Chapter 11 video lecture

1. The lipid bilayer
    a. The fluid mosaic model
        i. A theory about how the lipid bilayer is put together
        ii. Globular integral membrane proteins- mobile within a set of phospholipids and cholesterol
    b. Mostly made up of lipids and proteins
2. Cell membranes act as selective barriers
    a. The contents inside the cell is different from the environment from outside the cell
    b. Eukaryotic cell has an organelle inside the cell
    c. Membrane prevents molecules on one side of the membrane from mixing with those on the other
    d. Also lets thru the important molecules
    e. Plasma membrane- encloses the cell
    f. Internal membrane (eukaryote) enclosing an intracellular compartment
3. The membrane
    a. Involved in communication, import/export, and growth/ movement
    b. Receptors- sensors for receiving information
    c. Channels and pumps- import and export of molecules
    d. Cytoskeleton
        i. Adding a new membrane
        ii. Capacity for movement and expansion
4. Membranes allow cell compartments: organelles
    a. Allows chemical reactions to be separated from each other
    b. Eukaryotes are the only cells with membrane bound organelles
    c. Protects vital structure (DNA) (nuclear envelope)
    d. Double membranes
        i. Nucleus
        ii. Mitochondrion
        iii. Peroxisomes
        iv. Lysosomes
        v. Golgi
        vi. Chloroplasts (plants)
5. Membrane lipids
    a. A phospholipid:
        i. Hydrophilic head = eater loving
        ii. Hydrophobic tails = water fearing
    b. Amphipathic- both hydrophobic/philic properties
        i. Applies to most phospholipids and membrane proteins
    c. Most abundant= phospholipids
        i. If done by weight its actually 50% proteins
6. Amphipathic

a. Hydrophilic- water lovers
    i. Dissolves readily in water- charged atoms or polar groups
    ii. Ex. acetone
b. Hydrophobic- water haters
    i. Insoluble in water- uncharged and nonpolar
    ii. Ex. Methylpropane
c. These properties are important for molecular organization
    i. The lipid membrane (inside) is hydrophobic
    ii. Polarity if amino acids effects protein folding (3D)
    iii. Surfaces of the membrane are hydrophilic

7. Phosphatidylcholine
    a. Most common phospholipid in cell membranes
8. Different types of membrane lipids
    a. All are amphipathic
    b. Ex: cholesterol (sterol), glactocerebroside (glycolipid), phosphatidylserine (phospholipid)
    c. Fat molecules are hydrophobic... phospholipids are amphipathic
9. Phospholipid bilayers spontaneously close
    a. Energetically unfavorable when edges are exposed to water
    b. Forms sealed compartments which makes it energetically favorable.
        i. Fundamental to creation of living cells
10. Liposome
    a. Pure phospholipids added to water
    b. Sphere of phospholipids with water on the inside and the outside
11. Phospholipids can move within the plane of the membrane
    a. Lipids move around in the membrane
        i. Proteins are required to "flip-flop" to occur
        ii. Flipping from one layer to the other doesn't happen frequently
        iii. Switching places happens frequently
    b. Lipids aren't static
12. Lipid bilayer fluidity
    a. Lipid rafts- specialized membrane microdomains compartmentalize cellular processes by serving as organizing centers for the assembly of signaling molecules
        i. Influence membrane fluidity and membrane protein trafficking
        ii. Regulate neurotransmission and receptor trafficking
        iii. More ordered and tightly packed then the surrounding bilayer, but float freely in the bilayer
        iv. Have been reported in other parts of the cell like the golgi and lysosomes
    b. Transmembrane proteins
    c. 2 properties of hydrocarbon tails affect how tightly they pack together in the bilayer
        i. Length
            1. Shorter= decreases interaction of tails and increases fluidity
        ii. Number if double bonds they contain
            1. Double binds = kink in tail
                a. More difficult to pack against one another

    b. More unsaturated hydrocarbon tails= more fluid
        i. **UNSATURATED= LIQUID AT ROOM TEMP**
    c. Straight tails are saturated

13. Cholesterol
    a. In animal cells only
    b. Constitutes about 20% of the lipids in te membrane by weight
    c. Short and rigid= fills space between neighboring phospholipid molecules left by the kinks
    d. Stiffens the bilayer= more rigid and less permeable
14. Lipid bilayer is asymmetrical
    a. Two halves of bilayer have different sets of phospholipids and glycolipids
    b. The ones near the extracellular space are different from the ones near the cytosol
15. Different lipids play different roles
    a. Phosphatidylcholine- mainly structural, found on the outside
    b. Sphingomyelin- myelin sheathing, mostly outside, signaling
    c. Phosphatidylserine- found on inside, flips to outside during apoptosis
    d. Phosphatidylethanolamine- found on inside, involved in membrane fusion
    e. Glycolipids- provides energy and acts as cell surface maker
    f. Cholesterol- maintain fluidity and structure of the membrane
    g. Inositol phospholipids- important signaling molecules
16. Bilayer synthesis
    a. New membrane synthesis- occurs in the ER
    b. New membrane exported to other membranes by budding and fusion
        i. Bilayer pinches off from ER to form vesicles which can then be incorporated to another membrane fusing with it
    c. Orientation is maintained stays the same no matter where it is
17. Flippases
    a. Catalyze the transfer of phospholipid molecules opposite of monolayer
    b. Phospholipids flip flop from one layer to the other
        i. Can happen on purpose in an organized layer
    c. (cell exterior- asymmetric lipid bilayer of plasma membrane) --- (cytosol) → delivery of new membrane from ER → flippase catalyzes transfer of specific phospholipids to cytosolic monolayer
        i. Golgi membrane
18. Membrane proteins
    a. VIDEO:
        i. Phospholipids contain glycerol and fatty acids but also contain a phosphate group rather than a fatty acid attached to the third carbon of glycerol
        ii. When placed in a liquid environment, phospholipids arrange themselves into a phospholipid bilayer so that only the hydrophilic heads interact with the watery environments
        iii. Various proteins in the bilayer serve many functions
            1. Some involved in the transport of substances across the membrane
            2. Other help in cell to cell communication