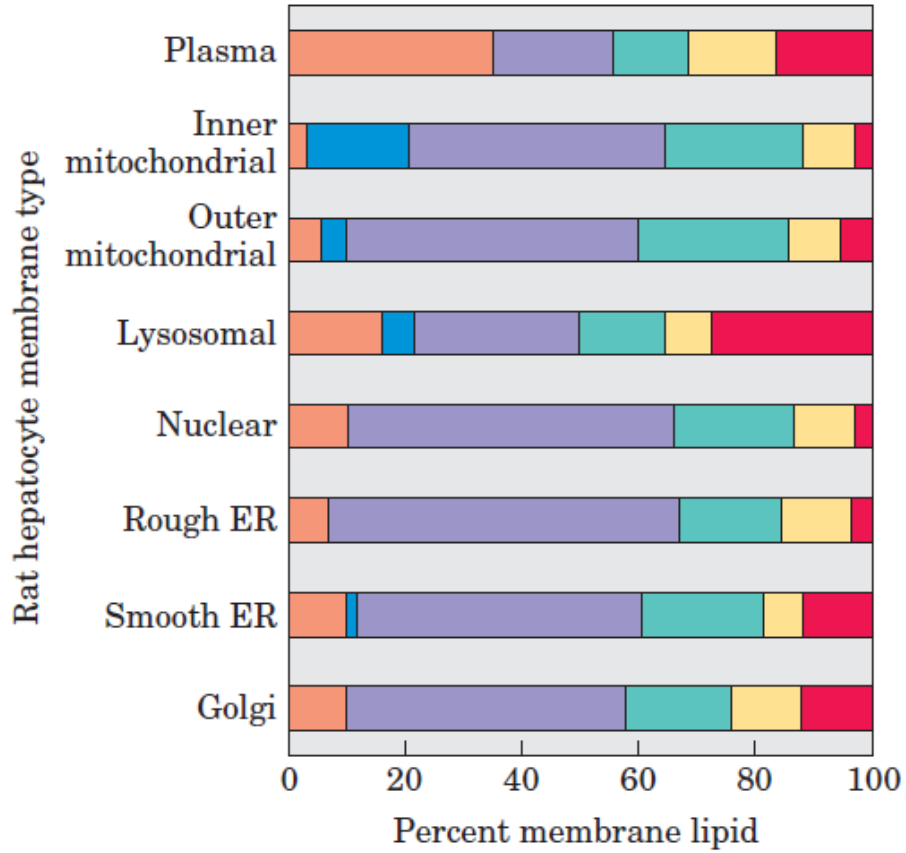
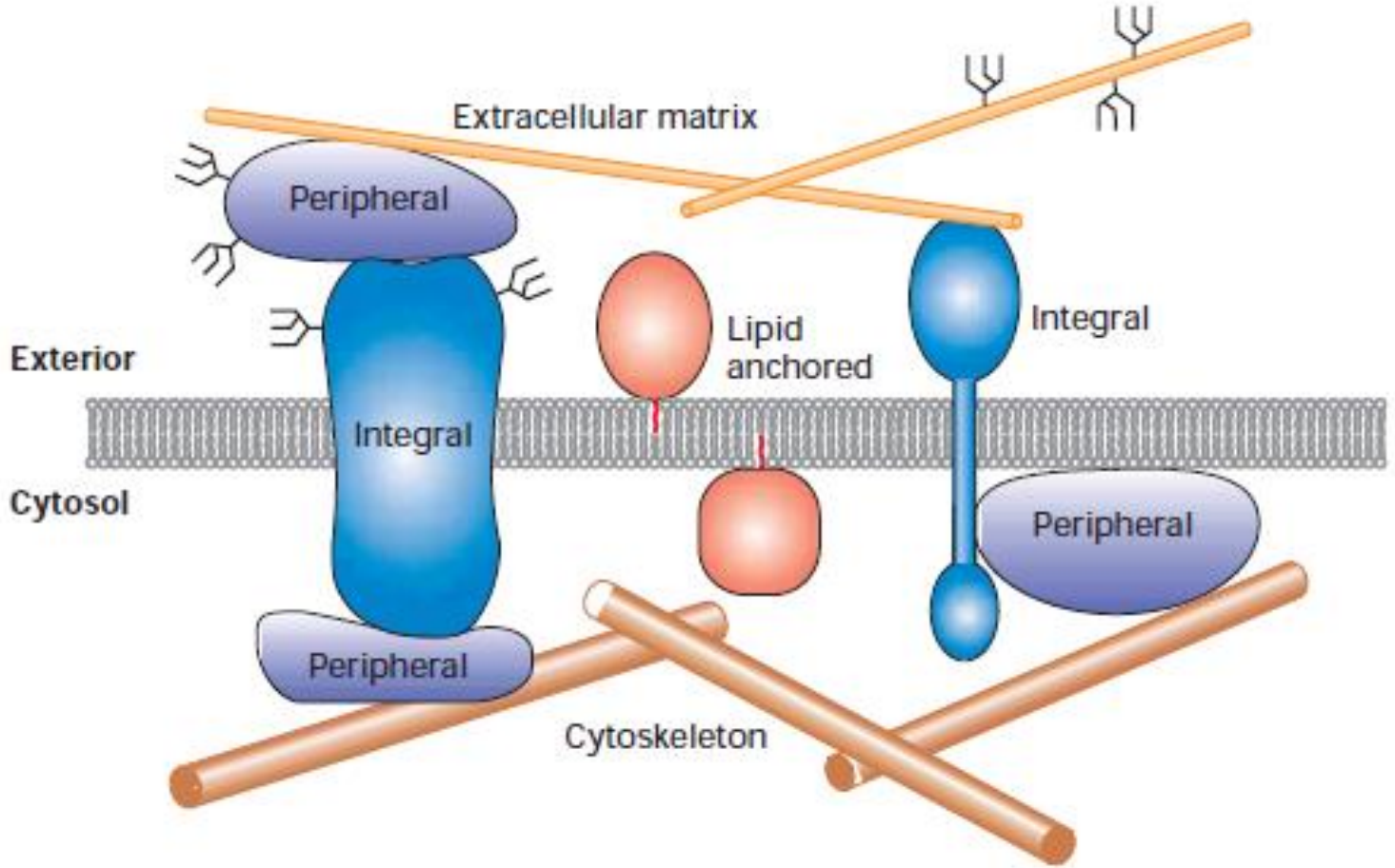
Lecture 3

Membrane phospholipid	Percent of total membrane phospholipid	Distribution in membrane
Phosphatidyl-ethanolamine	30	
Phosphatidylcholine	27	
Sphingomyelin	23	
Phosphatidylserine	15	
Phosphatidylinositol	5	
Phosphatidylinositol 4-phosphate		
Phosphatidylinositol 4,5-bisphosphate		
Phosphatidic acid		



Different ways how proteins interact with the membrane

1. Integral membrane protein
2. Lipid anchored membrane proteins
3. Peripheral membrane proteins



a cell membrane typically contains about 50 times more lipid molecules than protein molecules

Integral membrane proteins

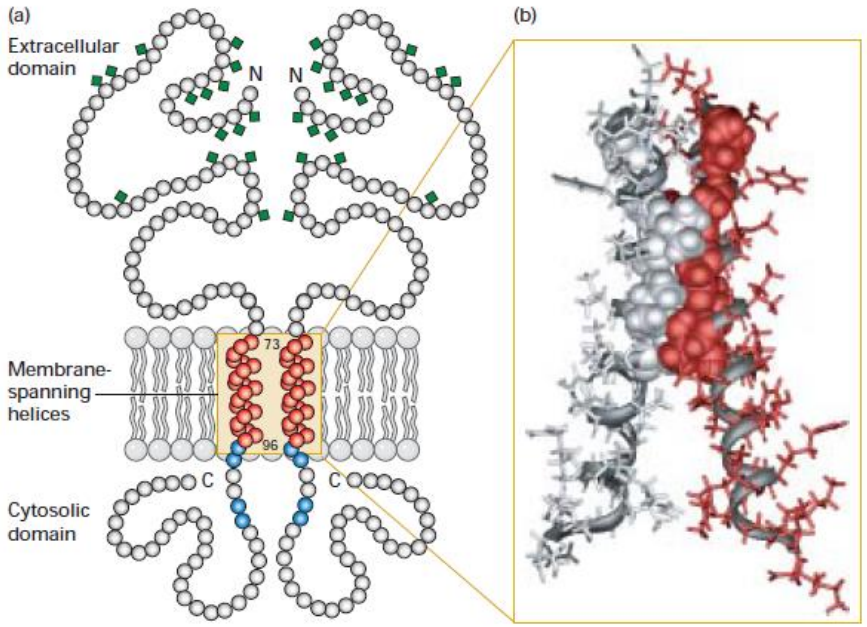
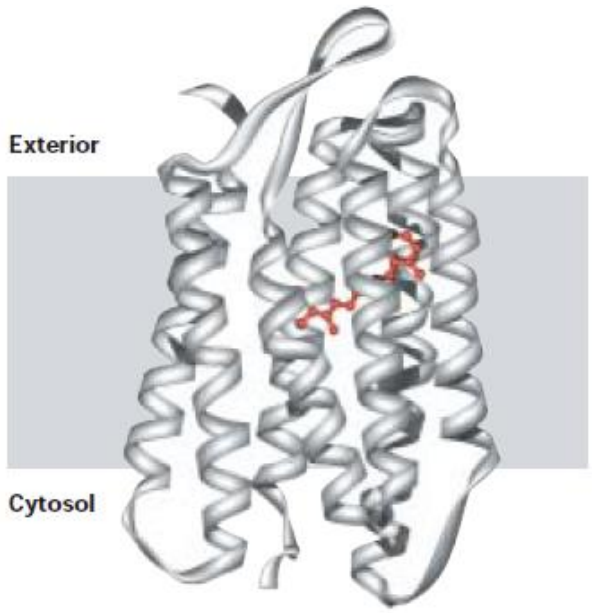
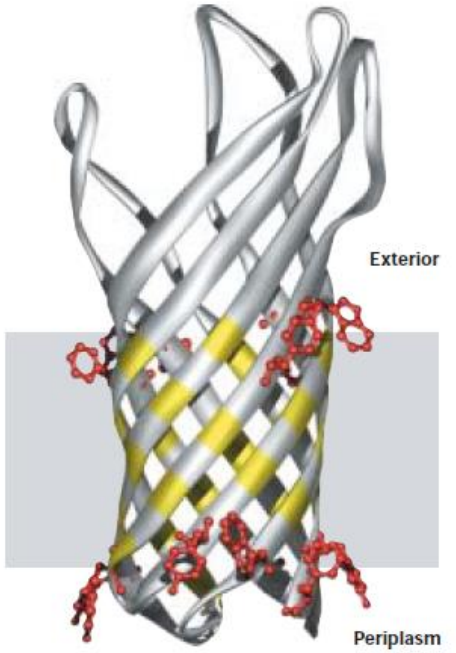


Diagram of dimeric glycophorin showing major sequence features and its relation to the membrane. The single 23-residue membrane-spanning helix in each monomer is composed of amino acids with hydrophobic (uncharged) side chains (red spheres).

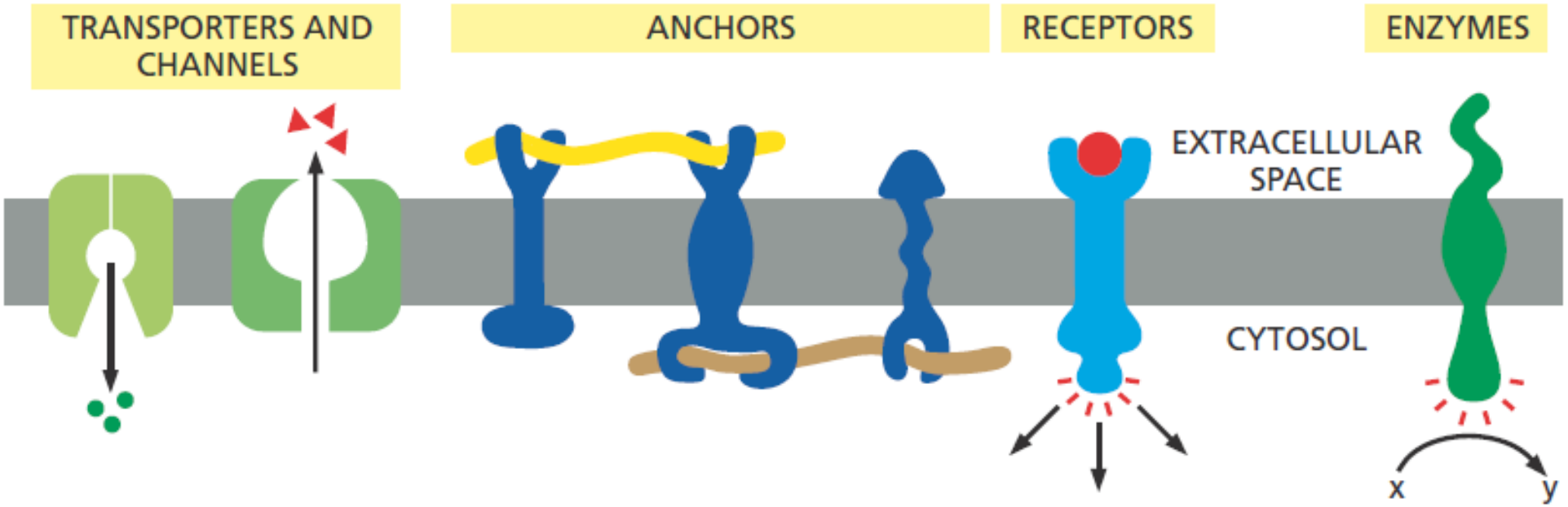


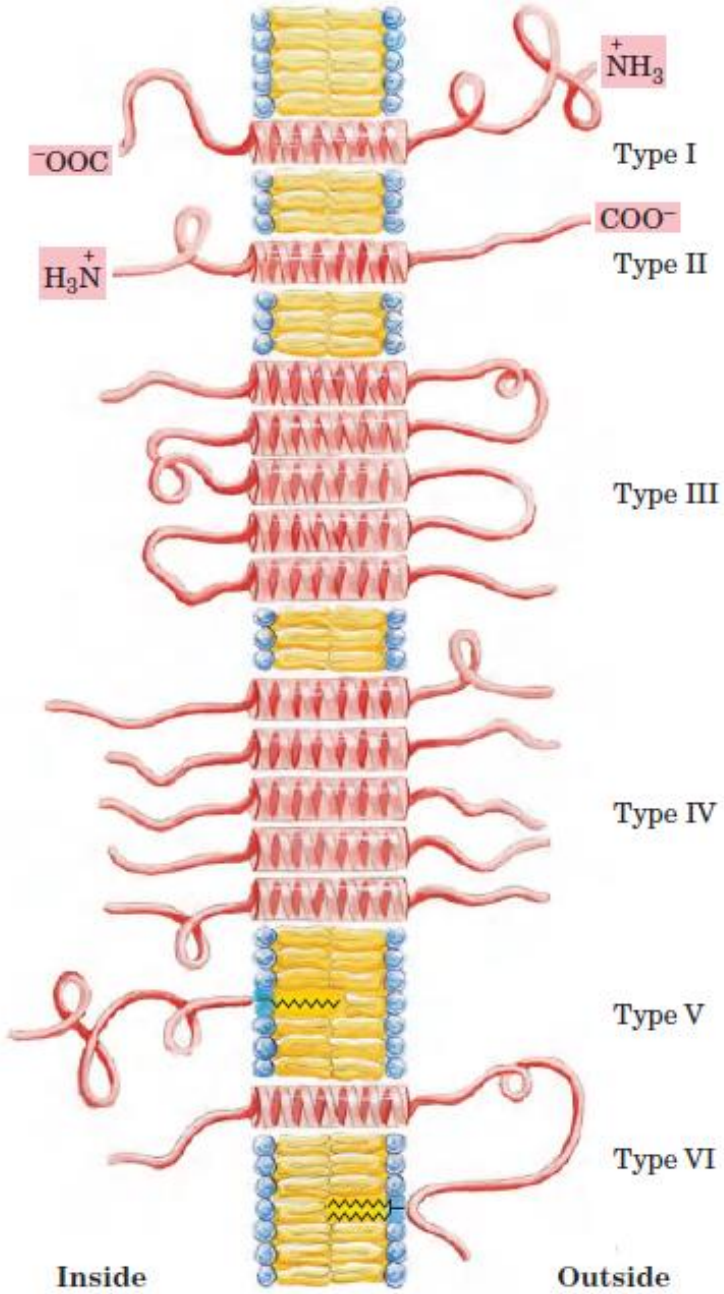
The seven hydrophobic helices in bacteriorhodopsin traverse the lipid bilayer.



All porins are trimeric transmembrane proteins. Each subunit is barrel shaped, with strands forming the wall and a transmembrane pore in the centre.

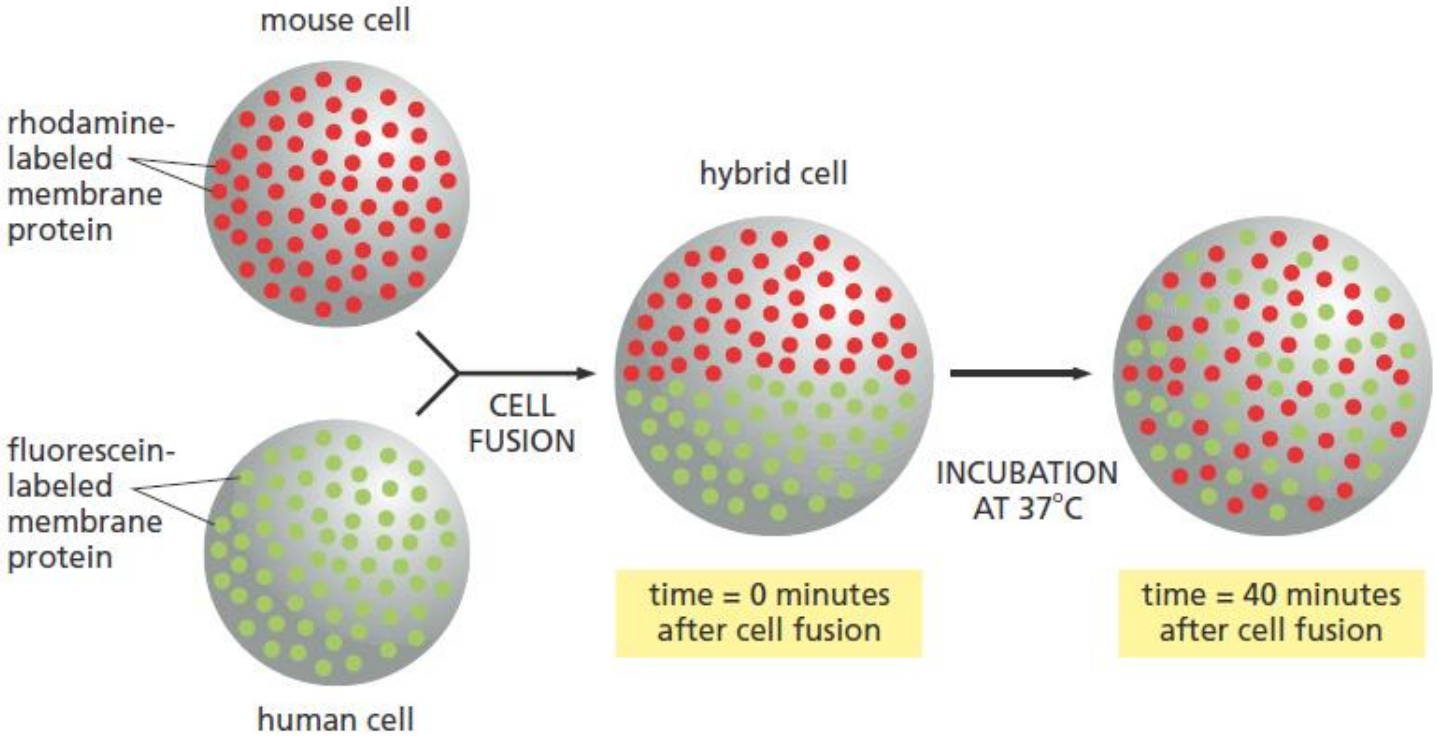
Membrane proteins perform various functions




$^{+}NH_3$
^{-}OOC
Type I
COO^{-}
H_3N^{+}
Type II
Type III
Type IV
Type V
Type VI
Inside
Outside

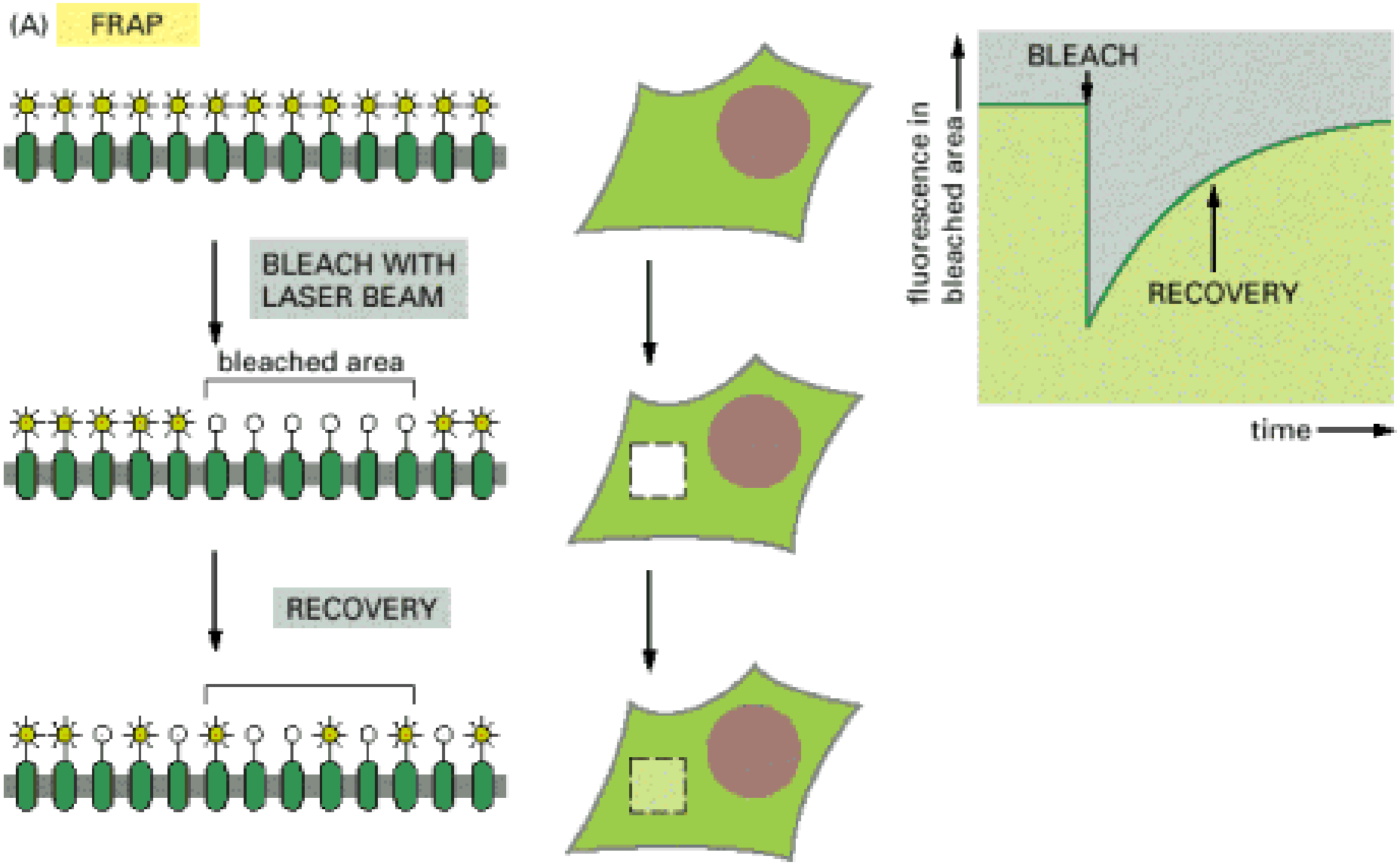
Membrane proteins can move freely

Because a membrane is a two-dimensional fluid, many of its proteins, like its lipids, can move freely within the plane of the lipid bilayer.



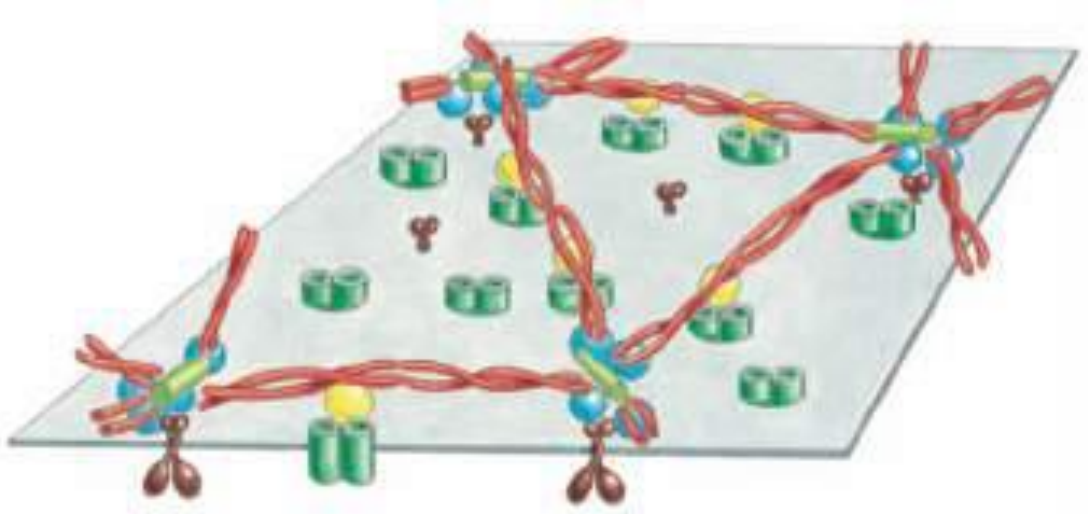
In the last class we also spoke about FRAP – Fluorescence Recovery After Photobleaching

Fluorescence Recovery After Photobleaching

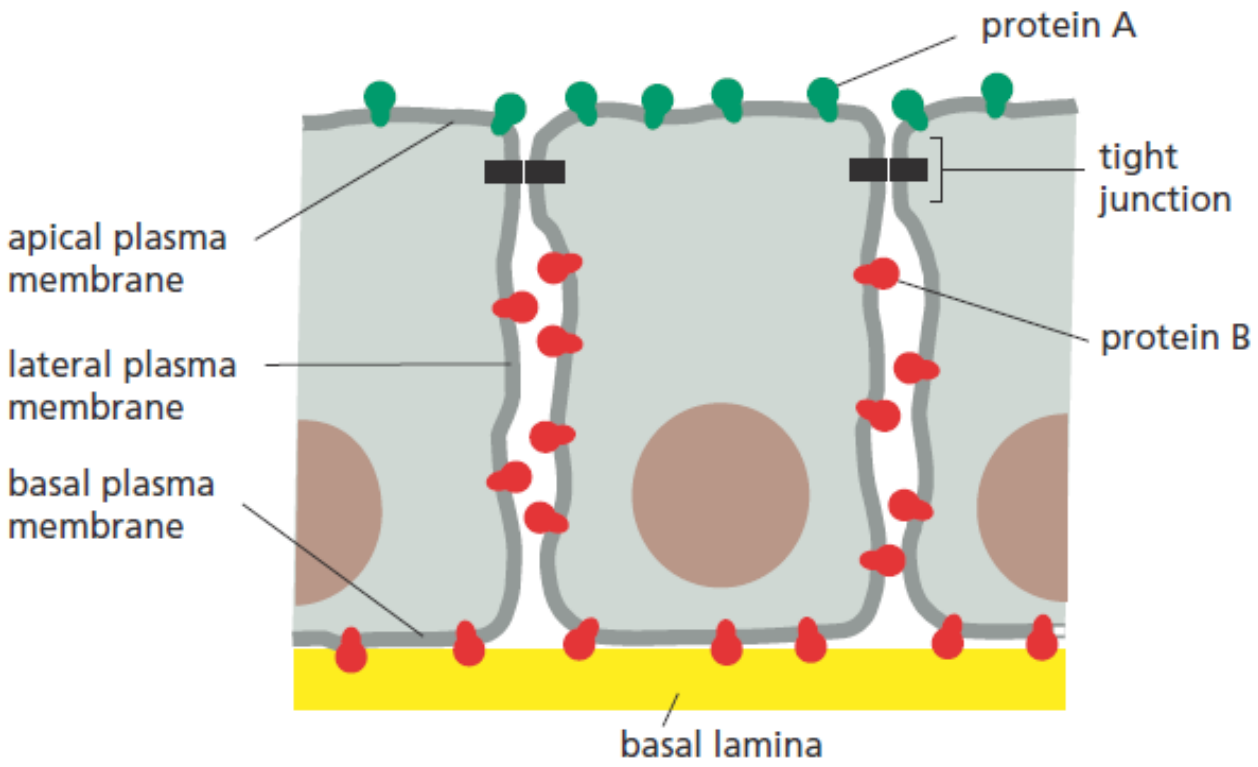


The mobility of integral proteins in the plasma membrane of living cells is restricted by interactions with the rigid submembrane cytoskeleton

Some integral proteins are permanently linked to the underlying cytoskeleton; these proteins are completely immobile in the membrane.



A spectrin meshwork forms the cell cortex in human red blood cells



Membrane proteins are restricted to particular domains of the plasma membrane of epithelial cells in the gut.

Protein A (in the apical membrane) and protein B (in the basal and lateral membranes) can diffuse laterally in their own membrane domains but are prevented from entering the other domain by a specialized cell junction called a tight junction.

The basal lamina is a mat of extracellular matrix that supports all epithelial sheets

Each type of transmembrane protein also has a specific orientation with respect to the membrane faces.

This asymmetry in protein orientation confers different properties on the two membrane faces.

Membrane proteins have never been observed to flip-flop across a membrane.

The picture of a cell membrane as a sea of lipid in which all proteins float freely is too simple

Cells have ways of confining particular proteins to localized areas within the bilayer membrane, thereby creating functionally specialized regions, or membrane domains, on the cell or organelle surface.

The Cell Surface Is Coated with Carbohydrate

Many transmembrane proteins contain carbohydrate chains covalently linked to serine, threonine, or asparagine side chains of the polypeptide.

Such transmembrane glycoproteins are always oriented so that the carbohydrate chains are in the exoplasmic domain.

Both glycoproteins and glycolipids are especially abundant in the plasma membranes of eukaryotic cells.

Because the carbohydrate chains of glycoproteins and glycolipids in the plasma membrane extend into the extracellular space, they are available to interact with components of the extracellular matrix as well as lectins, growth factors, and antibodies.