

Chapter 5 – Lipids, Membranes, & Cell Compartments

Part 1 – Membrane Structure & Function

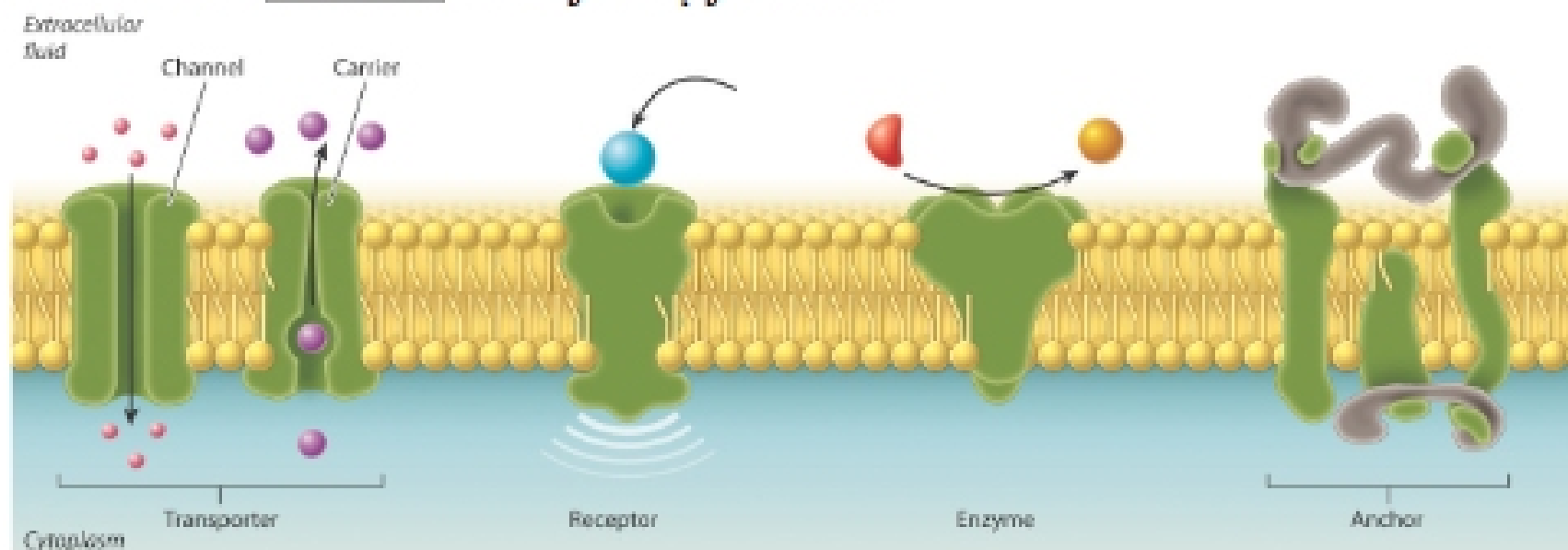
I. Lipids (Phospholipids)

- A. Phospholipids are **amphipathic** (hydrophilic/phobic)
- B. When placed in water, the polar heads spontaneously orient to interact with water, and the tails orient to interact with each other, making sphere →
- C. Membranes are **fluid**; lipids move (rotate/migrate) within a layer, but never switch layers
 - 1. Fluidity critical to function – cell changes membrane chem. to keep fluidity constant under changing conditions
- D. **Variable**
 - 1. Tails of phospholipids can be variable in their saturation (bent vs. straight) – not always 1 bent & 1 straight
 - a. **Tighter packing due to more saturated** (long/straight) fatty acid tails = increased weak interactions between phospholipids = **less membrane fluidity**
 - 2. Head groups may differ in size, shape, or charge

II. Lipids (Cholesterol) - Stabilize fluidity of animal membranes

III. Proteins

- A. Contained in most (99.9%) of membranes
- B. Bigger than phospholipids (& move less)
- C. **Give membrane function**. *Classified by function:*



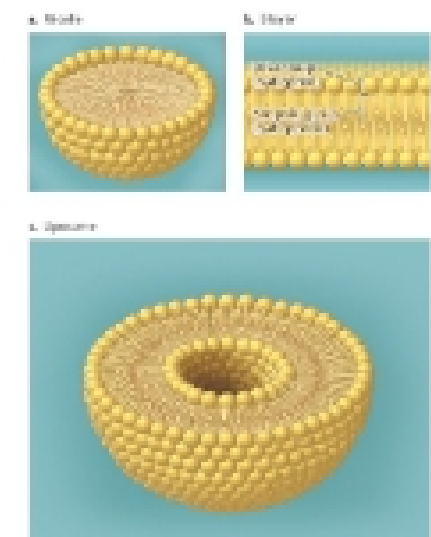
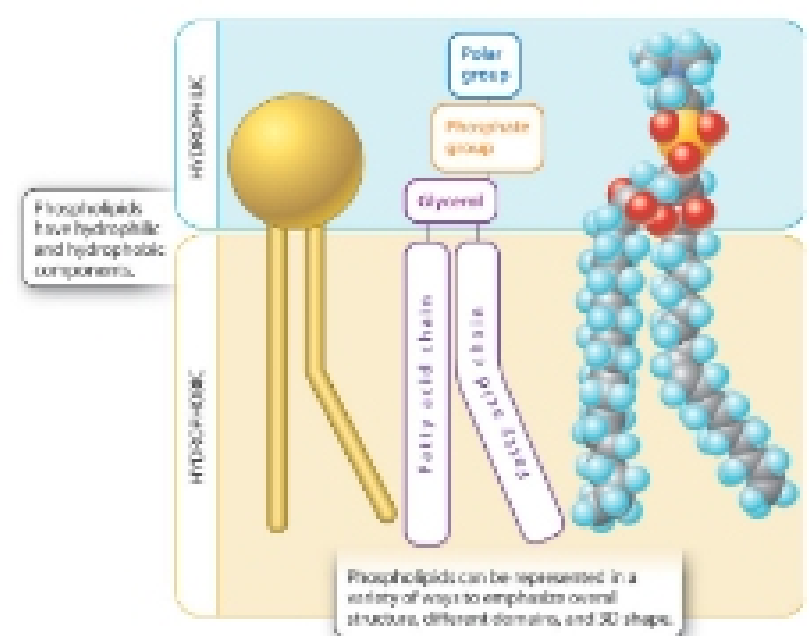
- 1. Allow materials to move across membrane (**transporter**)
- 2. Receive info from environment & transmit it into the cell (**receptor**) (*ex. senses*)
- 3. Catalyze reactions (**enzymes**) (*could be flipped to other side of membrane*)
- 4. Anchor cell to other cells or help maintain cell shape (**Anchors**)

D. Give the membrane **structure**. *Classified by structure:*

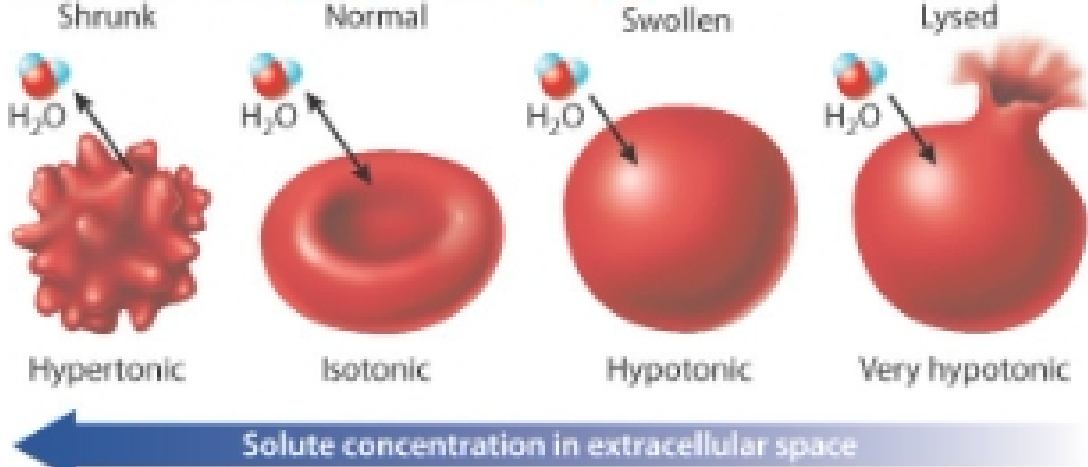
- 1. **Integral membrane proteins** – irremovable unless membrane is destroyed
 - a. **Transmembrane proteins** – many IMP's that **span** the membrane
 - b. Take form of alpha helices (secondary structure)
- 2. **Peripheral Membrane Proteins** – temporarily associate with membrane lipid or proteins through weak, noncovalent interactions

IV. All membrane components are **not uniform**

Part 2 – Membrane Function: Selective Barriers



Membranes Are Selectively Permeable, Based On:

- I. Incoming molecule's size
- II. Incoming molecule's charge
- III. Hydrophilic nature
- IV. Transmembrane concentration gradient (**diffusion force**)
 - A. Protein can facilitate diffusion
 1. **Channels** – just open & let it flow
 2. **Carriers** - proteins that bind to a molecule & change shape, which transports molecules across the membrane (not the same thing as a channel)
 3. **Active transport** – use energy & protein transporters to move against [] gradient
 - B. Osmosis: diffusion of H₂O
 1. Ex. in kidneys – aquaporin (protein) utilized in absorbing excess H₂O into nephrons
 2. Water diffuses across membranes in response to relative solute concentrations
 - a. **Hypertonic** environment: more concentrated than cell
 - b. **Isotonic**: concentration = to cell
 - c. **Hypotonic**: less concentrated than the cell
 - i. These 3 are describing environment relative to cell, but can be flipped to describe cell environment relative to outside environment
 - d. Effect of carrying tonicity – **fig. 5.14**
 - i. Hypertonic environment (outside cell) – cells shrink (H₂O leaves cell)
 - ii. Isotonic – no change (H₂O in = H₂O out)
 - iii. Hypotonic – cells swell (H₂O rushes in)

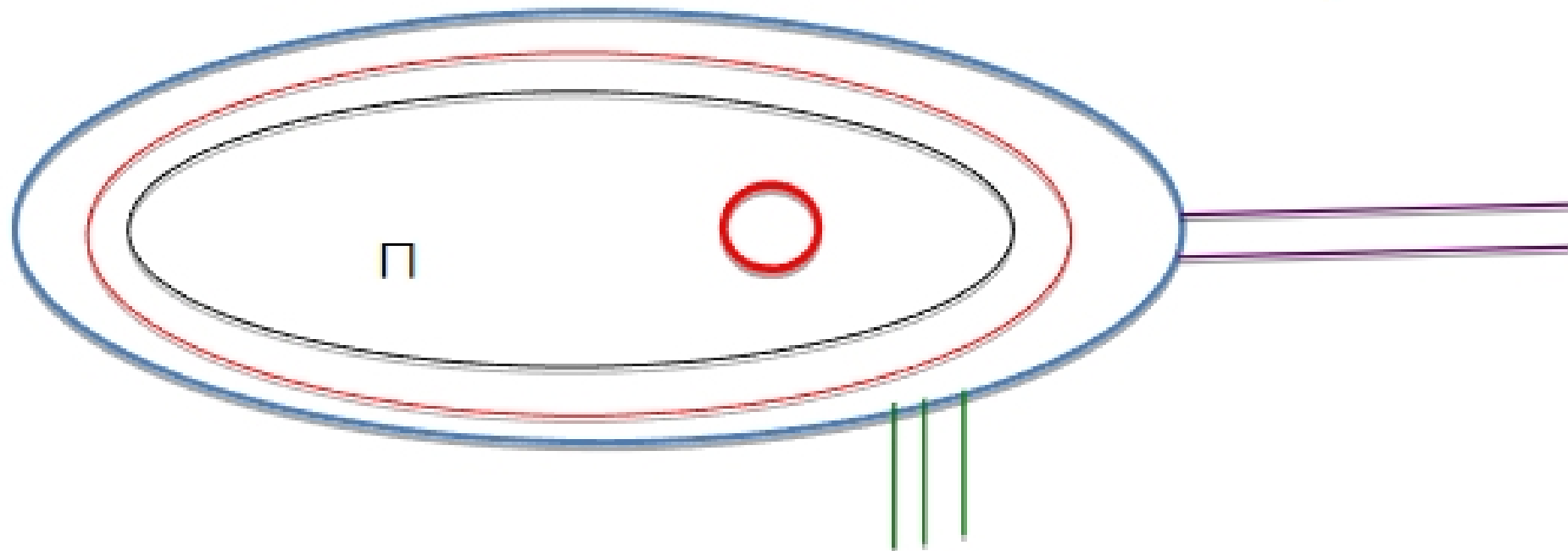
Part 3 – Introduction to Cells

- Vary in size, & are much bigger the molecules they contain

I. Typical PROKARYOTIC Structure

- A. Plasma membrane
- B. **Cell wall** made of peptidoglycan
- C. **Glycocalyx**: outer gelatinous covering
- D. **Flagella** (sometimes present) – can be grown/reabsorbed as needed
- E. **Pilli**: to attach or pick up DNA – covers surface
- F. **Ribosome** (□) – lots present
- G.

Nucleoid: region where circular chromosome is found



H. *Transcription & translation both happen in prokaryotes*

II. Typical EUKARYOTIC Cell Structure

- A. More variable externally
- B. More complex internally
- C. **Everything inside the membrane is the cytoplasm**
 - 1. *Nucleus is often not considered part of the cytoplasm*
 - 2. **Cytosol**: region inside the plasma membrane, but outside the organelles
 - a. 20-50% of cell volume
 - b. Site of chemical reactions
 - c. Contains ribosomes (ribosomes **are not** organelles)
 - d. Contains dense network of protein filaments (**cytoskeleton**)
 - i. Provides cell shape, organization, & movement
 - ii. Dynamic & highly regulated
 - iii. Protein constituting cytoskeleton is extremely dense (all over the cell)
- D. Plasma membrane is part of the **endomembrane system (ES)**: a membrane network in eukaryotic cells
 - 1. **ES** – includes membrane & membrane-bound organelles, which all interact

Endomembrane System

I. Nuclear Envelope