DNA MODELS

Design and Build a 3D model of a DNA molecule. You may work alone or with ONE partner from any of the IB Biology class sections.

Blueprint of Model

A one page "blue print" of your model is due **WEDNESDAY 2 January 2013.** The blue print should:

- Include a diagram or sketch of the final appearance of your DNA model.
- Be completed on unlined, white paper
- Be neatly hand or computer drawn. No eraser marks are allowed.
- Include the nucleotide base sequence of the DNA strand you are going to model.
- Have a scale, indicating how large your model will be in "real life."
- State how the model is to be displayed (i.e. hung, mounted or free standing).
- List the materials that will be used to build the model.

If you are working with a partner, you may turn in the same blueprint (either printed twice or photocopied). However, both partners must turn in a blueprint and it must have both partners names listed.

Class time will not be provided for working on or photocopying the blueprints.

Completed Models

Completed model are due in class **FRIDAY 18 JANUARY 2013.** Class time will not be provided for working on the DNA models.

The models are scored in two ways:

- The average score of your peers' assessment is recorded as class work (out of 100 points)
- ¼ of your teacher's score is recorded as lab work (out of 25 points).

Use the following scoring rubric as a guide:

Points Earned	MAX Possible Points	Model Components
Required	50 Points	The model can either hang as a mobile or be mounted on a display stand on a tabletop. The model is sturdy enough to be handled and touched without breaking.
Required		The model is NOT built using a commonly available "kit" (you can get ideas from kits and you may use instructions that you find)
Required		The model is between 6 inches and 4 feet long.
Required		The DNA molecule depicts all four types of nucleotides (A, T, C and G)
Required		The DNA bases are arranged in complementary pairs (A-T, C-G).
Required		The sugar phosphate "backbone" of the two helices is on the "outside", bases are on "inside"
Required		The bases radiate from the sugar.
Required		There are at least 10 nucleotide pairs.
Required		The diameter of the double helix backbone is consistent.
Required		There is a key to the parts of the DNA shown in the model.
The model can show any number of the following optional features. Any additional features after a maximum of 100 points will be scored as extra credit.		
	5	**Number of nucleotide pairs** ▪ 25 or more (score 5) ▪ 11-25 (score 3)
	5	**The blueprint matches completed product** ▪ Yes, the blueprints sequence, scale and appearance match the completed model (score 5) ▪ Kind of, but *either* the sequence, scale or appearance aren't the same (score 2)

	10	**10 nucleotide pairs per complete helix turn** ▪ YES, the model has 10 pairs per turn on its own, without being twisted by hand (score 10) ▪ YES, but the model has to be twisted by hand to get its correct shape (score 3)
	5	**Correct number of hydrogen bonds between bases** ▪ YES, there are 2 between A and T and 3 between C and G (score 5) ▪ YES, the key has the correct number of bonds, but the model itself doesn't (score 2)
	5	**The two complementary strands are anti-parallel** ▪ YES, both strands are correct and labeled (sugar end is 3', phosphate end is 5') (score 5) ▪ YES, both strands are correct, but they are not labeled (score 2)
	15	**The shape of purines and pyrimidines in model mimic chemical shape** ▪ YES, the molecular structure of the bases is clear and very detailed. <u>Each atom</u> of the molecule has been modeled (score 15) ▪ YES, the molecular structure has been depicted (i.e. drawn), BUT each atom is not *modeled* (score 10) ▪ KIND OF, I can tell the number of "rings" in the molecule, but not the exact molecular structure (score 5) ▪ WELL, the molecular structure has been depicted for only one purine and pyrimadine or as part of the key (score 3) ▪ SORT OF, I can tell that one is bigger than the other, but not the number of rings or the molecular structure (score 2)
	10	**The deoxyribose molecule chemical shape is depicted** ▪ YES, the molecular structure of the sugar is clear and very detailed. Each atom of the molecule is modeled (score 10) ▪ SORT OF, the molecular structure has been depicted (i.e. drawn), BUT each atom is not *modeled* (score 5) ▪ KIND OF, the molecular structure has been depicted for only one deoxyribose molecules or as part of key (score 3)
	10	**The phosphate molecule chemical shape is depicted** ▪ YES, the molecular structure of the phosphate is clear and very detailed. Each atom of the molecule is modeled (score 10) ▪ SORT OF, the molecular structure has been depicted (i.e. drawn), BUT each atom is not *modeled* (score 5) ▪ KIND OF, the molecular structure has been depicted for only one deoxyribose molecules or as part of key (score 3)
	10	**Strands of the model can be separated or partially separated.** ▪ YES, the strands easily separate and come back together (score 10) ▪ YES, but it is hard to separate the bases or they do not go back together easily (score 3)
	5	**Model has artistic merit. It is striking, colorful, unique, and dramatic.** ▪ YES, the model obviously took a lot of time, effort and creativity. It is one of the best I've seen (score 5) ▪ KIND OF, it is nicely built and looks nice, but it isn't that unique (score 3) ▪ SORT OF, it is somewhat creative, but looks like it was put together without much thought (score 1)
	5	**Model is made of materials that can be recycled or composted** ▪ YES, every single part of the model will be reused, recycled or composted (score 5) ▪ KIND OF, some (but not all) of the model will be reused, recycled or composted (score 3)
	10	**Model depicts an actual DNA sequence** (*directions will be provided in class) ▪ YES, the name and sequence of the gene and the organism from which it comes is clearly labeled. The scientific name is italicized (score 10) ▪ KIND OF, the name of the gene and the organism from which it comes is clearly labeled but the name is not italicized (score 7) ▪ SORT OF, name of the gene is given, but not the organism in which it is found (score 3)
	10	**Description of the gene sequence that is modeled** ▪ YES, there is a detailed description of the function of the gene. The student clearly put some effort into describing it (score 10) ▪ KIND OF, there is a description, but it looks like it was copied and I don't under stand what it means (score 3) ▪ SORT OF, name of the protein the gene codes for is given, but no description is provided (score 2)
	155	**TOTAL**

Directions for Modeling an Actual DNA Sequence

Email your teacher to be assigned a genetic disease. Then, create a report for display next to your model. Your display can be creating as a miniature poster using a manila folder as the structure. Include the following information:

- The name of the genetic disease
- Information about the genetic disease. Start your research at this site: http://www.tylermedicalclinic.com/diseases.html but include additional information and photographs as necessary.

You also need to include information about the gene associated with the genetic disease and the protein which that gene encodes. To get this information, visit http://www.ncbi.nlm.nih.gov/sites/entrez?db=gene. This site is managed by the National Center for Biotechnology Information and the National Institutes of Health. Any time a federally funded genetic researcher discovers something about a gene, they must publish that information to this website.

In the search bar along the top of the page, select GENE from the drop down menu and type in the name of the genetic disease and hit the "GO" button. A list of search results will be returned. The links are to information about the gene associated with the disease. Select the link next to the first result. In your report, include:

- The name of the gene
- The gene symbol
- The chromosome on which the gene is located (info found on search results page)
- The species from which gene was sequenced
- A description of the protein coded for by this gene (includes information included on this page, but be sure to include additional information and photographs as necessary). For full points, you will be asked to verbally explain the function of the protein encoded by the gene. So, don't just write a bunch of information that doesn't make sense to you! Try to explain the function of the protein to at a high school IB Biology student level. Ask Ms. vB if you need help!!

Click through the links under the "Bibliography; GeneRIFs: Gene References Into Function" lists. These are links to scientific papers that describe the gene and the disease it is associated with. This will provided additional information for you to include in your description of the disease.

Scroll down towards the end of the page until you find the heading: **NCBI Reference Sequences (RefSeq).** Click a **GENOMIC sequence** (either GenBank or FASTA). The resulting page will provide the entire DNA sequence for 1 strand of the gene (you can figure out the sequence of the complementary strand). You may need to scroll down the page to see the sequence. Often time, the DNA sequence is hundreds or thousands of nucleotides long. Remember, you only need to model the first 10 nucleotide pairs (the first 25 for additional points). In your report, include the first 500 DNA sequence for the gene associated with your assigned genetic disease.