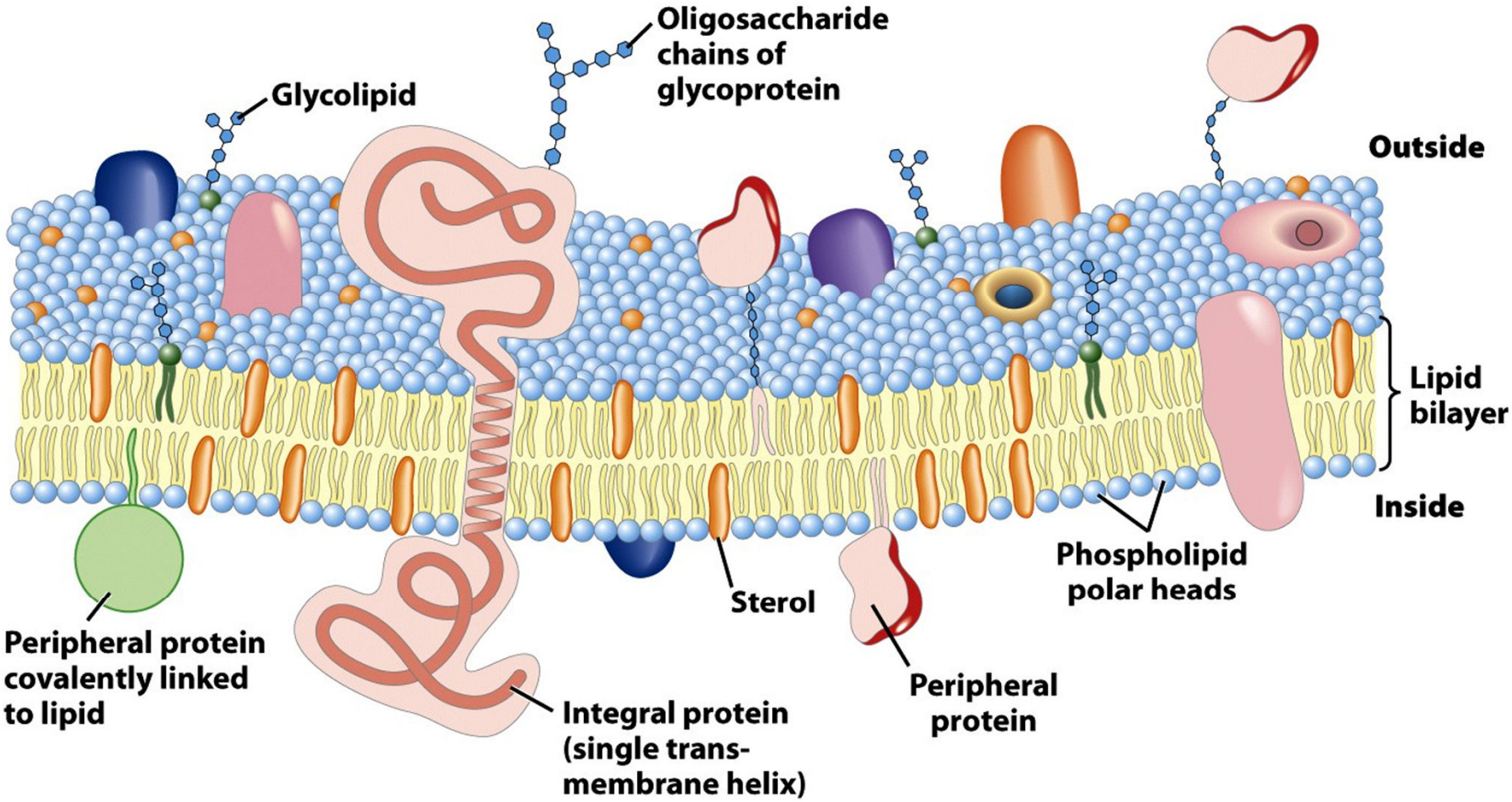
Biological membranes are heterogeneous lipid bilayers with proteins



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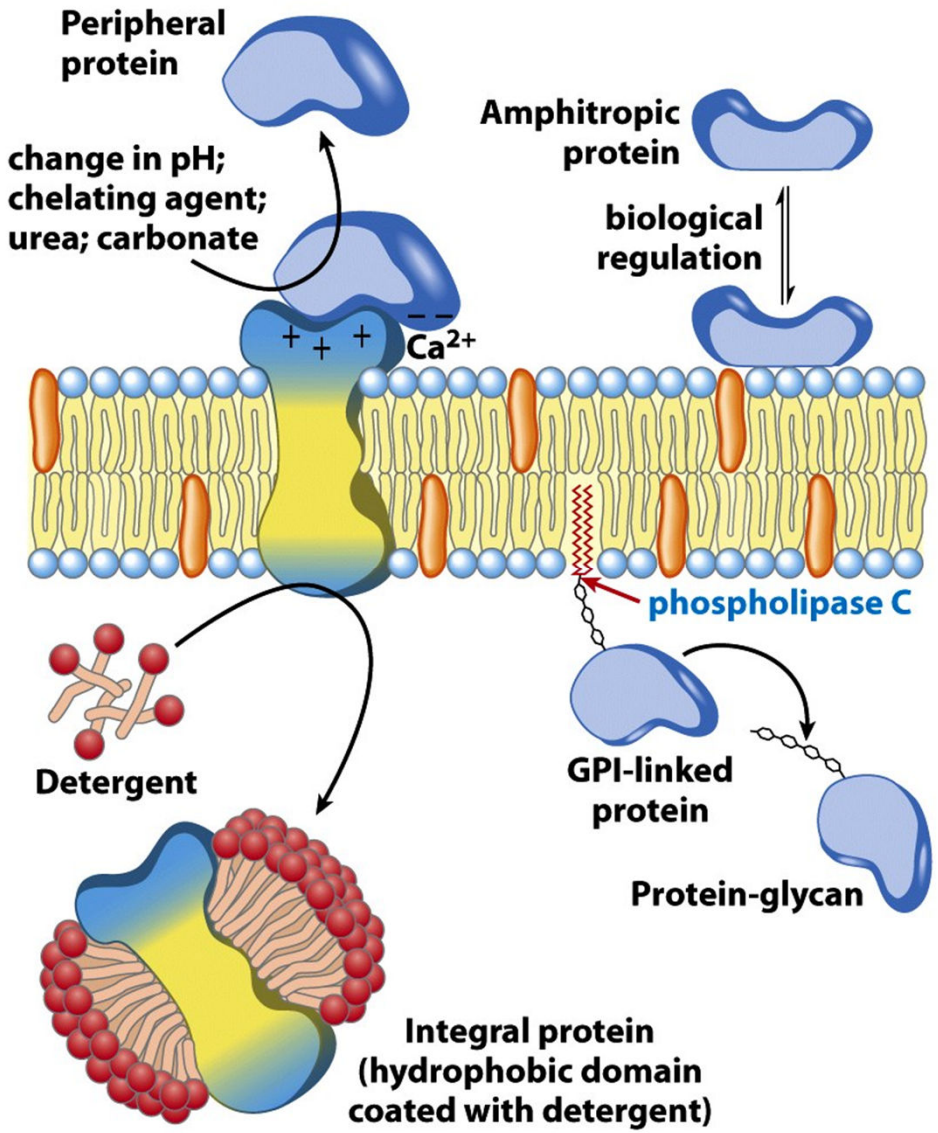
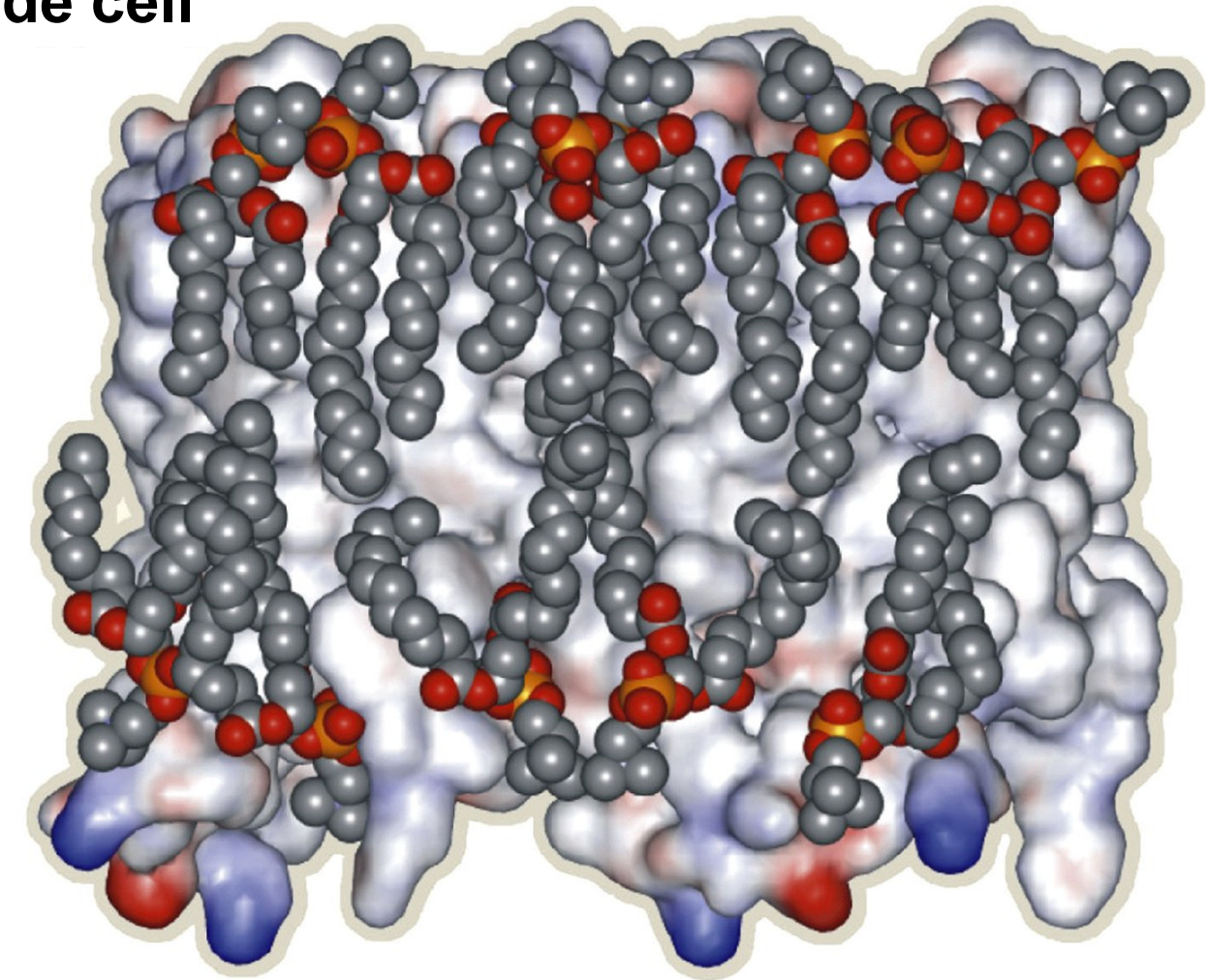
Different types of mb proteins require different conditions for mb release



Integral membrane proteins directionally insert in the membrane bilayer

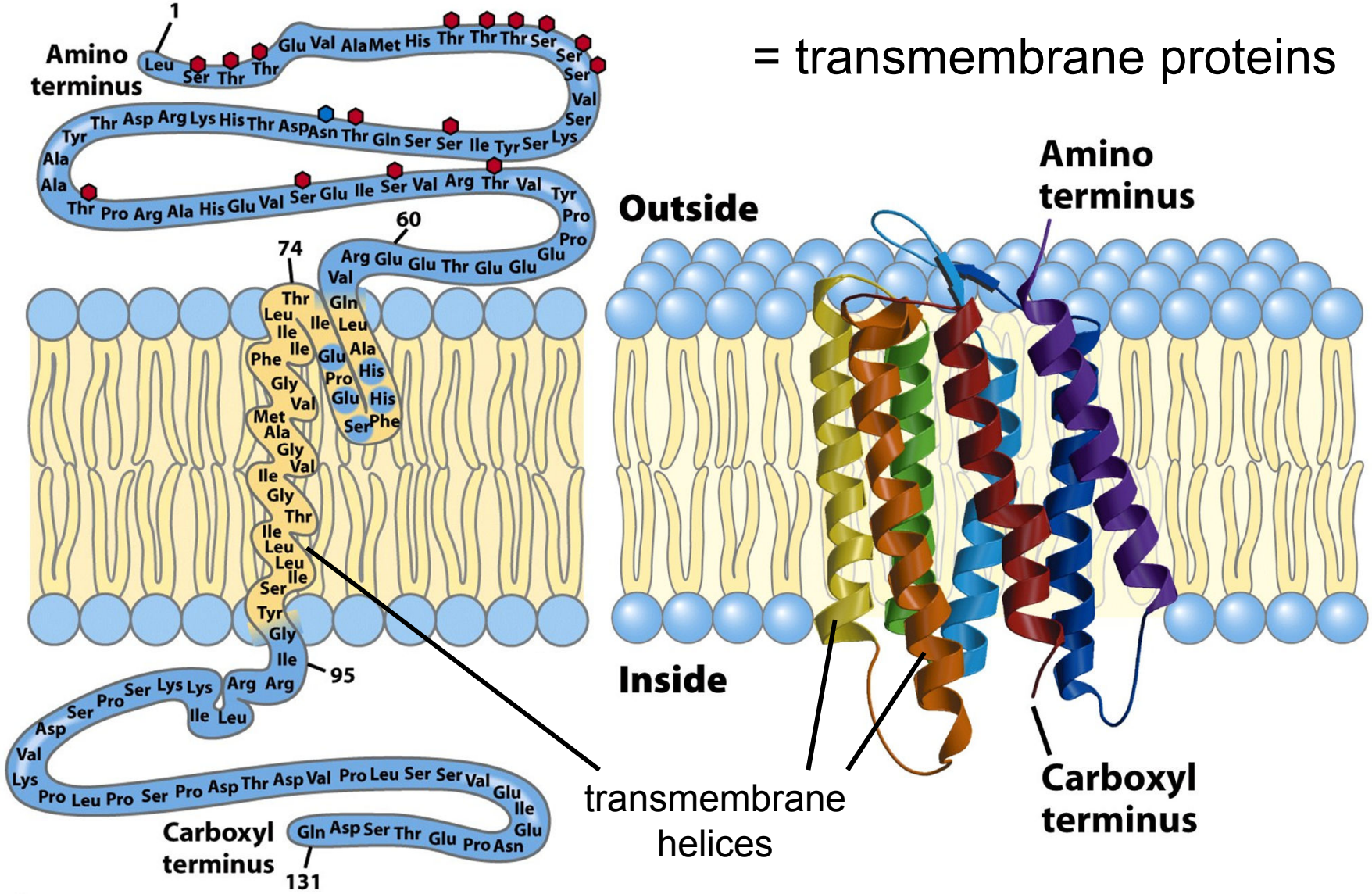
Outside cell



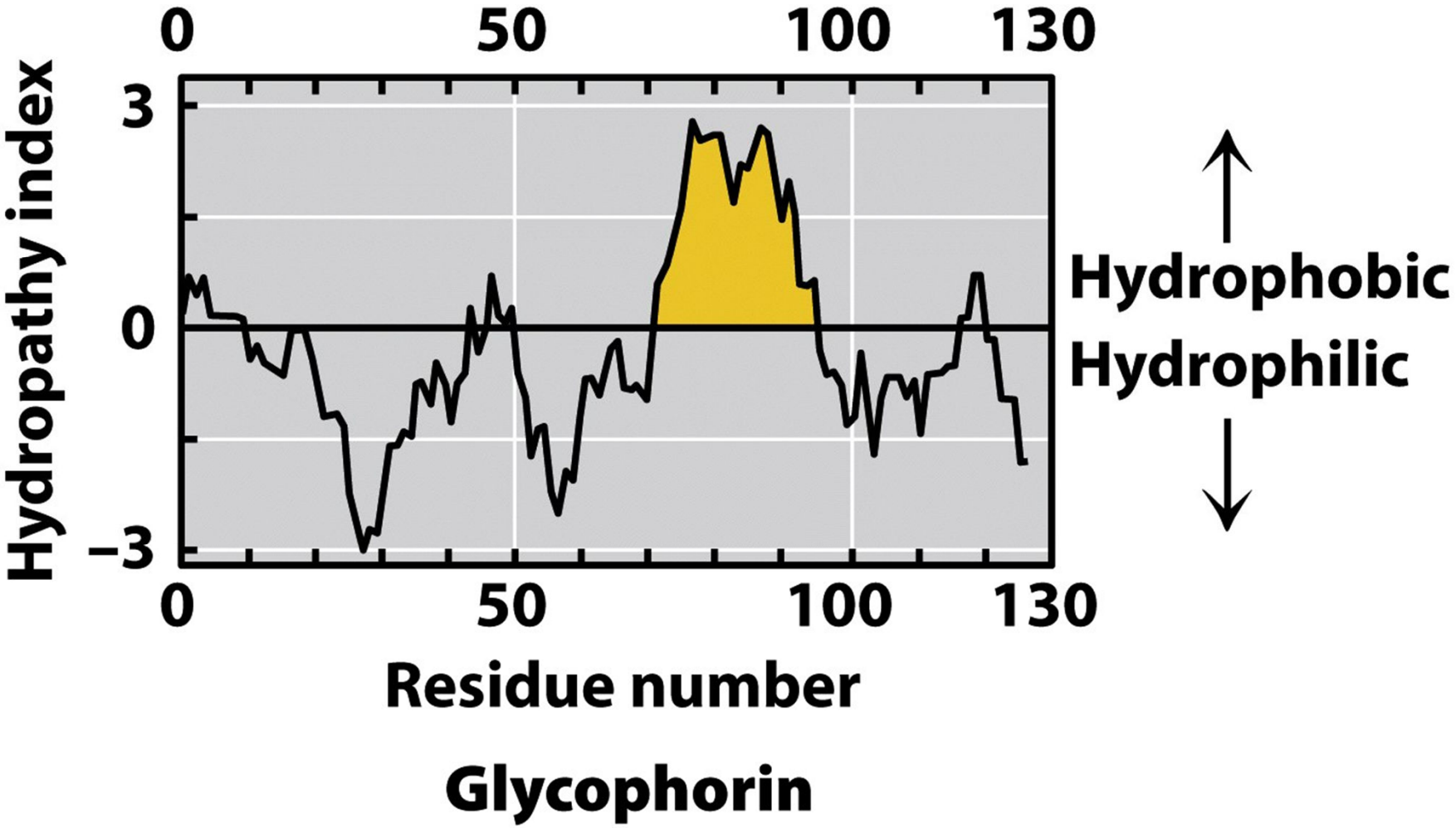
Inside cell

Glycophorin and bacteriorhodopsin are integral proteins that span (cross) the bilayer

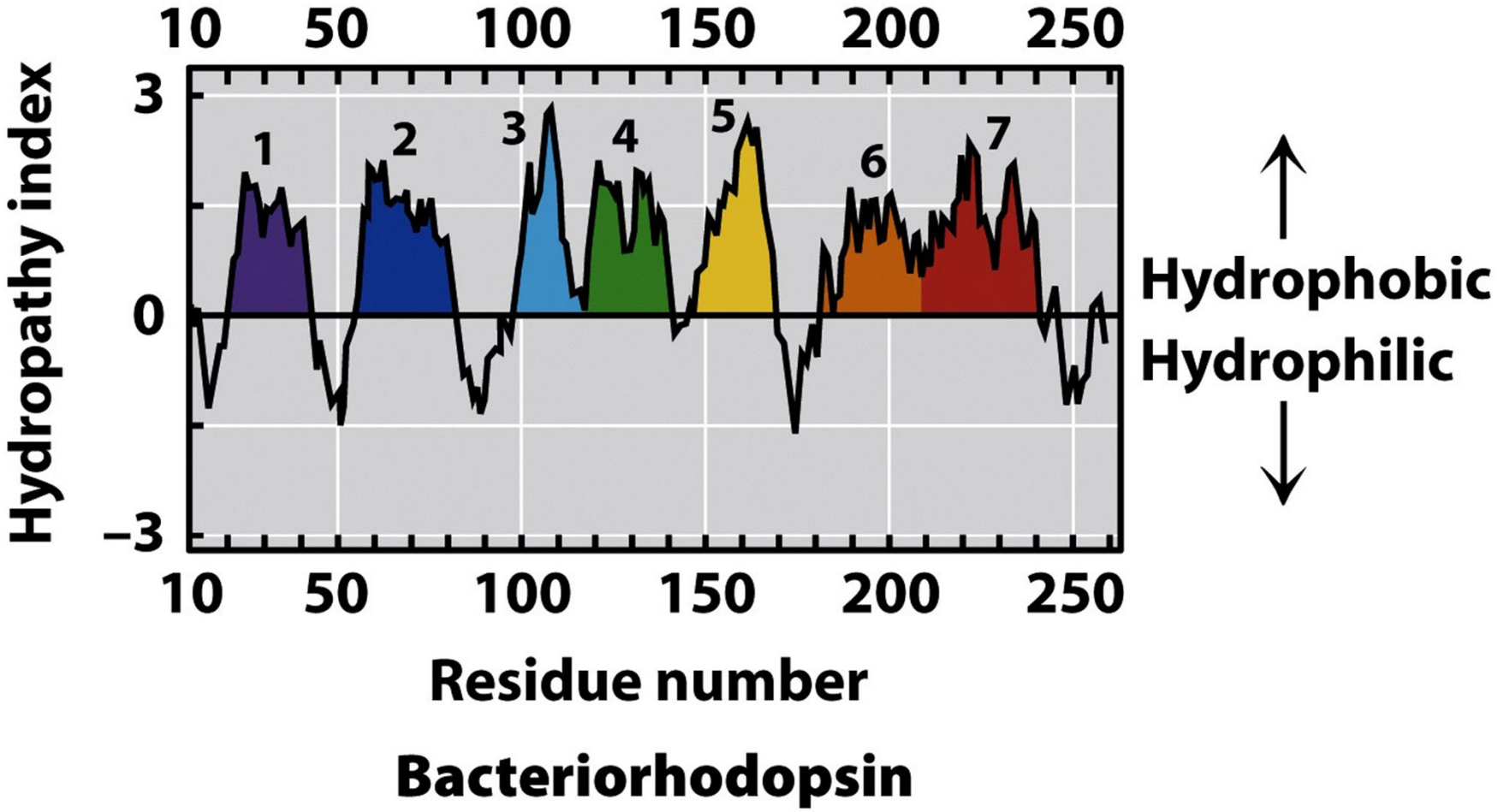
= transmembrane proteins



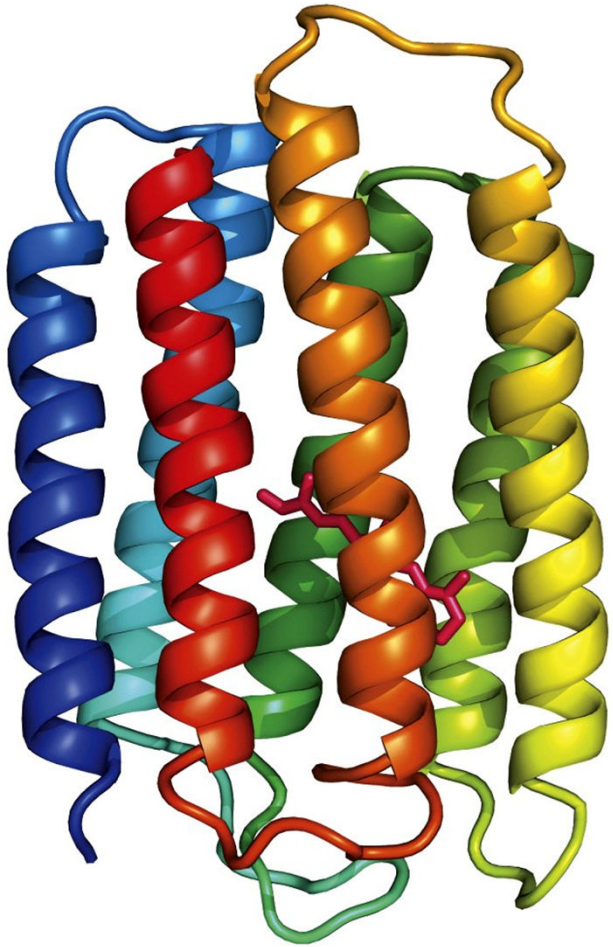
Transmembrane helices are predicted by hydrophobic stretches of 20-25 aa residues



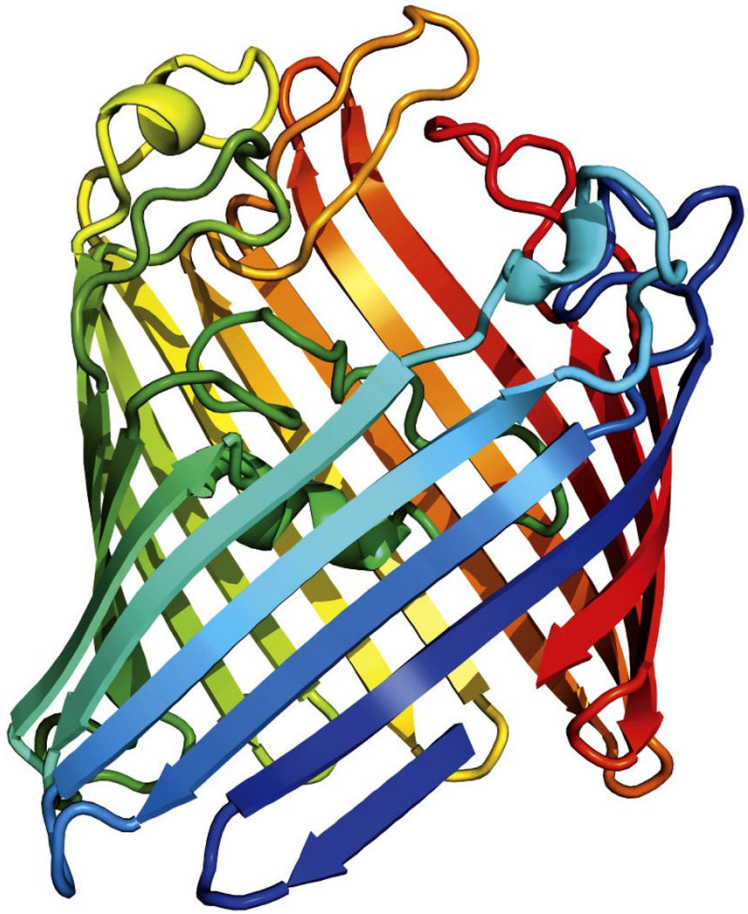
Transmembrane helices are predicted by hydrophobic stretches of 20-25 aa residues



Transmembrane regions are usually α-helices or continuous β-sheets (β-barrels)

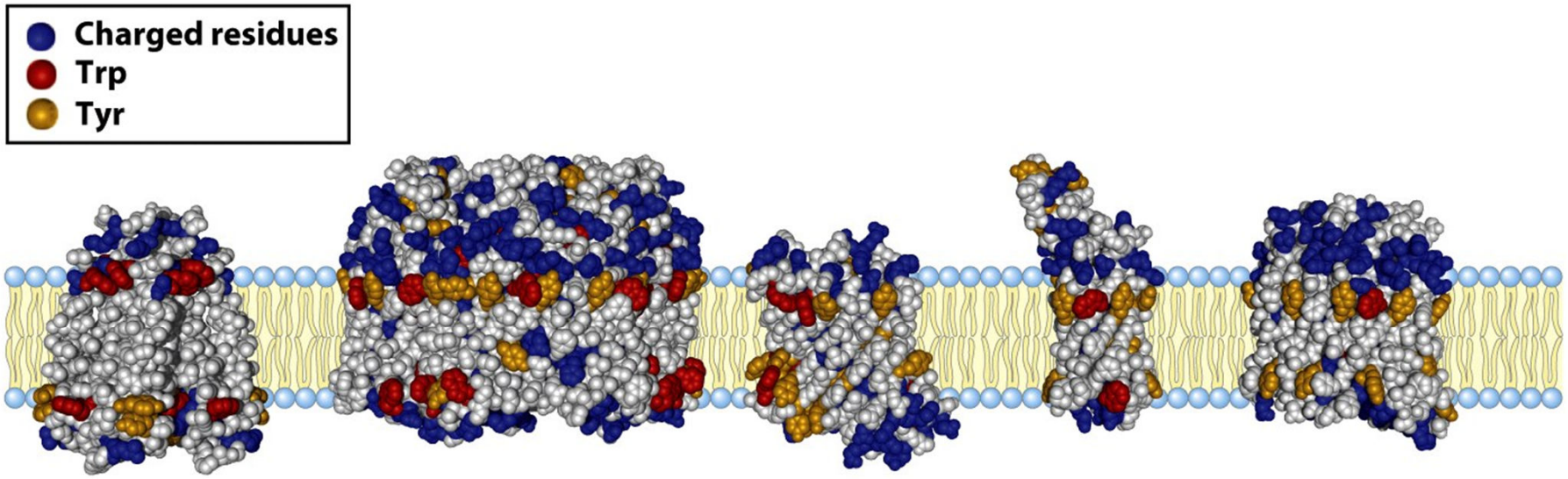


Bacteriorhodopsin:
a light-driven proton pump



Porin:
a pore-forming protein

A protein's surface polarity corresponds to its environment



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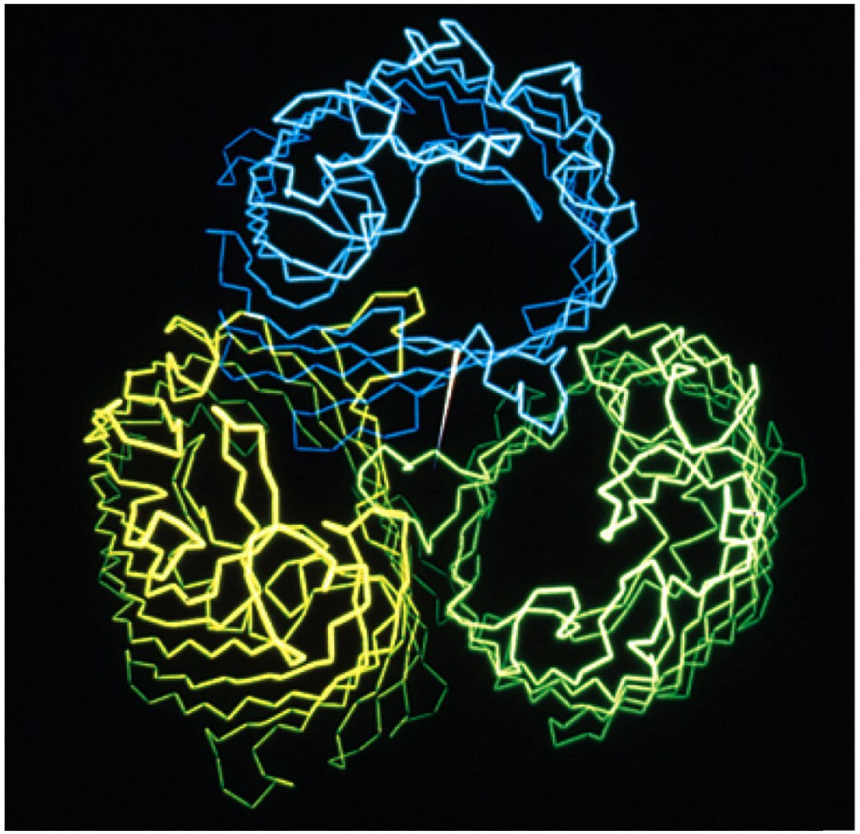
Tyr and Trp exhibit 'snorkeling' – pointing their polar group toward mb exterior

Also, often 'positive inside' – positively charged aa's facing cytoplasmic region

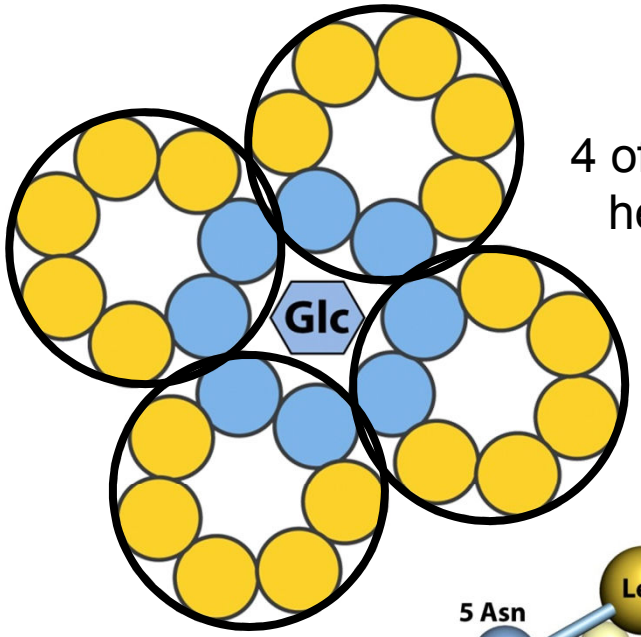
In integral transport proteins, interiors are hydrophilic and exteriors are hydrophobic

Porin trimer

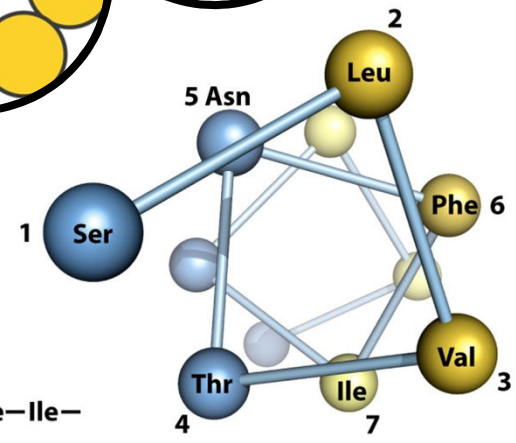


Courtesy of Tilman Schirmer and Johan Jansonius, University of Basel, Switzerland

Glucose transporter



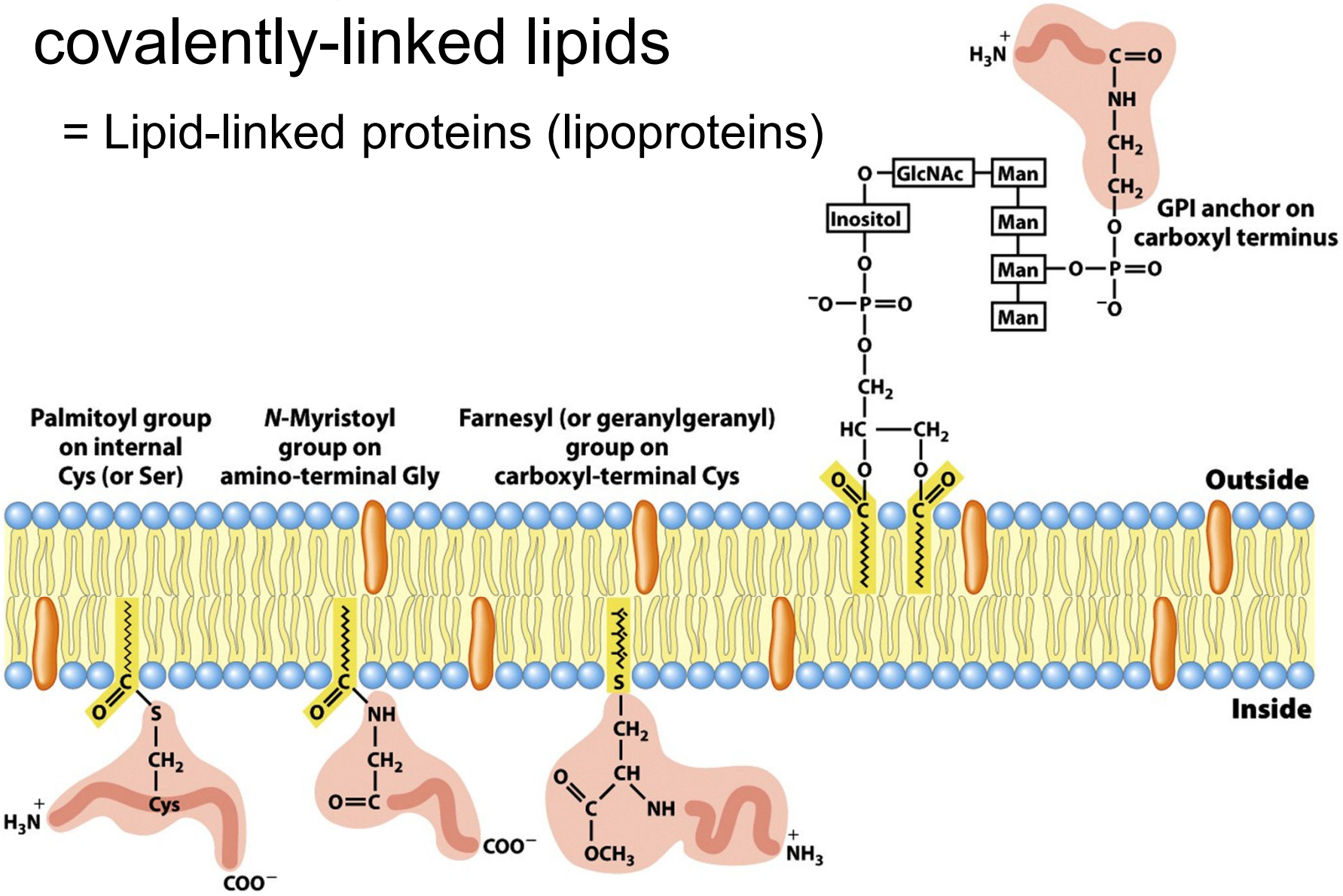
4 of its TM helices



—Ser—Leu—Val—Thr—Asn—Phe—Ile—

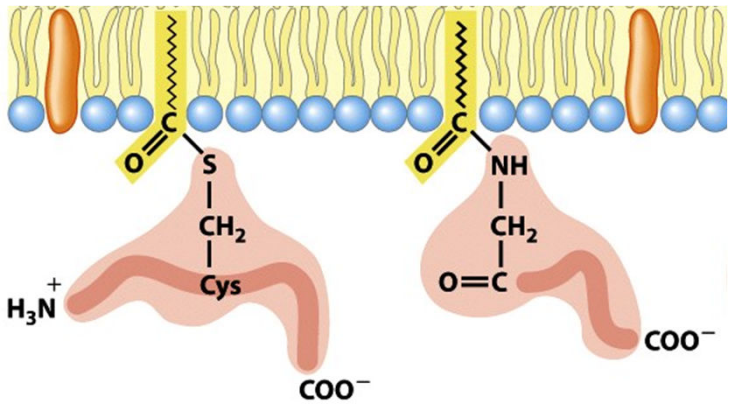
Some integral membrane proteins contain covalently-linked lipids

= Lipid-linked proteins (lipoproteins)

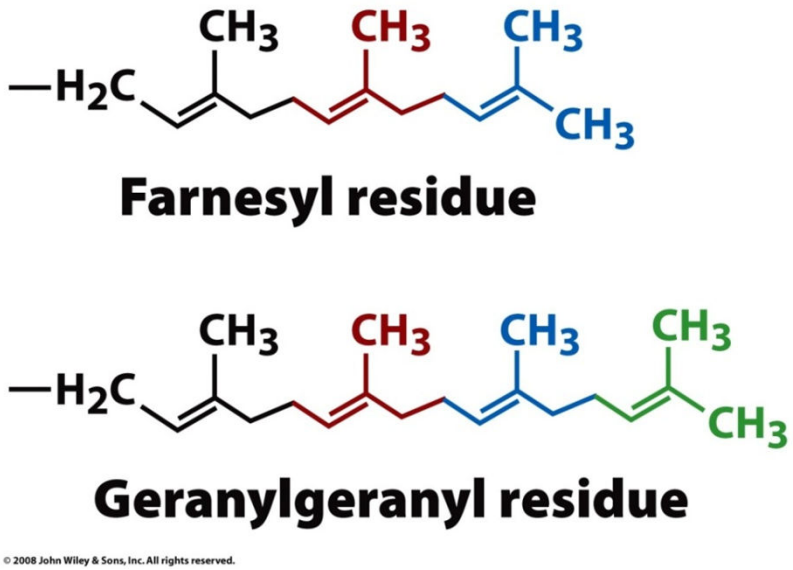


Some lipid-linked proteins are fatty-acylated

- Myristic acid (14:0) is attached to N-terminal α-amino group of Gly (via an amide linkage)
  - Permanent modification
  - Myristoylated proteins are found in many subcellular compartments
- Palmitic acid (16:0) is attached to a specific Cys (via a thioester linkage)
  - Reversible modification; may be removed by a palmitoyl thioesterase
  - Palmitoylated proteins are found on the cytoplasmic face of the plasma membrane



Some lipid-linked proteins are “prenylated”



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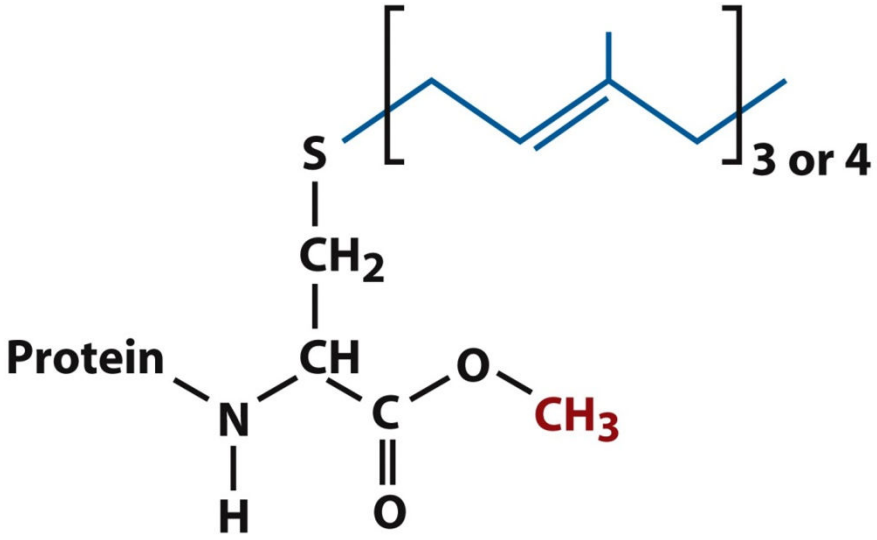
Isoprene units are linked to a C-terminal Cys



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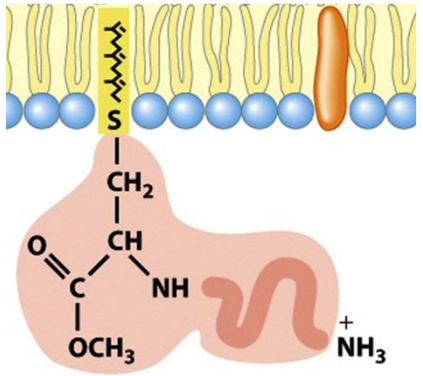
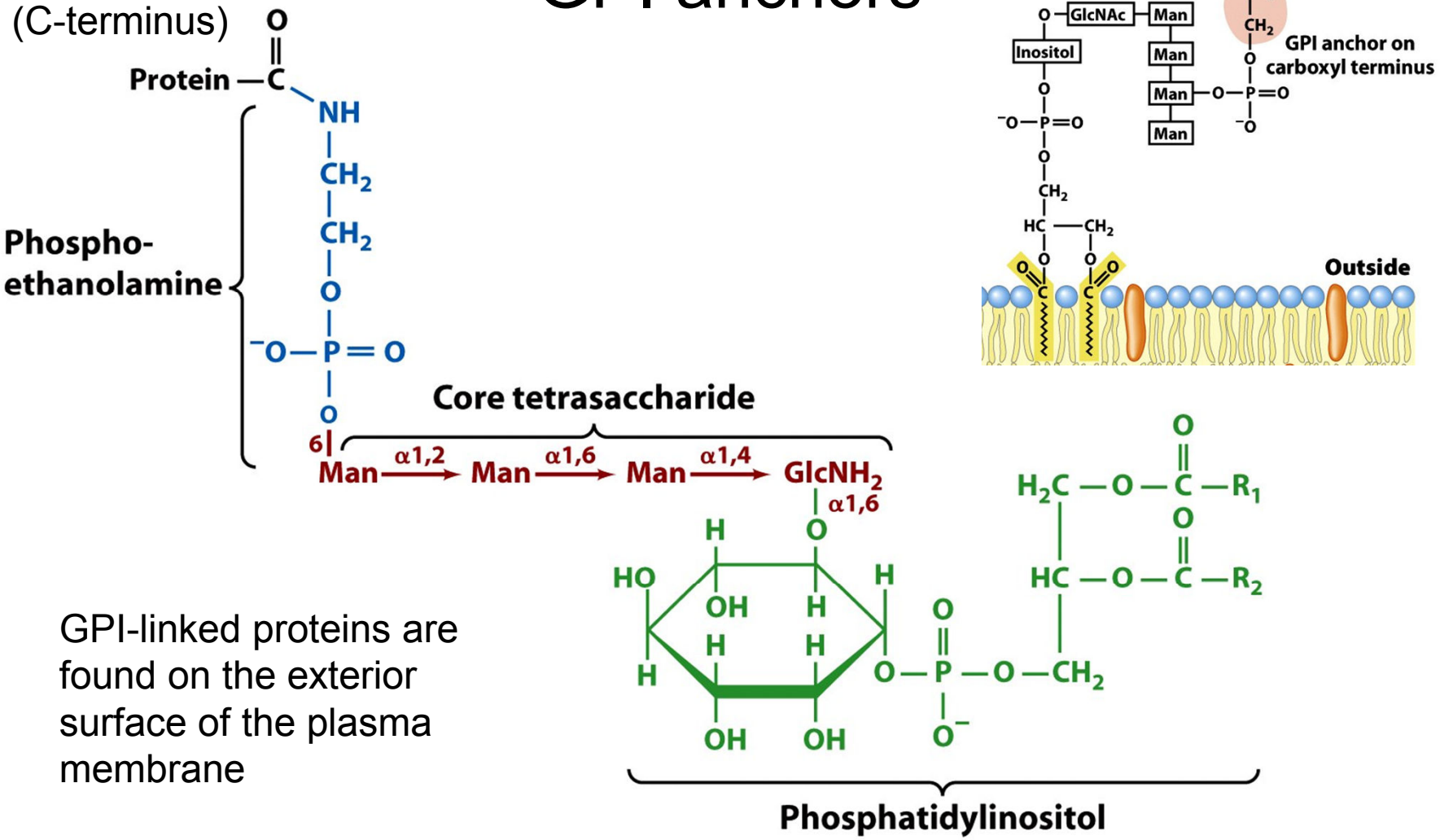
C-terminal C-X-X-Y motif determines which type of lipid will be attached



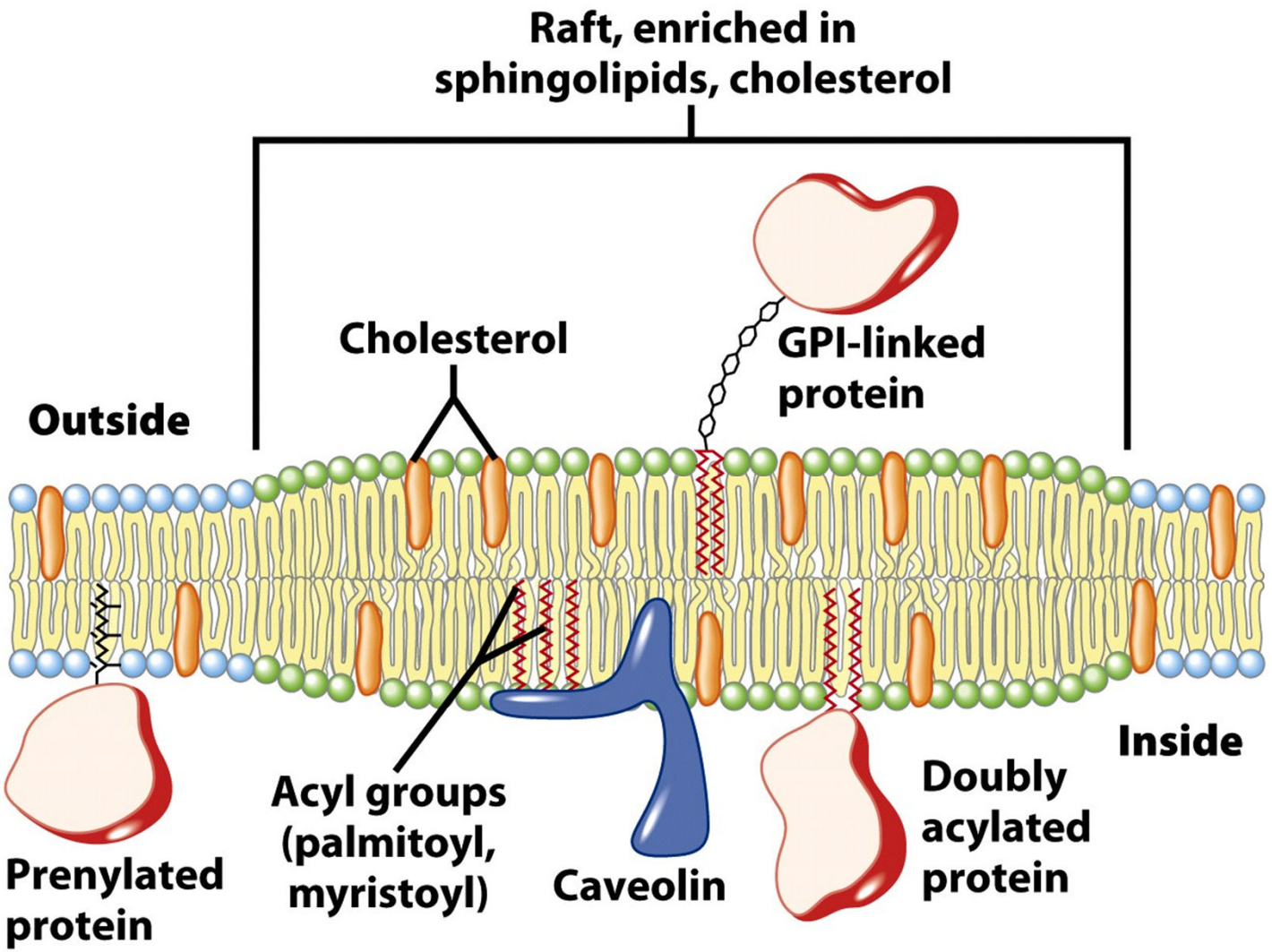
Some lipid-linked proteins have GPI anchors



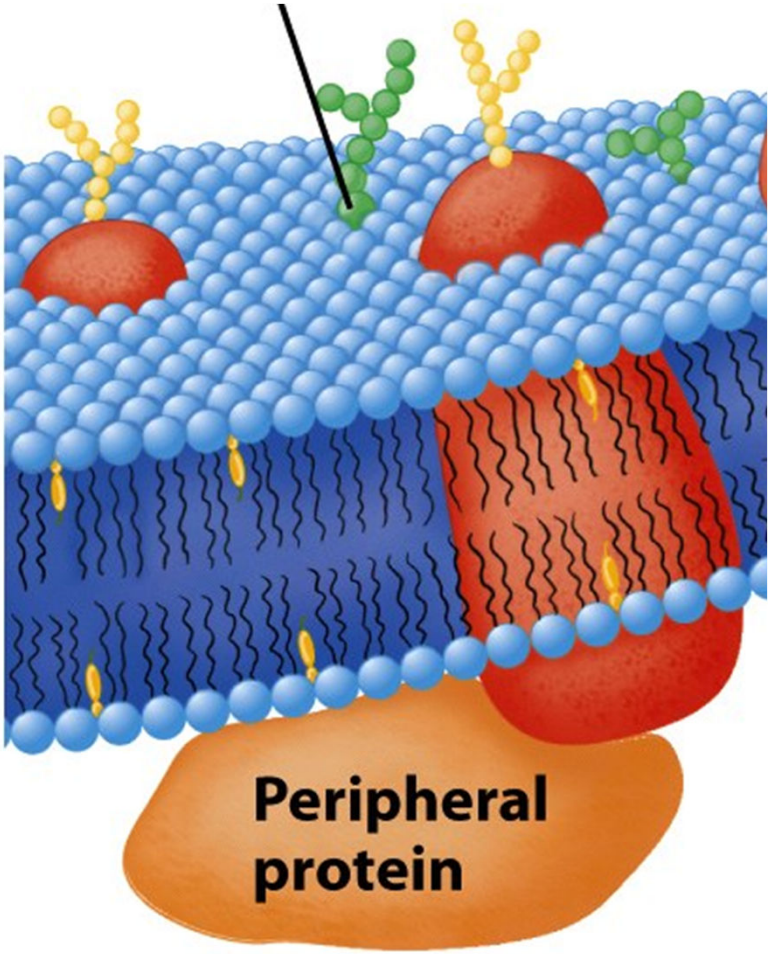
GPI-linked proteins are found on the exterior surface of the plasma membrane

Glycosyl**p**hosphatidyl**i**nositol anchor

Lipid-linked proteins cluster in or outside of rafts based on their linked lipid



Peripheral membrane proteins bind to the surface of the membrane



Common interaction: ion pairs

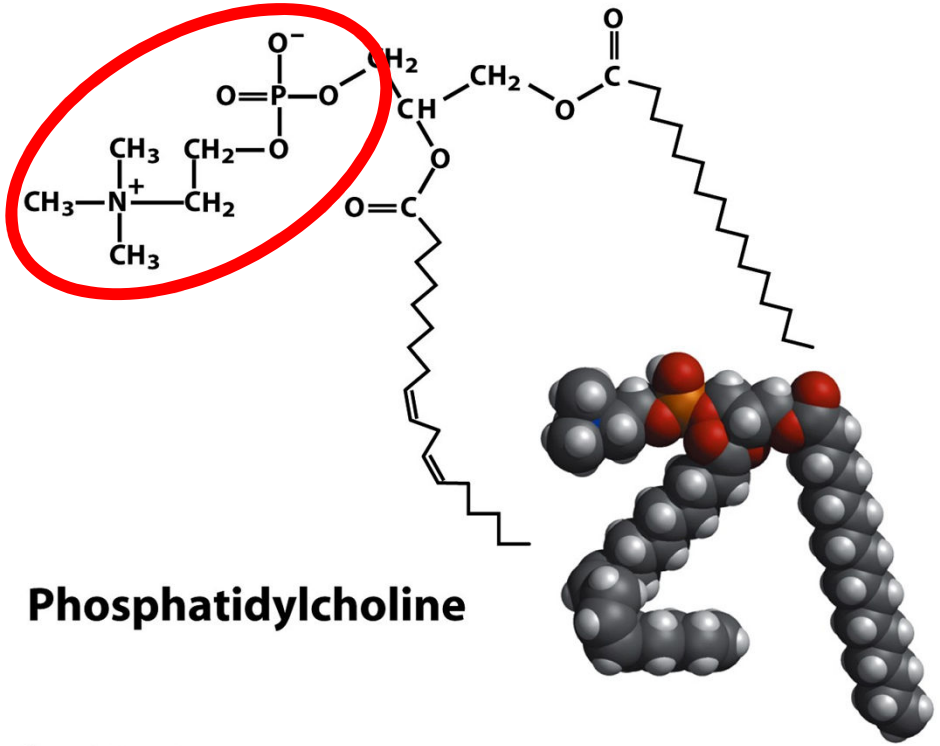


Figure 10-14 part 1
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Solutes move across a permeable mb to equalize concentration and charge

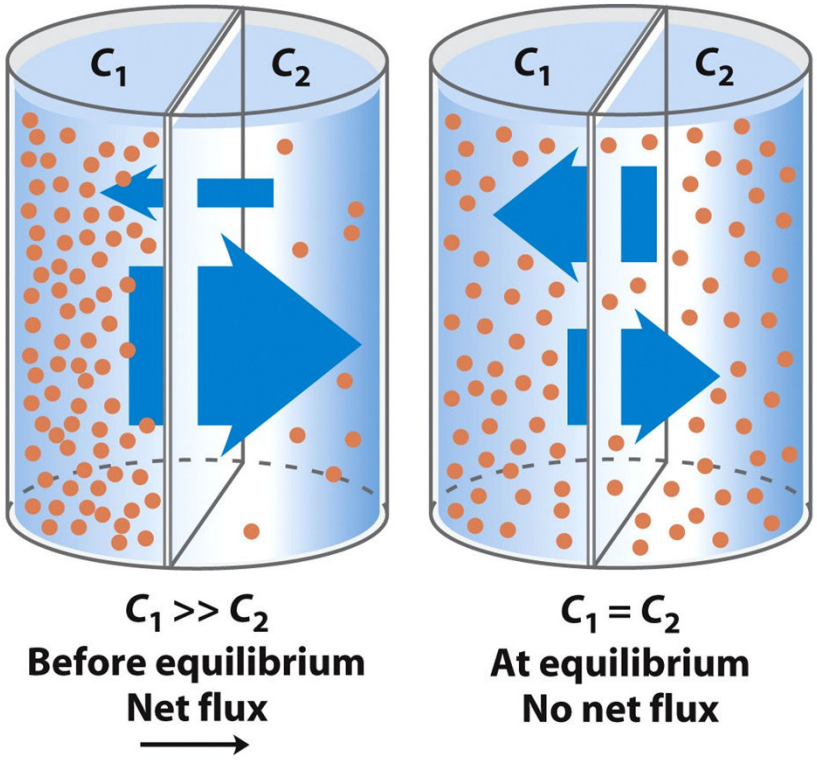

Figure 11-26a
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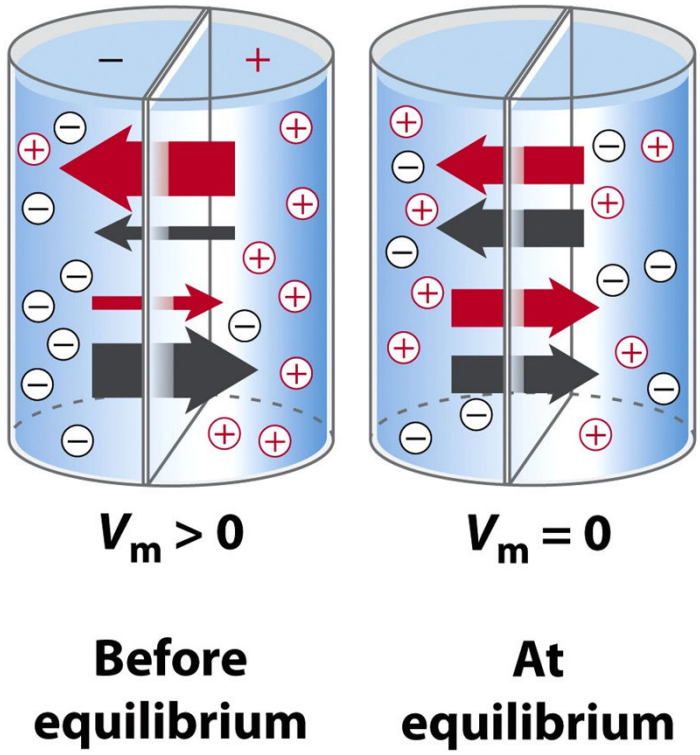

Figure 11-26b
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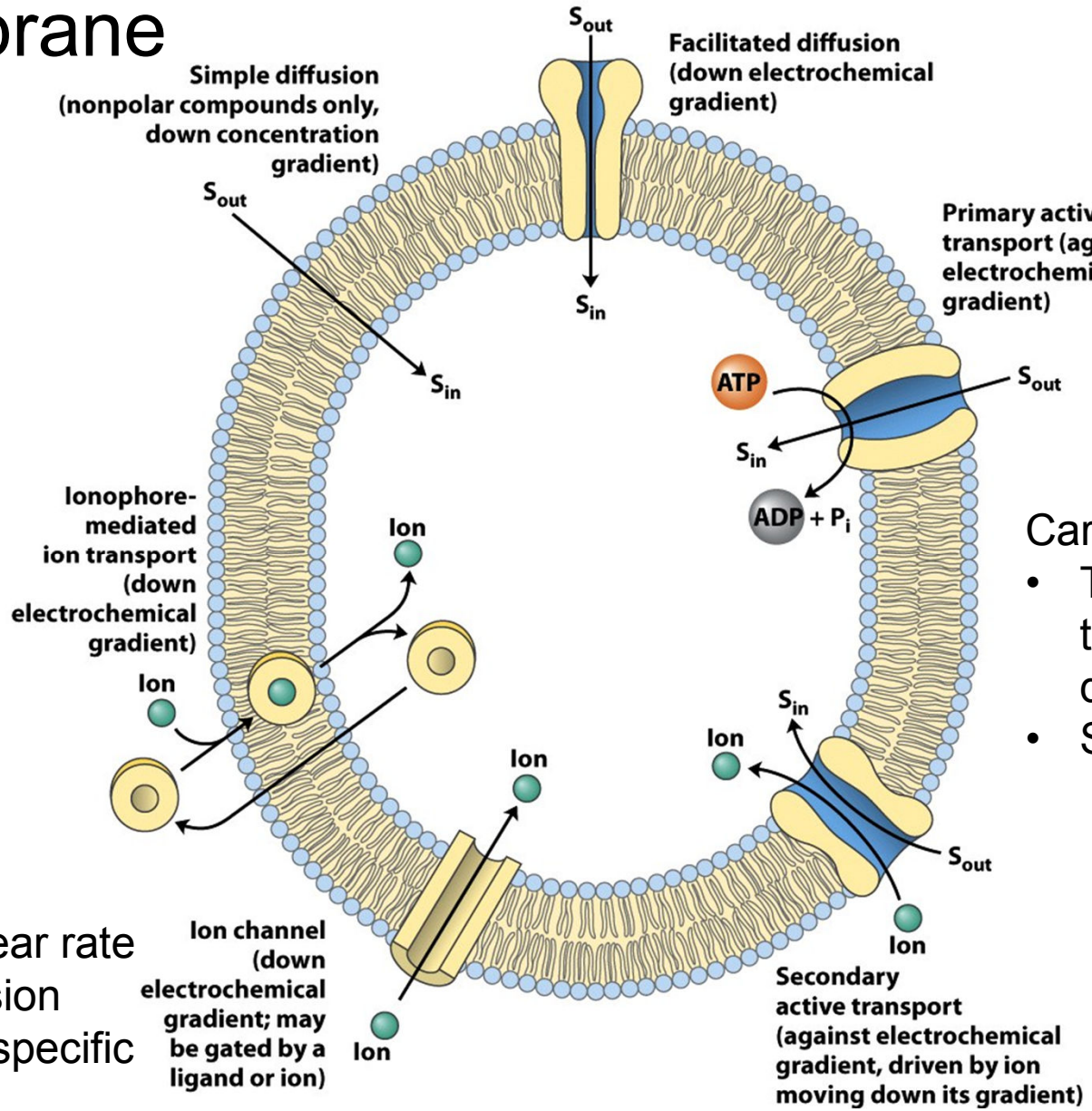
Transporters catalyze passage through the membrane

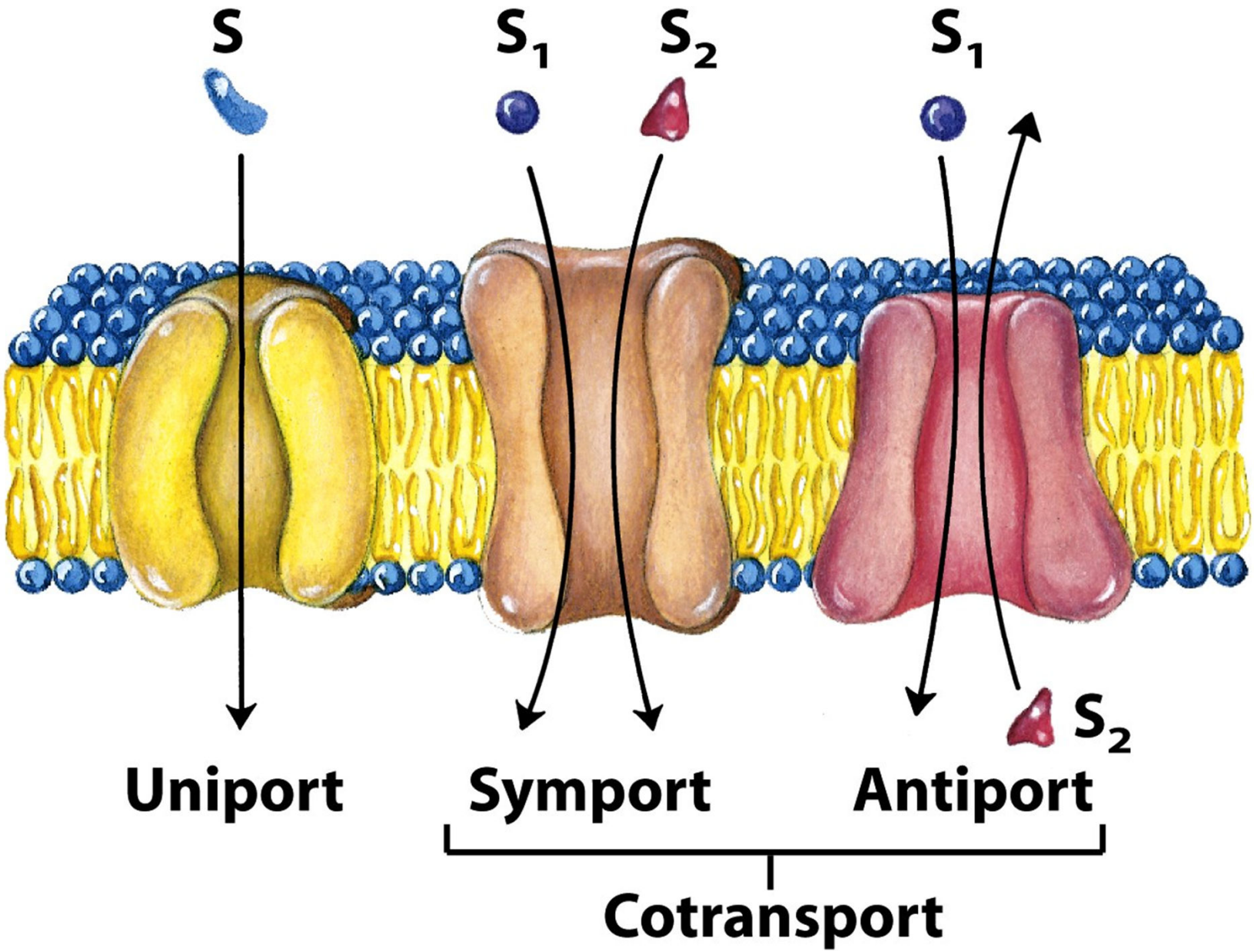


Carriers:

- Transport slower than free diffusion
- Stereospecific

Channels:

- Transport near rate of free diffusion
- Less stereospecific


S
S_1
S_2
S_1
S_2
Uniport
Symport
Antiport
Cotransport

Glucose enters the cell via passive transport (through a uniporter)

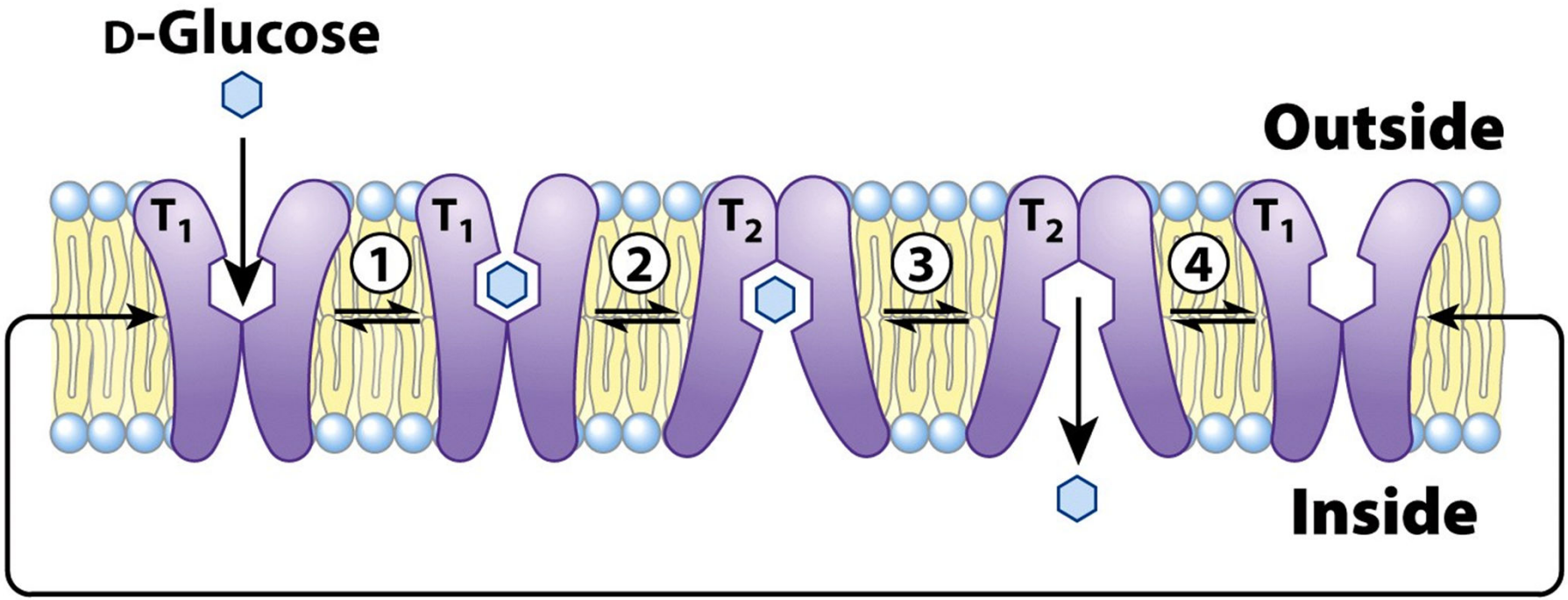


Figure 11-31
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Lactose enters *E. coli* cells via secondary active transport (through a symporter)