

# The Cell Membrane

---

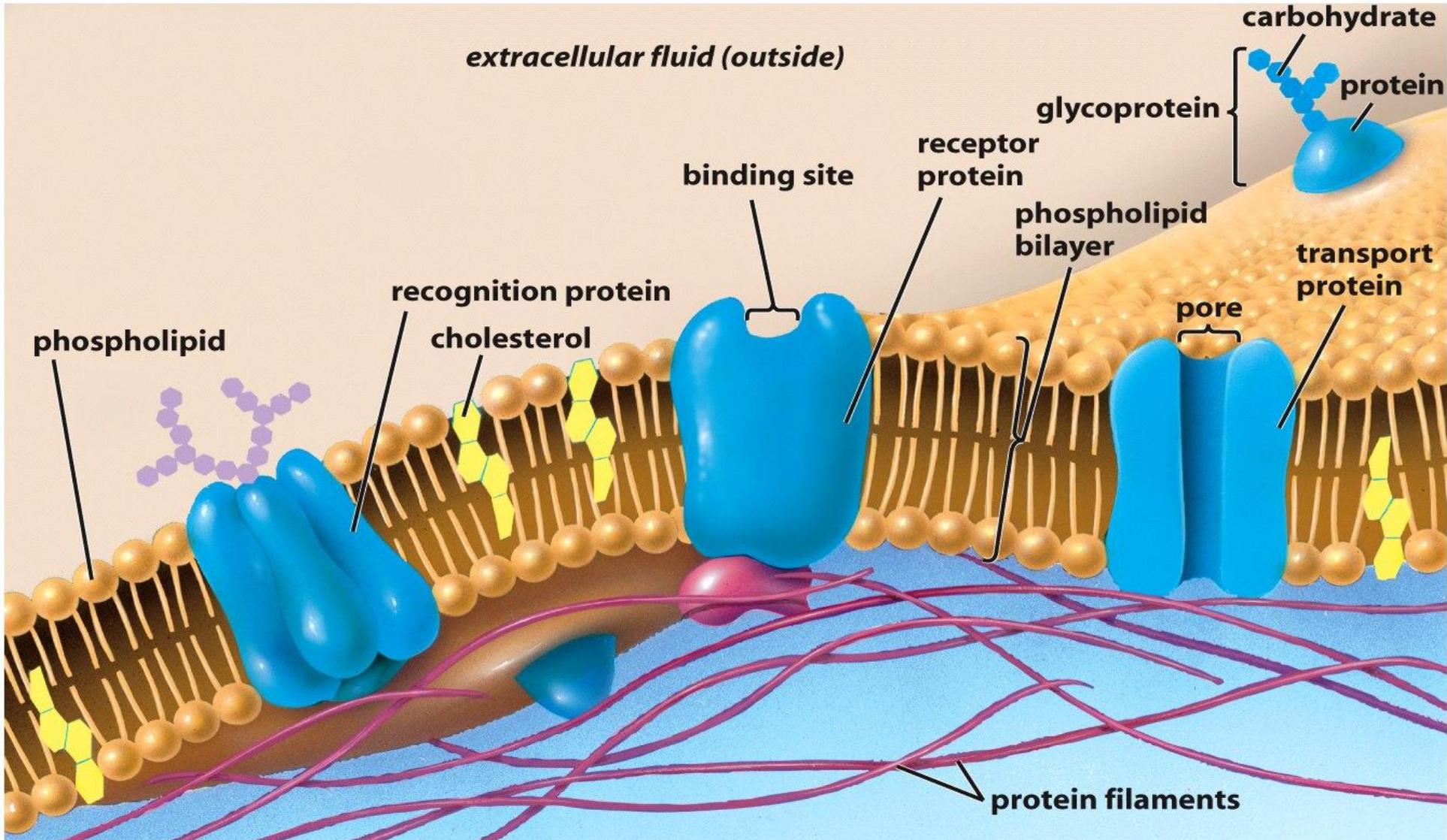
*Question of the Day:*

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

# Big Idea

---

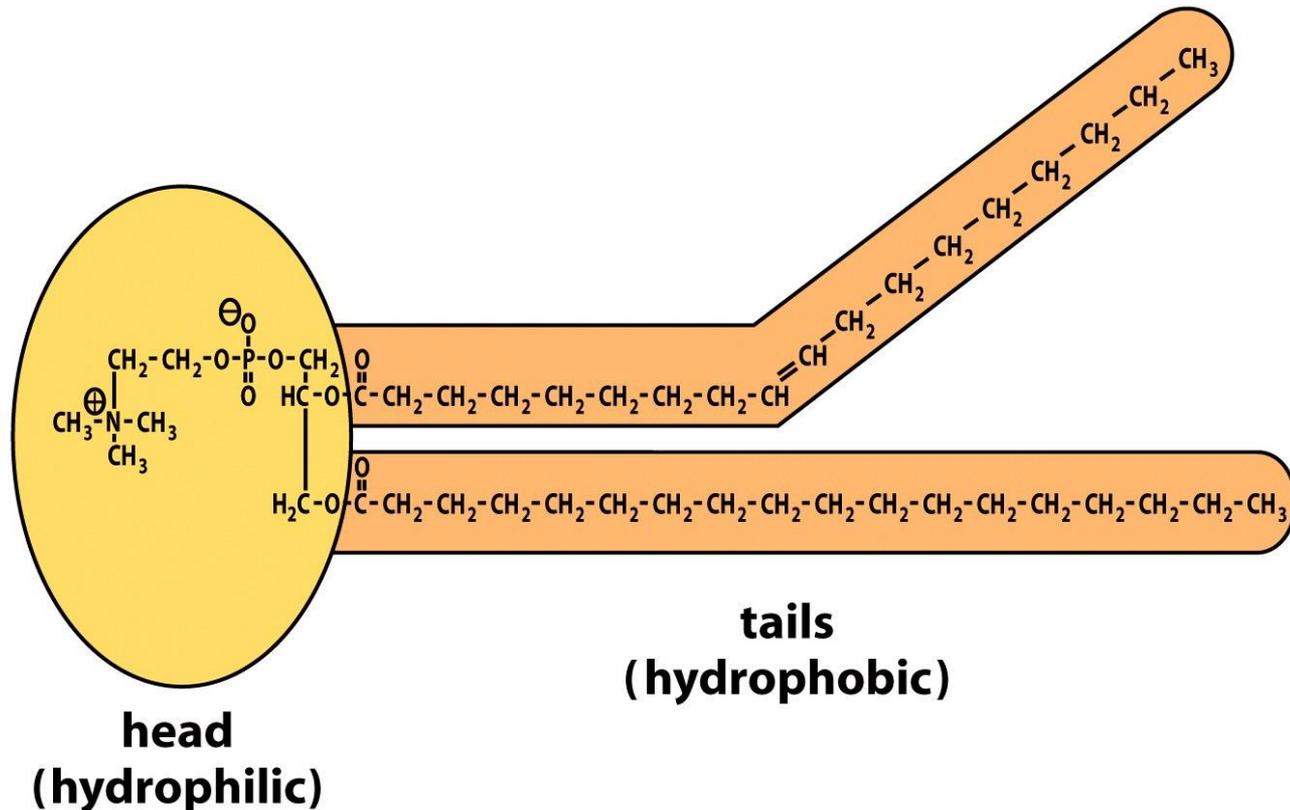
- Membranes are “**Fluid Mosaics**” in which proteins move within layers of lipids
- The **phospholipid bilayer** is the fluid portion of the membrane
  - A **mosaic of proteins** is embedded in the membrane
  - Membranes are dynamic, ever-changing structures



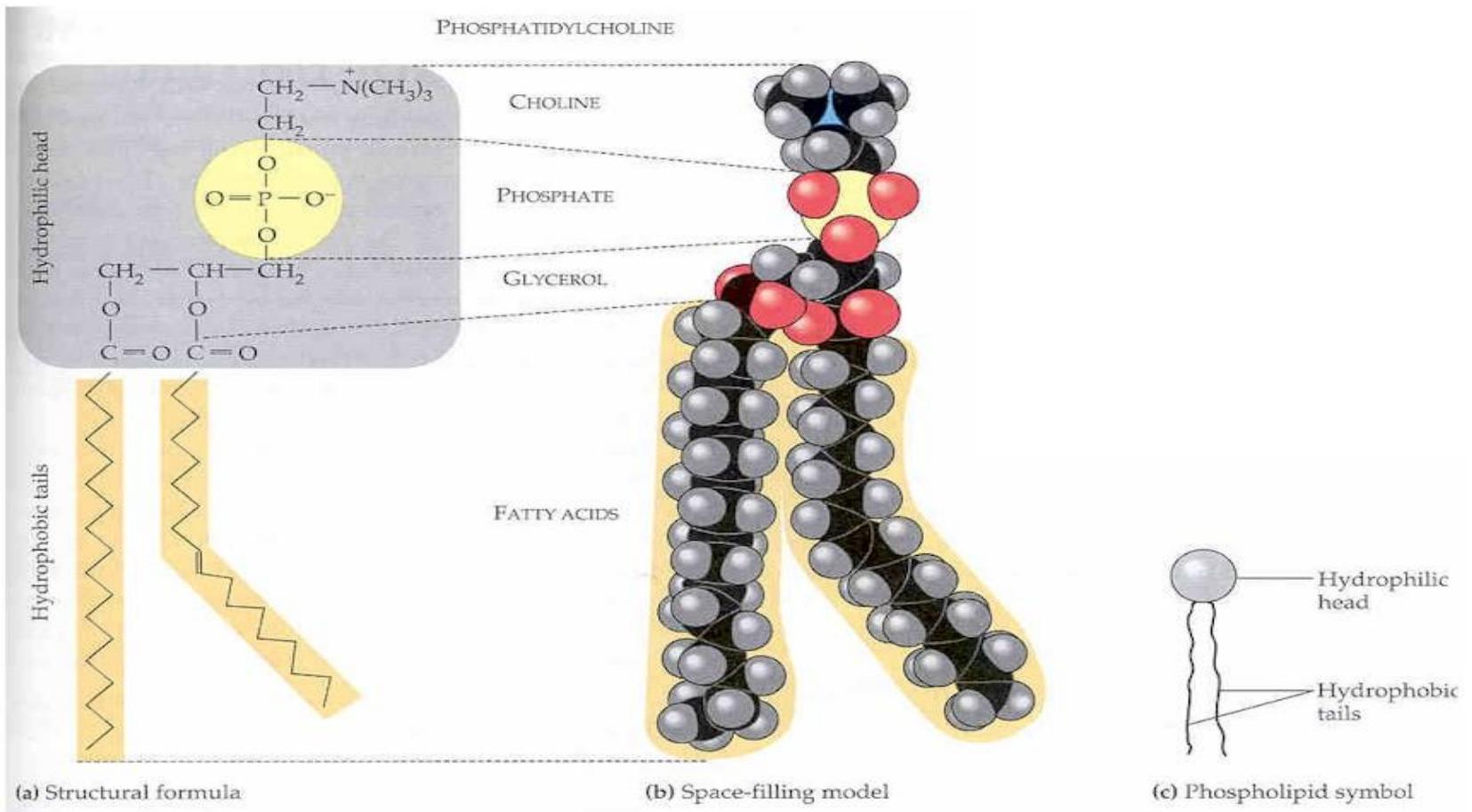
The plasma membrane is a bilayer of phospholipids that form a fluid matrix in which various proteins (blue) are embedded. Many proteins have carbohydrates attached to them, forming glycoproteins. Three of the five major types of membrane proteins are illustrated here: recognition, receptor, and transport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

# The Phospholipid Bilayer

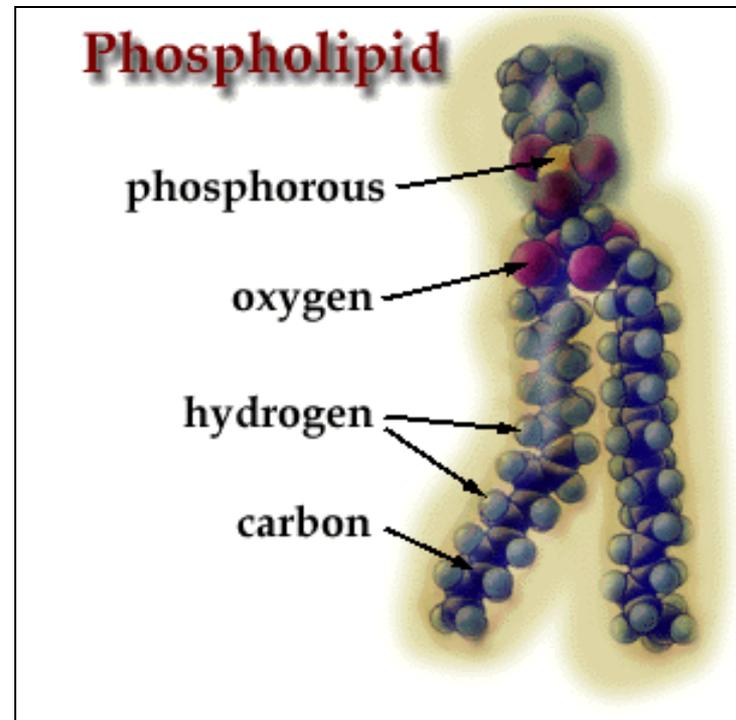
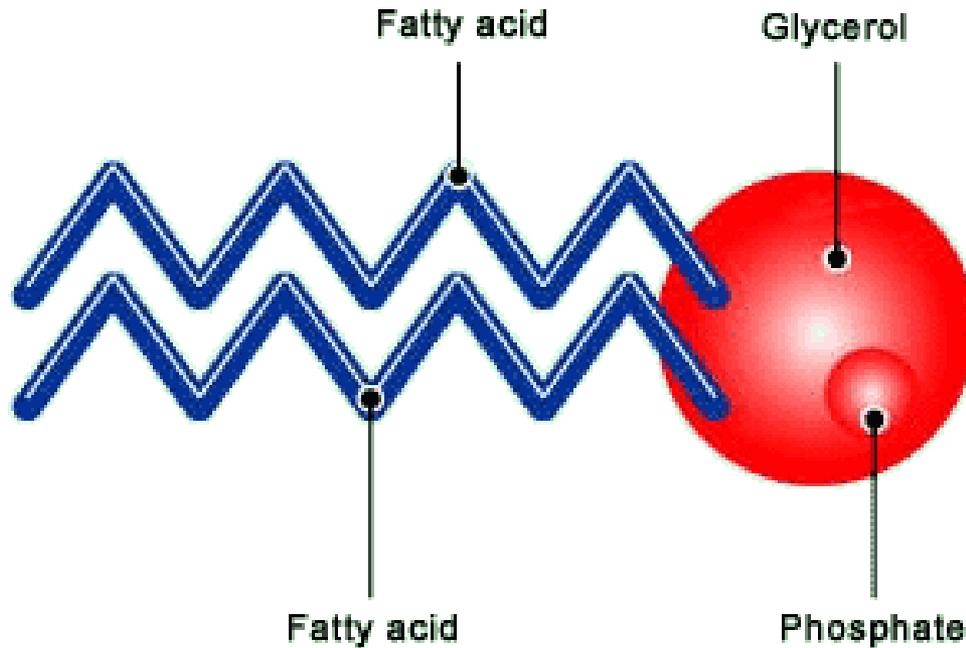
Phospholipids are the basis of membrane structure



# Head is a phosphate bonded to a glycerol



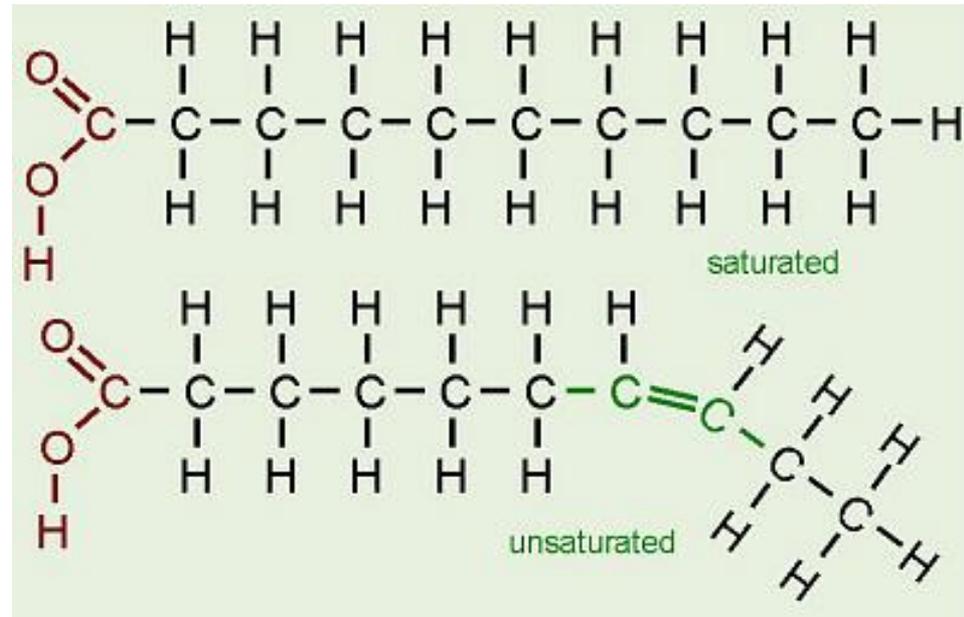
Tails are **fatty acids** (chains of hydrogen and carbon atoms, termed “**hydrocarbon chain**”)



# Hydrocarbon tail can be saturated or unsaturated

- **Saturated**

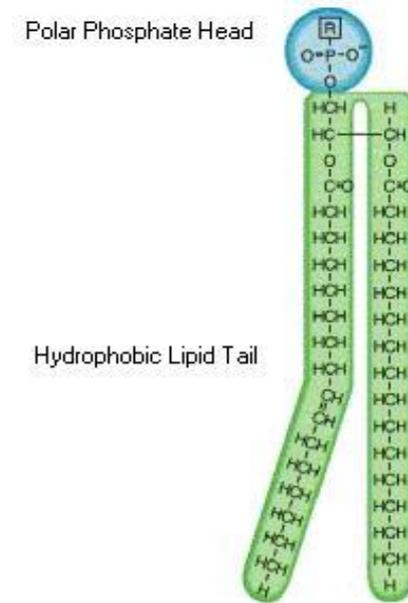
- Have as many hydrogen present as can bond to the carbons (so they lack double bonds between the carbons)
- Causes a straight chain (which decreases fluidity of the membrane)



# Hydrocarbon tail can be saturated or unsaturated

- **Unsaturated**

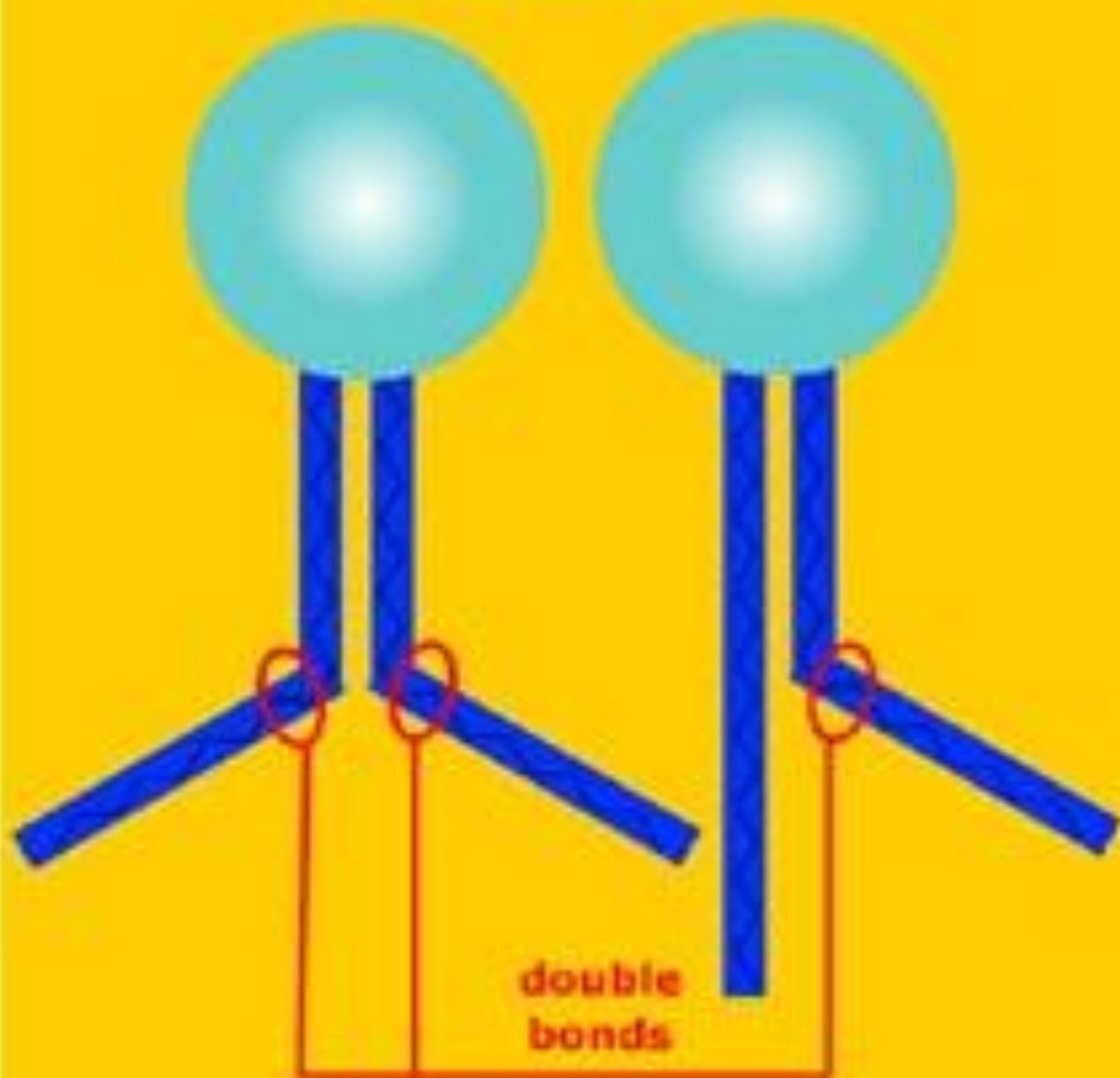
- Have fewer hydrogen present then can bond to the carbons (so there are double bonds between the carbons)
- Causes kinked chains (which increases fluidity in the membrane because kinks at the carbon-to-carbon double bond hinder close packing of phospholipids.)

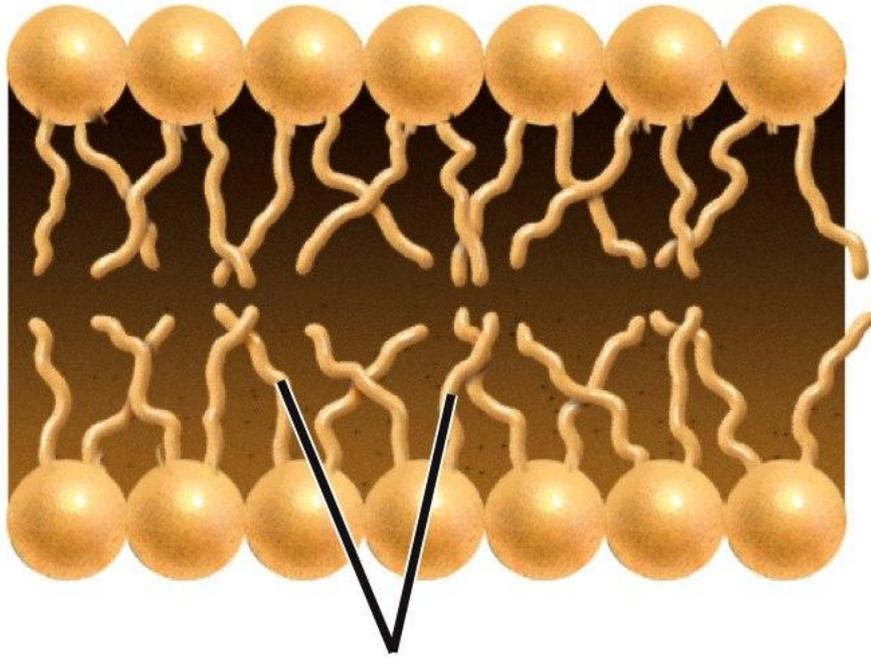


**Saturated**

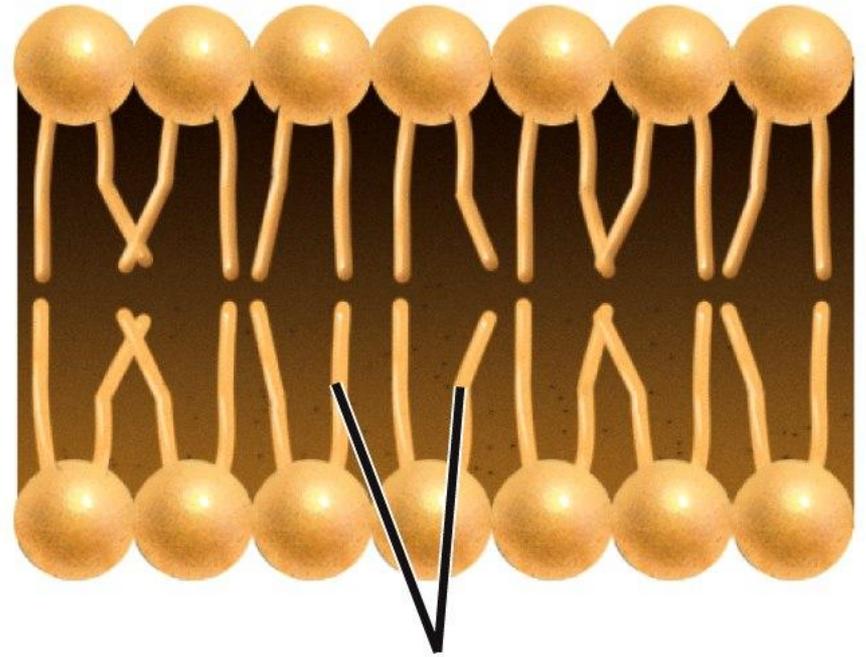


**Unsaturated**





**more fluid**



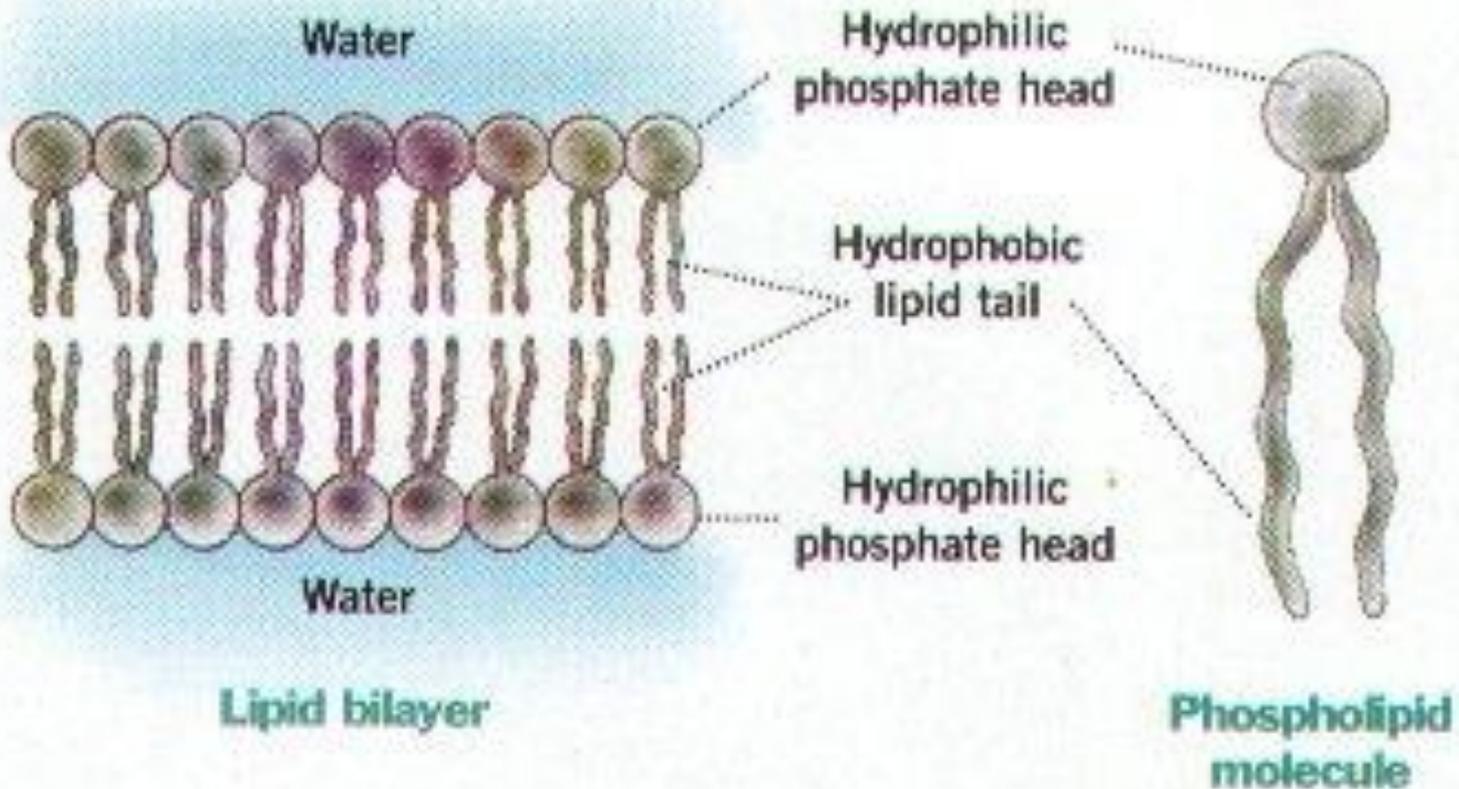
**less fluid**

Figure 5-4 Biology: Life on Earth, 8/e  
© 2008 Pearson Prentice Hall, Inc.

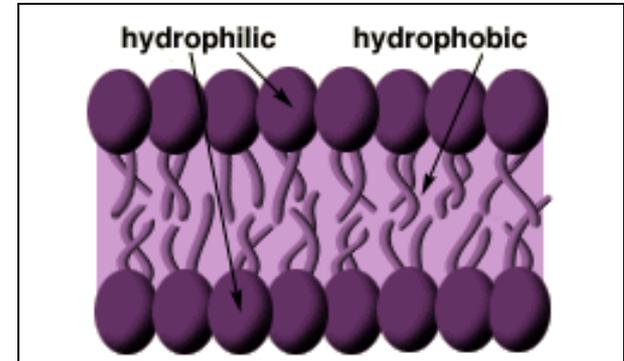
# The Phospholipid Bilayer

---

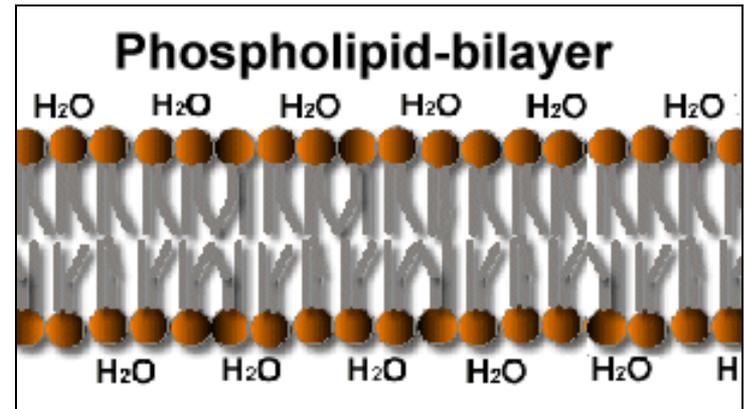
- The cell exterior and interior face watery environments



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



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



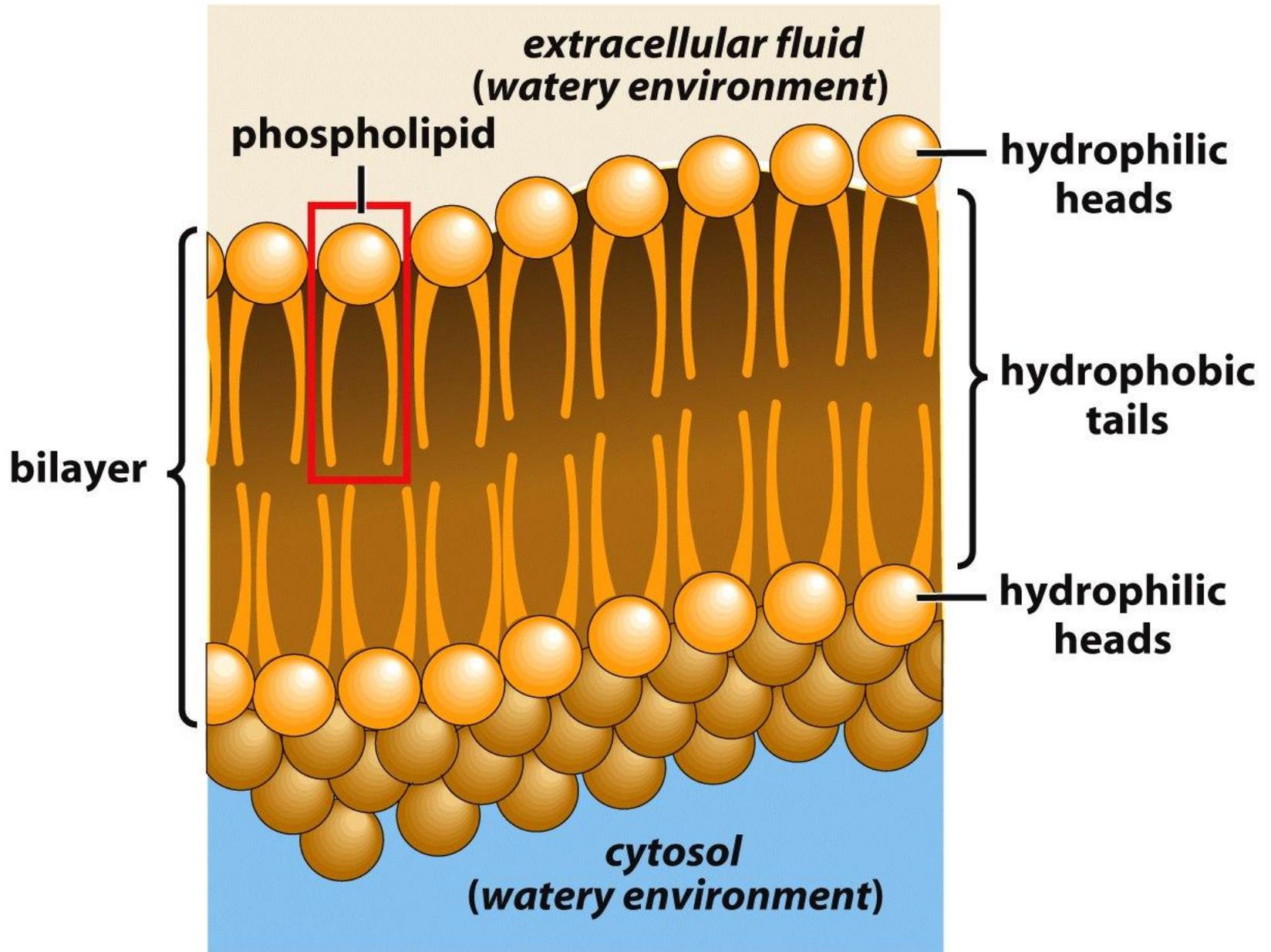


Figure 5-3 Biology: Life on Earth, 8/e  
© 2008 Pearson Prentice Hall, Inc.

# Why called “FLUID”

---

Phospholipid bilayer is flexible, allowing for cellular shape changes

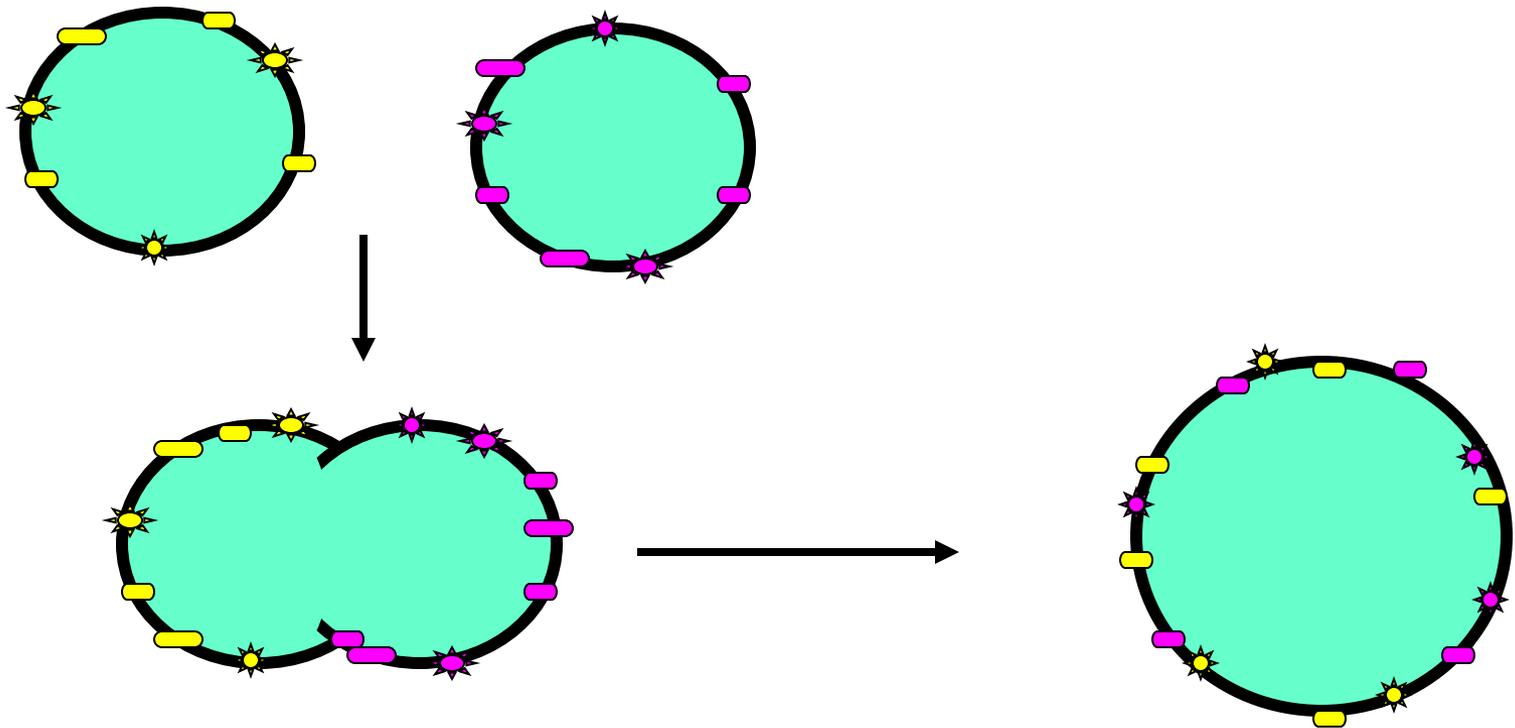
Membrane lipids (and some proteins) can drift laterally within the membrane.

- 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.

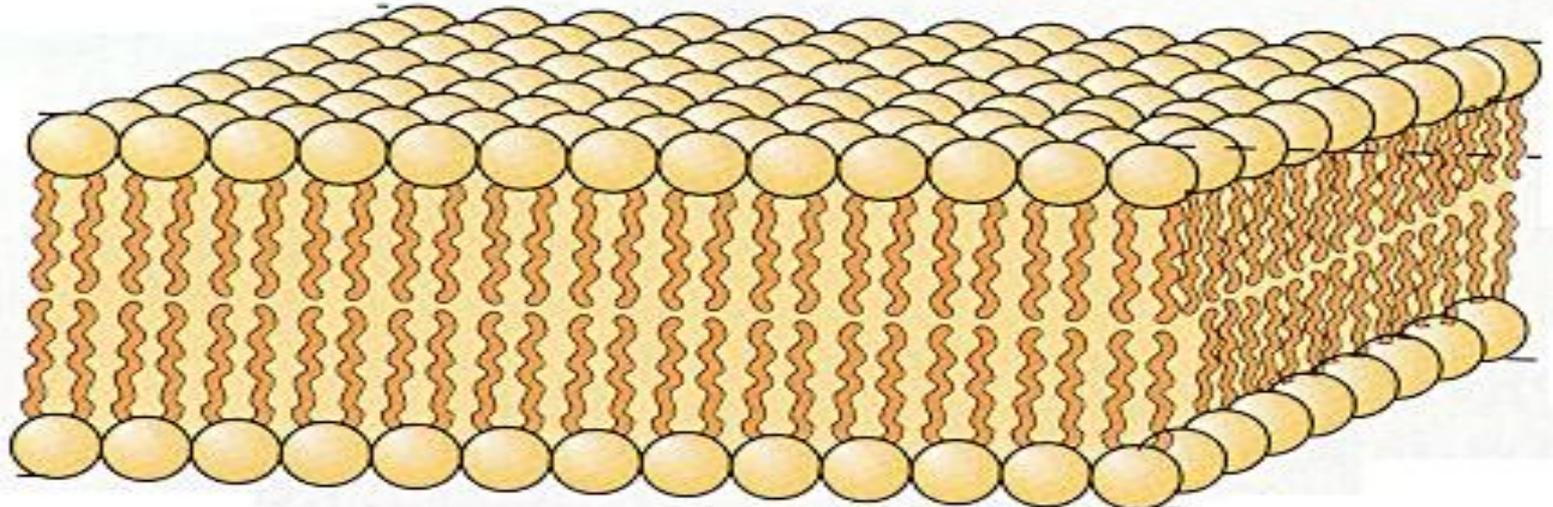
# Evidence for the Fluid Mosaic Model (cell fusion experiment)



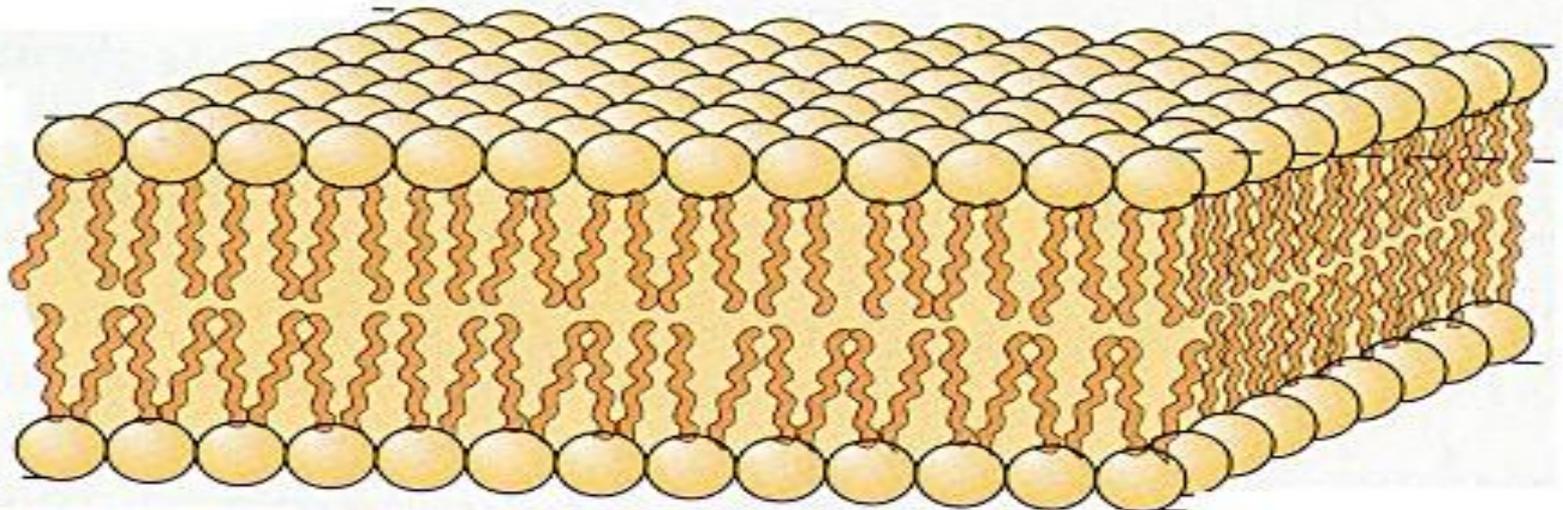
Membranes must be fluid to  
work properly!!!!

**gel phase--low temperatures**

**hydrocarbons are tightly packed**

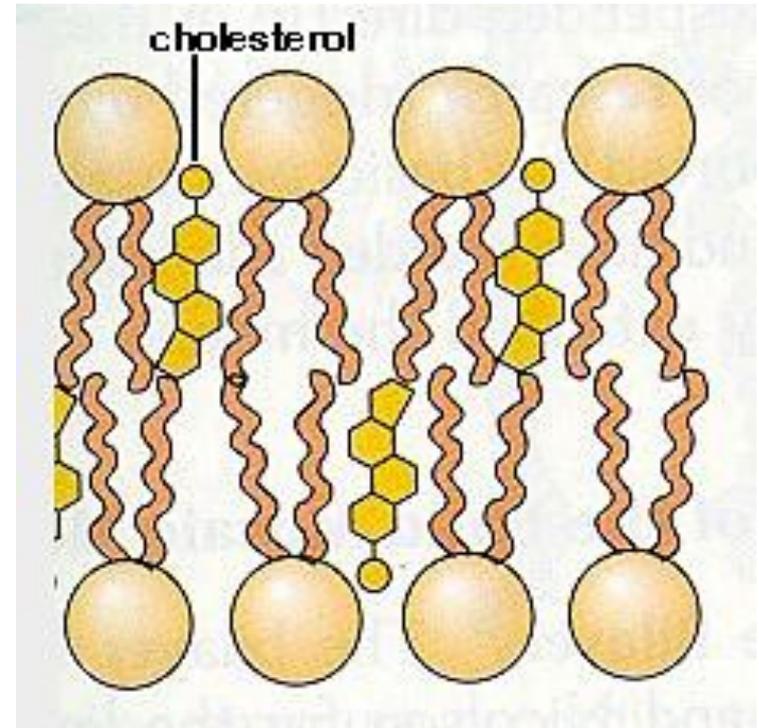


**at higher temperatures--moves to fluid phase**



**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

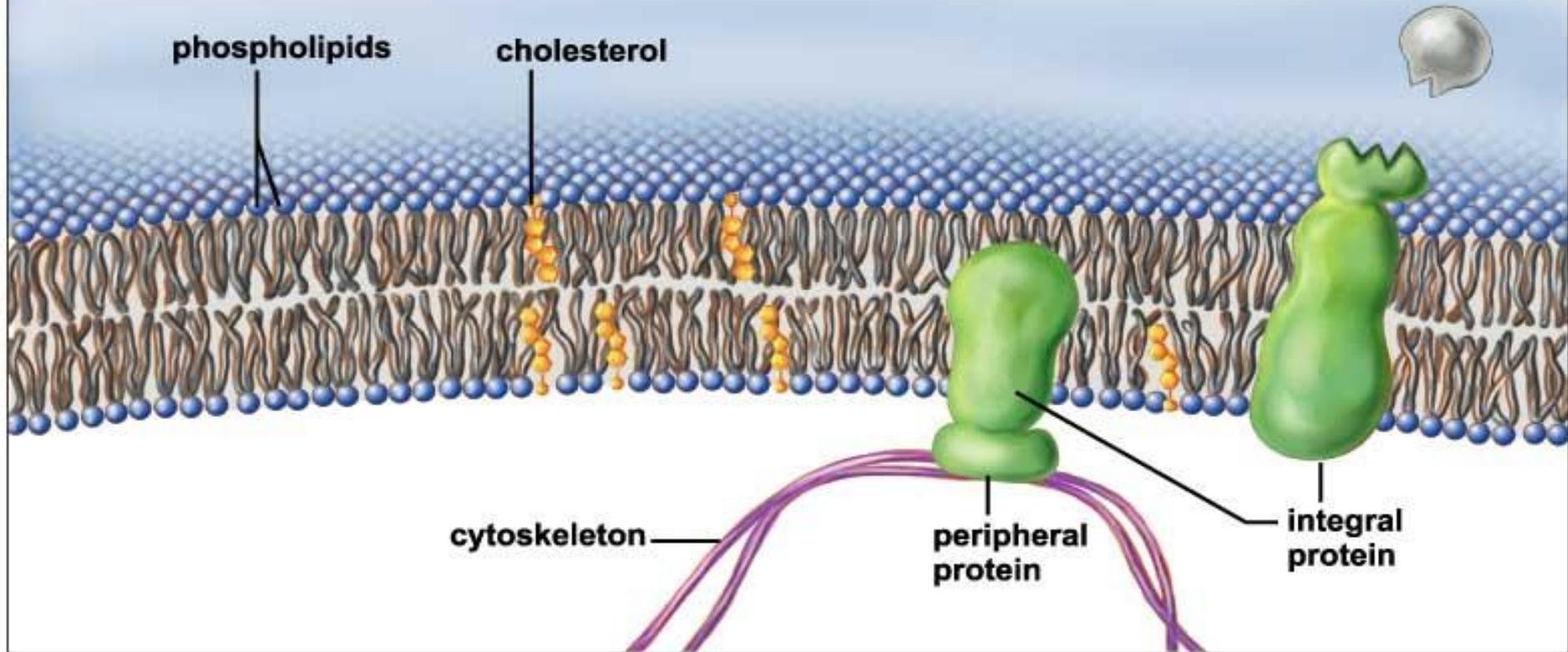


# Membrane proteins form a “Mosaic”

---

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

## THE PLASMA MEMBRANE



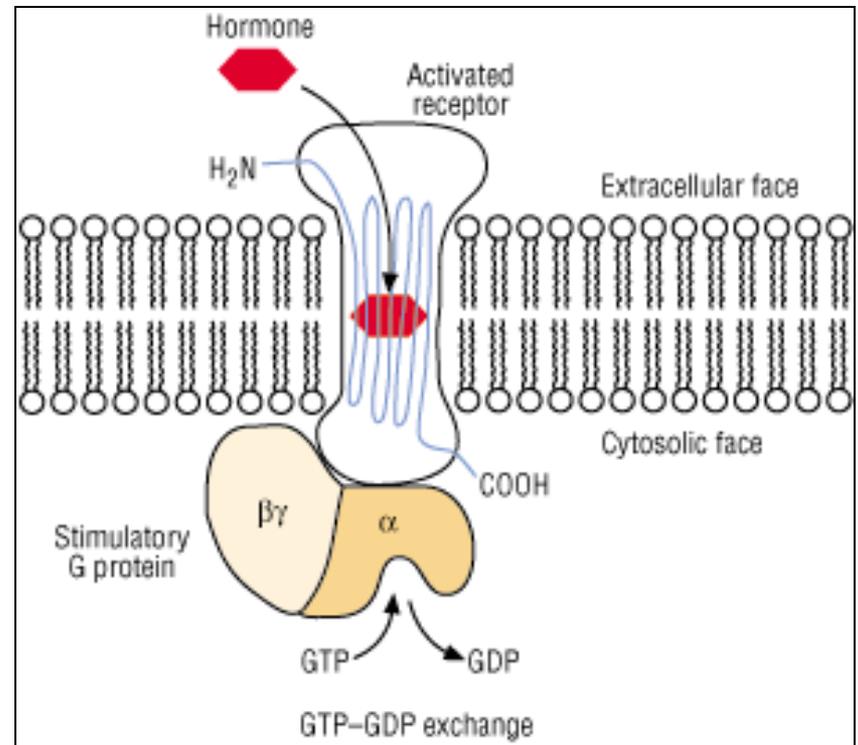
# Membrane Proteins Form a Mosaic

---

- 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



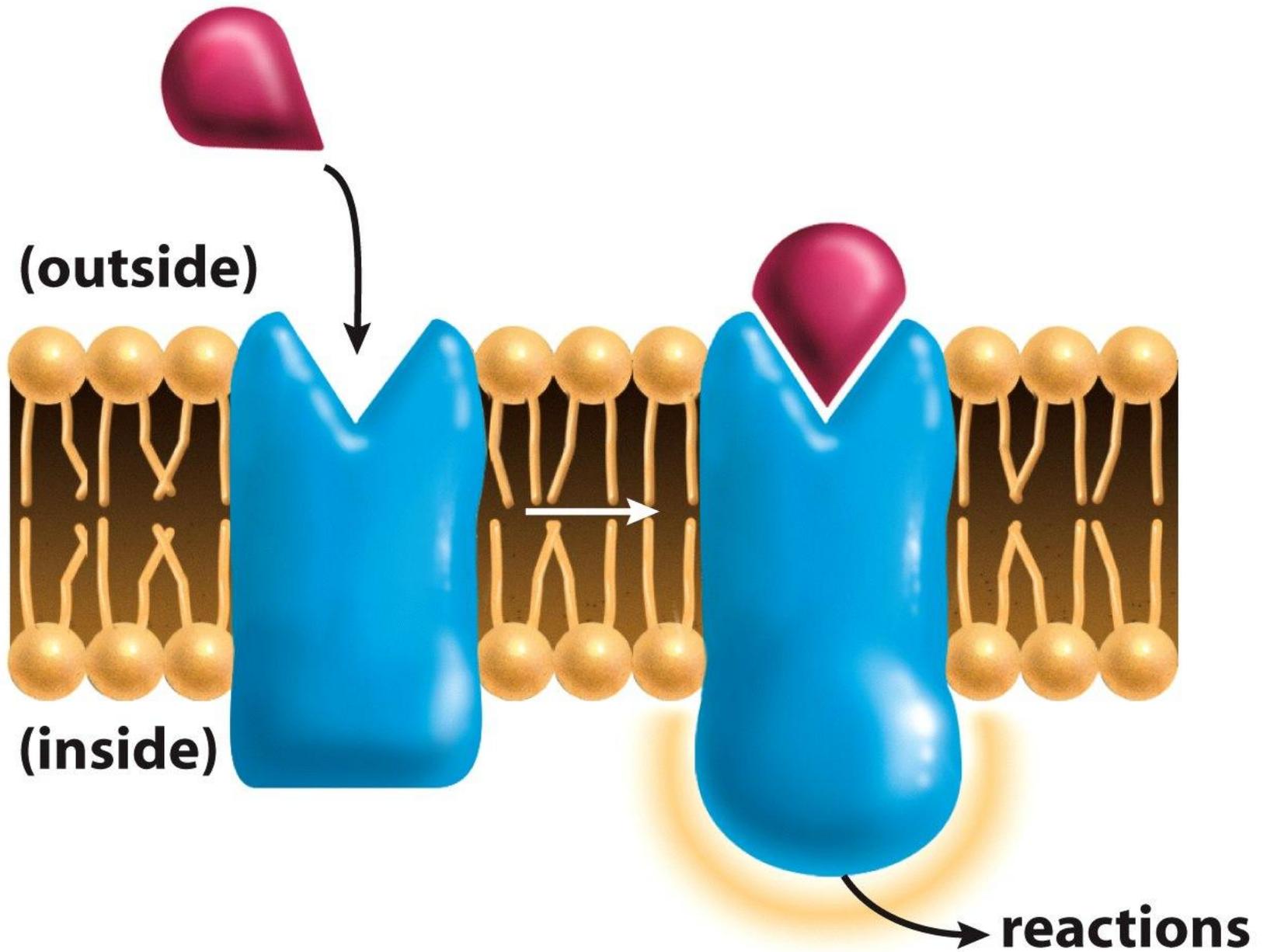


Figure 5-5 Biology: Life on Earth, 8/e  
© 2008 Pearson Prentice Hall, Inc.

# 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

---

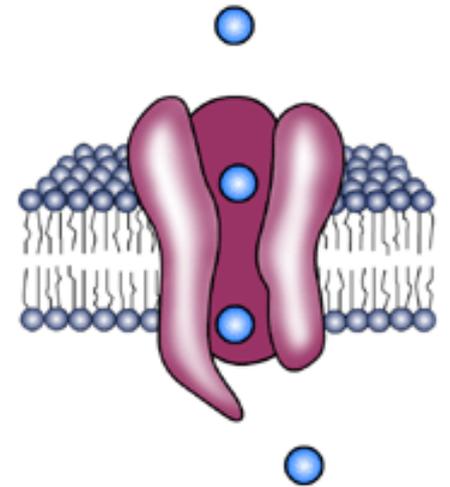
- **Enzymes**
  - Promote chemical reactions that synthesize or break apart biological molecules

# Membrane Proteins Form a Mosaic

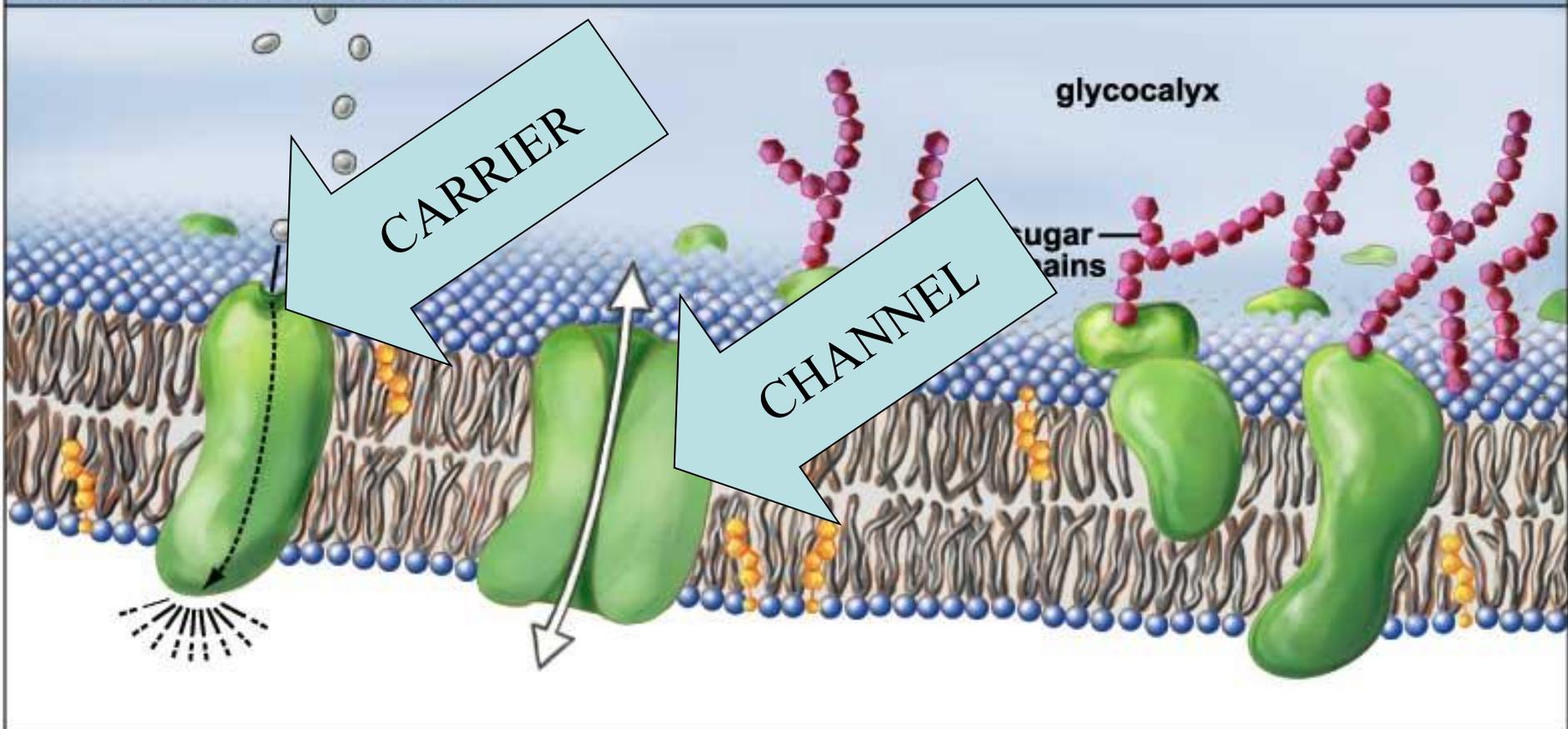
---

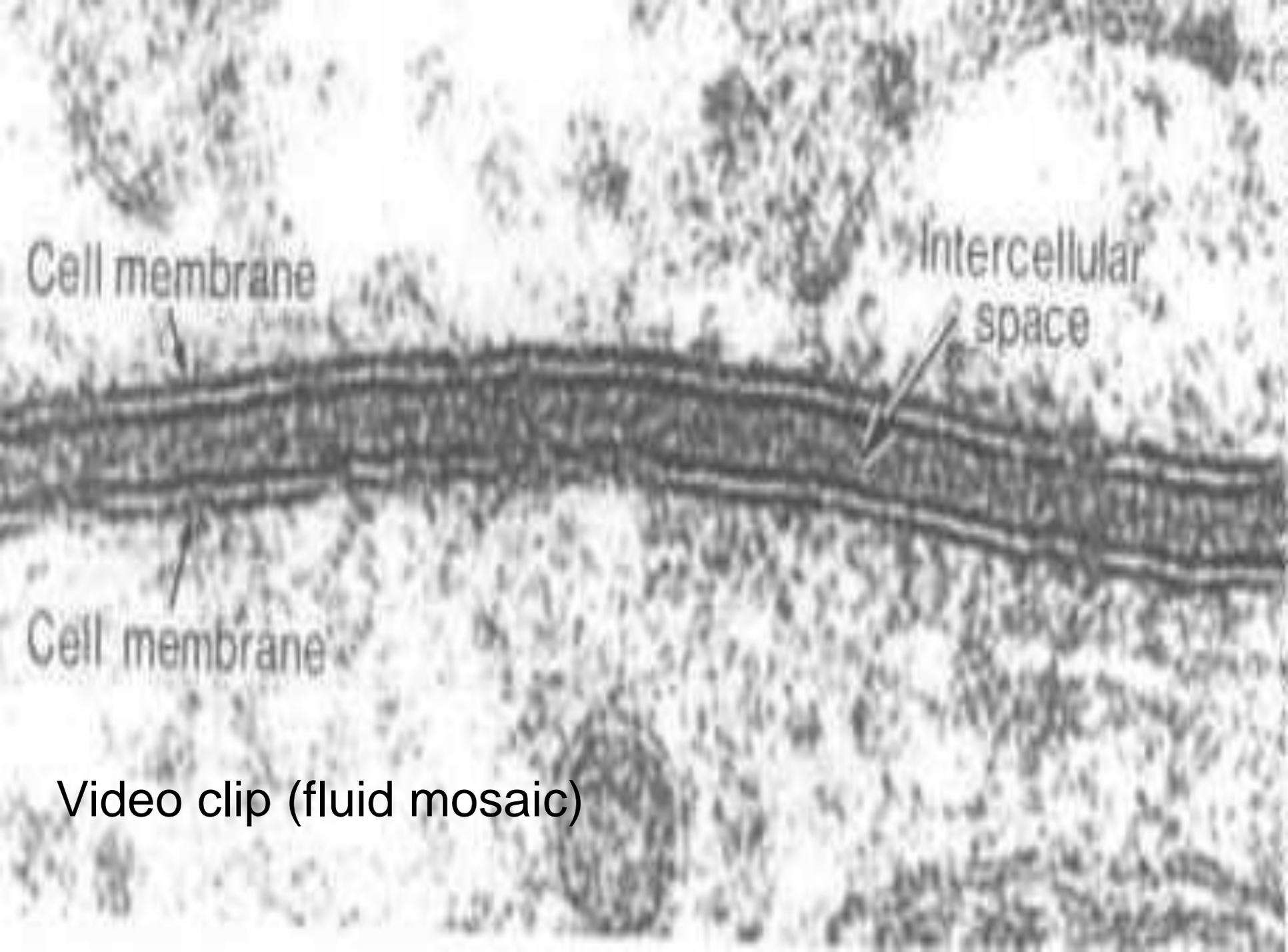
- **Adhesion Proteins**
  - Anchor the cell membrane to inner cytoskeleton, to proteins outside the cell, and to other cells

- **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)