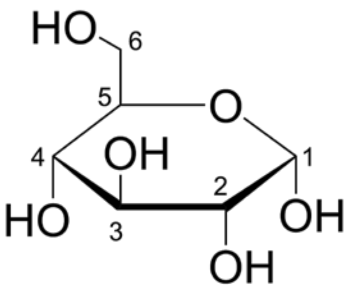
Diet and Hormones

1. We discussed how phosphorylation of enzymes can have a huge impact on if the enzyme is active. One example of this is the phosphorylation of the enzyme Glycogen phosphorylase activates the enzyme (turns it on). When this enzyme is active, glycogen is broken down to provide energy to the cell.
    a. Which hormone (insulin or glucagon) will trigger the phosphorylation of this enzyme? Why?

    b. Glycogen is a polymer of glucose. This enzyme catalyzes the breaking of these linkages – each bond that breaks uses exactly one equivalent of equivalent of ATP and results in one molecule of glucose-1-phosphate. Below is an image of glucose with the carbons numbered. Draw the product of phosphorylation on carbon 1.

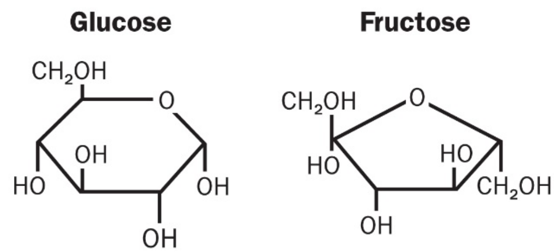


2. We discussed how glucagon is released in response to low blood sugar. Glucagon interacts with a GPCR on the surface of cells to stimulate the initiation of glycogen or fat breakdown. Using any combination of text and sketch, explain how glucagon interaction with the GPCR can result in the release of cAMP.

3. G-proteins are enzymes that catalyze the hydrolysis of GTP. Surprisingly, these enzymes are very slow.
    a. What does this suggest about the activation energy for the catalyzed process?

    b. Think critically about the role that G-proteins play in this process. Why does it make sense that these are slow enzymes?

4. We learned that glucokinase, an enzyme present in high quantities in the liver, will use glucose as a substrate but not fructose. The structures of fructose and glucose are shown below. It is the 6th carbon (top left of each molecule – CH_2OH) that gets phosphorylated by this enzyme.



a. Which molecule will have a lower Km value? Why did you make this selection?

b. Use these two structures and the relative Km values to predict what features the active site might have to allow it to distinguish between the two molecules.