

Recombinant DNA for Teachers

James G. Duvall III

OCCASIONALLY something comes along that changes your life. In this case it was a flyer from San Francisco State University's biology department. It announced the "Recombinant DNA Workshop for Teachers." As a high school chemistry and college anthropology instructor I couldn't resist applying for this program. The application was basically a description of how I thought this training could be used in my own classroom. Funding was supplied by the National Science Foundation, Genentech, Inc. (a major producer of recombinant products for the medical world) and the California State Department of Education.

The driving force behind this program is Lane Conn, a graduate student at San Francisco State University. He was formerly a biology and physical science teacher at Logan High School in Union City, California. Conn's degrees in chemistry and biology make him highly qualified for this project and he has a strong desire to bring recombinant DNA technology into the public school classroom, even though the technology is very expensive and beyond the reach of many science department budgets. Conn has developed a joint industry-school relationship through Genentech, Inc., supplier of transportation and most of the money for classroom supplies and materials during the school year following completion of teacher training; and the National Science Foundation, supplier of funding for the training including room, board and a stipend on one of several campuses. My training took place in the biology department of the University of California, Santa Cruz during the summer of 1989.

Learning New Techniques

Having never been on the Santa Cruz campus, I was stunned by its beauty and surroundings. After settling into my Kresge College dorm room, it was time to start learning.

Classes started punctually at 8 a.m. Our first day involved meeting all the staff members including Robert Edgar, a professor of biology at U.C. Santa Cruz and one of the founders of the Human Genome Project; Mike Dalby, a biology instructor at the same

institution; and many "lead teachers," previously trained high school teachers there to assist.

Twenty-four teachers were selected for two weeks of training and a one-week session of the Science and Technology in Society symposium sponsored by the California Department of Education. We were all excited and slightly nervous since most of us had graduated from college before this technological development. A subject pretest, resulting in many low scores, was followed by two hours of lecture by Dr. Edgar. Before the morning was over we had completed a lab directed by Dr. Dalby on the physics of the gel electrophoresis box. After a brief lunch break we completed two more labs. This became our pattern during the next two weeks of intensive training.

The entire purpose of our training was to learn to teach the Cold Spring Harbor DNA Science Laboratory Protocols. These protocols lead the student through the entire process for taking *E. coli* cells and transforming them into a new strain of *E. coli* cell resistant to the antibiotics kanamycin and ampicillin. The Cold Spring Harbor Protocols include 10 labs, some of which take as long as four hours to complete. In addition, Dr. Dalby interjected six of his own exercises which made our two weeks very busy. Evenings were spent studying.

Techniques learned included:

1. How to "cut" DNA into identifiable fragments with endonucleases (restriction enzymes).
2. How to separate these fragments into groups based on their size.
3. How to make *E. coli* cells competent to take specific DNA fragments into their plasmid ring and thus become transformed into a new cell.
4. How to identify whether or not this transformation had taken place and resulted in the creation of a new cell strain.

It takes an unbelievable number of steps and procedures to reach these results. This type of work was completely new to me, but I could follow the protocols because they were well planned, explained and executed under the excellent guidance of the lead teachers and Dr. Dalby. After so much intensive training, the examination was nearly a snap!

Impact on Society

The final week was a change of pace compared to the first two. Science, Technology and Society was

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the framework for this symposium which was attended by teachers from two other sites (CSU, Sacramento and San Francisco State University). There were presentations on how DNA recombinant technology could be used in society, and a large segment of time was spent learning how to implement this technology in the biology and chemistry classroom.

Presenters discussed such diverse topics as Bovine Somatotropin Hormone (BST), a milk production stimulant hormone synthetically produced by genetic engineering; Polymerase Chain Reaction (PCR), a new technology for amplifying small amounts of DNA into usable quantities for criminology work (e.g. to conclusively identify a suspect in crimes such as murder and rape); and the newest drugs on the market that are produced synthetically with this technology (e.g. human insulin).

While all of these topics were fascinating, the small group sessions spent brainstorming and discussing how to use this new training in our individual classrooms, were probably of more importance to us.

Many strategies were developed. Some teachers opted to use just two or three of the Cold Spring Harbor Protocols as an introduction to DNA. Others decided to take their classes through the entire process. At the completion of our three-week session, we said farewell to newfound friends and headed off to share their valuable new skills with our students.

Science teachers of any grade level are encouraged to apply for this program or for similar programs being offered across the U.S. NABT offers some hands-on lab experiences in this field at its national conferences; the Pennsylvania Commonwealth Partnership, a consortium of approximately 15 Pennsylvania private colleges, is developing a similar program. Others will be offered as this technology is recognized as being applicable to the high school setting. As of summer 1991, five university sites will be offering this program in California alone. For more information contact Lane Conn, Biology Department, San Francisco State University, 1600 Holloway Ave., San Francisco, CA 94132.

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