Cellulose

The major component in all paper is the biopolymer cellulose. While cellulose is made up of a string of simple sugar units, it's pretty tough stuff. No animal can digest it directly although some bacteria can. In this page we'll discuss a few important points about cellulose: we'll look at its structure and see how its stucture makes cellulose good for making paper and we'll see how any acid left in the paper will eventually lead to the destruction of the paper.

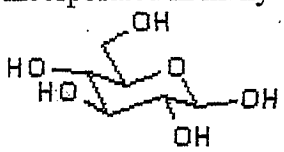
Cellulose has three properies that in combination make it nearly ideal for making paper.

- It is a long molecule with some structural rigidity.
- It is relatively stable so that it will not decompose easily.
- It can form a multitude of hydrogen bonds with other cellulose molecules.

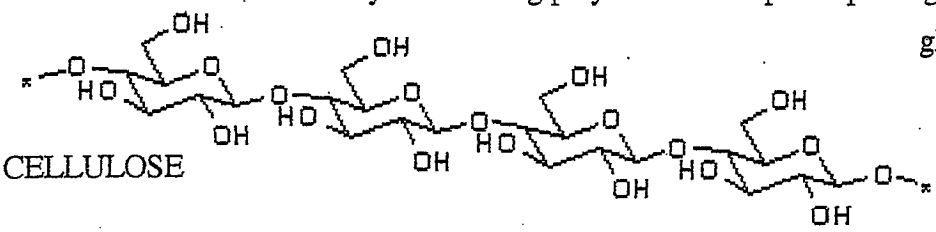
This last feature is especially important since these hydrogen bonds between interlacing cellulose fibers provide the collective forces that hold paper together.

Structure and Stability

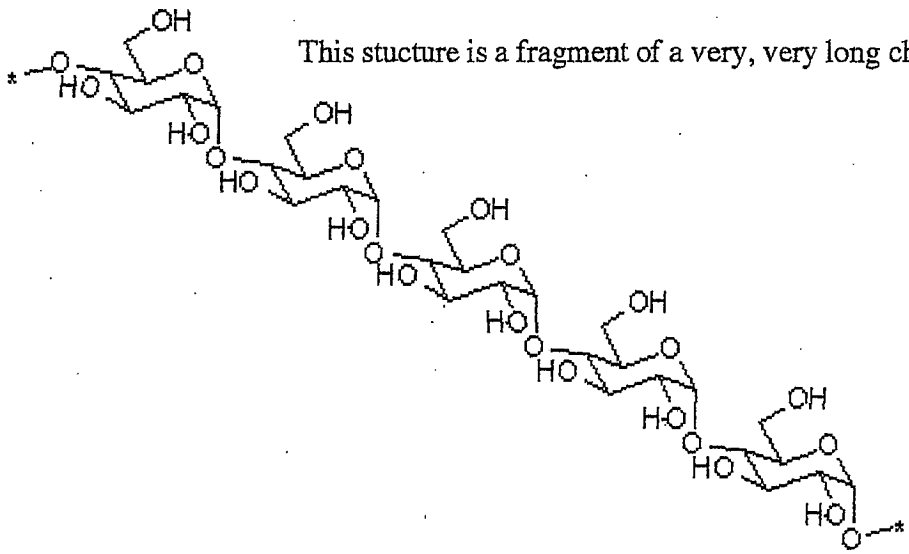
Glucose is the most common, and not incidentally the most stable, of the simple sugars. It is incorporated in many biomolecules.



Cellulose and the common starch amylose are long polymers made up of repeating units of glucose.



CELLULOSE This stucture is a fragment of a very, very long chain of glucose units.

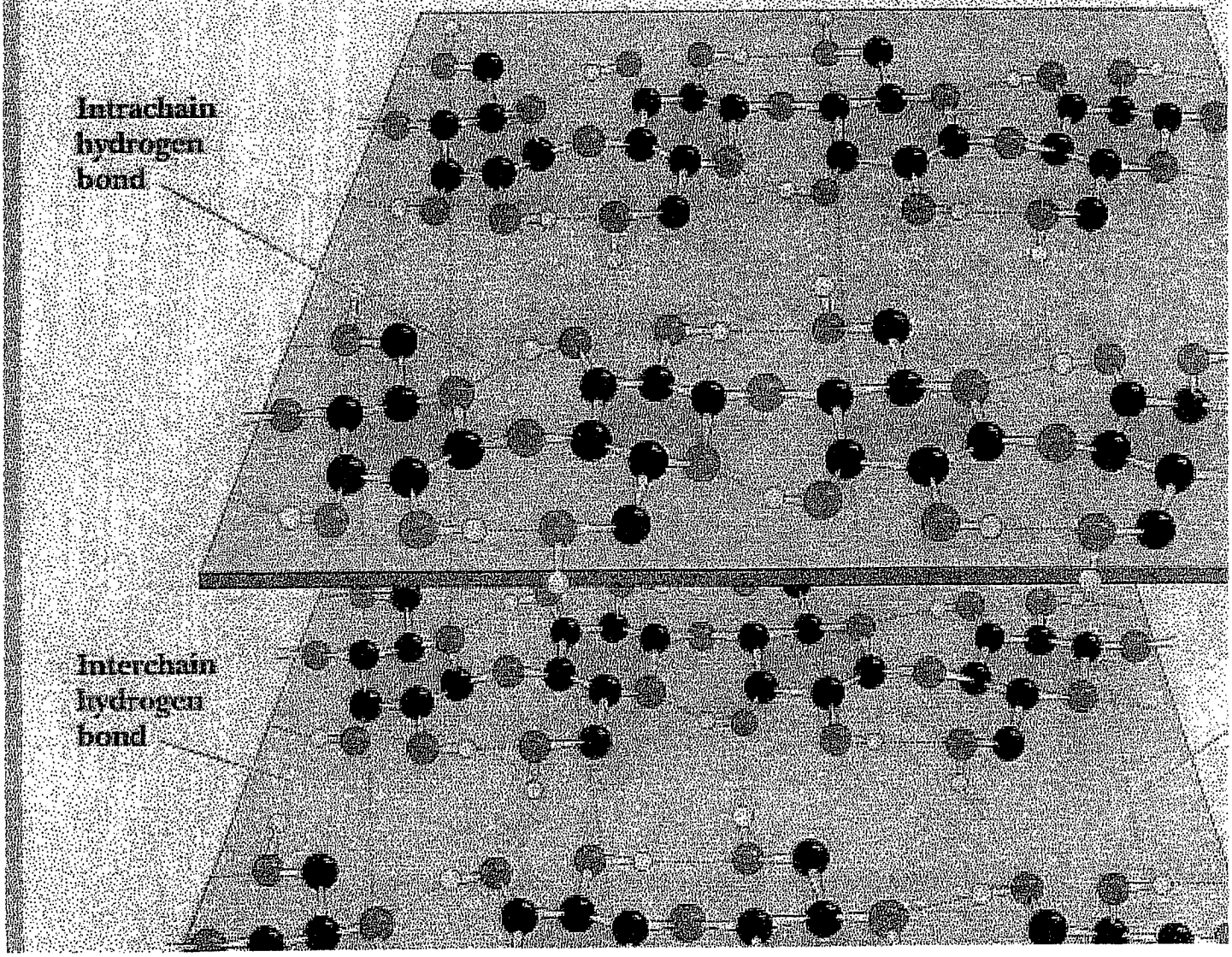


AMYLOSE This stucture is a fragment of a very, very long chain of glucose units.

But cellulose differs from amylose only in the linking structure between the glucose units. This makes it more resistant to cleavage by ACIDS and digestive enzymes than amylose is. (In fact, mammals do not have enzymes capable of hydrolyzing cellulose but can digest amylose.) This stability of cellulose makes it possible for us to depend on cellulose-containing materials -- wood, paper, cloth -- in many aspects of our daily life. Since this is the only difference in structure, it is reasonable to assume that the difference in stability between cellulose and starch eminates from the difference in the geometry of the oxygen links between each glucose unit in these polymers.

Structure of Cellulose

Garrett & Grisham: Biochemistry, 2/e
Figure 7.27



http://www.nd.edu/~aseriann/cellulose.html