

6.7: Oligosaccharides

Learning Objectives

- Describe the role of carbohydrates as cell markers.
- Identify the blood type classified as the universal donor/acceptor.

Oligosaccharides

An **oligosaccharide** is a saccharide polymer containing a small number (typically two to ten) of monosaccharides. Oligosaccharides can have many functions; for example, they are commonly found on the plasma membrane of animal cells where they can play a role in cell-cell recognition. In general, they are found attached to compatible amino acid side-chains in proteins or to lipids.

Oligosaccharides are often found as a component of **glycoproteins** or **glycolipids**. They are often used as chemical markers on the outside of cells, often for cell recognition. Oligosaccharides are also responsible for determining blood type.

Blood Type

Cell markers are carbohydrate chains on the surface of cells where they act as “road signs” allowing molecules to distinguish one cell from another. ABO blood markers found on red blood cells are made up of oligosaccharides that contain either three or four sugar units (Figure 6.7.1).

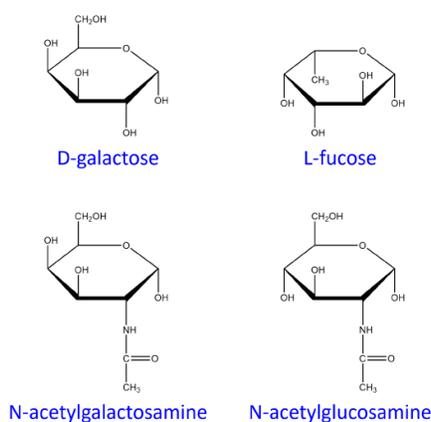


Figure 6.7.1: Structures of monosaccharide units present in ABO blood markers.

Carbohydrates attached to red blood cells determine the ABO blood type (Figure 6.7.2).

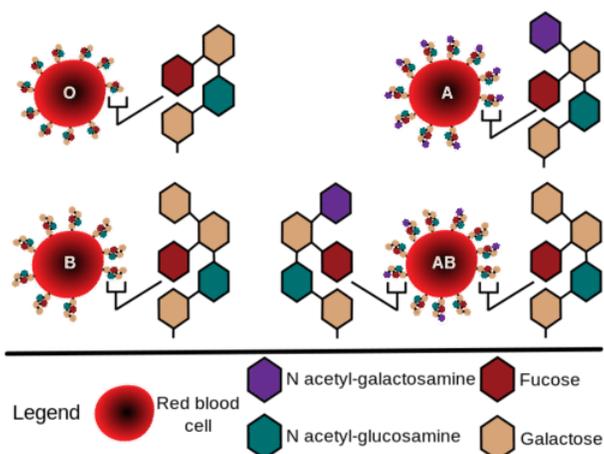


Figure 6.7.2: ABO blood types.

Of the four blood types, type O has the fewest types of saccharides attached to it while type AB has the most. As a result, type O blood is considered the **universal donor** because it doesn't have any saccharides present that will appear as foreign when transfused into blood of another type. The reverse is not true. For example, if type A blood is given to a patient with type O blood, it will be rejected by the body because there is an unknown species being introduced to the body. Type A blood cells contain N-acetylgalactosamine which is not present in type O blood. A person with type O blood would undergo rejection upon receiving type A blood. Since type AB blood has all possible saccharides, type AB blood is considered the **universal acceptor**. The Rhesus factor (Rh) in blood also affects donor and acceptor properties but it does not depend on carbohydrates. The Rh factor is determined by the presence (Rh+) or absence (Rh-) of a specific protein on the surface of red blood cells.

✓ Example 6.7.1

Indicate whether the following blood types could be accepted by a person with type A blood:

- Type AB
- Type O

Solution

- No, because type AB blood has saccharides that are not present in type A blood. Therefore, the presence of this foreign substance would be rejected.
- Yes, this is the universal donor. Although it does not have all of the same saccharides as type A, no foreign substances are introduced.

? Exercise 6.7.1

Indicate whether the following blood types could be accepted by a person with type AB blood:

- Type B
- Type O

Summary

- All blood types include the N-acetylglucosamine, galactose, and fucose; but differ in the absence or presence of additional units.
- Type O blood is considered the universal donor.
- Type AB blood is considered the universal acceptor.

Contributors and Attributions

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