

# MEMBRANES: A HISTORY OF THEIR UNDERSTANDING

Rvsd 10/11/93, 10/10/94, 10/14/96, 10/11/00, 10/10/01, 15 Oct 03, 14 Oct 05, 10 Oct07, 17Oct08, 14Oct09, 13Oct10, 14Oct11  
 BKH (4th), p. 164-195, BKH 5<sup>th</sup>: 158-166, 6<sup>th</sup>: 154-171, 7<sup>th</sup>:

**Functions of membranes:** (see illustration on p. 157)

- 1: define, **compartmentalize** (plasma membrane, intracellular membranes form compartments)
- 2: **localization** of specific functions within compartments as in organelles , **marker enzymes** identify compartments: zB: acid phosphatase in lysosomes
- 3: **control flow** of substances (passive transport, active transport, endocytosis, exocytosis)
- 4: **detection** receptors on surface, G proteins, signal recognition, generate cAMP
- 5: **cell adhesion, communication** special intercellular connections

**HISTORY:** (p 159 for time line)

**Overton,** 1890s **Lipids important membrane components:**  
 lipid soluble solutes (*lipophilic*) enter cell easily, cell coat had lipids  
 concluded membranes were a mix of cholesterol & lecithins

**Langmuir** 1905 **Measured fatty acid monolayer surface area:**  
 studied behavior of long-chain fatty acids: used **Langmuir trough** to measure surface area of spread lipids on surface of water (monolayer)

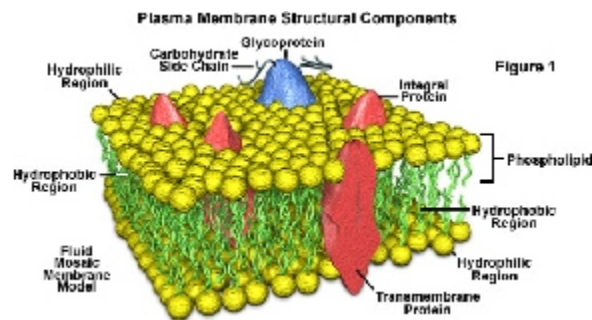


**Gorter & Grendel** 1925 **Membranes are bilaminar:**  
 estimated surface area of RBC, dissolved lipids with acetone, measured area, = 2x surface area, therefore 2x layer? (**two errors:** RBC shrunk upon drying on slide, acetone only extracted some of lipids--off setting errors...)



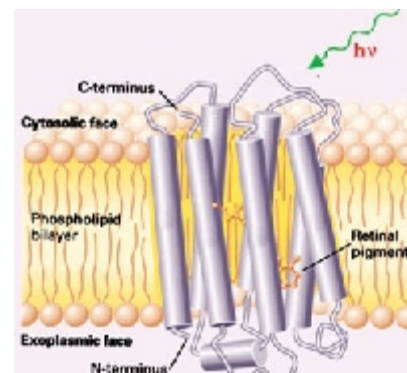
**Davson & Danielli** 1935 **Proposed protein-lipid sandwich:**  
 Why glucose enter easily, galactose not? Proposed proteins guard gate, as layer outside of bilayer, like "protein-lipid sandwich" (NOT)

**Robertson** 1960 **Supported sandwich model, proposed all membranes similar:**  
 electron microscope pictures showed trilaminar RR track structure, suggested unit membrane for all membranes, thought outer dark layers protein (p 160)



**Singer & Nicolson** 1972 **Proposed fluid mosaic model, proteins integral:** (analysis: table: p 161 illus' p 162)  
 Noted that protein/lipid ratio varies in membranes (0.25 in myelin sheath, 4 in some bacteria), but thickness did not. Thus proposed proteins imbedded in membranes, not a layer, **fluid mosaic** structure. ( )

**Henderson & Unwin** 1975 **All integral protein have conserved series of alpha helices.** (P 162)  
 noted crystalline bacteriorhodopsin had 7 regions of hydrophobic AAs in alpha helix which embed in lipid layer, (transmembrane regions of protein)



Video of fluid mosaic membrane: <http://www.youtube.com/watch?v=ULR79TiUj80>