Fischer projections are often used in carbohydrate chemistry to clearly show the arrangement of groups around the chiral carbon atoms in monosaccharides.

**D-glucose** – “open” form representations

The “closed” form is predominant. To get this, the Fischer projection can be turned on its side and wrapped up to give a Haworth structure. By carefully following these steps, the stereochemistry (3D arrangement) of all the chiral carbons in a monosaccharide can be maintained.

1. Tip to the right
2. Count/Number the “ring” atoms
3. Align the ring atoms in a row
4. Curl to Haworth arrangement
5. Draw the new ring bond
6. New OH is down for α or up for β
There are three monosaccharides that appear in nutritionally important disaccharides.

D-glucose  
\[
\begin{array}{c}
\text{CHO} \\
\text{H} & \text{OH} \\
\text{HO} & \text{H} \\
\text{H} & \text{OH} \\
\text{CH}_2\text{OH}
\end{array}
\]

D-galactose  
\[
\begin{array}{c}
\text{CHO} \\
\text{H} & \text{OH} \\
\text{HO} & \text{H} \\
\text{H} & \text{OH} \\
\text{CH}_2\text{OH}
\end{array}
\]

D-fructose  
\[
\begin{array}{c}
\text{CH}_2\text{OH} \\
\text{C} & = \text{O} \\
\text{HO} & \text{H} \\
\text{HO} & \text{H} \\
\text{H} & \text{OH} \\
\text{CH}_2\text{OH}
\end{array}
\]

The 6-membered rings containing oxygen that are most common for glucose and galactose are called a pyranose. The top left Haworth structure above is called the α-pyranose form of D-glucose.

The 5-membered rings with oxygen commonly formed by fructose are referred to as a furanose. Therefore, the lower right structure is D-fructose in the β-furanose form. Aldohexoses can also form furanoses. Just find the oxygen 5 atoms away from the carbonyl! To the right is the α-furanose form of D-glucose.

Natural monosaccharides are all of the D form. The L form of a particular monosaccharide is the mirror image of the entire D form, not simply the OH on the next to last carbon atom.