

## 5.1.5

# Carbohydrates

In addition to lipids and proteins, the membranes also contain carbohydrates. These are short-chained polysaccharides (oligosaccharides) that attach to the proteins and lipids on the extracellular layer of the membrane. If attached to a protein, they are called **glycoproteins**, and if attached to a lipid, they are called **glycolipids**. One function of these oligosaccharides bound to membrane proteins or lipids is to form additional cell markers. Human blood types (A, B, AB, or O), for example, are determined by glycoproteins expressed on red blood cells. *Note: Human blood groups are determined by a sphingolipid oligosaccharide. The branched chain common in all groups is Glc-Gal-GalNAc-Gal-Fuc. Type A has an additional GalNAc; B has an additional Gal; and O has no additions.*

Additionally, some cells, such as the apical surface of epithelial cells, have a dense layer of glycoproteins referred to as the **glycocalyx**. The glycocalyx has been implicated in cell recognition during development, adherence of cells to each other, and playing a role in the permeability of the membranes.



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