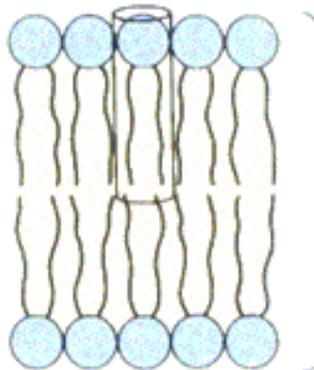
Name of glycerophospholipid	Name of X	Formula of X	Net charge (at pH 7)
Phosphatidic acid	—	— H	-1
Phosphatidylethanolamine	Ethanolamine	— CH ₂ -CH ₂ -NH ₃ ⁺	0
Phosphatidylcholine	Choline	— CH ₂ -CH ₂ -N ⁺ (CH ₃) ₃	0
Phosphatidylserine	Serine	— CH ₂ -CH(NH ₃ ⁺) COO ⁻	-1
Phosphatidylglycerol	Glycerol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



Micelle

(a)

Ac. grasos

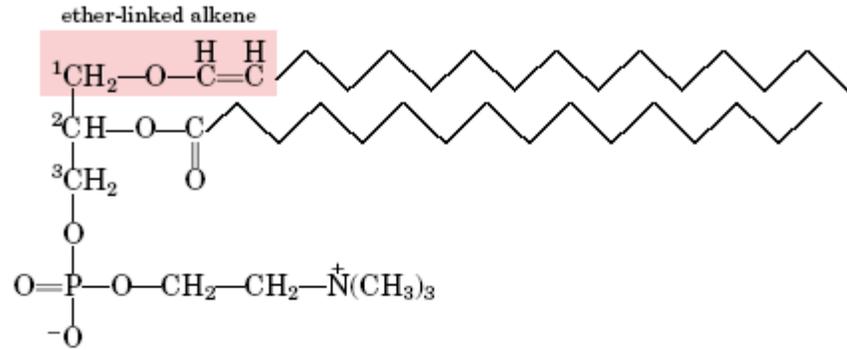


Bilayer

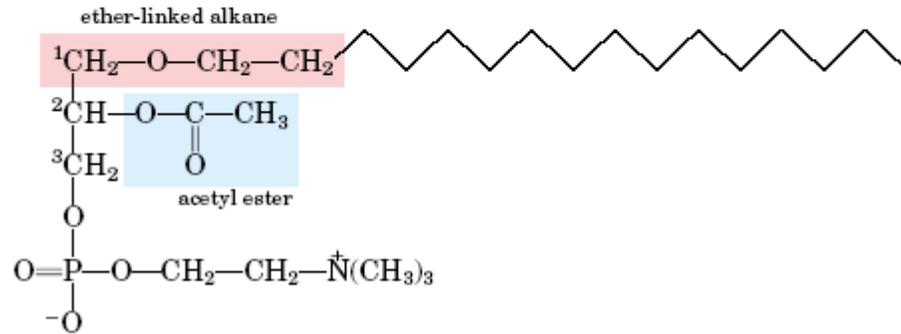
(b)

fosfolípidos

Lípidos con enlace eter

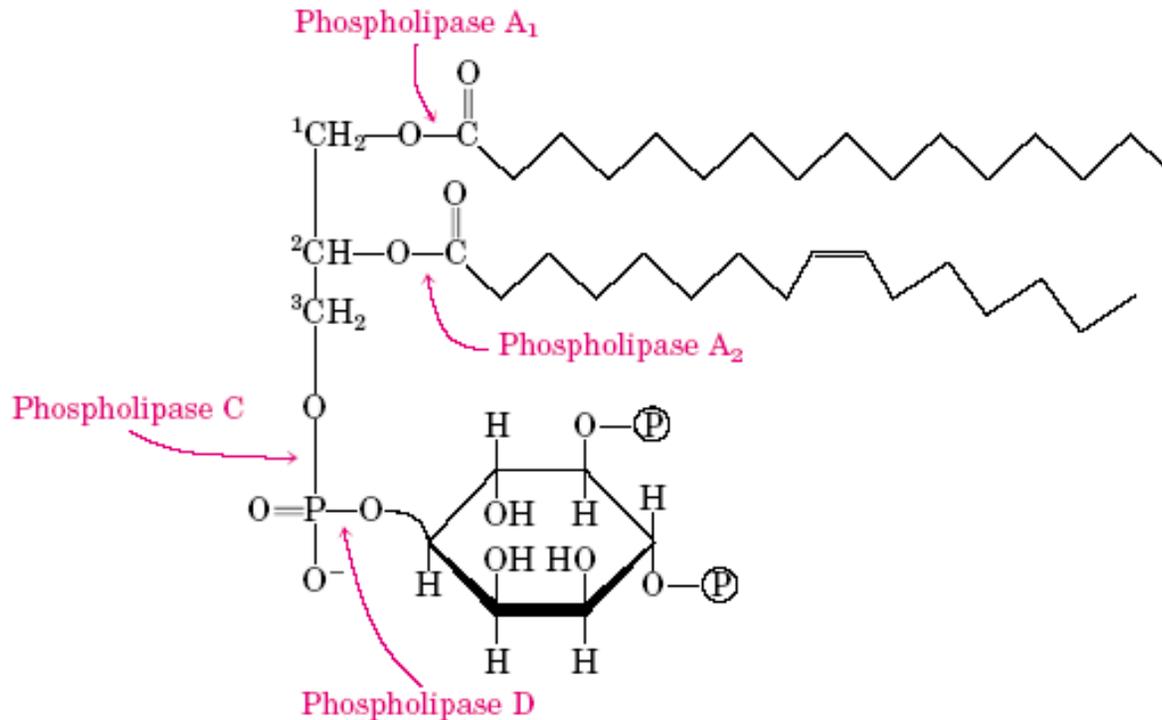


Plasmalogen



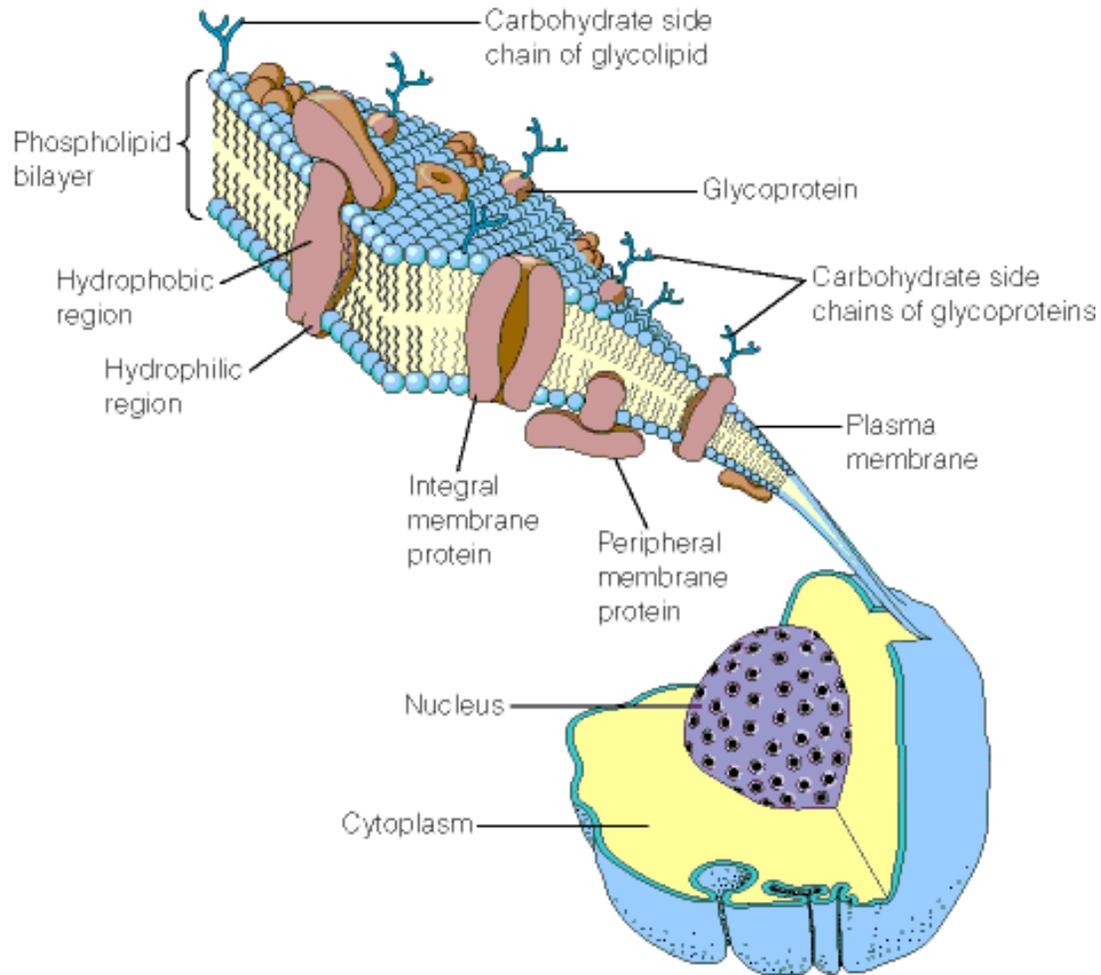
Platelet-activating factor

Degradación enzimática de los fosfolípidos



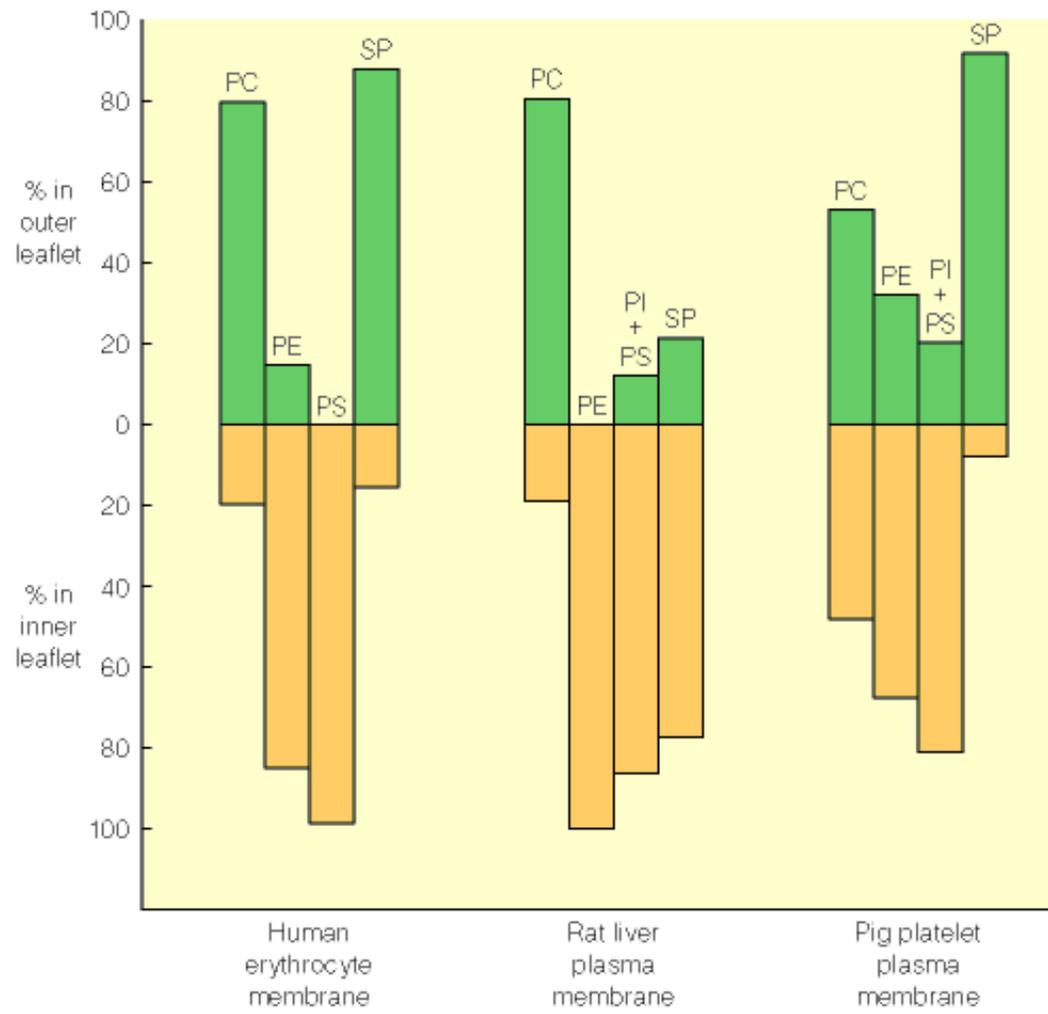
Fosfolipasas A1 y A2 generan los derivados lisofosfogliceridos (de tipo 1 y 2)

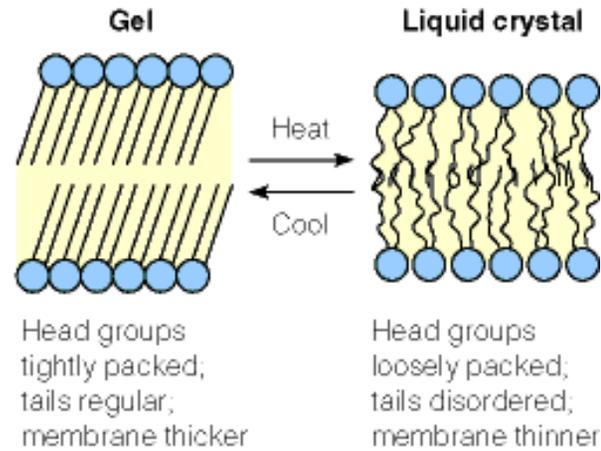
Membranas



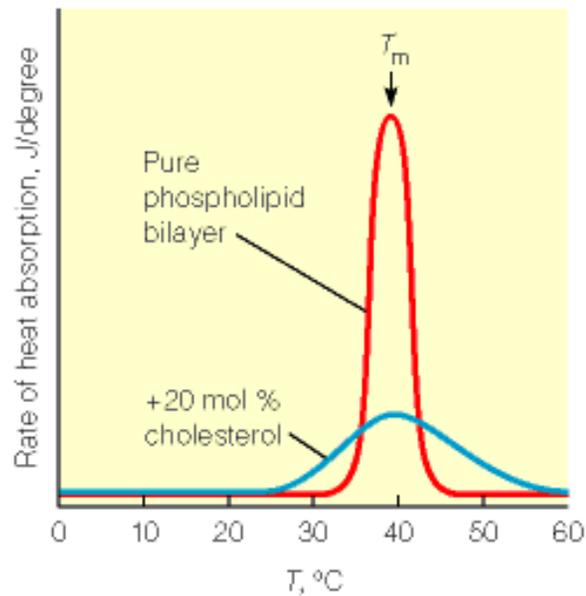
Lipid	Percentage of Total Composition in			
	Human Erythrocyte Plasma Membrane	Human Myelin	Beef Heart Mitochondria	<i>E. coli</i> Cell Membrane
Phosphatidic acid	1.5	0.5	0	0
Phosphatidylcholine	19	10	39	0
Phosphatidylethanolamine	18	20	27	65
Phosphatidylglycerol	0	0	0	18
Phosphatidylinositol	1	1	7	0
Phosphatidylserine	8.0	8.0	0.5	0
Sphingomyelin	17.5	8.5	0	0
Glycolipids	10	26	0	0
Cholesterol	25	26	3	0
Others	0	0	23.5	17

Source: Data from C. Tanford, *The Hydrophobic Effect* (New York: Wiley, 1973).



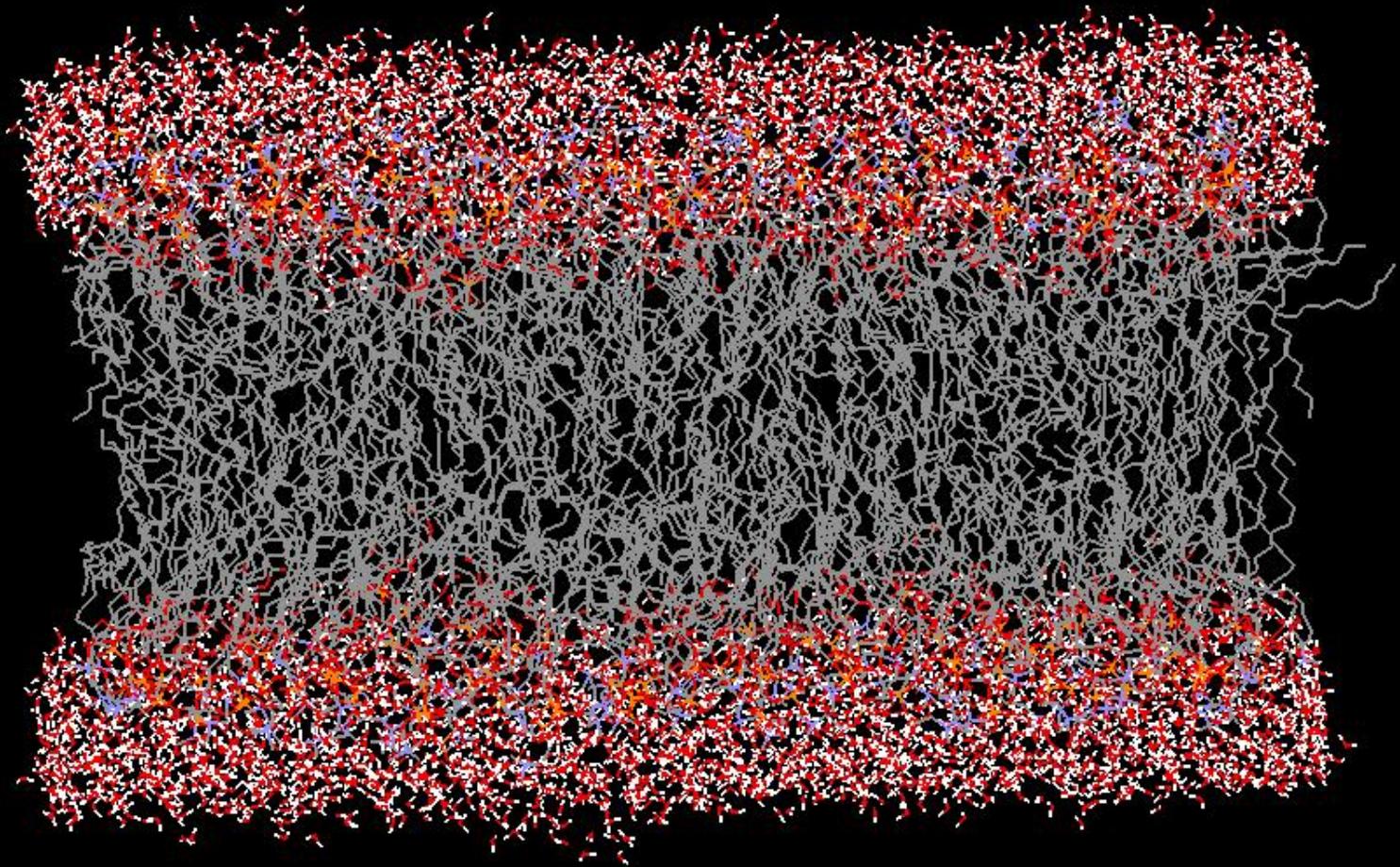


(a) Transition

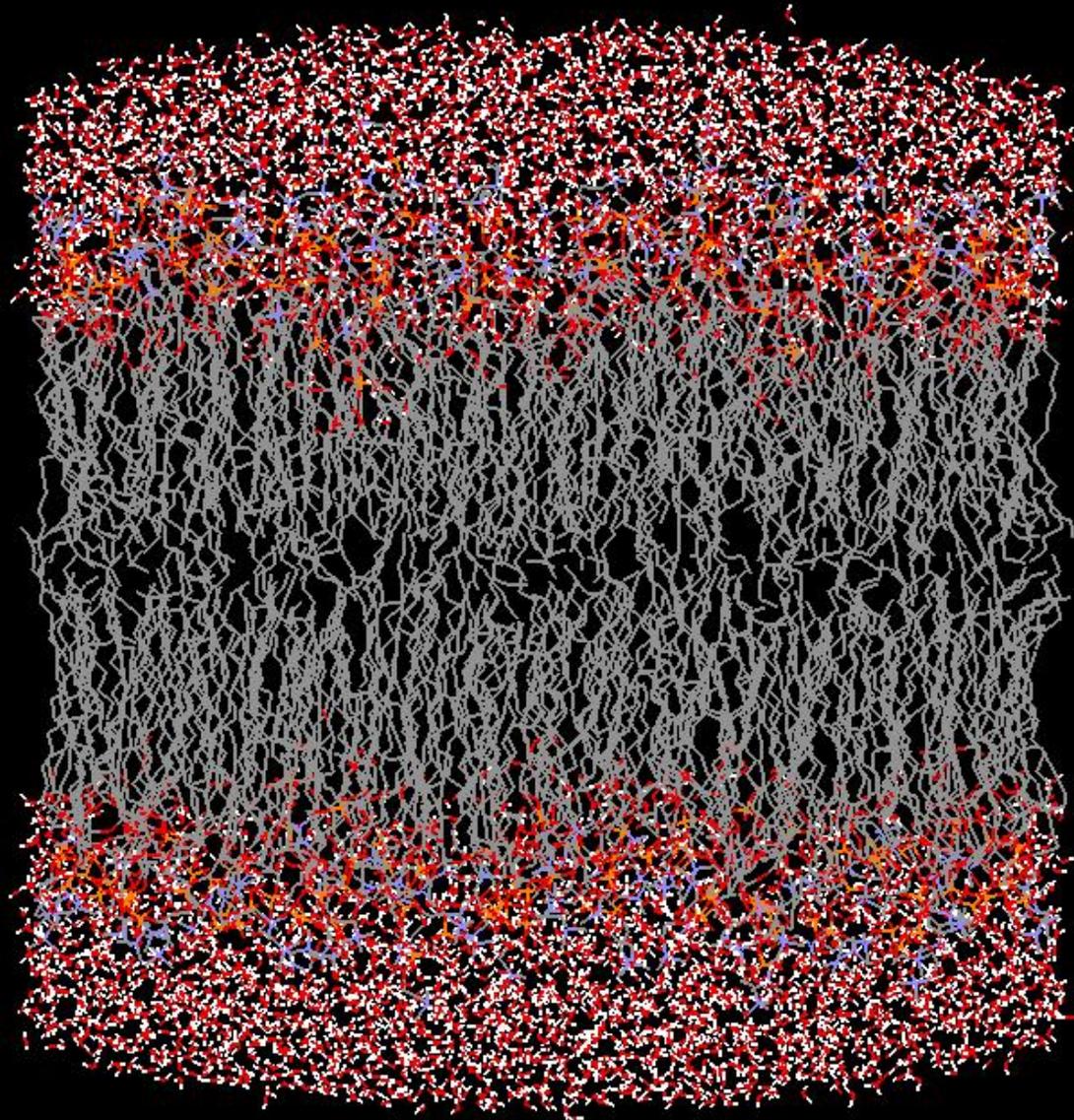


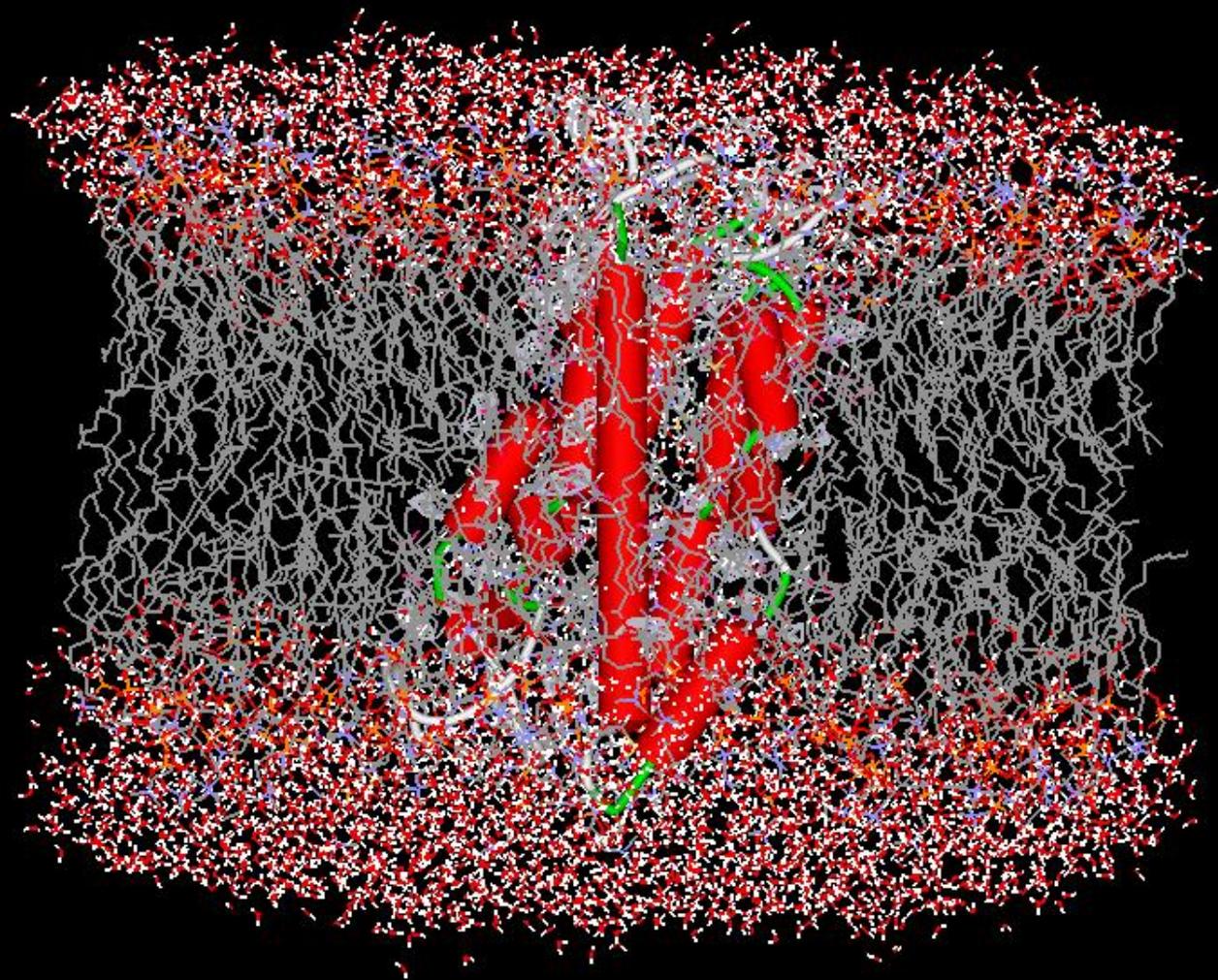
(b) Transition with and without cholesterol

Cristal liquido (sol)

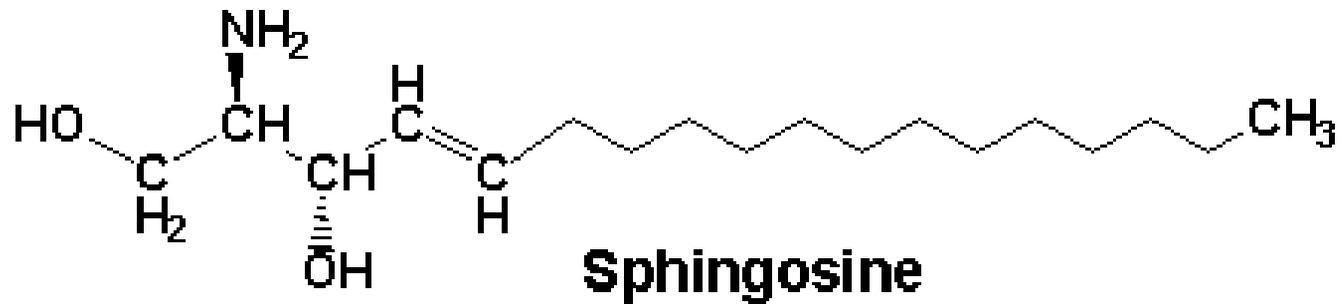
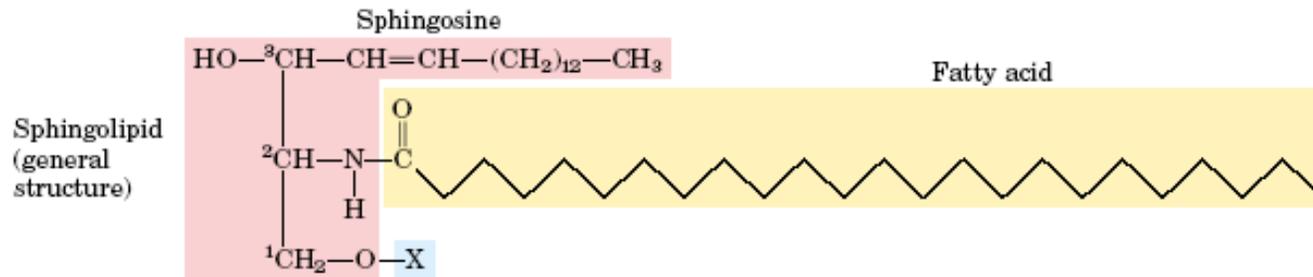


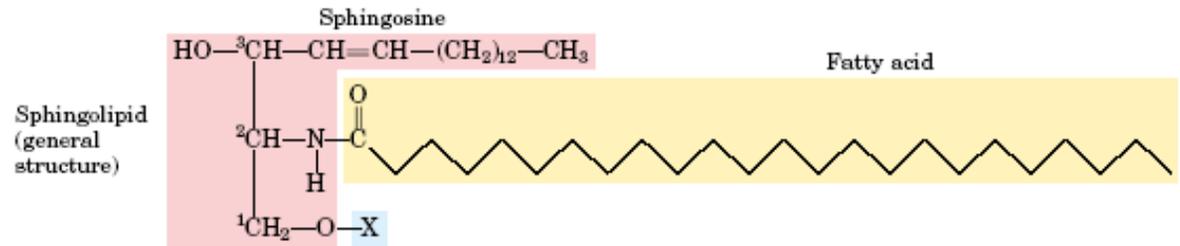
Gel





Esfingolípidos





Name of sphingolipid	Name of X	Formula of X
Ceramide	—	— H
Sphingomyelin	Phosphocholine	
Neutral glycolipids Glucosylcerebroside	Glucose	
Lactosylceramide (a globoside)	Di-, tri-, or tetrasaccharide	
Ganglioside GM2	Complex oligosaccharide	

Esfingomielinas

Glicosfingolípidos

Cerebrósidos

Globósidos

Gangliósidos

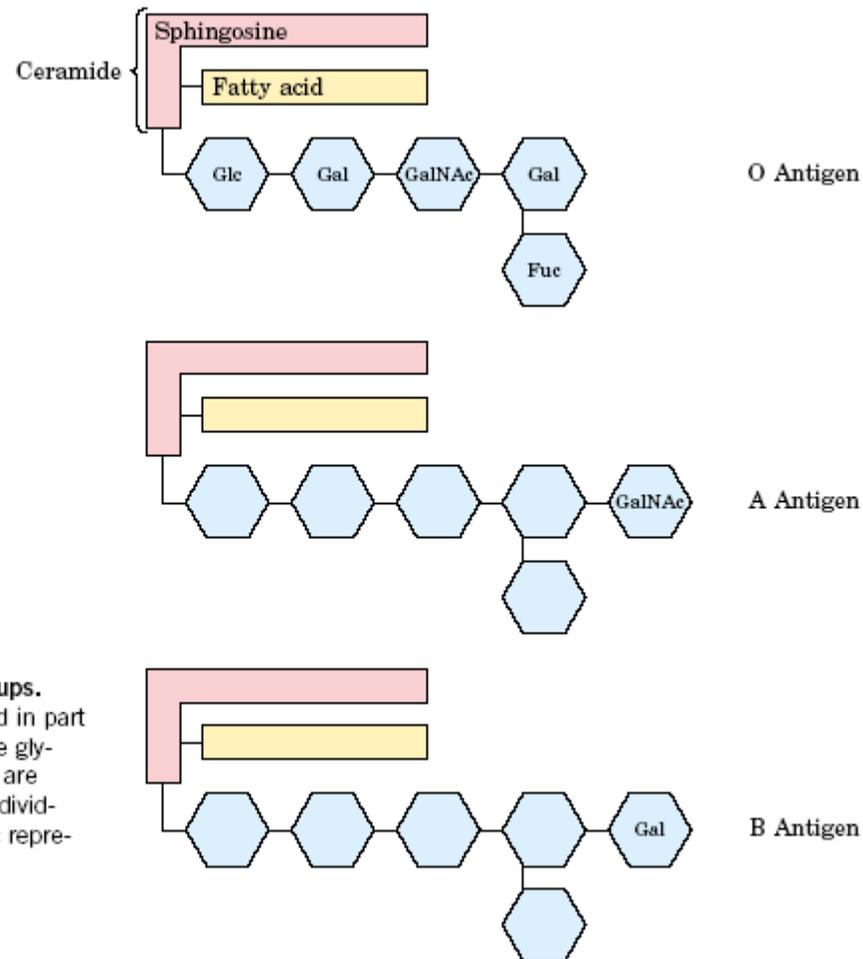


figure 11-12

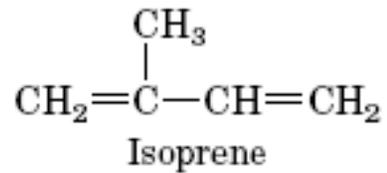
Glycosphingolipids as determinants of blood groups.

The human blood groups (O, A, B) are determined in part by the oligosaccharide head groups (blue) of these glycosphingolipids. The same three oligosaccharides are also found attached to certain blood proteins of individuals of blood types O, A, and B, respectively. (Fuc represents the sugar fucose.)

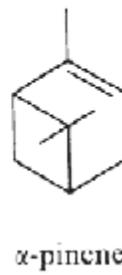
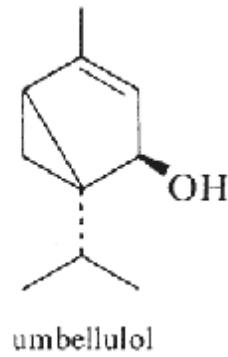
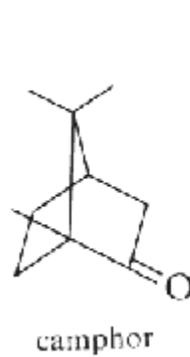
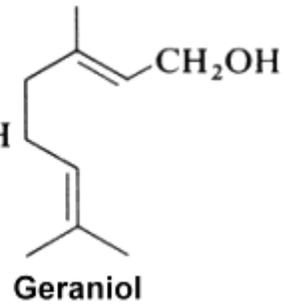
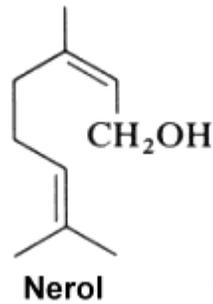
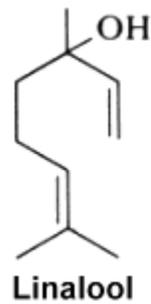
Terpenoides

Derivan de la unión de unidades de isopreno. Grupo muy diverso

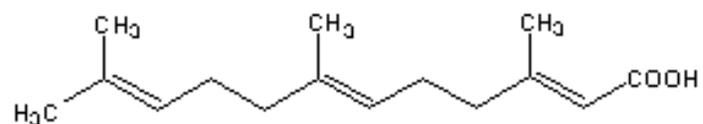
Hormonas sexuales, hormonas de insectos, vitaminas liposolubles, aceites esenciales, alcaloides, polímeros(caucho)



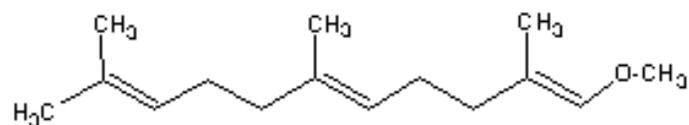
Monoterpenos (2 unidades de terpenos)



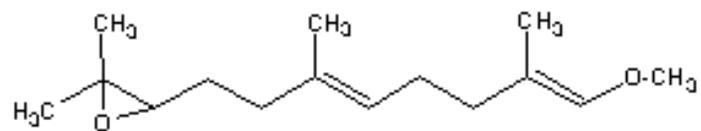
Sesquiterpenos (3 unidades de terpenos)



Farnesoic acid



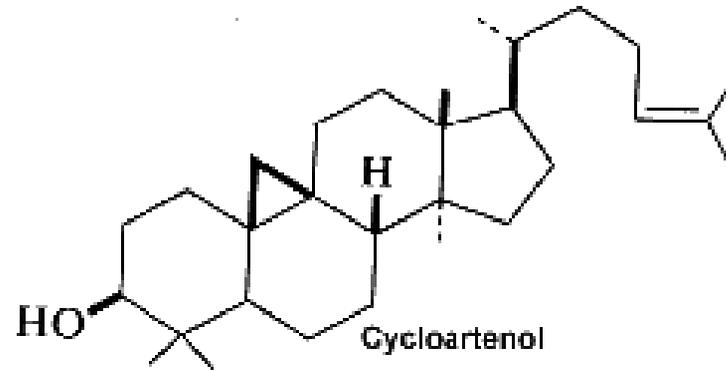
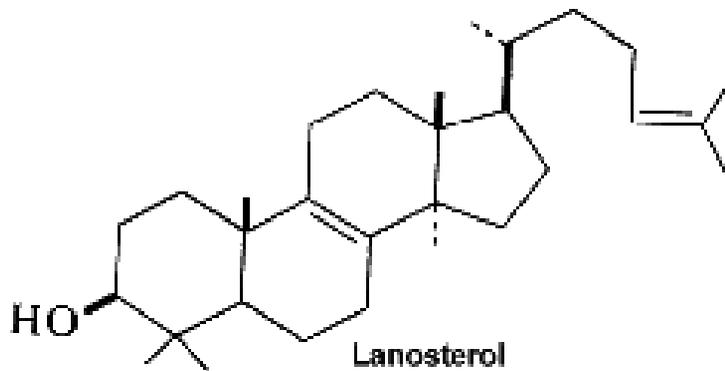
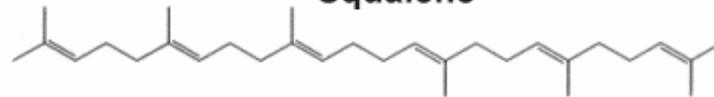
Methyl farnesoate



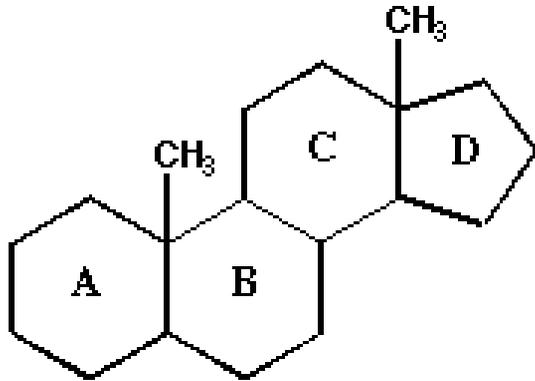
Juvenile hormone III

Triterpenoides (6 unidades de isopreno)

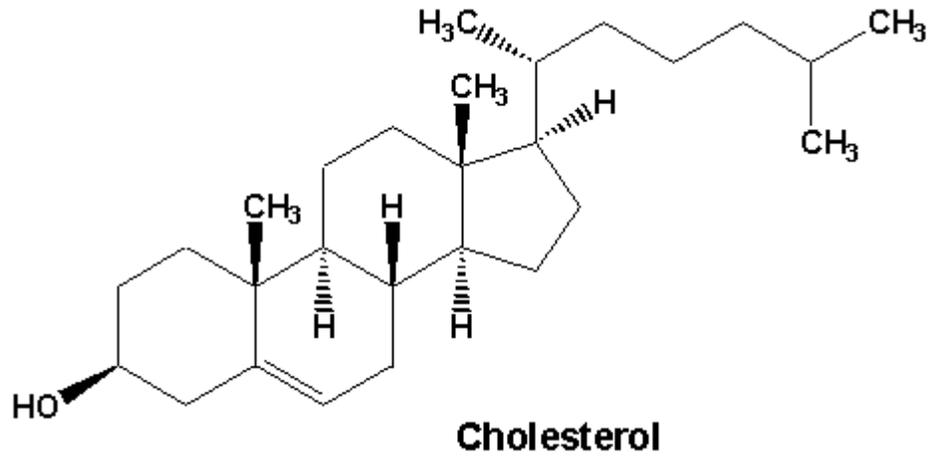
Squalene

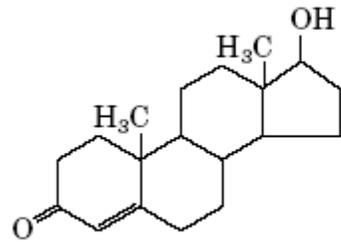


Esteroles

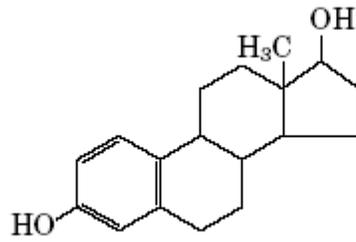


ciclopentanoperhidrofenantreno

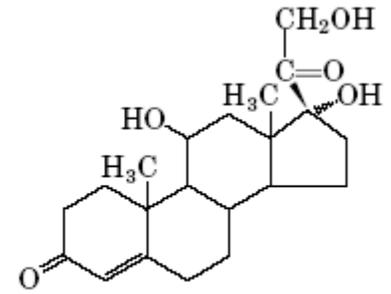




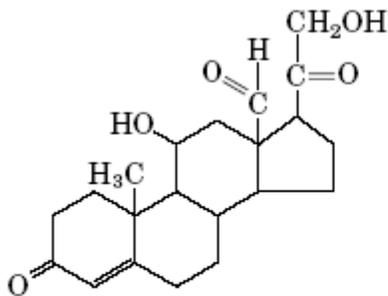
Testosterone



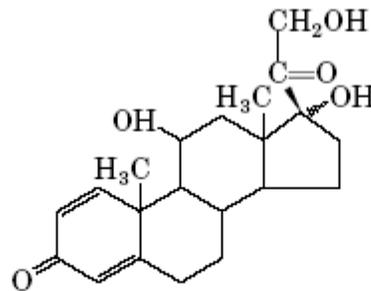
Estradiol



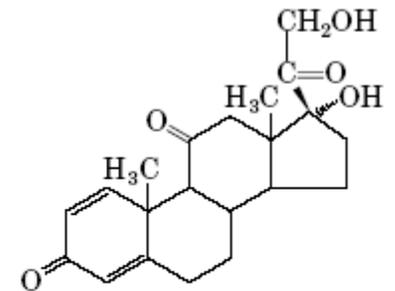
Cortisol



Aldosterone



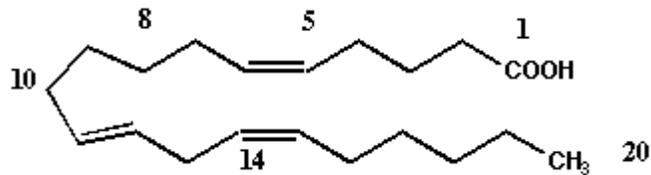
Prednisolone



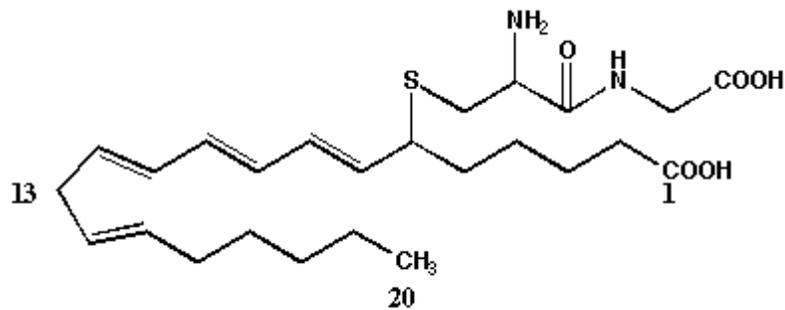
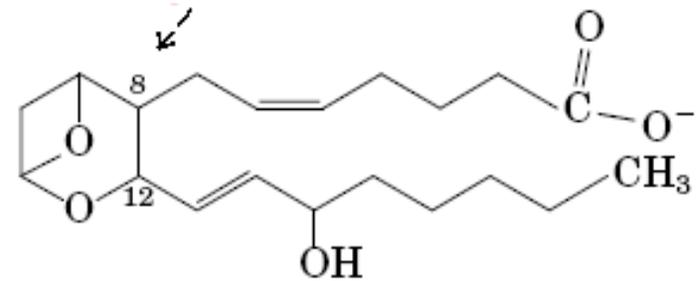
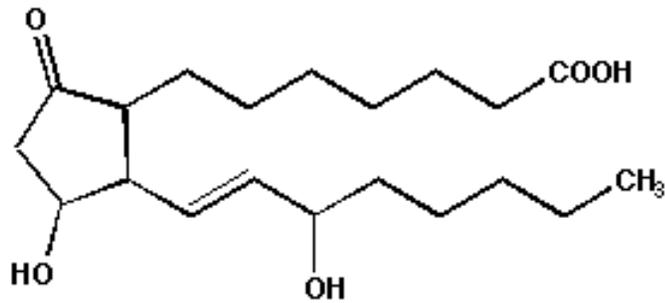
Prednisone

Hormonas esteroideas

Eicosanoides: Prostaglandinas, leucotrienos y tromboxanos

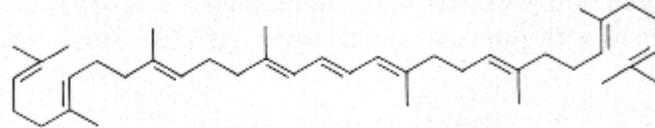


Ac. araquidónico 20:4($\Delta^{5,8,11,14}$)

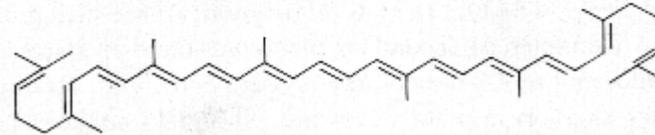


Carotenoides

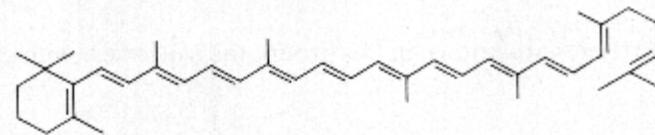
phytoene (C₄₀H₆₄; colorless; λ_{\max} , 285 nm)



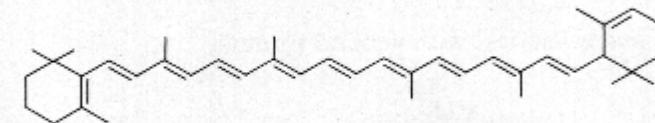
lycopene (C₄₀H₅₆; red; λ_{\max} , 476 nm)



γ -*carotene* (C₄₀H₅₆; orange; λ_{\max} , 460 nm)



α -*carotene* (C₄₀H₅₆; orange; λ_{\max} , 456 nm)



β -*carotene* (C₄₀H₅₆; orange; λ_{\max} , 463 nm)

