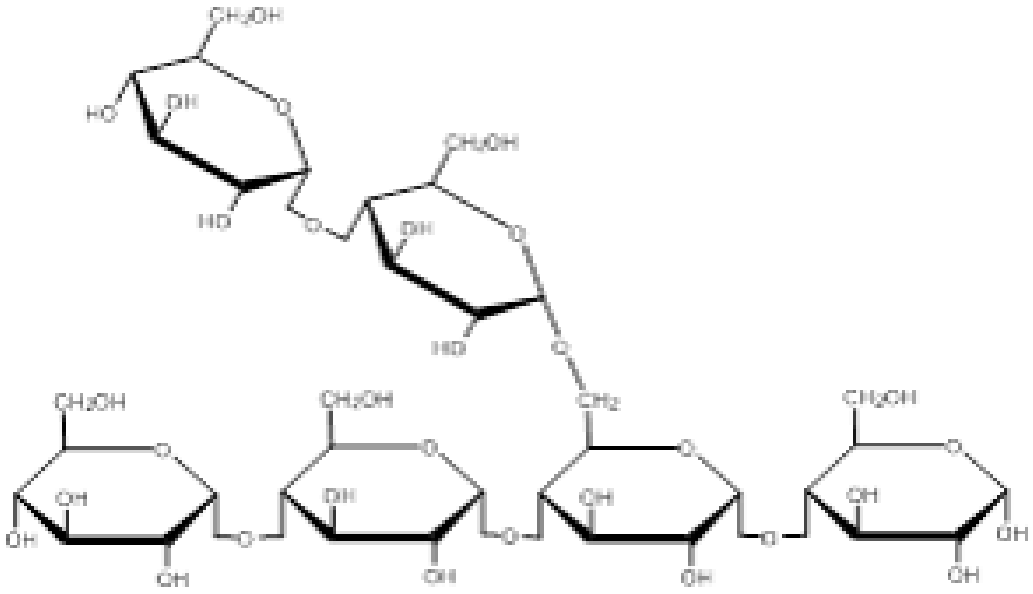
3.1.3

Polysaccharides

Polysaccharides are long chains of monosaccharide subunits linked together through dehydration synthesis reactions. Typically these chains contain hundreds to thousands of monosaccharides linked together through glycosidic linkages. Because of their length, polysaccharides are considered complex carbohydrates., Polysaccharides can be classified into two based on their function as either energy storage or anatomical structure. Storage polysaccharides include starch and glycogen. Plants and animals store sugar for energy use in the form of glycogen (animals) and starch (plants). Starch is a large polymer of glucose subunits and may be branched or linear. Amylose is a long, unbranched chain of glucose subunits. Amylopectin, on the other hand, has a branched structure (see figure below). It is the proportion of each form of starch in a particular food that determines the food's ability to be digested. Foods with a large amount of amylopectin are digested and absorbed rapidly because of its many branches, which facilitates hydrolysis. Foods that have higher levels of amylose break down at a slower rate. Some examples of starches include seeds, grains, corn, beans, potatoes, and rice.

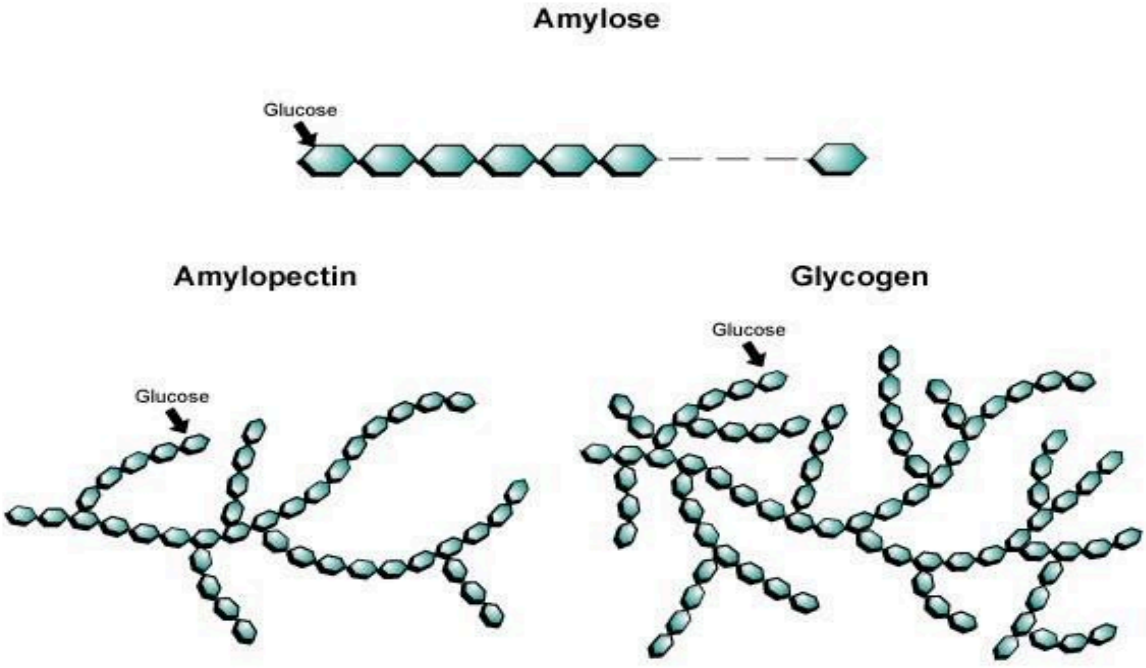


Branched Polysaccharide Amylopectin: Image created by MG, 2013

The image above shows branching in a polysaccharide molecule. Branching allows increased enzymatic breakdown and faster digestion.

Glycogen is the storage form of carbohydrates in animals. Glycogen, like starch, is a polymer of glucose subunits. It is similar in structure to amylopectin, but it is even more highly branched. We store glycogen primarily in our livers and skeletal muscles. The branched structure of glycogen allows for easy breakdown by enzymes in the body to release the glucose, so it can be utilized for energy. Glycogen stored in the muscle provides the energy required by the muscle for exercise, especially during high-intensity and endurance activities. Glycogen stored in the liver is utilized to provide other

tissues with energy, such as the neurons in the nervous system. The glycogen in skeletal muscle can be depleted in as little as one hour of vigorous exercise. On the other hand, during a fast, liver glycogen will last 12–24 hours.



Amylose, Amylopectin & Glycogen Structure. Image created by BYU-I student Hannah Crowder, 2013

This image above shows different degrees of branching in amylose, amylopectin, and glycogen.

As mentioned above, some polysaccharides are built for structural support. Cellulose is an important structural molecule in plants. Cellulose is a polymer of glucose but is assembled using different glycosidic linkages Humans do not have the enzymes to hydrolyze this linkage and cannot digest cellulose. However, as an insoluble fiber, cellulose is still an important part of the human diet as it promotes intestinal health and helps to lower cholesterol (via bile salt removal). Cellulose is especially plentiful in leafy vegetables and in whole grains.