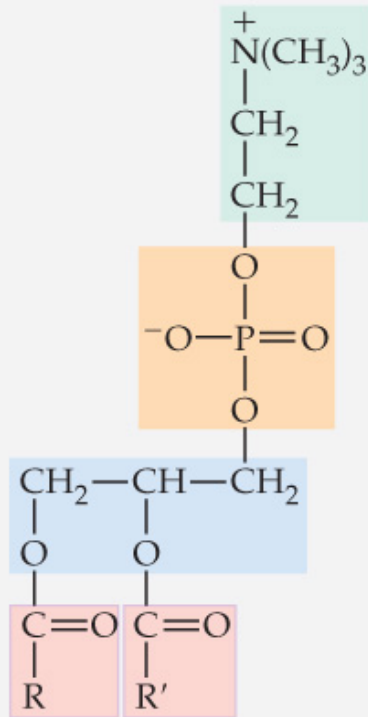
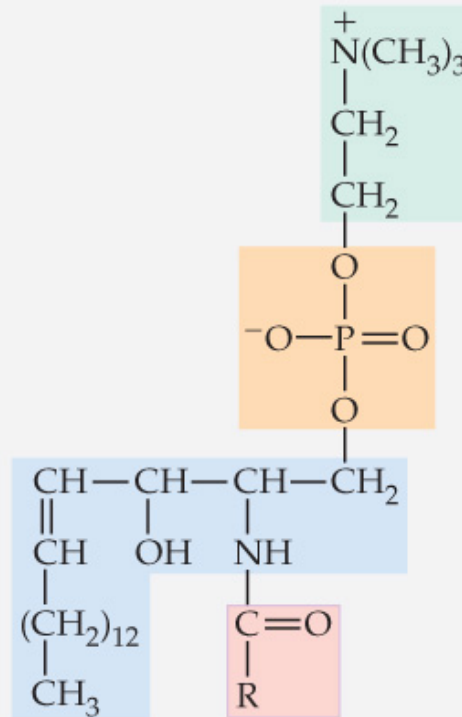


Ch23: Lipids

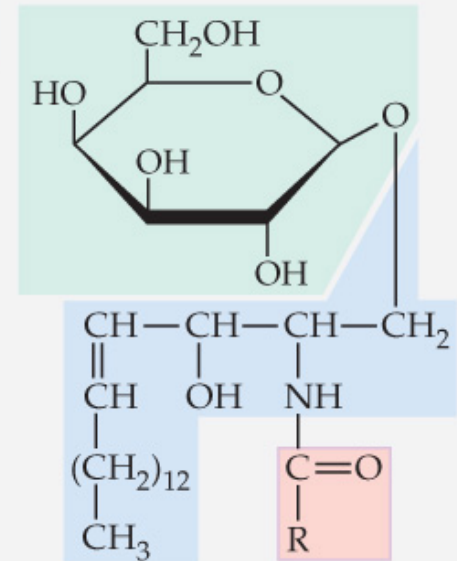
# Phospholipids and Sphingolipids



A glycerophospholipid  
(a phosphatidylcholine)



A sphingomyelin

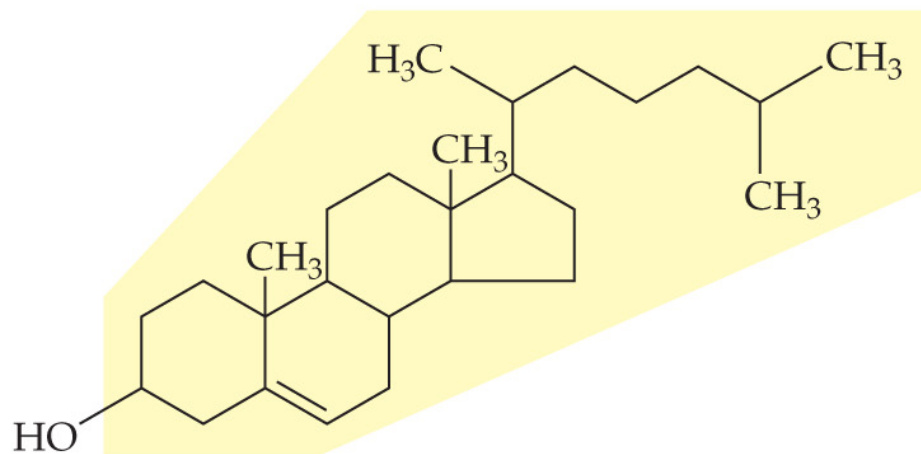
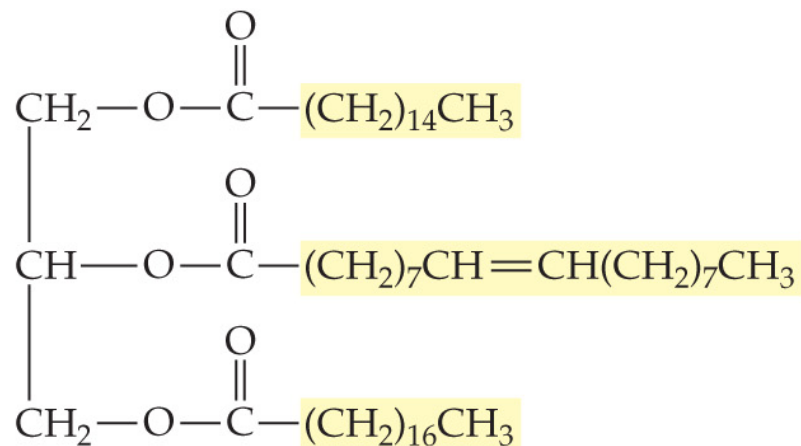
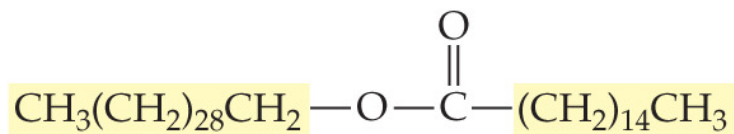


A glycolipid

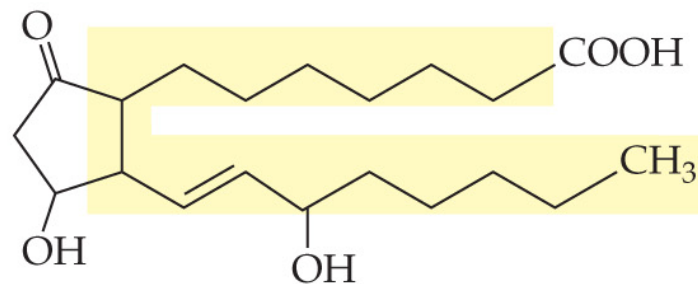
Phospholipids

Sphingolipids

# Which family of lipid?

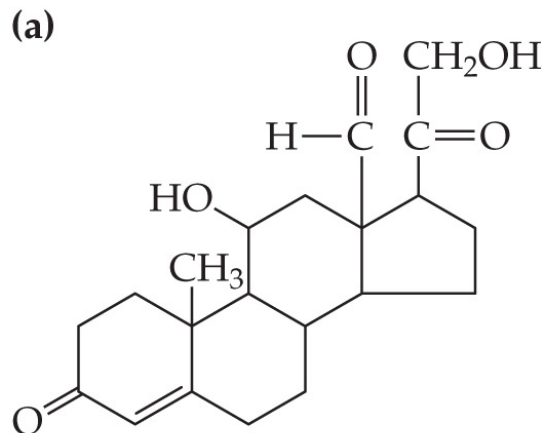


Cholesterol,

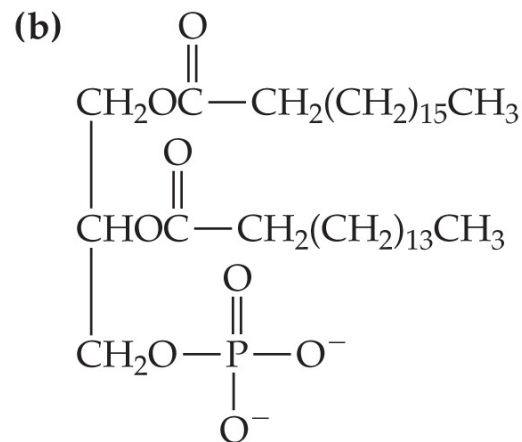
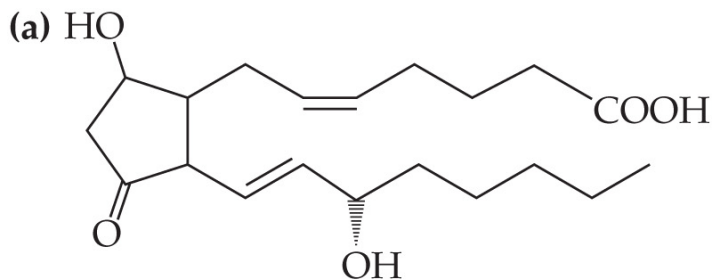
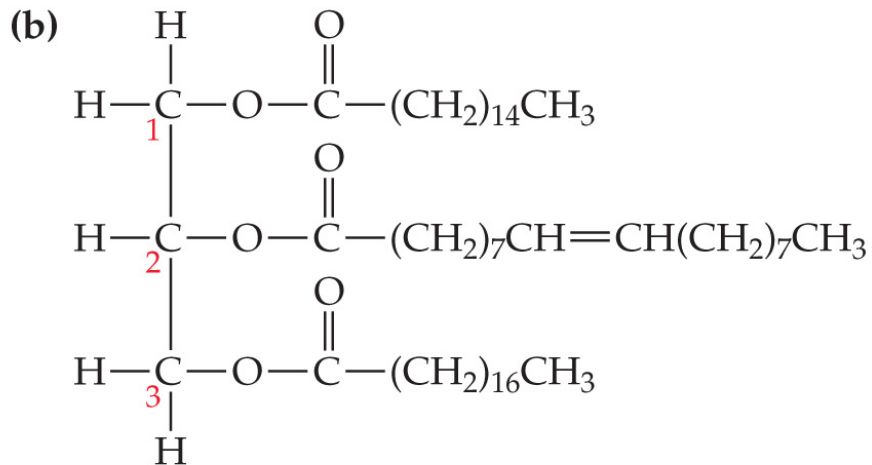


A prostaglandin

# Which family of lipid?



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# Fatty Acids

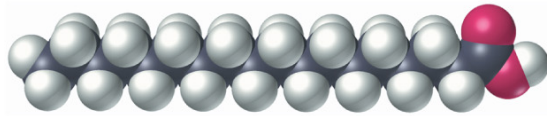
**TABLE 23.1 Structures of Some Common Fatty Acids**

Name	Typical Source	Number of Carbons	Number of Double Bonds	Condensed Formula	Melting Point (°C)
<b>Saturated</b>					
Lauric	Coconut oil	12	0	$\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$	44
Myristic	Butter fat	14	0	$\text{CH}_3(\text{CH}_2)_{12}\text{COOH}$	58
Palmitic	Most fats and oils	16	0	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$	63
Stearic	Most fats and oils	18	0	$\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$	70
<b>Unsaturated</b>					
Oleic	Olive oil	18	1	$\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}(\text{cis})$	4
Linoleic	Vegetable oils	18	2	$\text{CH}_3(\text{CH}_2)_4\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}(\text{all cis})$	-5
Linolenic	Soybean and canola oils	18	3	$\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CHCH}_2\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}(\text{all cis})$	-11
Arachidonic	Animal fat	20	4	$\text{CH}_3(\text{CH}_2)_4(\text{CH}=\text{CHCH}_2)_4\text{CH}_2\text{CH}_2\text{COOH}(\text{all cis})$	-50

# Fatty Acids

## Saturated

*A saturated fat has only single C-C bonds and appears straight*

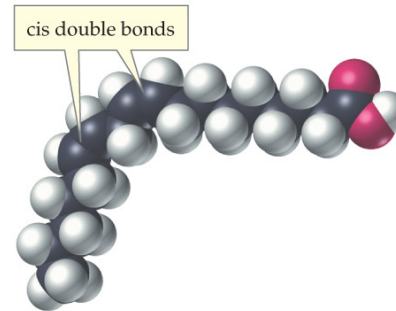


Stearic acid, an 18-carbon saturated fatty acid

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## Unsaturated

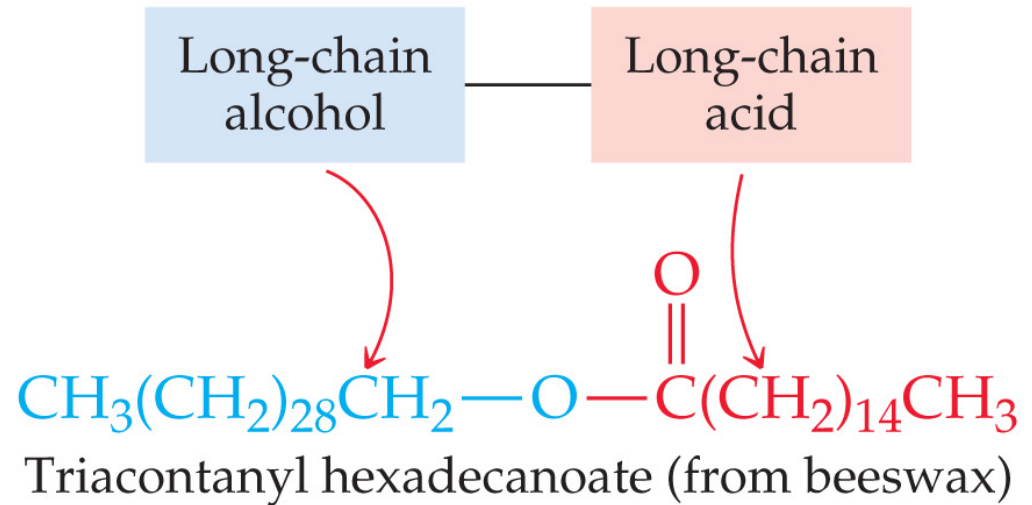
*Unsaturated fats bend due to cis double bonds*



Linoleic acid, an 18-carbon unsaturated fatty acid

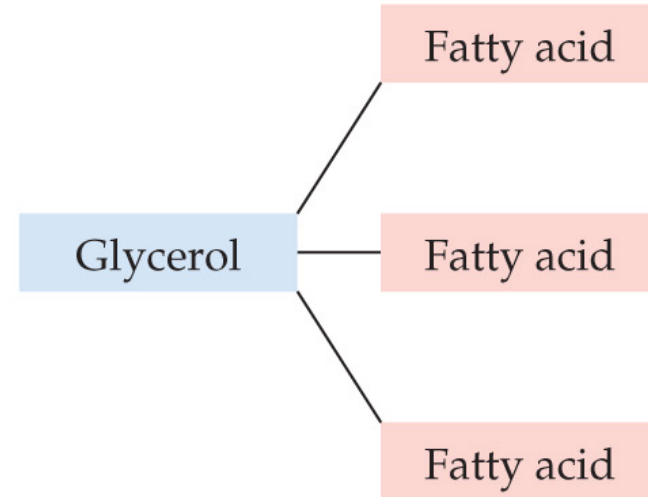
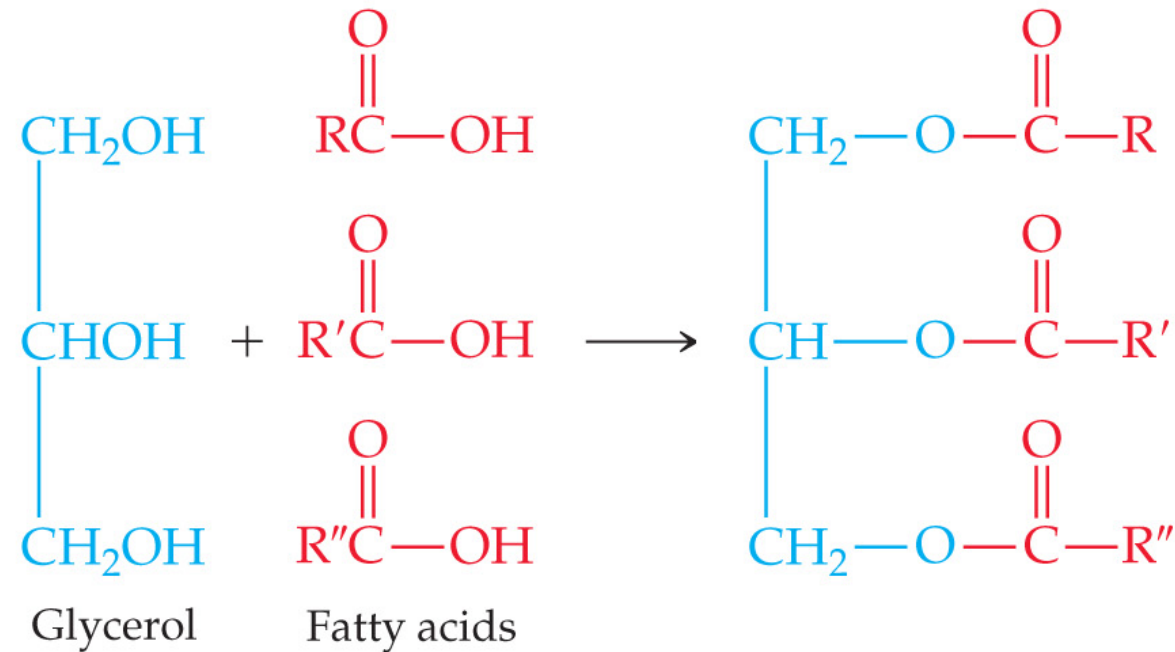
# Lipid Family: Waxes

*Example of a wax*



# Lipid Family: Triacylglycerols

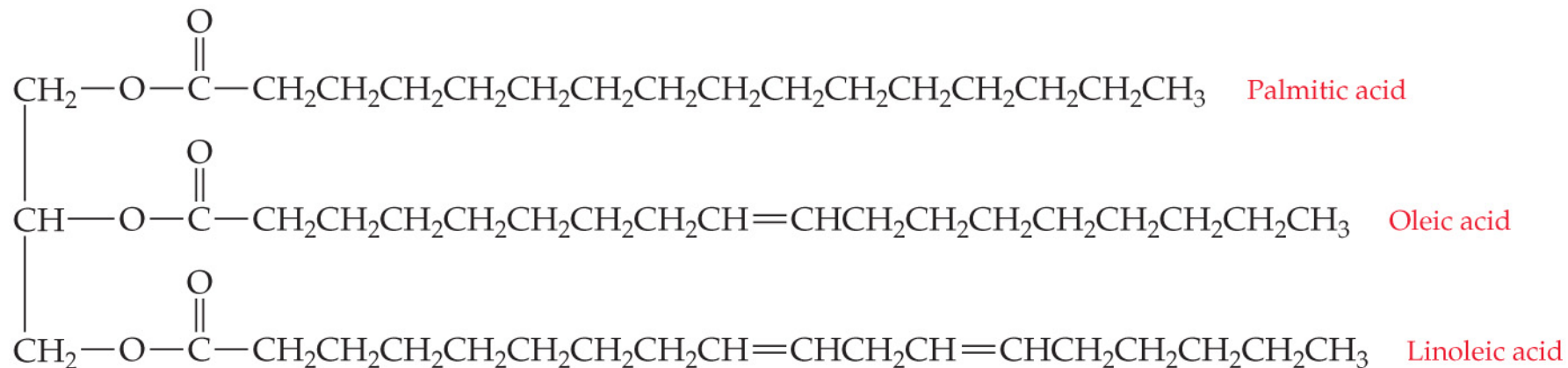
## *Triacylglycerols*





# Example of Triacylglycerols

*Example of a triacylglycerol*



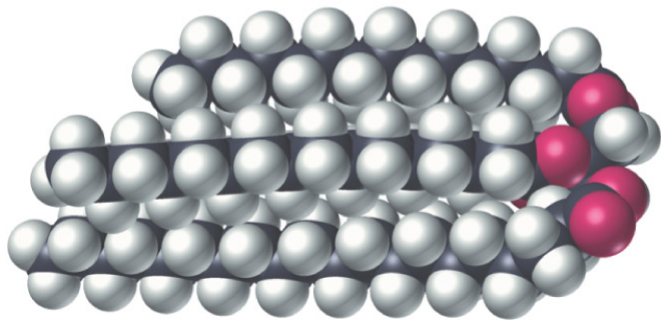
# Composition of Some Common Fats and Oils

**TABLE 23.2** Approximate Composition of Some Common Fats and Oils\*

Source	Saturated Fatty Acids (%)				Unsaturated Fatty Acids (%)	
	C12:0 Lauric	C14:0 Myristic	C16:0 Palmitic	C18:0 Stearic	C18:1 Oleic	C18:2 Linoleic
<b>Animal Fat</b>						
Lard	—	1	25	15	50	6
Butter	2	10	25	10	25	5
Human fat	1	3	25	8	46	10
Whale blubber	—	8	12	3	35	10
<b>Vegetable Oil</b>						
Corn	—	1	8	4	46	42
Olive	—	1	5	5	83	7
Peanut	—	—	7	5	60	20
Soybean	—	—	7	4	34	53

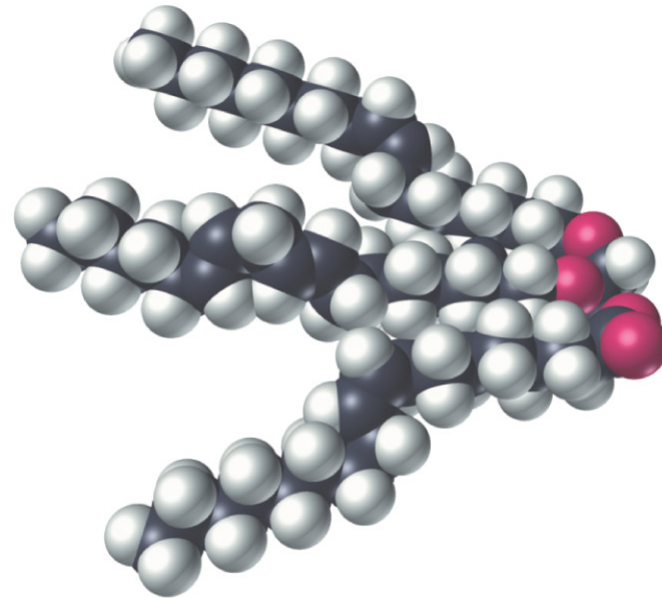
\*Where totals are less than 100%, small quantities of several other acids are present, with cholesterol also present in animal fats.

# Triacylglycerols with Different Percentages of Unsaturated Fatty Acids



A fat

High percentage of  
Saturated fatty acids

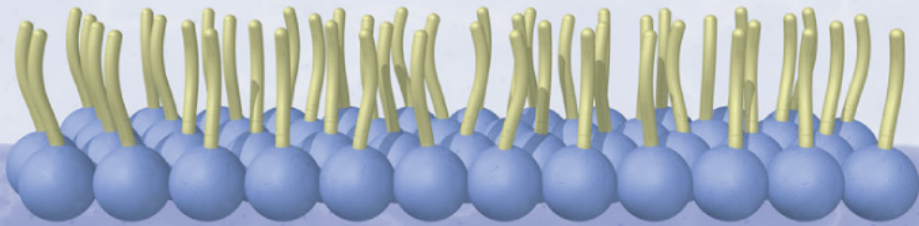


An oil

High percentage of  
Unsaturated fatty acids

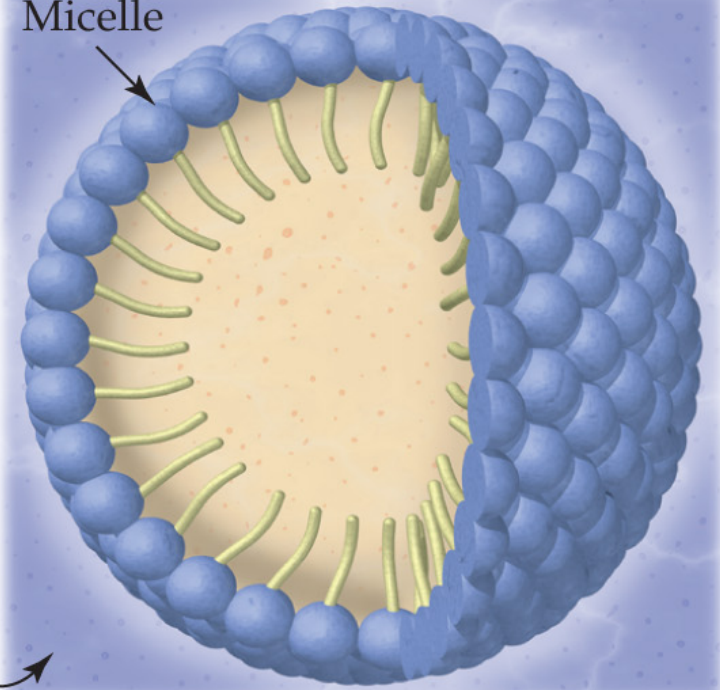
# Soap Molecules in Water

Air



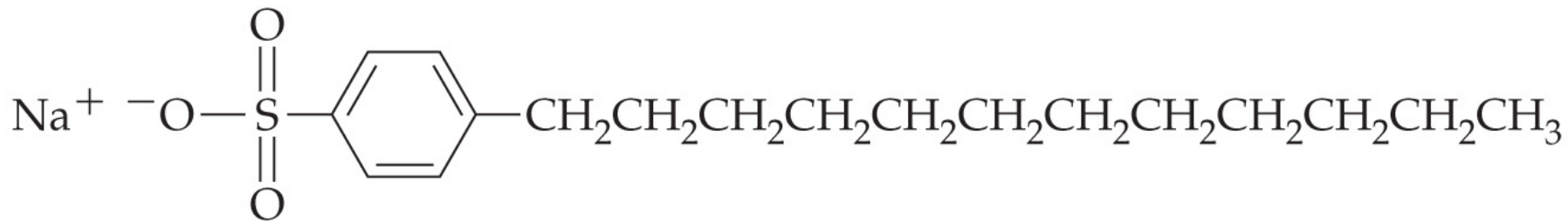
Water

Micelle



Water

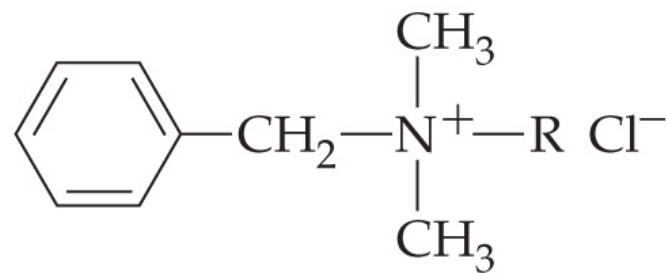
# Detergent Structures



Sodium dodecylbenzenesulfonate  
(An ionic detergent)



A polyether  
(A nonionic detergent)



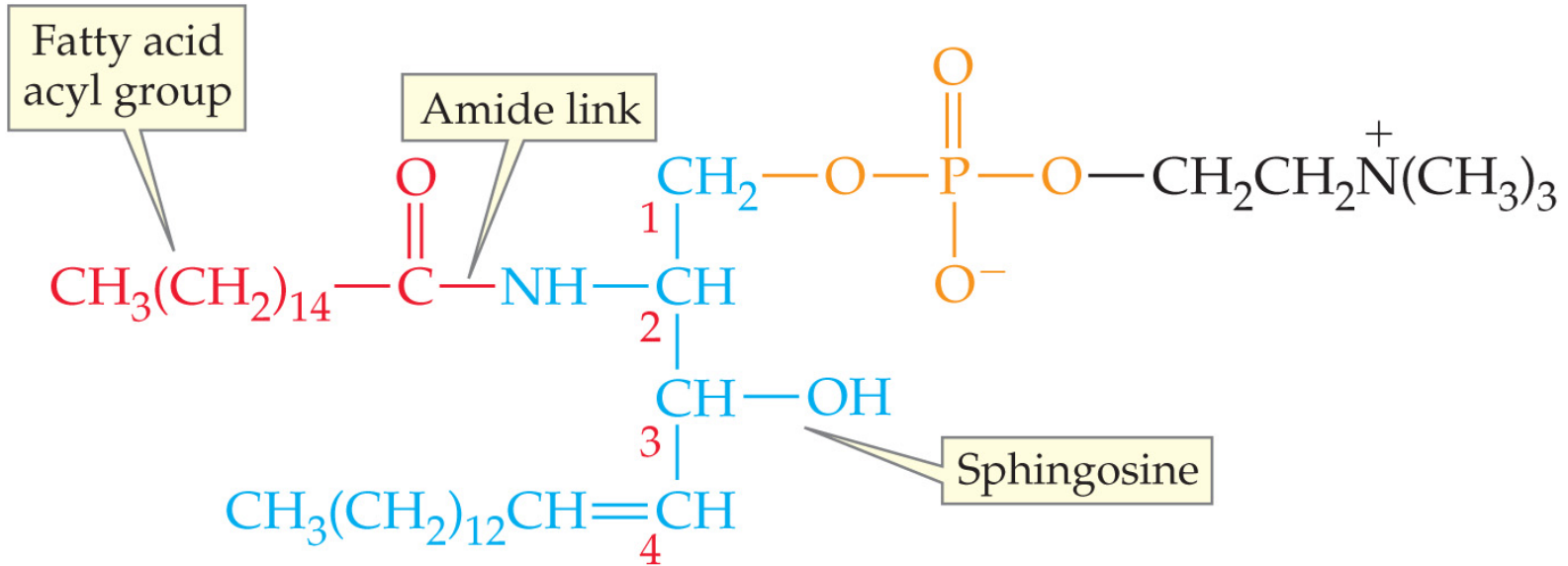
A benzalkonium chloride;  $\text{R} = \text{C}_8\text{H}_{17}$  to  $\text{C}_{18}\text{H}_{37}$   
(A cationic detergent)

# Lipid Family: Glycerophospholipids

TABLE 23.3 Some Glycerophospholipids

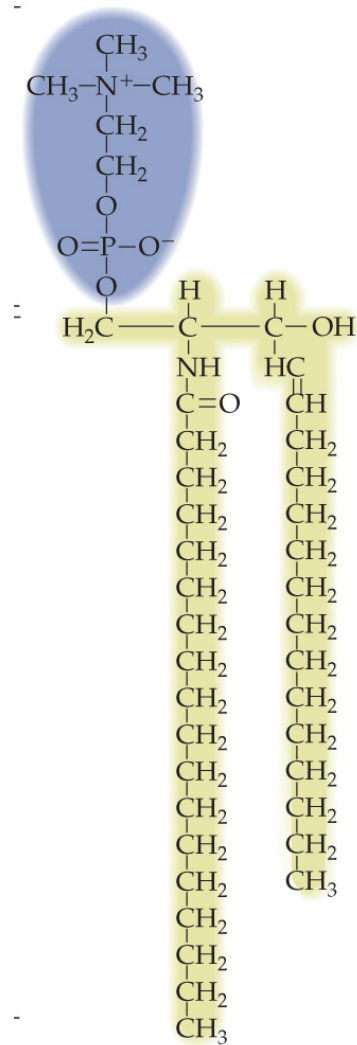
PRECURSOR OF X (HO-X)	FORMULA OF X	NAME OF RESULTING GLYCEROPHOSPHOLIPID FAMILY	FUNCTION
Water	—H	Phosphatidate	Basic structure of glycerophospholipids
Choline	—CH <sub>2</sub> CH <sub>2</sub> N <sup>+</sup> (CH <sub>3</sub> ) <sub>3</sub>	Phosphatidylcholine	Basic structure of lecithins; most abundant membrane phospholipids
Ethanolamine	—CH <sub>2</sub> CH <sub>2</sub> NH <sub>3</sub> <sup>+</sup>	Phosphatidylethanolamine	Membrane lipids
Serine		Phosphatidylserine	Present in most tissues; abundant in brain
<i>myo</i> -Inositol		Phosphatidylinositol	Relays chemical signals across cell membranes

# Lipid Family: Sphingomyelins



A sphingomyelin (a sphingolipid)

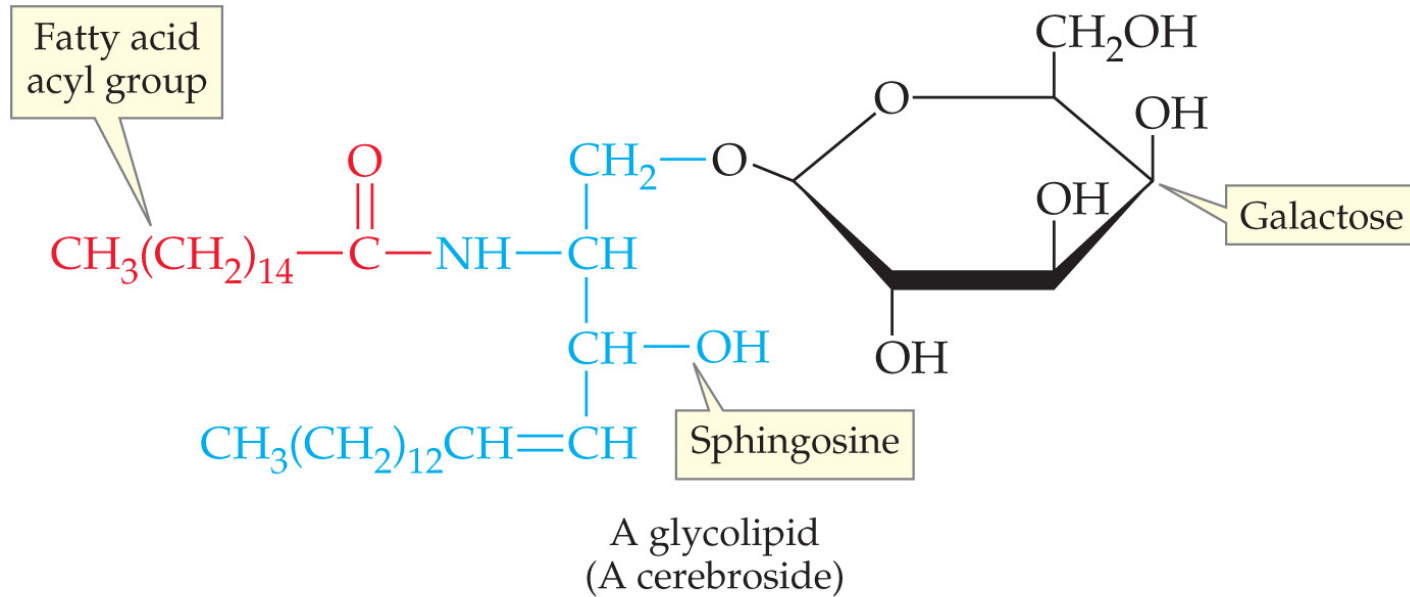
# Sphingomyelin Structure



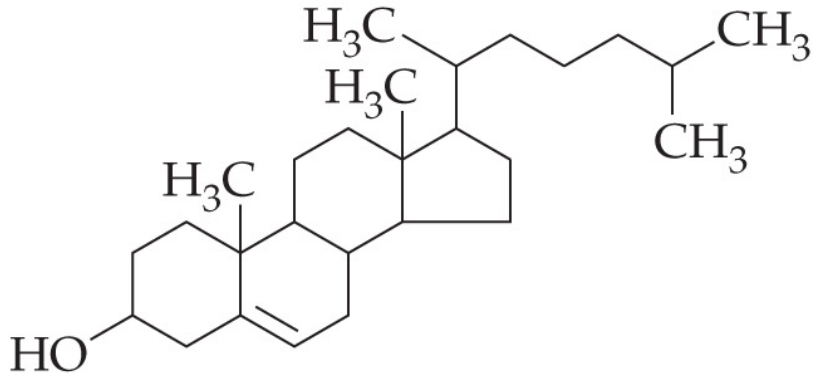
A sphingomyelin



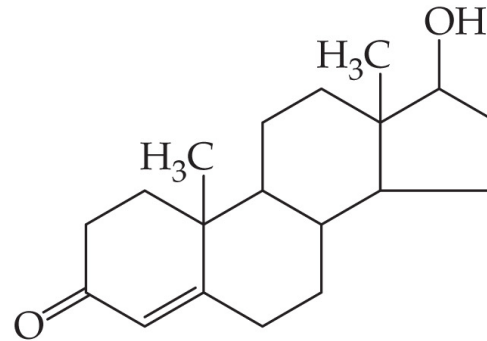
# Lipid Family: Glycolipid



# Lipid Family: Sterols

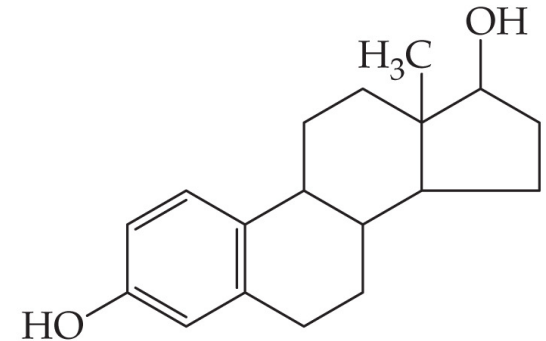


Cholesterol



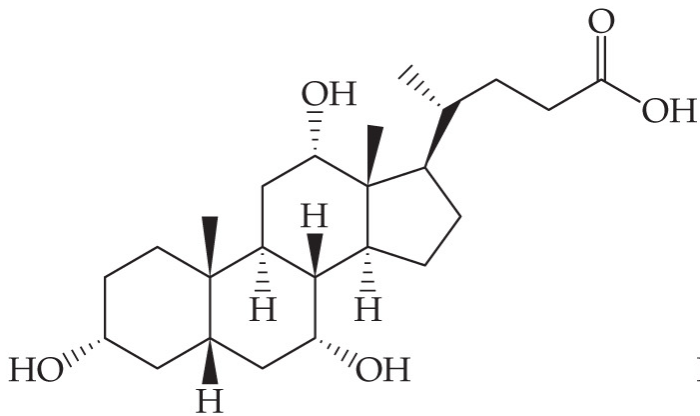
Testosterone  
(an androgen)

## Hormones

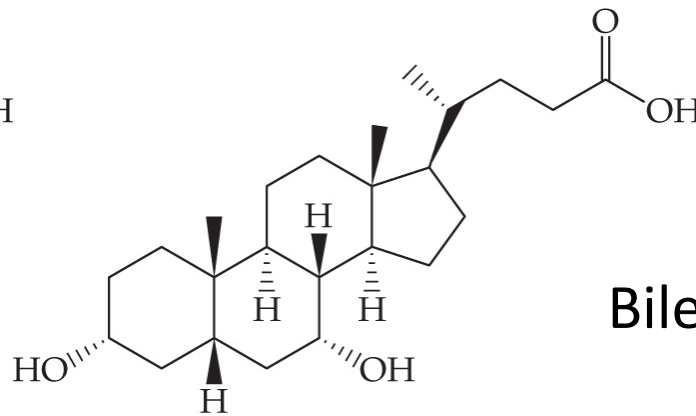


Estradiol  
(an estrogen)

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Cholic acid



Chenodeoxycholic acid

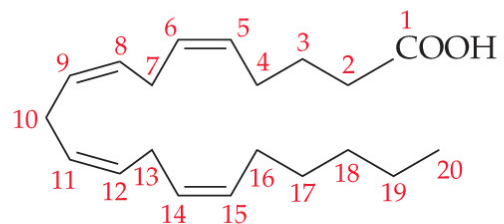
## Bile Acids

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# Lipid Family: Eicosanoids



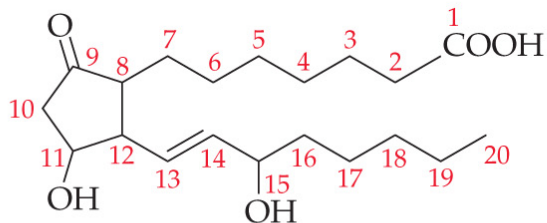
Arachidonic acid



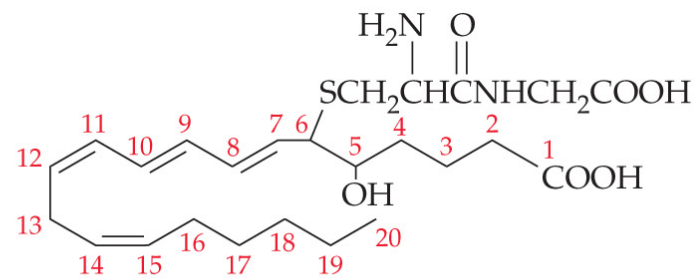
Arachidonic acid (bent)

Multistep  
enzyme-catalyzed  
synthesis

Multistep  
enzyme-catalyzed  
synthesis

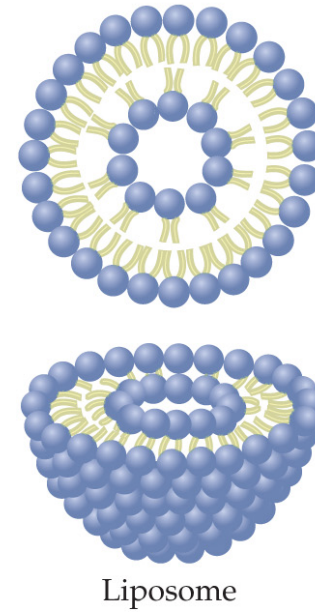
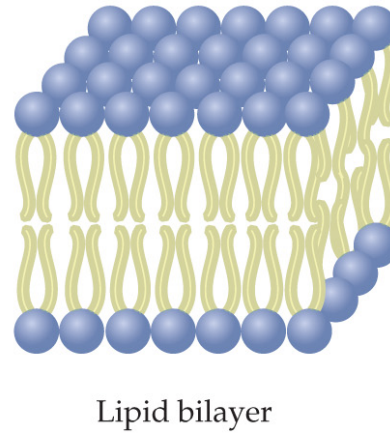
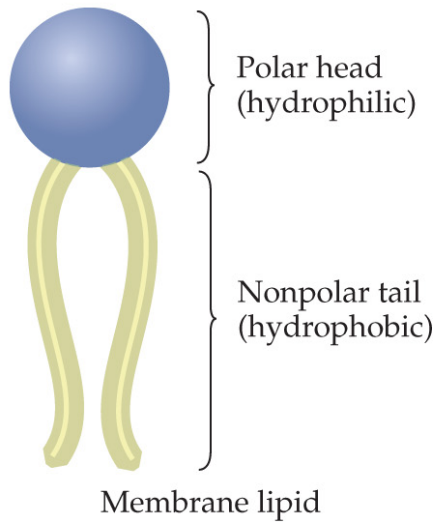


PGE<sub>1</sub>, a prostaglandin

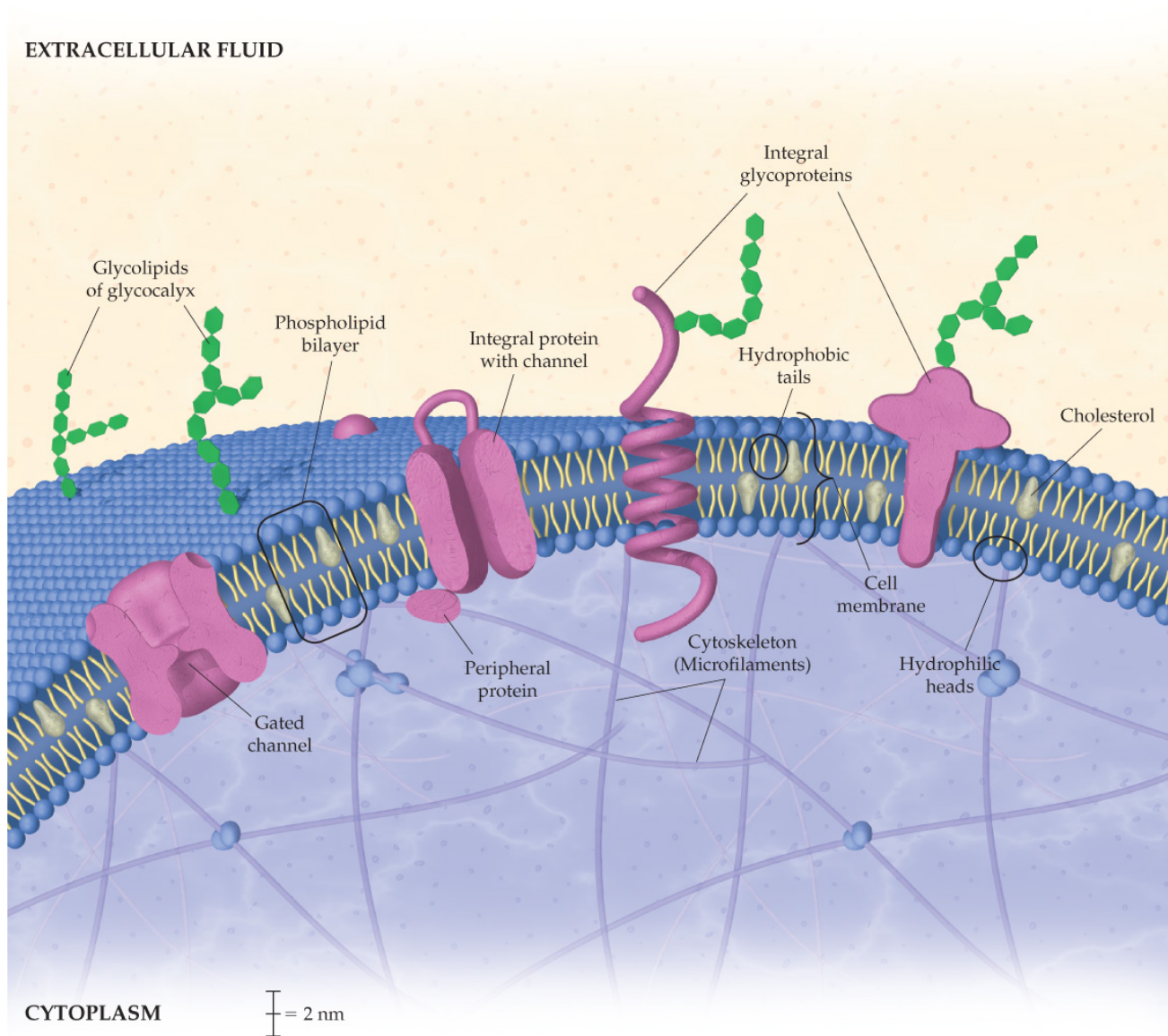


Leukotriene D<sub>4</sub>

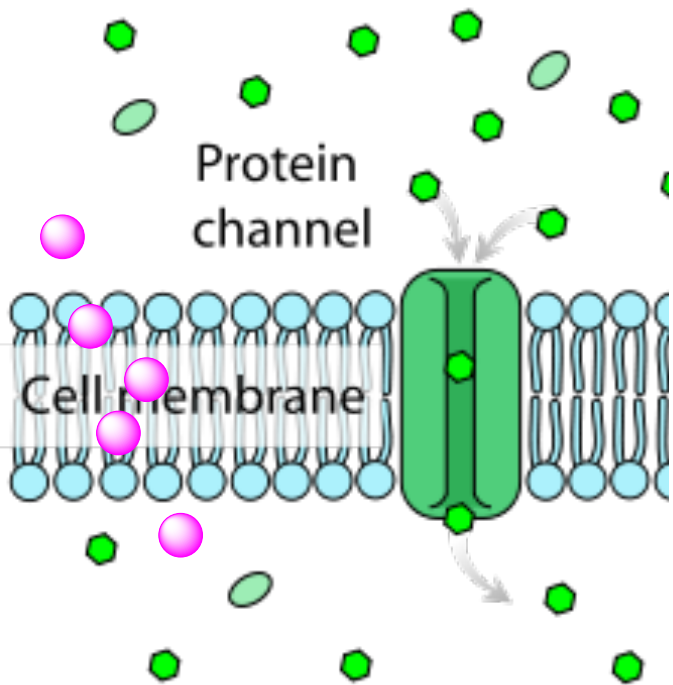
# Lipid Bilayer



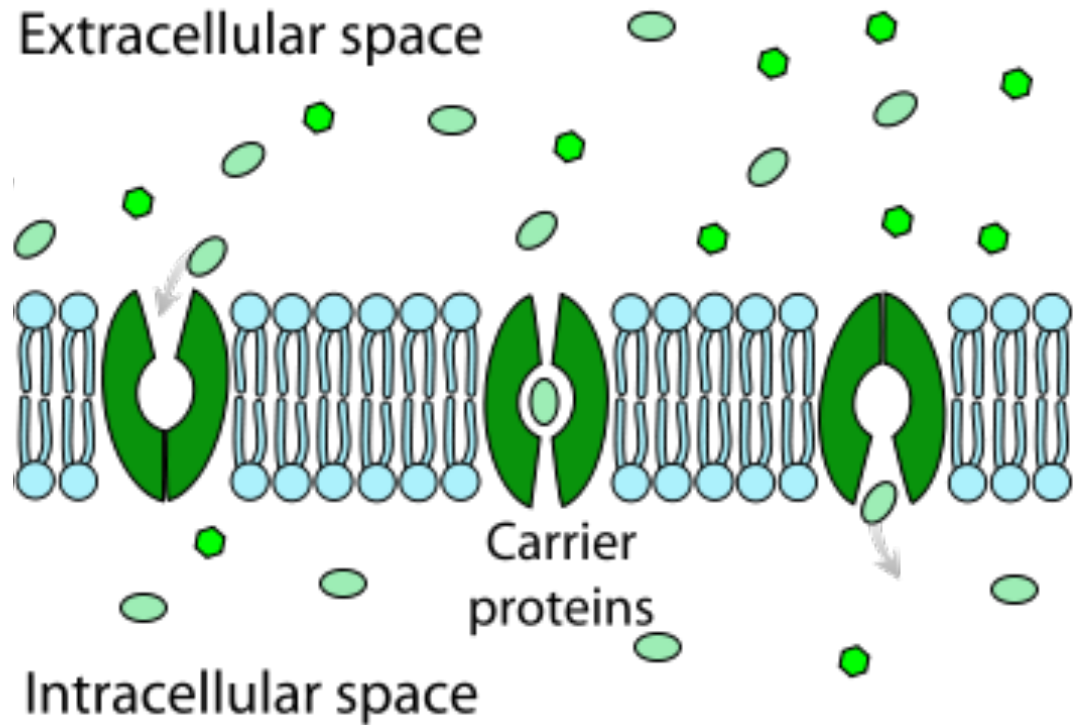
# Cell Membrane



# Passive Transport

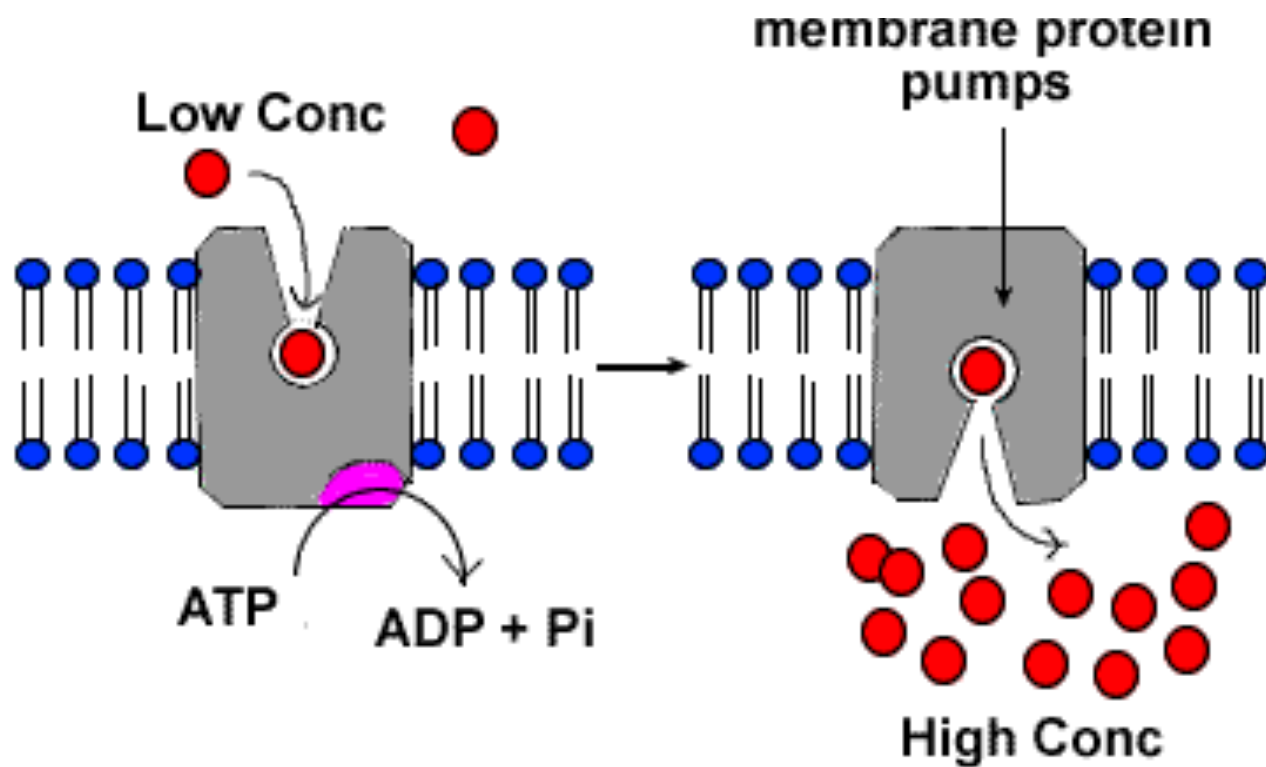


Simple Diffusion



Facilitated Diffusion

# Active Transport



# Na<sup>+</sup>/K<sup>+</sup> Pump

