Understandings:

1. Explain that phospholipids form bilayers in water due to the amphipathic properties of phospholipid molecules.

- A phospholipid has a hydrophilic phosphate head with two hydrophobic hydrocarbon tails. Since there is water both in the inside and outside the cell, the phospholipids will form a bilayer. This is indeed the cell membrane.

The thickness is usually around 10nm.

2. List and explain the most crucial membrane proteins.

- There are two types of membrane proteins. It is either an integral protein or a peripheral protein. An integral protein has a hydrophobic part, therefore able to be immersed in the phospholipid. A peripheral protein is hydrophilic therefore only sits on the outer side of membrane.

The most crucial membrane proteins are:

Protein	Type
Hormone receptors	Integral protein
Immobilized enzymes	Integral protein
Glycoproteins for cell adhesion	Integral protein
Channels for passive transport	Integral protein
Pumps for active transport	Integral protein
Electron carriers	Usually peripheral protein

3. State that cholesterol is a component of animal cell membranes.

- Animal cells have molecules called cholesterol. These are mainly hydrophobic, thus are embedded between the phospholipid bilayer.

The membrane is fluid and what controls the fluidity is the cholesterol. How it does that is interesting. When the temperature increases, they make the distance between phospholipid decreases and when cold, they make them further apart.

Applications and skills:

1. Explain how cholesterol in mammalian membranes reduces membrane fluidity and permeability to some solutes.

- Apart from what has already been said above, cholesterol act as a disruptive solid in between the phospholipids. It prevents the lipids from becoming a solid, but it also prevents the lipids from becoming too fluid. It also prevents permeability to hydrophilic solutes such as ions.

2. Be able to draw the fluid mosaic model.

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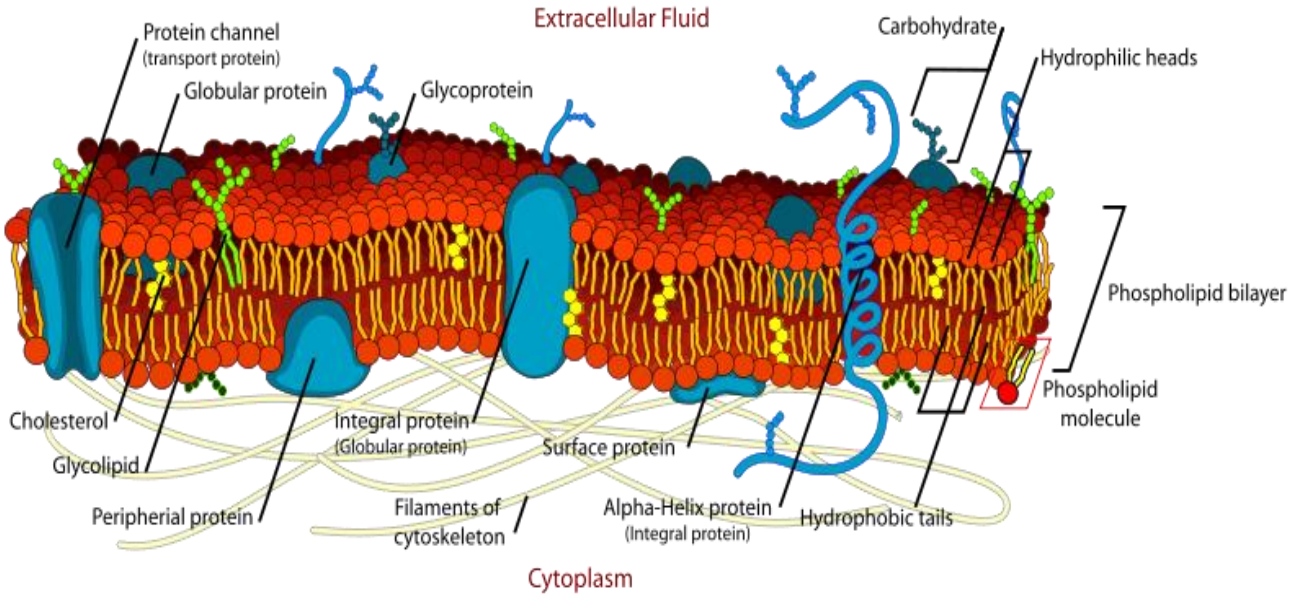
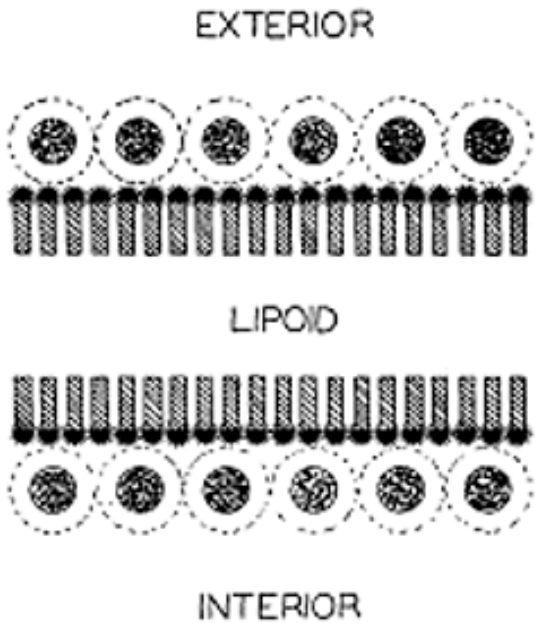


Only things you have to include are: the phospholipid, integral proteins, peripheral proteins and cholesterol.

3. Be able to analyze evidence from electron microscopy that led to the proposal of the Davson-Danielli model.

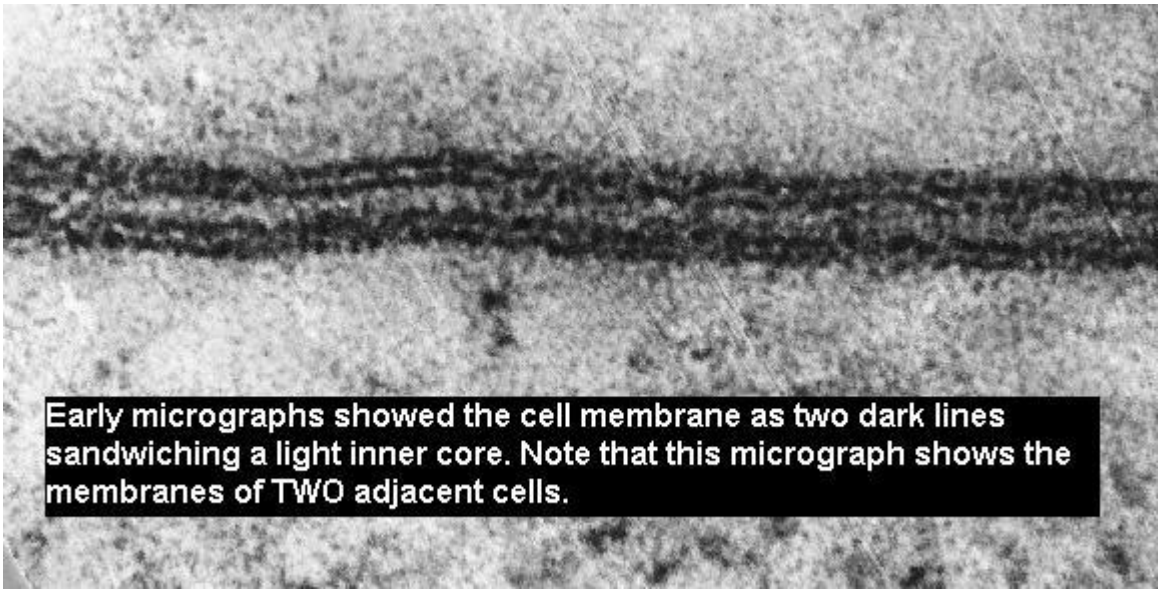
- First of all, what is Davson-Danielli model? Well, in 1930s people had limited knowledge of the ultrastructure because electron microscopes were not introduced until 1950s. What Davson and Danielli proposed was that there is a phospholipid bilayer (they were correct on this one) and <u>that these layers were coated with a layer of protein</u> (which is the false part).

This is a picture of the original publication by Davson and Danielli.



How did they reach this conclusion? Well, when they saw pictures like this one below, they identified two dark lines and one light inner core. So they thought that the light inner core was the phospholipid bilayer while the dark lines were protein coatings.

This was accepted because it explained why membranes are very often impermeable.



Nevertheless, what they actually saw were some integral proteins, peripheral proteins and the darker lines were also largely the phosphate head. Unfortunately, they were wrong. This model could not explain the vast difference of membranes, the change in shapes that membranes could do, and how the proteins could stabilize the membrane.

4. Be able to analyze the falsification of the Davson-Danielli model that led to the Singer-Nicolson model.

- The next question is how people falsified this seemingly reliable Davson-Danielli model. Well, there are three experiments we should know.

1. Freeze-etched electron micrograph. This is basically a method of freezing a membrane and then peels the two layers off. What one saw were not a smooth surface of lipid tails, but rather bumps. These were later identified as proteins embedded within the phospholipid bilayer.

2. Structure of membrane proteins. When scientists analyzed the proteins, they varied greatly in size hence unable to form a uniform layer. In addition, most of them were hydrophobic; therefore being in contact with water would be near impossible. They must've been embedded inside the membrane.

3. Fluorescent antibody tagging. By coloring proteins on one cell and fusing with an uncolored cell, one could see the movement of the proteins. It showed that after few minutes, the color was almost uniformly distributed; hence proteins were free to move.

TOK:

1. The explanation of the structure of the plasma membrane has changed over the years as new evidence and ways of analysis have come to light. Under what circumstances is it important to learn about theories that were later discredited?