

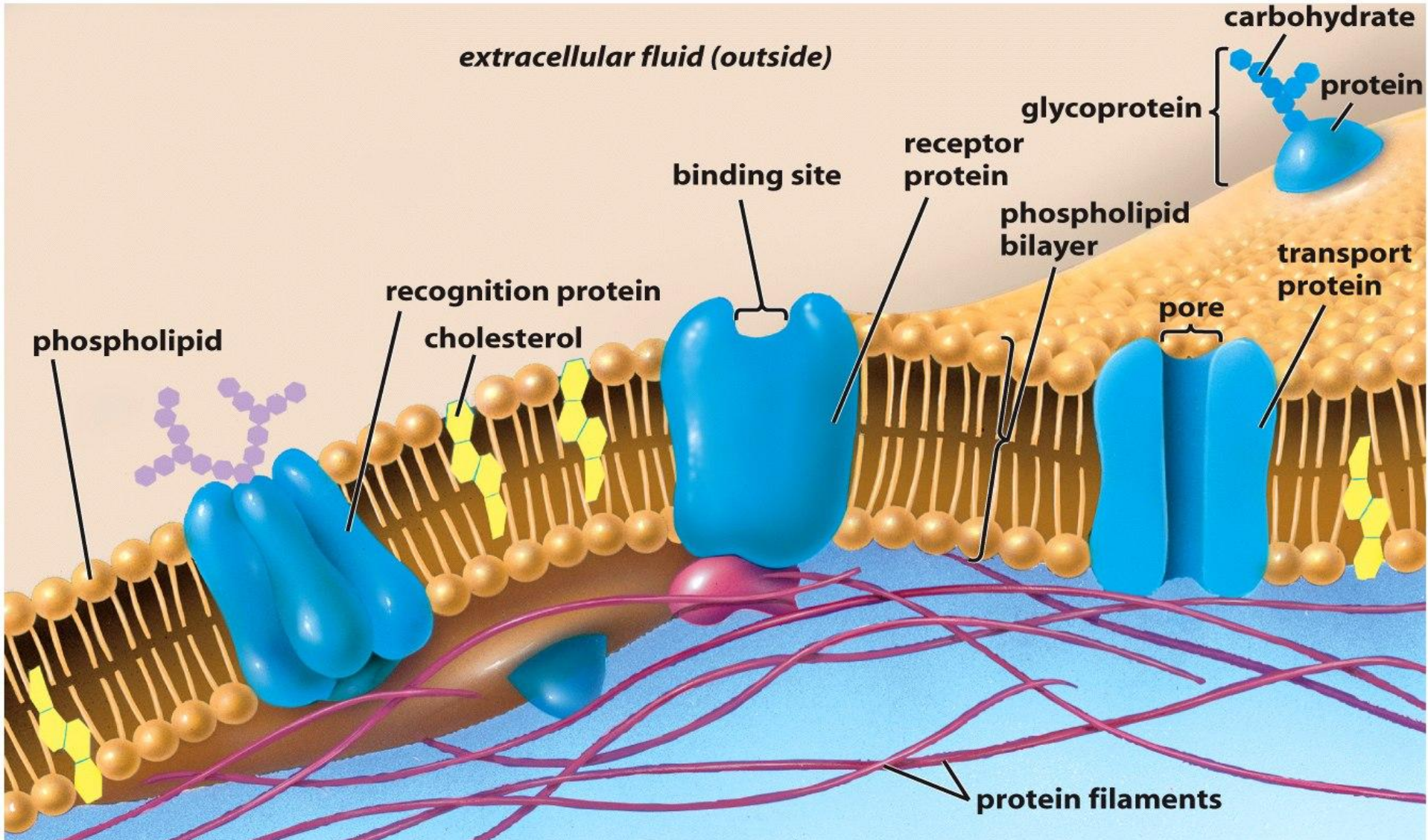
The Cell Membrane

Question of the Day:

How Is the Structure of a Membrane Related to Its Function?

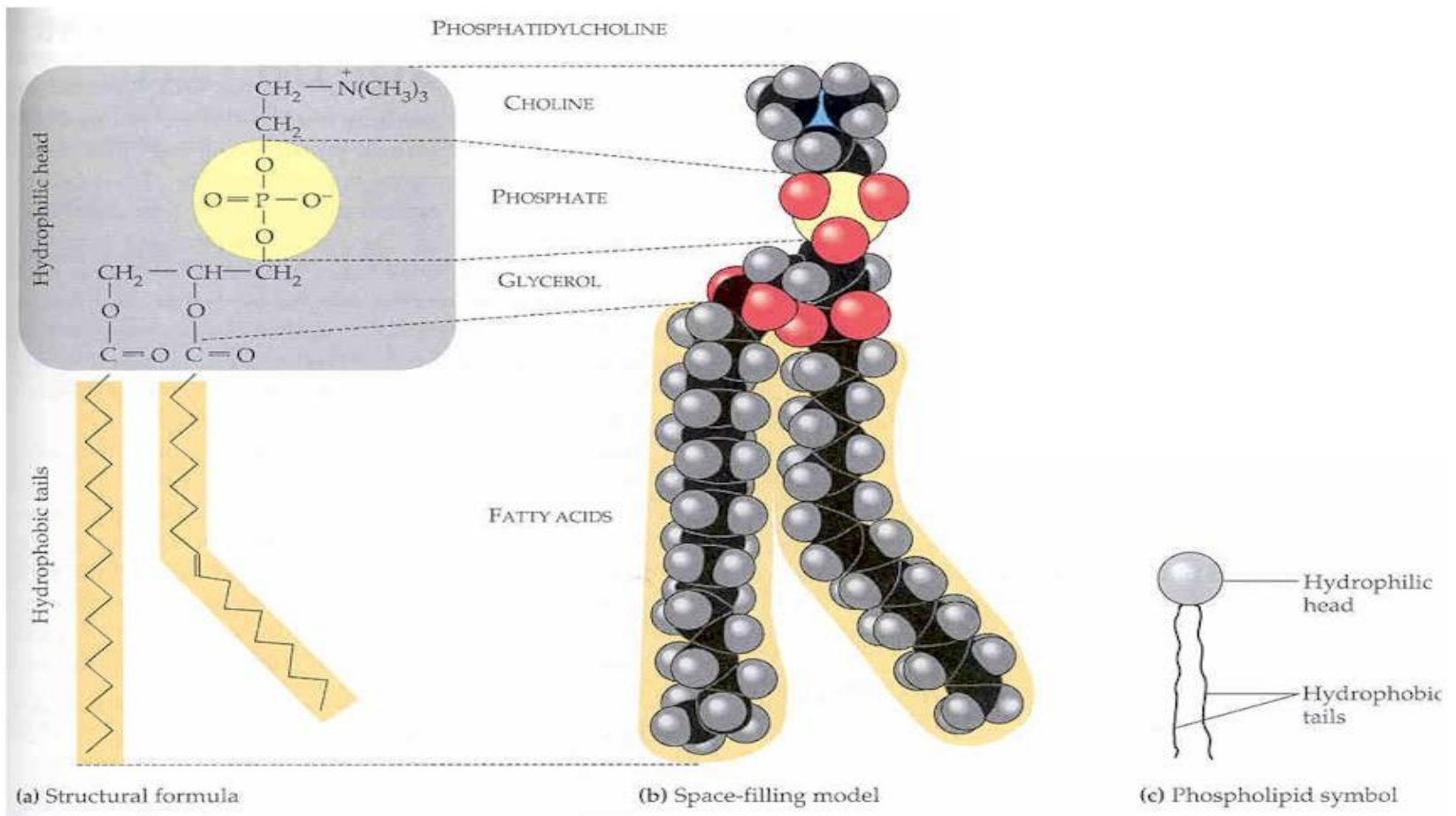
Big Idea

- Membranes are “**Fluid Mosaics**” in which proteins move within layers of lipids
- The **phospholipid bilayer** is the fluid portion of the membrane
 - A **mosaic of proteins** is embedded in the membrane
 - Membranes are dynamic, ever-changing structures

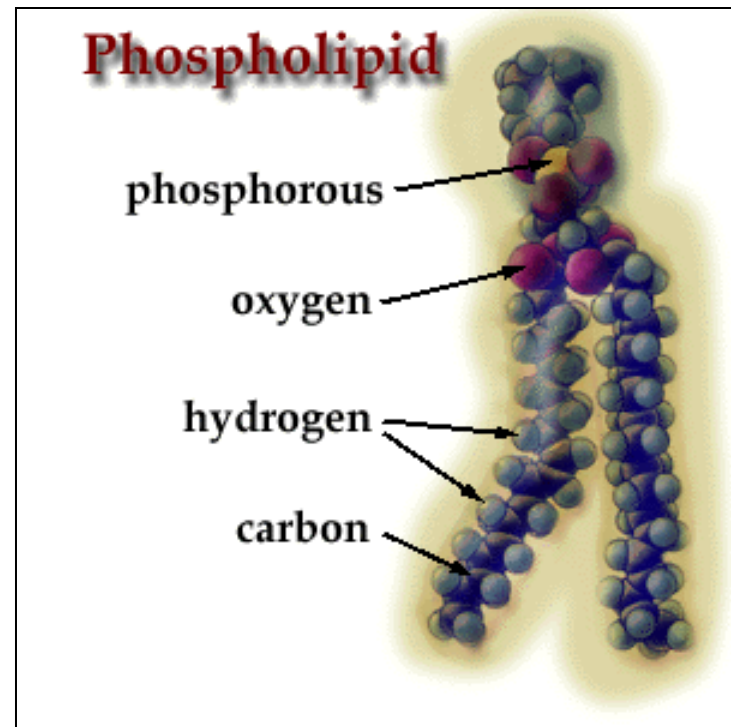
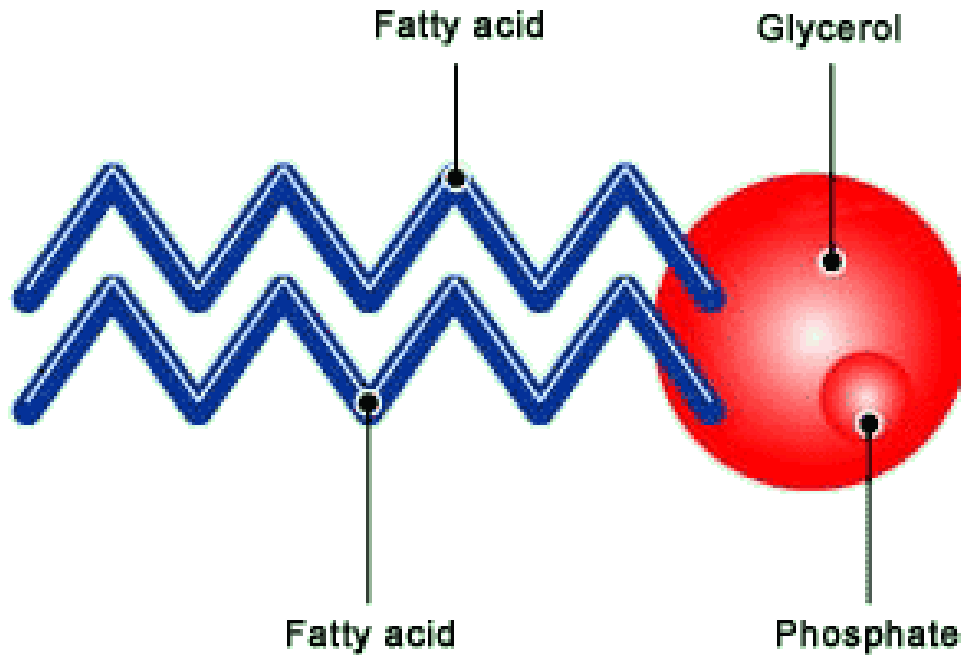


The plasma membrane is a bilayer of phospholipids that form a fluid matrix in which various proteins (blue) are embedded. Many proteins have carbohydrates attached to them, forming glycoproteins. Three of the five major types of membrane proteins are illustrated here: recognition, receptor, and transport proteins.

Head is a **phosphate** bonded to a **glycerol**



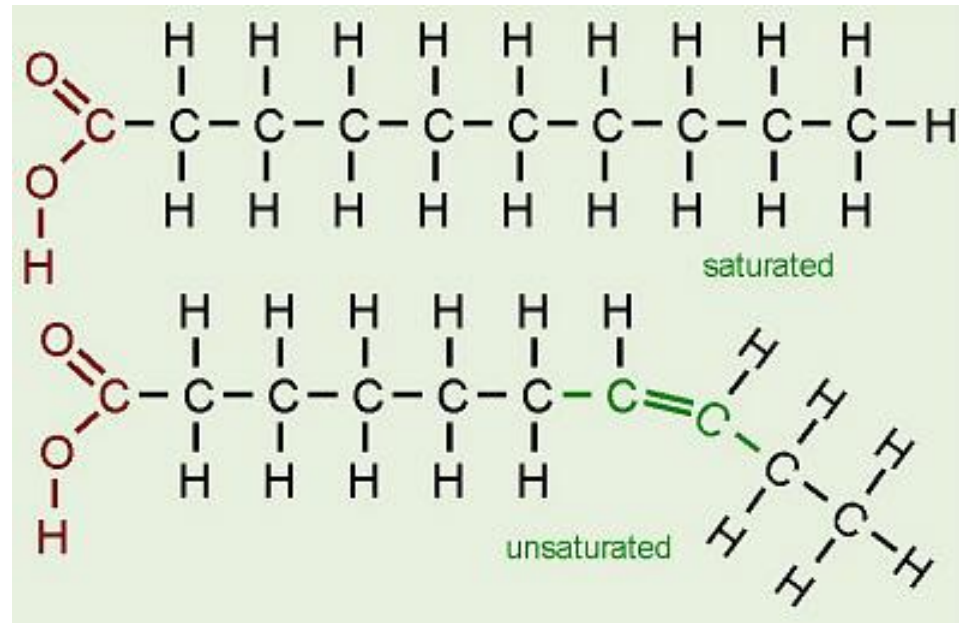
Tails are **fatty acids** (chains of hydrogen and carbon atoms, termed “**hydrocarbon chain**”)



Hydrocarbon tail can be saturated or unsaturated

- **Saturated**

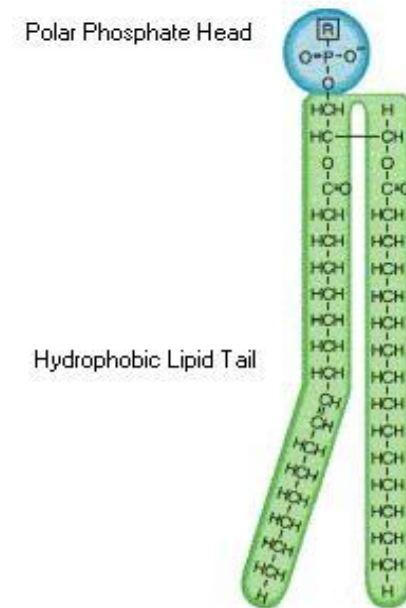
- Have as many hydrogen present as can bond to the carbons (so they lack double bonds between the carbons)
- Causes a straight chain (which decreases fluidity of the membrane)



Hydrocarbon tail can be saturated or unsaturated

- **Unsaturated**

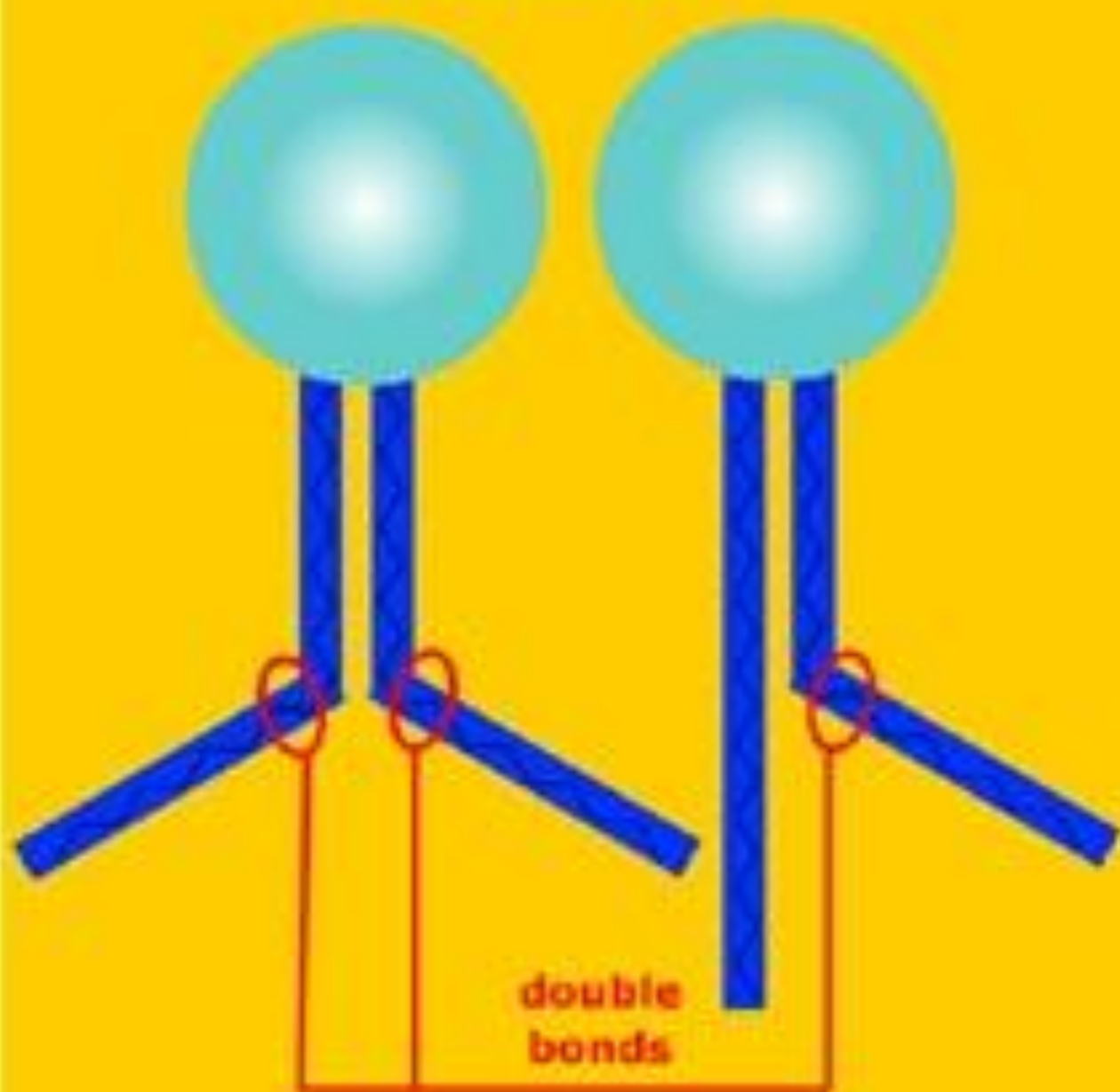
- Have fewer hydrogen present then can bond to the carbons (so there are double bonds between the carbons)
- Causes kinked chains (which increases fluidity in the membrane because kinks at the carbon-to-carbon double bond hinder close packing of phospholipids.)

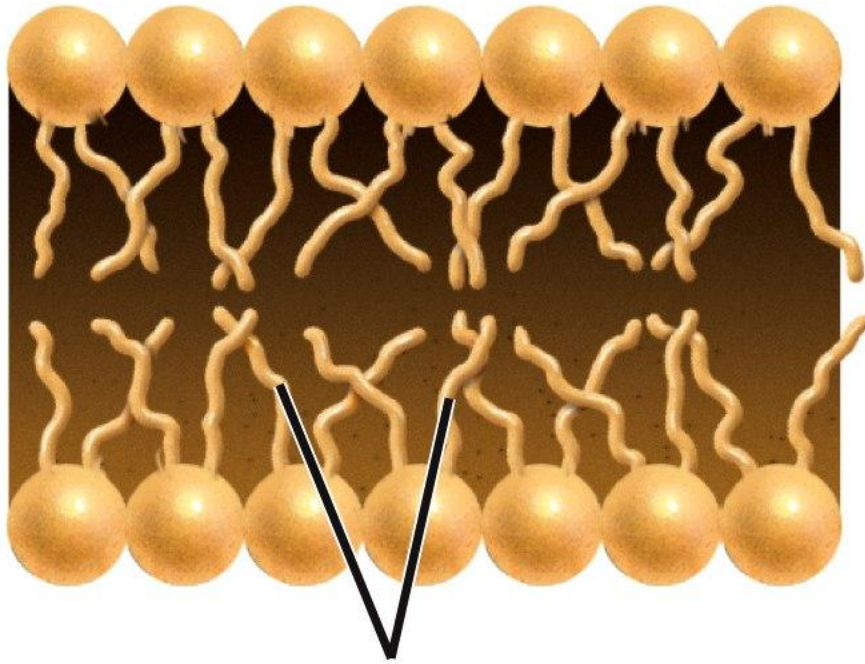


Saturated

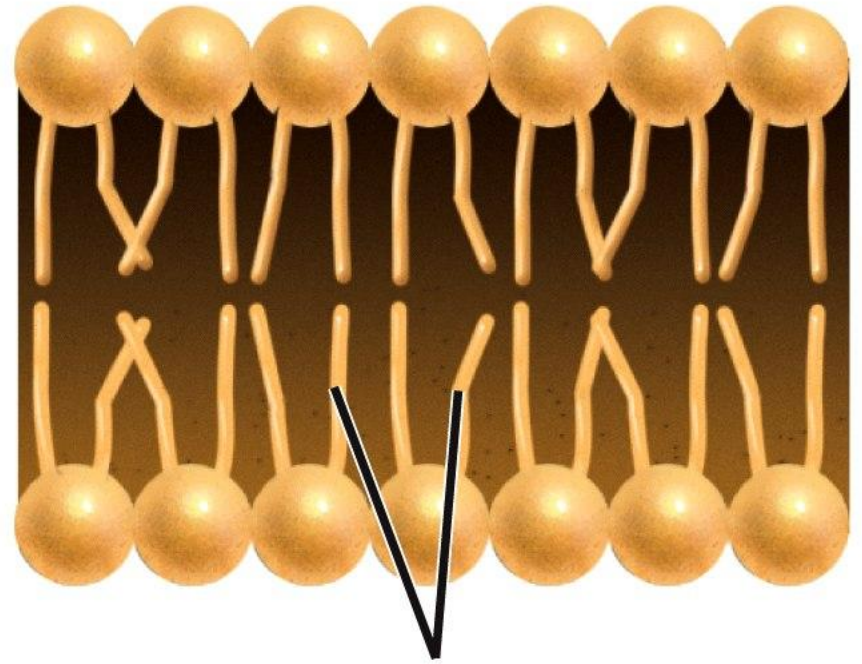


Unsaturated





more fluid

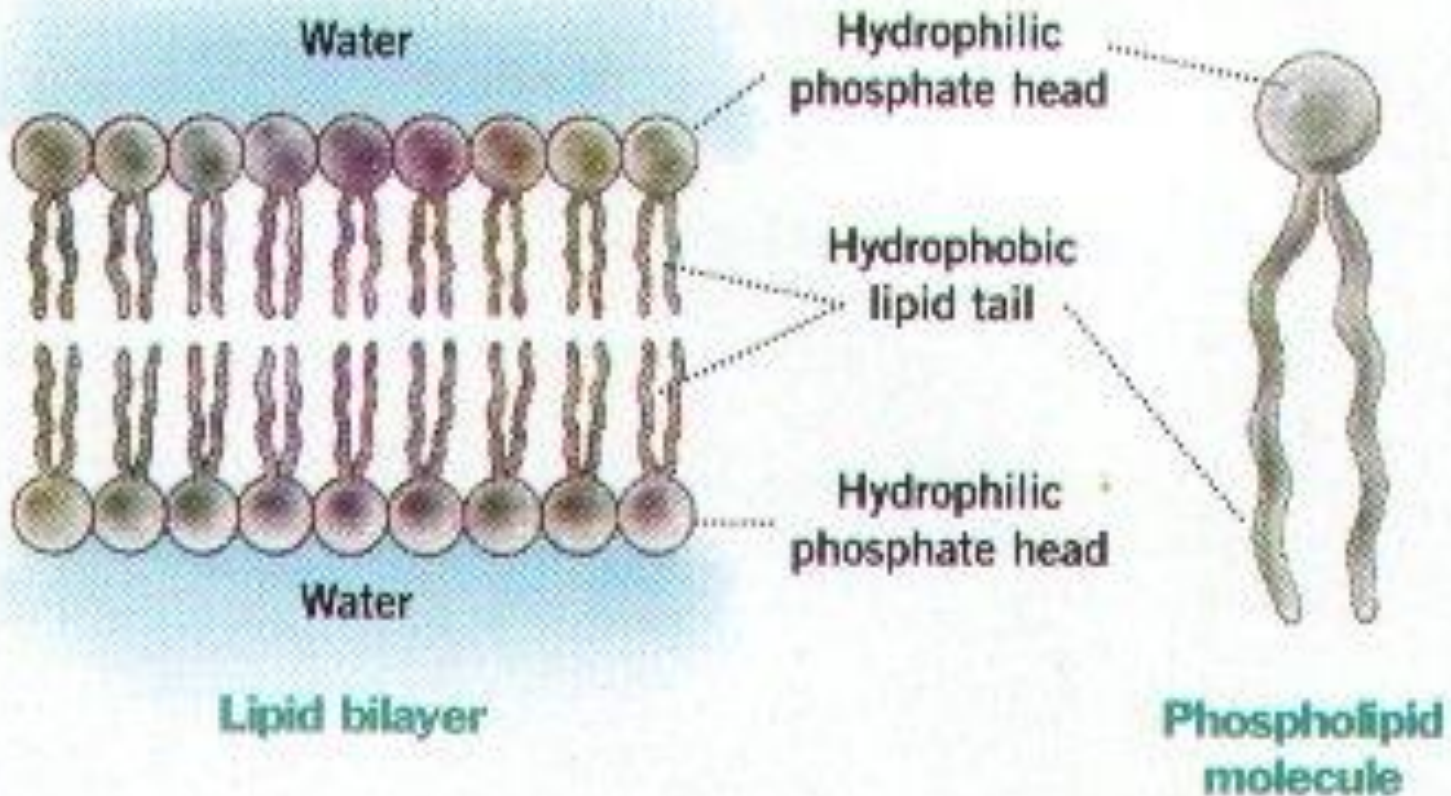


less fluid

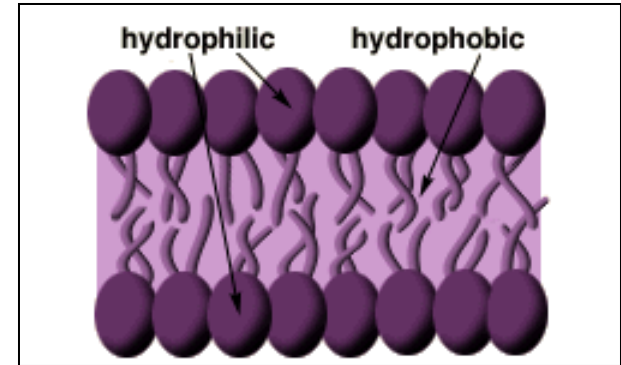
Figure 5-4 Biology: Life on Earth, 8/e
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The Phospholipid Bilayer

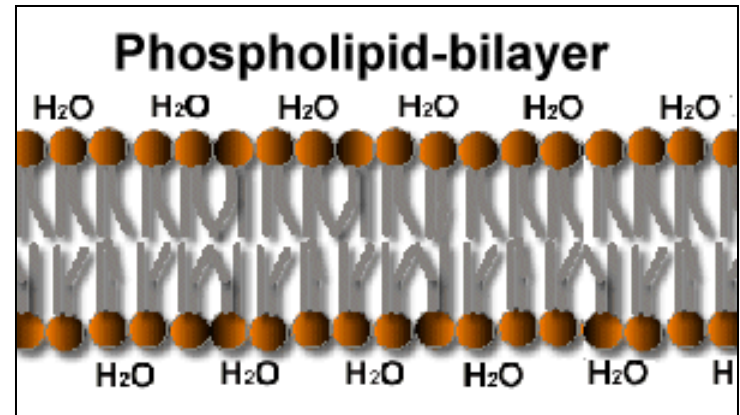
- The cell exterior and interior face watery environments



- **Hydrophilic** (“water loving”) head portions are exposed to water.



- **Hydrophobic** (“water fearing”) tail portions of are oriented inside the bilayer.



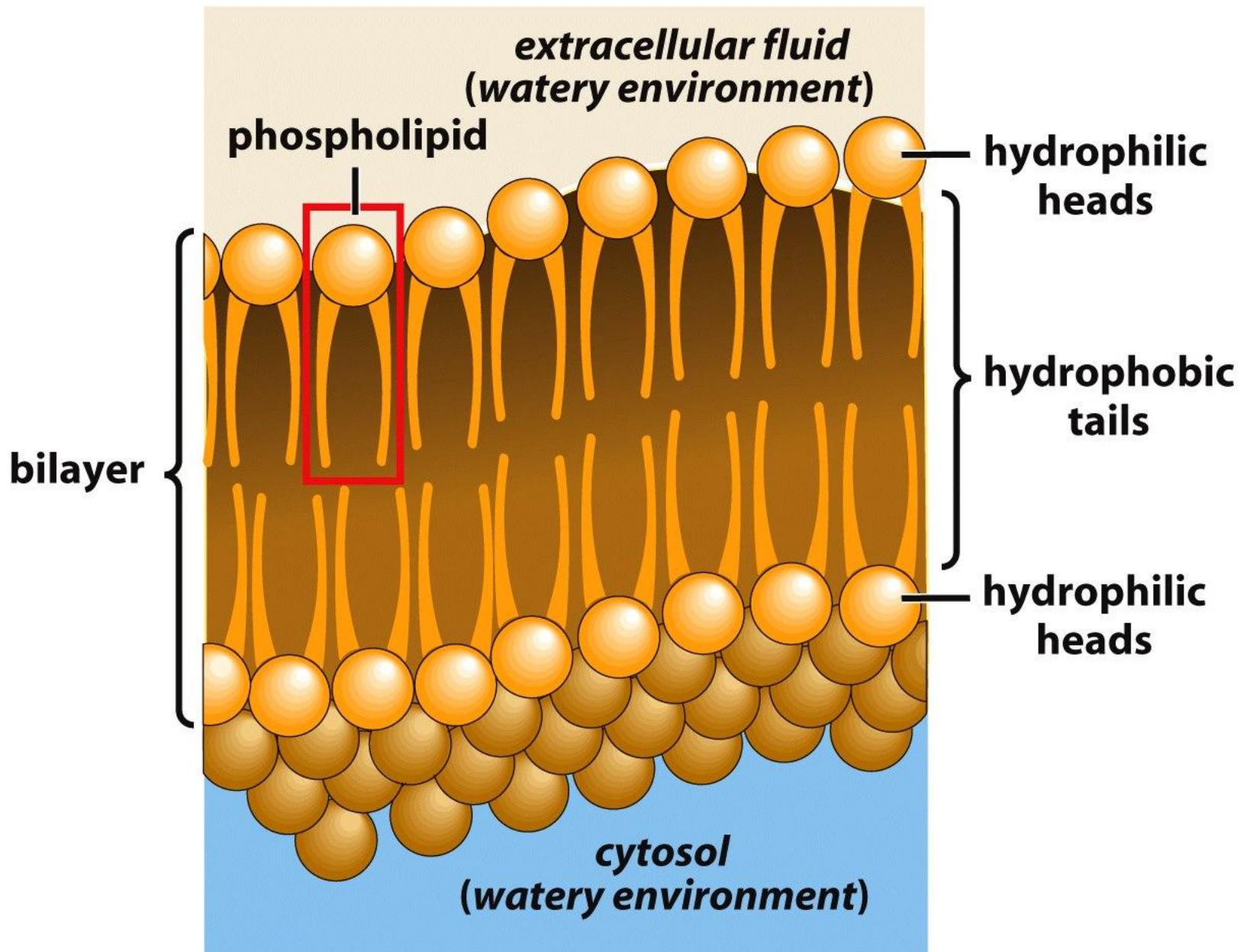


Figure 5-3 Biology: Life on Earth, 8/e
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Why called “FLUID”

Phospholipid bilayer is flexible, allowing for cellular shape changes

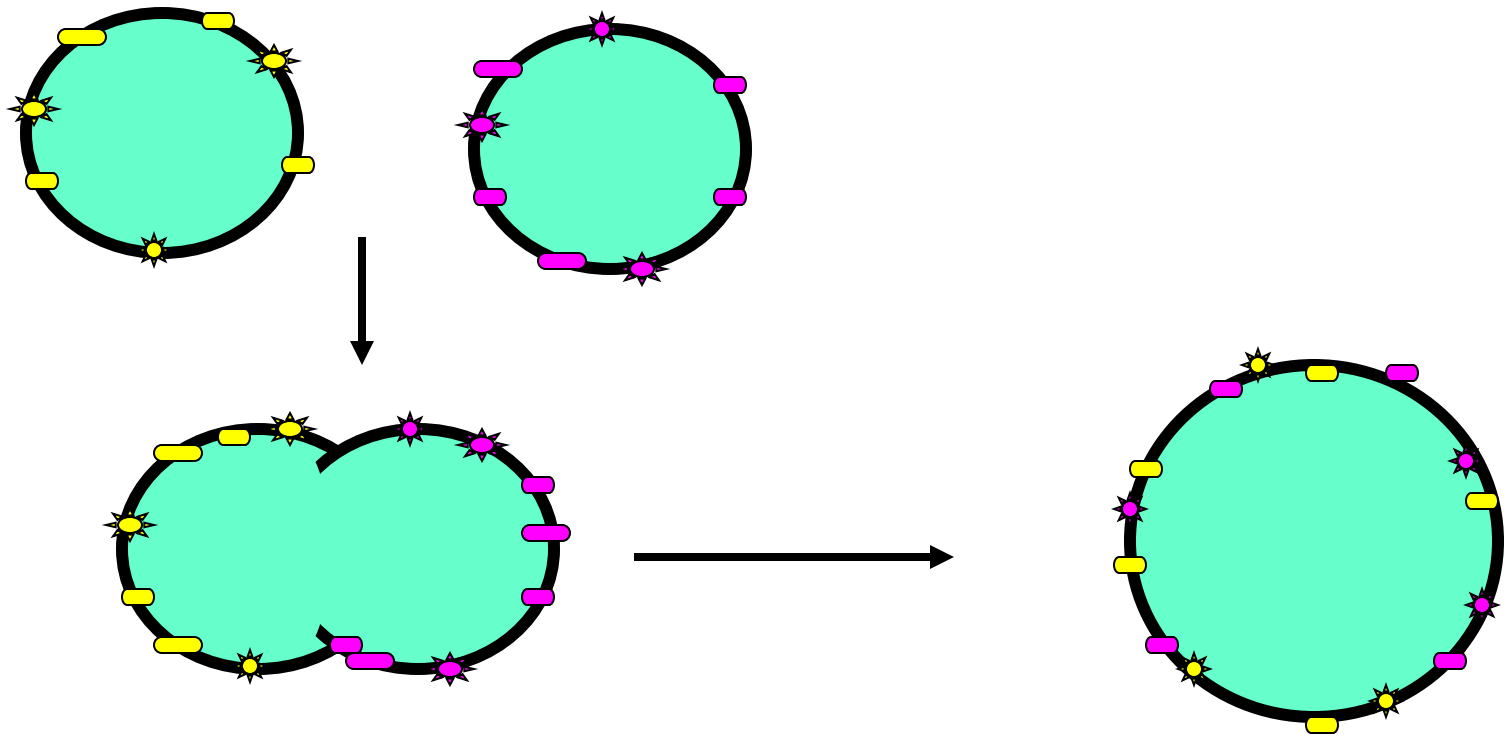
Membrane lipids (and some proteins) can drift laterally within the membrane.

- Individual phospholipid molecules are not bonded to one another

- Proteins drift more slowly than lipids

- Some membrane proteins are tethered to the cytoskeleton and cannot move far.

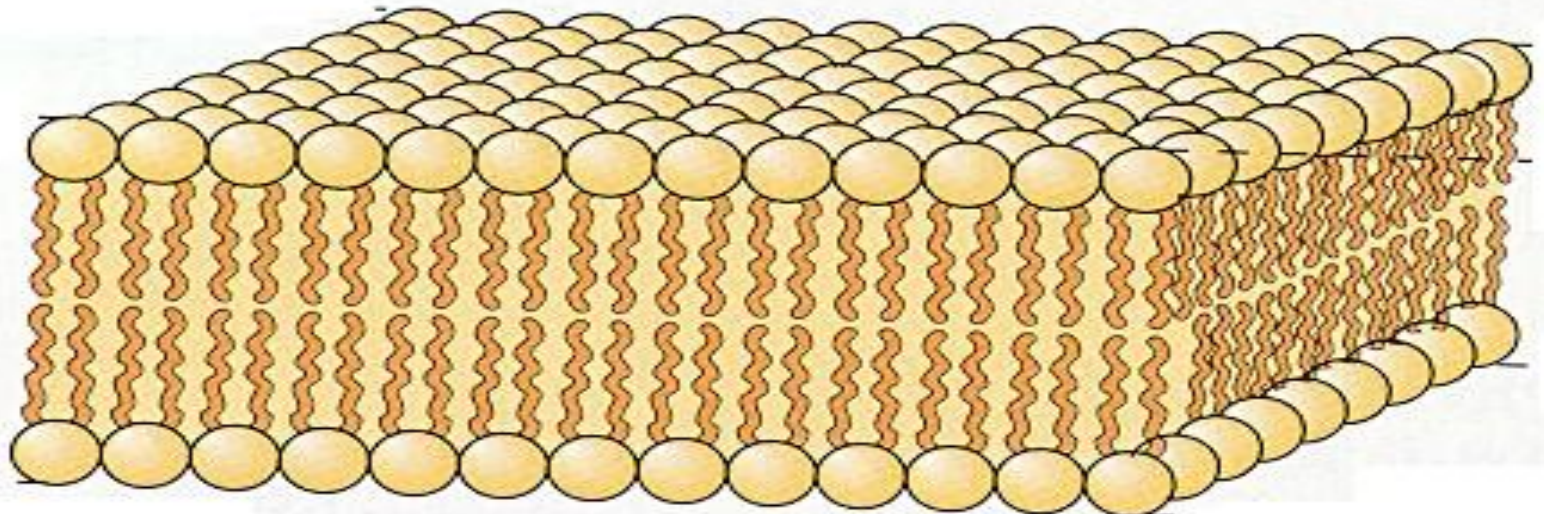
Evidence for the Fluid Mosaic Model (cell fusion experiment)



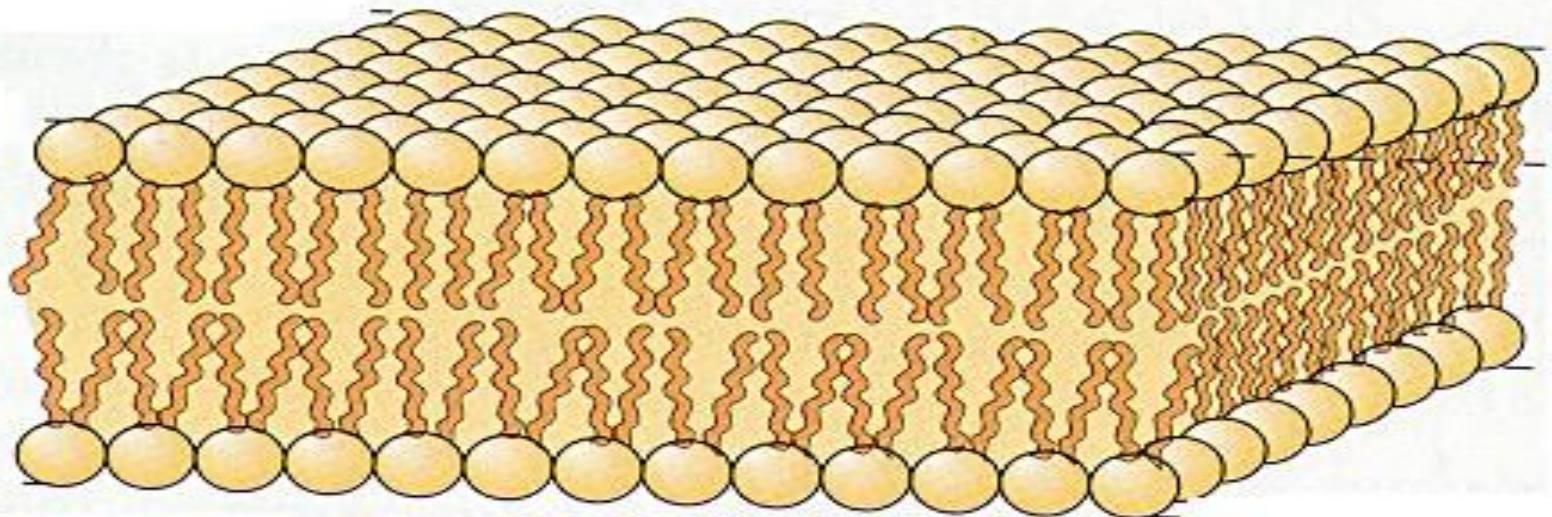
Membranes must be fluid to
work properly!!!!

gel phase--low temperatures

hydrocarbons are tightly packed

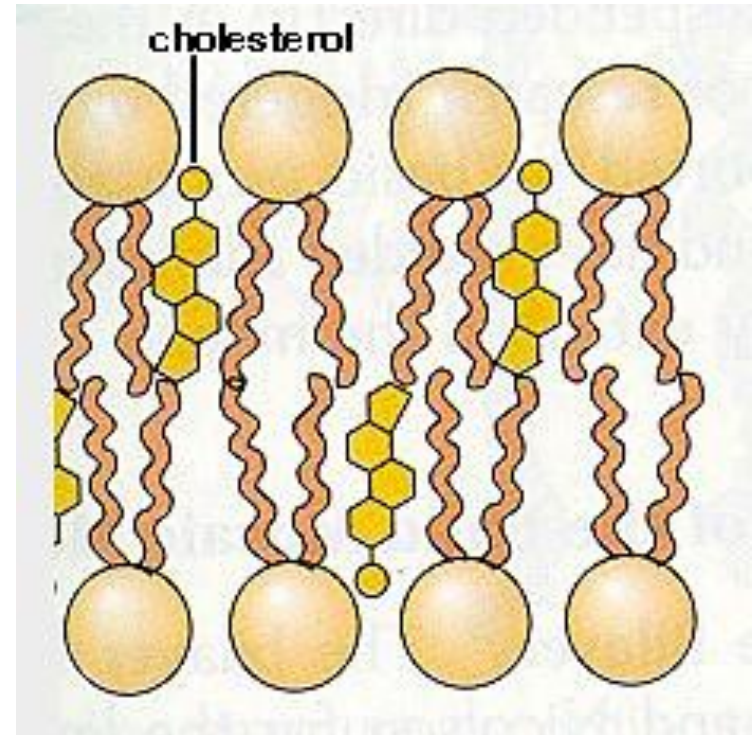


at higher temperatures--moves to fluid phase



bilayer "melts", movement is allowed

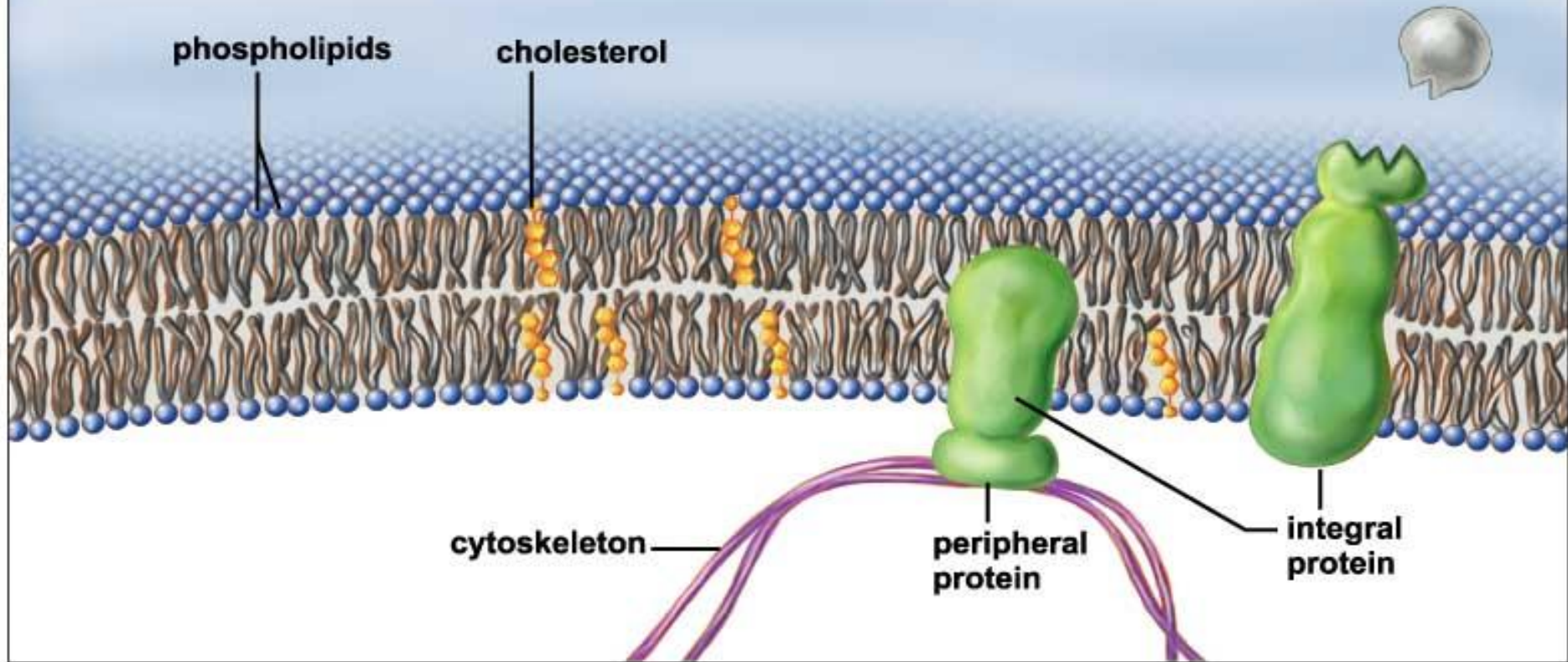
- In eukaryotes, a fat molecule called **cholesterol** modulates the membrane fluidity by making the membrane:
 - Less fluid at warmer temperatures
 - More fluid at lower temperatures



Membrane proteins form a “Mosaic”

- **Integral Proteins** (span the membrane)
- **Peripheral Proteins** (not embedded, attached to membrane surface)

THE PLASMA MEMBRANE

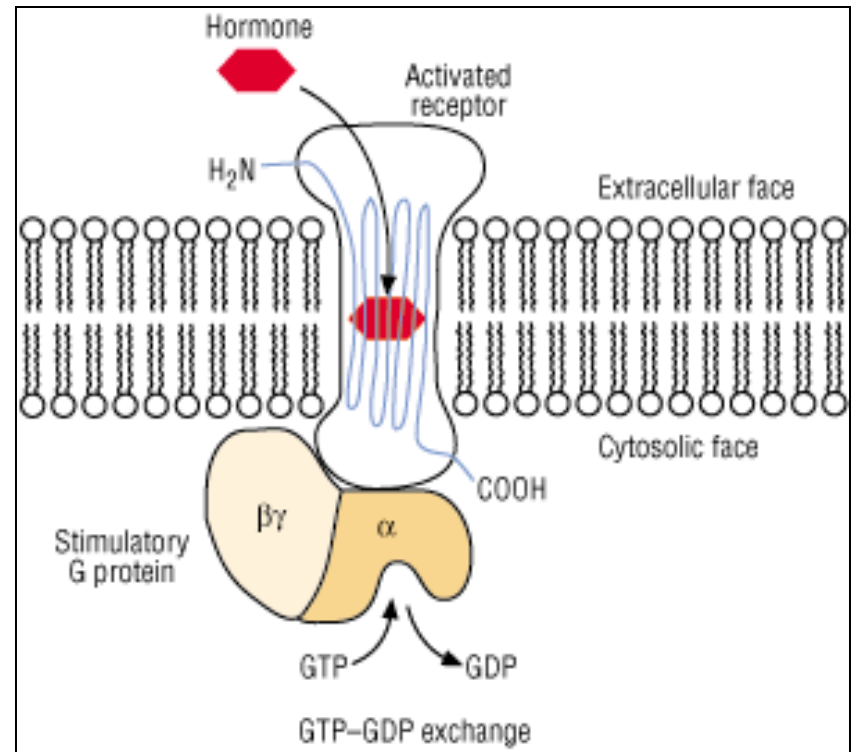


Membrane Proteins Form a Mosaic

- Categories of membrane proteins
 - Receptor Proteins
 - Recognition Proteins
 - Enzymatic Proteins
 - Adhesion Proteins
 - Transport Proteins

Functions of membrane proteins

- **Receptor proteins** bind to specific molecules found outside the cell (like hormones) and trigger changes in cell action



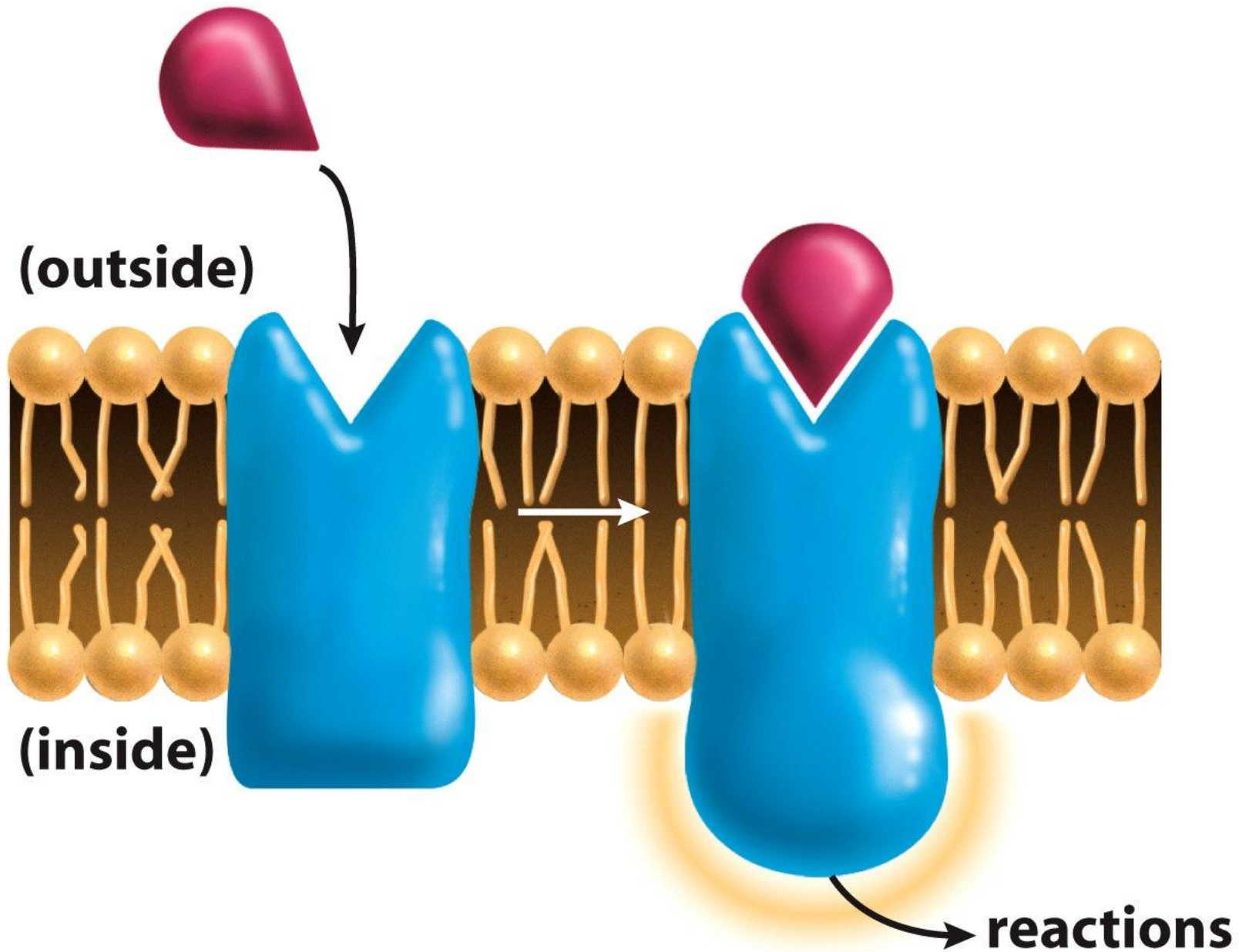


Figure 5-5 Biology: Life on Earth, 8/e
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Membrane Proteins Form a Mosaic

- **Recognition Proteins**
 - Serve as identification tags on the surface of a cell
 - Often times these are **GLYCOPROTEINS**-proteins with an attached small sugar molecule (called an oligosaccharide)

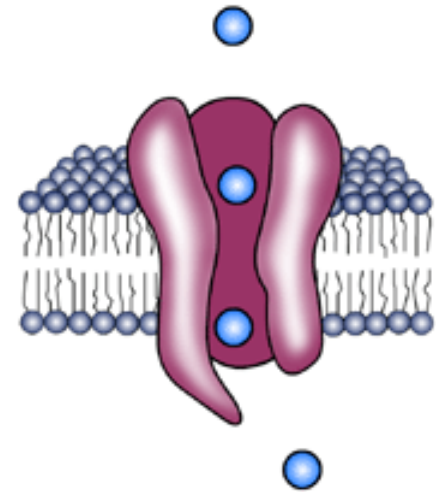
Membrane Proteins Form a Mosaic

- **Enzymes**
 - Promote chemical reactions that synthesize or break apart biological molecules

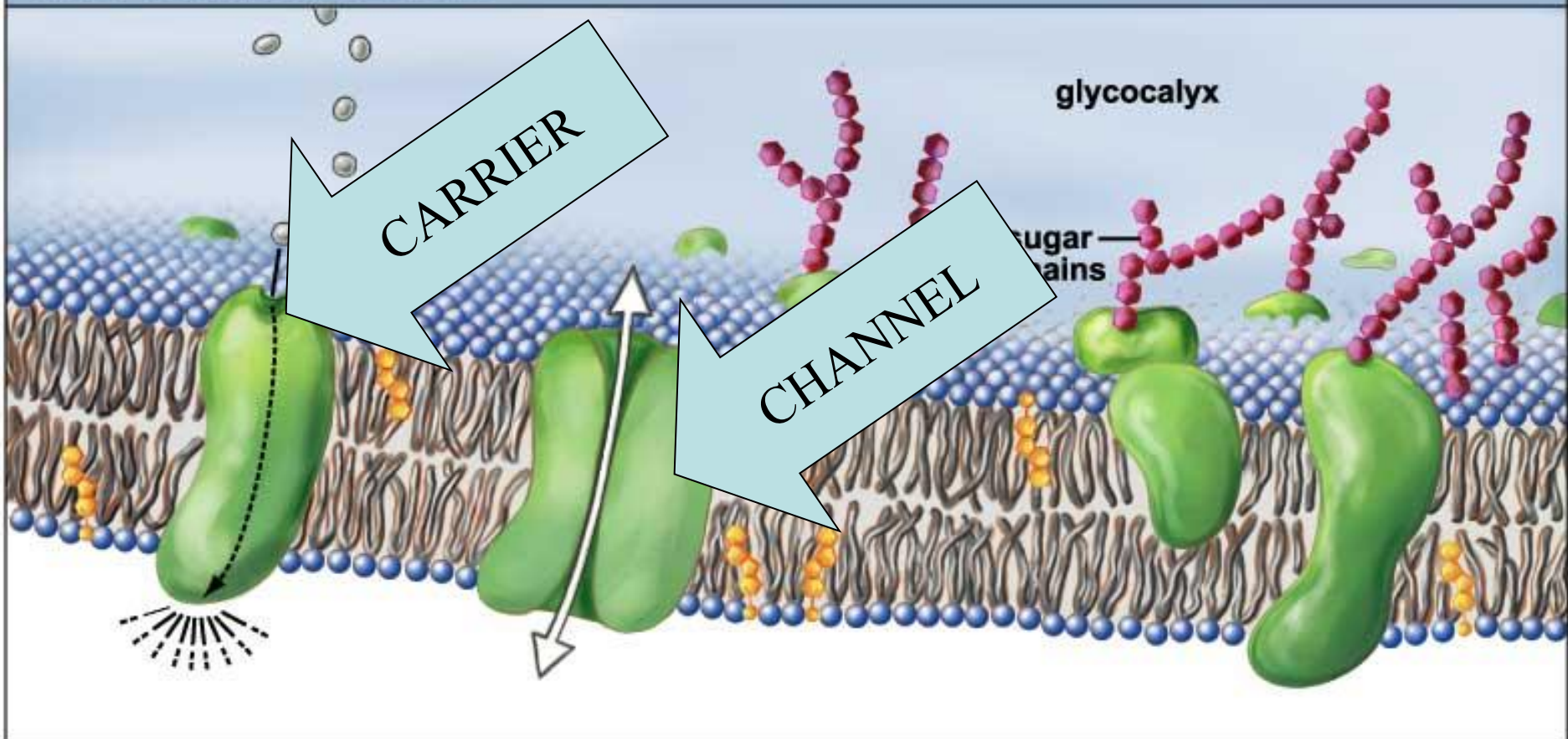
Membrane Proteins Form a Mosaic

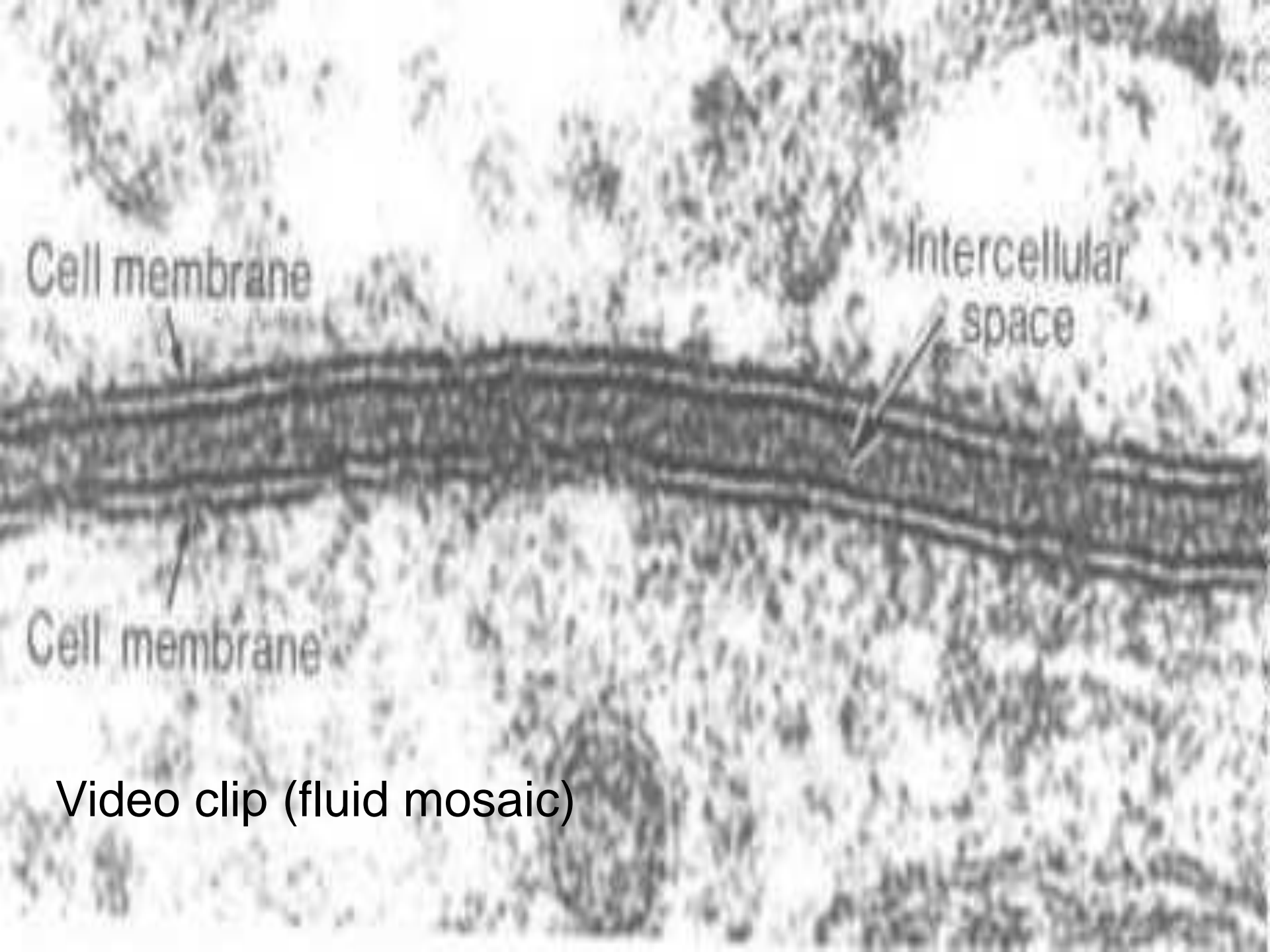
- **Adhesion Proteins**
 - Anchor the cell membrane to inner cytoskeleton, to proteins outside the cell, and to other cells

- **Transport proteins** allow substances to move into or out of the cell through the membrane
 - **Channel proteins** serve as pores through which substances can move
 - **Carrier proteins** bind specific substances and change shape to force the material across the membrane (some need energy input to work)



THE PLASMA MEMBRANE





Cell membrane

Intercellular space

Cell membrane

Video clip (fluid mosaic)