THE HELIX HANDOUT

by Frank Deis

Most people have trouble remembering the difference between a right-handed helix and a left-handed helix. Since helices crop up in biochemistry, here are some hints for keeping them straight in your head. The first concept you need is that helices continue to look the same when you turn them upside down. You can't turn a right-handed helix into a left-handed helix just by inverting it, you have to untwist it and sart over.

An easy way to classify helices is by looking at the direction the visible fibers run when the helix is vertical. They will either go up to the right or up to the left. If they go up to the right, the helix could be called a "Z-twist" helix, because the vertical stroke of the letter Z goes up to the right. "Z-twist" helices are right-handed. Notice that a "Z" looks the same when turned upside down, just like a helix. The other possible form of helix would have fibers which go up to the left, like the vertical stroke of the letter "S". Thus, left-handed helices are also called "S-twist" helices. I remember the connection by reminding myself that "sinister" means "left" in Latin, which led to the chiral abbreviation "S" to go with "R" or "recto", to the right.

This "Z and S" or "right and left" nomenclature may be applied to anything helical, including ropes, yarns, screw-threads, and biochemical polymers. Most helices around us are "Z-twist" or right-handed. Nearly all screw threads "close" in a "clockwise" direction, meaning that they are right-handed. The only counter-example I can think of are hot-water faucets in the U.S. (not true in Europe) and wheel lugs on one side of certain large Chrysler automobiles, which "close" in a counterclockwise direction and are left-handed. Some knitting yarns and "twisty" telephone connector wires are also left-handed.

Most biochemical polymers form right-handed helices, including the single alpha helix of proteins and two main forms of double helical DNA, the A form (described by Rosalind Franklin) and the B form (Watson and Crick). The collagen triple helix is also right-handed, but the individual strands of tropocollagen have an "S-twist."

There is one confusing situation involving DNA. If you can remember that it is the opposite of what it sounds like, you will be fine. A third form of the DNA double helix, described by Alexander Rich, is known as the "Z-form" because the strands "zig-zag." This is a left-handed form of DNA. So all you have to remember is that the only important biochemical helix with an "S-twist" is "Z-form DNA" the one with the backward name!