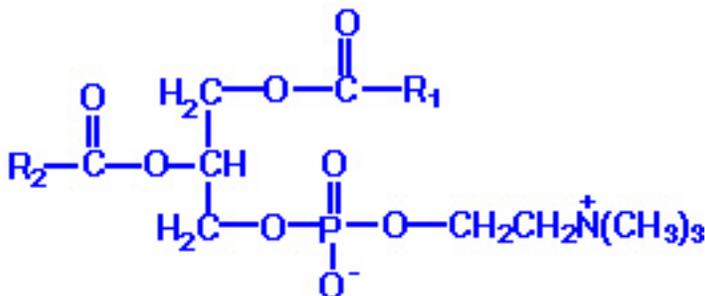


#### 4.14 Amphipathic surfactants

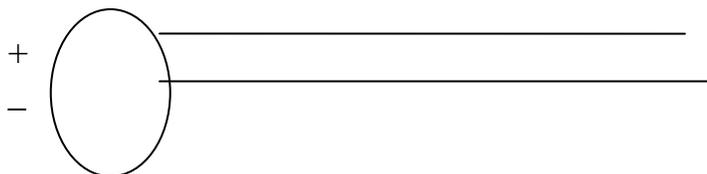
Amphipathic surfactants contain both a positive and negative charge on the hydrophilic portion of the surfactant. The most common amphipathic emulsifying agent is **lecithin (phosphatidyl choline)** whose structure is shown below.



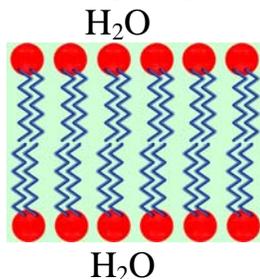
where  $R_1$  and  $R_2$  are usually 11-21 C atoms long.

It has both a positive quaternary ammonium ion and a negatively charged phosphate ester in its hydrophilic portion and is called **amphipathic** because of the dual charge.

Label the hydrophilic and hydrophobic portions. Lecithin has **two** long non-polar chains in contrast to the previous soaps and detergents we showed which only have one. As a result, the shorthand notation for lecithin is



Besides forming micelles, lecithin can also form lipid bilayers which also maximize “like dissolves like” solubility. Lipid bilayers are a primary component of cell membranes.



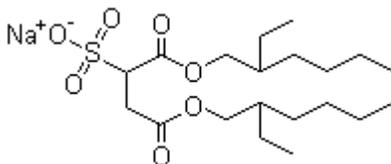
Lecithin is a major component in biological membranes and is obtained commercially from egg yolks, soybeans, and other sources. It is a good emulsifying agent. It is used in salad dressings and mayonnaise to emulsify

vinegar and oil, the two primary ingredients of salad dressings. In old fashioned vinegar and oil salad dressing there are two separate layers, vinegar and oil. When shaken vigorously, the two separate layers are broken up into tiny intermixed droplets, but the two layers separate out quickly. When lecithin or other surfactants are added, an emulsion is formed that has an opaque creamy consistency and does not separate into separate oil and water layers. In homemade salad dressing the active emulsifying agent is egg yolk, which is a very rich source of lecithin.



Lecithin is also found in some cake mixes. Cake mixes frequently contain both flour (hydrophilic) and shortening (fat). Mixing these together requires an emulsifying agent. Although cake mixes generally recommend the addition of an egg (which provides additional emulsifying action via lecithin), additional lecithin or other emulsifying agents are frequently included in the cake mix itself.

Several synthetic “detergent” molecules are used as laxatives and stool softeners. The structure of **dioctyl sodium sulfosuccinate** (abbreviated **DSS** for obvious reasons) or **docusate** (pronounced DOK you sate) is shown below. It is marketed under a variety of trade names and is recommended for the treatment of constipation and fecal impaction. Label the hydrophilic and hydrophobic portion of the molecule. It may act as a laxative by inhibiting water reabsorption as well as emulsifying the bowel contents.



DSS is one of the major components of Corexit 9500, one of the dispersants used in the Gulf oil spill.