

Lecture 24 – wrapping up lipids and membranes

December 7, 2020

421/621 exam covers ALL material from last exam, including today's lecture (not a full lecture today!)

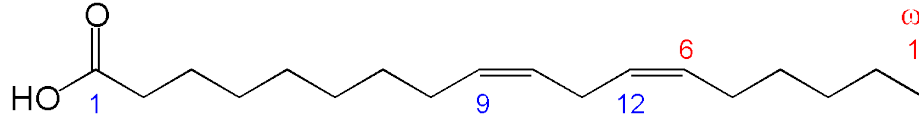
Also –glycoprotein synthesis is figure 27-41,27-43 in the text

Outline of topics for lipids

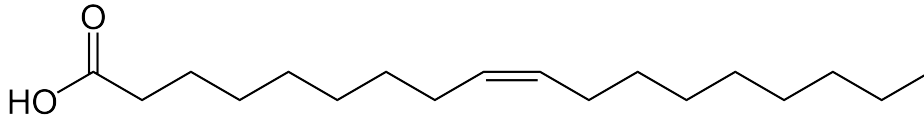
- naming of different kinds of lipids **return to naming today**
 - Fatty acids
 - triacylglycerides
 - membrane lipids
 - steroids and terpenes
- melting temperature (and importance for membrane fluidity)
- micelles, liposomes, and bilayers
- Membranes – lateral vs transverse (flip-flop) diffusion
- Proteins in membranes

Systematic naming – start counting from carboxylic acid,

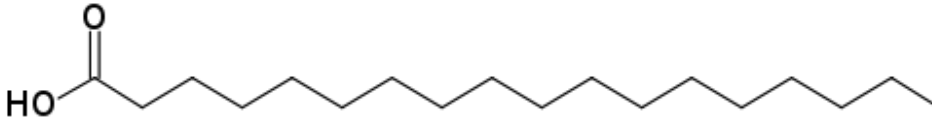
#carbons:#unsaturations, Δ position of unsaturations



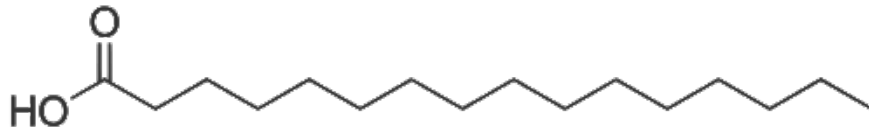
Linoleic acid, **18:2**($\Delta^{9,12}$)



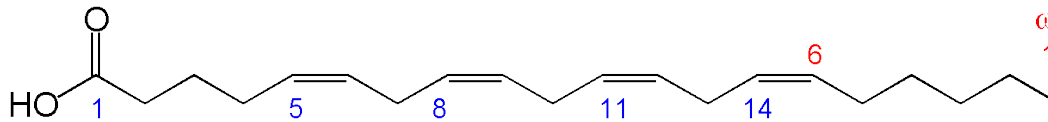
Oleic acid, **18:1**(Δ^9)



Stearic acid, **18:0**



Palmitic acid, **16:0**



Aracadonic acid, **18:4**($\Delta^{5,8,11,14}$)

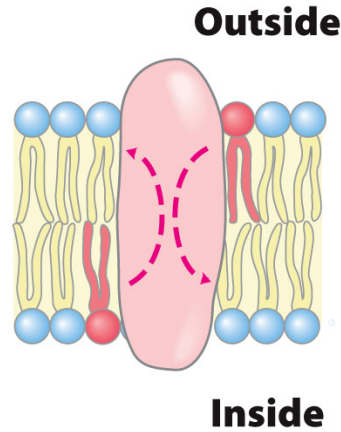
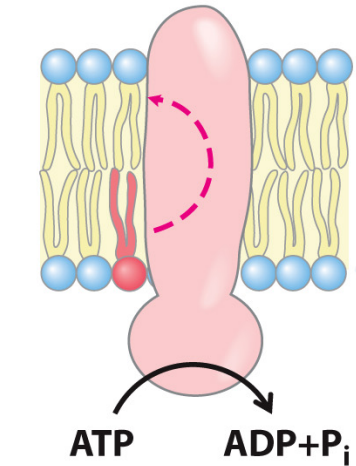
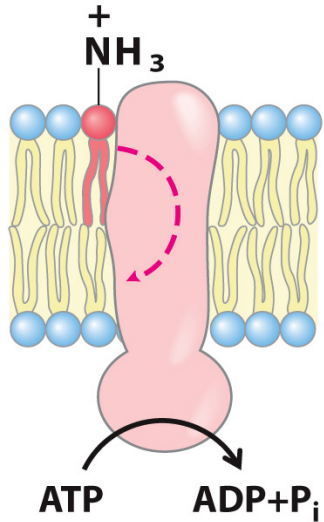
Melting
Point
increasing



Outline of topics for lipids

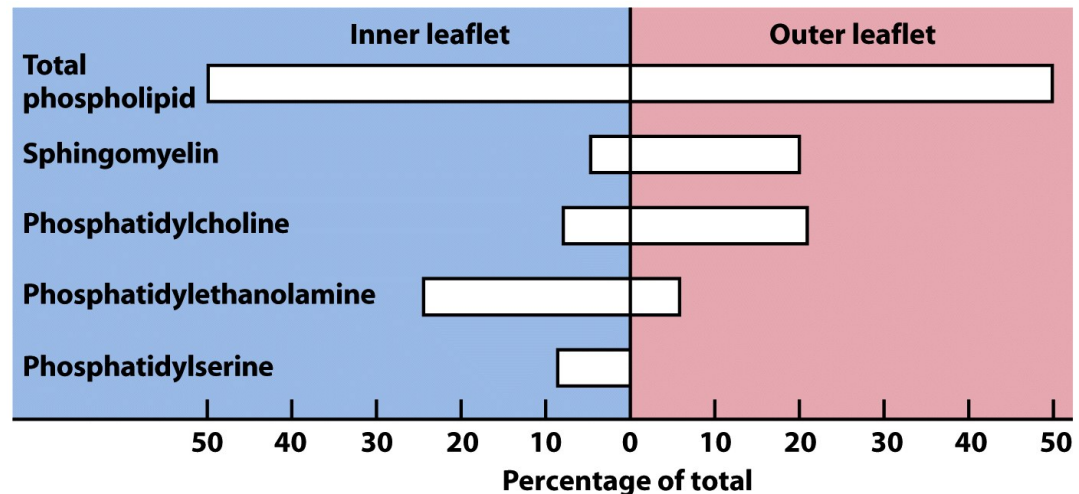
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Catalyzed transbilayer translocations

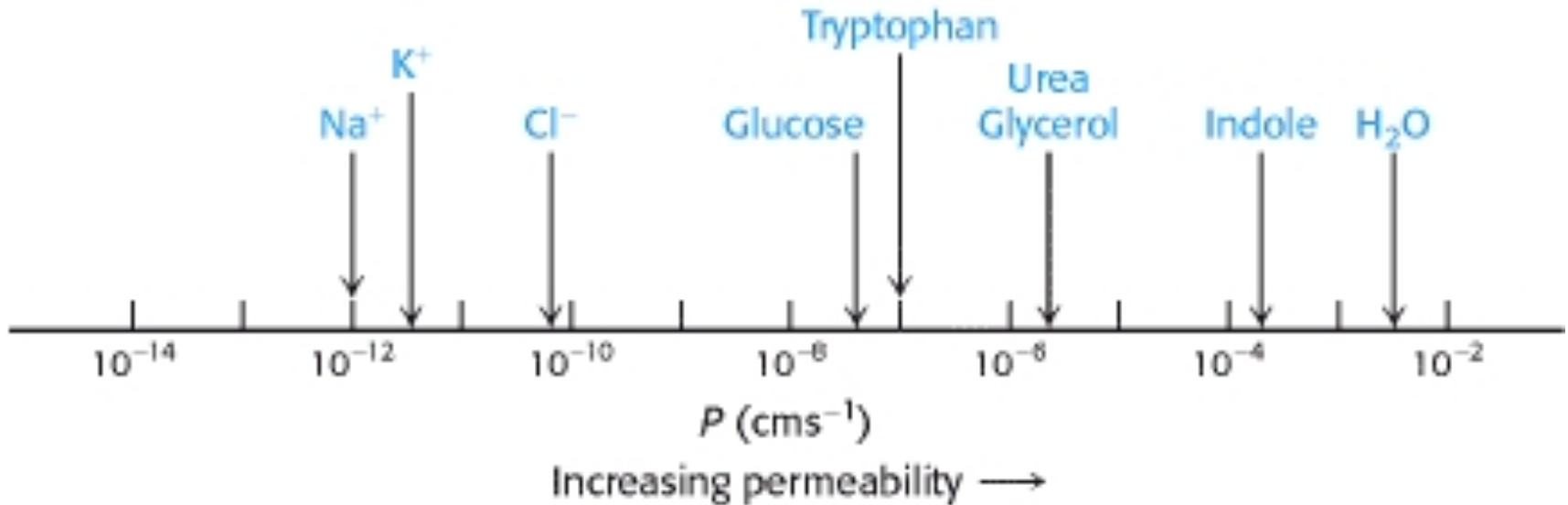


Biological
implications –
asymmetric
membranes

Figure 11-15c
Lehninger Principles of Biochemistry, Seventh Edition
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The lipid bilayer has selective permeability



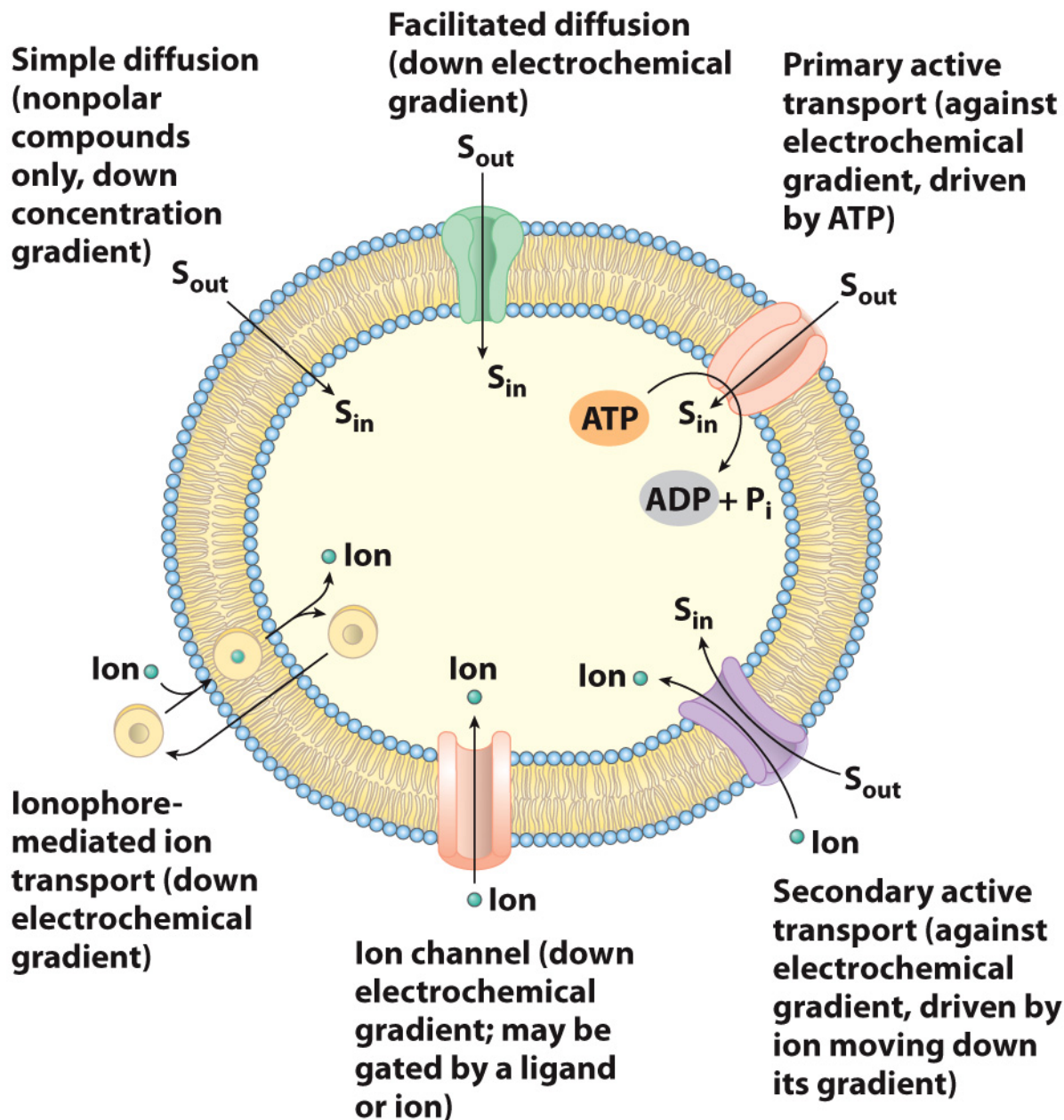
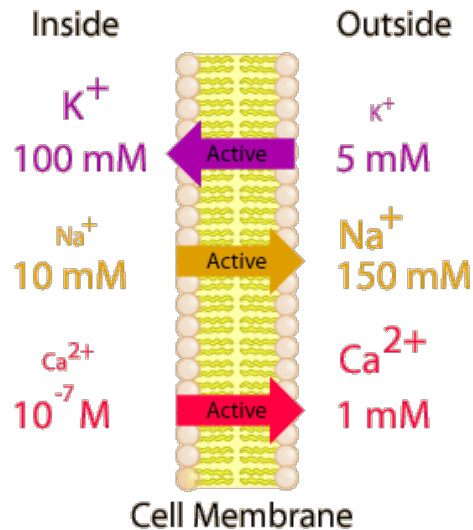


Figure 11-24

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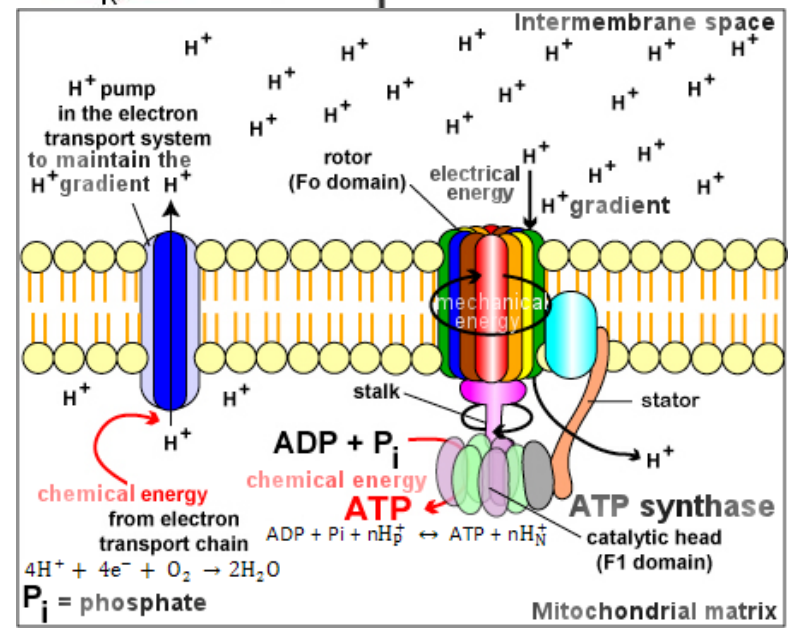
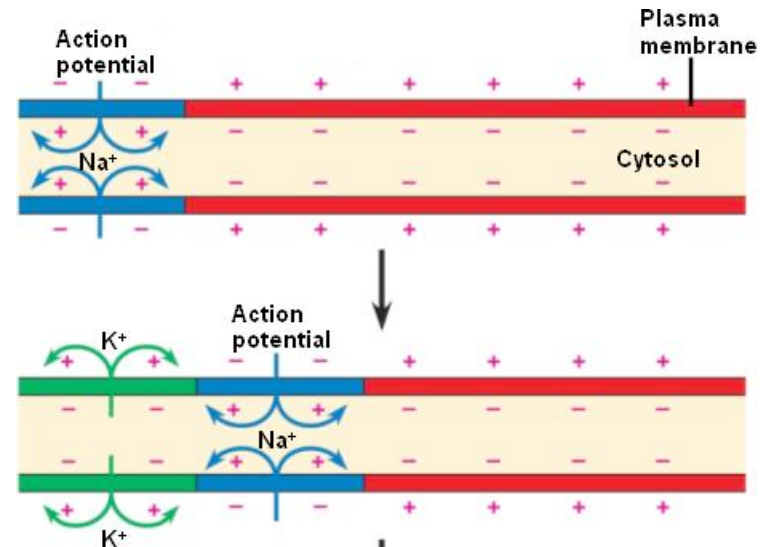
Biological implications of selective permeability



Selective permeability is utilized to establish concentration gradients across membranes

Used by cells for many different functions

- nerve cell function
- ATP synthesis



Membrane Proteins

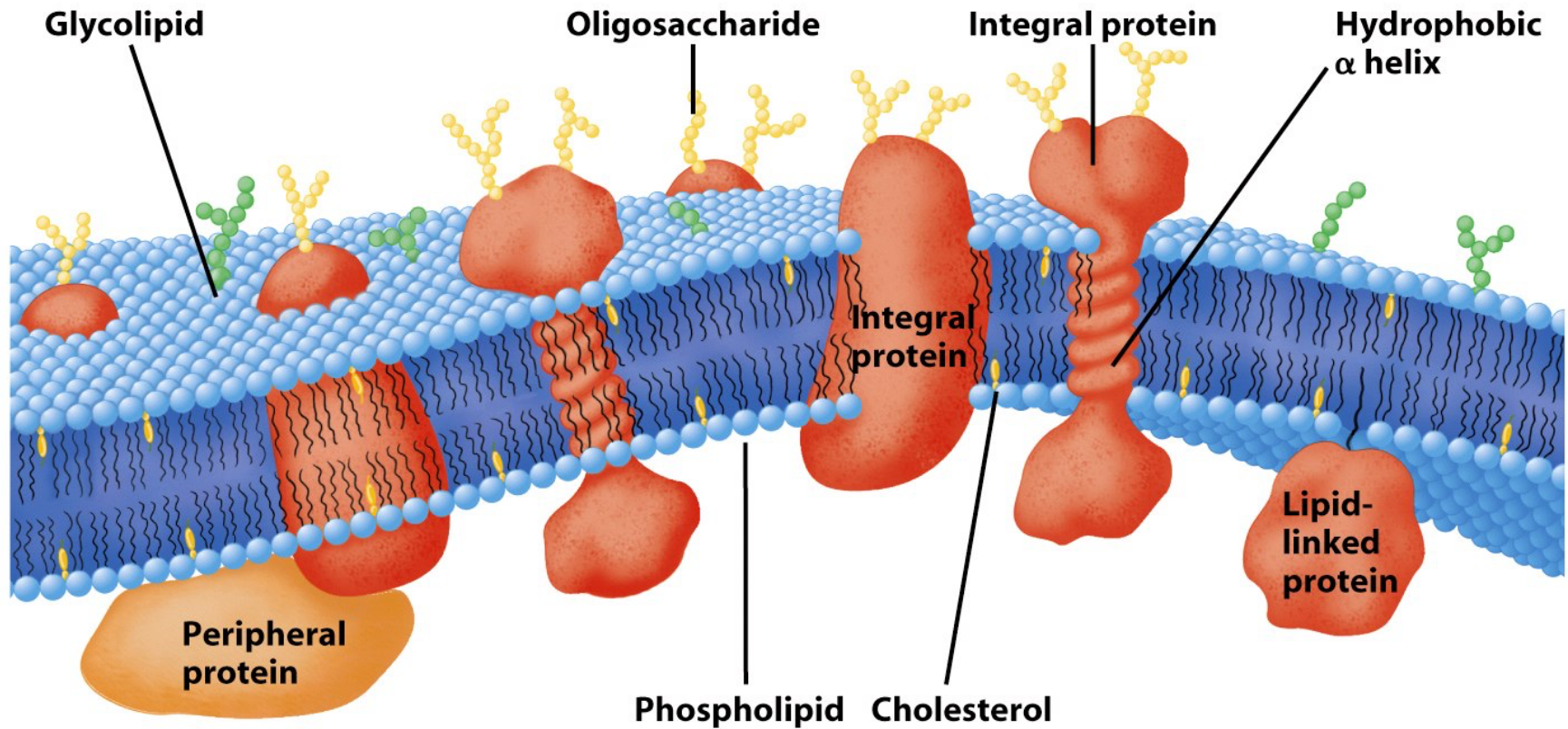
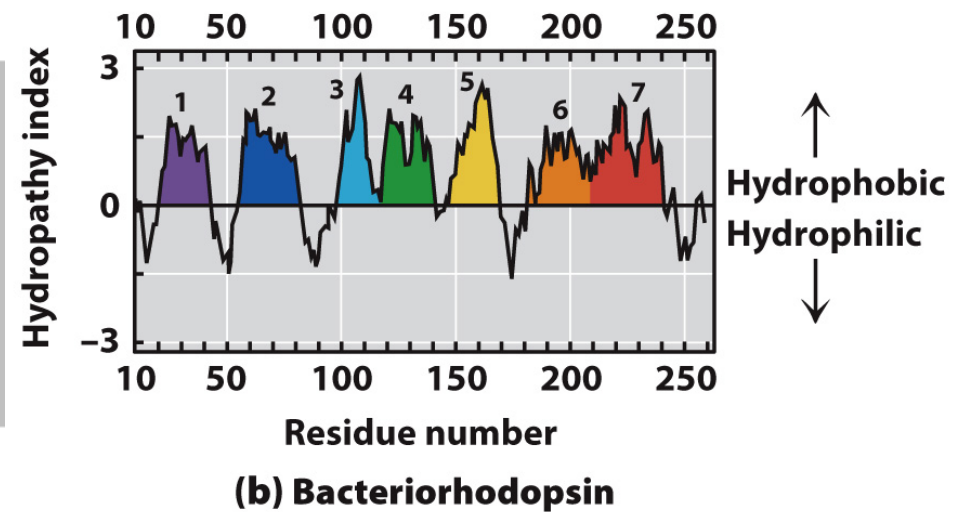
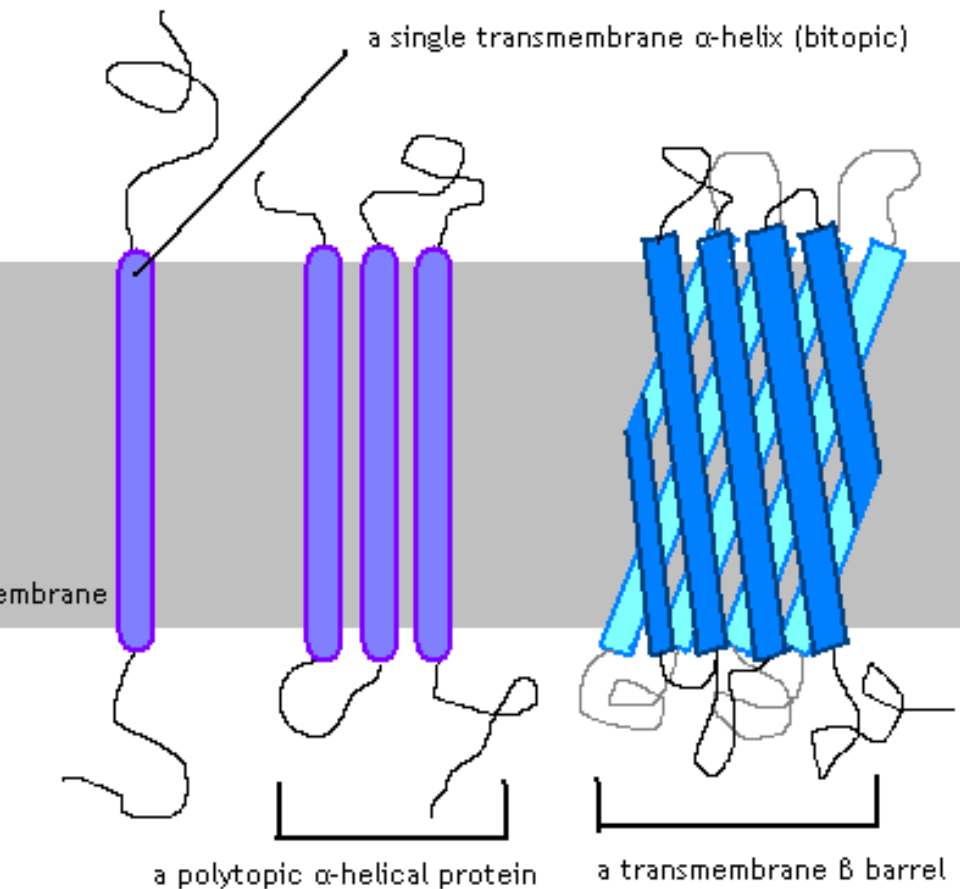


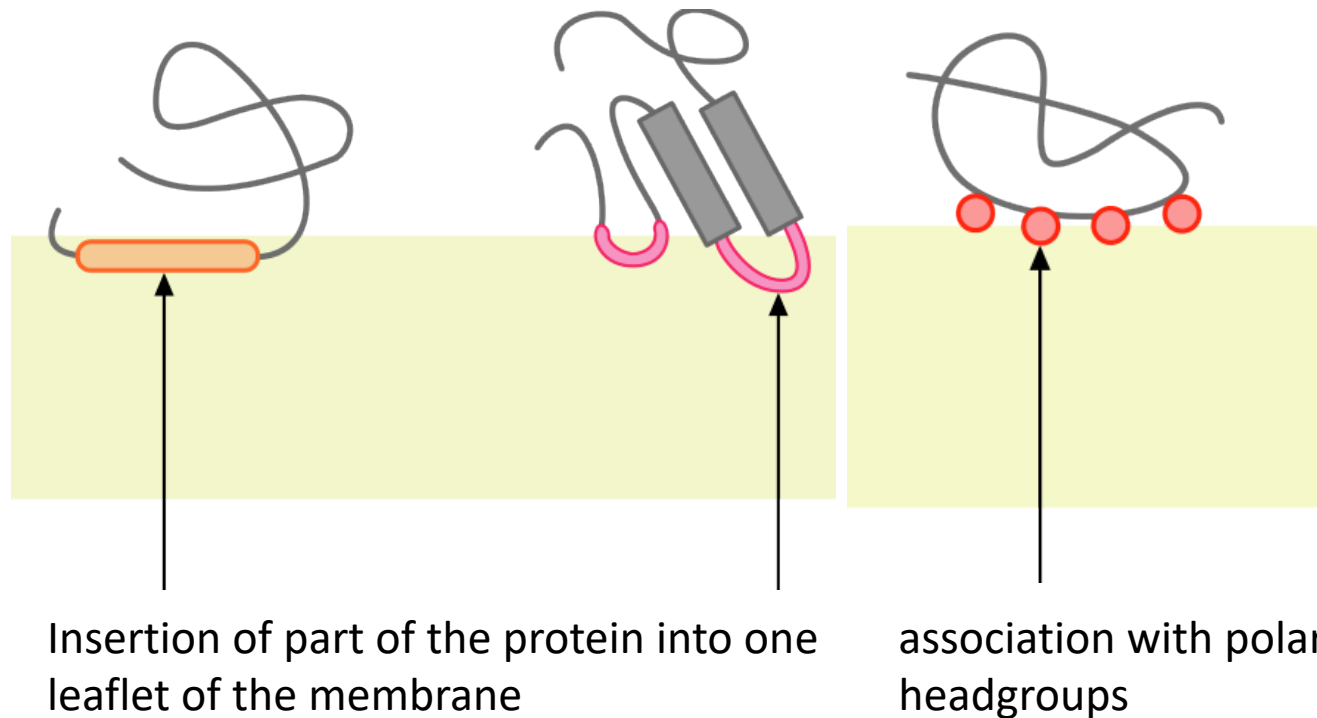
Figure 9-26 Fundamentals of Biochemistry, 2/e
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Integral membrane proteins



Purification requires detergent to extract from membrane

Peripheral Membrane proteins

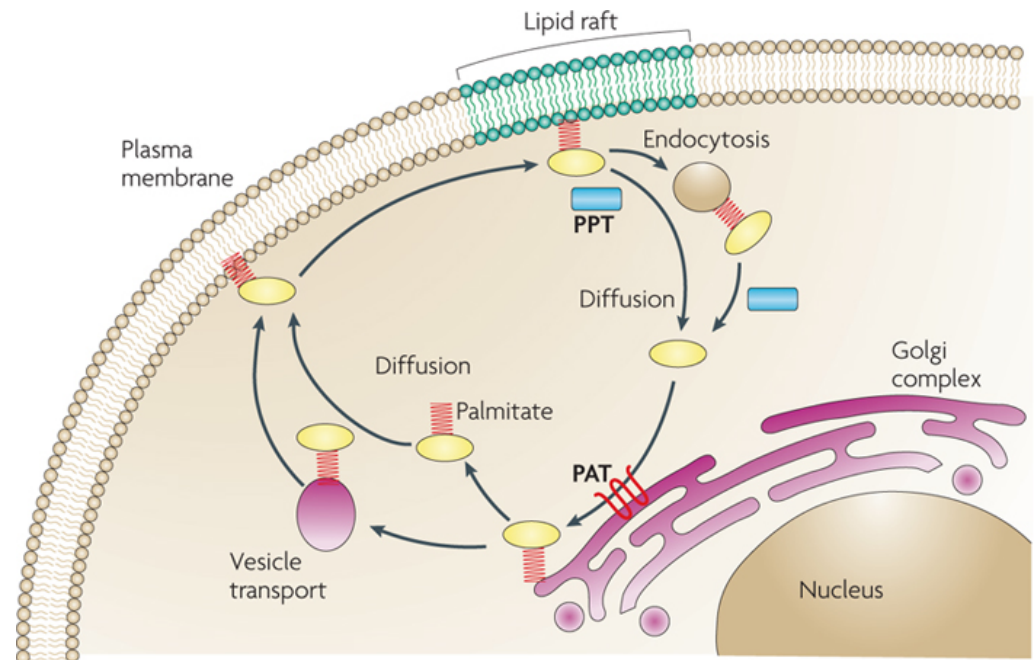
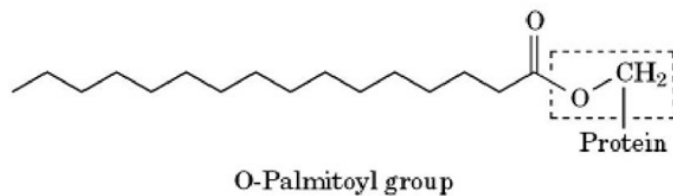
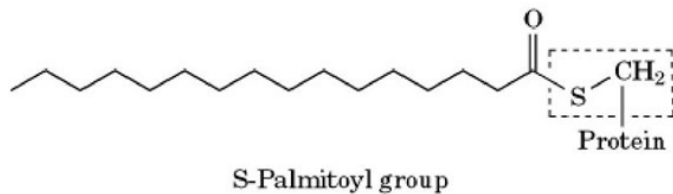
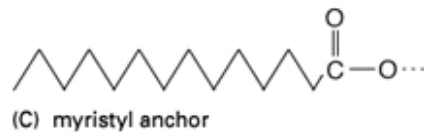
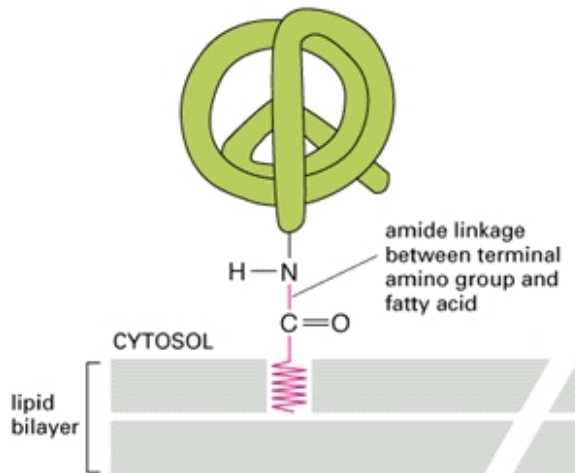


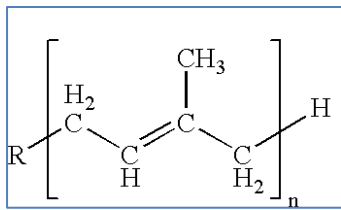
Often solubilized by high salt concentrations (especially for proteins associated with headgroups only) or low concentrations of detergent

(A) protein anchored to membrane by a fatty acid chain

Fatty acid anchors

- myristic acid (14:0) – via amide – irreversible;
- Palmitic acid (16:0) via thioester (ester) linkage; reversible



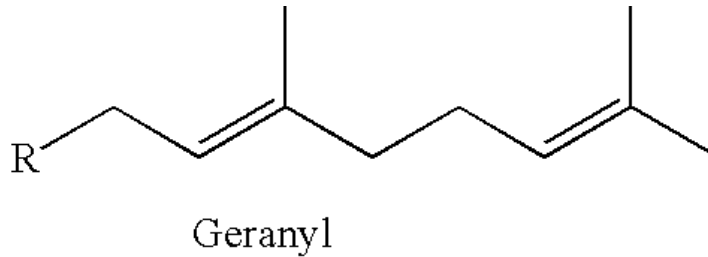


Isoprene (prenyl) anchors

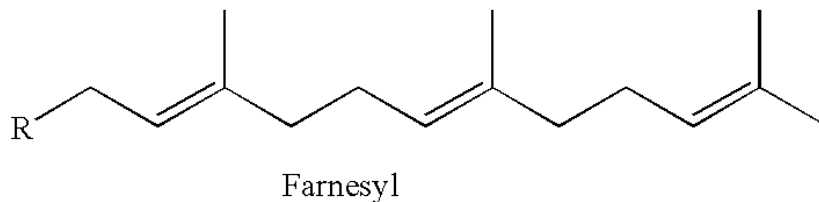
- Prenylated via thioether linkage

lipids comprised of isoprene
(above, 5C) polymers are called

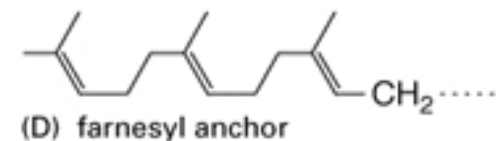
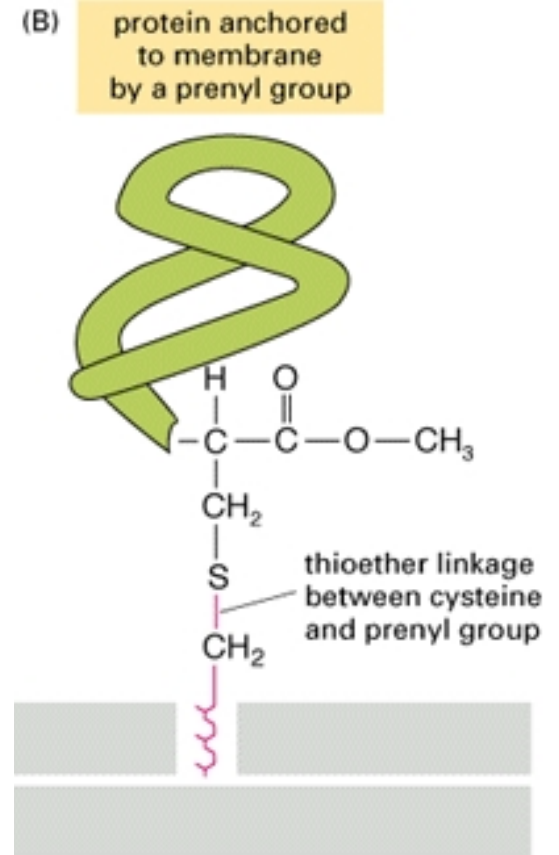
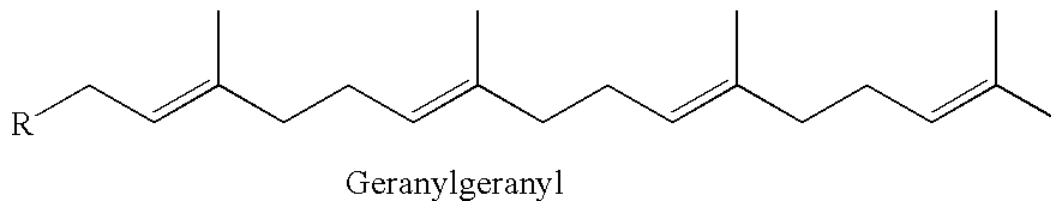
- geranyl – 2-isoprenes; C10



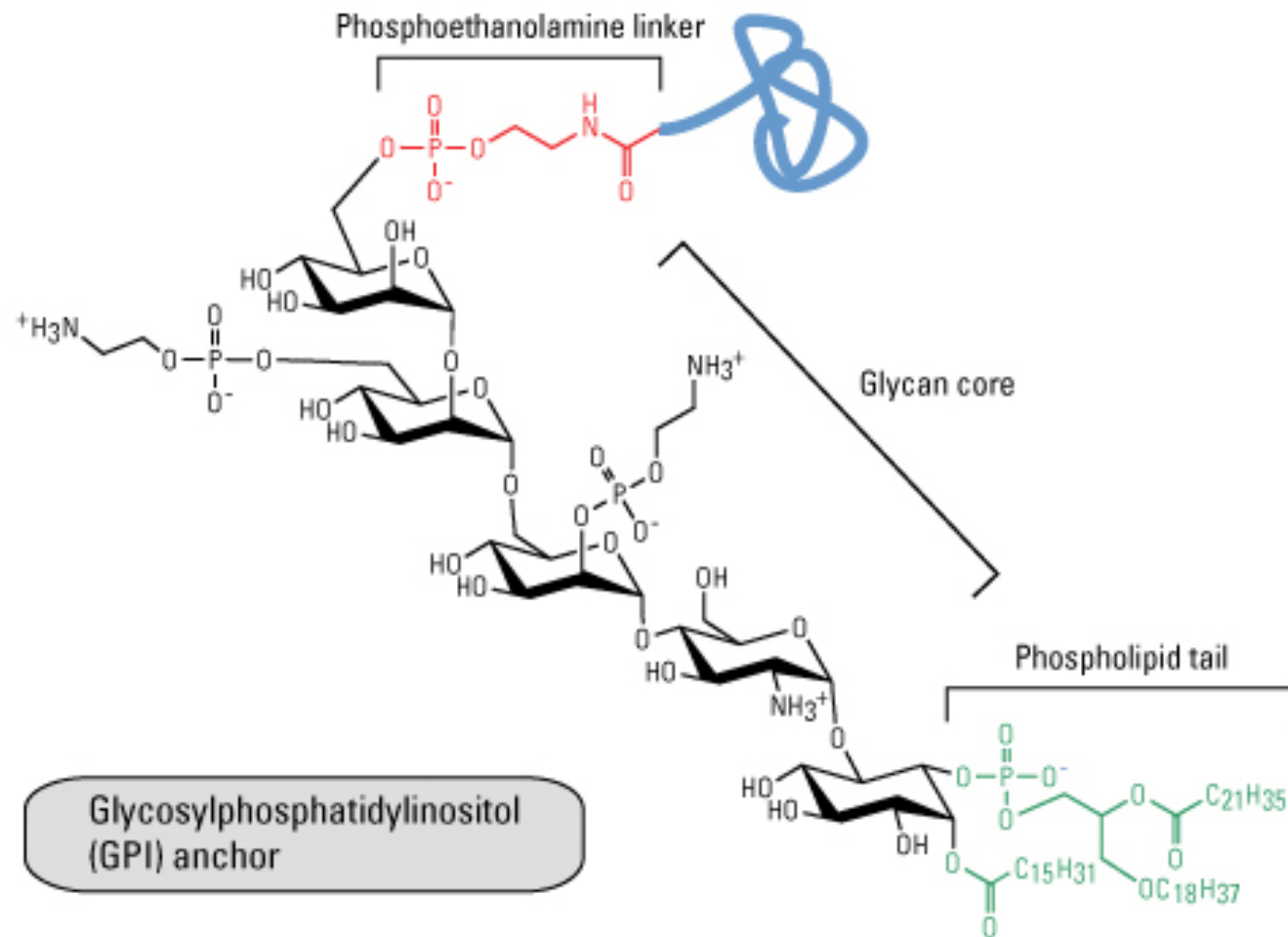
- farnesyl – 3-isoprenes; C15



- geranylgeranyl – 4 isoprenes; C20



- Linkage to GPI anchor – anchor proteins on outside of cell membrane via amide linkage to C-terminus



Summary of membrane proteins

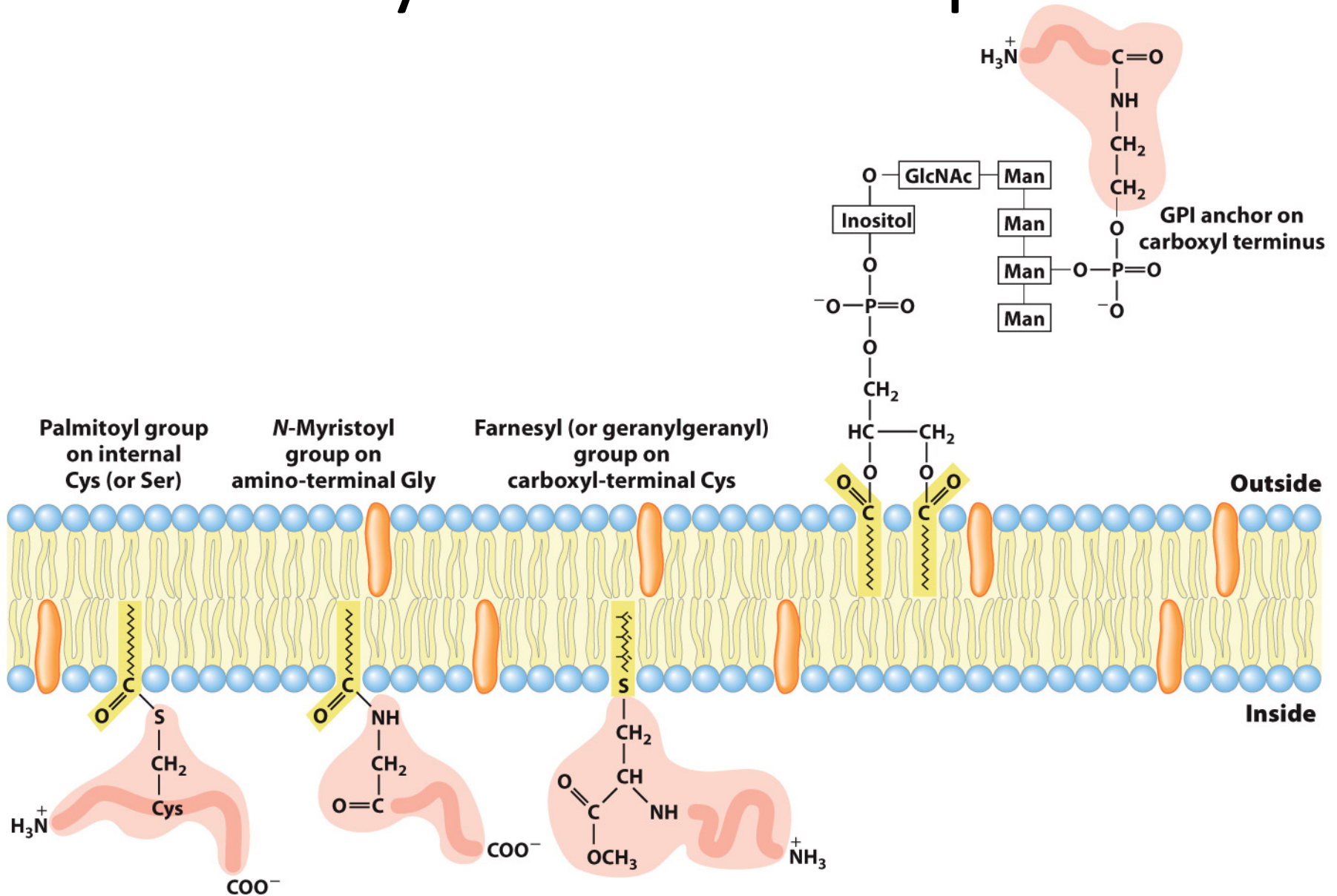


Figure 11-13

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lipids

- Types of lipids
 - **Fatty acids** – carboxylic acid and long aliphatic chain; saturated, monounsaturated, polyunsaturated
 - **Triacylglycerols** – energy storage – glycerol acylated on each alcohol with fatty acid
 - **phospholipids**
 - glycerophospholipids – 2 fatty acids, glycerol, phosphate
 - hydrophilic headgroups
 - sphingolipids – sphingosine + fatty acid + phosphate
 - also had headgroups, if a sugar it is a glycosphospholipid
 - **steroids** – cholesterol and hormones – rigid 4 ring structure
- Micelles and liposomes
 - **micelle** – single layered vesicle that forms when [lipid] > **CMC**
 - **liposome** – double layered vesicle formed by lipids that have cylindrical shape
- **Lipid Bilayers**
 - selectively permeable – large or charged molecules cannot cross

membranes

- diffusion of lipids and proteins within membranes
 - need for fluid-like state, lateral diffusion BUT NOT transverse diffusion
- Membrane asymmetry – different membranes have differing lipid composition
- How are proteins attached to or embedded in membranes?
 - Integral membrane proteins
 - peripheral membrane proteins
 - lipid-linked proteins through amide (irreversible) or thioester (reversible) linkages