

DNA Literacy Program

Since the explosion of information made possible by the invention of the printing press, a democracy has needed to be a society of literates. Similarly, the growing importance of molecular biology demands a society of *DNA literates*. Unfortunately, DNA science is advancing so fast that the gap between biotechnological progress and public understanding widens every day.

The overarching goal of Cold Spring Harbor Laboratory's DNA Literacy Program is to close this biotechnology understanding gap. Our primary target audiences are secondary and freshman college instructors who teach both general biology and advanced elective courses. Since biology constitutes the most widely studied science in the United States, its instruction offers a major channel through which science literacy in general and DNA literacy in particular can be spread.

We believe that DNA literacy must become biology teachers' foremost concern. The current failure to emphasize DNA science in our schools means failure to teach the most exciting topics biology has to offer; failure to present socially and personally relevant issues; and, in the final analysis, failure to fulfill teaching's most important function—to prepare citizens capable of informed votes on policy issues.

The DNA Literacy Program now consists of two elements: the local Cold Spring Harbor Curriculum Study and the national Vector DNA Science Workshop Program. Close interaction, over the past two years with 250 educators from 12 states and Great Britain, has helped us crystallize program goals and evaluate our progress toward reaching them.



Dr. Morris Birnbaum, right, research associate at Memorial Sloan-Kettering Cancer Center, talks with students and teachers after his lecture "Molecular Regulation of Glucose Transport," the fourth of six *Great Moments* Lectures.

The Vector Mobile DNA Laboratory Staff: (l. to r.) Program Director David Micklos, DNA Workshop Coordinator Christine Bartels, summer lab aide Jeff Mondschein, and Technical Advisor Dr. Greg Freyer (below).



Cold Spring Harbor Curriculum Study

The Curriculum Study was founded in January 1985 as a consortium between Cold Spring Harbor Laboratory and eight local school districts. The program, which has grown to include 19 school districts on Long Island and in Westchester County, uses local resources and teaching systems as a proving ground for novel educational materials on DNA science.

Program Director David Micklos and Dr. Greg Freyer, now a research associate at Memorial Sloan-Kettering Cancer Center, developed an articulated set of lab experiences introducing teachers to the major concepts and techniques of molecular biology. Their protocols, presuming no specific prior knowledge, are the basis of a five-day workshop, *Recombinant DNA for Beginners*, which has become the central component of our educational efforts.

Our experience indicates that the hands-on summer workshop is a good format for acquainting teachers with the laboratory materials and training them to initiate lab-teaching at their own schools. After holding a regional workshop both in 1985 and 1986 for about 40 individuals each, we estimate that at least 600 students have now performed experiments under the supervision of participating teachers. Participants setting up DNA science labs for their classes receive further support through joint equipment purchase options, telephone consultation, and site visits by Cold Spring Harbor staff. In the *Great Moments* lecture series for students and teachers held at Grace Auditorium, renowned speakers from both the Laboratory and outside institutions cover a number of notable achievements and current issues in molecular biology.

Vector DNA Science Workshop Program

The successful Curriculum Study experience in New York State and interest from numerous educators around the country suggested the feasibility of a mobile laboratory which would carry all equipment and reagents necessary to administer *Recombinant DNA for Beginners* workshops at any location the United States. In summer 1986 a grant from Citibank, N.A., allowed us to equip our first Vector van and take the teacher-training course on the road. Vector Workshops were held in seven locations: Huntington and Irvington, New York; Boston, Massachusetts; Concord, New Hampshire; Chicago, Illinois; Milwaukee, Wisconsin; and Davis, California.

Thus, the complete set of experiments was successfully performed by over 200 enthusiastic high school and college teachers nationwide. Survey data indicate that all of them felt excited and reinvigorated in their profession, gained increased awareness and understanding of DNA science, and were stimulated to seek more information on their own. Within months of the Vector experience, many of them have been able to restructure their generally outdated syllabi to accommodate molecular biology topics, and a significant number have actually started to introduce DNA labs to their classes.

We have found, however, that regional teaching infrastructures—cluttered syllabi, meager equipment funds, lack of teacher support and incentives, and inadequate class time—are major obstacles to successful lab implementation. In the future, many of our activities will be directed at increasing administrators' awareness and creating follow-up activities for workshop participants.

Prospectus

For summer 1987, we have scheduled double the number of teacher-training courses and purchased a second Vector van. Again, our excursions will take us to various parts of the country, from New York City and New England to sites in the Southeast, Midwest and West. We are now in the process of recruiting staff members for Vector II.

The lab manual accompanying the workshop, *Recombinant DNA for Beginners: A First Laboratory Course in Molecular Biology*, will be jointly published by Cold Spring Harbor Laboratory Press and Carolina Biological Supply Company this year. Carolina Biological, with its well-established distribution network, will help us retol science classrooms by marketing both the manual and all necessary reagents.

It has become apparent that crucial to widespread biotechnology will be a national clearinghouse and teacher-training center specializing in DNA science education. We are now looking for major support from foundations, biotechnology-oriented companies, and public agencies that will make reality our dream to develop a DNA Learning Center at Cold Spring Harbor. Proposed features of the facility include a teaching laboratory, computer graphics laboratory, DNA library, and science media development unit, all aimed at bringing the excitement of molecular biology to the lay public.



Students and teachers receive supplies for an experiment during a Vector Workshop.



Proposed DNA Learning Center in Cold Spring Harbor Village.



Teachers prepare to separate DNA fragments using gel electrophoresis.

Support

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Our activities are coordinated with numerous educational and research institutions, including the New York State Bureau of Science Education, Science Teachers Association of New York State, Science Supervisors Association, National Science Teachers Association, New York City Board of Education, State University of New York, California State Board of Education, Biotechnology Program of the University of California at Davis, Macy Bioprep Program, Marquette University, Cleveland Clinic Foundation, Argonne National Laboratory, North Carolina Biotechnology Center, Utah State University, Bronx High School of Science, Thomas Jefferson High School for Science and Technology, St. Paul's School, Choate Rosemary Hall, and the Winsor School.

The Curriculum Study consists of the following school districts: Cold Spring Harbor Central School District; Commack Union Free School District; East Williston Union Free School District; Great Neck Union Free School District; Half Hollow Hills Central School District; Herricks Union Free School District; Huntington Union Free School District; Irvington Union Free School District; Jericho Union Free School District; Lawrence Union Free School District; Manhasset Union Free School District; North Shore Central School District; Northport-East Northport Union Free School District; Oyster Bay-East Norwich Central School District; Plainview-Old Bethpage Central School District; Portledge School; Port Washington Union Free School District; Sachem Central School District at Holbrook; Syosset Central School District.



Students practice methods for bacterial culture.