Phospholipid Membranes

1. Need 3 students. Each will hold 2 of the 6 red fuzzy pipe cleaner lipids. Make sure you don't select students wearing red shirts. The pipe cleaners won't show up against the background.

2. Review the parts of the phospholipid:

    Glycerol-phosphate head
    2 fatty acid tails

3. Review hydrophobic vs hydrophilic.

4. Have students demonstrate how to hide the tails. What conformations are possible?
    a. bilayer
    b. micelle (dish water: soap is both hydrophilic and hydrophobic. Hydrophobic ends mix with oil and hydrophilic ends interact with water forming a micelle with oil in the middle).
    c. liposomes (drug-delivery)

5. Fluid mosaic model:
    a. Lipids move transversly with neighbors 10^7 times per second. A lipid can traverse the entire length of the cell in 1 second. Have students scramble about.
    b. Flipping layers occurs only about once a month (?...really, old info I think), facilitated by an enzyme called flippase. Helps balance bilayers, especially when the cell is expanding. Ask students why it is unlikely a likely a phospholipid would just spontaneously flip on its own.
    c. Have one student be a transmembrane protein. Pop them in between the students serving as lipids. If using a TA or a professor, you can grab their wrists and "tether" them to the cytoskeleton. If using a student, hand them a ball and tether the ball. Discuss protein movement in the fluid membrane (tethered vs untethered).

6. Packing: Saturated vs Unsaturated
    a. Define saturated vs unsaturated.
    b. Have students line up the membrane. Have another student come up and put kinks in the membrane. Pack without touching. Look at the space between the lipids.
    c. Stick cholesterol in (2 or 3 more students) with cholesterol molecules on card stock.
    d. Discuss the effect on fluidity. Cholesterol makes the membrane more rigid but also helps prevent packing when the temperature drops.
    e. Discuss the effect of a cold spell on plants. Plants produce more unsaturated lipids in the autumn before freezing temperatures set in. A cold snap without the acclimation period leads to fractured membranes. Cytosol leaks out of the membrane where ice crystals caused ruptures.