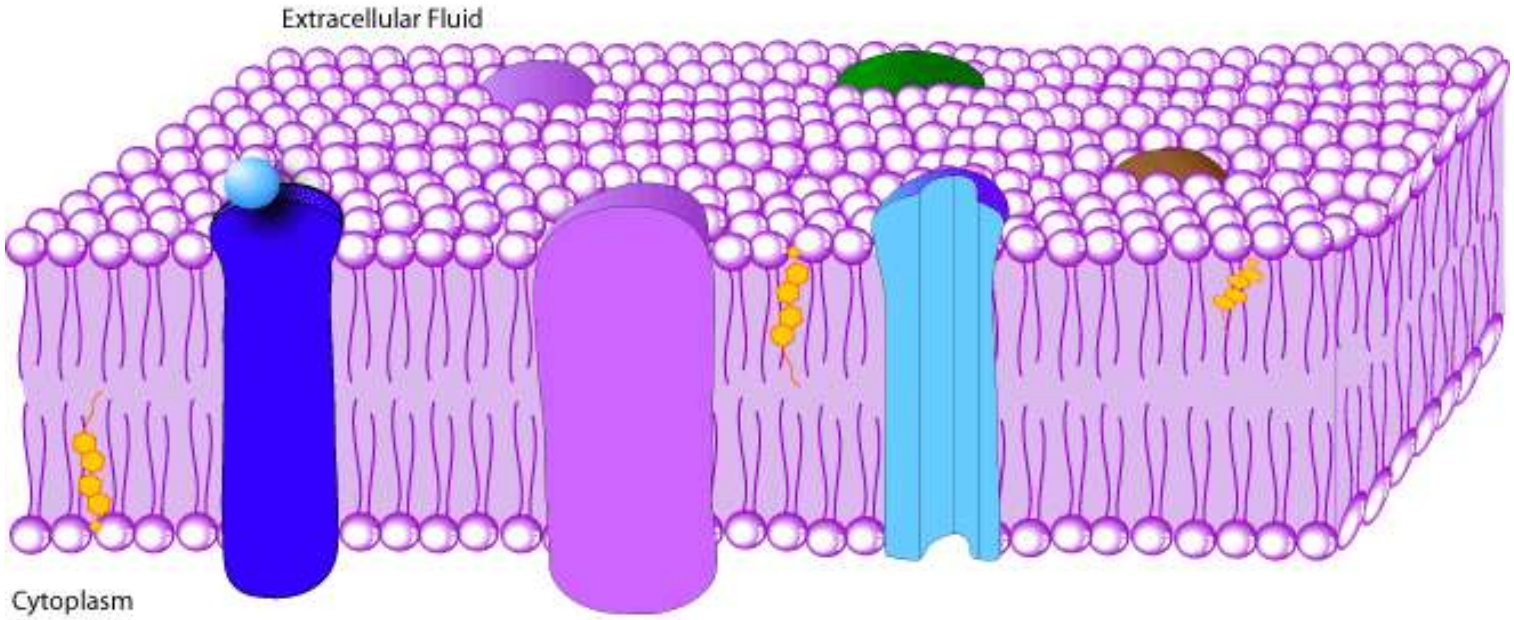
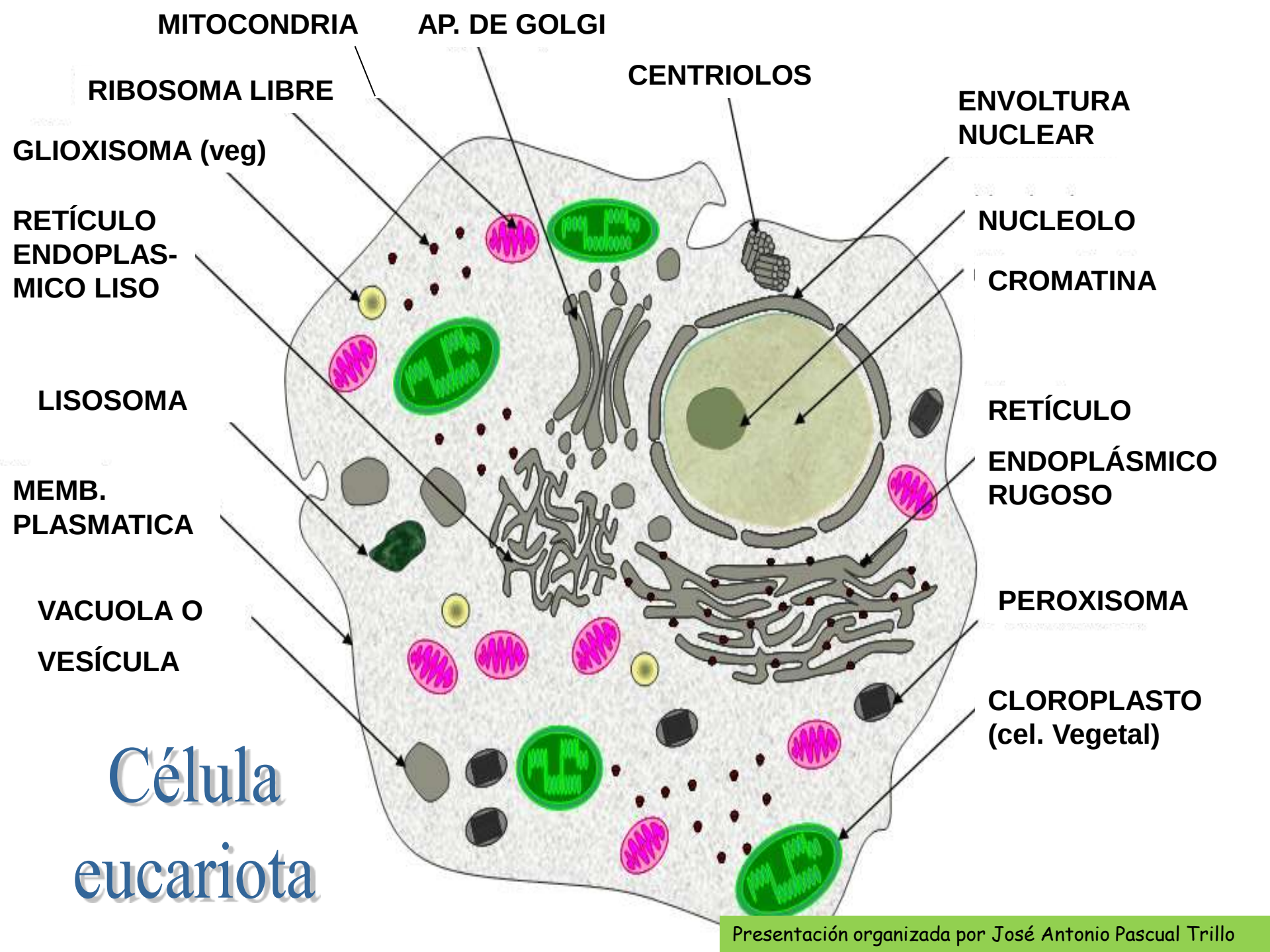
MEMBRANAS DE LA CELULA

Presentación organizada por
José Antonio Pascual Trillo

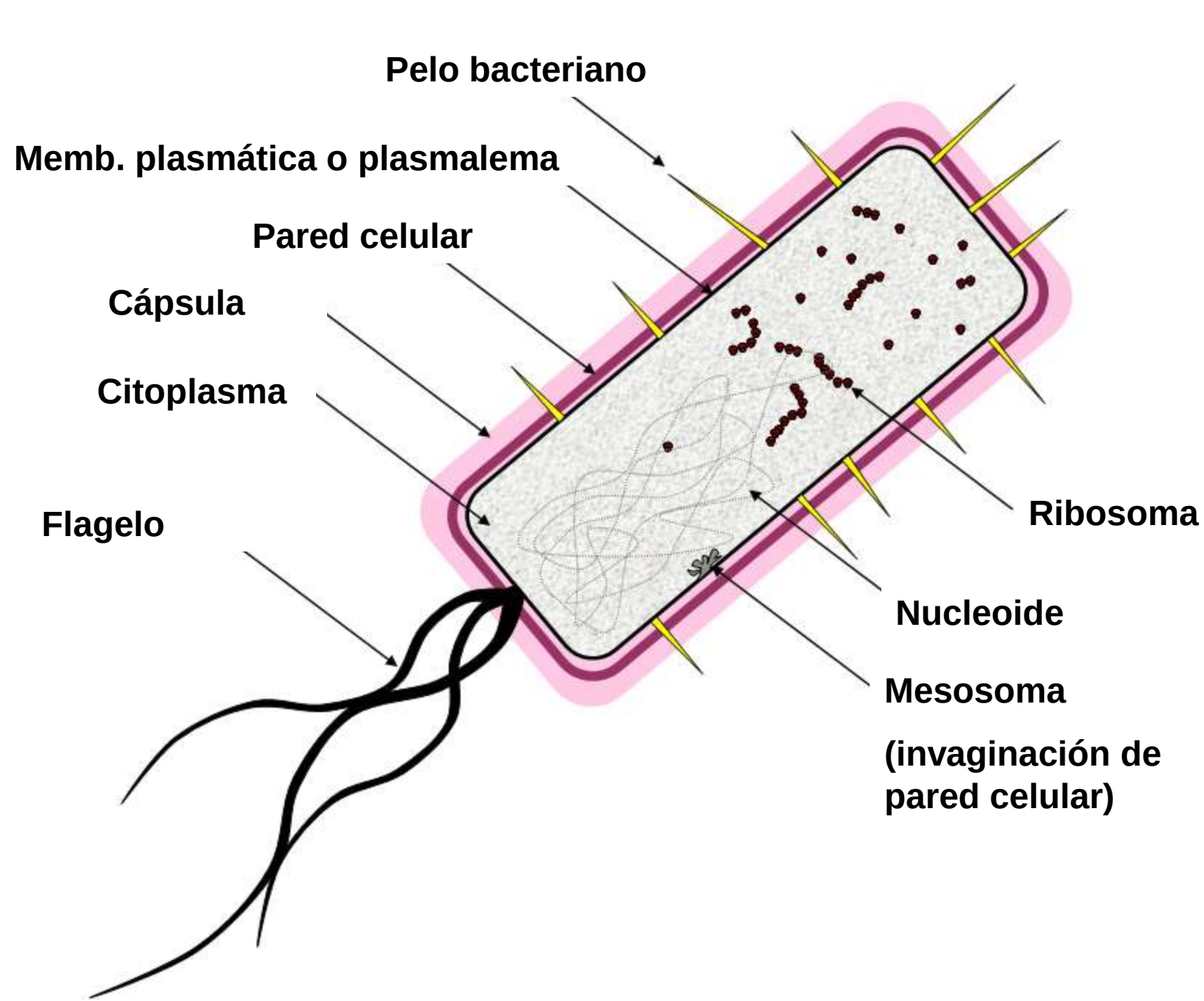
MEMBRANAS


Extracellular Fluid
Cytoplasm


Phospholipid
Intergral Proteins
Cholesterol
Ion Channel
Ligand

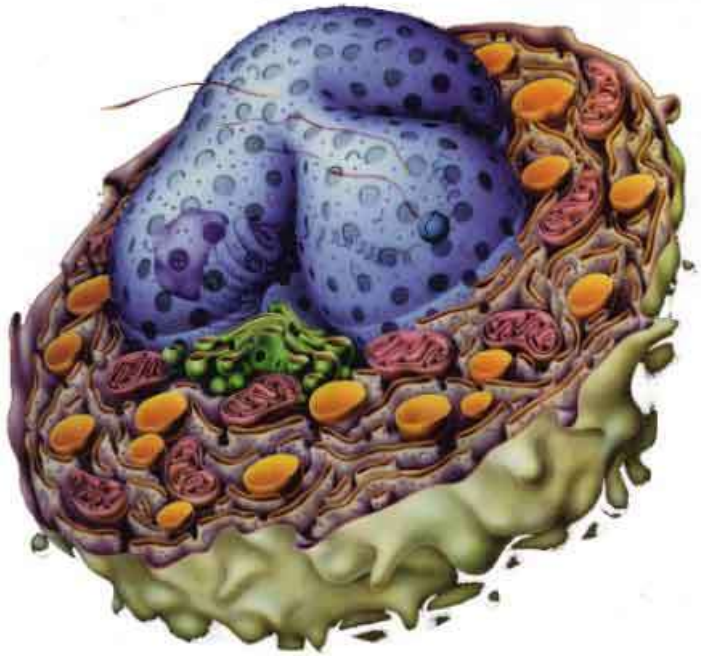


Célula eucariota

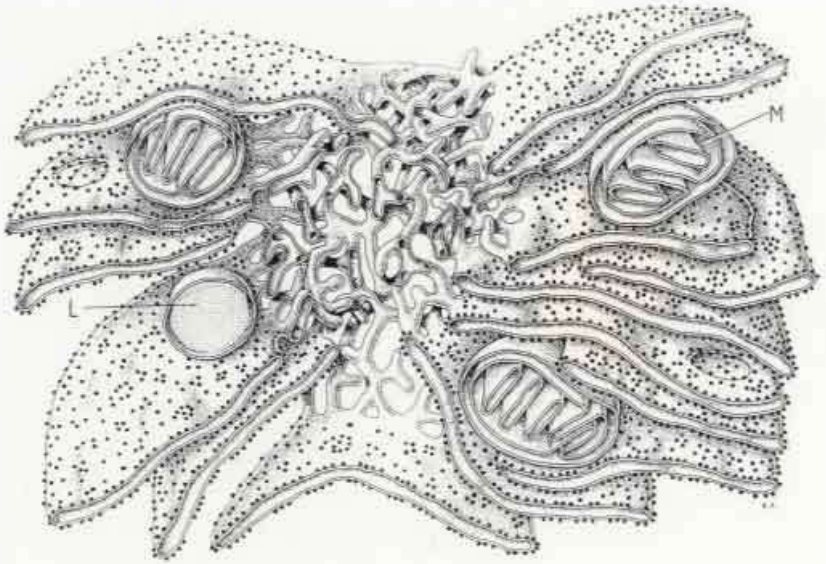

Pelo bacteriano
Memb. plasmática o plasmalema
Pared celular
Cápsula
Citoplasma
Flagelo
Ribosoma
Nucleoide
Mesosoma
(invaginación de pared celular)

The Cell

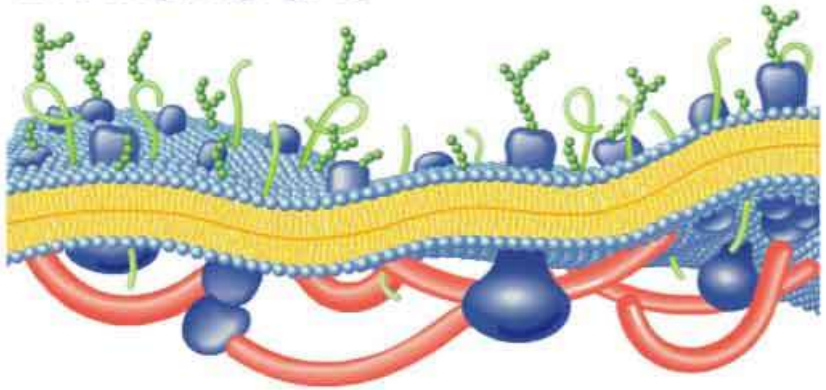
Membrane View:

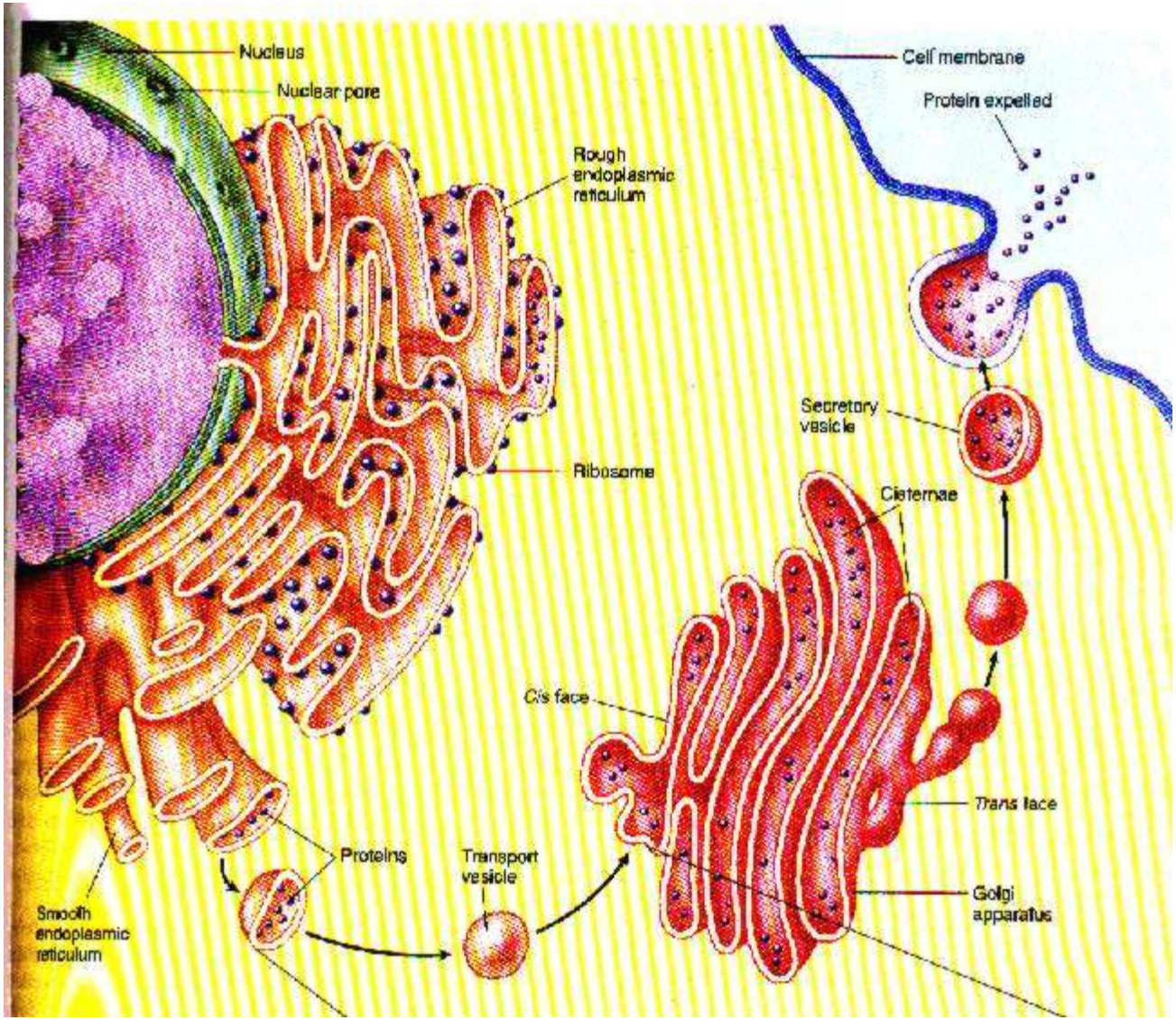


Endoplasmic Reticulum

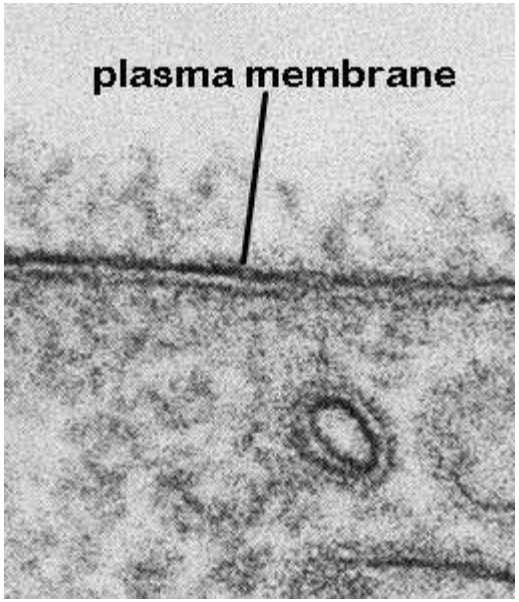


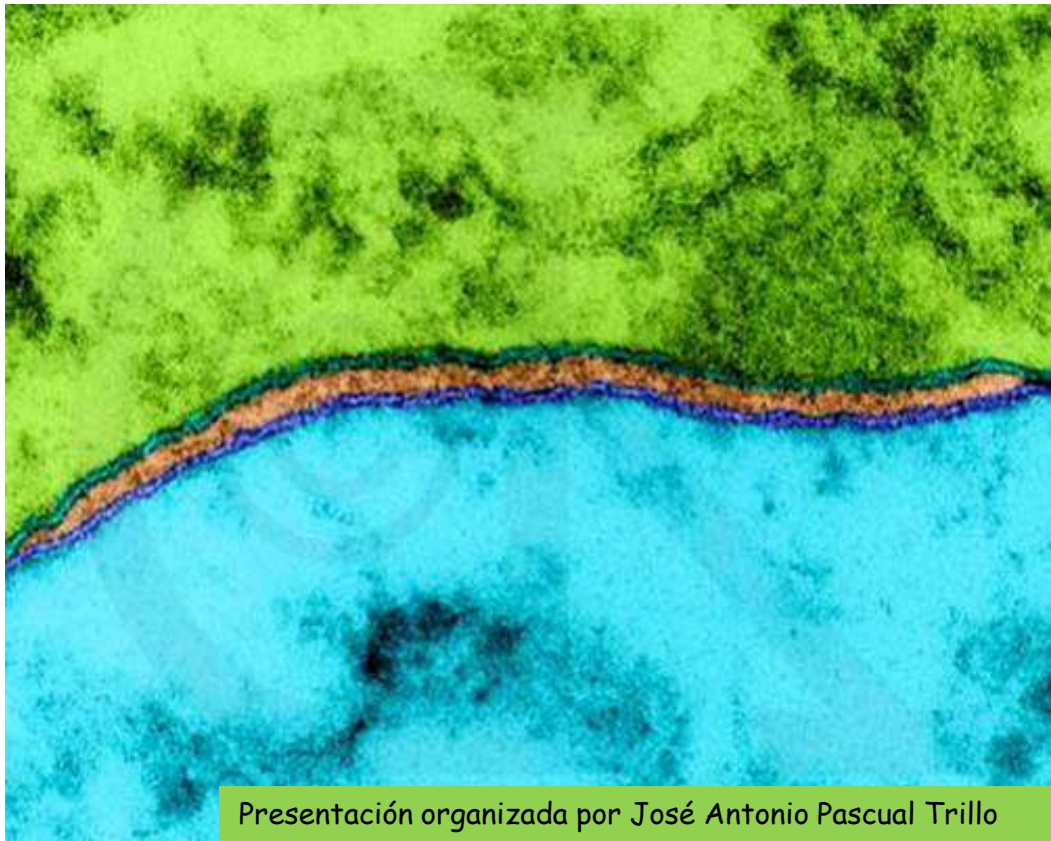
Biomembrane



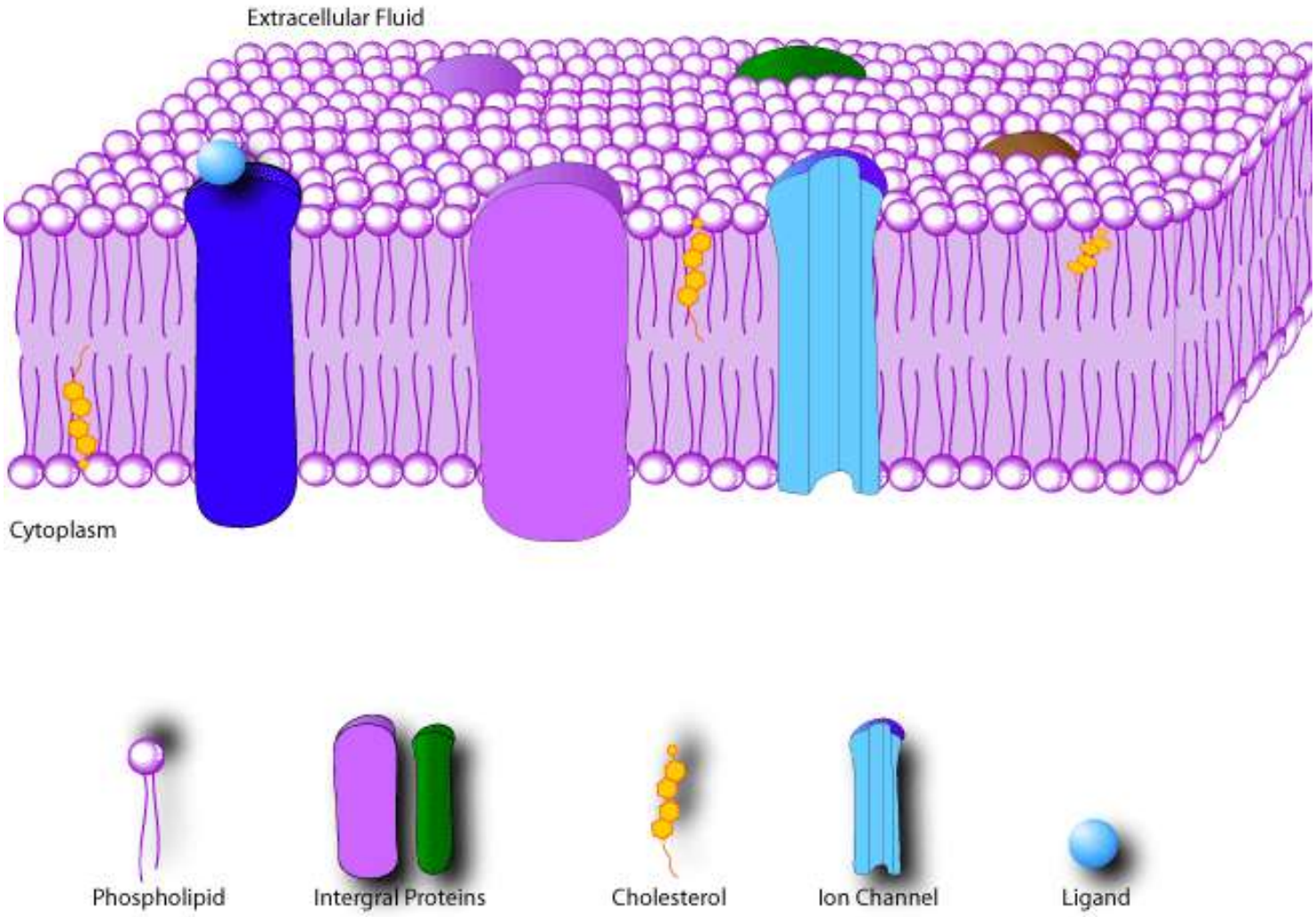

Nucleus
Nuclear pore
Rough endoplasmic reticulum
Ribosome
Cell membrane
Protein expelled
Secretory vesicle
Cisternae
Cis face
Trans face
Golgi apparatus
Proteins
Transport vesicle
Smooth endoplasmic reticulum


Cell membrane
Intercellular space
Cell membrane

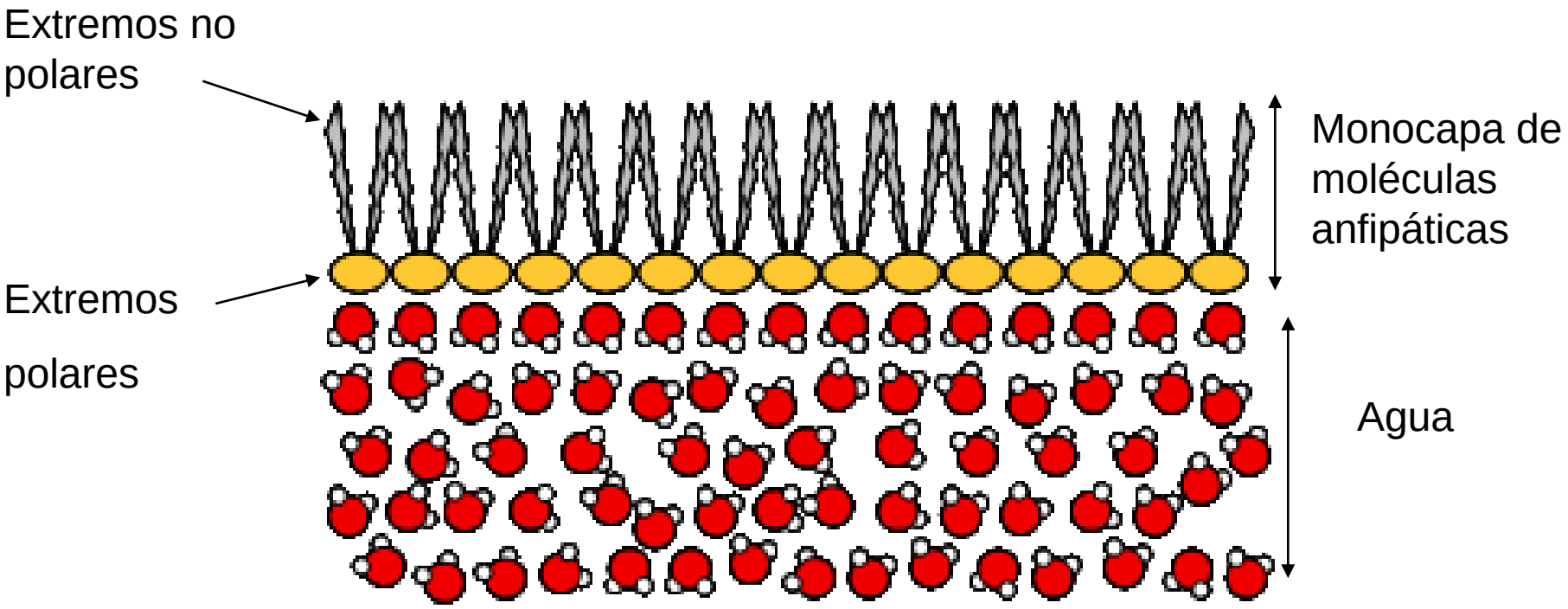

plasma membrane



MEMBRANA PLASMÁTICA



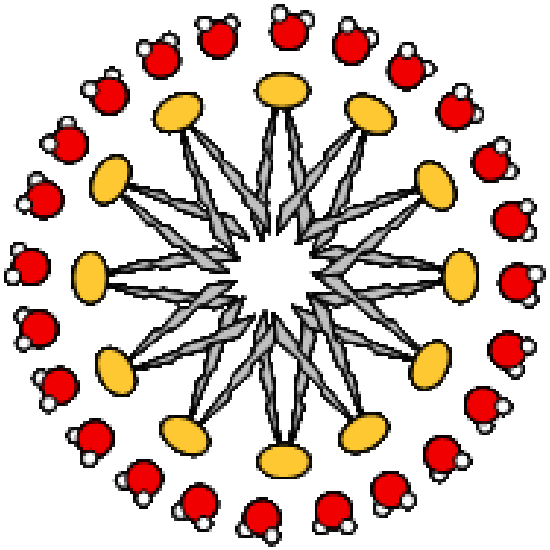
Modelos históricos de membrana



Modelo monocapa de Langmuir (1920):

cuando los fosfolípidos de membrana se disuelven en benceno, pueden dispersarse como una monocapa sobre la superficie del agua

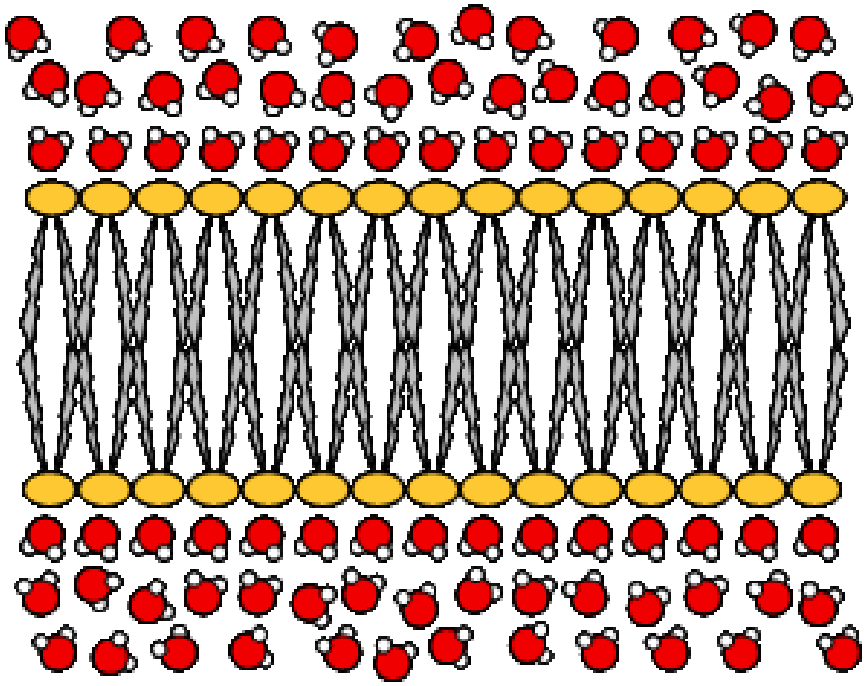
Modelos históricos de membrana



Modelo micelar

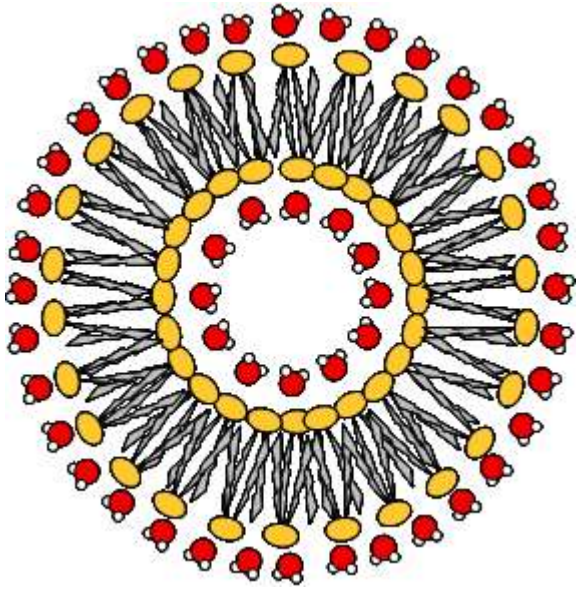
Los fosfolípidos en agua formas estructuras en micela con los extremos apolares protegidos en el interior

Modelos históricos de membrana



Modelo bicapa de Gortner & Grendel (1925)

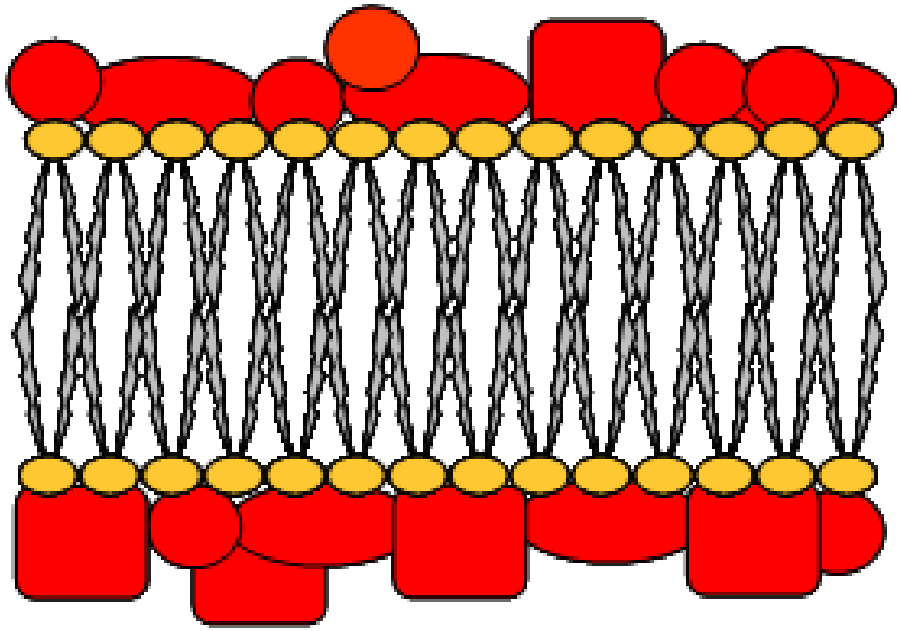
Modelos históricos de membrana



Modelo Liposoma

Vesículas con una doble capa externa y un espacio interior

Modelos históricos de membrana

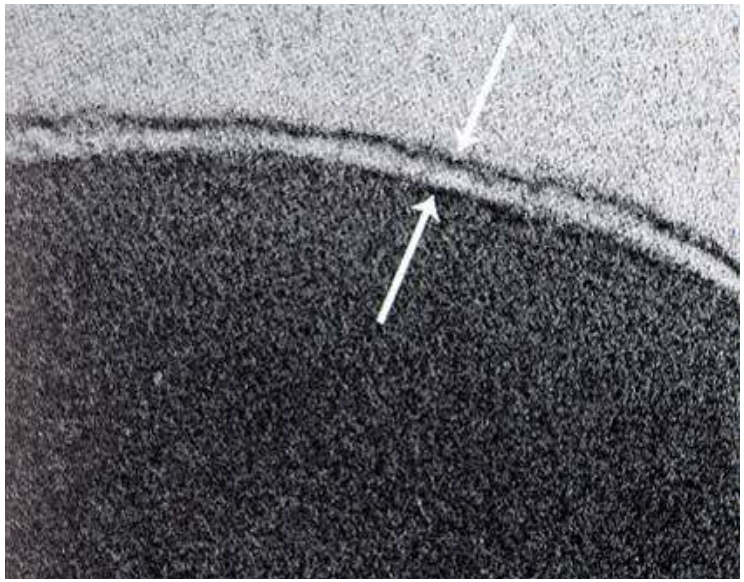


Modelo “sandwich” de Danielli y Davson (1935)

Bicapa lipídica recubierta por una capa de proteínas globulares

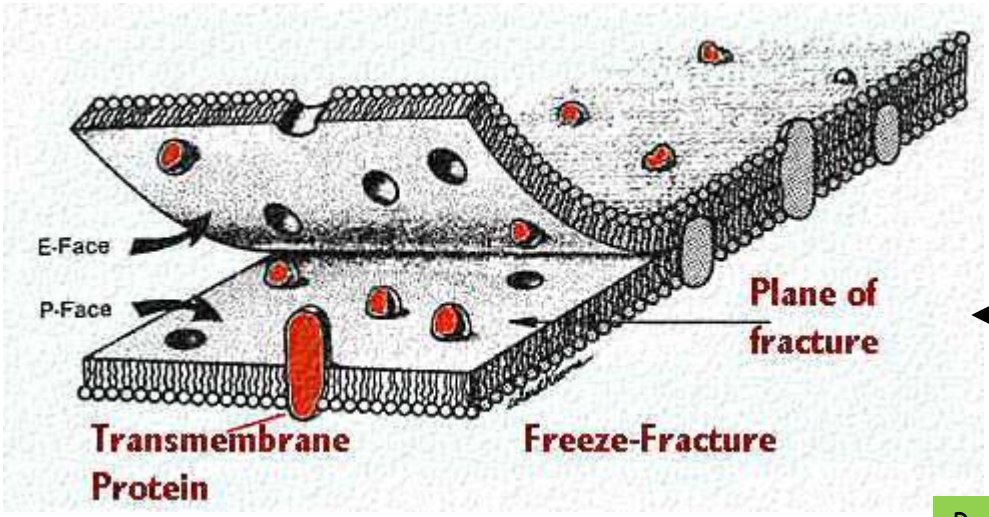
Modelos históricos de membrana

Proteínas
Lípidos
Proteínas

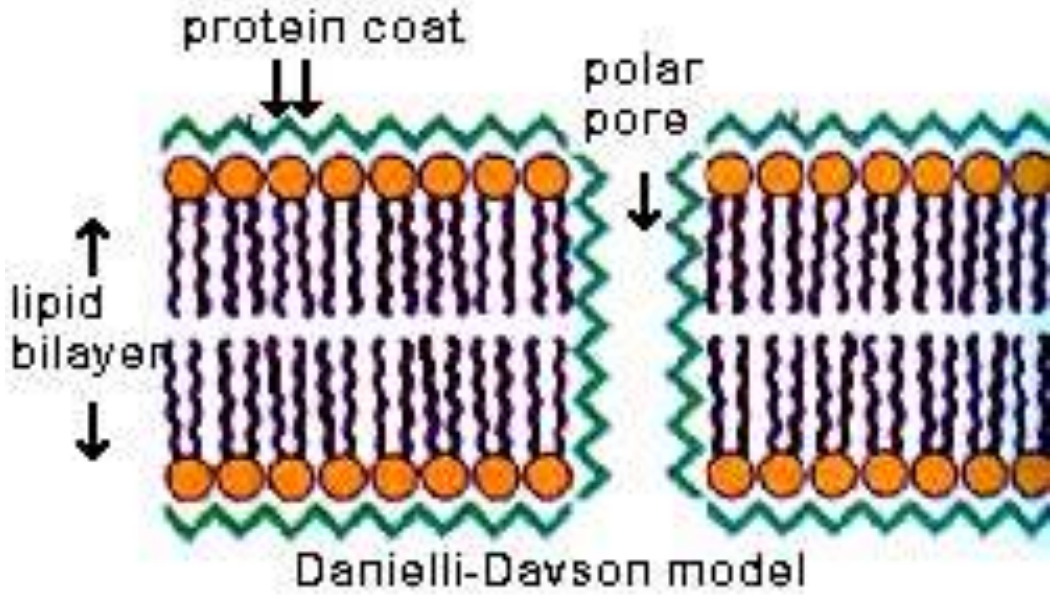


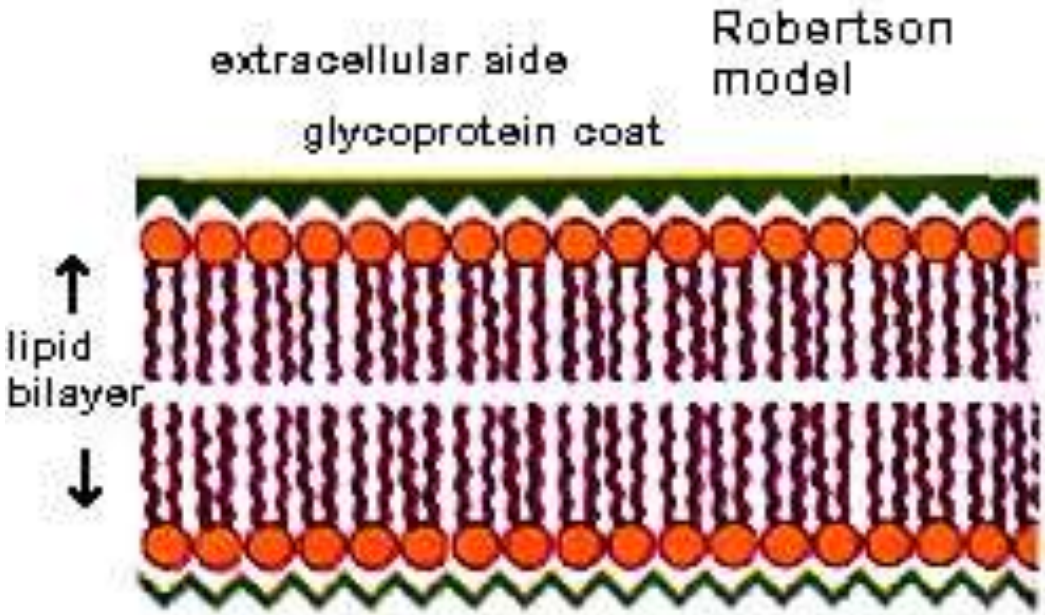
7nm

Unidad de membrana de Robertson

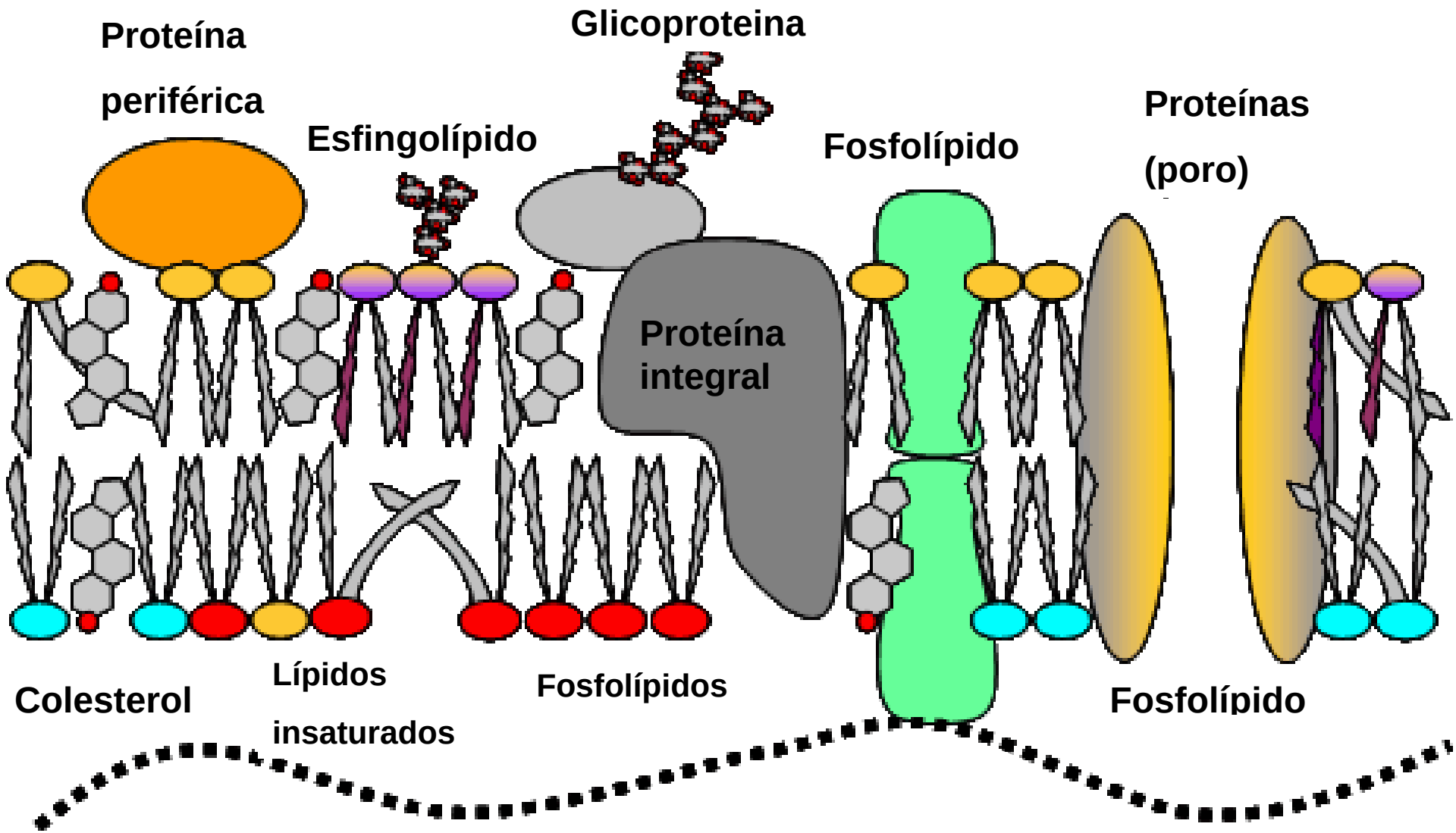


Problema: la criofractura de la célula muestra poros en la membrana incompatibles con la unidad de membrana


protein coat
polar
pore
lipid
bilayer
Danielli-Davson model

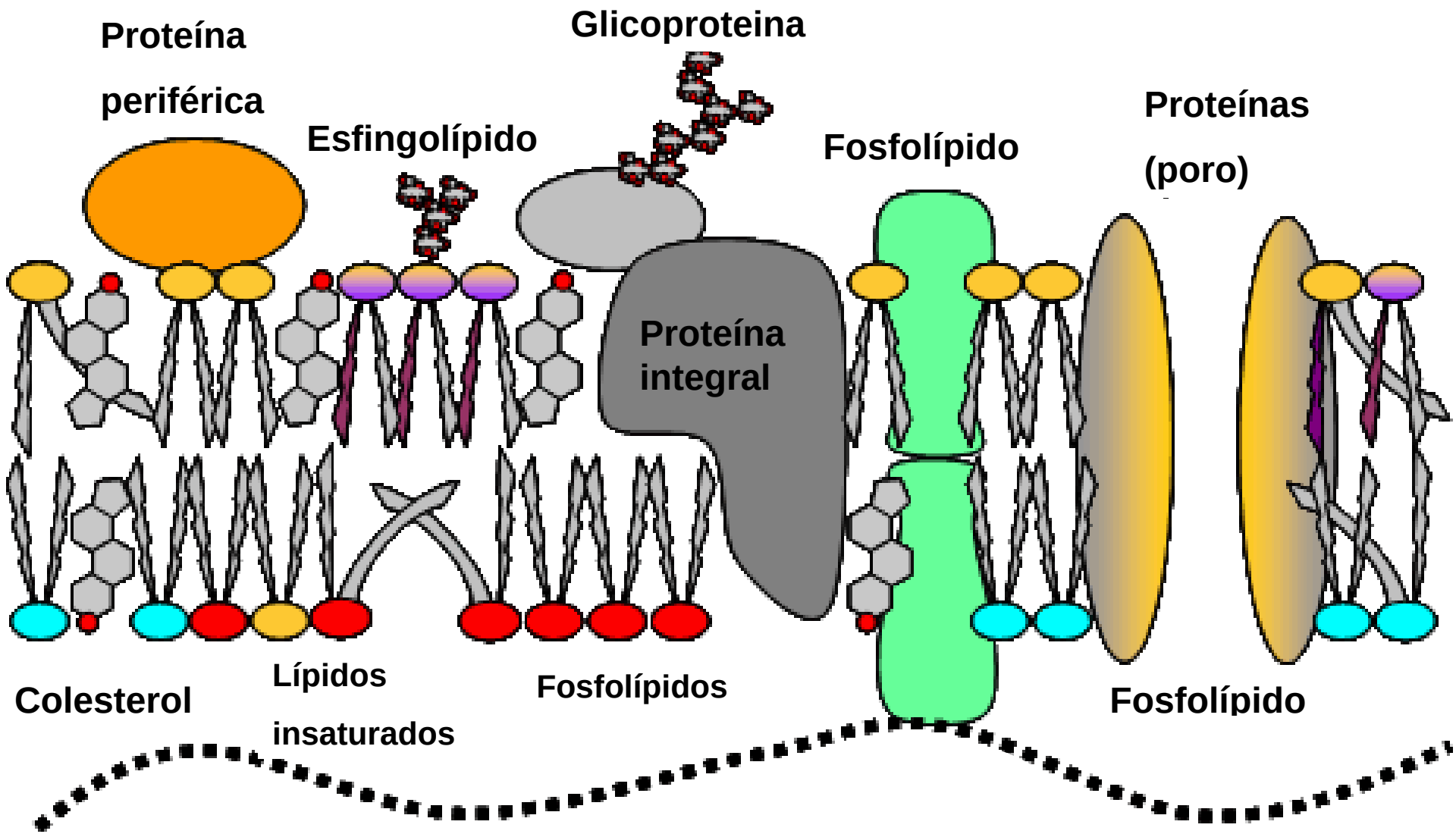

extracellular side
Robertson
model
glycoprotein coat
lipid
bilayer

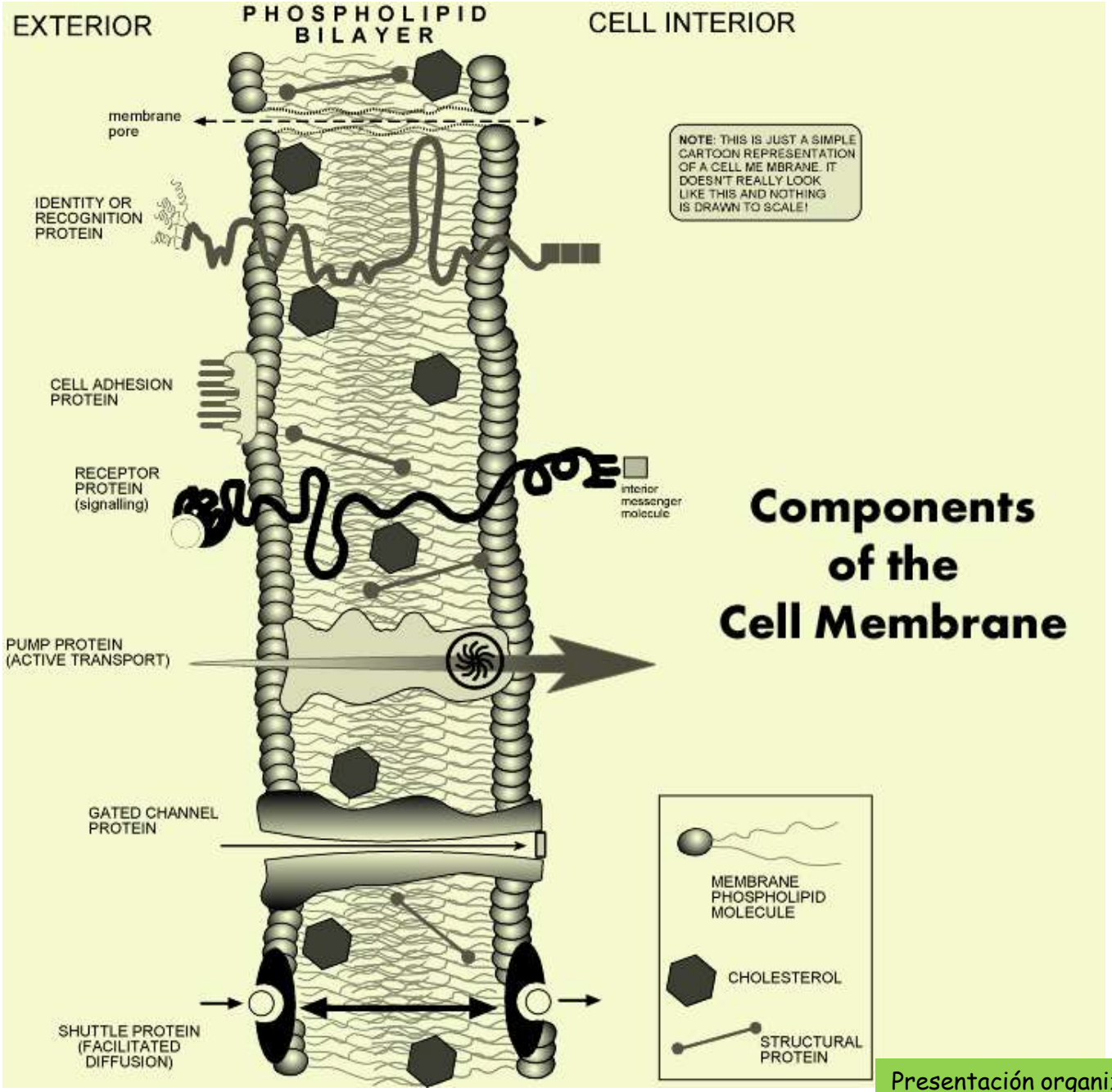
Modelos históricos de membrana

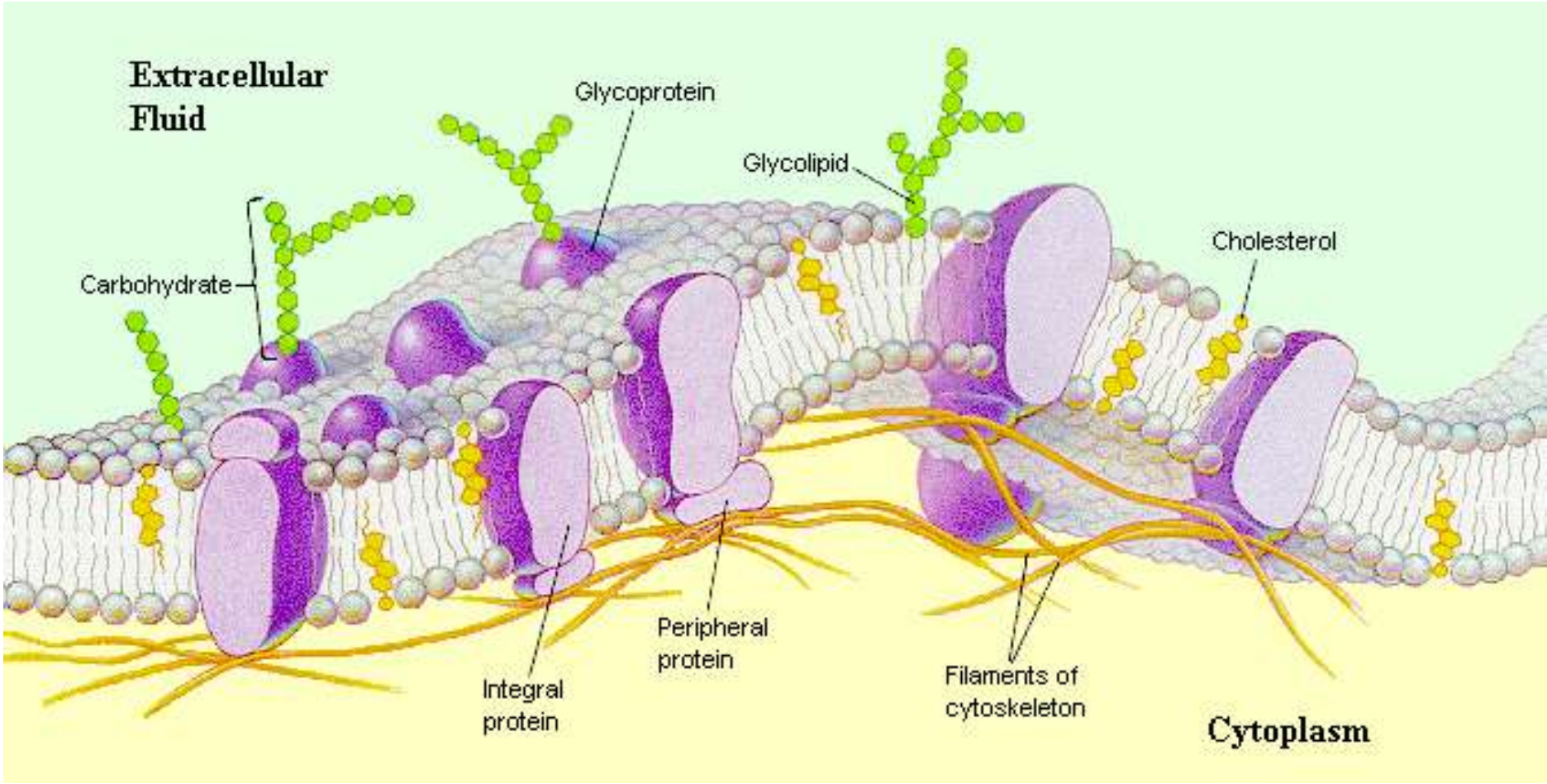


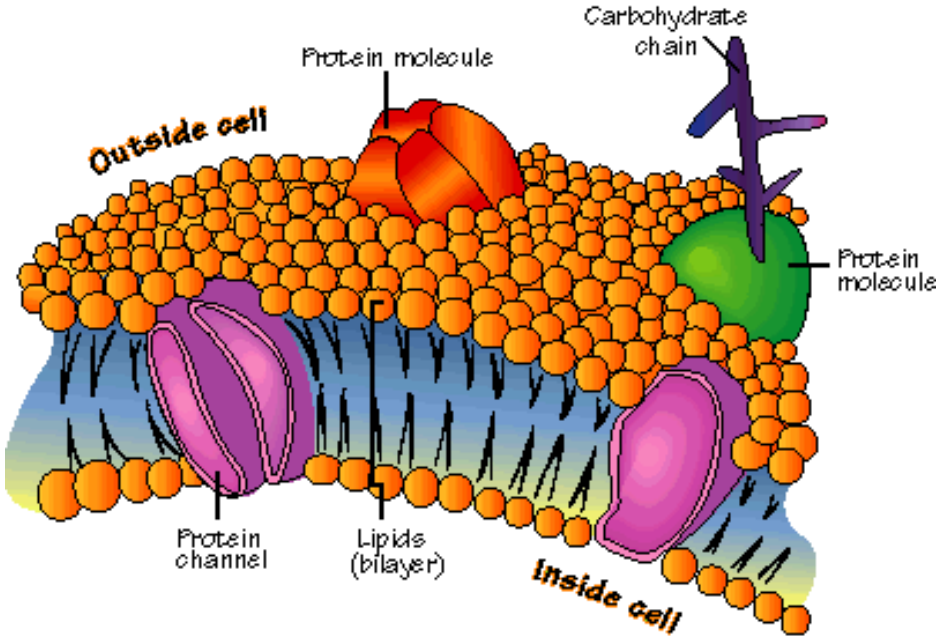
Mosaico fluido de Singer-Nicholson (1972)

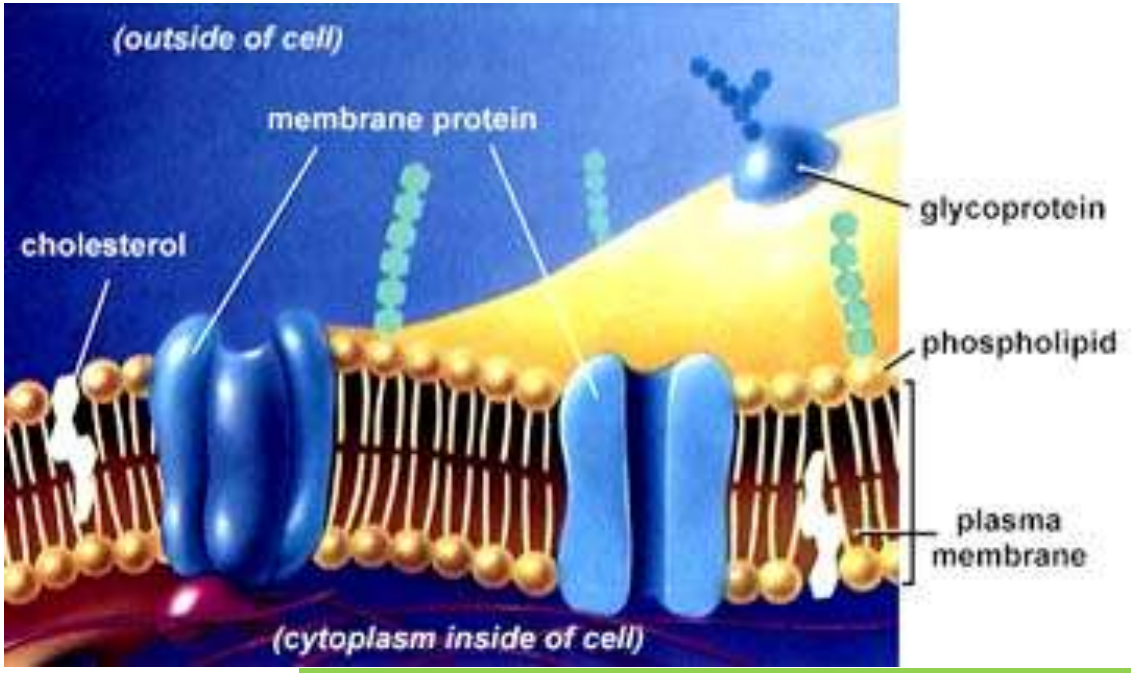
Bicapa lipídica de fosfolípidos con proteínas integrales o no, y otras moléculas adosadas.

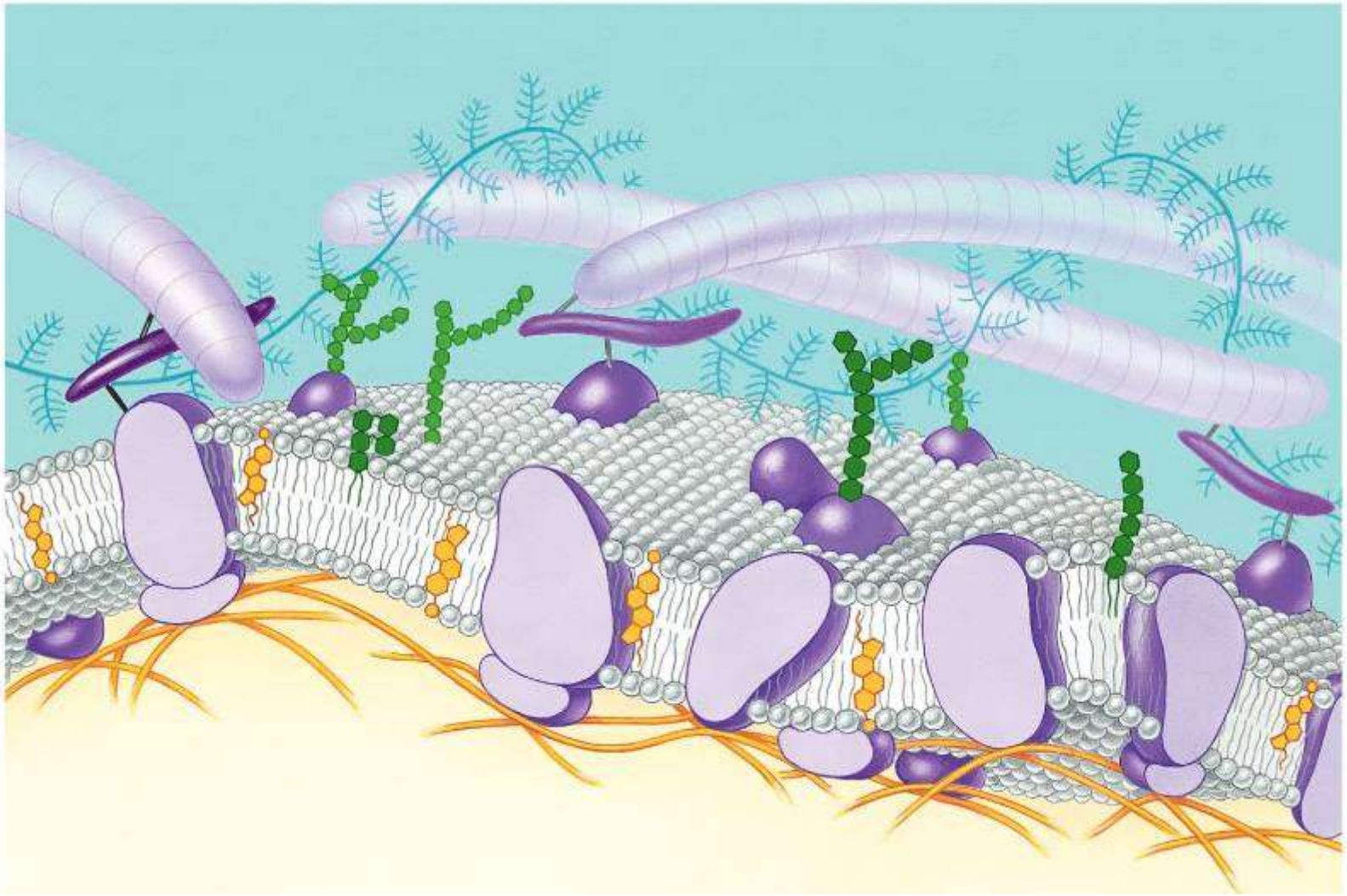

Proteína periférica
Glicoproteina
Esfingolípido
Fosfolípido
Proteínas (poro)
Proteína integral
Colesterol
Lípidos insaturados
Fosfolípidos
Fosfolípido

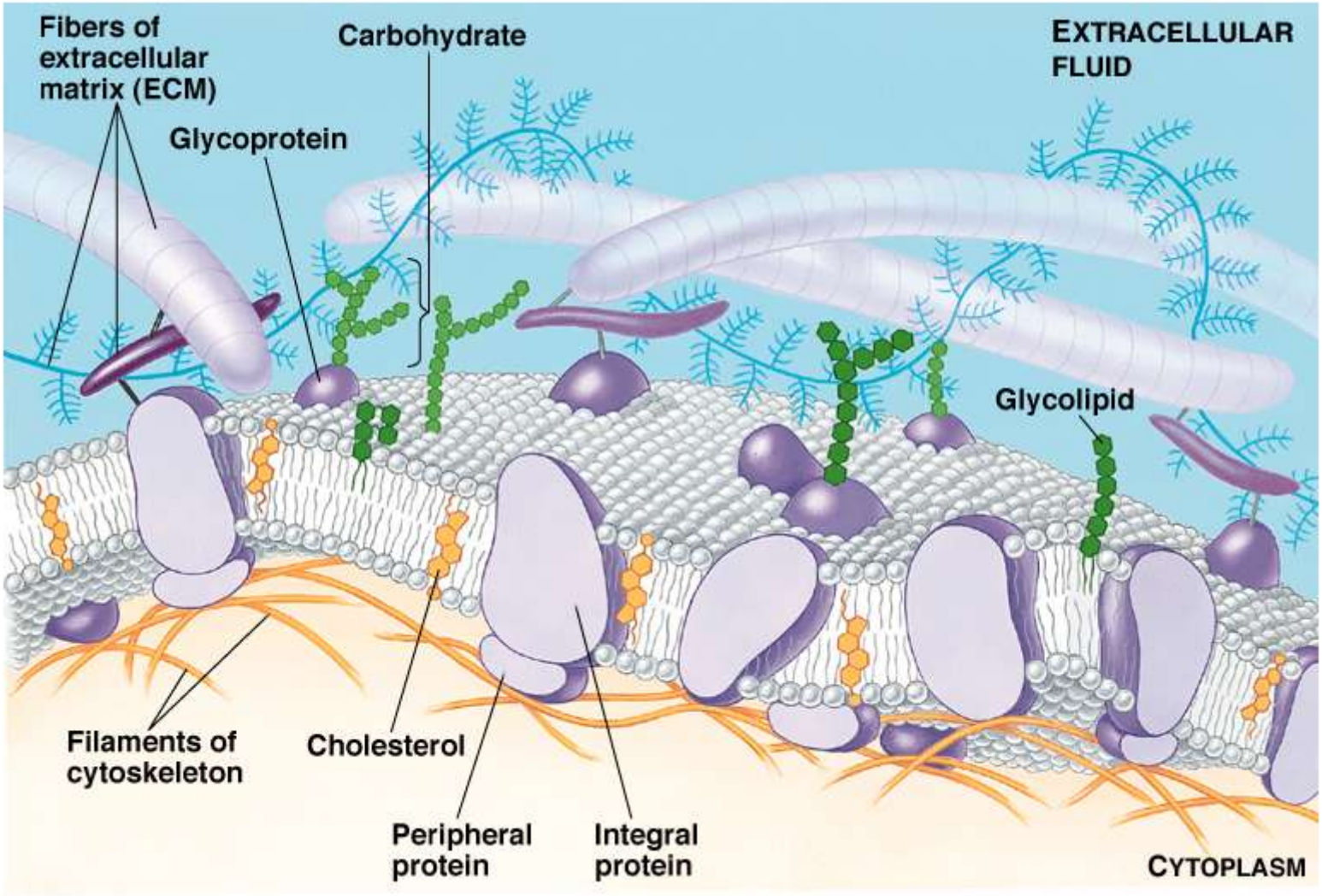

EXTERIOR
PHOSPHOLIPID BILAYER
CELL INTERIOR
membrane pore
NOTE: THIS IS JUST A SIMPLE CARTOON REPRESENTATION OF A CELL ME MBRANE. IT DOESN'T REALLY LOOK LIKE THIS AND NOTHING IS DRAWN TO SCALE!
IDENTITY OR RECOGNITION PROTEIN
CELL ADHESION PROTEIN
RECEPTOR PROTEIN (signalling)
interior messenger molecule
Components of the Cell Membrane
PUMP PROTEIN (ACTIVE TRANSPORT)
GATED CHANNEL PROTEIN
SHUTTLE PROTEIN (FACILITATED DIFFUSION)
MEMBRANE PHOSPHOLIPID MOLECULE
CHOLESTEROL
STRUCTURAL PROTEIN


Extracellular Fluid
Glycoprotein
Glycolipid
Carbohydrate
Cholesterol
Peripheral protein
Integral protein
Filaments of cytoskeleton
Cytoplasm


Carbohydrate chain
Protein molecule
Outside cell
Protein molecule
Protein channel
Lipids (bilayer)
Inside cell

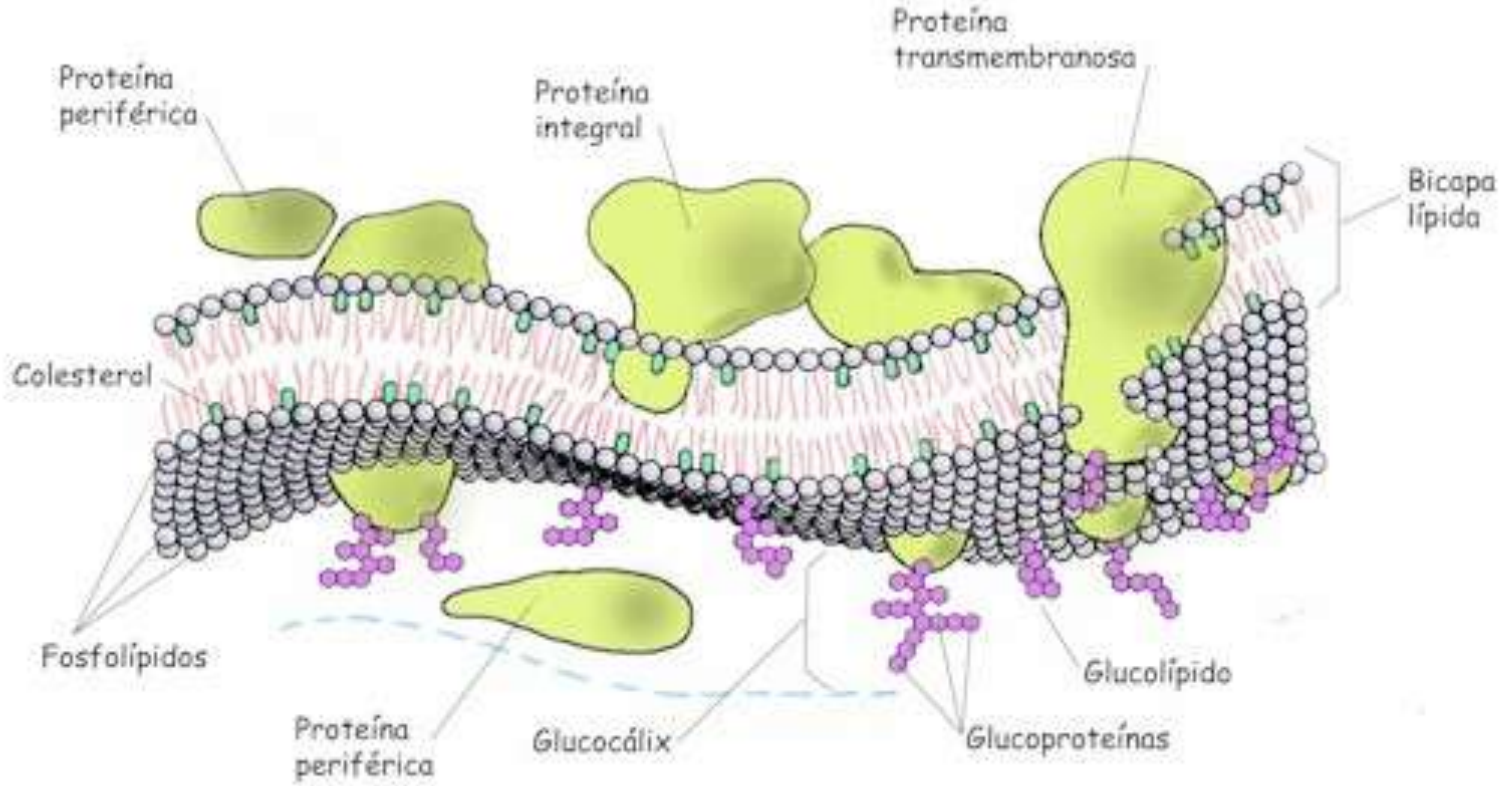

(outside of cell)
membrane protein
glycoprotein
cholesterol
phospholipid
plasma membrane
(cytoplasm inside of cell)



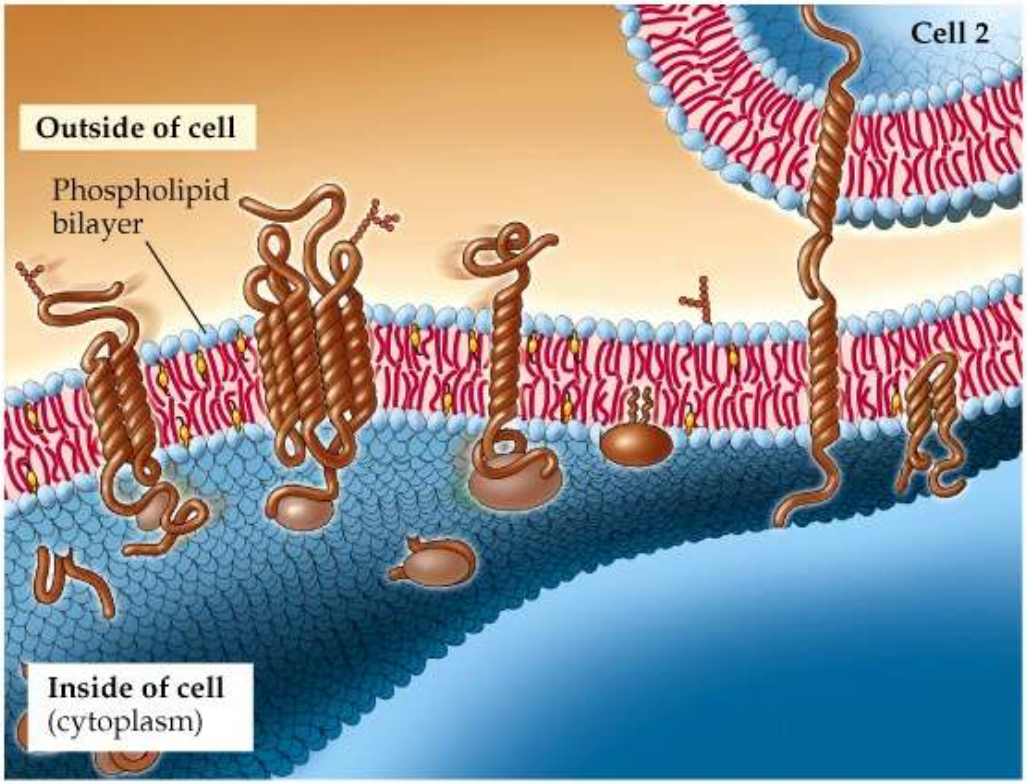

Fibers of extracellular matrix (ECM)
Carbohydrate
EXTRACELLULAR FLUID
Glycoprotein
Glycolipid
Filaments of cytoskeleton
Cholesterol
Peripheral protein
Integral protein
CYTOPLASM

MEMBRANA PLASMÁTICA

INTERIOR: CITOSOL



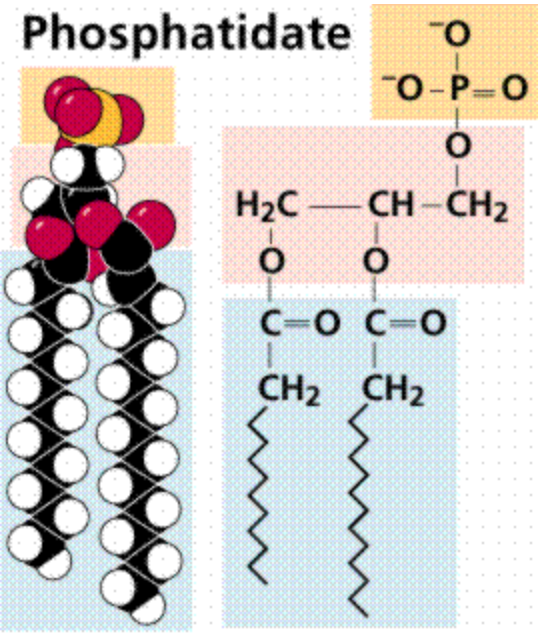
EXTERIOR: ESPACIO INTERCELULAR

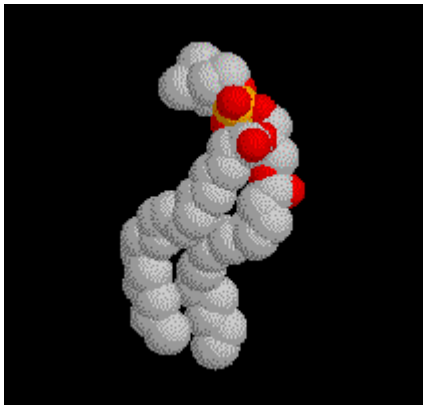


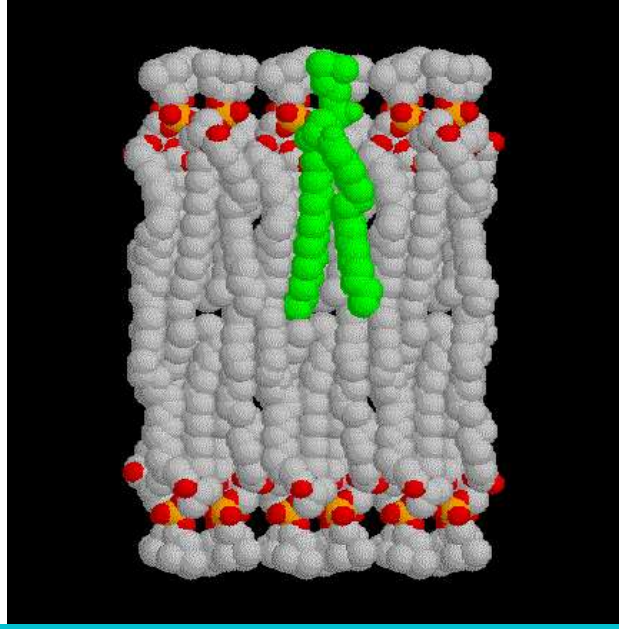
Composición de membranas

MEMBRANA DE:	Proteínas (% peso)	Lípidos (% peso)	Glúcidos (% peso)
Nervio con mielina	18	79	3
Eritrocito	49	43	8
Cloroplasto	70	30	0
Interna de mitocondria	76	24	0
MEDIA	**52**	**40**	**8**

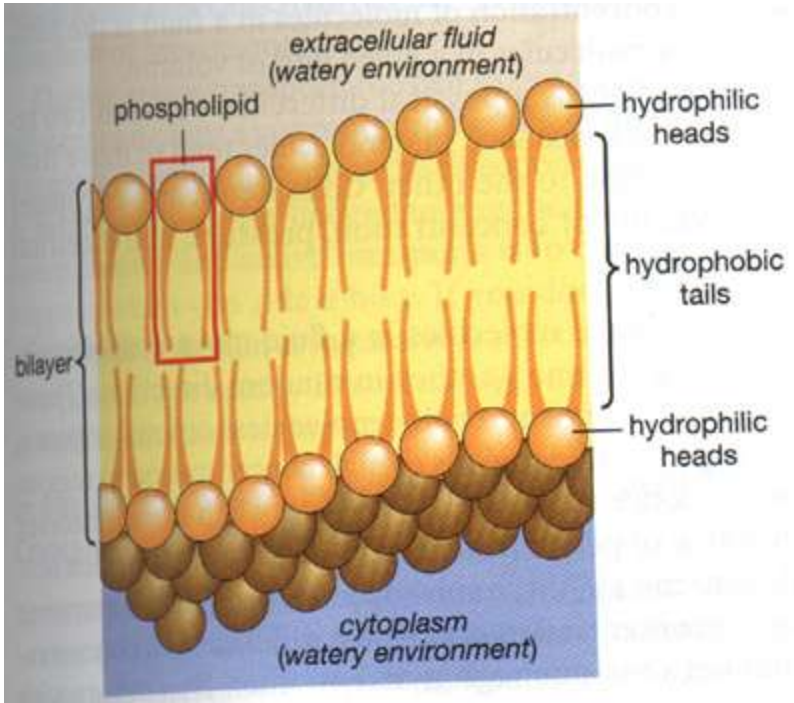
BICAPA LIPÍDICA

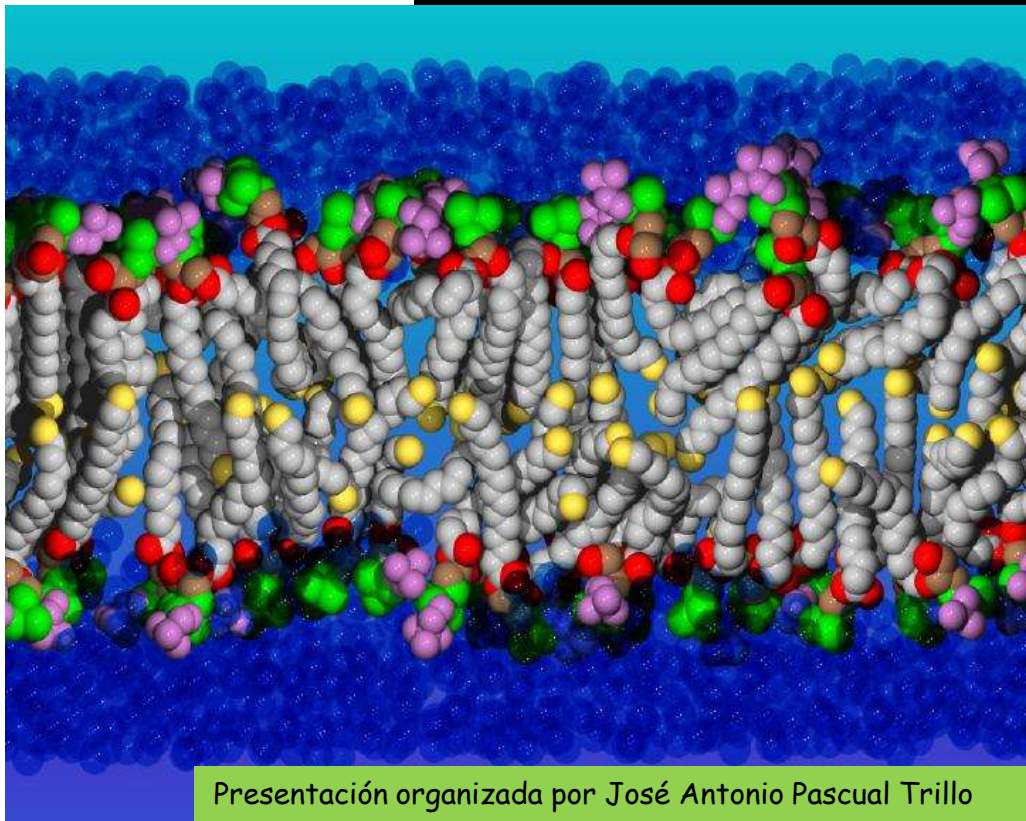




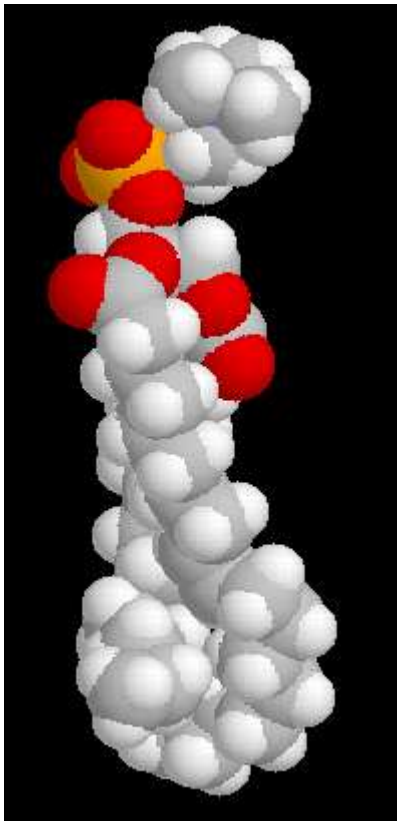


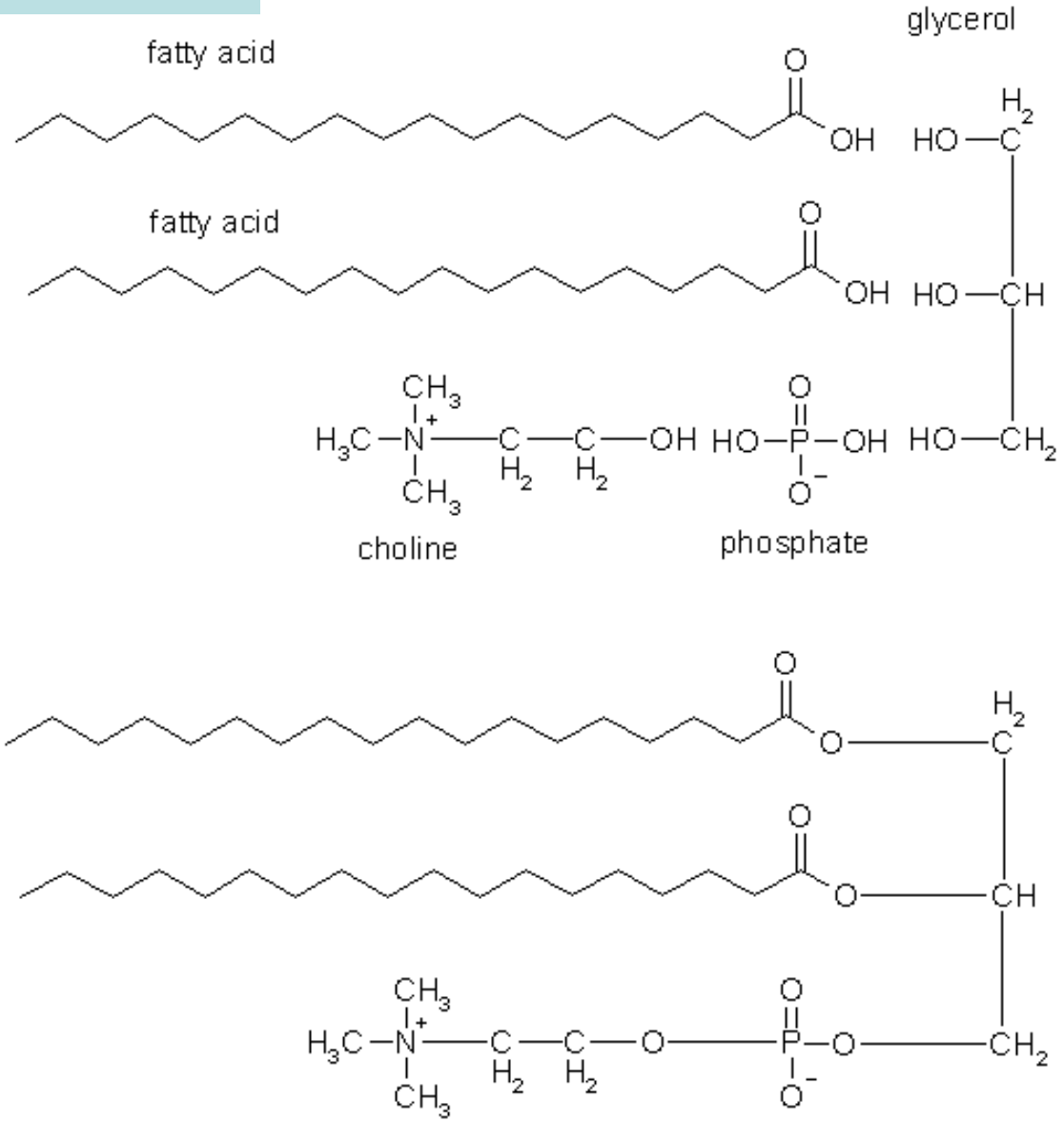
Fosfolípidos

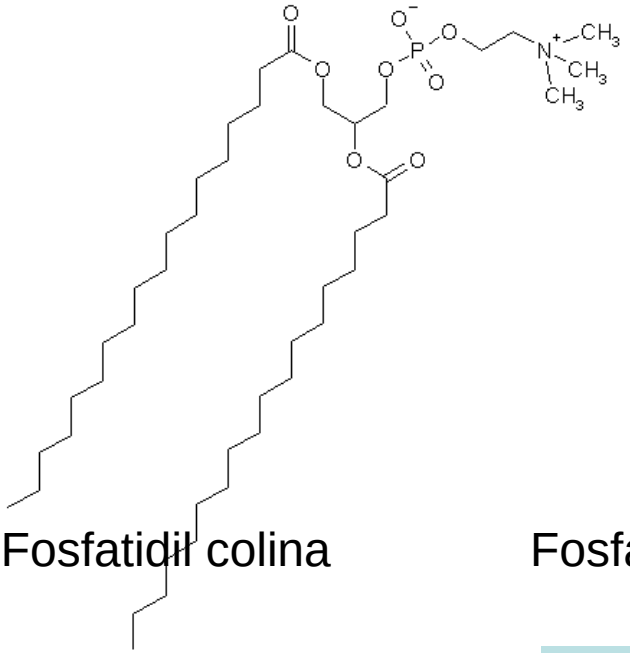




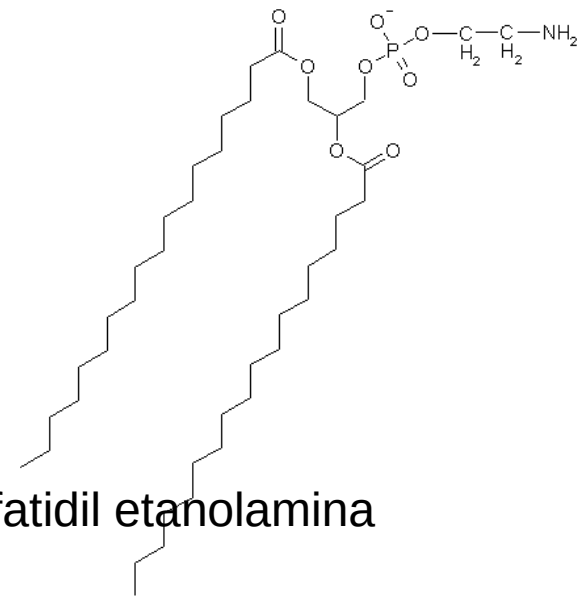
FOSFOLÍPIDOS DE MEMBRANA



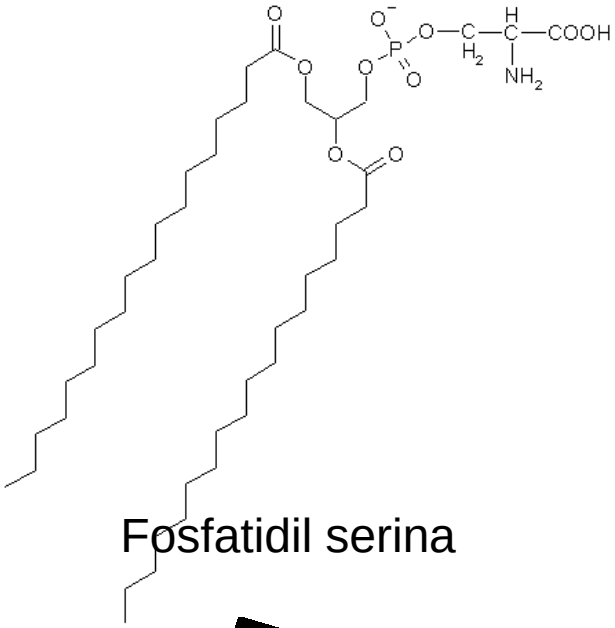




Fosfatidil colina

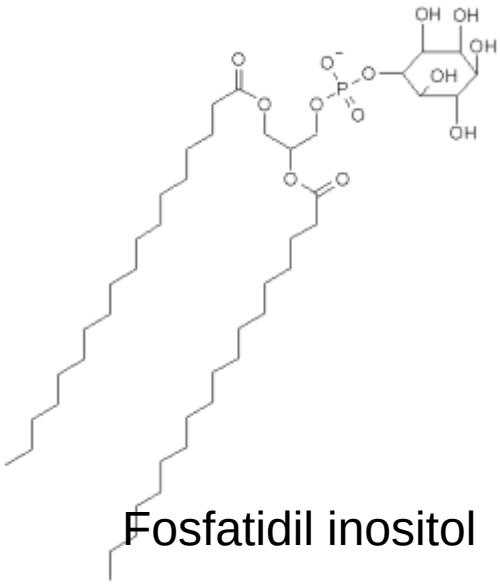


Fosfatidil etanolamina

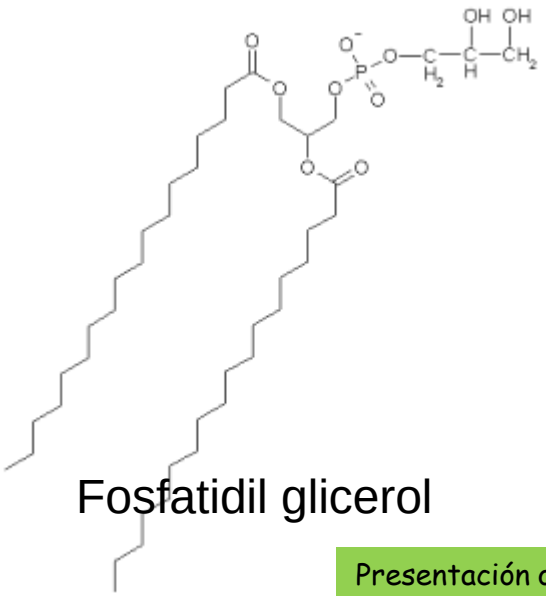


Fosfatidil serina

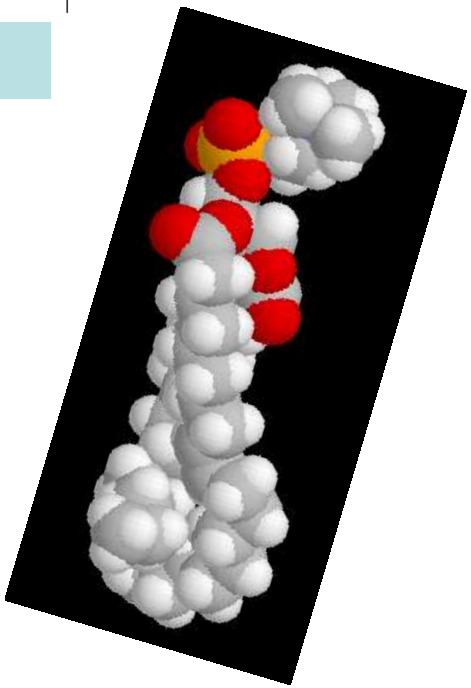
FOSFOLÍPIDOS DE MEMBRANA



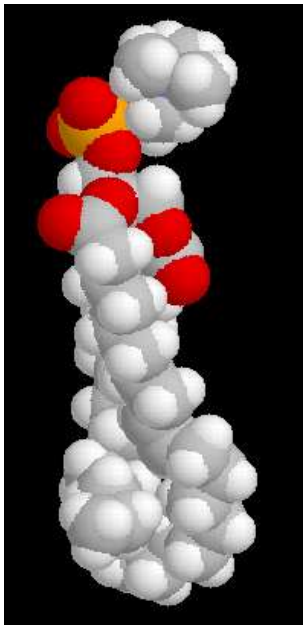
Fosfatidil inositol



Fosfatidil glicerol

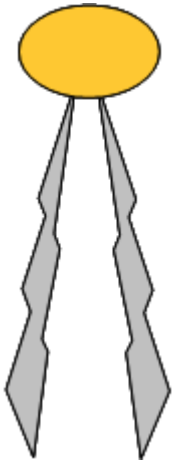


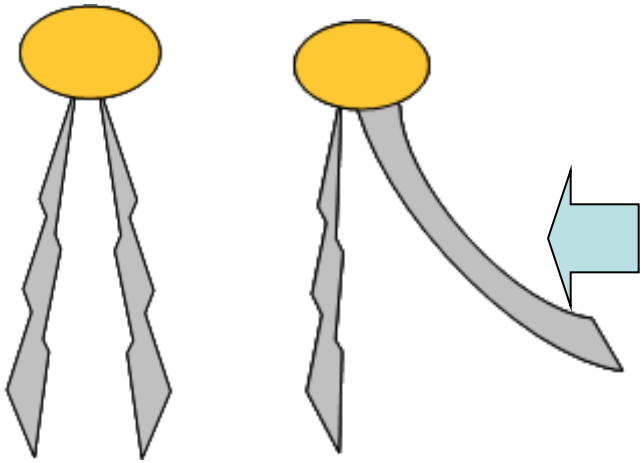
FOSFOLÍPIDOS DE MEMBRANA



Parte polar: fosfato + radical aminado

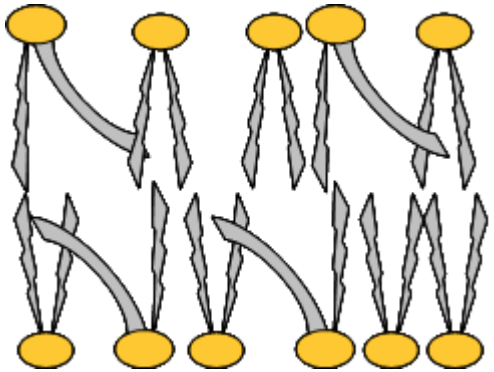
Parte apolar: cadenas alifáticas de ácidos grasos

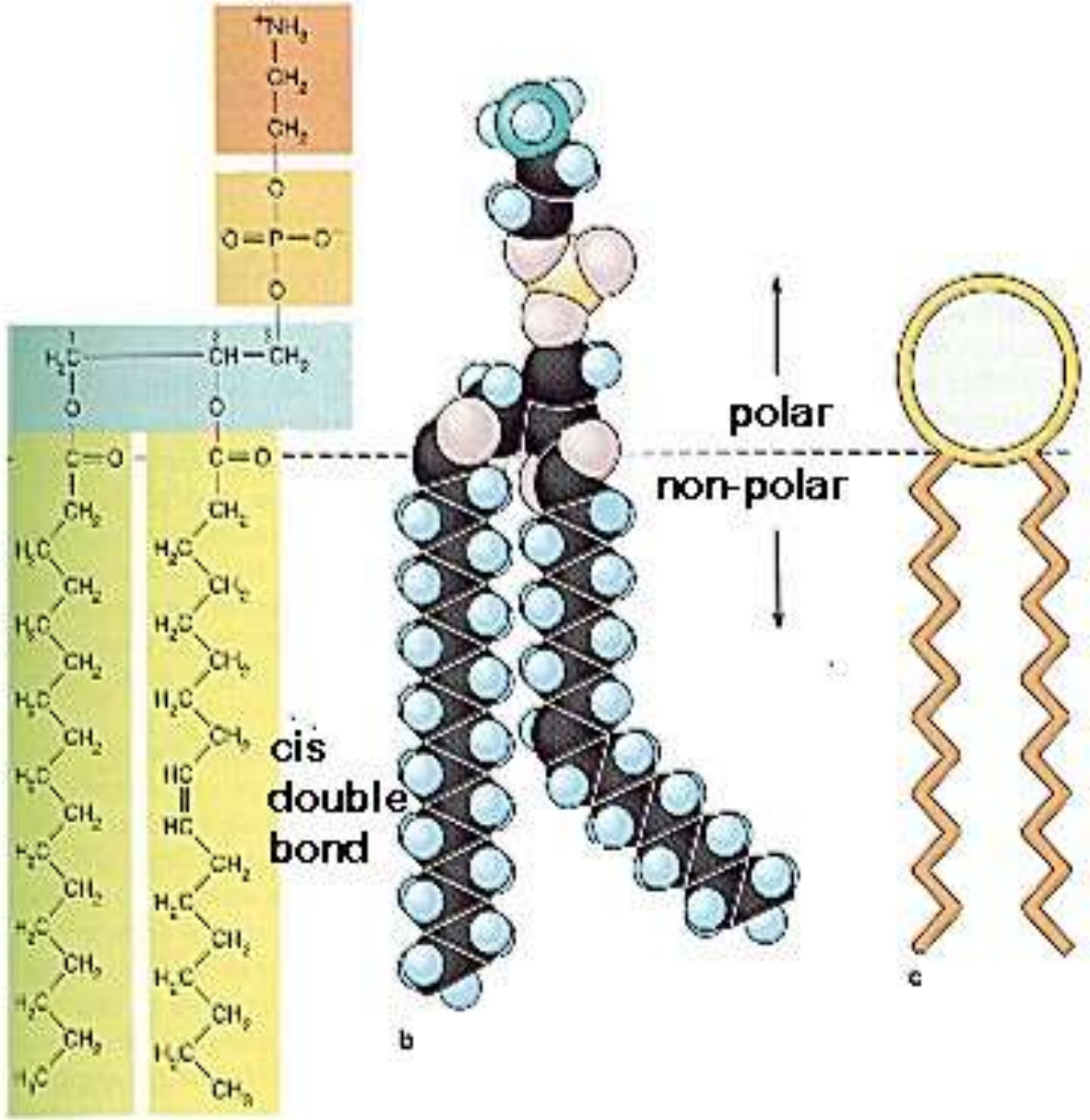


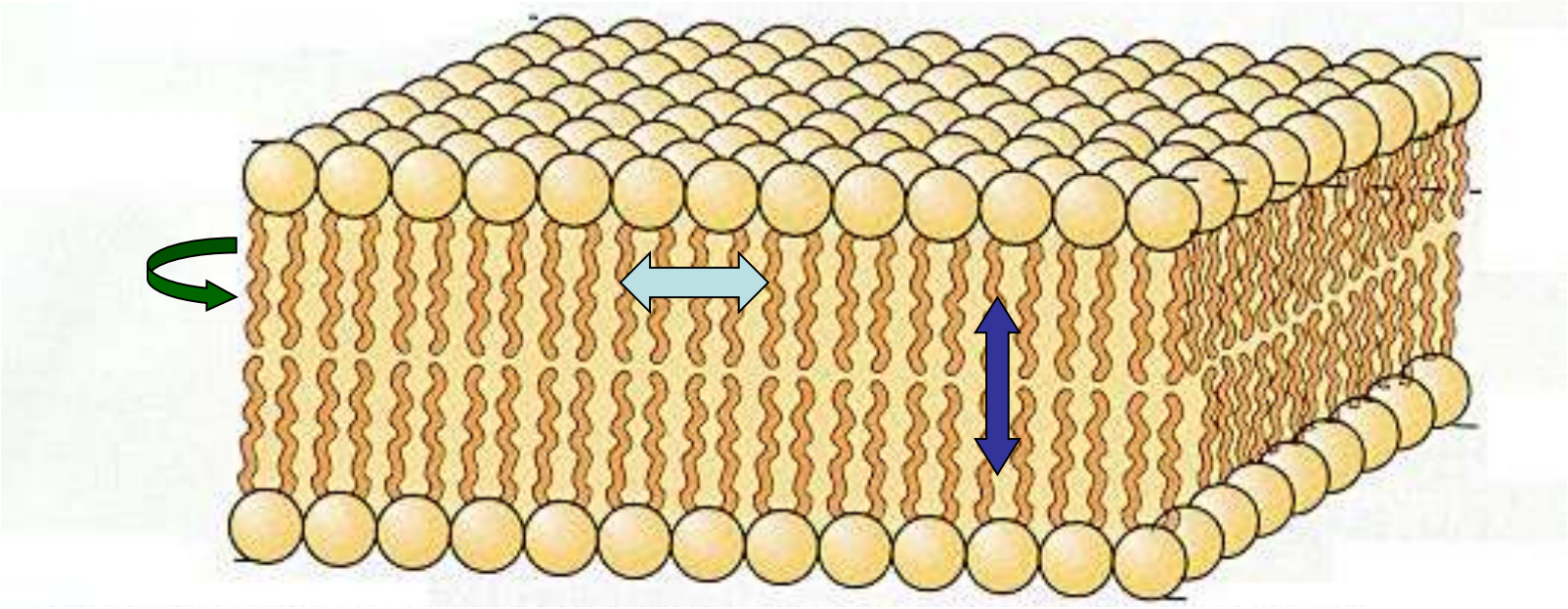


Cuando alguna de las cadenas de ácidos grasos es insaturada, la cadena se tuerce

ESO AUMENTA LA FLUIDEZ DE LA MEMBRANA




cis
double
bond
polar
non-polar
b
c

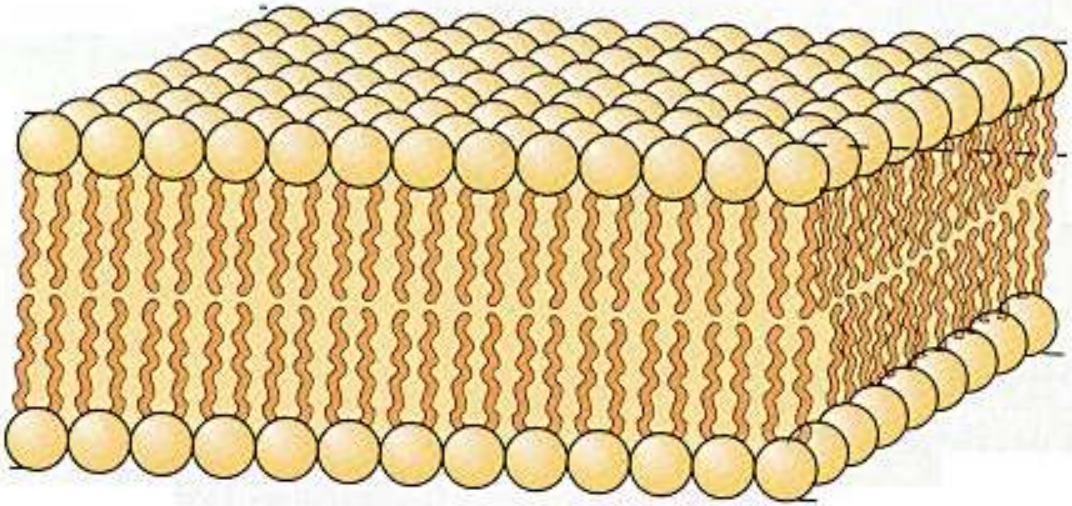


Movimientos de los lípidos de membrana:

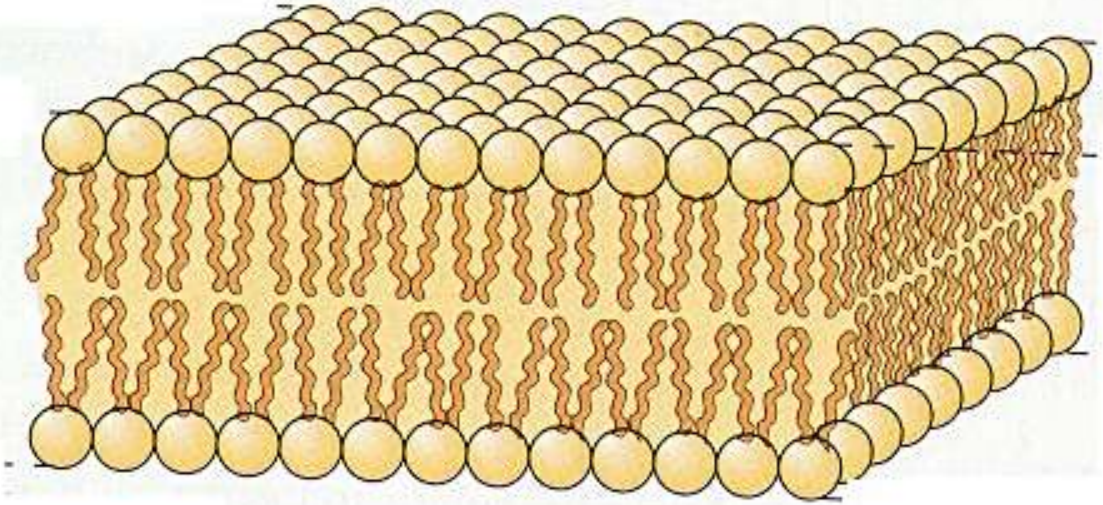
- **Rotación** (giro en torno a eje mayor)
- **Difusión lateral** (dentro de la bicapa)
- **Flip-flop** (de una monocapa a otra, con ayuda de “flipasas”)

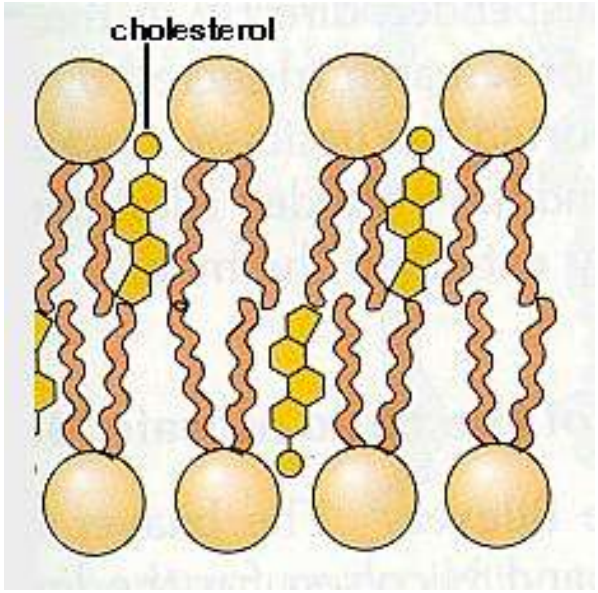
Fase “gel”: bajas temperaturas

Cadenas muy empaquetadas



Altas temperaturas: fase fluida





Colesterol

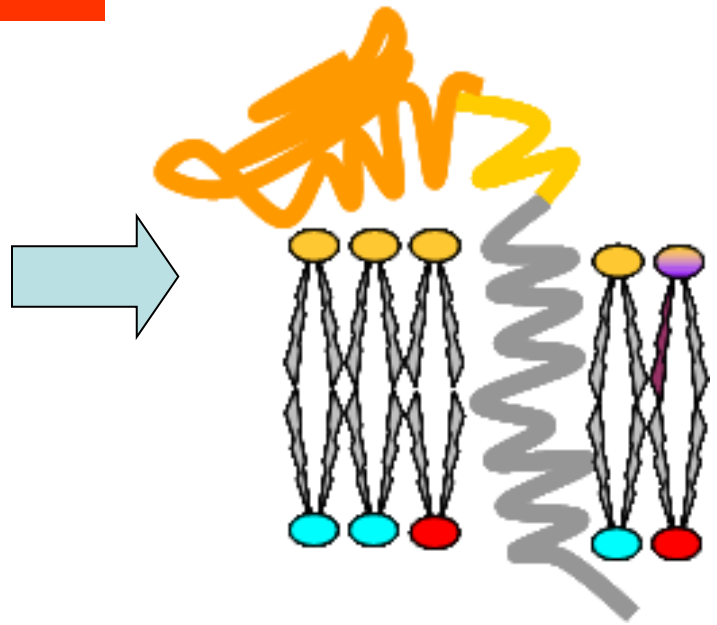
Inmovilizan las cadenas de hidrocarburos de los fosfolípidos, contribuyendo a hacer la bicapa:

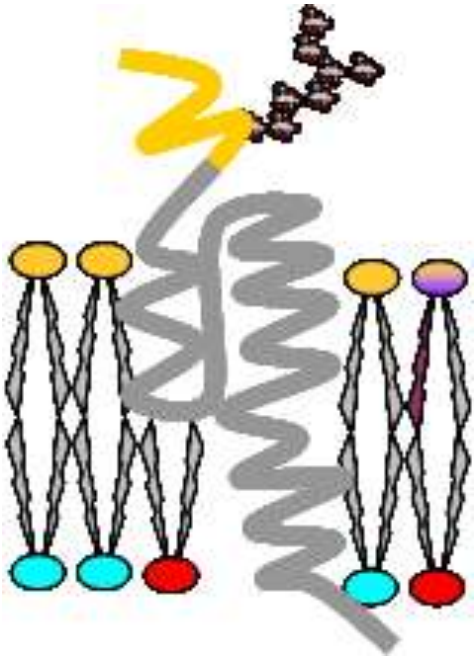
- menos deformable (menos fluida)
- menos permeable a sustancias hidrófilas

Además evita la cristalización de las cadenas hidrocarbonadas de los fosfolípidos

PROTEINAS DE MEMBRANA

Las **proteínas periféricas de membrana (extrínsecas)** se unen por interacciones no covalentes con otras proteínas de membrana. Por ello, pueden ser separadas con cierta facilidad

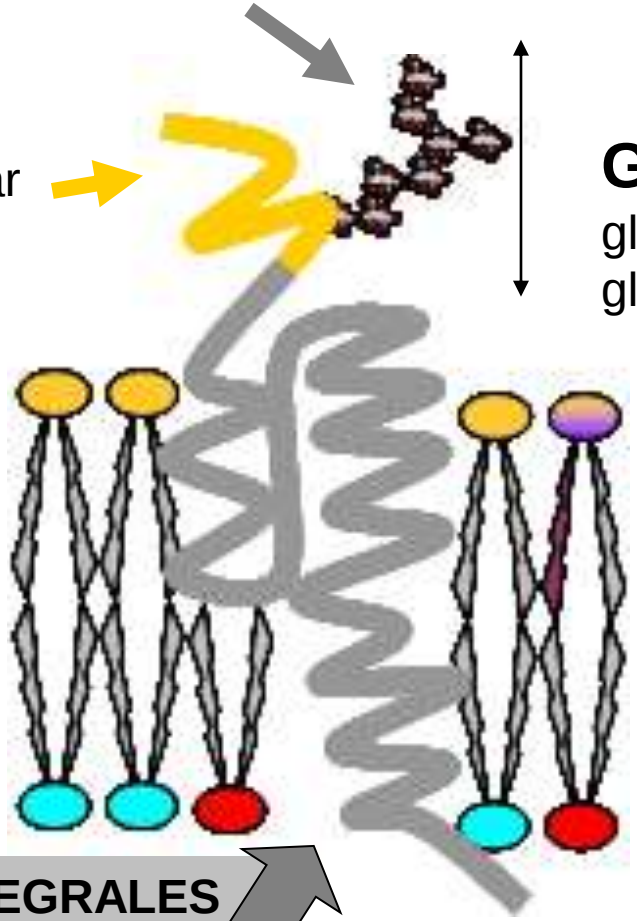




En las **proteinas integrales de membrana (intrínsecas)**, los aminoácidos hidrófobos forman una doble hélice en el interior de la bicapa lipídica, dejando las partes hidrófila o polares hacia el exterior. A esas zonas externas de la proteína se pueden unir glúcidos (glucoproteinas)

Oligo y polisacáridos: uniones fuertes a la proteína. Difíciles de separar

Porción polar o hidrófila de la proteína: puede estar unida a glúcidos´: **GLUCOPROTEINA**



Glucalix : capa laxa de glúcido (glucoproteinas y glucolípidos)

Proteinas integrales

PROTEINAS INTEGRALES

(INTRÍNSECAS)

Pueden ocupar toda la bicapa (TRANSMEMBRANA)

o no

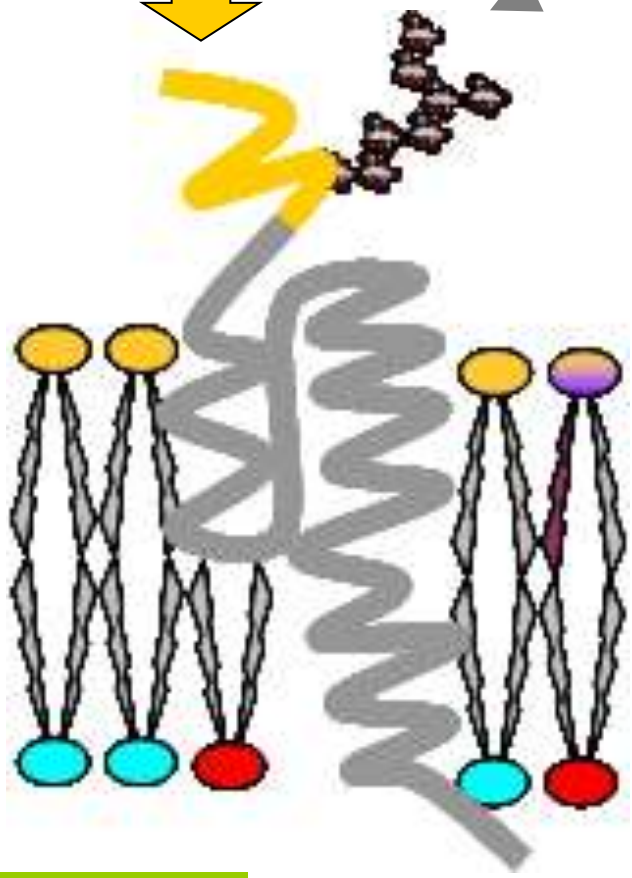
A menudo adoptan una estructura helicoidal (hélice α) en el interior de la bicapa

Aminoácidos hidrófobos o apolares

Porción hidrófila (sobresaliente)

GLUCOPROTEINA

A menudo unida a oligo o polisacáridos:



GLICOCALIX

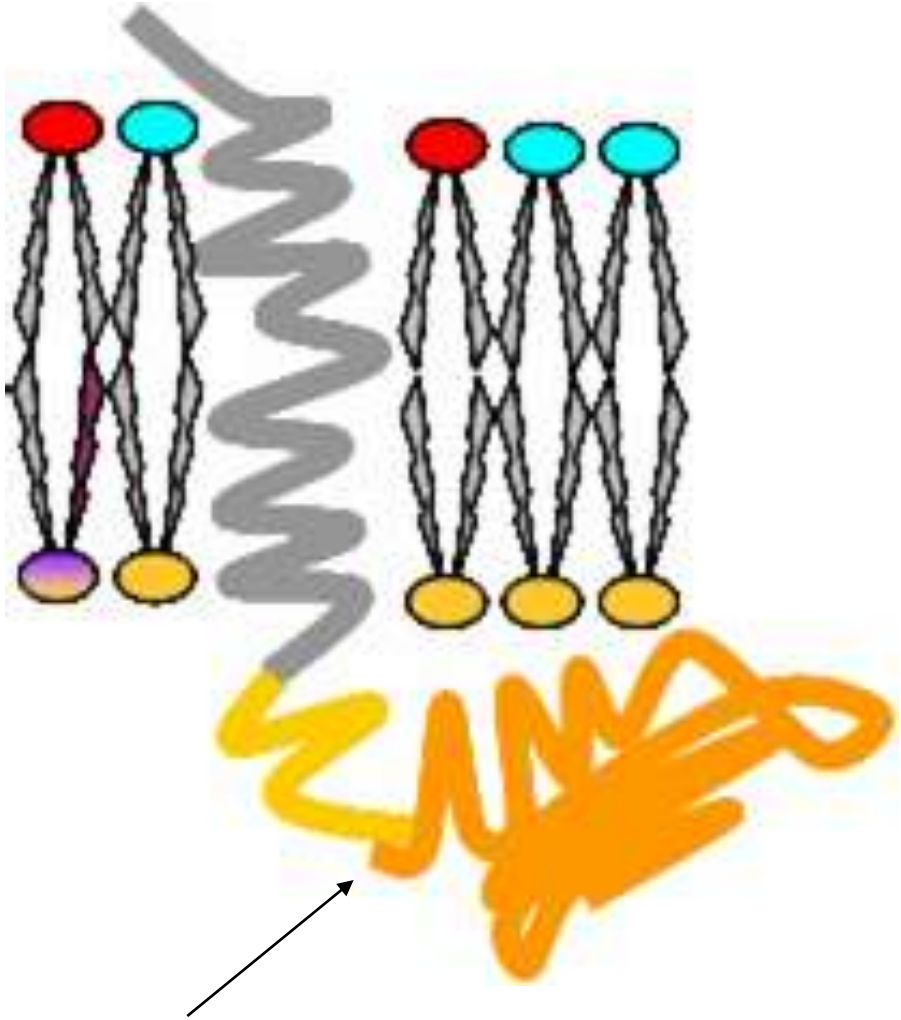
Capa laxa de oligo- y polisacáridos unidos a lípidos o proteínas de membrana

PROTEINAS INTEGRALES

(INTRÍNSECAS)

Proteinas integrales

Proteinas periféricas



PROTEINAS PERIFÉRICAS

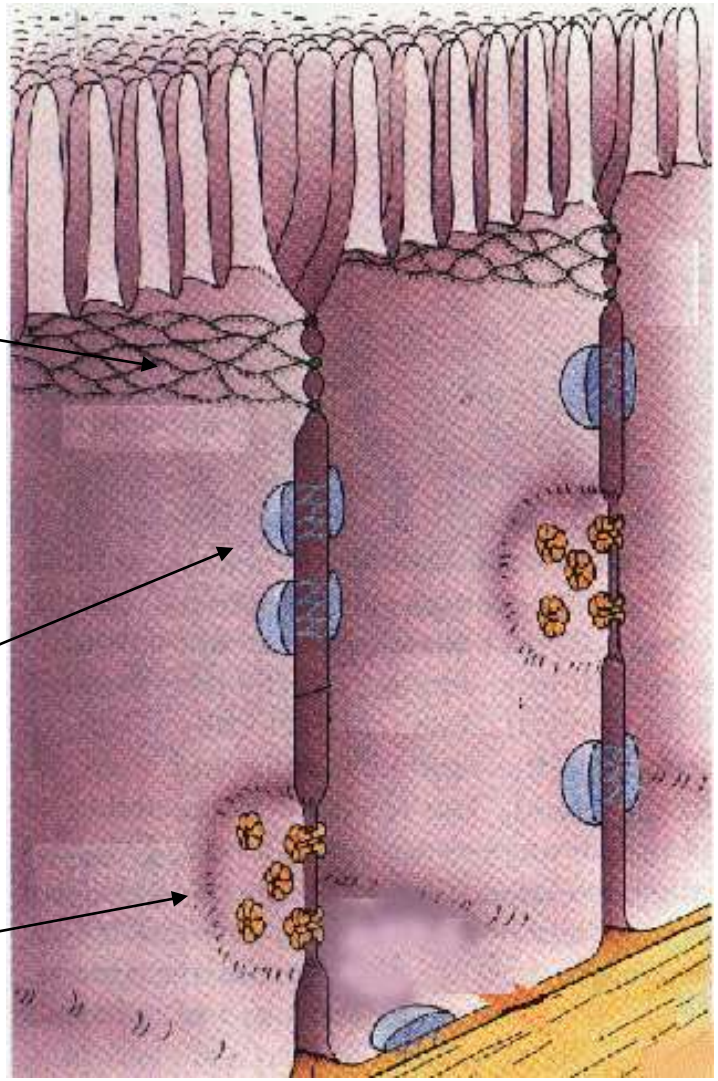
(EXTRÍNSECAS)

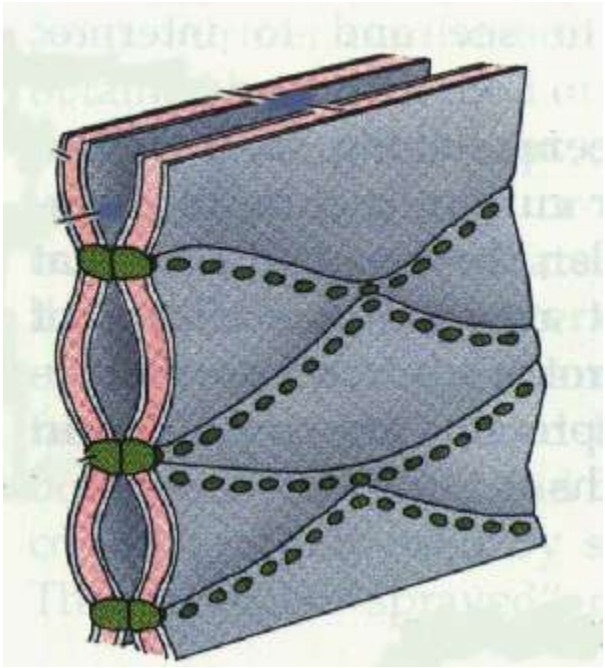
Enlaces no covalentes con otras proteínas de membrana

(fáciles de separar)

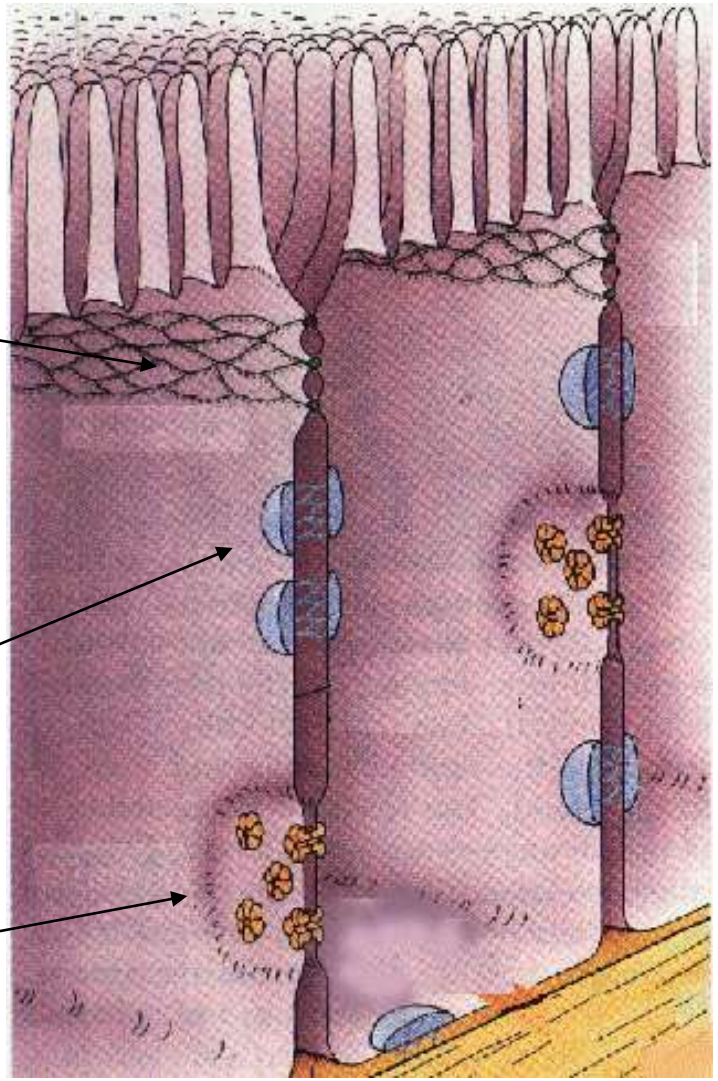
Más frecuentes en lado citoplasmático (interior)

UNIONES INTERCELULARES



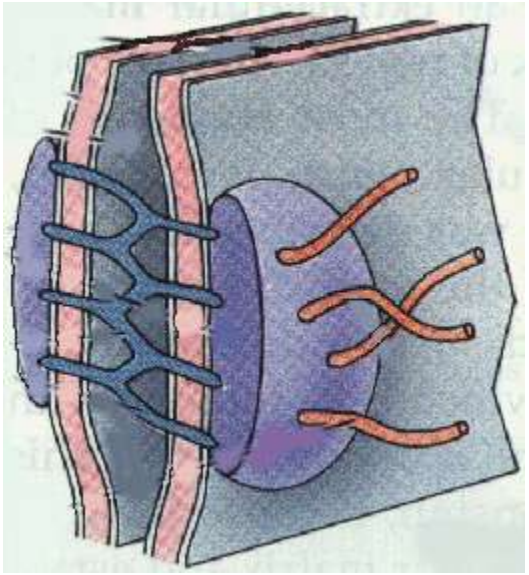


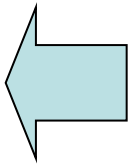
Unión estrecha



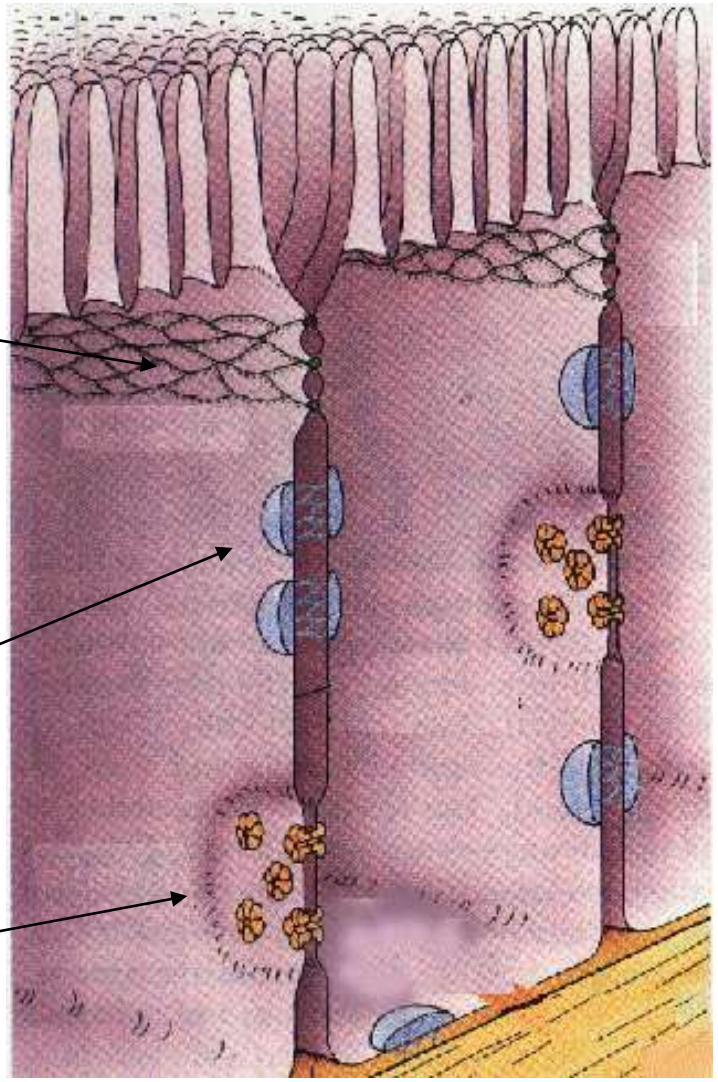
Desmosoma

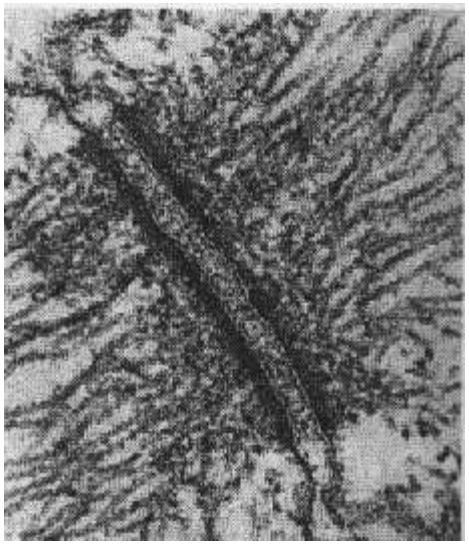
Unión de hendidura o gap

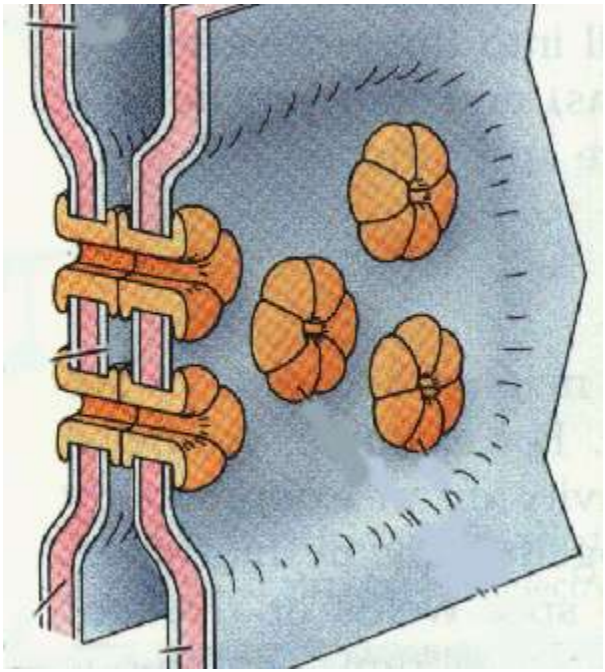


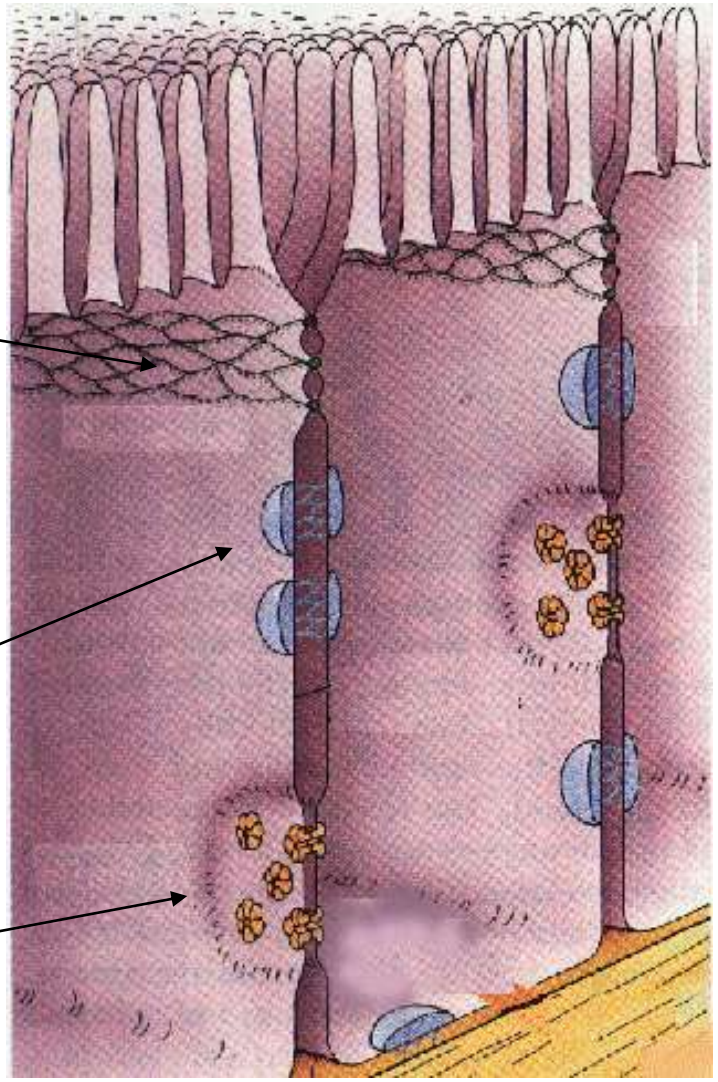


Desmosoma



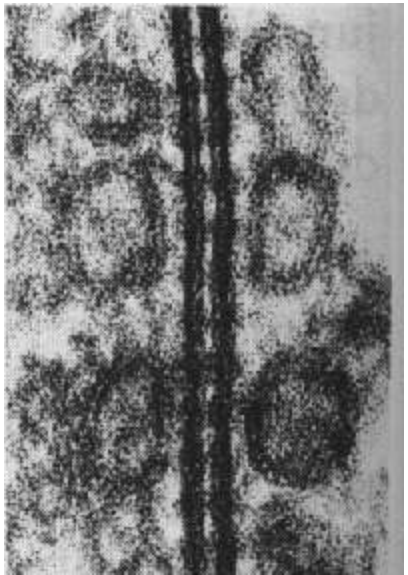




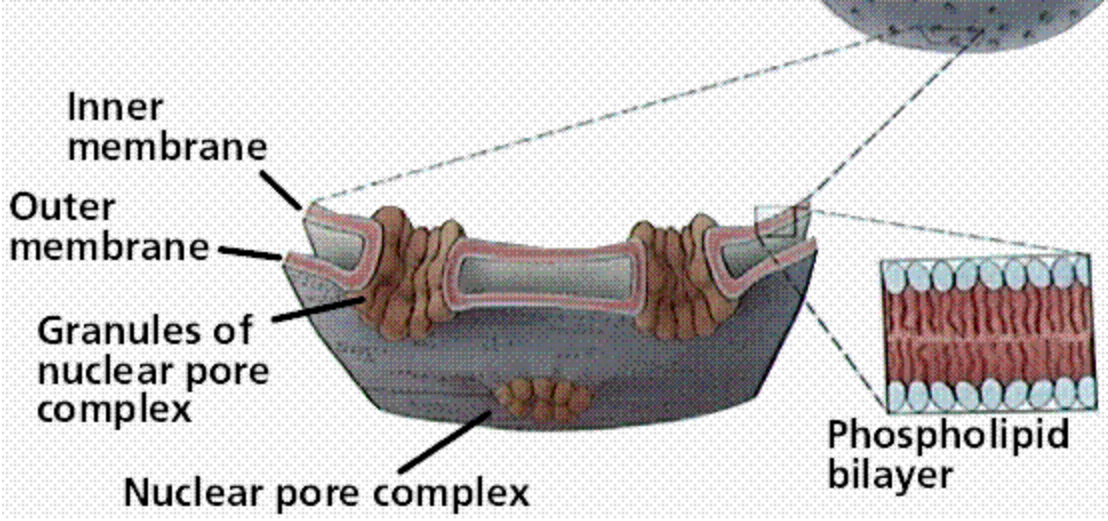


Unión estrecha

Desmosoma



Unión de hendidura o gap


Inner membrane
Outer membrane
Granules of nuclear pore complex
Nuclear pore complex
Phospholipid bilayer