

MCB 150

Lipids and Biomembranes Part 1

Today's Learning Catalytics Session ID is:
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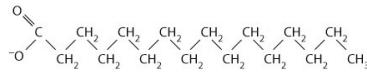
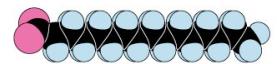
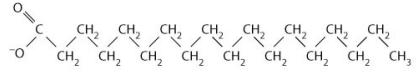
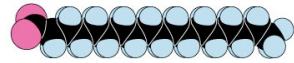
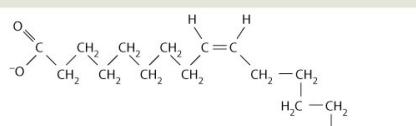
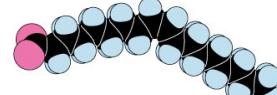
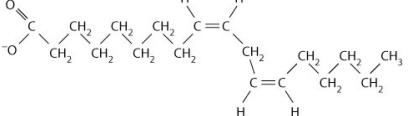
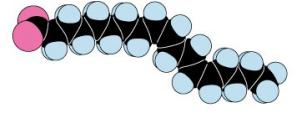
Our next large biological molecule: **Lipids**

- Defined by a physical property, not a chemical structure
- Vary widely in structure
- We will focus on three primary functions, and four primary types of lipids:

Energy Storage	Biomembrane Composition	Chemical Signaling
Triglycerides	Phospholipids & Glycolipids	Steroids



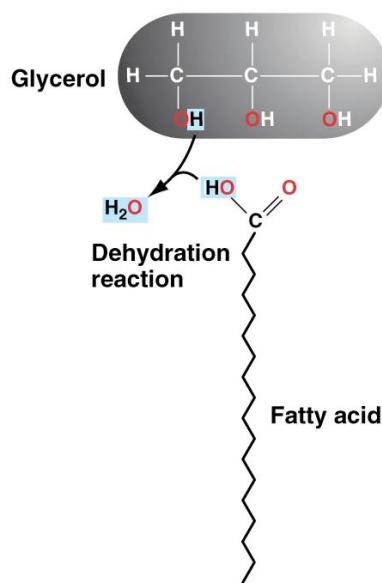
The monomers of (biological membrane) lipids: Glycerol and Fatty Acids

Name of Fatty Acid	Number of Carbon Atoms	Number of Double Bonds	Structural Formula	Space-Filling Model
Saturated				
Palmitate	16	0		
Unsaturated				
Stearate	18	0		
Oleate		1		
Linoleate	18	2		

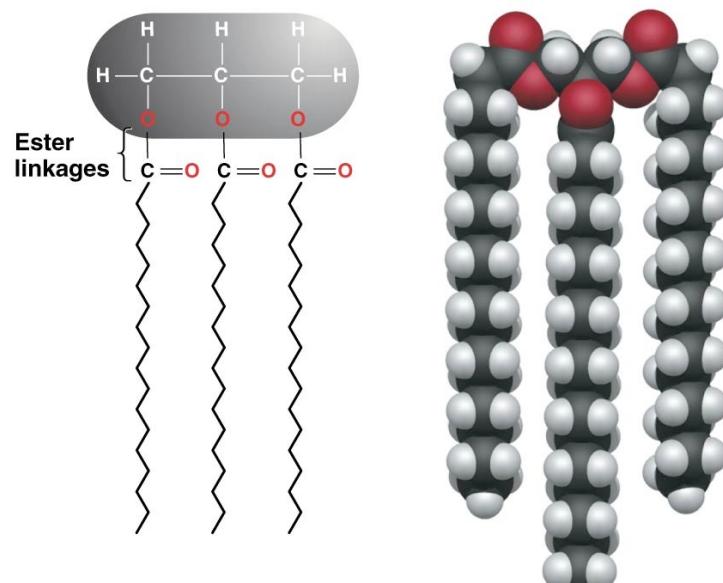


3 Fatty Acids + Glycerol = Triglyceride

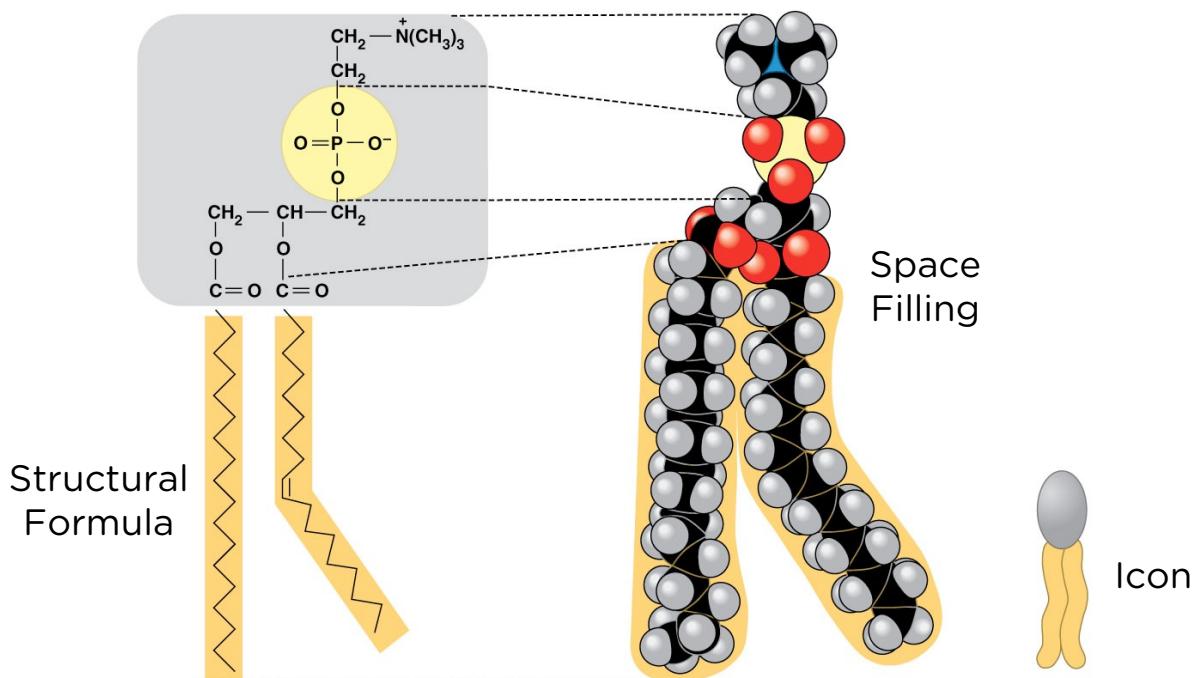
(a) Fats form via dehydration reactions.



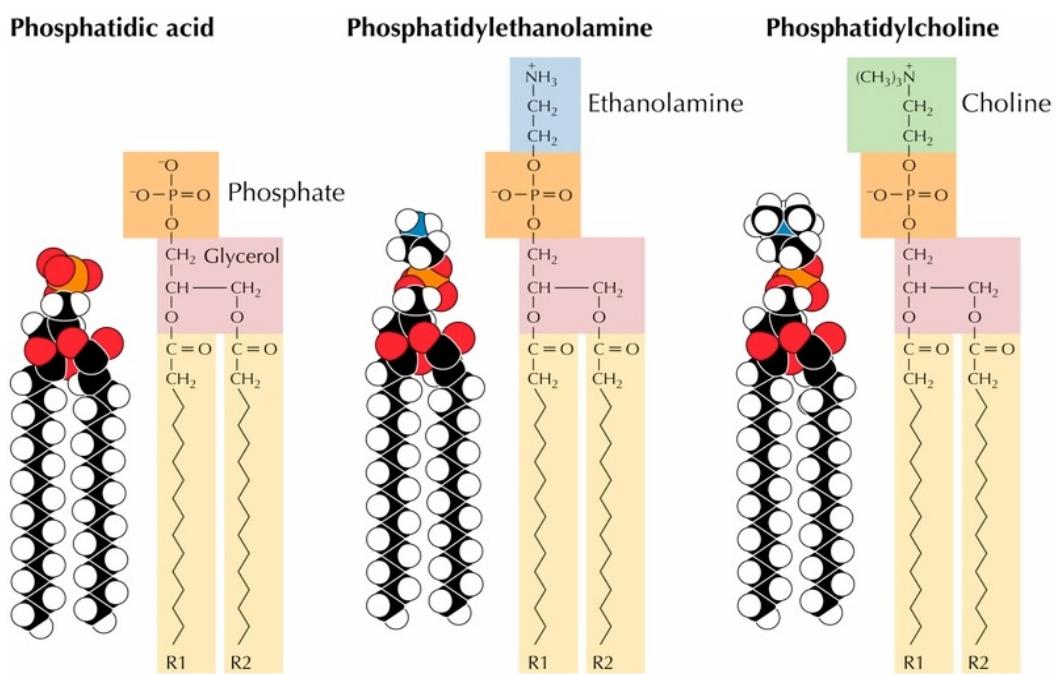
(b) Fats consist of glycerol linked by ester linkages to three fatty acids.



2 Fatty Acids + Glycerol + Phosphate = Phospholipid

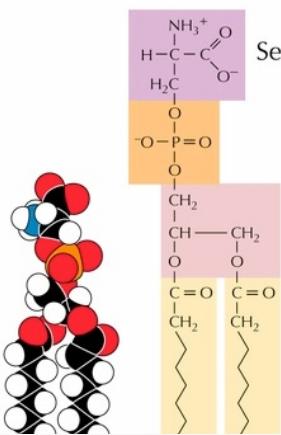


Common examples of major membrane Phospholipids:



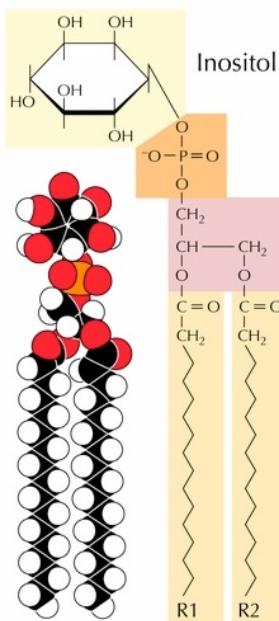
Common examples of major membrane Phospholipids:

Phosphatidylserine



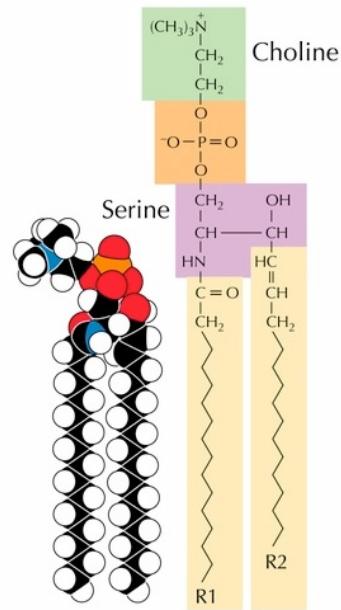
Serine

Phosphatidylinositol



Inositol

Sphingomyelin



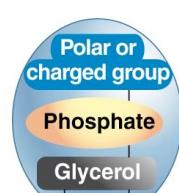
Choline

Take-home point:
A lot of variety in
polar head groups

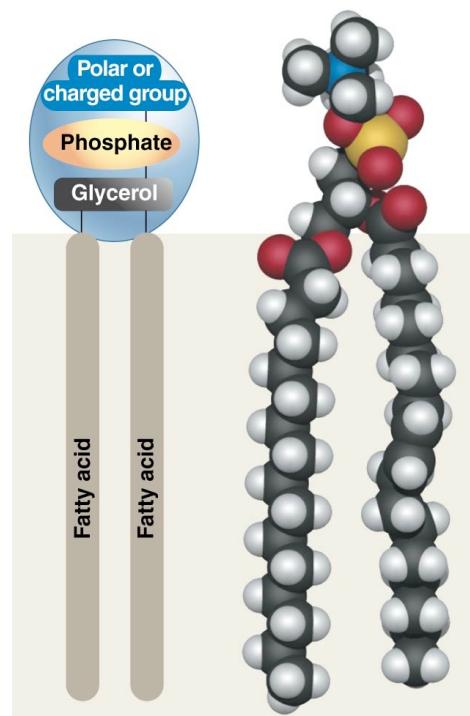


Fatty Acid tails in phospholipids can vary too

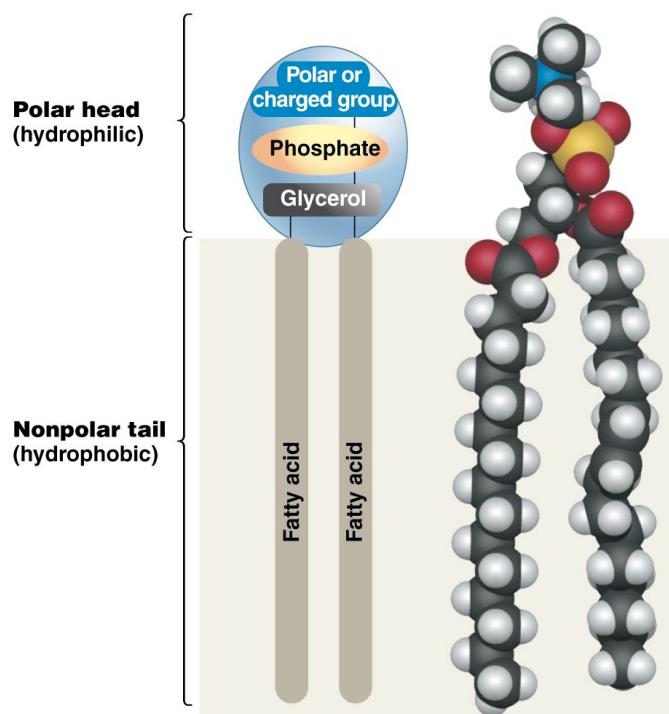
Polar head groups vary
as previously shown



But the fatty acids can
also vary in length and
degree of saturation



Phospholipids are Amphipathic



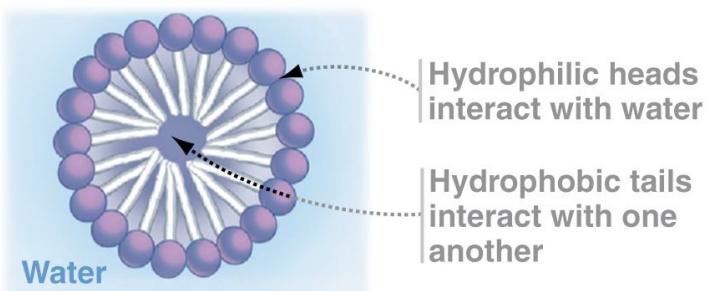
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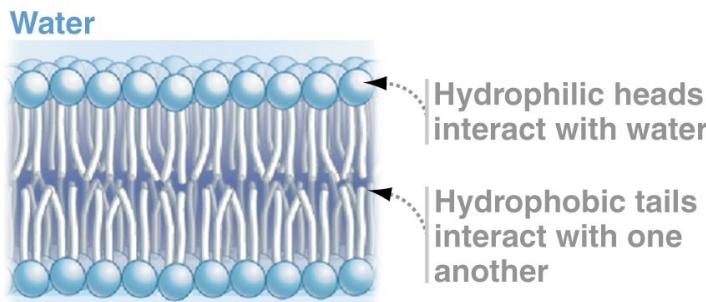
Phospholipids in water will spontaneously form **micelles** or **bilayers**

(a) Lipid micelles



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(b) Lipid bilayers



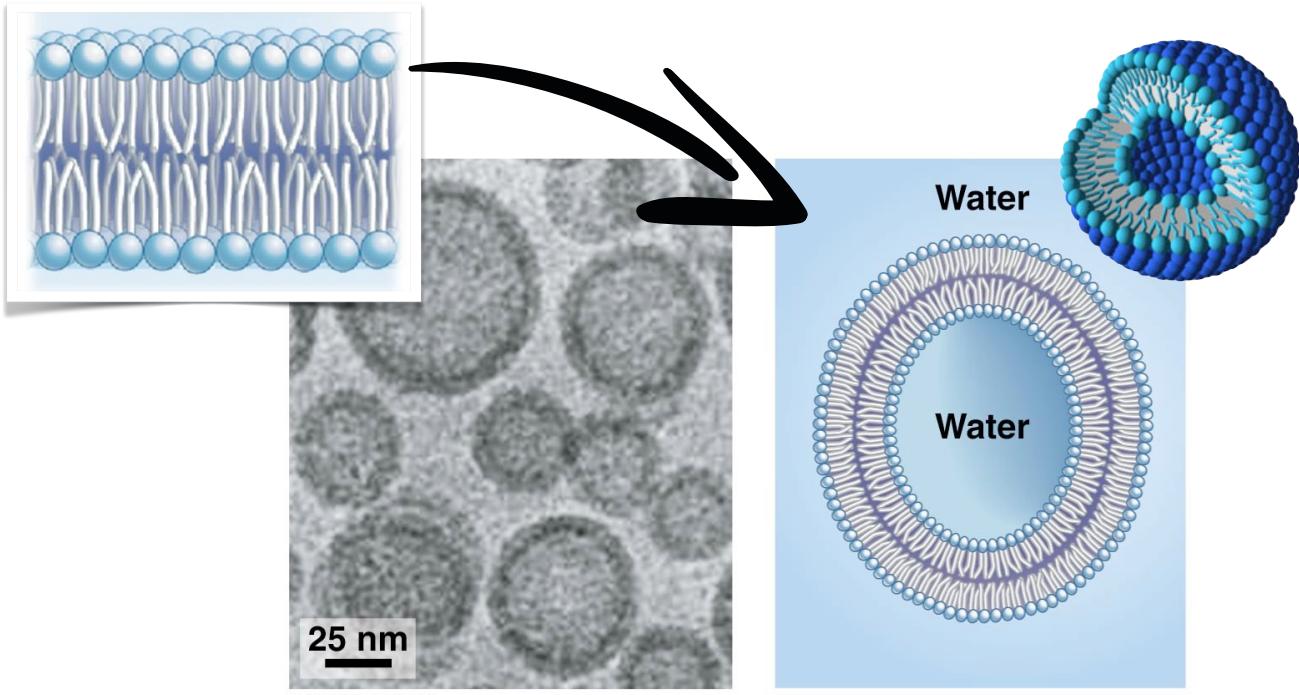
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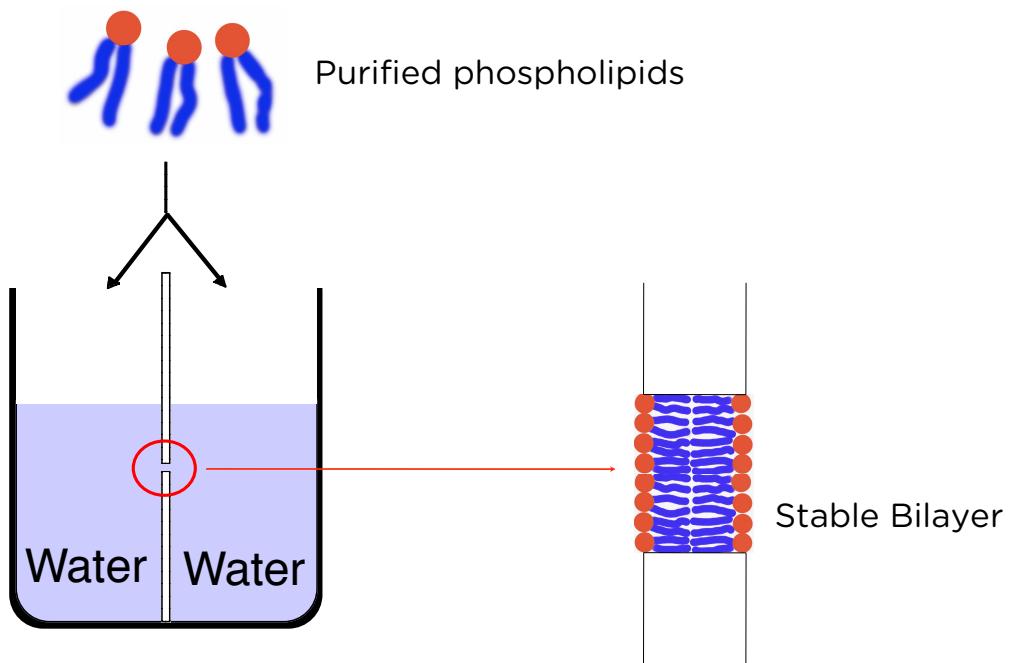
Bilayers have exposed edges, and will fold into liposomes



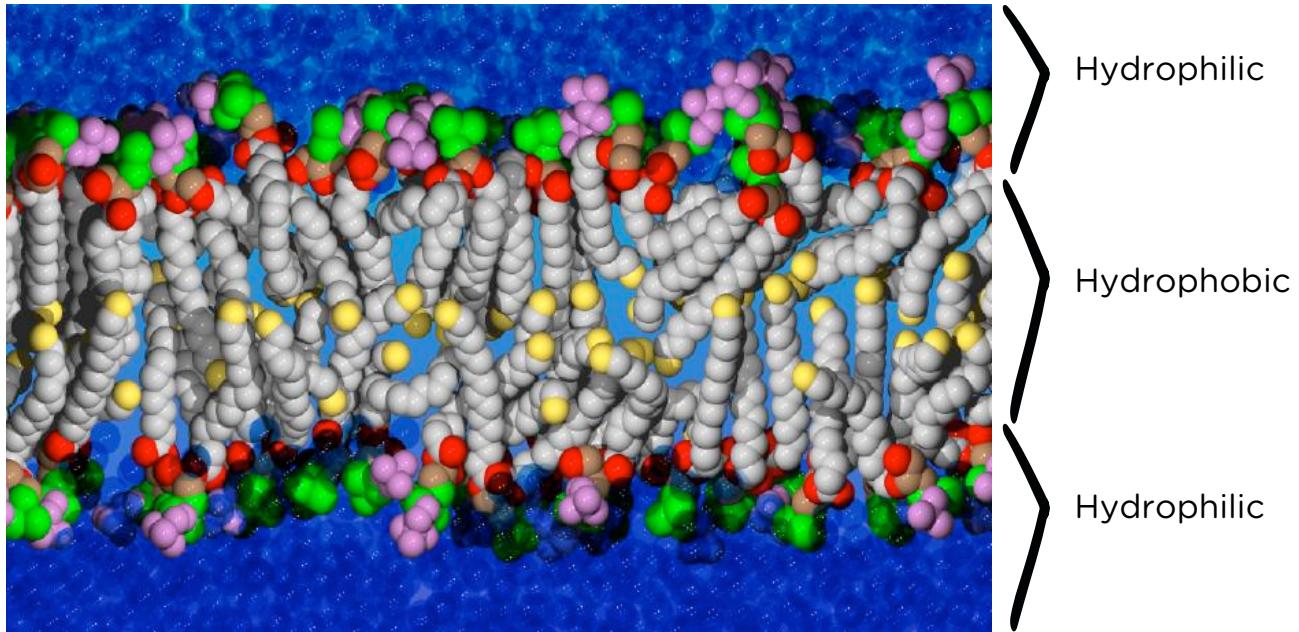
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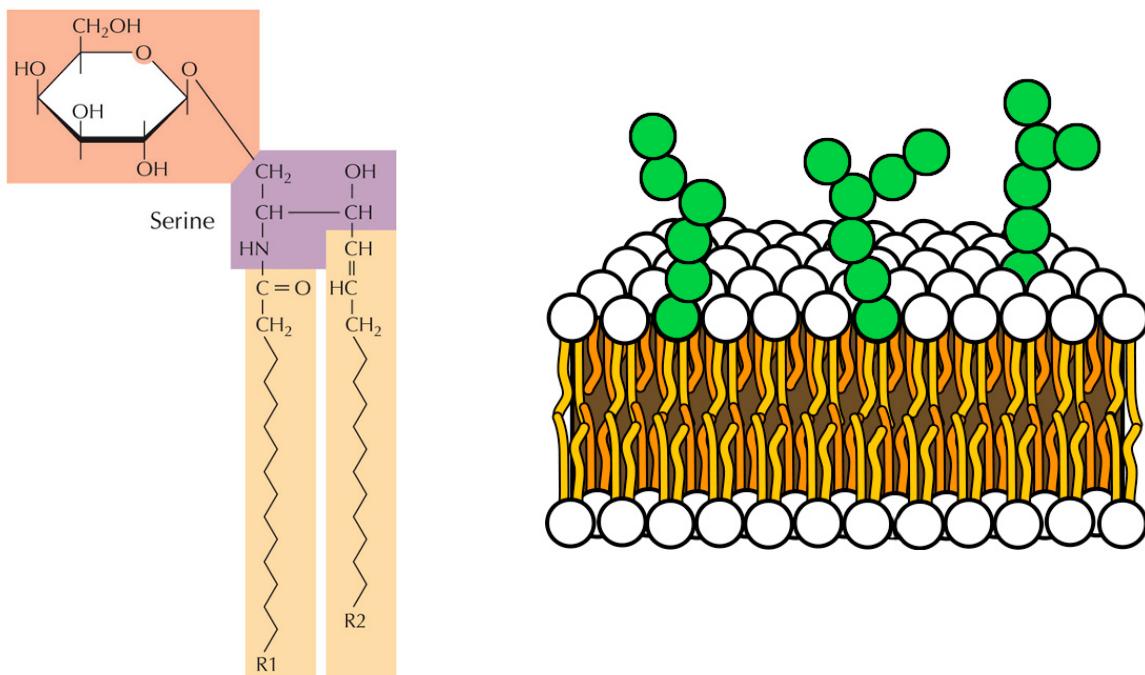
We can study lipid properties through artificial bilayers



Exclusion of water at the bilayer interface:



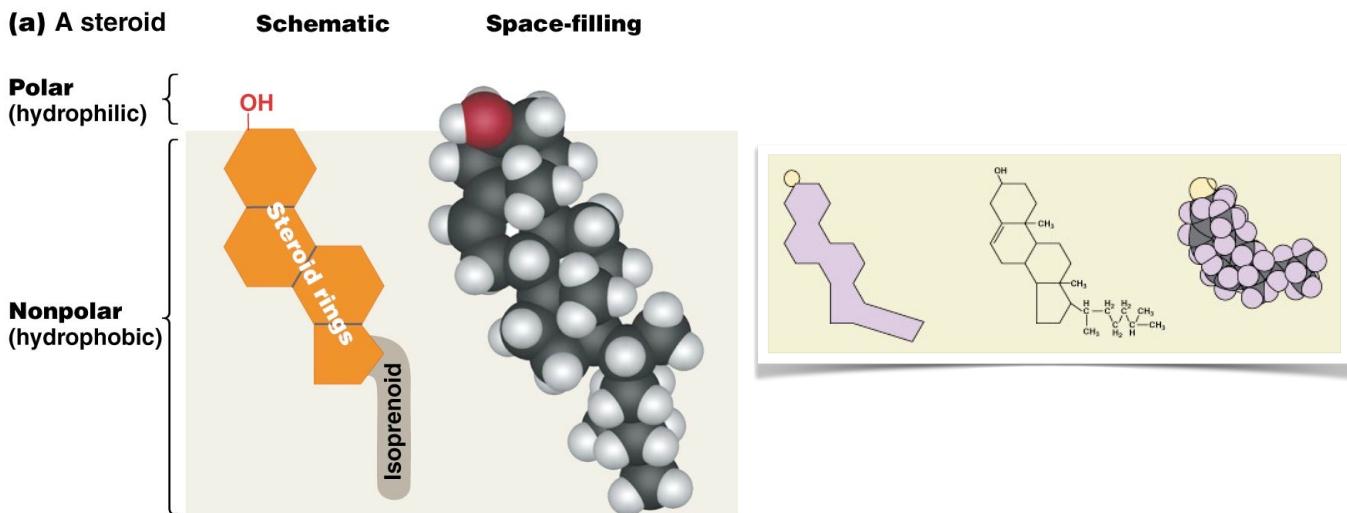
Some membrane lipids are **Glycolipids**



The fourth type of lipids are **Steroids**

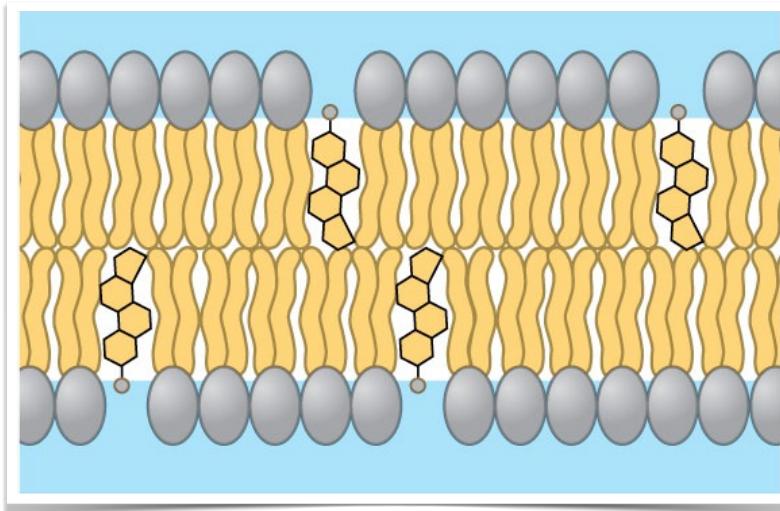
- Can be used as circulating hormones like estrogen and testosterone, or as membrane components

(a) A steroid

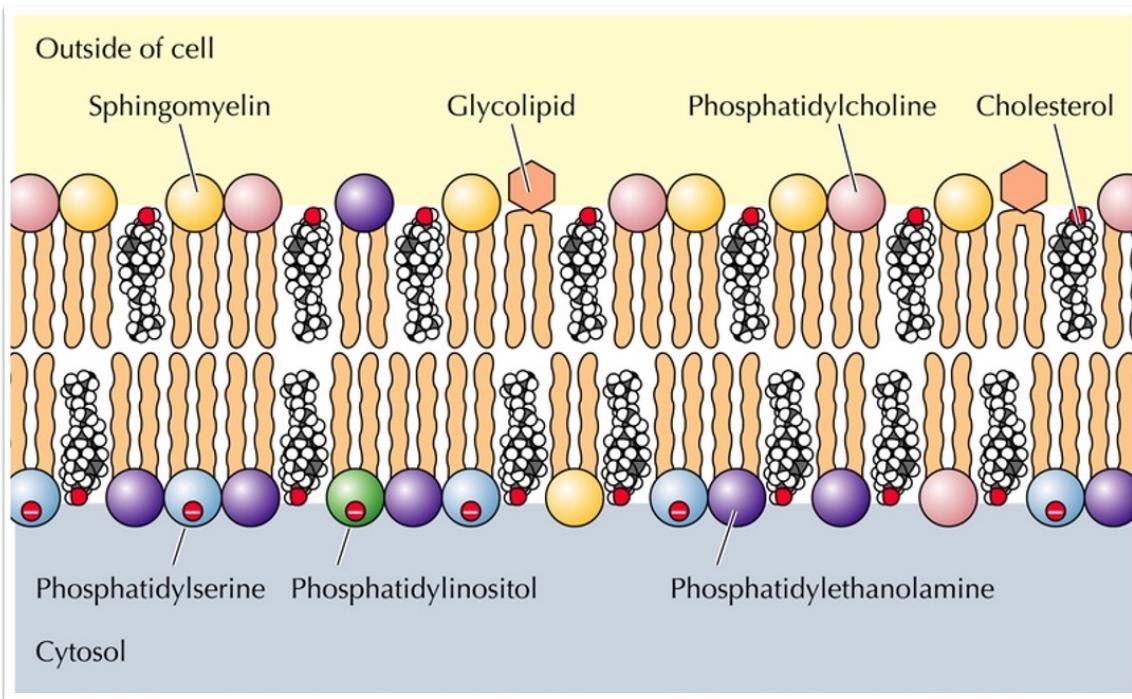


The fourth type of lipids are **Steroids**

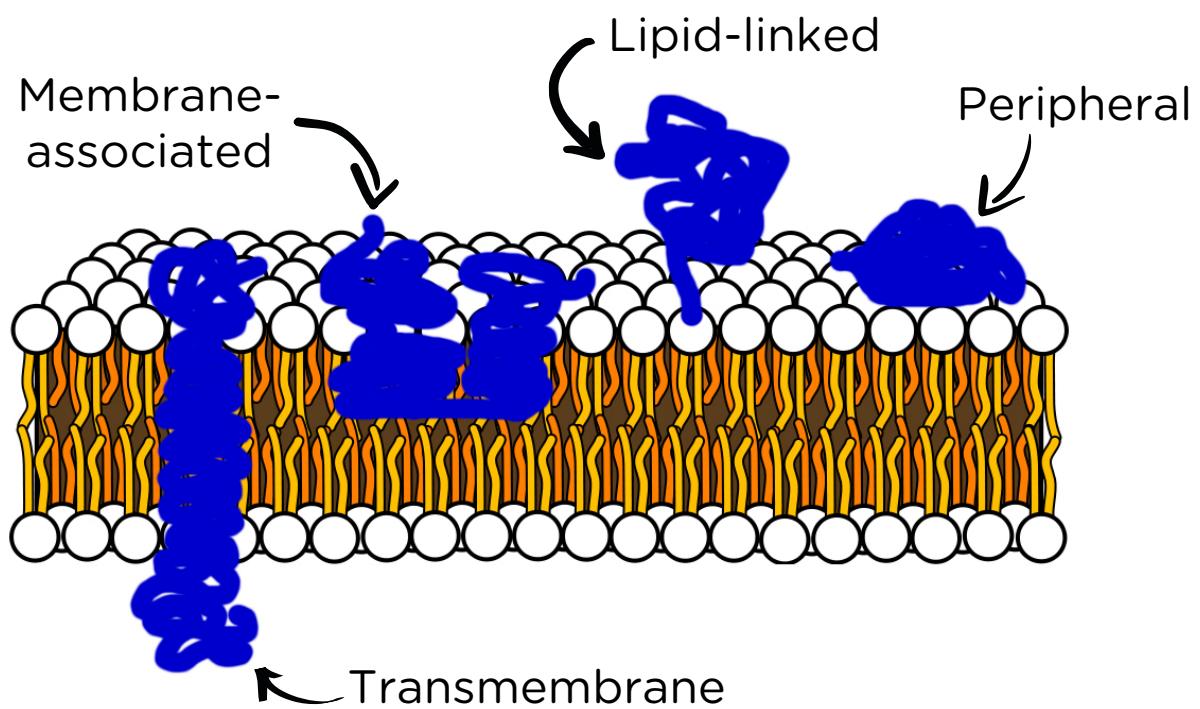
- Animal cells have cholesterol in their biomembranes
- Plants & fungi: different steroids; bacteria: none



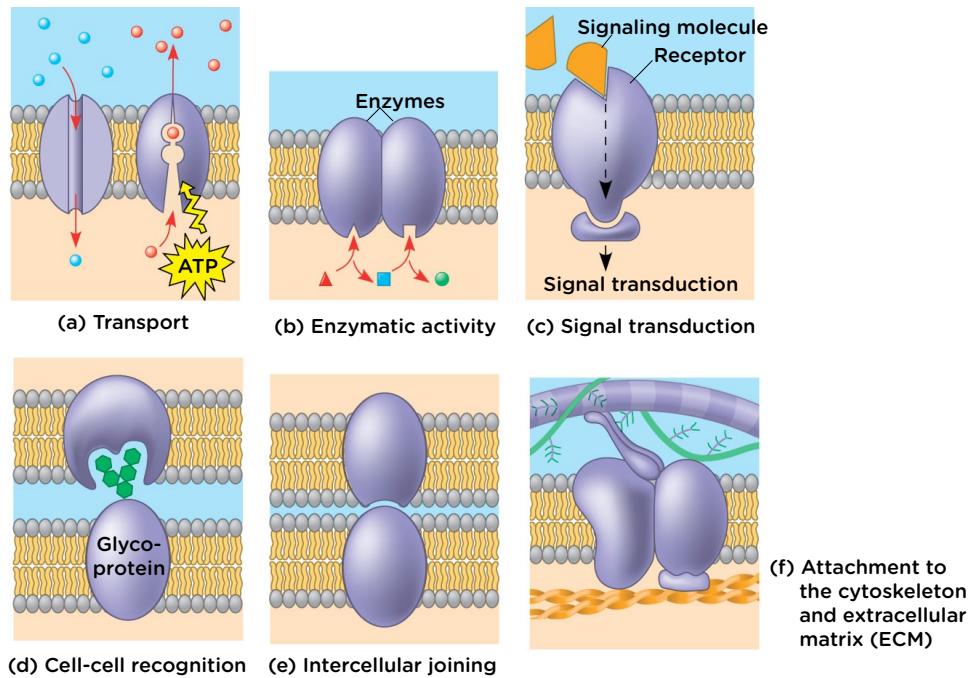
Biomembranes are Asymmetrical



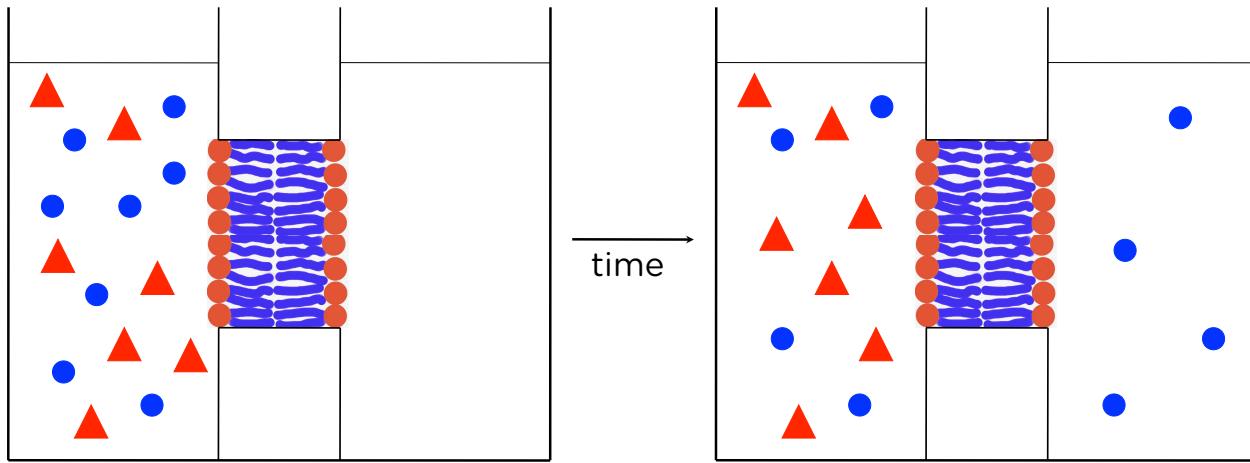
Biomembranes have associated Proteins...



...and those proteins serve a variety of functions



Can anything and everything cross a lipid bilayer?



- Answer: NO, the membrane is selective
- Biomembranes are **Selectively Permeable**