



Located in the
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Harlem DNA Lab

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Teacher Development Program in Genetics & Biotechnology

Offered by the Dolan DNA Learning Center in collaboration
with the New York City Department of Education
Sponsored by the Howard Hughes Medical Institute

The Dolan DNA Learning Center (DNALC) of Cold Spring Harbor Laboratory (CSHL) and the New York City Department of Education (NYC DOE) are proud to announce a professional development program to enable teachers to deliver hands-on, inquiry-based experiments in genetics and biotechnology. With funding from the Howard Hughes Medical Institute, this program will reach 820 New York City science faculty over five years. The program will train 8th through 12th grade teachers to implement lab activities to complement the NYC *Scope and Sequence*, Life Science, Living Environment, and AP Biology curricula.

Complete **Certificate Training** in four 6-hour sessions and receive three P-credits. Select either of two lab sequences, which provide differentiated instruction for middle school, high school and AP Biology teachers. (Living Environment teachers may select either sequence, depending on their classroom needs.)

8th Grade Science/Living Environment

- DNA Structure and Isolation
- Variability & Inheritance
- DNA Transformation & Protein Isolation
- DNA Analysis & Forensics

Living Environment/AP Biology

- DNA Transformation & Protein Isolation
- DNA Analysis & Forensics
- PCR and Human DNA Variation, Part I
- PCR and Human DNA Variation, Part II

Select from a variety of weekday and Saturday dates to complete your training during the 2008-09 school year. All training will take place at *Harlem DNA Lab*, a state-of-the-art laboratory facility located in the John S. Roberts Middle School at 120th Street and 1st Avenue.

Leadership Training (60 hours) during the summer will provide follow-up and recognition to elite teachers who can implement advanced genetics, biotechnology, or research electives – or support the DOE's required 8th grade exit research projects. The workshop will sample molecular and genomic analysis in humans and in key model systems (*E. coli*, *C. elegans*, and plants).

Certificate and leadership training is provided by expert DNALC staff, and is offered free-of-charge to participating teachers. A certificate documenting training hours will be provided upon completion. All training will take place in the *Harlem DNA Lab*, at 120th Street and 1st Avenue.

To get on the mailing list, please call (516) 367-5170, email dnalc@cshl.edu, or go to www.dnalc.org/harlemdnalab.

Targeted Laboratories

The project team has worked to develop a limited set of “icon” laboratories, which embody process skills and key concepts of genetics and biotechnology. The juxtaposition of two major genetics/biotechnology units in 8th and 9th grades provides an opportunity to move students from descriptive to quantitative analysis of genetic processes – in keeping with the DOE's “spiraling curriculum” in which topics are revisited in greater depth in successive years.

DNA Structure and Isolation

Through interviews and animations, *DNA Interactive* (www.dnai.org) introduces students to the “players” and “the pieces of the puzzle” they contributed to solving the structure of DNA, including Nobel Laureate James D. Watson, formerly of Cold Spring Harbor Laboratory. This rich historical story can be complemented with easy-to-build DNA models and DNA extractions from bacteria, food, or human cheek cells.

Variability and Inheritance

Mendelian Genetics Students reflect upon humankind's earliest attempts at genetic engineering – selective breeding of agricultural plants and animals. By studying a landmark experiment conducted by George Shull at CSHL, students observe hybrid vigor in corn, which is the basic method used to make all hybrid corn in the U.S. and abroad. The same basic principles of inheritance apply to humans.

Mutations and Variability At the beginning of the 20th century at Columbia University, Thomas Hunt Morgan used mutant fruit flies to understand the physical basis of heredity, showing that genes indeed occupy specific locations on chromosomes. *Drosophila* and the round worm *C. elegans* can show students how model organisms help scientists understand mutations, variability, and natural selection. Identifying distinctive looking flies among a mixture of dead *Drosophila*, or behavioral mutants among living *C. elegans*, hones observation skills and cements the relationship between mutations and traits.

DNA Transformation and Protein Isolation

Hands-on laboratories offer a stimulating means to integrate the concepts “gene” and “genetic engineering” that are present in the 8th grade unit of the NYC *Scope and Sequence*. Student experiments recreate work done in Martin Chalfie's laboratory at Columbia, where green fluorescent protein (GFP) was first cloned into *E. coli*. The GFP protein is then isolated by a simple “batch” method, which illustrates how many biotech products are produced.

DNA Analysis and Forensics

The applied use of restriction enzymes to precisely cut DNA arose from basic research on the interaction of bacteria and their parasitic viruses, the phages. CSHL Nobelist Richard Roberts popularized the use of restriction enzymes in research. Using restriction enzymes and gel electrophoresis, students can digest and analyze DNA in the same way. The *DNA Interactive* Internet site traces the development of DNA fingerprinting, and its use in forensic DNA analysis.

PCR and Human DNA Variations, Part I & II

Experiments on students' DNA polymorphisms – including *Alu* insertions and mitochondrial point mutations – extend the description of genotype-phenotype to the molecular level. Deriving population measures from class results and analyzing common ancestry with bioinformatics provides links between genetics and evolution – which follow one another in the Living Environment syllabus. An online excursion to the *Eugenics Archive* can show how New York Institutions led a misguided effort to use genetic selection to artificially guide human evolution.

