A Review/Testimonial for the Indigo® Instruments 12 Base Pair DNA Double Helix Model

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In 2010 we created a course entitled "Cloning, Transgenics and Bioethics" at St. Andrew's Episcopal School in Ridgeland, MS, USA. In addition to discussing the ethical concerns surrounding human genetic manipulation, we also spent a great portion of the class understanding the strict stereospecific requirements of polymers in organic and biochemistry. Our ultimate focus was to understand, in detail, the structure and function of nucleic acids. Most importantly, we wanted to understand how information flowed from our data storage molecules (DNA) to our functional molecules (protein enzymes). Any mistakes in this transfer of nonrandom sequence information is what we would call a mutation and could result in serious genetic disorders.

As we were going through the standard whiteboard and pencil and paper work in biochemistry, one of my students suggested that we build a model of DNA. I told the students to find one that would work for our purposes. One of those students went online and found Indigo Instruments' twelve base pair model of B-form DNA. We had the funding, so we ordered one. It was exactly what we wanted and needed.

First, the model is large enough for students to get a good understanding of the monomers (nucleotides) that make up the polymer (DNA). Each of the nucleotides, the A, T, G, and C's that one learns about in introductory biology class was approximately the size of a human palm. Students learned about the differences between the purines, consisting of two rings, and pyrimidines which consist of a single ring. Furthermore, they had to understand the required geometry surrounding the individual carbons and nitrogens making up the rings. It was of particular importance when looking at the 4 and 5 carbons on the purine rings, as there are three different bond angles around those carbons. It requires student focus during assembly. Simply flipping the "atom" around would warp the rings. When it is done incorrectly, it shows in the shape of the overall model. Finally, the double bonds on the bases and the hydrogen bonds connecting pairs of bases are obvious and contribute to the understanding of the overall structure.

In addition, the building of the 2'-deoxyribose requires that one pay attention to the chirality of the carbon atoms in the ring, as well as employing the 2'-endopucker towards the 5'-phosphate. Students enjoyed this level of specificity.

While we did many things in the class that students found informative and interesting, they all said that building the model was the highlight of the course. While the model was originally designed to be disassembled and reused, we ordered a new one for each class. The models began showing up all over campus. As the course became more popular, it was offered twice a year. It came to us that instead of creating two models a year that were approximately 1 meter tall, we would combine them and make a 24 base pair model that was about 2 meters tall. Overall, we ordered and built 10 models. I found them to be well worth the price.

Without reservation, I can strongly recommend this particular model building exercise. It requires and reinforces a strong understanding of the details of DNA structure. While it does have a reasonably high level of complexity, it is fun to build and most educational.

DNA Double Helix 12 Base Pair Molecular Model from Indigo® Instruments.