Advanced Cell Biology. Lecture 29

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April 6th, 2011

Outline

Questions and answers

Membranes

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Membranes

Previous final question: the answer

How to make a transgenic organism (GMO)? Shortly describe a technique.

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How to make a transgenic organism (GMO)? Shortly describe a technique.

- Make a recombinant DNA
- Initiate its recombination with cellular DNA
- Obtain progeny with recombinant DNA in germ line (if animal)
- GMO

Selective barriers

Membranes:

- Receive information
- Import and export molecules
- Have a role in moving and expanding cell

Cellular compartments

- Prokaryotes are one-membrane cells
- Eukaryotes have multiple closed and open one- and double-membrane compartments

Eukaryote cell compartments

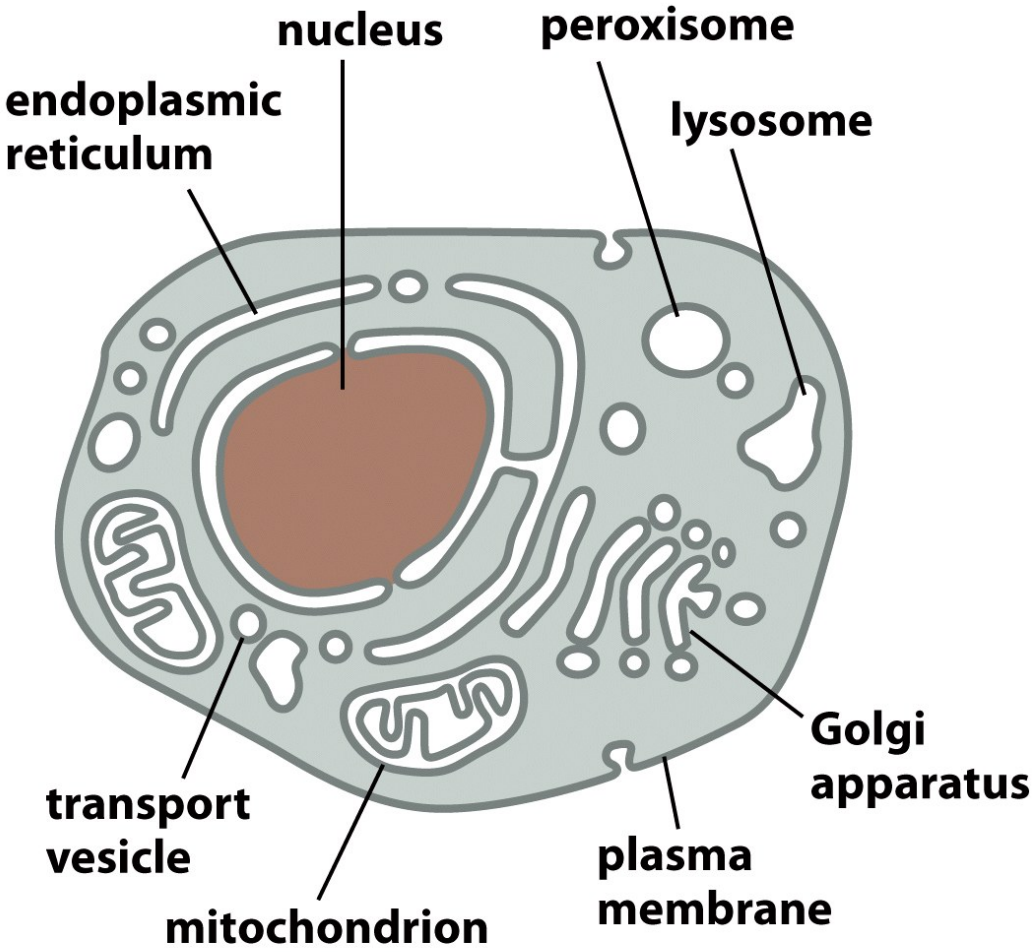

Figure 11-3 Essential Cell Biology 3/e (© Garland Science 2010)

Lipid bilayer

- Two layers of lipids
- Scattered proteins
- Carbohydrates attached to outer surface (cortex)

Amphipathic lipids

- Phospholipids
- Sterols
- Glycolipids

Amphipatic membrane lipids

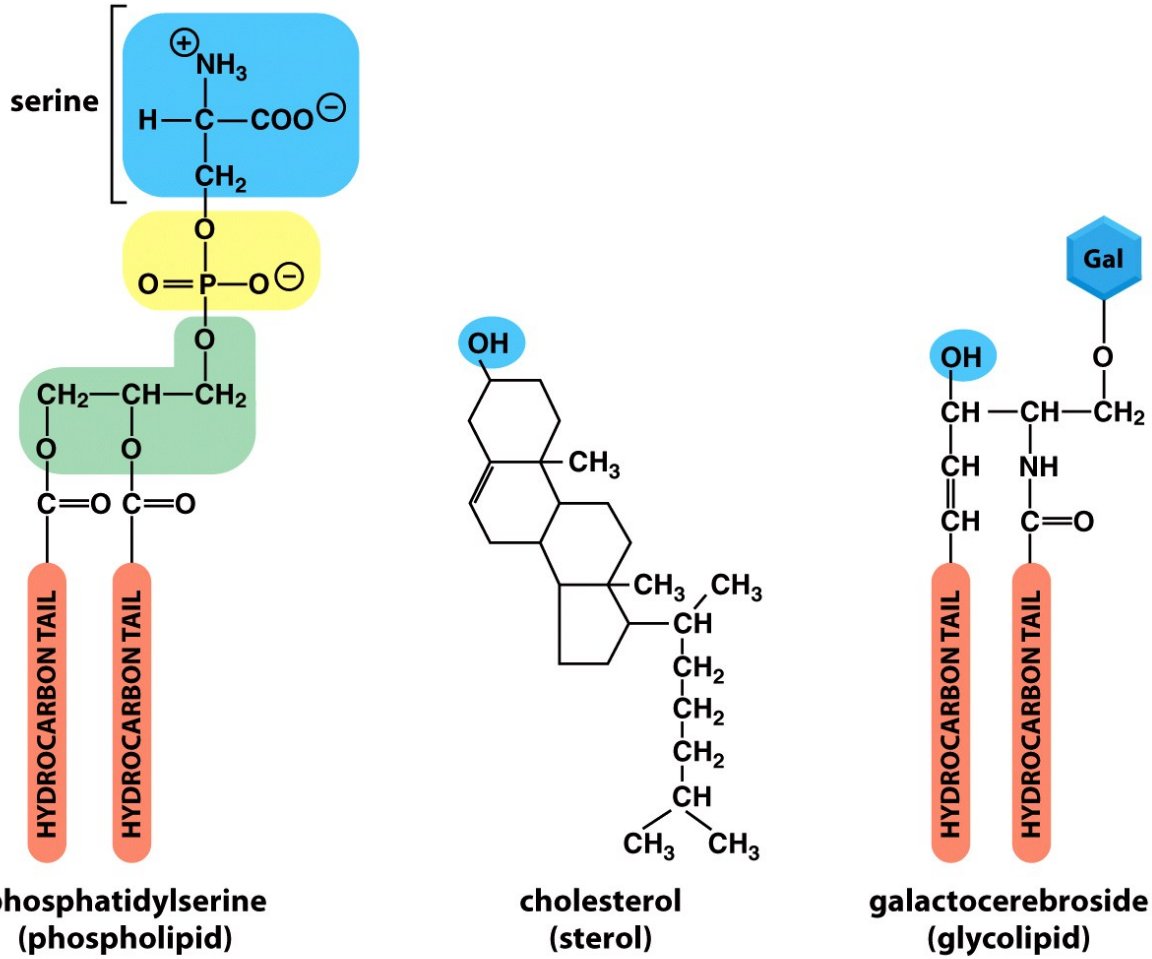

Figure 11-7 Essential Cell Biology 3/e (© Garland Science 2010)

Membrane lipids movie

Fluids

- Physically, membranes are lipid liquid suspension in water
- In artificial conditions, liposomes have structure similar to membranes
- Coacervate theory of life origin based on liposome existence
- Cholesterol can stiff membranes

Membrane fluidity movie

Liposomes

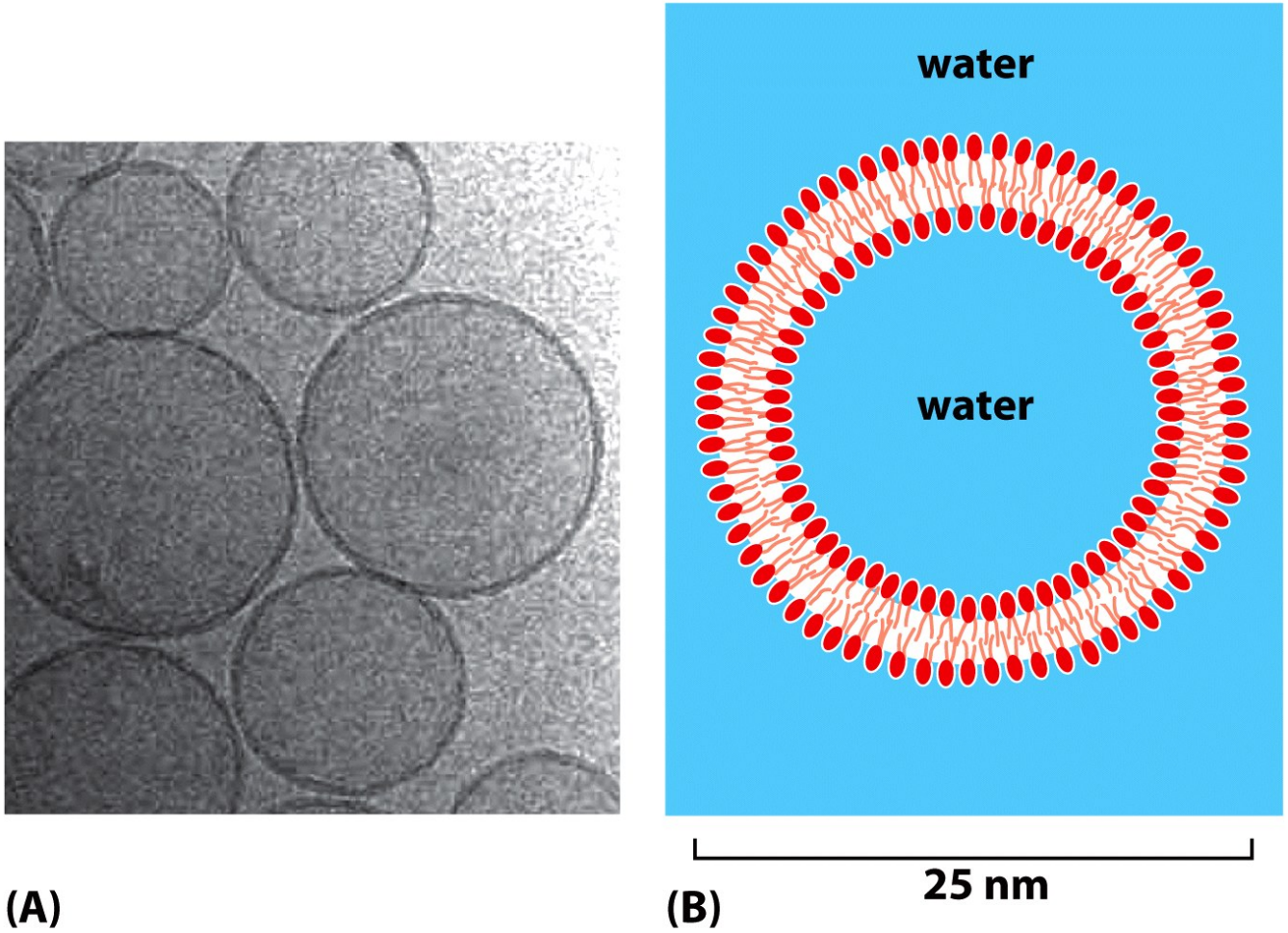

Figure 11-13 Essential Cell Biology 3/e (© Garland Science 2010)

Asymmetry

- Different types of phospholipids located unevenly between two layers
- Enzyme flippase transfer lipids between layers

Saving membrane asymmetry

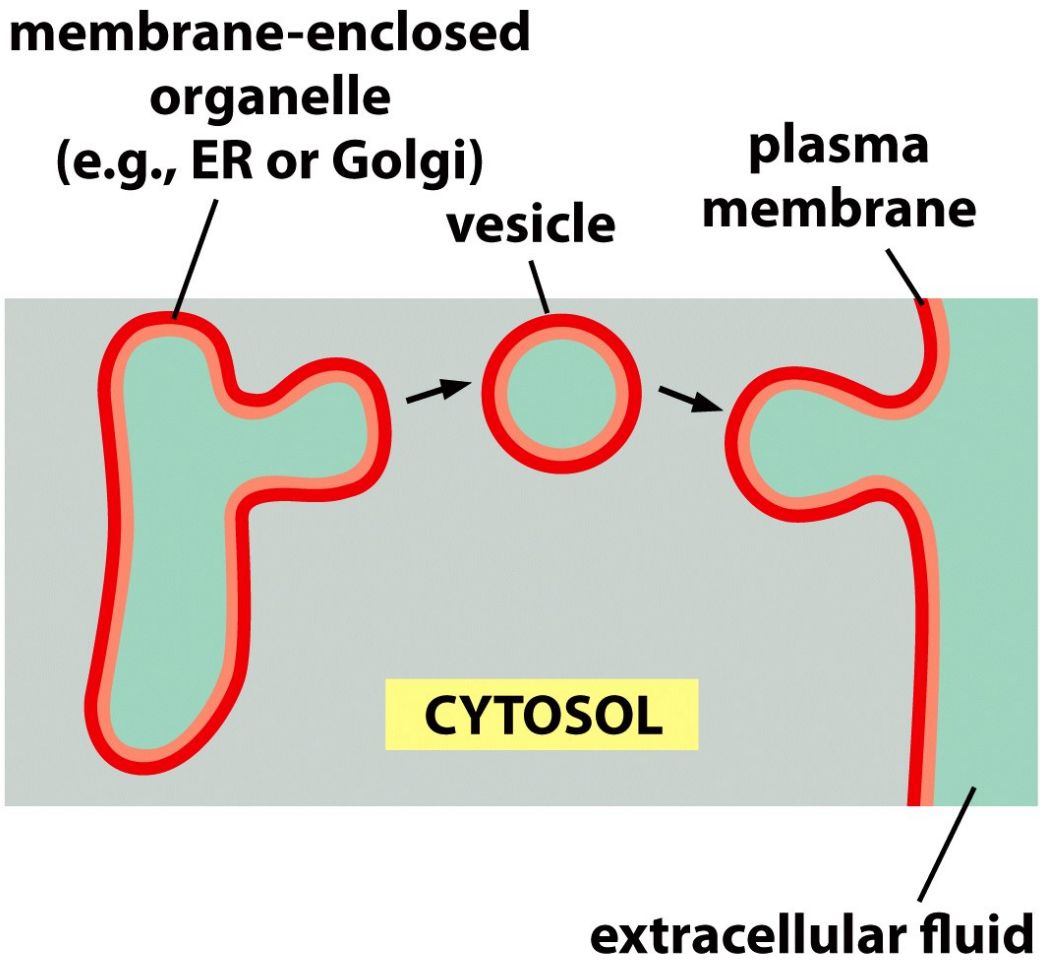

Figure 11-19 Essential Cell Biology 3/e (© Garland Science 2010)

Membrane proteins: functional groups

- Transporters: Na^+ pump
- Anchors: integrines
- Receptors: PDGF (platelet-derived growth factor) receptor
- Enzymes: adenylyl cyclase (catalyze cAMP production)

Functional groups of membrane proteins

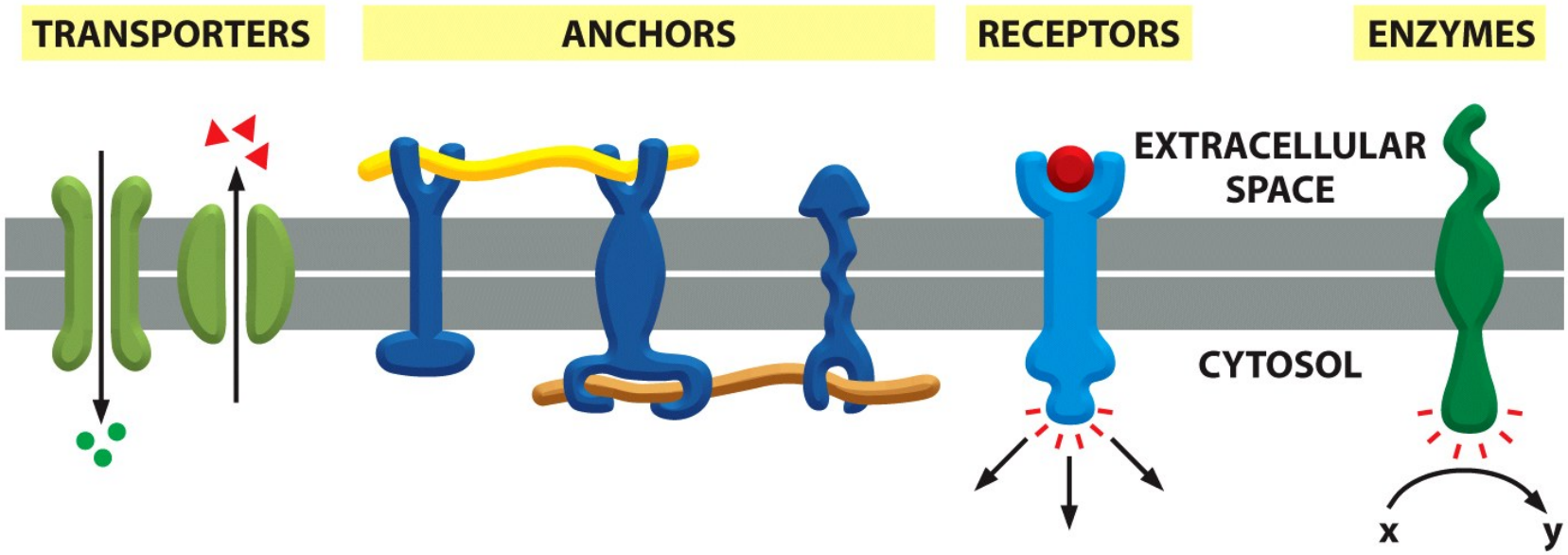

Figure 11-20 Essential Cell Biology 3/e (© Garland Science 2010)

Membrane proteins: positional groups

- Transmembrane (integral, IMP)
- Monolayer-associated (IMP)
- Lipid-linked (IMP)
- Protein-attached (peripheral, PMP)

Positional groups of membrane proteins

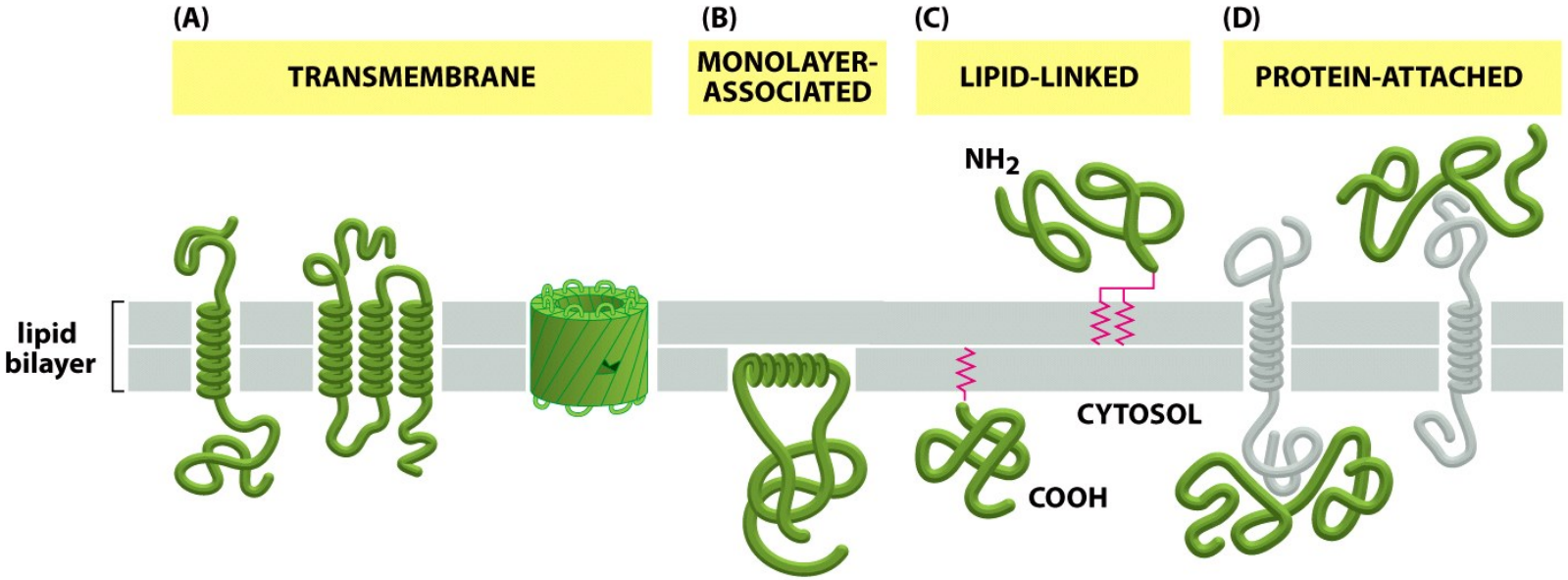

Figure 11-21 Essential Cell Biology 3/e (© Garland Science 2010)

Membrane proteins: secondary structure

- Mostly α-helices
- Sometimes also β-barrels (porins)

Porin: β-barrel

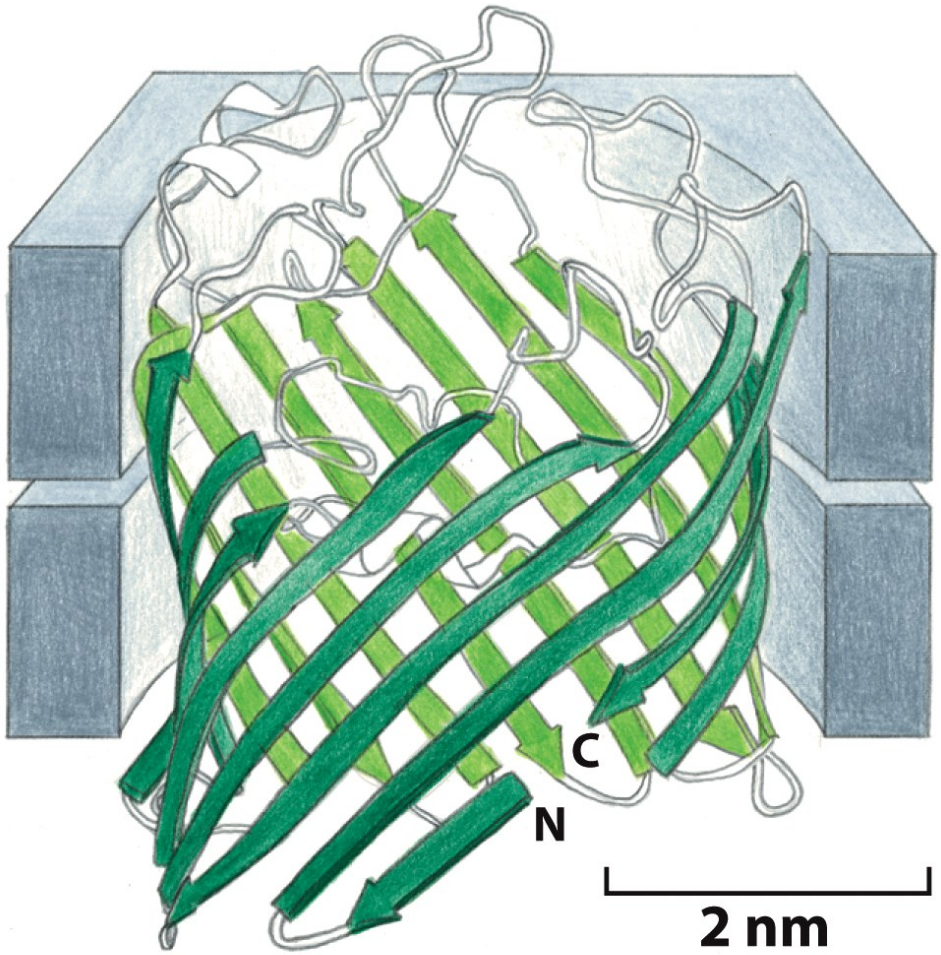

Figure 11-25 Essential Cell Biology 3/e (© Garland Science 2010)

Detergents

- Small lipid-like molecules
- Solubilize phospholipids, leaving proteins intact

Membrane disruption movie

Bacteriorhodopsin

- Small protein of ≈250 amino acids
- Proton pump activated by light

Bacteriorodopsin

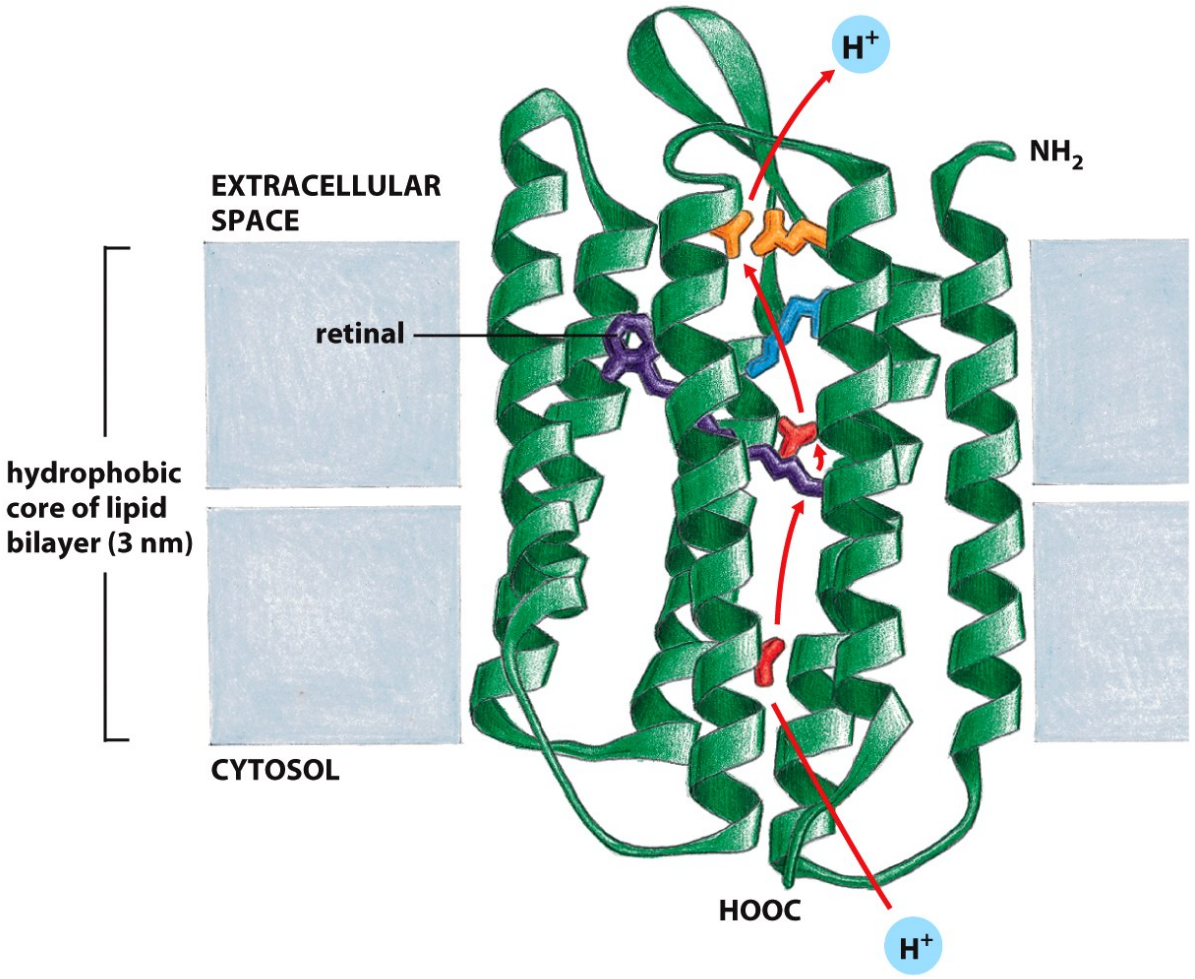

Figure 11-28 Essential Cell Biology 3/e (© Garland Science 2010)

Bacteriorodopsin movie

Cell cortex

- Cell cortex proteins like spectrins form a supportive network
- This network will stabilize a “lipid liquid” movements
- Some peptides may be restricted to particular domains of membrane

Spectrins

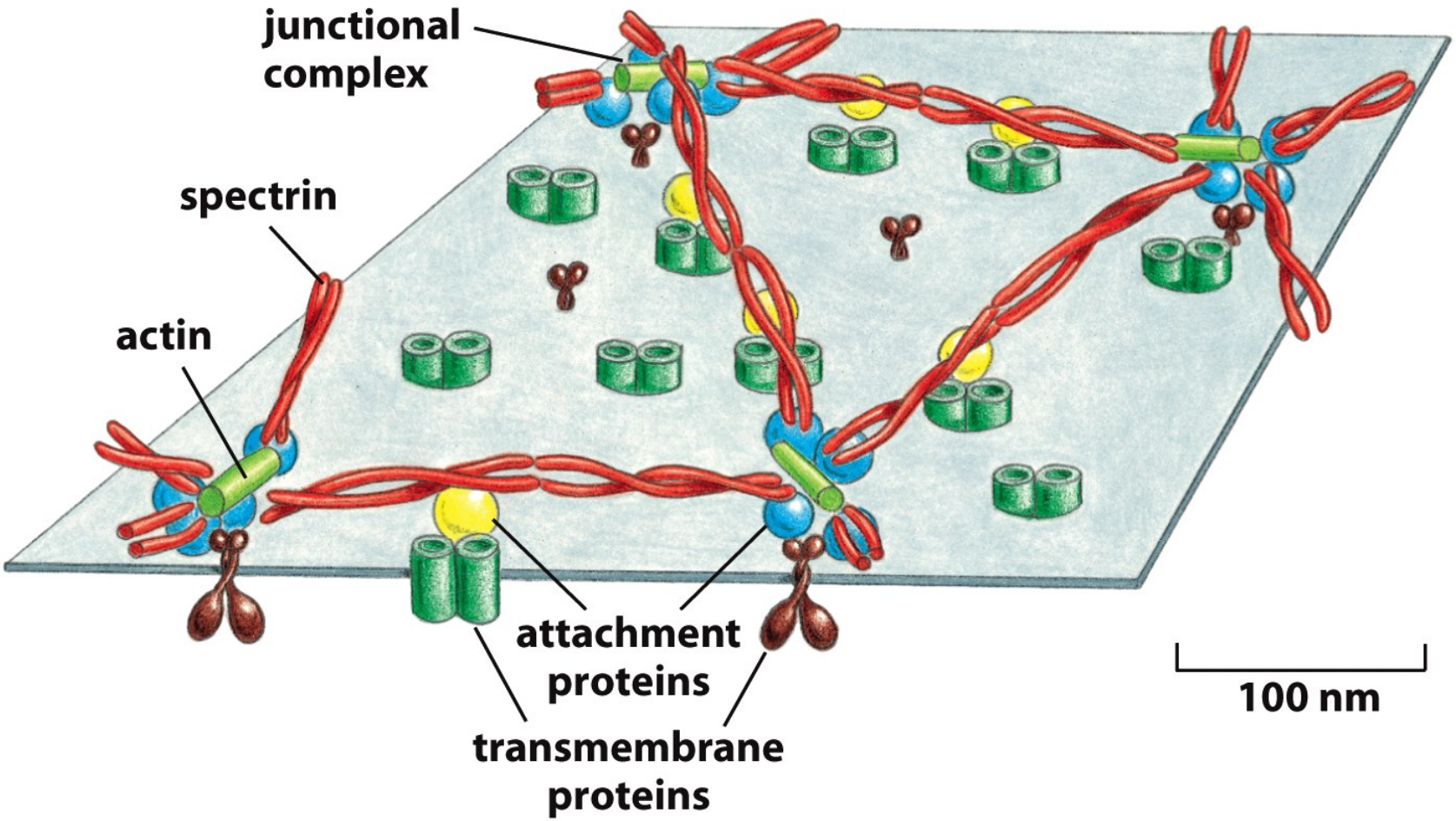

Figure 11-31a Essential Cell Biology 3/e (© Garland Science 2010)

Plasmae membrane domains

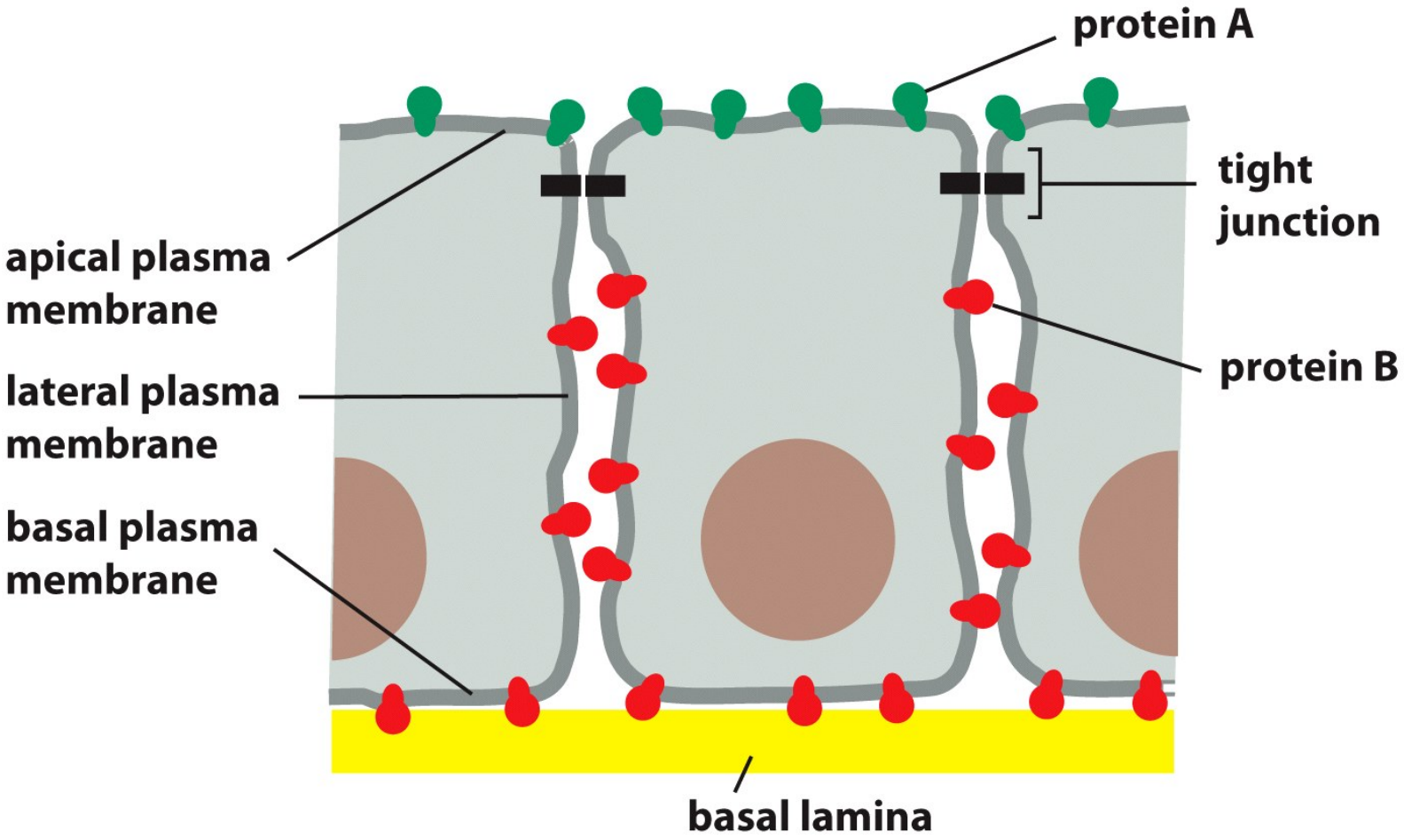

Figure 11-34 Essential Cell Biology 3/e (© Garland Science 2010)

Membrane (cortex) carbohydrates

- Glycoproteins and peptidoglycans
- Form carbohydrate layer
- Protect, lubricate and used as recognition molecules (e.g., for lectins)

Cortex

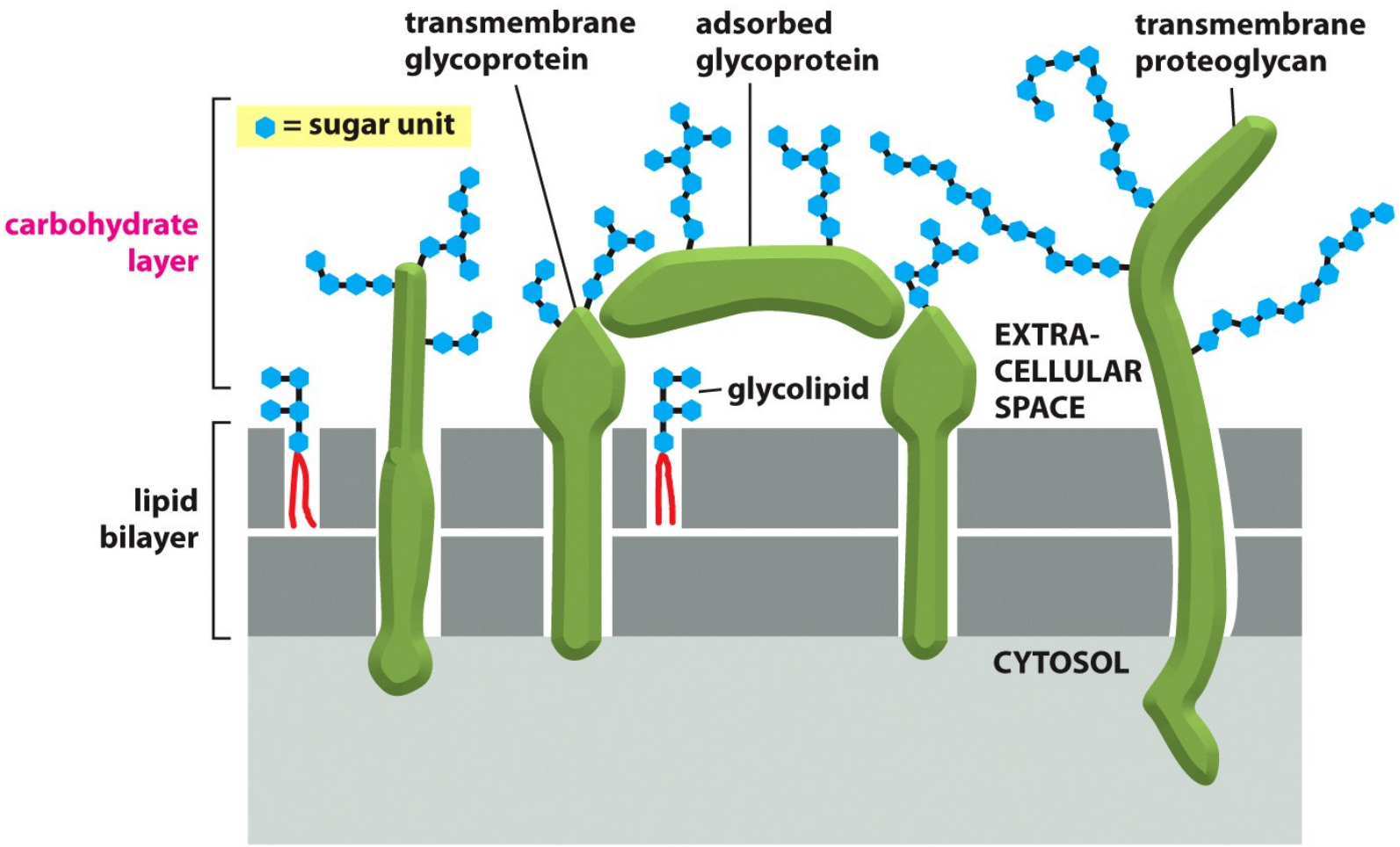

Figure 11-35 Essential Cell Biology 3/e (© Garland Science 2010)

Lectins

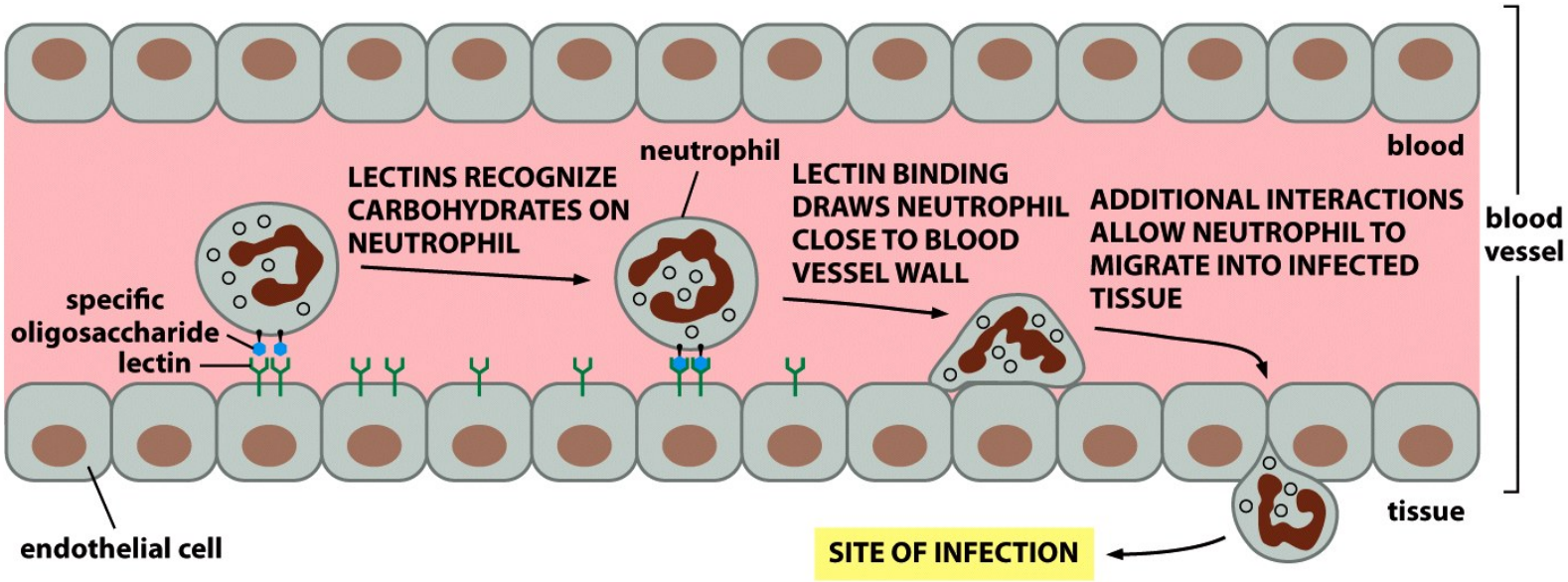

Figure 11-39 Essential Cell Biology 3/e (© Garland Science 2010)

Some methods of membrane research

- FRAP (fluorescence recovery after bleaching)
- SPT (single-particle tracking) microscopy
- Solubilizing and reconstituting of membrane proteins

FRAP movie

Final question (1 point)

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What is the function of anchor protein?

Summary

- Membranes are selective, bilayer, fluid barriers
- Membrane lipids are amphipatic
- Membrane proteins do trans-membrane jobs
- Membrane (cortex) carbohydrates are protectives and “informers”

For Further Reading

A. Shipunov.
Advanced Cell Biology [Electronic resource].
2011—onwards.
Mode of access: `http://ashipunov.info/shipunov/school/biol_250`.

B. Alberts et al.
Essential Cell Biology. 3rd edition.
Garland Science, 2009.
Chapter 11.