

Building a Triglyceride

Triglycerides are neutral fats. They are composed of a central **glycerol group** ($C_3O_3H_3$) that can attach to three **fatty acids tails** (long strands of carbon and hydrogen). Attaching a fatty acid tail to a glycerol group produces a water molecule and is called a **dehydration synthesis reaction**.

1. Create a triglyceride with three fatty acid tails by moving and connecting the pieces on the right.
2. Answer the question below and move to the next slide.

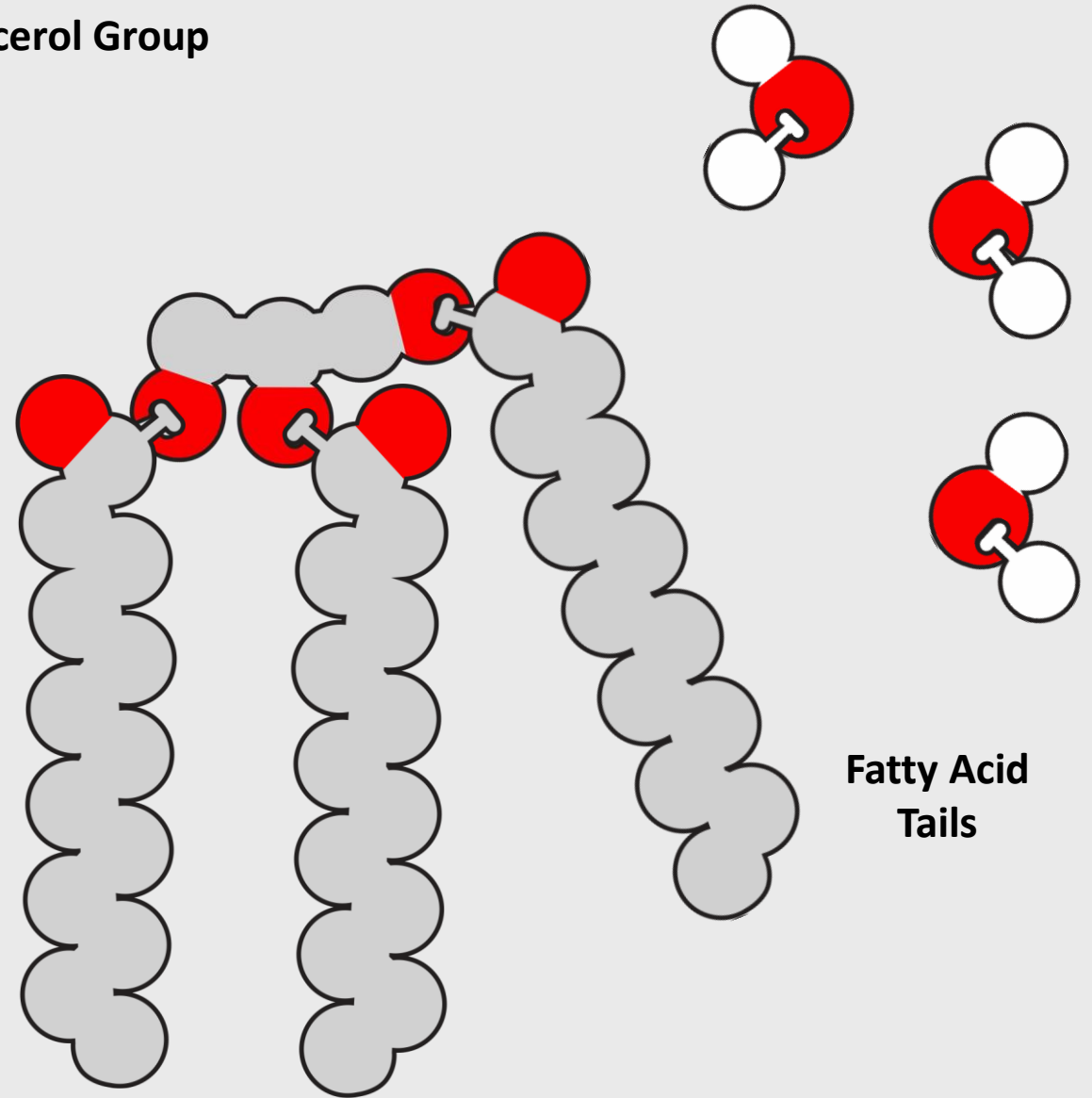
Atom Color Key

			
Carbon	Oxygen	Nitrogen	Hydrogen

How many water molecules did you generate while making the triglyceride?

3

Glycerol Group

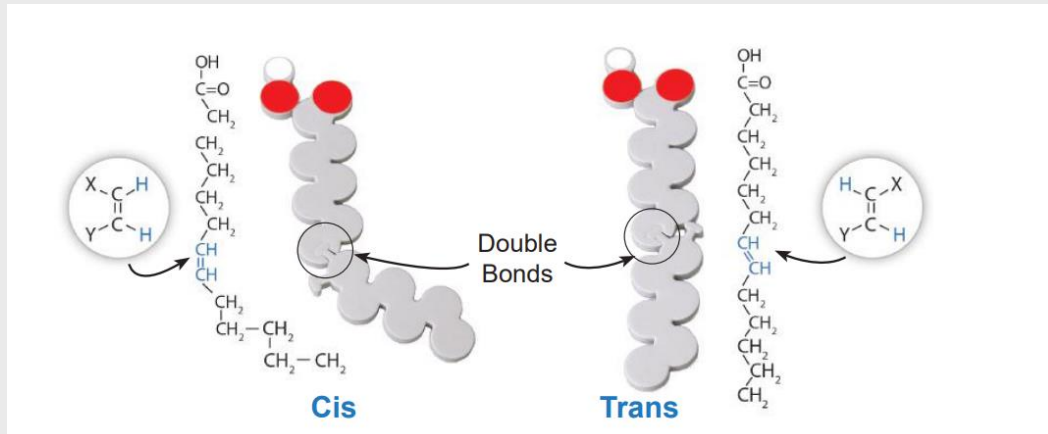


Saturated and Unsaturated

Not all fatty acid tails are the same. If they are **saturated** with hydrogen atoms, every carbon atom will have two hydrogen atoms attached. If they are **unsaturated**, some carbon atoms will have only one hydrogen atom attached to them.

Unsaturated tails can be either “**cis**” or “**trans**” depending on the location of the missing hydrogen atom(s). (See diagram below.)

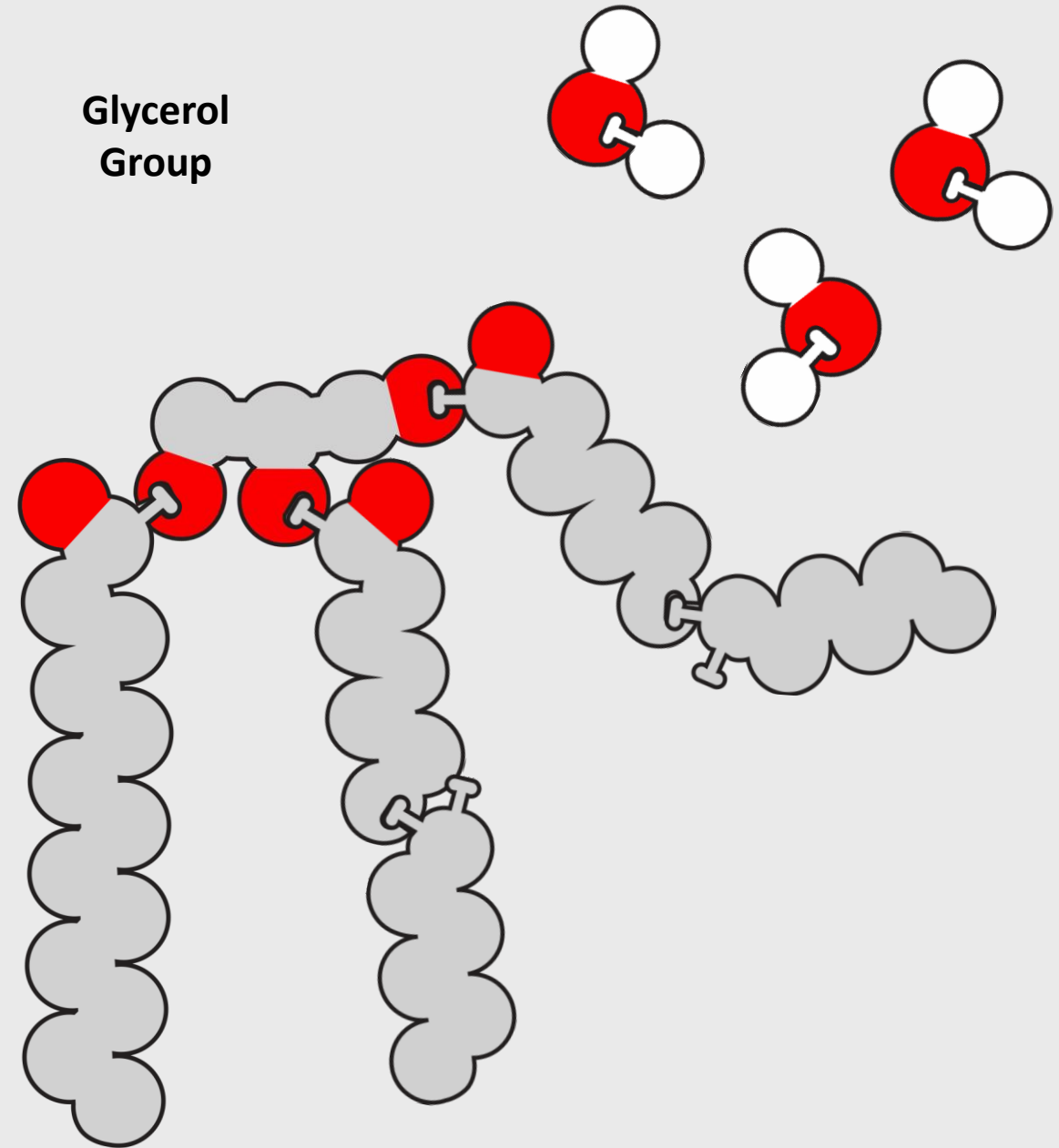
1. Arrange the parts on the right to create a triglyceride with three fatty acid tails: one fully saturated, one cis unsaturated and one trans unsaturated.
2. Answer the question below and move to the next slide.



Which do you think contains more unsaturated triglycerides: a liquid oil or hard butter? Why?

An oil, because the kinked fatty acid doesn't allow for the close packing of triglycerides found in solid fats.

Glycerol Group



Fatty Acid Tail Components

Building a Phospholipid

Phospholipids are another key type of fat. They are the main component of the **membranes** that surrounds cells and organelles.

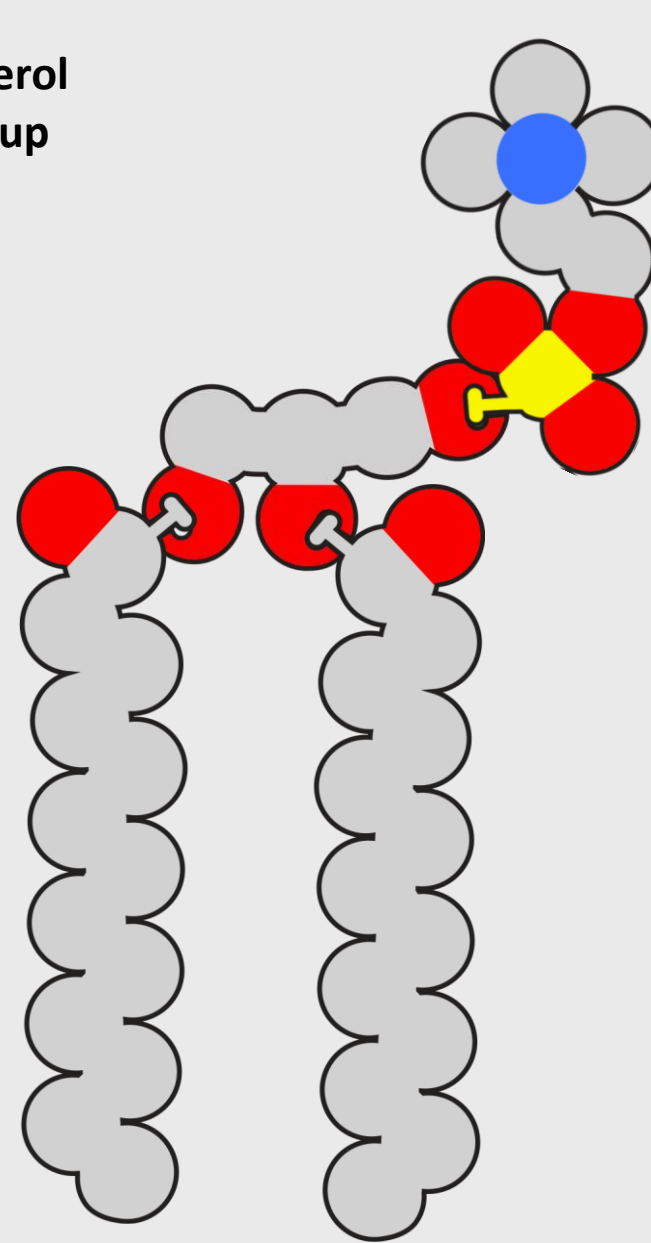
Like triglycerides, phospholipids are composed of a head and a central glycerol group. Instead of three fatty acid tails, however, there are only two.

1. Arrange the pieces on the right to create a phospholipid with one head and two fatty acid tails.
2. Answer the question below and then move to the next slide.

What is the difference between a phospholipid and a triglyceride?

Phospholipids have two fatty acid tails and triglycerides have three fatty acid tails.

Glycerol Group



Phospholipid Head

Fatty Acid Tails

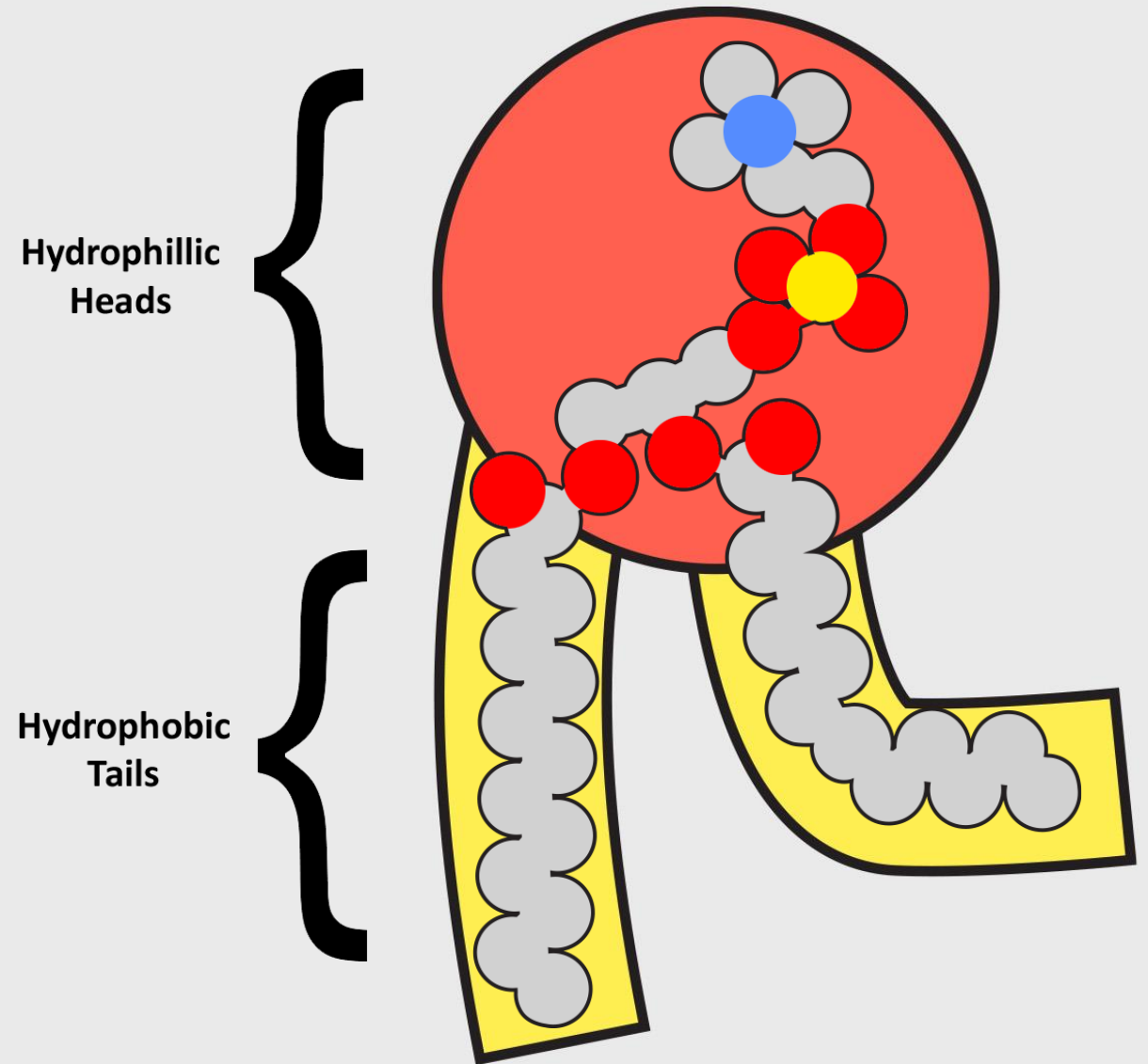
Hydrophobic and Hydrophilic

The two main regions of a **phospholipid** are shown on the far right. The hydrophilic head is **red** and the hydrophobic tails are **yellow**.

1. Move the phospholipid on the right and the two labels below onto the red and yellow image.
2. Answer the question and move to the next slide.

Why are the tails of the phospholipid hydrophobic?

The tails are mainly carbon atoms and can't bond with water molecules. They tend to clump together.

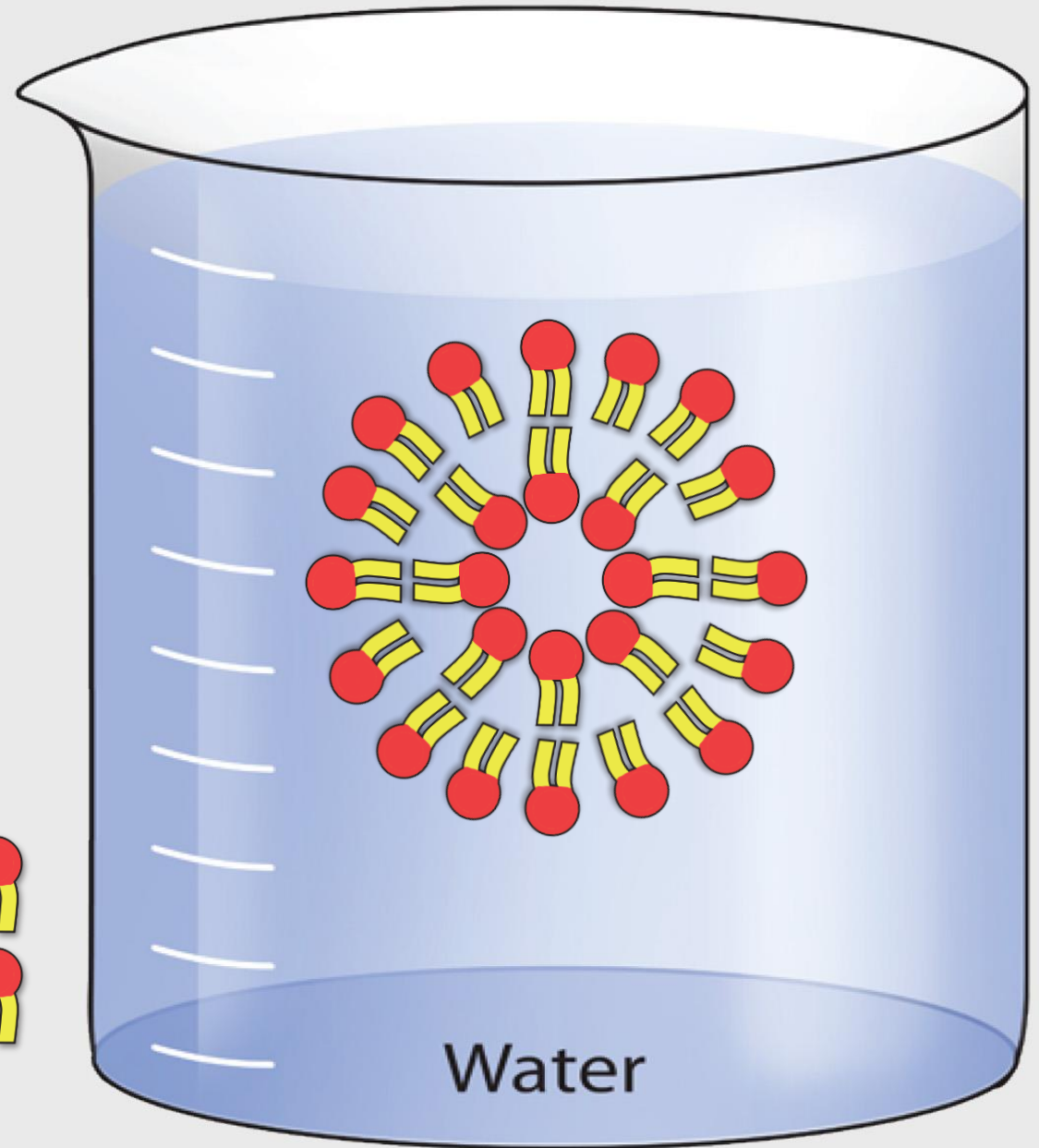
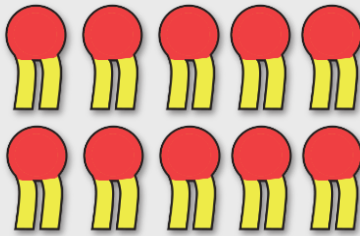
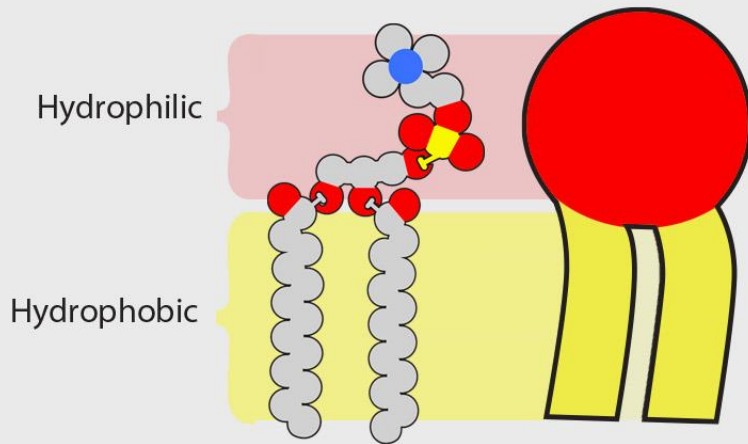


From Phospholipids to Membranes

Every phospholipid has a **hydrophilic** (water-loving) head, and two **hydrophobic** (water-fearing) fatty acid tails. (See figure below.)

When many **phospholipids** are placed in water, they assemble into a phospholipid bilayer, often called a **membrane**.

1. Drag the small phospholipid pieces on the right to construct a membrane in the beaker of water.
2. Move to the next slide.



Thought Questions

How many covalent bonds stabilize a membrane by joining one phospholipid to another?

Zero. The membrane is stabilized by hydrophobic interactions between the fatty acid tails of adjacent phospholipids.

Phospholipids come from your diet and your own cells. What do you think catalyzes the synthesis of phospholipids in your cells?

Proteins/enzymes

Phospholipids are called amphipathic. What do you think amphipathic means?

The molecule has both hydrophobic and hydrophilic properties.