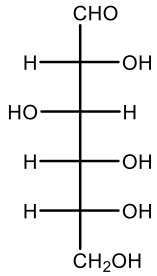
Understanding Monosaccharides and Stereochemistry

- **D/L Sugars**

  To determine whether a molecule is a D or L sugar, you must look at the position of the OH group that is attached to the chiral carbon farthest away. If that OH is to the right, it is a D sugar. If that OH is to the left, it is an L sugar.

- **D-Glucose**

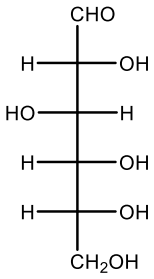
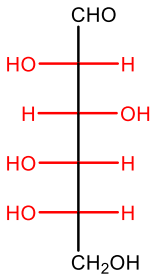
  The position of the other OH groups, depends on the identity of the carbohydrate. Whether the H or OH groups are shown on the left or right side of a Fischer projection is important, because it dictates the identity. For example, D-glucose is an aldohexose that will always have the following:

carbon #	D-glucose	
carbon 1	aldehyde group (CHO)	
carbon 2	H to the left and OH to the right	
carbon 3	OH to the left and H to the right	
carbon 4	H to the left and OH to the right	
carbon 5	H to the left and OH to the right	
carbon 6	two hydrogen and OH group	

  If the atoms aren't arranged this way, it won't represent D-glucose. For example, if carbon 4 has the OH is to the left and the H to the right (but everything else is the same), it represents D-galactose.

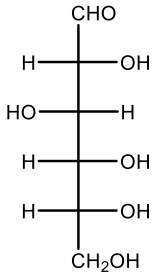
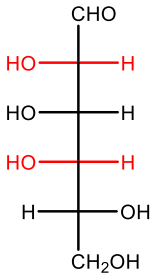
- **Enantiomers**

  D and L sugars (same monosaccharide) are enantiomers of one another. Enantiomers are stereoisomers that are complete mirror images. When looking at the Fischer projection of a carbohydrate, if all the chiral centers (horizontal lines) are the exact opposite, then the molecules are enantiomers. (Example: D-glucose and L-glucose)

D-glucose	carbon #	L-glucose
	carbon 1	
	carbon 2	
	carbon 3	
	carbon 4	
	carbon 5	
	carbon 6	

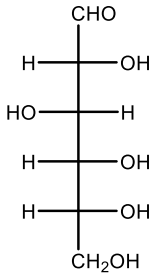
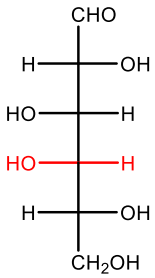
- **Diastereomers**

  Diastereomers are another form of stereoisomers. However, these molecules are not "perfect" mirror images. Diastereomers will have less than all of the chiral centers (horizontal lines) that are opposites. (Example: D-glucose and D-talose)

D-glucose	carbon #	D-talose
	carbon 1 carbon 2 carbon 3 carbon 4 carbon 5 carbon 6	

- **Epimers**

  Epimers are another form of stereoisomers (actually a special type of diastereomer). However, only one chiral center (horizontal line) is the opposite and all the others are the same. For example, D-glucose and D-galactose are epimers because the molecules are identical, except for the arrangement of the H and OH around carbon 4.

D-glucose	carbon #	D-galactose
	carbon 1 carbon 2 carbon 3 carbon 4 carbon 5 carbon 6	

So, to sum it up:

- the last chiral carbon tells whether it is D or L.
- the arrangement of H and OH around each chiral center (horizontal line) gives the identity of the carbohydrate.
- there are three types of stereoisomers that can exist when looking at the Fischer Projections. To determine which is present, look at how many chiral centers (horizontal lines) are the opposite:
  - all opposite = enantiomers
  - only 1 opposite = epimers
  - more than 1, but less than all = diastereomers