DNA - Big Model

I'm afraid that I can't find pictures of the model that we made, and it has since disappeared during the remodeling of my old Biology classroom. However, I estimate that it was about 2 feet (60 cm) wide by about 7.5 feet (222 cm) long. It was made mostly from sheets of Styrofoam (probably 3/4 - 1" thick), from which we had cut the 21 16 cm x 60 cm rectangles for the 21 base-pairs. After marking and painting each basepair, we strung them in proper sequence on a 1/2" steel rod through the middle of each rectangle, with rubber reinforcing grommets/washers on both sides of each hole in those base-pair rectangles. We attached two strips of adding machine tape spiraling around the outside, connecting to the outer ends of the bases, and attached deoxyribose sugars (pentagon shapes) alternating with phosphate groups (discs). to the tapes. Each pentagon shape was attached at the point where the base met the strip, and each disc was attached between the pentagons.

The base-to-base space was about 10 cm. The spacing and corresponding diameter of the model was proportional to the information that those actual dimensions are about 0.34 nm and 2.0 nm respectively. The length resulted from the fact that there are 6 letters and a space in our school name (Del Mar), with each letter corresponding to an amino acid symbol (or space), which in turn reflected a DNA codon of three bases.

Deciding on the desired final size (space to store/display vs length of school/mascot name), and using proportional algebra to figure out the model dimensions would be an excellent exercise for the student(s) doing the project. We displayed our model in the large school display case every year for awhile, and kept it suspended horizontally from the central I-beam in our classroom the rest of the time. Every year, after finishing our DNA unit, our students were asked to decode the "message" in the model DNA for extra credit. I don't believe anyone ever actually did it! Must have been my failure to build sufficient mystery and stimulate curiosity The were only told which end of which strand was the 5' end (not clearly obvious in the model).

Actually, this "challenge" was hinted at from time to time during the year, then, after finishing my Do-It-Yourself DNA kits and my "Say it with DNA" assignment <http://www.indiana.edu/~ensiweb/connections/genetics/dna.les.html>, they were formally challenged to apply their skills to the Big Model. Maybe you'll have more luck. Notice that you will be limited to 20 letters (all but B, J, O, U, X, and Z), since there are only 20 amino acids involved. If you must, you could fake it a bit by re-assigning unique codons for those letters, perhaps using codons for which there are several versions for the same amino acid, e.g., for A, G, L, P, R, and S. But this would be compromising the actual DNA Dictionary, so I would avoid it if you can. You can find the DNA Dictionary in the DNA Message Maker page (under Materials in "Say it with DNA" lesson).

The hardest part is cutting out the rectangles, discs and pentagons from the styrofoam. I use thinner (1/2" Styrofoam for the discs and pentagons). I found a hot-wire Styrofoam "cutter" in our art department, so you might check there. Careful, the wire gets real hot! Marking and painting the basepairs is also a bit tedious. I decided to paint the Adenines red, the Thymines yellow, the Cytosines blue and the Guanines green. I would mask off the other base, and spray paint each base in turn. Obviously, you need to decide on the "message" (school name, mascot, or maybe your name) first, then figure out the sequence of codons, then figure out the total number of A-T rectangles and total number of C-T rectangles.

Attached are copies of my starting templates (taken from a paper model of DNA) on which I've marked off the rectangular shape to be used. Make transparencies of these, project them on the wall or board with your overhead, adjust to size desired, then trace off the rectangles, each with its < or C interface (for AT or CG interfaces). That will become your template for cutting the basepair rectangles. I used the < and (interfaces based on the flat paper model (attached) that I had used in my DNA kits. You may want to make the steel rod holes more central for purposes of strength.

Good luck. Let me know how it goes.
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