Fig 11.16 (c) and 11.17 show structures of two common sphingolipids.

Sphingolipids are composed of sphingosine, a fatty acid and either a phosphate ester of an alcohol (Fig 11.6 (c)) or a sugar (Fig 11.17).

Sphingosine is a C_{18} amino alcohol as shown in Fig 11.16 (a) and below

In sphingolipids the fatty acid forms an amide linkage to the amino group of sphingosine as shown in the Figs..

In sphingolipids the phosphate ester forms a diester linkage to the OH group of C_1 of sphingosine as shown in Fig 11.16 (c).

For the sphingolipid shown in Fig 11.17, the sugar β-D-galactose forms a glycosidic linkage with the C_1 OH of sphingosine.

Glycerolphospholipids and sphingolipids are often referred to as polar lipids that can be represented pictorially as follows

In an aqueous environment polar lipids aggregate so that hydrophobic interactions minimize contact of the nonpolar hydrocarbon chains with H_2O and hydrophilic interactions maximize contact of the polar group with H_2O.

Polar lipids typically aggregate to form bilayers as represented below

In the bilayer the polar groups on each side interact with H_2O molecules by H-bonding and dipole-dipole interactions as indicated below

The hydrocarbon chains of the lipids form a nonpolar region that has limited exposure to H_2O.

Membranes are composed of polar lipids and proteins. Figs. 2 and 3 describe the fluid mosaic model of membrane structure.

In this structure <u>integral</u> protein molecules are embedded in a bilayer of polar lipid molecules.

Note that some of the protein molecules span the entire thickness of the membrane while others are only exposed to the aqueous solution on one side of the bilayer.

While the surfaces of integral proteins exposed to H_2O are hydrophilic, the surfaces of integral proteins embedded in the bilayer are hydrophobic.

The membrane also contains peripheral proteins, not shown, which interact with the polar groups of lipids and proteins on each side of the bilayer.

An important characteristic of a membrane is that the bilayer is fluid, which means that it has the properties of a viscous liquid.

A consequence of the fluid nature of the bilayer is that protein and lipid molecules in the membrane can diffuse laterally in the bilayer.

Fig 11-16 describes an experiment that shows the fluid nature of cell membranes.

A fluorescent group was attached to a membrane component so that the entire surface of an immobilized cell fluoresces (black in handout Fig) on exposure to low intensity light.

When an intense laser light pulse was focused on a small region of the cell, the fluorescent groups were bleached, i.e., they no longer fluoresced.

With time, the fluorescence in the bleached area returned indicating that the bleached molecules diffused out and unbleached molecules diffused into the region.

Another characteristic of natural membranes is that they are asymmetric.

Membranes exhibit both transverse and lateral asymmetry.

Transverse asymmetry refers to the fact that the two sides of a membrane are different with respect to the proteins and lipids in the inner and outer leaflets (layers).

Different integral proteins are embedded in each side of the membrane during synthesis.

The large energy barrier for movement of the H_2O exposed hydrophilic portion of the protein across the lipid bilayer prevents proteins from equally distributing themselves on both sides of the membrane.

Differences in the lipid composition of each leaflet of the membrane are shown in Fig. 11-33.