

Membranas

MEMBRANAS

- As membranas tem estruturas tão diversas quanto funções
- Entretanto, várias características são comuns:
 - Formam barreiras entre compartimentos
 - São constituídas principalmente de lipídios e proteínas
 - Contém carboidratos
 - Proteínas específicas desempenham funções distintas em membranas

Membranas celulares

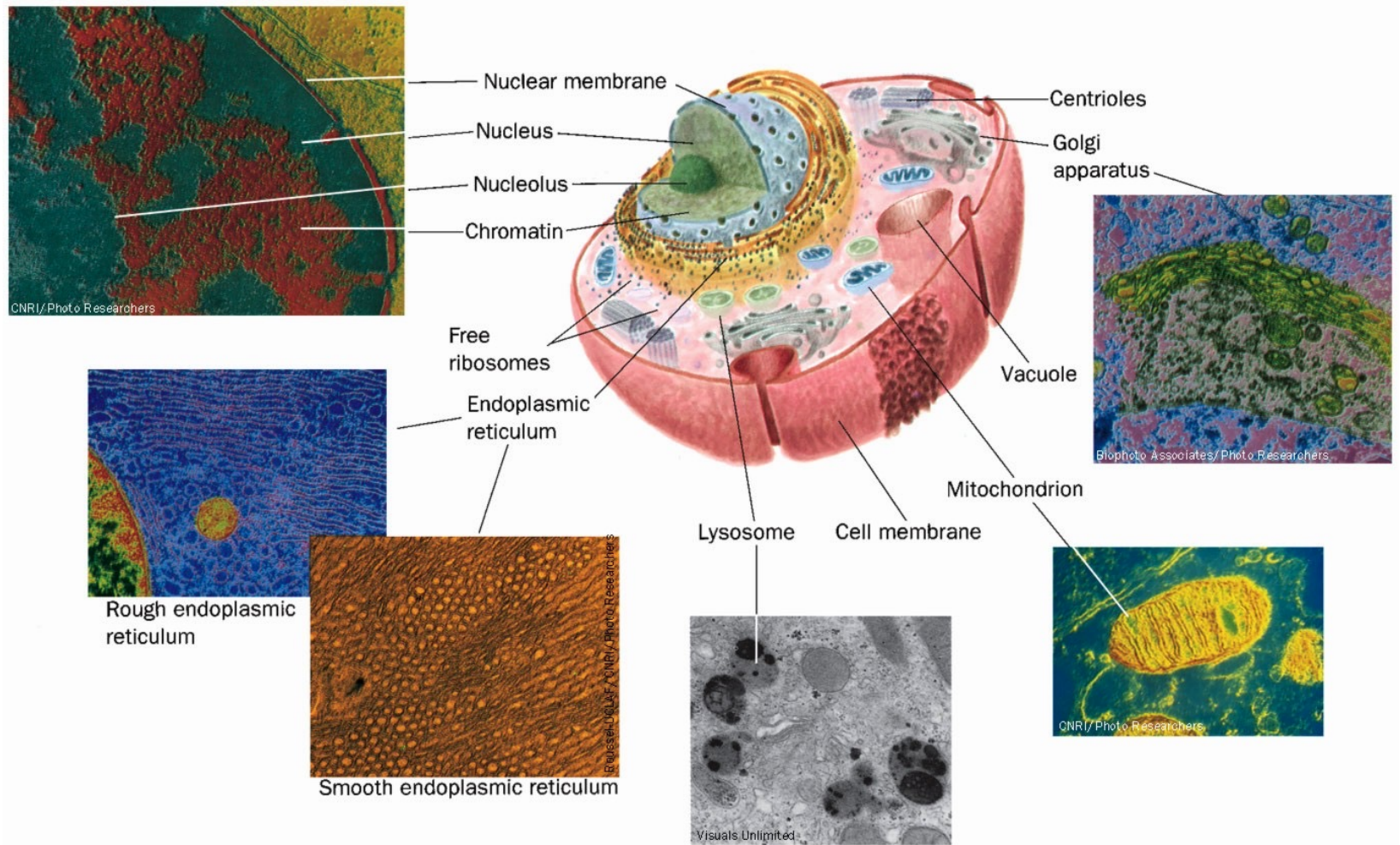
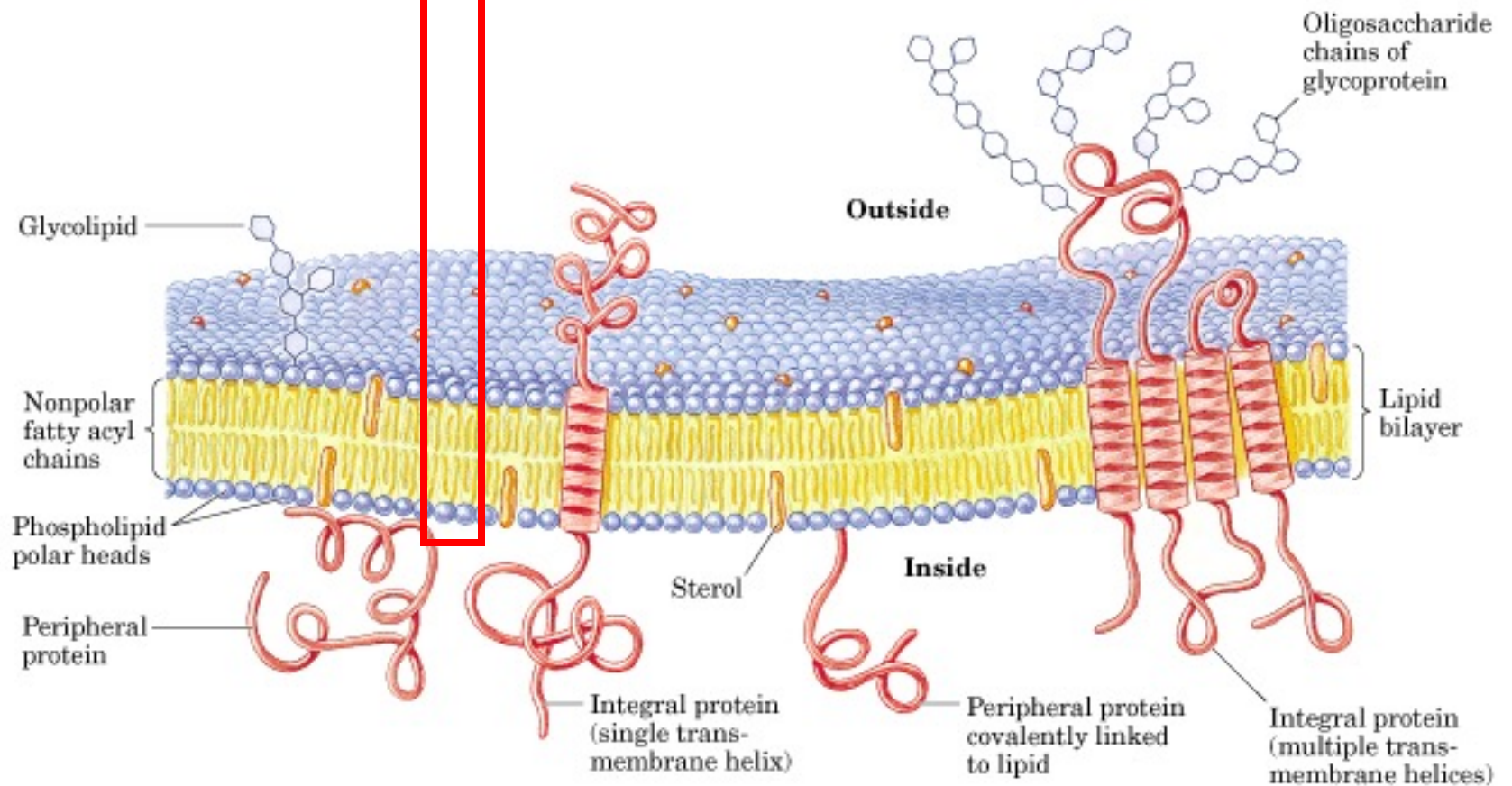


Figure 1-5 Schematic diagram of an animal cell accompanied by electron micrographs of its organelles.

LIPÍDIOS / MEMBRANAS



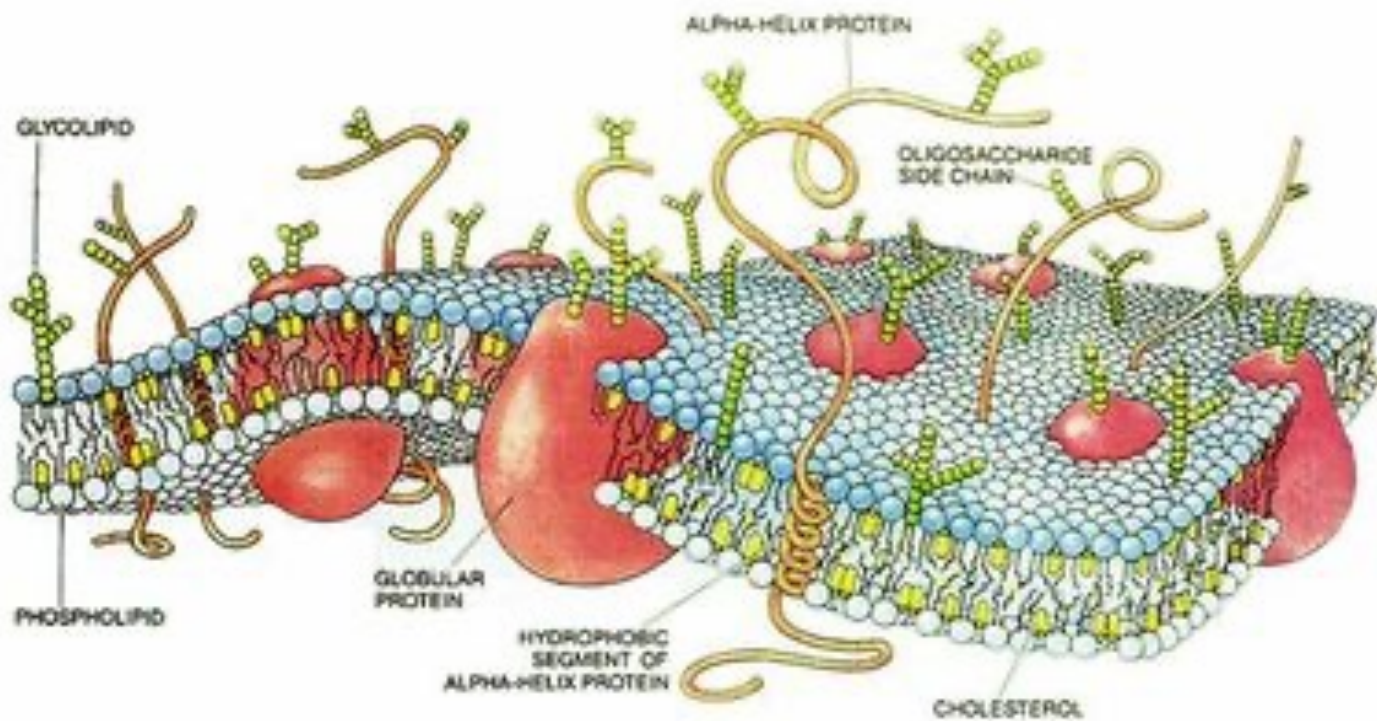
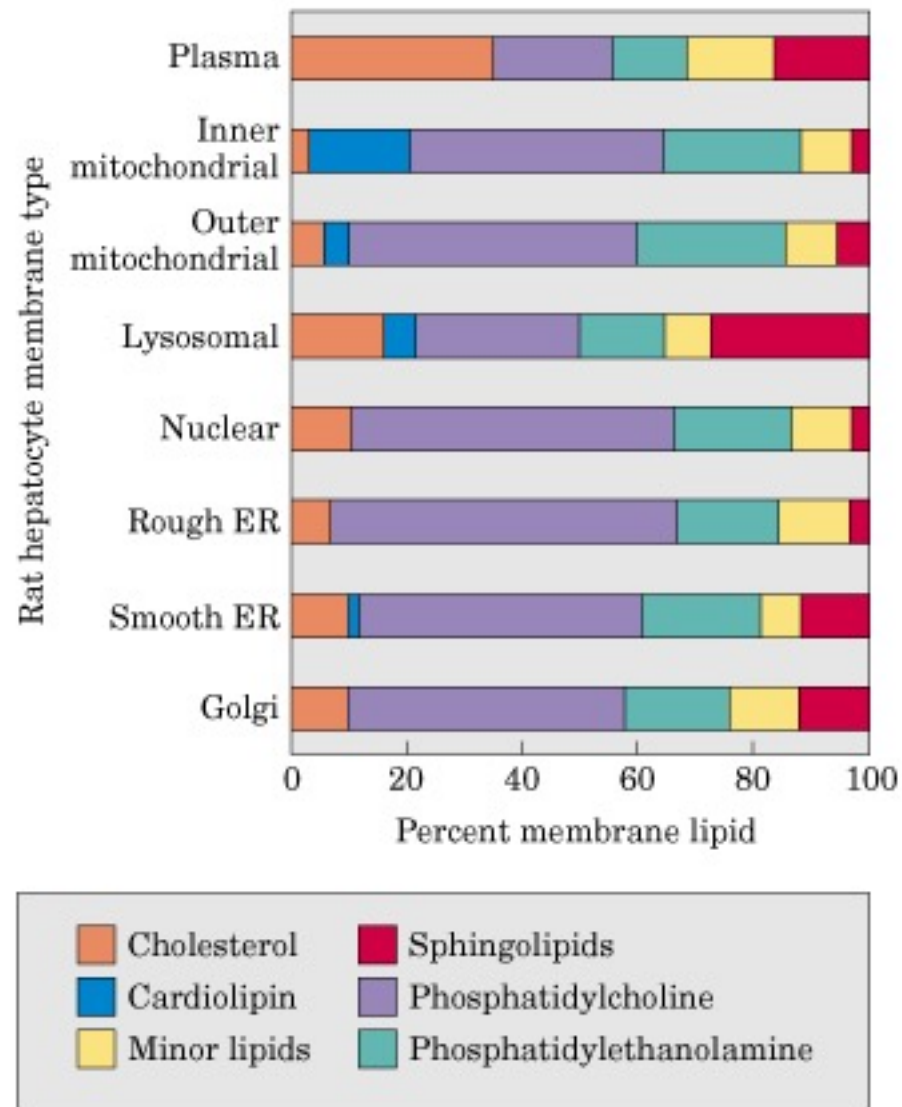


table 12-1

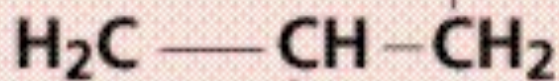
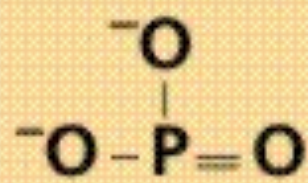
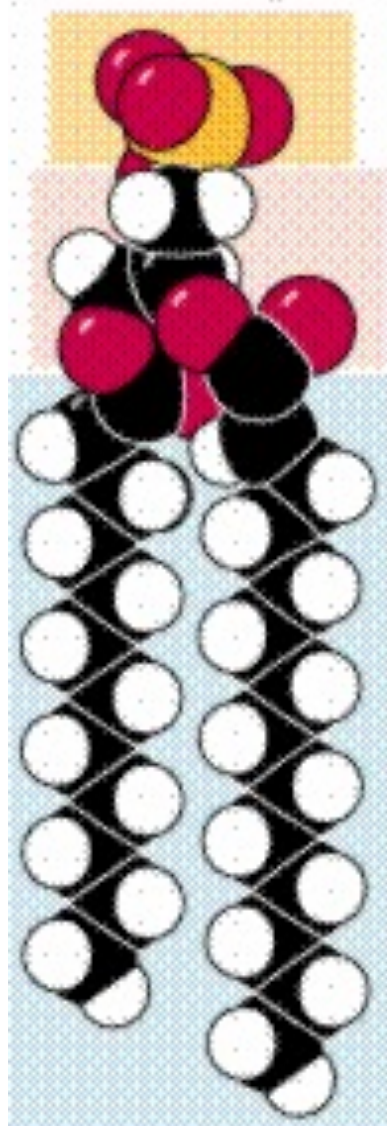
Major Components of Plasma Membranes in Various Organisms

	Components (% by weight)			Sterol type	Other lipids
	Protein	Phospholipid	Sterol		
Human myelin sheath	30	30	19	Cholesterol	Galactolipids, plasmalogens
Mouse liver	45	27	25	Cholesterol	—
Maize leaf	47	26	7	Sitosterol	Galactolipids
Yeast	52	7	4	Ergosterol	Triacylglycerols, sterol esters
<i>Paramecium</i> (ciliated protist)	56	40	4	Stigmasterol	—
<i>E. coli</i>	75	25	0	—	—

Lipid composition of the plasma membrane and organelle membranes of a rat hepatocyte



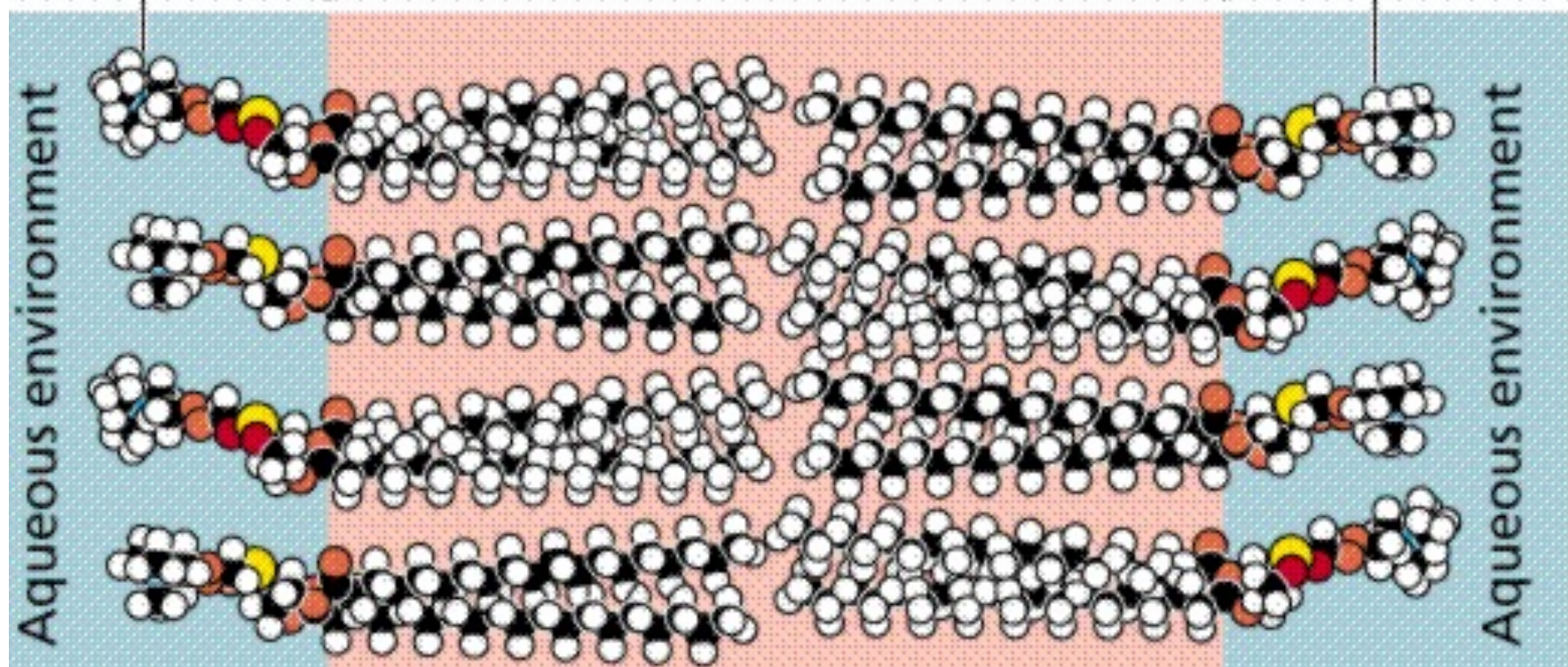
Phosphatidate



Polar,
hydrophilic
"head"

Nonpolar,
hydrophobic,
fatty acid "tails"

Polar,
hydrophilic
"head"



Biological membranes

Cell
Plasma and alveolar
membranes
tightly apposed



(a)

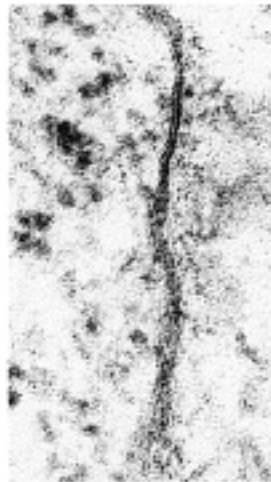


(b)



(c)

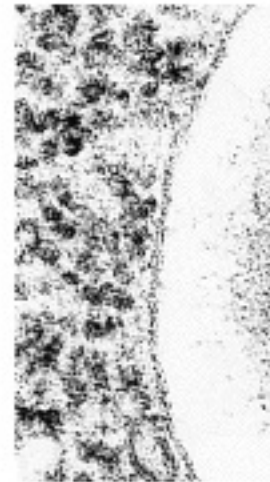
mitochondria



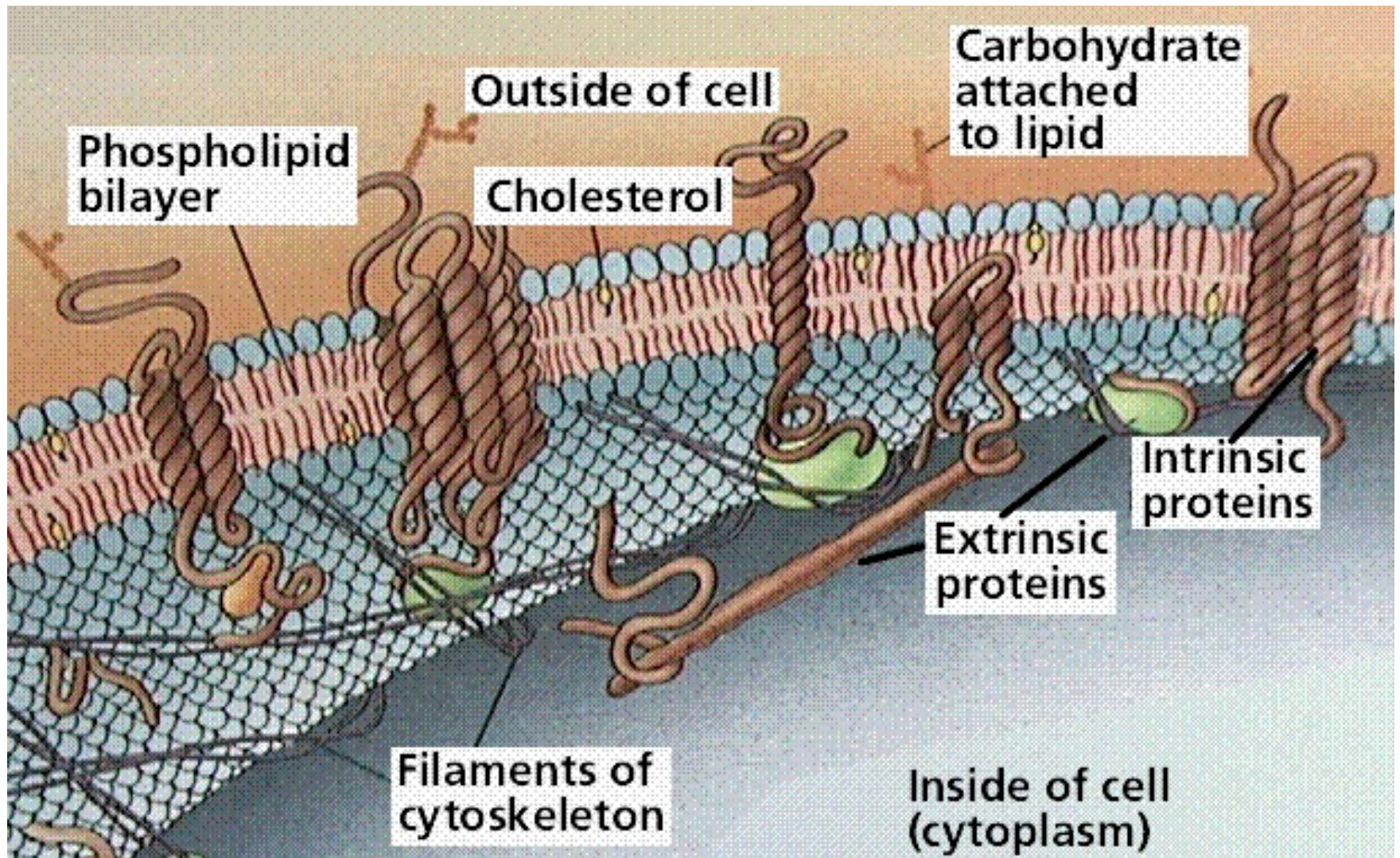
(d)



(e)



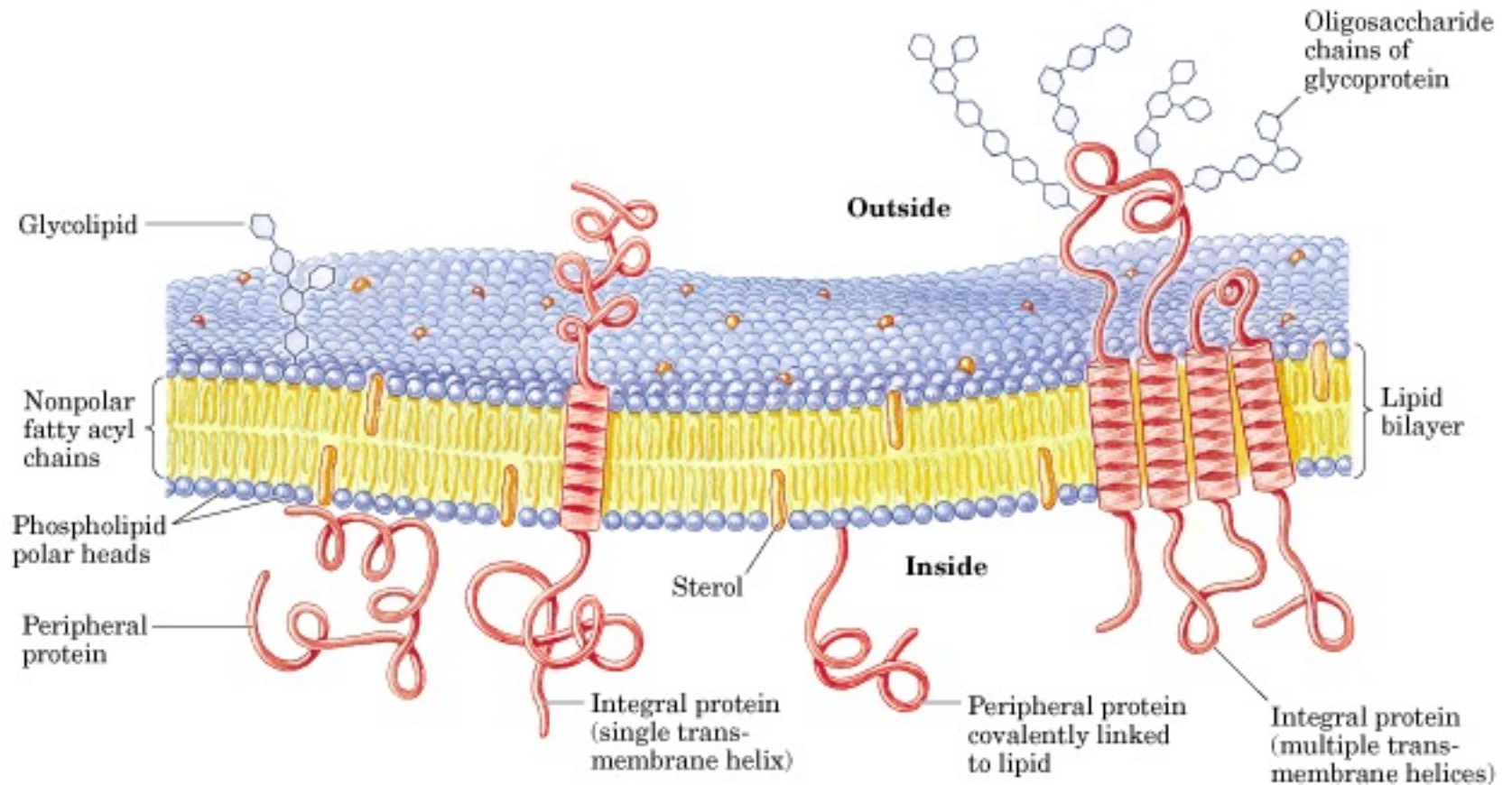
(f)



The supramolecular architecture of membranes

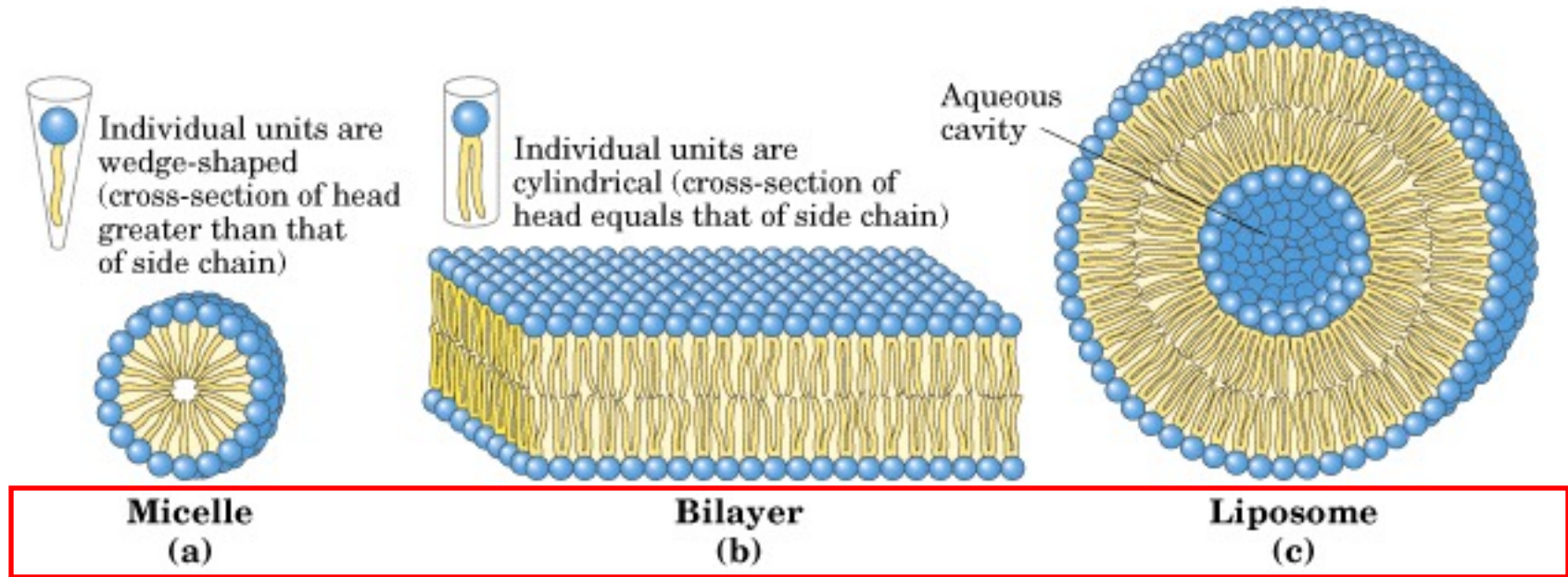
Fluid mosaic model for membrane structure

move laterally in the plane of the bilayer !



Lipídeos ANFIPÁTICOS podem formar micelas ou bicamadas lipídicas em soluções aquosas

Amphipathic lipid aggregates that form in water



As membranas são fluidas...



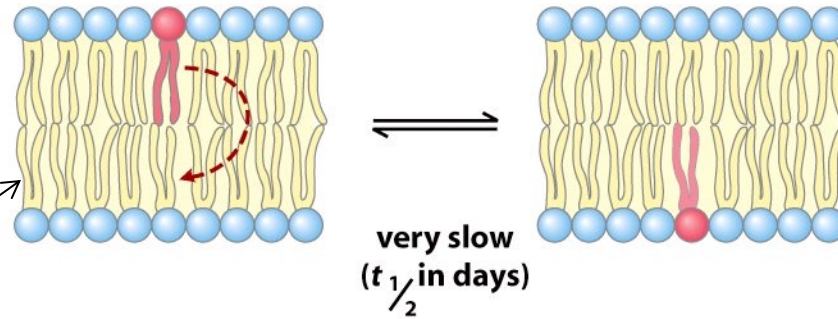
VESICLE



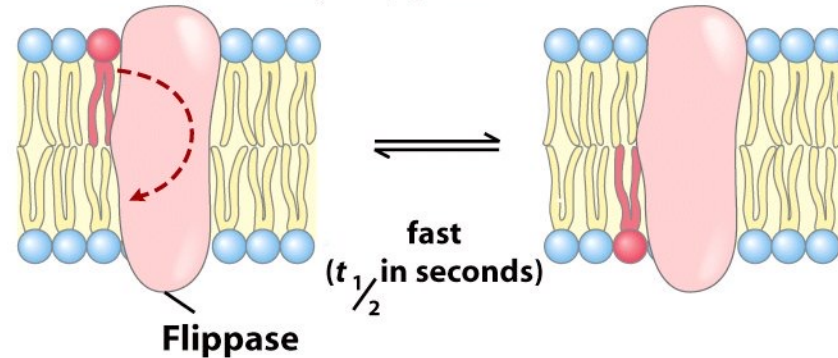
PLASMA
MEMBRANE

Difusão Transversal

(a) Uncatalyzed transverse ("flip-flop") diffusion

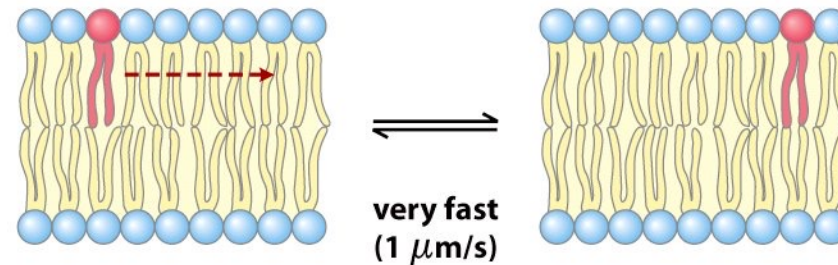


(b) Transverse diffusion catalyzed by flippase

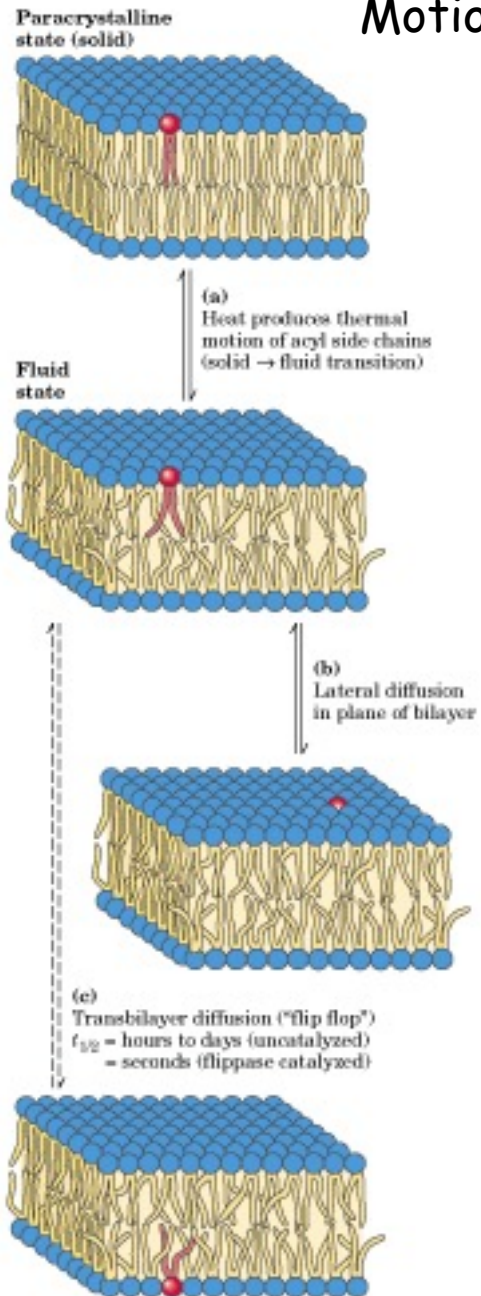


Difusão Lateral

(c) Uncatalyzed lateral diffusion



Motion of membrane lipids



Que fatores que influenciam a fluidez da mb?

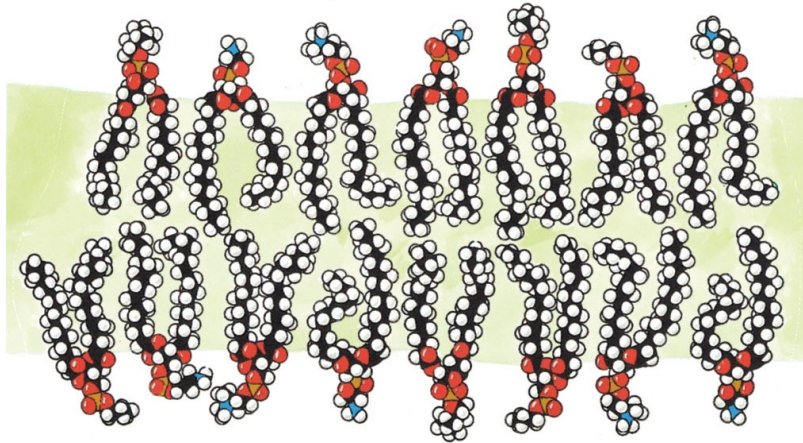
Temperatura

Composição de ácidos graxos

Colesterol

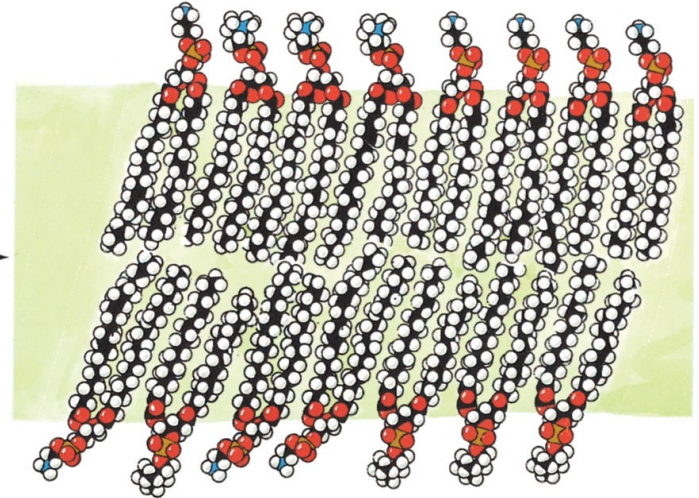
Temperatura de Transição

(a) Above transition temperature

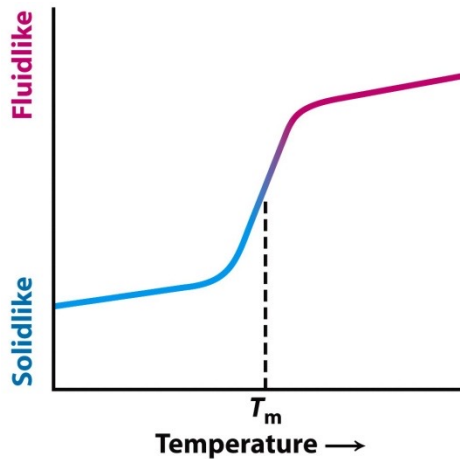


Líquido

(b) Below transition temperature



Gel “sólido”

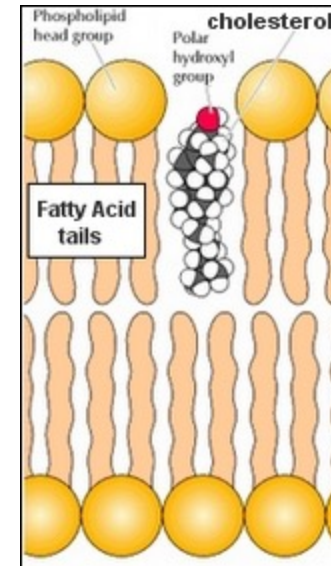
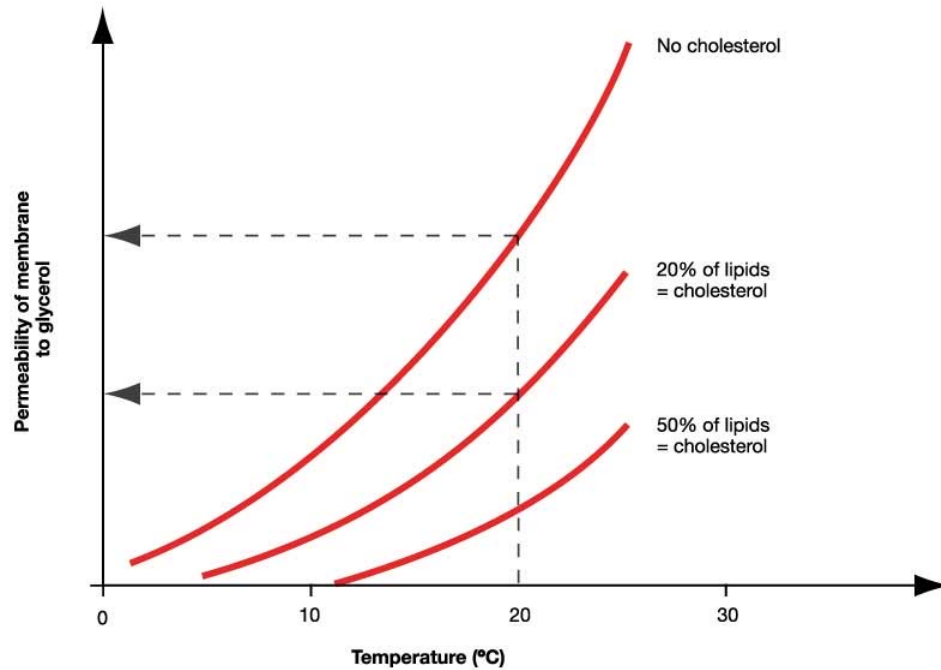


Composição de Ácidos Graxos

TABLE 11-2 Fatty Acid Composition of *E. coli* Cells Cultured at Different Temperatures

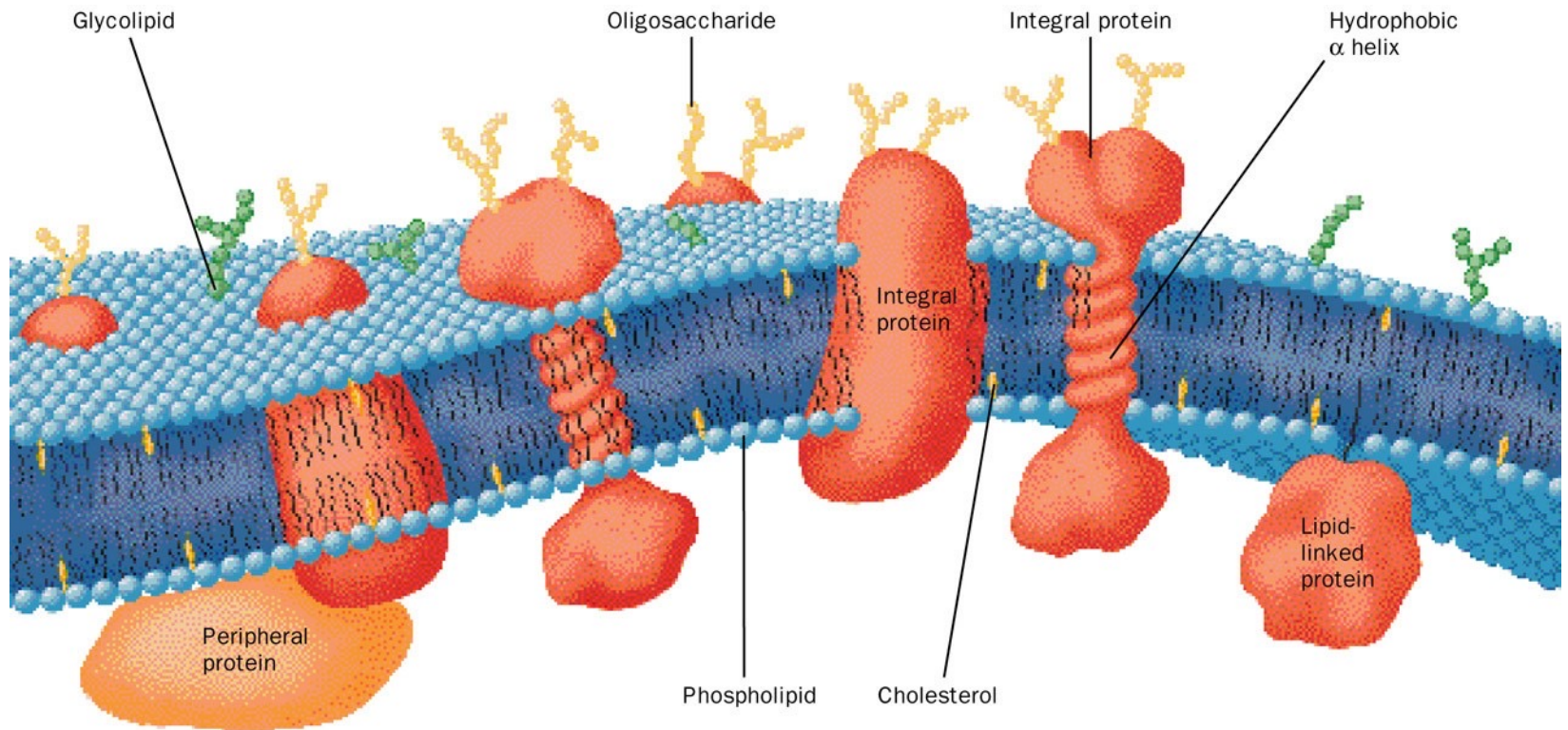
	<i>Percentage of total fatty acids*</i>			
	10 °C	20 °C	30 °C	40 °C
Myristic acid (14:0)	4	4	4	8
Palmitic acid (16:0)	18	25	29	48
Palmitoleic acid (16:1)	26	24	23	9
Oleic acid (18:1)	38	34	30	12
Hydroxymyristic acid	13	10	10	8
Ratio of unsaturated to saturated [†]	2.9	2.0	1.6	0.38

Colesterol



Membranas Biológicas

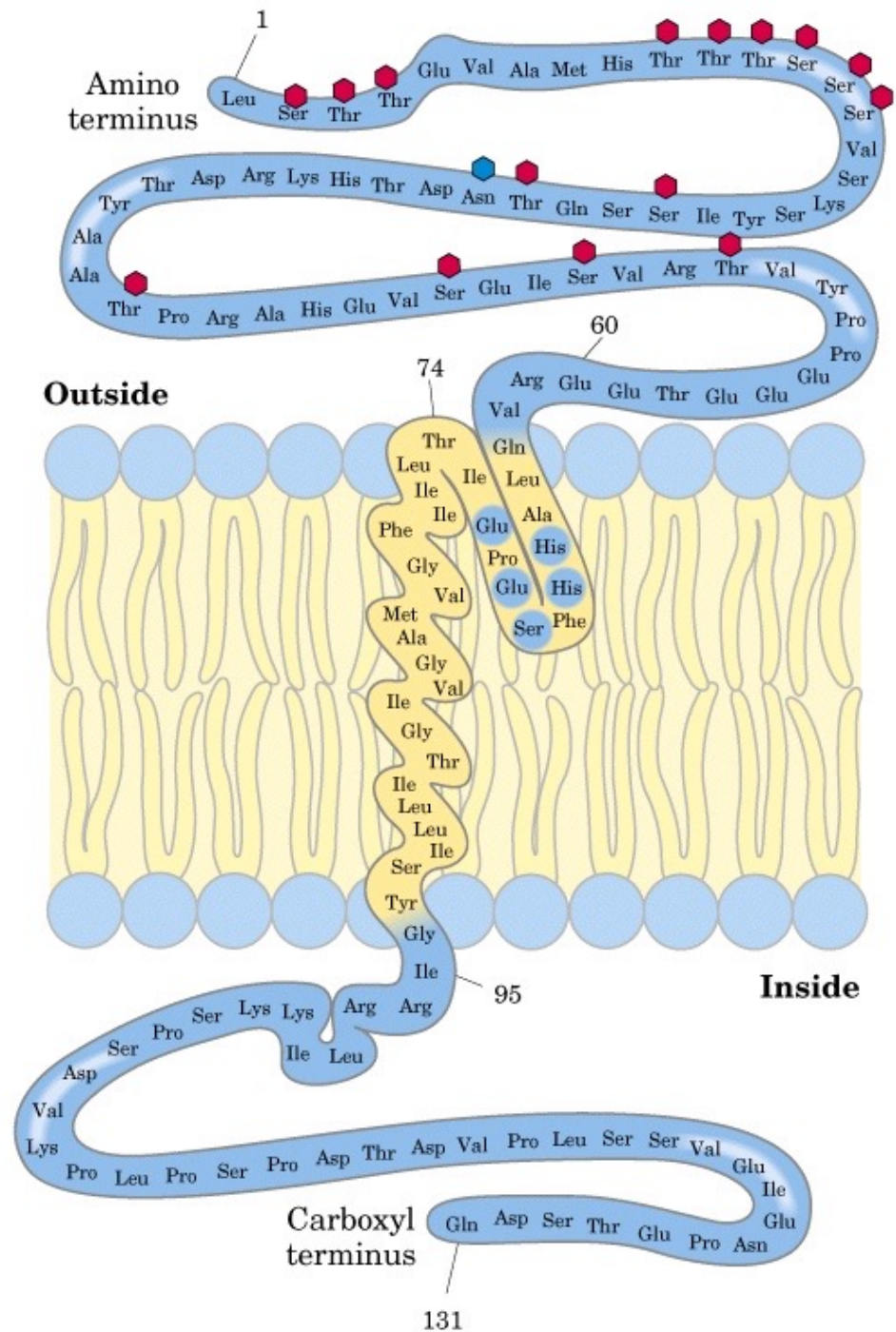
Membranas Biológicas



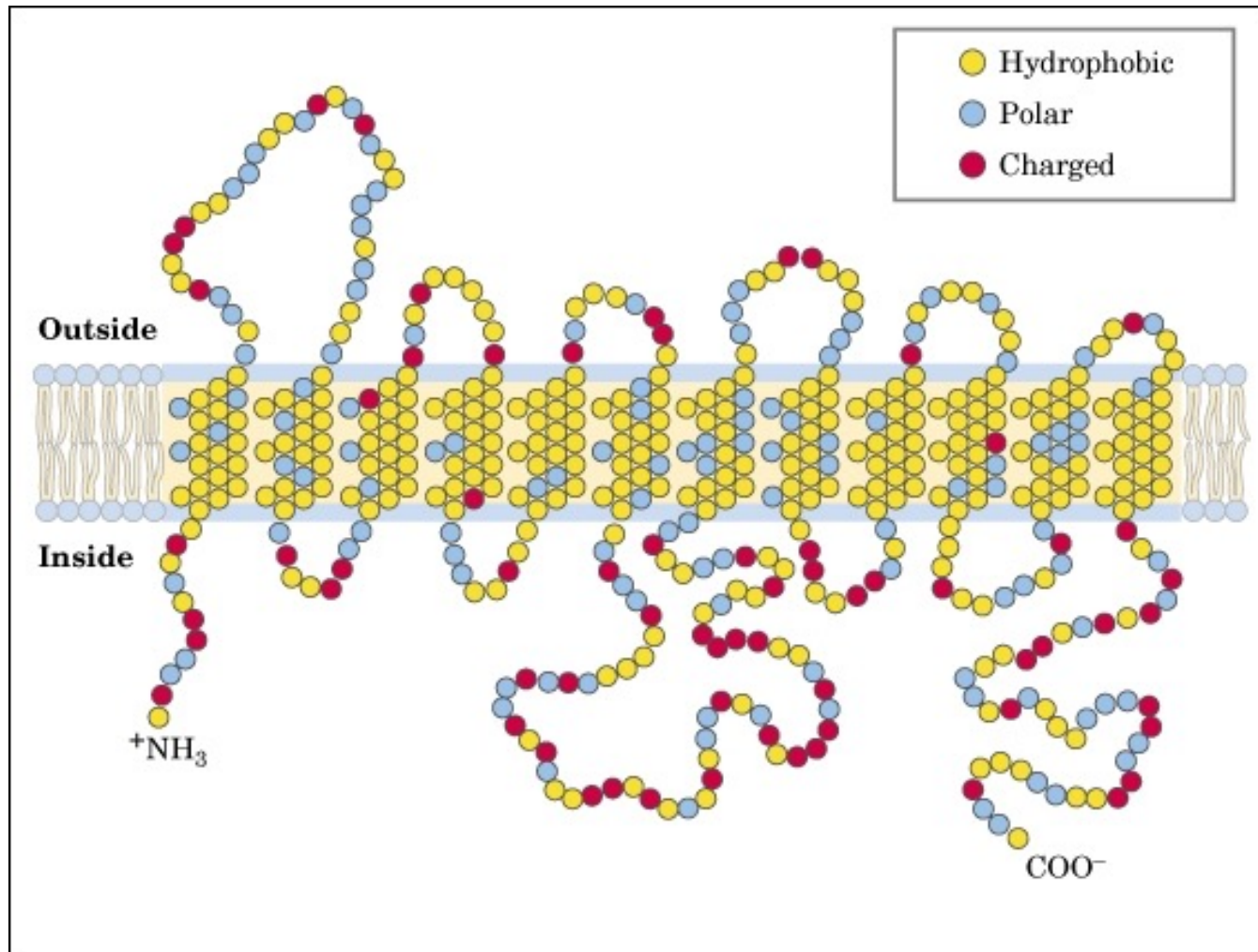
Modelo do Mosaico Fluido (1972, Singer&Nicholson)

A teoria postula que as “Proteínas são icebergs flutuando em um mar de lipídeos”

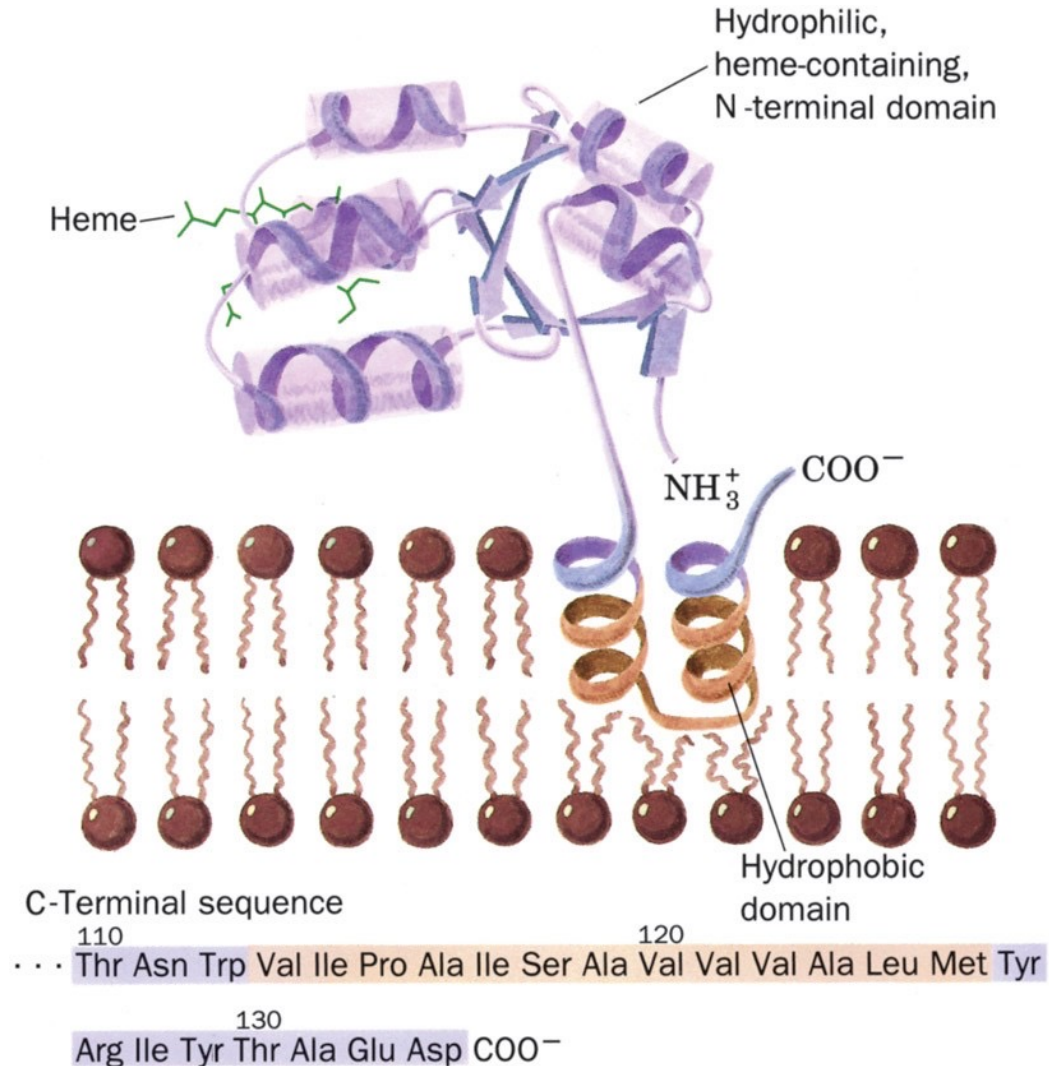
Proteína Integral



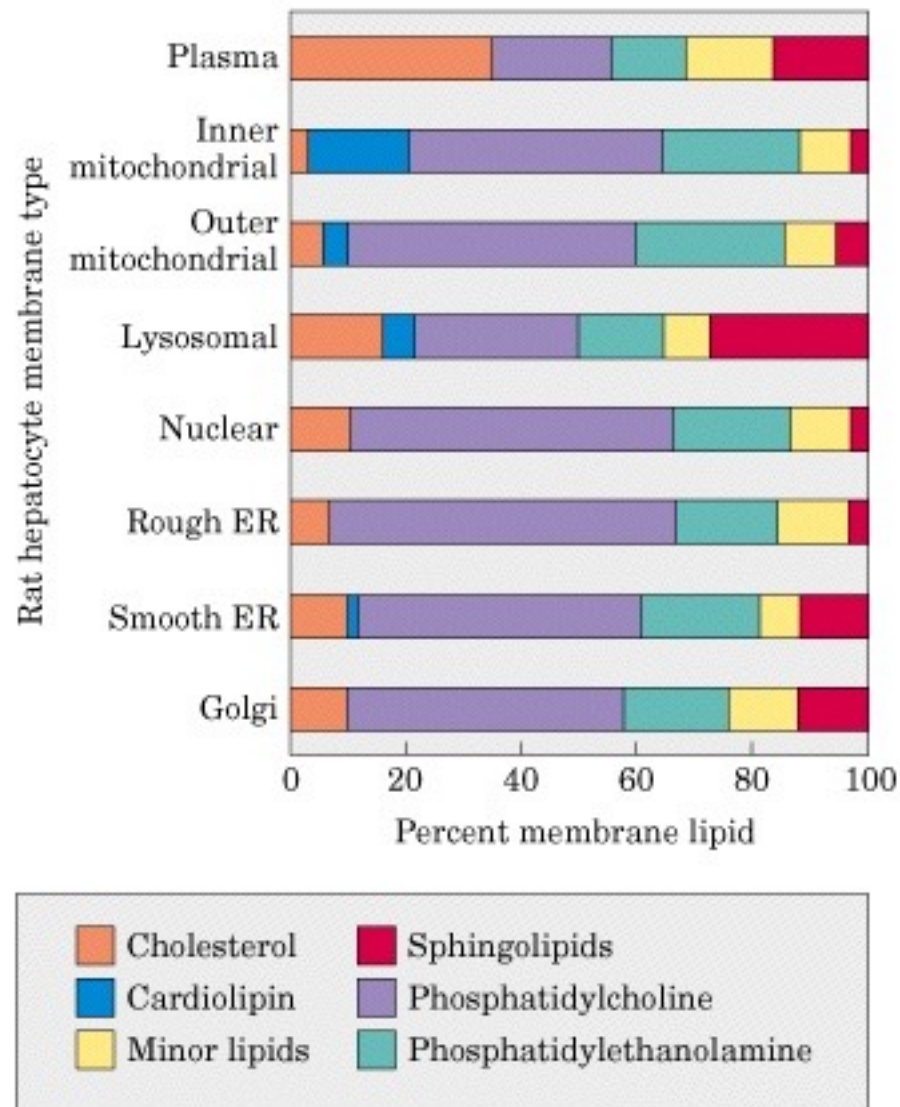
Proteína Integral



Proteína Periférica



Composição de lipídeos de uma membrana varia bastante de acordo com o tipo de organela e o tipo celular

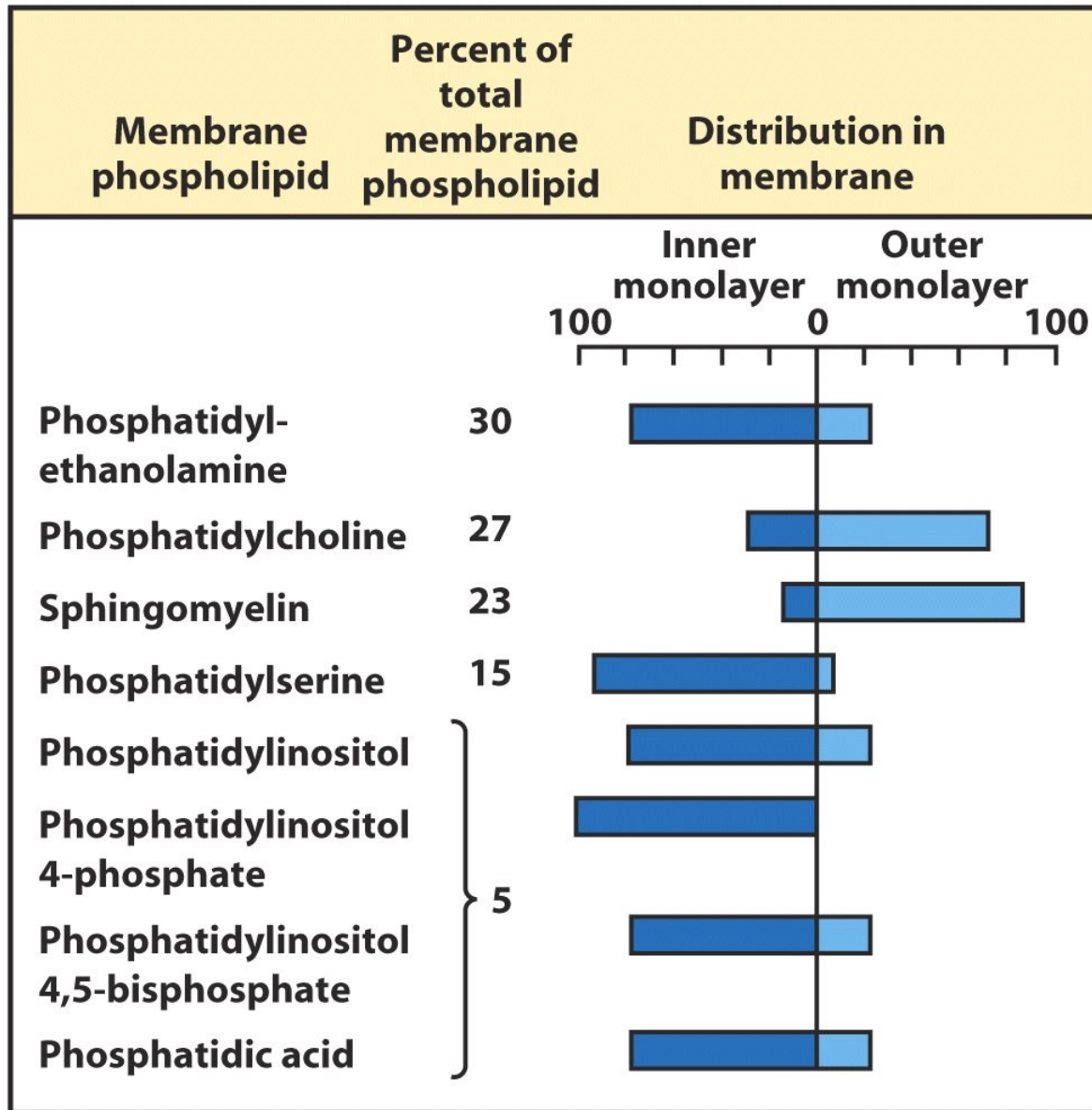


Lipid	Human Erythrocyte	Human Myelin	Beef Heart Mitochondria	<i>E. coli</i>
Phosphatidic acid	1.5	0.5	0	0
Phosphatidylcholine	19	10	39	0
Phosphatidylethanolamine	18	20	27	65
Phosphatidylglycerol	0	0	0	18
Phosphatidylinositol	1	1	7	0
Phosphatidylserine	8.5	8.5	0.5	0
Cardiolipin	0	0	22.5	12
Sphingomyelin	17.5	8.5	0	0
Glycolipids	10	26	0	0
Cholesterol	25	26	3	0

^aThe values given are weight percent of total lipid.

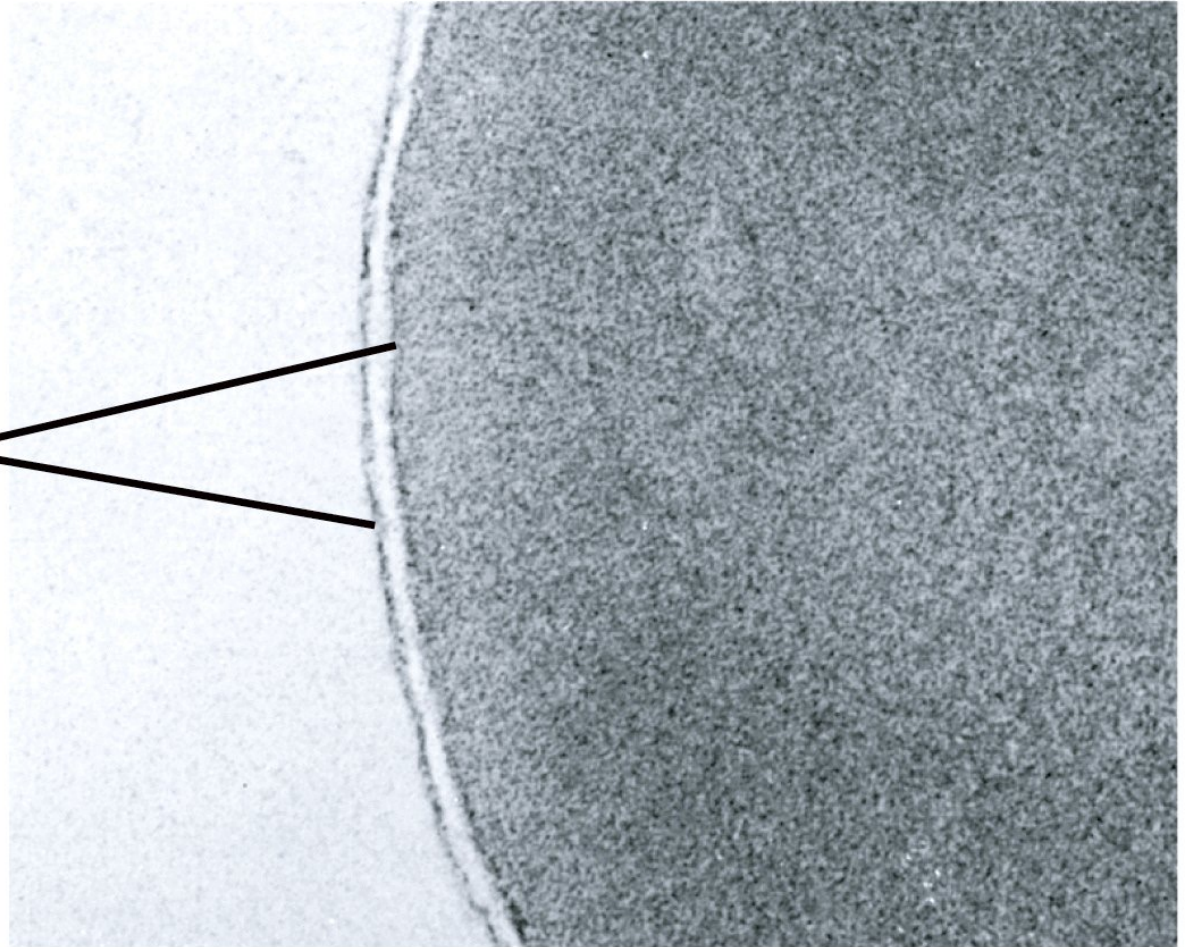
Source: Tanford, C., *The Hydrophobic Effect*, p. 109, Wiley (1980).

A distribuição de fosfolipídeos na bicamada
é assimétrica

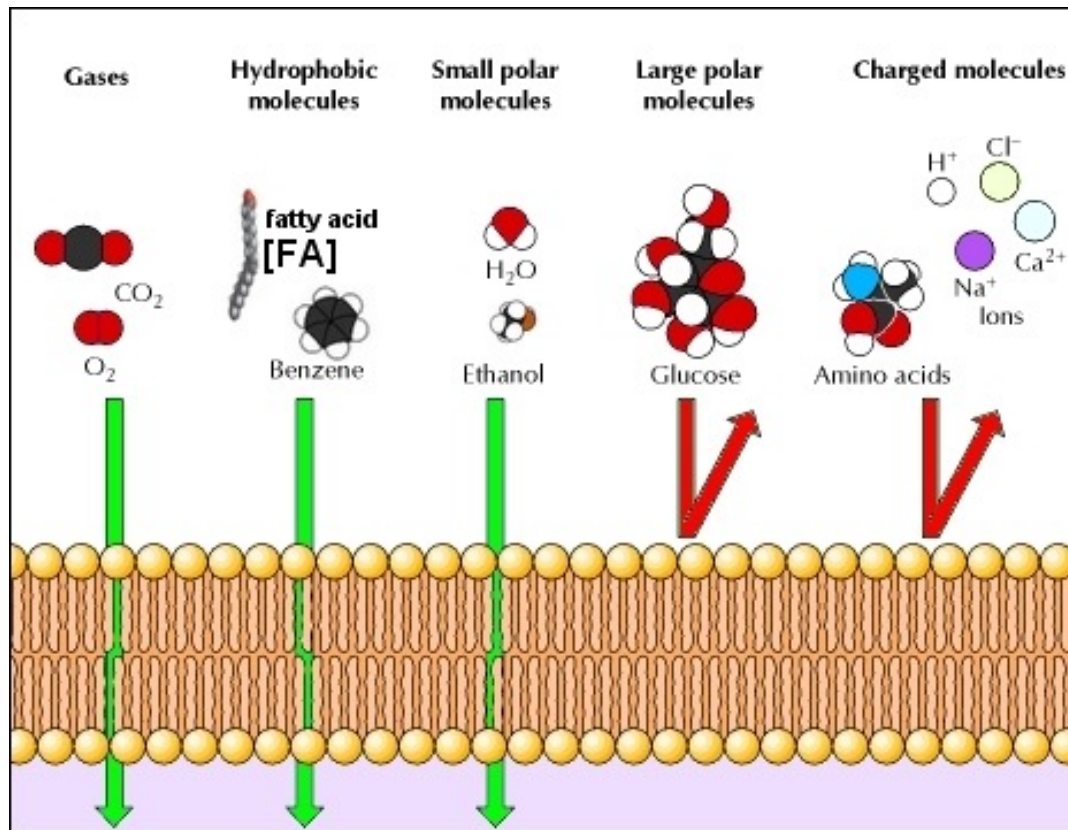


Transporte através das Membranas

**Membrane
bilayer**



Permeabilidade Seletiva

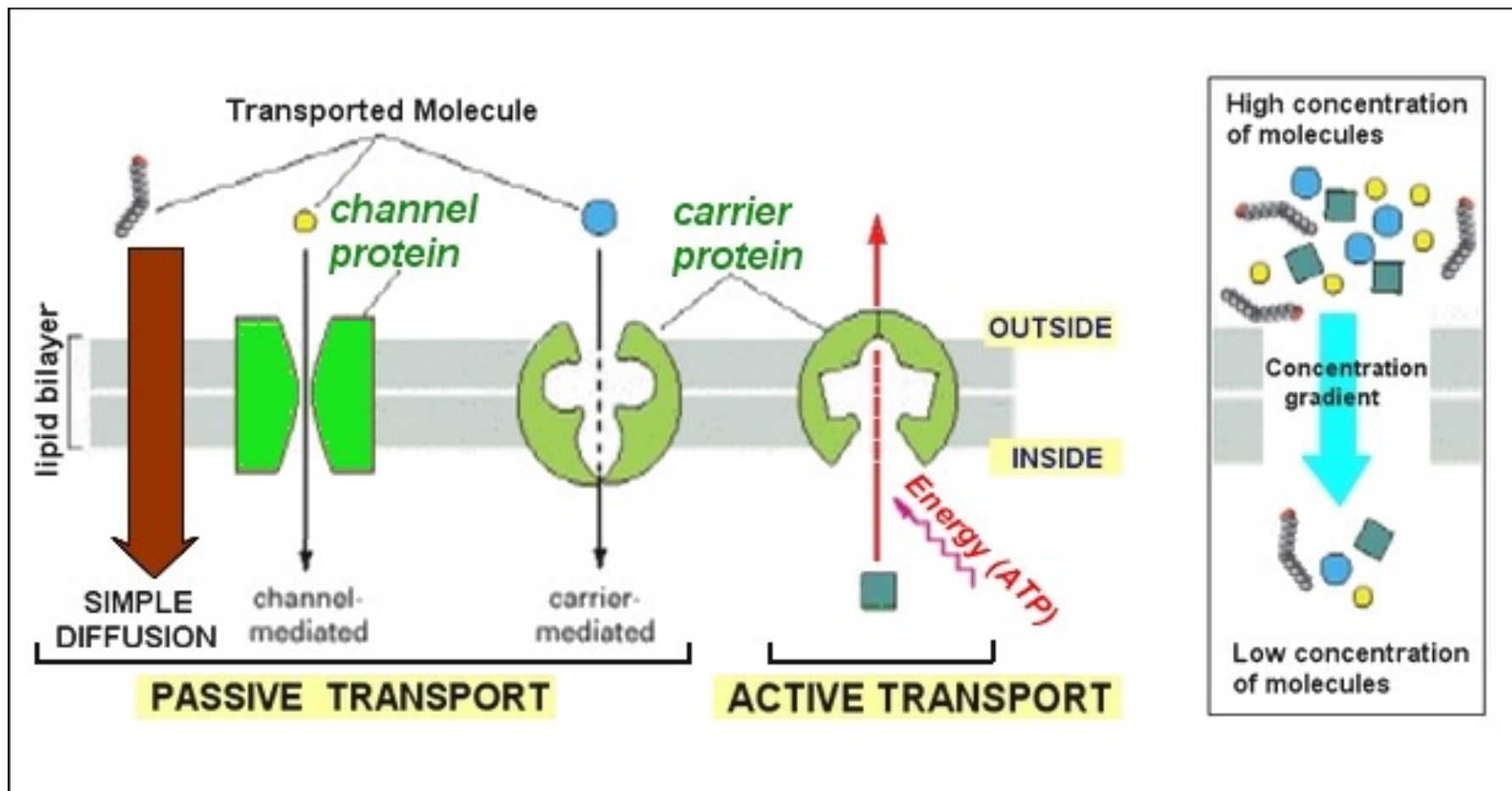


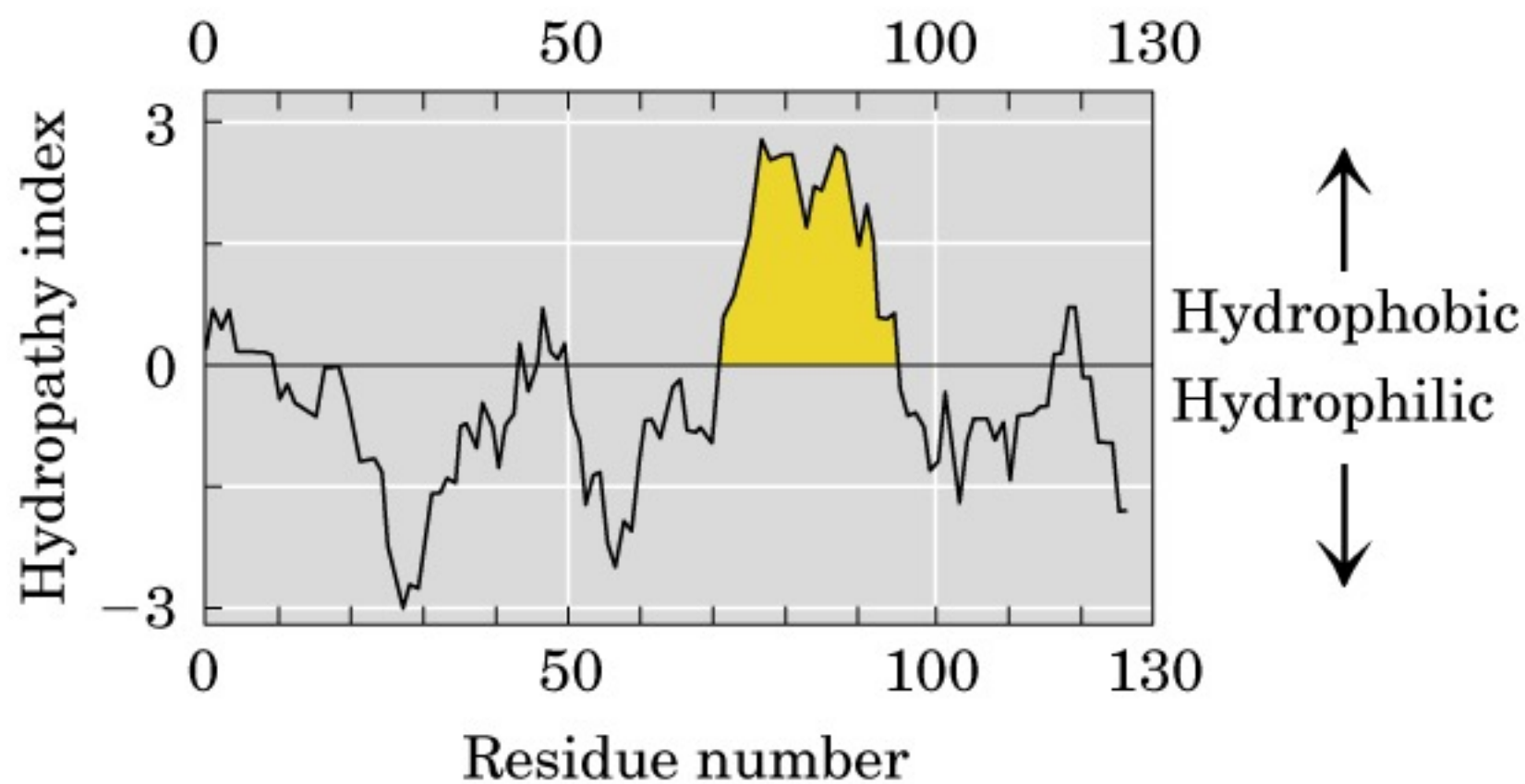
Tamanho = pequenas molécula atravessam, mas grandes não
 EX: H₂O, O₂, CO₂, etanol (PM=46), & glicerol (PM=92) atravessa, mas glicose (PM=180) não atravess

Polaridade = Moléculas hidrofóbicas podem se "dissolver" na bicamada, e moléculas polares não.

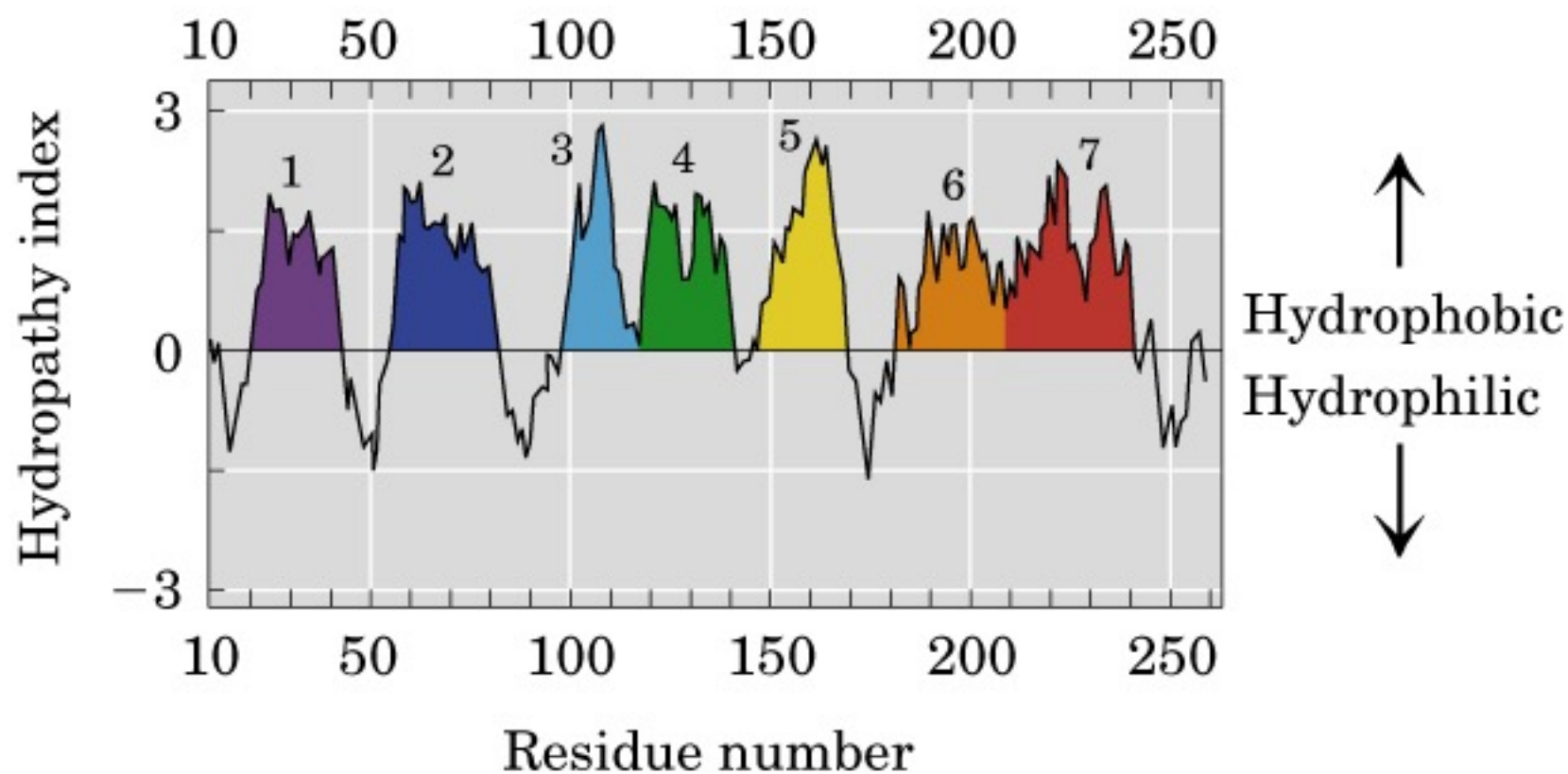
Etanol é mais apolar que glicerol, e portanto atravessa mais rapidamente.

Carga = Membranas são impermeáveis a íons carregados.

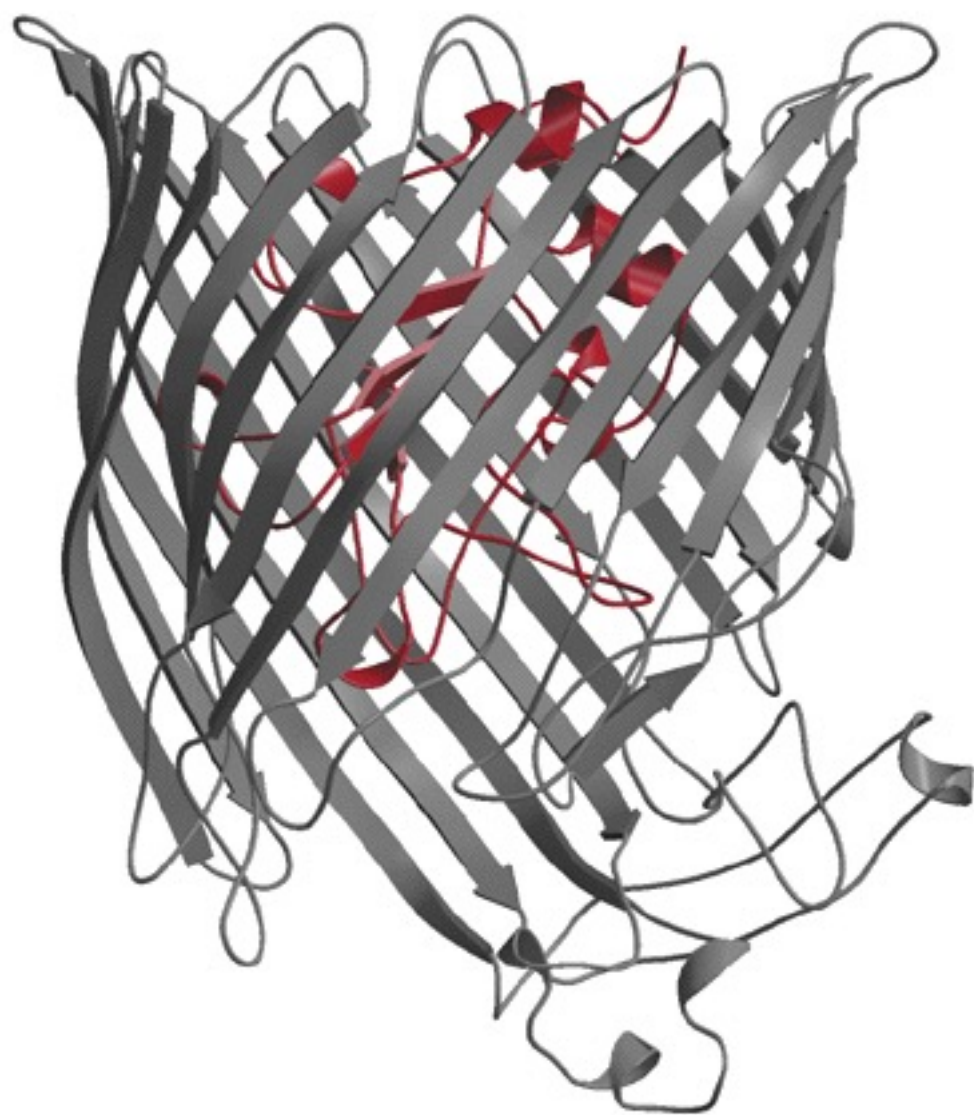


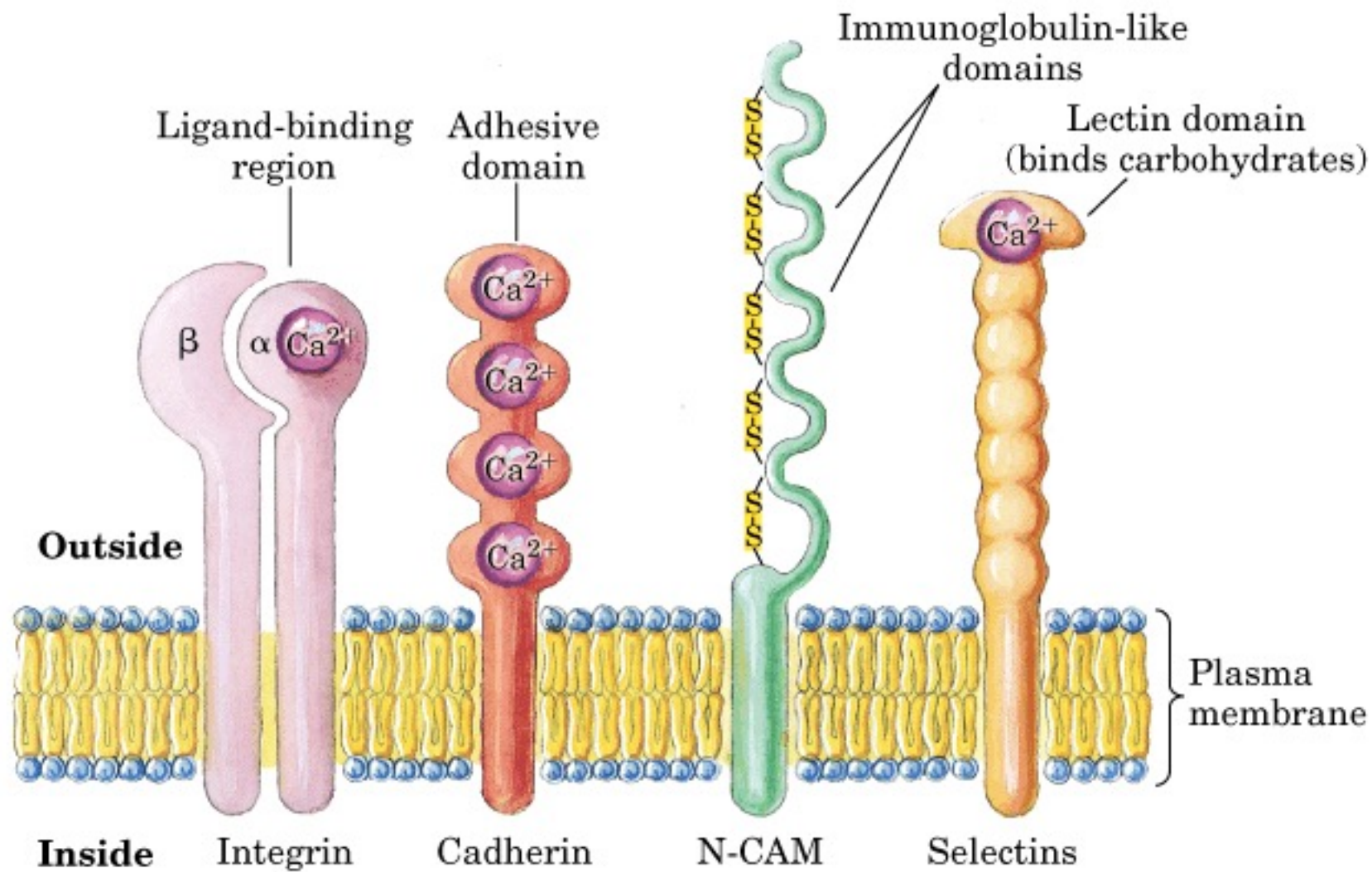


Glycophorin
(a)



Bacteriorhodopsin
(b)





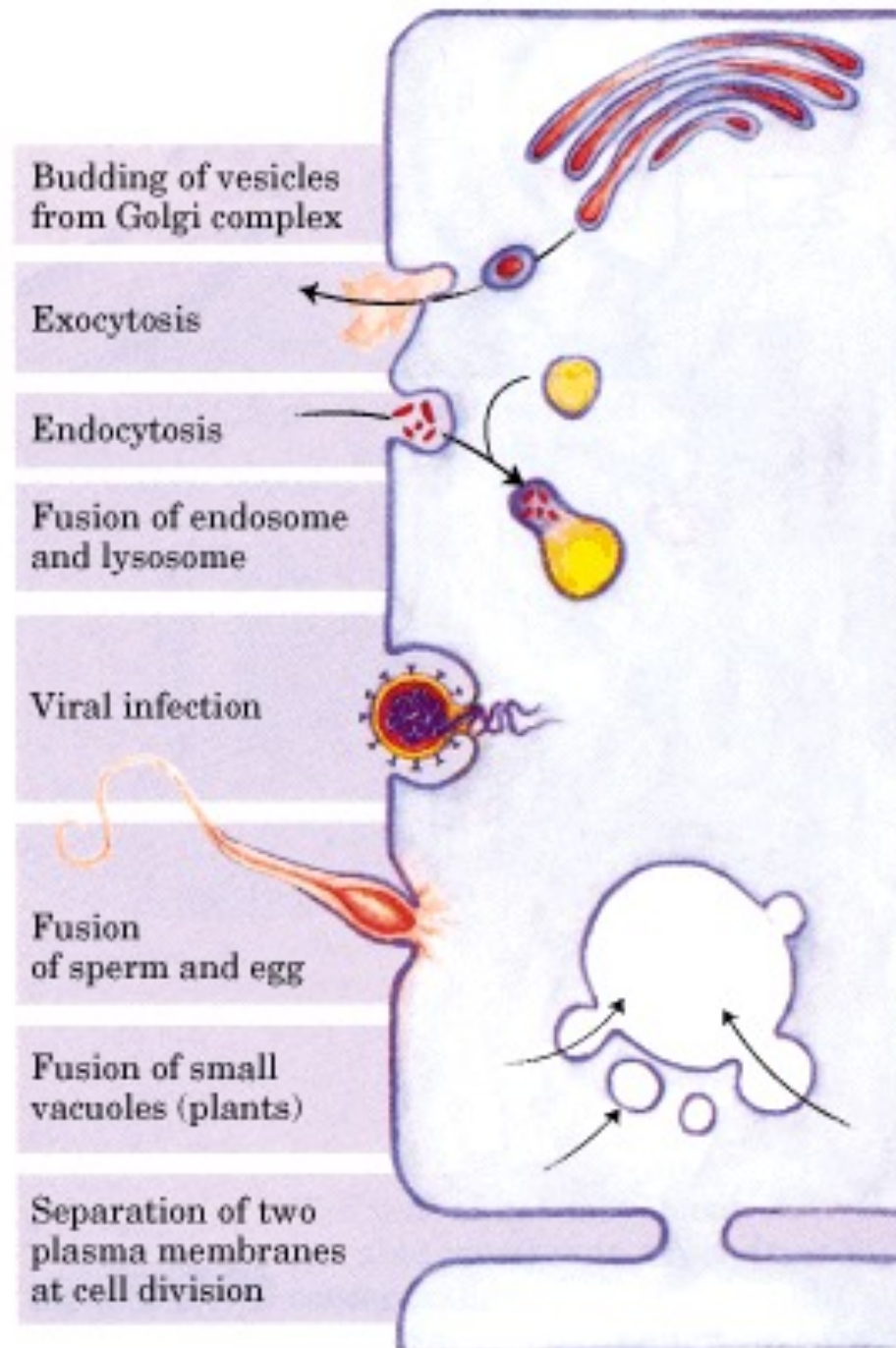


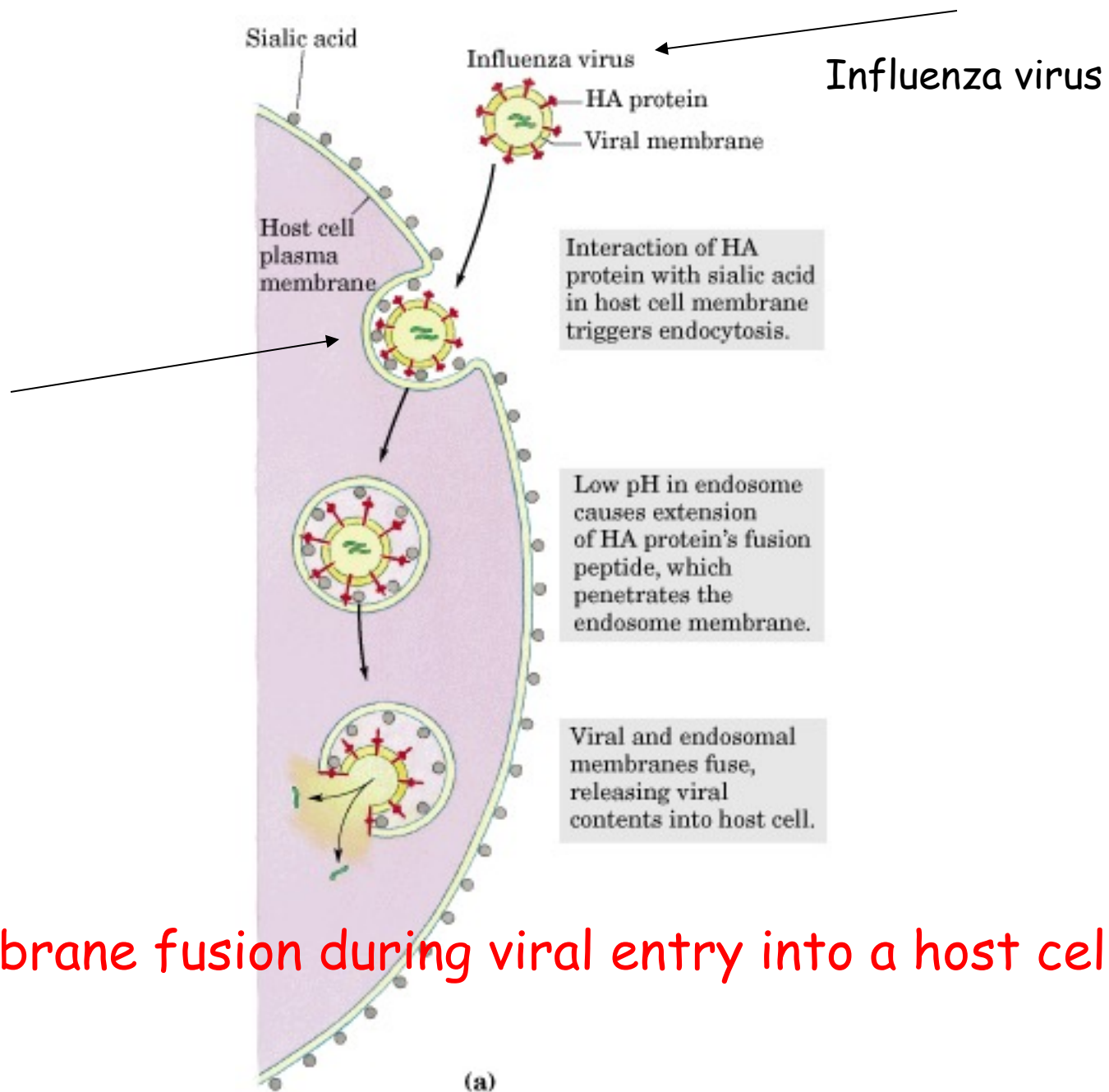
VESICLE



PLASMA
MEMBRANE

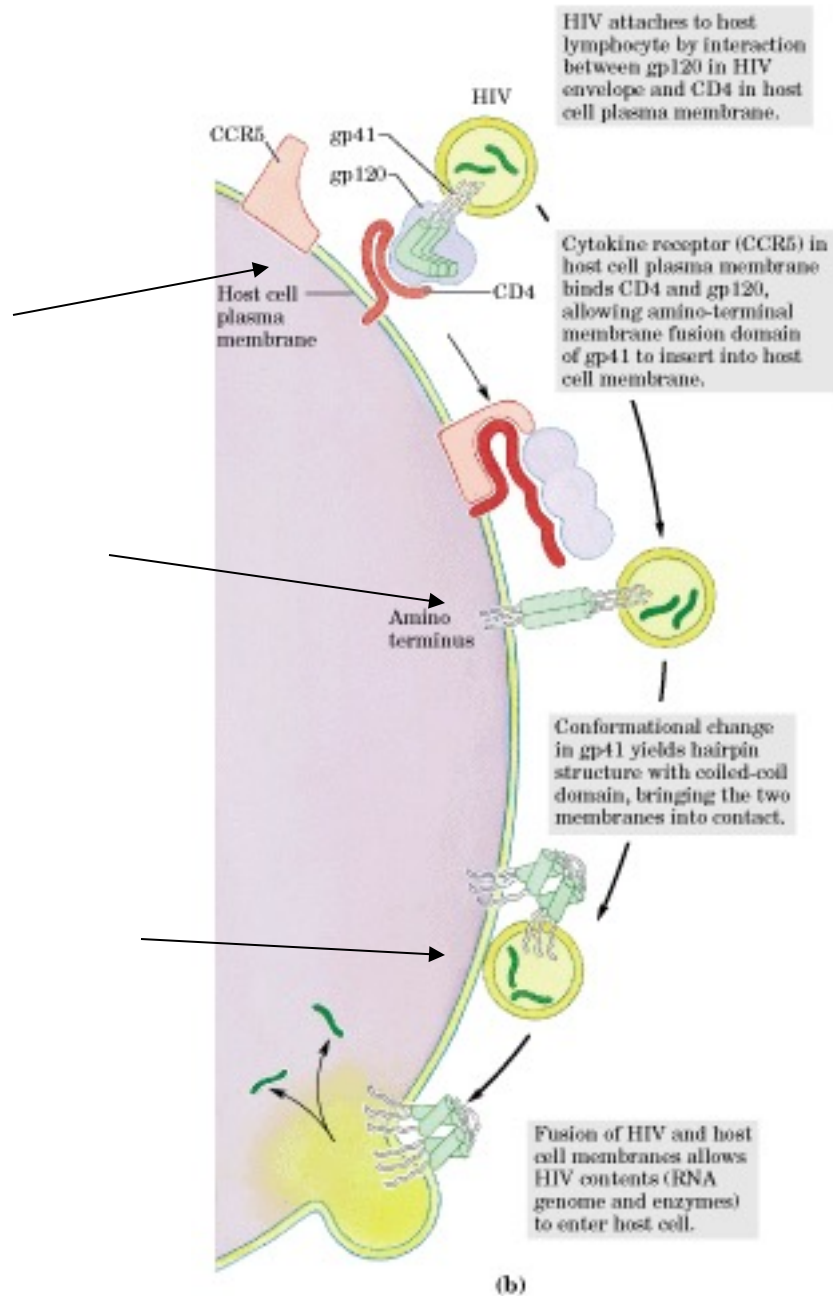
Membrane fusion





Membrane fusion during viral entry into a host cell

HIV



<https://www.youtube.com/watch?v=ZeyEYymuacg>

<https://www.youtube.com/watch?v=fEjq0oozZ5A>