Carbohydrates: In lecture, you mentioned that beta-1,4 glycosidic linkages are more stable than alpha-1,4 glycosidic linkages. I was just wondering why that is. There seems to be no difference between the two linkages other than the orientation of the hydrogen atom.

The basis for the answer is the "bends" in alpha linkages vs the "straightness" of beta linkages, and the resulting effect on stabilization of the molecules by hydrogen bonding with their neighbors. Cellulose, with its beta linkages, is fully "extended" because the alternating glucose molecules are at 180 degree turns to each other. This allows very easy hydrogen bonding, not only between monomers in the same fibril, but also with neighboring fibrils, making the entire structure much more stable and resistant to hydrolysis by, for example, digestive enzymes. This is why most animals like us cannot digest cellulose. Starch/glycogen, on the other hand, are composed of alpha linkages, which cause each glycosidic linkage to bend slightly. This is not shown well in your textbook, but the following figure shows what I'm talking about:

As you can see, the bends in alpha linkages will curve the molecules enough that stablization by hydrogen bonding is much less significant. Since the bonds are therefore more accessible to hydrolytic enzymes, the covalent linkages between monomers are more easily broken. So you're right, a covalent bond is a covalent bond. But at the level of the biochemistry, different types of linkages have a significant role on the stability of the resulting polysaccharide.

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