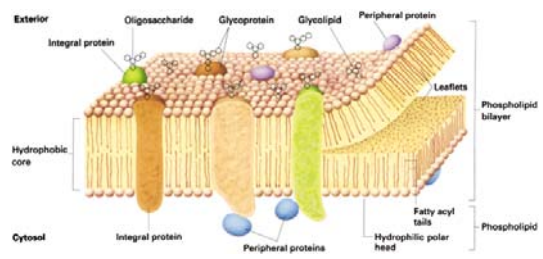
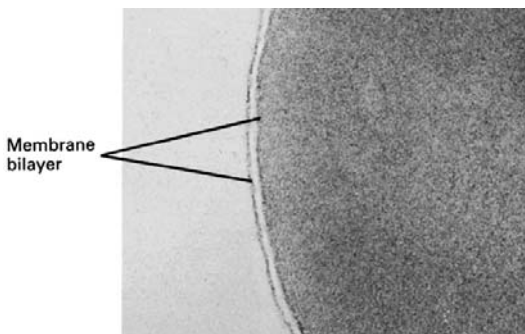
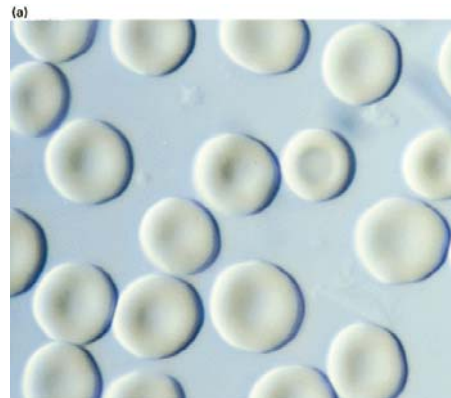


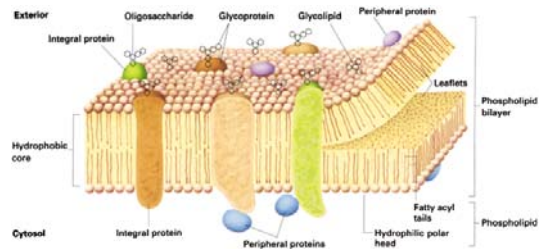
## History of the study of membranes

- 1895 – Charles Overton shows that membranes are made of lipids
- 1917 – Irving Langmuir extracts lipids from cells
- 1925 – E. Gorter and F. Grendel measure surface area of erythrocyte and lipid film extracted from erythrocyte to show that there is enough lipid to cover cell twice
- 1935 – Hugh Davson and James Danielli propose that membrane is a “sandwich” of lipid between two layers of protein
- 1972 – S.J. Singer and G. Nicolson propose fluid mosaic model in which membrane is a sea of lipid with icebergs of protein floating in the lipid bilayer



## Current model of membrane structure

- Phospholipid bilayers are the structural units of all membranes
- Phospholipids are amphipathic = possess hydrophilic “heads” and hydrophobic “tails”
- Each layer of a phospholipid bilayer = a membrane leaflet



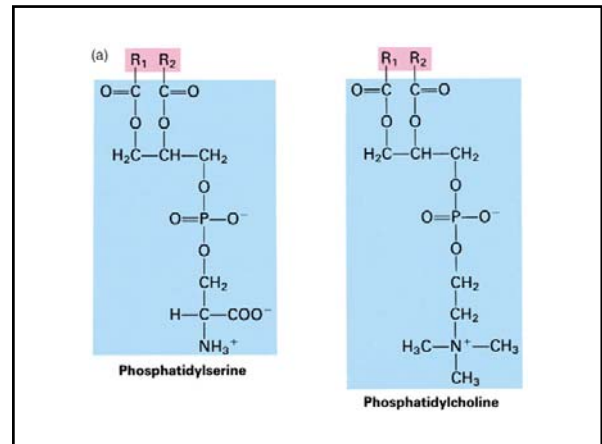
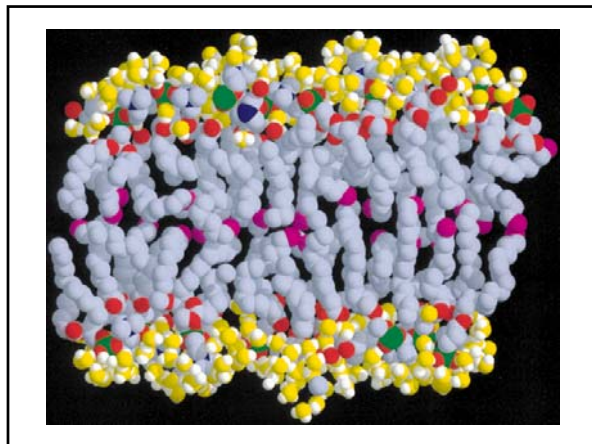
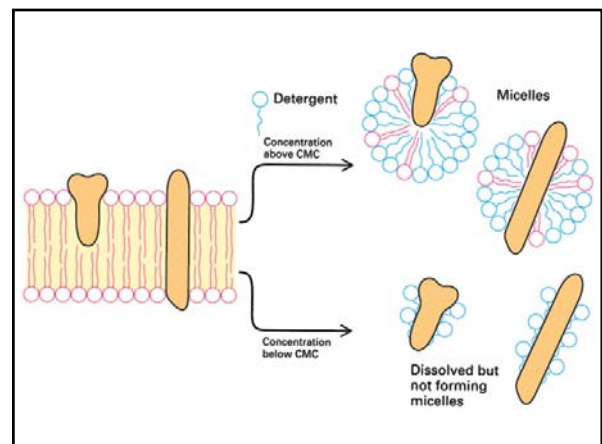
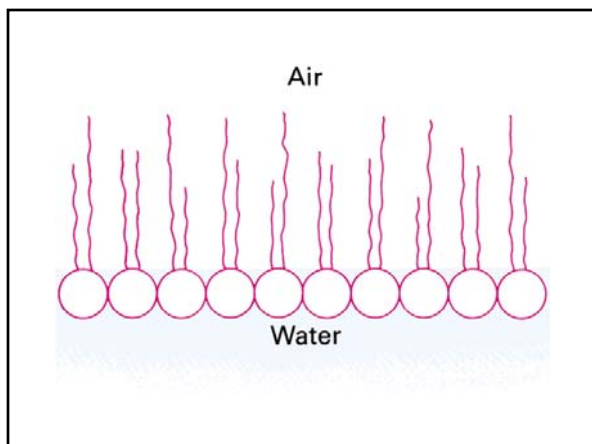
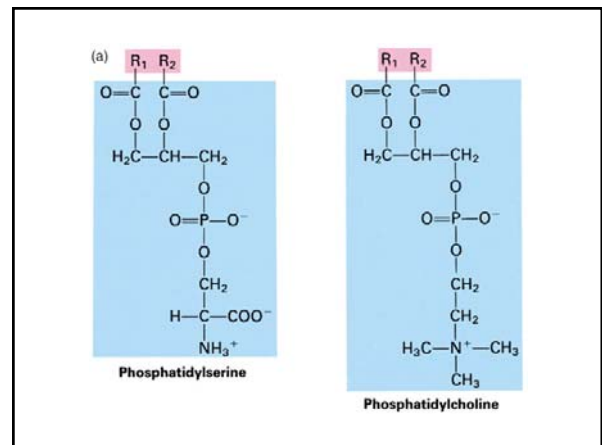
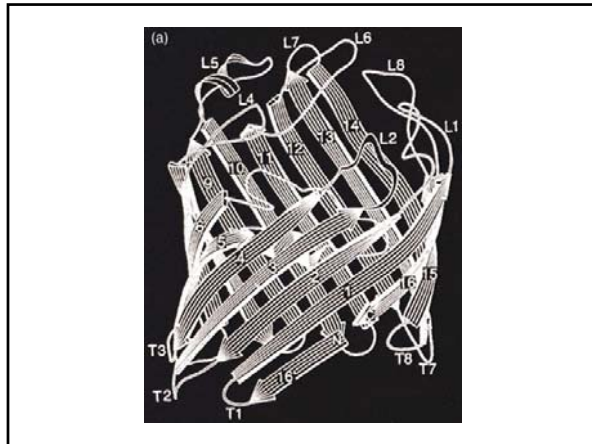


TABLE 14-2 Some Typical Fatty Acids Found in Cells		
Chemical Formula	Systematic Name	Common Name
<b>SATURATED FATTY ACIDS</b>		
$CH_3(CH_2)_{10}COOH$	n-Dodecanoic	Lauric
$CH_3(CH_2)_{12}COOH$	n-Tetradecanoic	Myristic
$CH_3(CH_2)_{14}COOH$	n-Hexadecanoic	Palmitic
$CH_3(CH_2)_{16}COOH$	n-Octadecanoic	Stearic
$CH_3(CH_2)_{18}COOH$	n-Eicosanoic	Arachidic
$CH_3(CH_2)_{22}COOH$	n-Tetracosanoic	Lignoceric
<b>UNSATURATED FATTY ACIDS</b>		
$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$		Palmitoleic
$CH_3(CH_2)_5CH=CH(CH_2)_7COOH$		Oleic
$CH_3(CH_2)_3CH=CHCH_2CH=CH(CH_2)_7COOH$		Linoleic
$CH_3CH_2CH=CHCH_2CH=CHCH_2CH=CH(CH_2)_4COOH$		Linolenic
$CH_3(CH_2)_4(CH=CHCH_2)_4CH=CH(CH_2)_7COOH$		Arachidonic





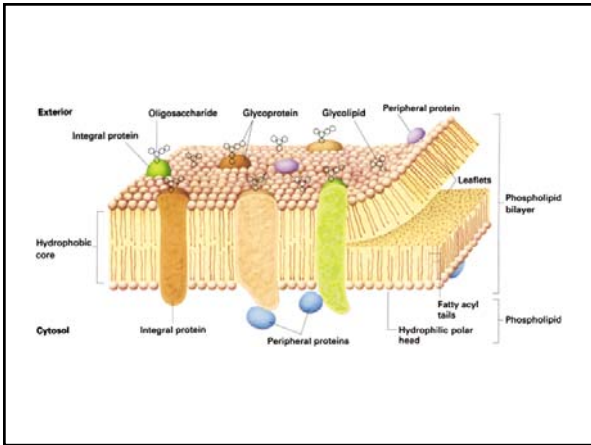


### Some functions of membrane proteins

- Enzymes
- Receptors
- Junctions
- Cell adhesion
- Cell recognition
- Connection of extracellular matrix to cytoskeleton

### Principles of membrane organization

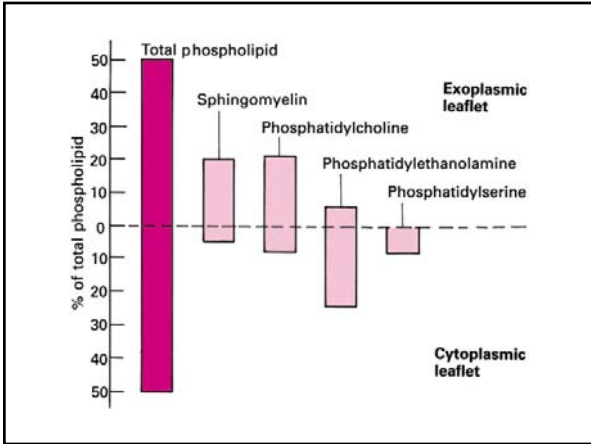
- All membranes contain proteins and lipids; many contain carbohydrates
- Lipid composition varies with membrane type
- Protein to lipid ration varies with the type of membrane
- The two membrane leaflets have different lipid compositions



**TABLE 14-1 Chemical Composition of Some Purified Membranes**

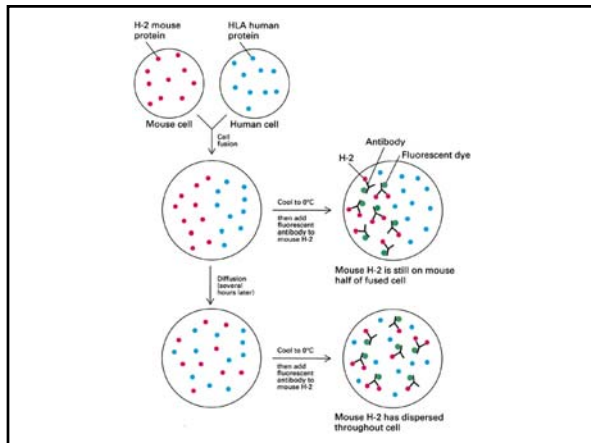
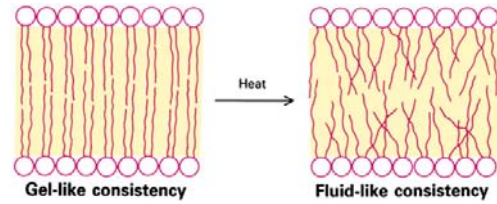
Membrane	Percentage by Weight		
	Protein	Lipid	Carbohydrate
Myelin	18	79	3
Plasma membrane:			
Human erythrocyte	49	43	8
Mouse liver	44	52	4
Ameba	54	42	4
Chloroplast spinach lamellae	70	30	0
<i>Halobacterium</i> purple membrane	75	25	0
Mitochondrial inner membrane	76	24	0

SOURCE: G. Guidotti, 1972, *Ann. Rev. Biochem.* 41:731.

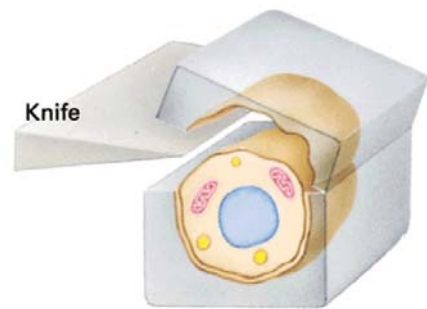


## Principles of membrane organization (cont.)

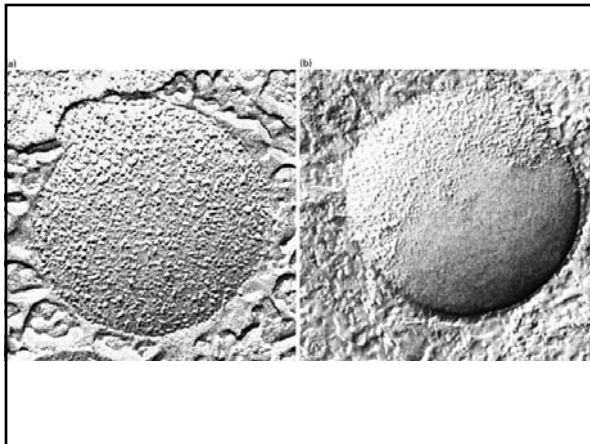
- The membrane is fluid = most proteins are laterally mobile in the phospholipid bilayer.
- Fluidity was first demonstrated by Frye and Edidin (J. Cell Sci. 7: 319, 1970)
- Proteins bind asymmetrically to the lipid bilayer
- The cytoskeleton affects organization and mobility of some surface membrane proteins



(a)



Fracture splits the plasma membrane



(b)

