University at Buffalo
Genome, Environment and Microbiome
Community of Excellence

DNA Structure/Function Introductory Lesson

Objectives:	• Create a model of a double helix • Observe supercoiling of a double helix • Recognize that we look like biological family members because DNA is inherited from parents • Demonstrate proper use of transfer pipette • Utilize scientific processes to extract DNA from their own cells • Discover careers that exist as a result of an increased understanding of DNA • Defend stance on whole genome sequencing	
Bell Question	Is it OK to genetically modify mosquitos to reduce the spread of Zika virus? Why or why not?	3 min
DNA manipulative	Students work in pairs to create double helix models using rubber tubing and demonstrate supercoiling	5 minutes
DNA Extraction "Genes in a Bottle" (Bio Rad)	• During incubation period, discuss: o DNA Sequencing o What can a DNA sequence tell us? o Sampling of the pros and cons of sequencing human genomes ▪ Early intervention ▪ Insurance companies ▪ NCAA Division I testing for Sickle Cell Anemia o Career as a Genetic Counselor – help people understand what genetic sequencing is and guide them in making decisions. • Throughout the extraction students are reminded of the following: o Difference between eukaryotic and prokaryotic cells o Eukaryotic cells have nuclei, which is where the DNA is found o Detergents are used to break apart cell membranes o Enzymes end in the suffix –ase and speed up cellular processes. In this instance, using a protease to break apart proteins	35 min
Homework Explanation	• Research the pros and cons of sequencing human genomes and write a one page opinion paper explain why you would or would not choose to sequence your genome, if cost was no option.	2 minutes
DNA Origami	Fold a piece of paper, with base pairs matched up, into a double helix (if time allows)	8 minutes

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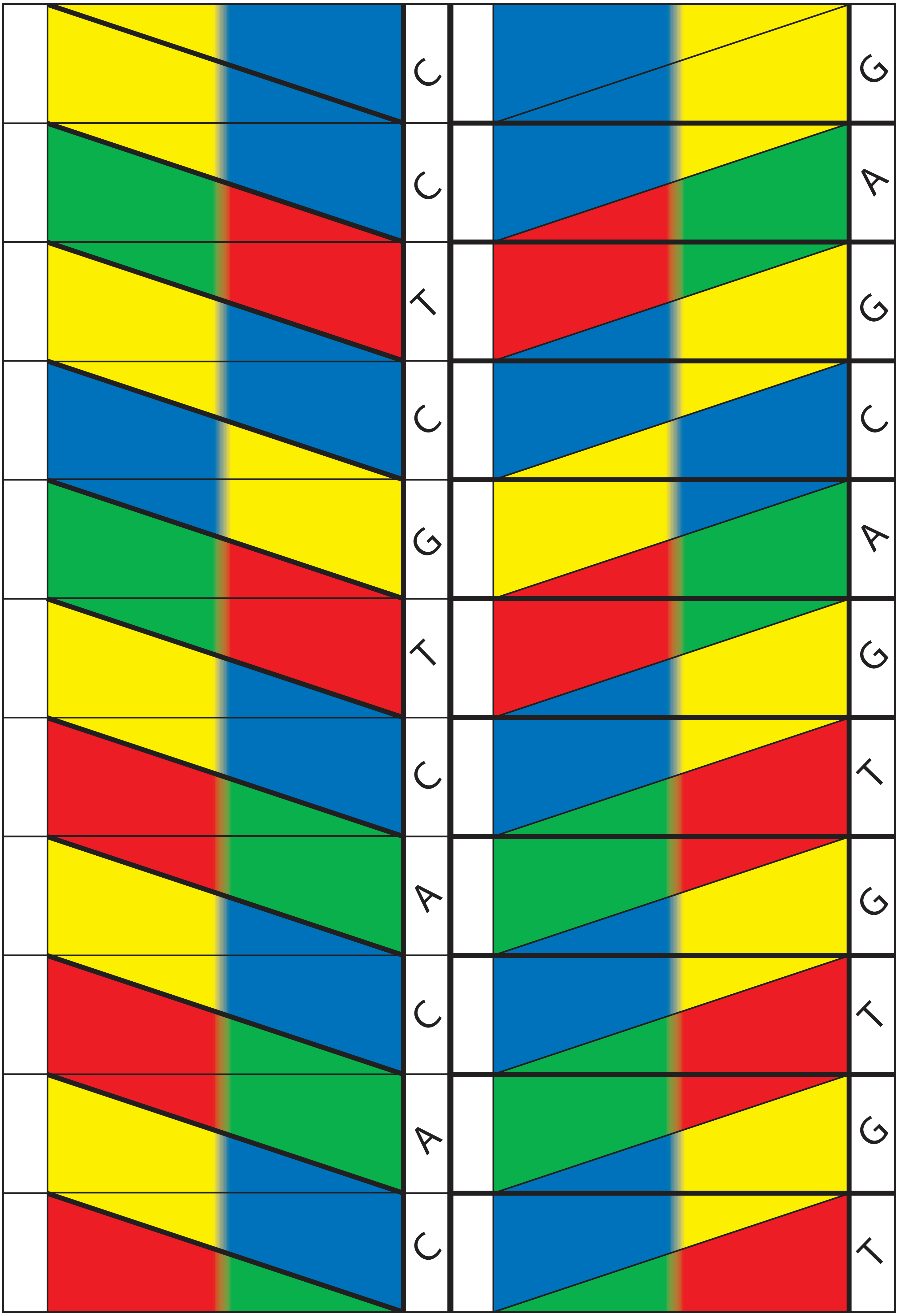
Standards Met:

Living Environment 1.1c	Science provides knowledge, but values are also essential to making effective and ethical decisions about the application of scientific knowledge
Living Environment 1.2a	Important levels of organization for structure and function include organelles, cells, tissues, organs, organ systems, and whole organisms
Living Environment 1.2g	Each cell is covered by a membrane that performs a number of important functions for the cell
Living Environment 2.1b	Every organism requires a set of coded instructions for specifying its traits. For offspring to resemble their parents, there must be a reliable way to transfer information from one generation to the next. Heredity is the passage of these instructions from one generation to another.
Living Environment 2.1c	Hereditary information is contained in genes, located in the chromosomes of each cell.
Living Environment 2.2e	Knowledge of genetics is making possible new fields of health care.
Living Environment 7.3a	Societies must decide on proposals which involve the introduction of new technologies. Individuals need to make decisions which will assess risks, costs, benefits and trade-offs.
ELA 1a	Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
RST 8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.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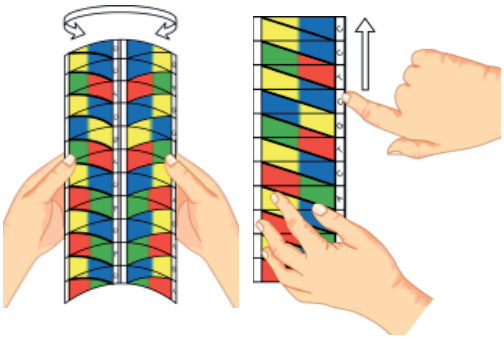
Fold your own DNA

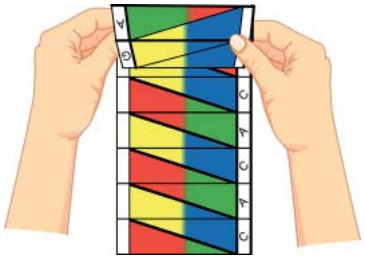
Note: All folds should have a thin line on the inside and a thick line on the outside.



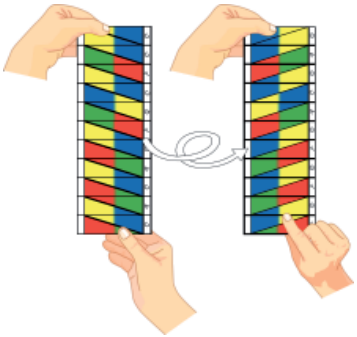
1. Fold in half lengthwise. Make all creases as firm as possible (use your fingernail!)

2. Hold the paper so that the thick lines are diagonal and the thin lines are horizontal. Fold the top segment down and then unfold.

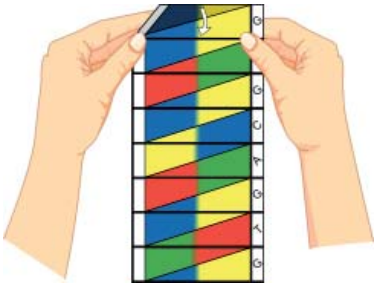
3. Fold the top two segments down along the next horizontal line. Unfold.



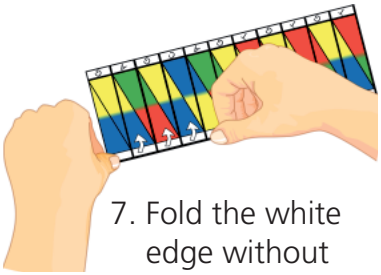
4. Repeat for all segments.



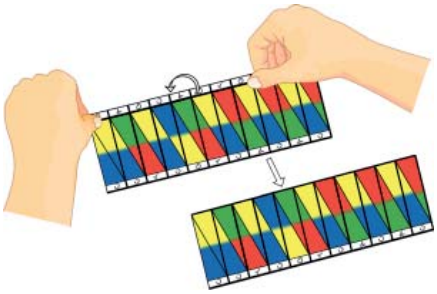
5. Turn the paper over.



6. Fold along the first diagonal line. Unfold and fold along the second diagonal line. Repeat for all diagonal lines.

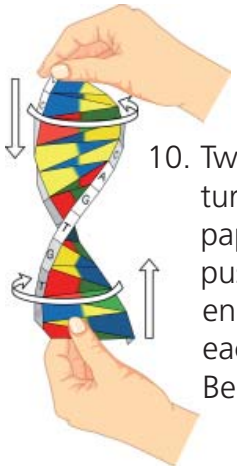


7. Fold the white edge without letters up.



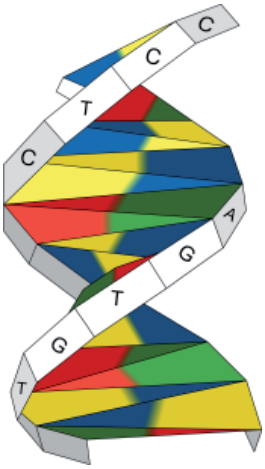
8. Fold the other edge away from you. Partly unfold both edges.

9. You can now see how the model is starting to twist.



10. Twist and turn the paper while pushing the ends towards each other. Be brave!

11. Now let go.



Admire your completed DNA double helix!

Only another 2,999,999,989 (or so) more to complete your whole genome!

Designed by Alex Bateman (2003)

ASK?

EMBL-EBI

wellcome trust sanger institute