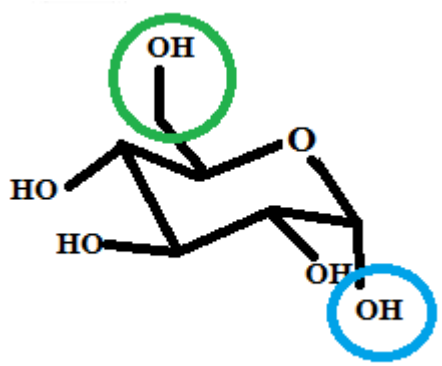
A Guide to α and β Carbohydrates

α-and β Carbohydrates are determined by position of the OH group attached to the anomeric carbon and the CH_2OH group attached to the other carbon next to the ether.

Alpha Carbohydrates:

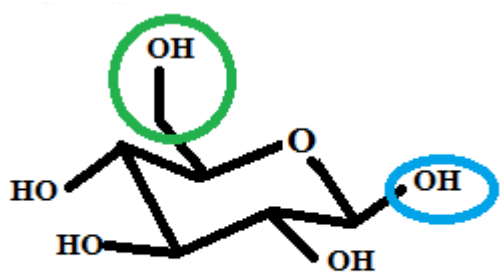
A-carbohydrates do not always have the OH group on the anomeric carbon pointing down. α-carbohydrates have a cis configuration between the OH group and the CH_2OH group. This means that the OH group and the CH_2OH group are on opposite sides of the ring.



In this drawing of α-D-glucopyranose, the OH group (circled in blue) attached to the anomeric carbon and the CH_2OH group (circled in green) are in a cis configuration. The OH group is on the bottom of the ring and the CH_2OH group is on the top of the ring.

Beta Carbohydrates:

β-carbohydrates do not always have the OH group on the anomeric carbon pointing up. β-carbohydrates have a trans configuration between the OH group and the CH_2OH group. This means that the OH group and the CH_2OH group are on the same side of the ring.

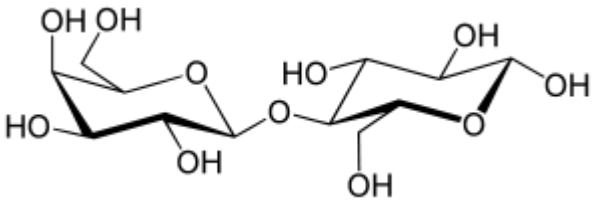


In this drawing of β-D-glucopyranose, the OH group (circled in blue) attached to the anomeric carbon and the CH_2OH group (circled in green) are in a trans configuration. The OH and the CH_2OH groups are on the top of the ring.

Alpha and Beta linkages:

Alpha and Beta linkages are found in disaccharides and polysaccharides. These glycosidic linkages are the bonds between two simple sugars within a disaccharide or polysaccharide. Alpha linkages are easily digested by the human body. Beta linkages are stronger than Alpha linkages because they are more stable. Carbohydrates with Beta linkages are not easily digested by the human body, except for lactose because most humans have an enzyme which breaks down this disaccharide.

These glycosidic linkages cause the anomeric carbon to be in a fixed position. Alpha glycosidic linkages causes the anomeric carbon to be fixed in the Alpha configuration. Beta configurations cause the anomeric carbon to be fixed in a Beta configuration.



The molecule to the left is lactose. Lactose has a beta linkage between Galactose and Glucose. The anomeric carbon on the galactose is fixed in the beta position since it is bonded to the glucose.

In carbohydrates there are acetals and hemiacetals.

Acetals are the R-O-C-O-R group. The carbon in the acetal has a fixed alpha or beta position.

Hemiacetals are the R-O-C-OH group. The carbon in the acetal group has a mix between alpha and beta. This is found on simple sugars and in disaccharides or polysaccharides on the carbon which is not involved in the glycosidic linkage. This mix of alpha and beta is represented by a squiggly line to the OH.

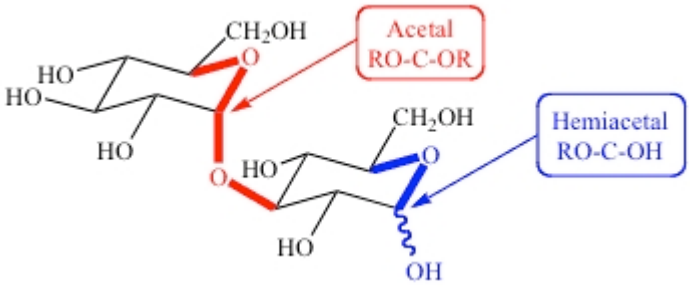


Image sources:

Wikipedia

Dr. Hardinger's Chem 14C Webpage