DNA LEARNING CENTER

ANNUAL REPORT 1999

ADMINISTRATION	INSTRUCTION	MULTIMEDIA
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To many, 1999 will be remembered as the year of the Internet. As Internet stocks and initial public offerings soared, so did the number of visitors to our World Wide Web (WWW) site, *Gene Almanac*. Like other established WWW sites–and people who bought technology stocks early on–we were able to ride the crest of Internet interest in 1999. More than 380,000 people visited *Gene Almanac*, requesting 14.5 million documents from our Web server–a threefold increase over 1998. Visitation peaked in October, when our server logged 68,221 visitors, 177,863 page views, and 2.5 million document requests. This growth was fueled primarily by the release of our animated online genetics primer, *DNA from the Beginning (DNAFTB)*, which by year's end accounted for the majority of pages viewed at our site.

Unlike conventional textbooks, which are organized around chapters, *DNAFTB* is organized around key concepts. To date, we have released sections on 24 concepts in classical and molecular genetics. Each contains an animation that presents key experiments as done by the scientists, a gallery with seldom-seen archival photos, video interviews, biographies, and links to other Web sites of interest. The site received positive reviews in the NetWatch column of *Science* (http://www.science.com), *HMS Beagle* (http://www.biomednet.com/hmsbeagle), and *Oncology Times.*

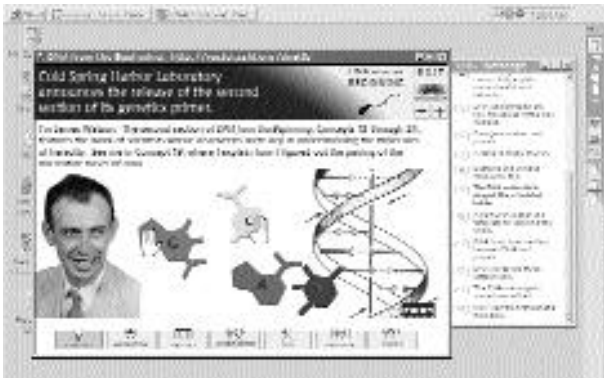
Late in the year, we passed another milestone when Carolina Biological Supply Company (CBS) became the first sponsor of *Gene Almanac*. CBS is one of the nation's oldest and most respected suppliers of science products for the education market. Since 1987, the DNALearning Center (DNALC) has collaborated with CBS to develop the *DNA Science* laboratory text and more than ten molecular genetics experimental kits. We were surprised to find that other major science centers have yet to seek sponsorships for their WWW sites.

This logo first appeared on the DNALC web site in November.

We continued to expand our server infrastructure to accommodate the exponential increase in visitation. Frequent crashes showed that our Microsoft NT server and database system could not efficiently handle some of our complex scripts and bioinformatics routines. At the same time, experiments revealed that this system could not be scaled up to the heavy loads we predict over the next year. To remedy this situation, in November, we switched over to a Linux server running an open-source operating system, Web server, and database server. This combination has proved remarkably stable and has not experienced a single crash yet. Using open-source software has the added bonus of reducing our license costs to near zero, making future system expansions more affordable.

At year's end we had a portfolio of $2.66 million in the following projects involving Internet science education, making the DNALC one of the largest providers of multimedia learning materials for biology education:

- *DNAFTB*, funded by an $820,000 grant from the Josiah Macy, Jr., Foundation, is the worlds first online, animated genetics text. An encyclopedia of genetic disorders will be added soon.
- *VectorNet*, funded by a $500,000 grant from the Howard Hughes Medical Institute (HHMI), is a mobile computer laboratory designed to provide state-of-the-art bioinformatics to New York City students and teachers across the nation.



Word was spread about *DNA from the Beginning* with two postcard mailings to 12,000 biology educators around the nation. The mailings were timed to coincide with the release of the first section of concepts in March, and the second section in September.

- *Digital Image Archive on the American Eugenics Movement*, funded by a $405,000 grant from the National Human Genome Research Center, will allow students to explore materials from several archives that have never before been released for public use.
- *A Partnership to Develop Advanced Technology Units on Genomic Biology*, funded by a $600,000 grant from the National Science Foundation (NSF), is a nationwide program for high school and college faculty, which includes extensive use of Internet tools for analyzing genes.
- *The Science and Issues of Human DNA Polymorphisms*, funded by a $335,000 grant from the Department of Energy (DOE) Human Genome Project, is a nationwide training program for high school biology teachers, which includes custom, online databases of student "DNAfingerprints."

We Anxiously Await Construction of an Expanded Facility

As our virtual visitation continued its exponential growth, our real-world visitation has plateaued at about 30,000. Although we increased student lab instruction by nearly one third during the last two years, our teaching lab facilities are now completely saturated. Labs are fully booked year-round, and our staff teaches as many elementary students in schools as at the DNALC.

To make matters worse, the doubling of our staff during the past two years has made the basement offices cramped as well as dreary. At one point in 1999, 12 staff members shared 1000 square feet of office space. This situation was eased slightly at the expense of converting the Barbara McClintock exhibit into an administrative office. As the year progressed, we realized that we had "hit the wall" of growth and creativity in our current facility. At times it seemed that the deterioration of our work environment even threatened our high level of innovation. Therefore, news that the Town of Huntington approved our building permit for a 9000-square-foot *Biomedia* addition ended the year on a hopeful note. It now seems certain that several years of dreaming and planning will come to fruition. Construction will begin in spring 2000, with completion of the new facility scheduled for summer 2001. The prospect of upstairs offices, an additional teaching lab, and state-of-the-art facilities for multimedia production tempered the news that ten staff members will be relocated during construction. In the upcoming year, the instructional group will make its home in the small exhibit gallery on the main floor, and the multimedia group will move to a temporary office (a.k.a. a trailer) on the main CSHL campus.

Centerbrook Architects and Planners of Essex, Connecticut, have designed the new facility. This firm has been responsible for the eclectic mix of beautiful buildings and additions constructed at CSHLin the past 30 years. Their handiwork is also seen in the initial renovation of the DNALC, including the striking multimedia auditorium, or "multitorium." In 1998, the American Institute of Architects honored Centerbrook as architectural firm of the year.

True to form, principal architect Jim Childress has crafted a two-story brick addition that merges easily with the existing Georgian revival structure. Cunningly, the main level extends into the hill to the rear of the current building, allowing the second story to "emerge" on grade at the crest of the hill. Thus, seen from the back, the addition appears to be a single-story structure–in keeping with the residential feel of our neighborhood. The centerpiece of the addition, a hexagonal computer laboratory, is a 21st century reprise of the classical architecture that inspired the original building. A new exhibit on the Human Genome Project–including a *Visible Sequencing Lab* in which DNALC staff will produce DNA sequences from samples submitted by biology classes from around the country–will occupy expanded galleries. We cannot wait to inhabit our new spaces.

Developing the *VectorNet* Mobile Bioinformatics Laboratory

In the summer, we received a 4-year grant from the HHMI Precollege Science Education Initiative for Medical Research Institutes, effectively renewing a previous 5-year award. The new program will introduce high school students and teachers to the use of modern networked computing in genomic biology. Of 150 applicants and 35 awardees, the DNALC was one of only two institutions to receive the maximum award of $500,000.

The focal point of the program is *VectorNet*, a stand-alone, portable computer laboratory that demonstrates state-of-the-art server and networking technology. Ten laptop computers are linked to a central server via a wireless network. The central server mirrors the entire DNALC Web site, including bioinformatics tools and GenBank data sets. A presenter laptop with video projector allows the instructor to demonstrate use of the programs. This "bioinformatics laboratory in a box" can be shipped and set up anywhere, providing full bioinformatic resources without the need for an Internet connection.

VectorNet incorporates insight from 3 years' experience conducting bioinformatics training at sites in Great Britain and around the United States. We have found that even in the best of dedicated computer laboratories, any number of problems can halt work, including Internet and local network unreliability, local security provisions, nonuniform hardware setups, and software misconfigurations. By the same token, we have found that even the best of students and teachers have difficulty staying on task when they have the ability to check E-mail or sports scores. Therefore, we concluded that the best bioinformatics training experience is ensured by providing one's own network and all needed resources *offline*. This offers all the power of distributed computing without the distractions of an open Internet connection.

During the academic year, *VectorNet* will be placed in one public high school in each of the five boroughs of New York City. This local component of the program, *New York City Genes*, will allow large numbers of minority students in metropolitan New York to participate in an authentic analog of the Human Genome Project. The five schools are culturally and economically diverse: Stuyvesant High School, Manhattan; Jamaica High School, Queens; J.F. Kennedy High School, Bronx; Port Richmond High School, Staten Island; and Brooklyn Technical High School, Brooklyn. Each has a working DNA laboratory where students can generate DNA-polymorphism data, which can be used as a starting point in bioinformatics explorations. During a several-week loan period, *VectorNet* will be set up in the science wing of each high school, allowing students to move seamlessly among classroom theory and discussion, wet labs on DNA polymorphisms, and online computer analyses. *New York City Genes* is supported by an extensive collaboration with the Gateway to Higher Education Program of the Mount Sinai School of Medicine and New York City Public Schools. The Gateway Program prepares minority and low-income students to graduate from high school and go on to high achievements in college programs in medicine, science, and technology.

During the summer, *VectorNet* will be used in teacher-training workshops at locations around the country. The *Vector Bioinformatics Workshop* will target lead biology teachers, most of whom already incorporate hands-on DNAlaboratories into their classes. Our goal is for teacher participants to gain an intuitive command of key principles of genomic biology and bioinformatics, accelerate the development of technology environments in their own schools, incorporate case studies and workshop units into their teaching, and help catalyze instructional change at the local and regional levels. Workshops will be

hosted by members of the Association of Independent Research Institutions (AIRI), of which Cold Spring Harbor Laboratory is a member. Hosts for the summers of 2000 and 2001 will include the Foundation for Blood Research, Fred Hutchinson Cancer Research Institute, Oklahoma Medical Research Institute, Salk Institute, and Trudeau Institute.

Eugenics Archive Readied for Release

By year's end, we had substantially finished our 2-year project to develop an online *Digital Image Archive on the American Eugenics Movement.* Eugenics was an effort to apply Mendel's laws to breed "better" human beings. Eugenicists encouraged people with "good" genetic stock to reproduce and discouraged people with "bad" stock. They wrongly assumed that single genes explained complex behaviors and mental illnesses that we now know involve many genes. Eugenicists sought an exclusively genetic explanation of human development, neglecting the important contributions of the environment. The American movement began in about 1910 and reached its peak in the 1920s, when eugenics permeated many facets of public and private life. Flawed eugenics data were the basis for social legislation to separate racial and ethnic groups, restrict immigration from southern and eastern Europe, and sterilize people considered "genetically unfit." After enduring years of criticism, the American movement collapsed in 1940, as the horrid results of the Nazi eugenics program were revealed.

Digital Image Archive on the American Eugenics Movement, which will open to the public early in 2000, gives students, teachers, scholars, and the interested public an extraordinary window into a "hidden" chapter of history. We hope that the opportunity to revisit this period will stimulate people to think critically about our current involvement in human genetics. The site contains more than 1200 images drawn from four major scholarly archives: the American Philosophical Society Library, the Rockefeller University Archive Center, the Truman State University Archives, and the Cold Spring Harbor Laboratory Research Archives. By providing access to the eugenicists'own words and "data," we hope to challenge visitors to assume the role of historian-researcher. By focusing primarily on visual documents, we hope to engage young people and others who would not normally access a scholarly collection.

The *Eugenics Archive* makes no attempt to lead users to a "correct" interpretation of the materials. However, the site assists users in understanding the historical, social, political, and ethical context in which the American eugenics movement developed, flourished, and finally collapsed. Context is built into the *Archive* on two levels. First, users are encouraged to enter the site through a series of 11 virtual exhibits that introduce the key events, people, and social conditions that contributed to the development of eugenics. Second, all images are sorted into more than 20 topic areas. Browsing by topic or searching by keyword returns a set of related images with extended captions. The topic captions are designed to help the user understand relationships among images and the relationship of the image to the eugenics movement and society. Both levels were developed in collaboration with several leading historians of eugenics. At each level, users are reminded that the vast majority of what is presented as scientific "fact" by eugenicists was fundamentally flawed and has been discredited by modern research

The *Eugenics Archive* home page (left) includes links to "virtual exhibits" that provide context for the 1200 images in the *Archive.* The image window (above) provides basic information about the image, a link to a higher resolution "detail" image, access to source archives for use permissions, and a printer-formatted page.

standards. In November, the *Archive* was the subject of a feature article in the popular online magazine *Salon* (http://www.salon.com/tech/feature/1999/11/17/eugenics/index.html).

We believe that the *Eugenics Archive* can serve as a model for other online projects on the history and social interpretation of modern science. At the start of the project, none of the participating archives had policies governing the release of their materials over the Internet, and this project marks the first large-scale release of items via the Internet by a second party. We developed guidelines for online publication, educational "fair use" of documents, and privacy protections that can guide other projects dealing with the release of sensitive documents via the Internet. These policies were developed by consensus during 6 days of workshop sessions with our 15-member advisory panel (previous page.)

Instructional Program Continues to Grow

A record 10,150 students, 30% of them minorities, conducted experiments during field trips to the DNALC facility. Middle school labs–typically DNA extraction, microscope observation, or "green gene" engineering–take 1 hour. High-school labs–DNA restriction analysis, bacterial transformation, and human DNA polymorphisms–take between 2fi and 3fi hours. We also had a busy summer, instructing 444 students at 17 workshops at the DNALC and at sites in the New York metropolitan area. Five workshops for minority students, supported by the HHMI, were conducted at Central Islip High School (Suffolk County), Intermediate School #59 (Queens), Brooklyn Technical High School

(Queens), and J.F. Kennedy High School (Bronx). In addition, 400 students attended the 15th annual *Great Moments in DNA Science* honors seminars:

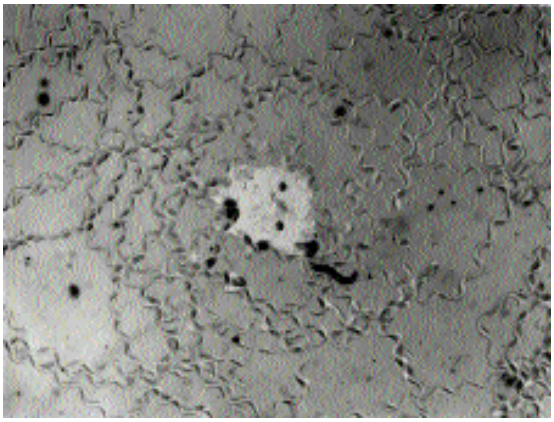
Sequence analysis of complex genomes, Dick McCombie, CSHL
Molecular studies on HIV Nef, an essential viral protein, Michael Greenburg, CSHL
Biology's gold rush: Mining genes from the Human Genome Project, John Kruper, DNALC

DNALC programs funded by the DOE, NSF, and Gateway to Higher Education reached 227 teachers at sites around the nation. During the academic year, the DOE workshop, *The Science and Issues of Human DNA Polymorphisms*, was conducted at California Lutheran University (Thousand Oaks), Fred Hutchinson Cancer Research Center (Seattle, Washington), and Laney Community College (Oakland, California). The NSF workshop, *Genomic Biology*, was conducted at New Hampshire Technical Community College (Portsmouth), Madison Area Technical College (Wisconsin), University of Maryland School of Medicine (Baltimore), and University of Texas (Austin). *Gateway Summer Institutes* for middle and high school faculty were conducted at Stuyvesant High School (Manhattan).

The middle school program, *Genetics as a Model for Whole Learning (GMWL)*, continued to expand, reaching 10,500 students from 60 elementary and middle schools. Participants include 19 districts and five private schools in Nassau, Suffolk, and Queens Counties. Under the *GMWL* program, fifth and sixth grade students typically perform labs in school, such as constructing cell models, observing examples of cells under compound microscopes, constructing DNAmodels, and observing mutated fruit flies with stereomicroscopes. In addition, students perform DNA extractions and bacterial transformations during a field trip to the DNALC. A chemistry lab sequence for advanced students includes experiments on molecular modeling, enzyme structure and function, practical enzymology, and bioreactors. These efforts were aided by a complete redesign of our instructional materials to make them more children friendly.

Two labs usually reserved for high school students–genetically engineering bacteria to glow green and making a personal DNA fingerprint–were successfully piloted with advanced middle school children. In collaboration with Mike Hengartner's lab, we also piloted *Caenorhabditis elegans* as a model for observing mutations in living organisms.

The *GMWL* program received a significant endorsement when we signed a 3-year, $100,000 contract with the New York City Board of Education to provide genetics instruction for Community School District 29 in southeast Queens. Located near Kennedy Airport, School District 29 serves 25,000 students in grades K through 8–of whom 95% are minorities, 67% are eligible for lunch assistance, and 31% have limited English proficiency. The new contract is the culmination of a collaboration begun in 1996, which has involved a total of 5100 fifth through seventh grade students. In addition to teacher training, the *GMWL* also includes parent workshops and a recognition dinner to familiarize district administrators and school board members with the program. We hope that the District 29 agreement becomes a model for other large-scale projects in New York City.



Middle-school students looked at *Caenorhabditis elegans* mutations as part of a pilot program. The *C. elegans* worm is the dark squiggle in the center of the image, and the longer lines are *C. elegans* tracks. This image was provided by Daniel Hoeppner of Cold Spring Harbor Laboratory.

Genomic Laboratory Development

During the year, we continued to develop new educational experiments and improve existing ones. As in the past, our objective is to identify research methods that can be modified for use in educational settings. We strive to identify "icon" labs, which illustrate key techniques and integrate key biological concepts. Recently, we have concentrated on labs that have a strong bioinformatics component and allow students to share data via the Internet. Typically, we test and popularize new labs through grant-funded workshops, and then develop a ready-to-use kit to be distributed by the Carolina Biological Supply Company.

Through grants from the HHMI, NSF, and DOE, we developed educational polymerase chain reaction (PCR) kits that use a 20-minute sample prep and three-part chemistry based on freeze-dried core reagents. These highly reproducible experiments allow students to analyze two types of chromosomal DNA polymorphisms–an *Alu* insertion and a VNTR repeat. These DNA variations offer an excellent starting point for discussions of disease diagnosis, forensic biology, identity testing, and the ethical implications of this technology.

In parallel with human-based labs, we developed a new lab for introducing plant genomics. Here, we have focused on *Arabidopsis thaliana*, a member of the mustard family that is considered the simplest model system for flowering plants. The lab allows students to visually compare wild-type and mutant plants, and then to relate the mutant phenotype to a PCR genotype showing an insertion polymorphism. In this case, a dwarf, curly-leaf phenotype is due to the insertion of the *Ds* transposon at the *Clf-2* locus. This system aptly illustrates how the first transposon system, discovered in the 1950s by CSHLscientist Barbara McClintock, has now been transformed into a research reagent that provides a relatively straightforward method for cloning genes of interest. As a defective transposon, *Ds* is similar to *Alu*–these ubiquitous "junk" DNAsequences can also stimulate students to consider the possible role of transposons as evolutionary agents. In developing this system for education, we relied heavily on research collaborators at the main Laboratory campus. Jean-Phillipe Vielle Calzada provided us with an amazingly rapid and efficient DNAprep from leaf material that does not require organic extraction, Rob Martienssen provided us with *Clf-2* stocks, and farm manager Tim Mulligan provided greenhouse space and taught us how to culture *Arabidopsis*.

Especially exciting has been the success of our new *Sequencing Service*, which allows students and teachers to analyze differences in their own DNA sequences. First, a highly variable region of the mitochondrial genome, the control region, is amplified via PCR. The amplified samples are mailed to the DNALC, where a high school intern performs the final DNAsequencing reaction. The mitochondrial sequences are then sent to the CSHL Genome Sequencing Center, where they are loaded onto a gel for analysis. Finally, the sequence data are posted at the *Sequence Server* facility at our WWW site (http://vector.cshl.org/sequences/). An easy to use interface allows users to launch database searches, sequence alignments, and phylogenetic analyses from a centralized workspace. With these tools, students can use their own DNA data to explore human population genetics and test theories of human evolution. Using this protocol, we have processed and posted more than 1300 sequence samples. We also piloted an mitochondrial sequencing field trip, in which students amplified and electrophoretically visualized their mitochondrial DNA during a 3-hour visit to the DNALC. Several days after being processed, their sequence data were posted on the Internet. We hope to introduce this as a standard lab field trip in academic year 2000–2001.

While we will continue to focus effort on the human mitochondrial control region, we intend to develop other educational sequencing projects that allow students to collect, analyze, and share new data. Apilot project on mitochondrial typing of trout, initiated by several of our high school interns, embodies several features that may make it attractive to students and teachers in many parts of the country: (1) Trout and other members of the salmon family are widely distributed in freshwater and saltwater throughout the United States. (2) Commercial and sport fisheries are of considerable economic importance in most regions of the country. (3) Conservation of wild populations and hybridization between species are important biological problems. (4) Tissue samples are readily available from fishermen, conservation departments, and supermarkets. (5) Primer sequences are conserved in most, if not all, species.

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Corporate Advisory Board

During the past several years, we have benefited greatly from the help of our Corporate Advisory Board (CAB), a group of business leaders from large and small companies around Long Island. Each year, this group takes on the challenge of raising 15% of the DNALC's annual operating expenses from local business sources. As has become its fashion, the CAB again exceeded its goal in 1999, raising a total of $256,000. Most of this went to support the activities of the DNALC, but some also supported the *Partners for the Future* Program at the main Laboratory campus. The CAB contribution has been a major factor in achieving a balanced budget for the past 2 years, including full payment of depreciation.

The 1999 board was ably led by Jack Leahy, of Citibank, who has been Chairman of the Board for the past 4 years. Key to the year's success was the 6th annual golf tournament, chaired by Eddie Chernoff and cochaired by John Kean. The tournament, which was hosted by special guest Deborah Norville, drew approximately 200 players and netted $145,000. The year was topped off by an additional $111,000 from the winter Annual Fund Drive.

Operating behind the scenes–organizing meetings, making calls, and nudging board members to follow up on leads–was Julie Sutherland, Development Officer of Corporate and Foundation Relations. We owe her special thanks for a job done so well. Julie succeeded brilliantly, despite having a very tough act to follow when she assumed this liaison position from Laura Hundt 2 years ago. During Laura's tenure, the CAB had also exceeded its yearly goals.

Staff and Interns

During the past 2 years, the management of the DNALC has become increasingly decentralized, allowing for greater collaboration among staff members. Under this arrangement, we have created a tier of senior "coordinators," who share responsibility for key management functions. This is in line with the educational movement to site-based management, where teacher teams are more directly responsible for institutional policy and change.

The first element of this decentralization occurred in 1998, when the DNALC high school and middle

school education groups were merged into a single group. Since then, this team of five people has been co-led by Educational Coordinators Patricia Maskiell, who is the primary liaison with school clients, and Scott Bronson, who is primarily responsible for laboratory development. The education group was strengthened in 1999 with the recruitment of lab instructor Danielle Sixsmith. Before she joined the DNALC, she made use of her degrees in biology and science education as a biology teacher at Martin Van Buren High School in Queens. In addition to her strong instructional background, Danielle has completed an internship at ImClone, a Manhattan-based biotechnology company.

The departure of *BioMedia* group leader John Kruper to the Internet startup company unext.com provided an opportunity to apply the same strategy of shared responsibility within the multimedia group. Thus, Shirley Chan was promoted to multimedia coordinator, and Matt Christensen was promoted to technology coordinator. Shirley is responsible for the content and day-to-day operation of the WWW sites. Her earlier work as science writer set the style and tone for *DNA from the Beginning*. Matt is responsible for the DNALC's computer backbone and functionality of the WWW sites. With expertise in Perl programming, he has developed many unique features at our WWW sites, including online editing interfaces that can be reached from any computer.

When part-time animator Gisella Walter left for a position in Manhattan's "silicon alley," we were fortunate to hire Chun-hua Yang as a full-time replacement. After completing undergraduate work in her native Taiwan, Chun-hua received two master's degrees–one in computer graphics from C.W. Post and one in design technology from Parsons School of Design. She brings a new world view and a fresh look to our WWW site. The resynthesized *Biomedia* group was rounded out with the recruitment of science writer Susan Conova. While doing doctoral research in marine zoology, Susan began writing about research topics for the newsletter of the Duke University Marine Laboratory. Just before she joined the DNALC, she completed an American Association for the Advancement of Science writing fellowship at ABCNEWS.com. The *Biomedia* group was further assisted by two summer interns, funded through a grant from the Josiah Macy, Jr., Foundation. Writing intern Ryan Luce recently completed his doctorate in chemistry at the University of Washington, and media design intern Maria Gililova, of Syracuse University, returned for a winter internship. Maria was primarily responsible for the fun caricatures of each staff member found in the "About" section of our WWW site.

The core administrative group, headed by Program Coordinator Judy Cumella-Korabik, was rounded out with the addition of secretary Nancy Daidola. Nancy obtained excellent administrative experience in several departments at Grumman Aerospace and most recently was a real estate agent with Coldwell Banker Sammis.

New employees in 1999:
From the left, Nancy Daidola, Secretary;
Chun-hua Yang, Multimedia Designer;
Danielle Sixsmith, Laboratory Instructor;
and Susan Conova, Science Writer.

As the year ended, we received news that the Laboratory had recruited Vin Torti as a full-time development officer dedicated to the DNALC. In addition to managing the CAB, Vin will raise funds for the construction of the *Biomedia* addition, as well as the substantial operating increase it will engender. Vin joined the Laboratory at the beginning of the new year, after having spent 3 years as development officer for Xaverian High School in Brooklyn. We were thrilled to find that Vin's background includes 15 years of teaching, so he has a true appreciation for our work. Vin will report to Development Director Rick Cosnotti, with whom he shares a background in theology.

Several researchers from the main CSHL campus provided part-time instruction for high school lab field trips: Joan Alexander (Wigler lab), Thomas Volpe (Futcher lab), Michelle McDonough (Van Aelst lab), and James Tong (Zhong lab). We bid farewell to Joel Stern, who left for graduate studies at Columbia University, and to Vivek Mittal, who assumed responsibility for the microarray program in Michael Wigler's lab.

College students and interns from high schools in Nassau and Suffolk Counties provided key support for the instructional and multimedia staff. Jermel Watkins, of the New York Institute of Technology, extended his record service to 5 years by providing regular help during the academic year, while Mera Goldman returned from Barnard College to help with summer workshops. Veteran high school interns Ken Mizuno (Cold Spring Harbor) and Yan Haung (Harborfields) assumed leadership roles as four of their colleagues left for their first year of college: Rebecca Yee (Huntington) to Wellesley, Karin Glaizer (Portledge) to Vassar, Hana Mizuno (Cold Spring Harbor) to the Massachusetts Institute of Technology, and Gerry DeGregoris (Chaminade) to Notre Dame. In the fall, we welcomed newcomers Daniel Goldberg (Half Hollow Hills East), Janice Lee (Oyster Bay), Adam Frange (Wantagh), Greg Bautista (Chaminade), Caroline Lau (Syosset), and Rebecca Shoer (Syosset). The *Biomedia* group was assisted by a brother-sister team from Syosset High School–Tracy Mak who came to work when brother Stephen began his freshman year at Cornell.

In addition to prepping for labs and editing multimedia files, many interns conduct independent research projects. In many cases, these projects contribute to the development of new student field trips, student and teacher workshops, and kits distributed by Carolina Biological Supply Company. Ken Mizuno was awarded high honors in the Long Island Science Congress for his work on mitochondrial DNA sequence analysis of Long Island brown trout (*Salmo trutta*), and Yan Huang performed a similar study of local rainbow trout (*Onchorhynchus mykiss*). This work laid the foundation for a collaboration with students from Curtis High School in Tacoma, Washington, who used our protocols and bioinformatics tools to study wild populations of coho and chinook salmon. Laura Roche (Cold Spring Harbor) was one of only six Long Island students selected for the Laboratory's *Partners for the Future* Program. Under this program, Laura joins Michael Hengartner's lab, which is investigating the developmental genetics of the nematode worm *C. elegans.*

1999 Grants

Federal Grants		Term of Grant	1999 Funding
National Institutes of Health ELSI Research Program	*Creation of a Digital Image Archive on the American Eugenics Movement*	3/98-2/00	$181,948
National Science Foundation	*A Partnership to Develop Advanced Technology Units on Genomic Biology*	8/97-7/00	$178,915
Department of Energy	*The Science and Issues of Human DNA Polymorphisms: An ELSI Training Program for High School Biology Teachers*	1/97-1/00	$85,732
Non-Federal Grants			
Hearst Foundation	*Genetics as a Model for Whole Learning*	7/98-6/99	$27,766
Howard Hughes Medical Institute	*Precollege Science Education Initiative for Biomedical Research Institutions*	7/94-8/99	$82,730
Josiah Macy, Jr. Foundation	*DNA from the Beginning*	10/97-9/00	$264,775

The following schools each awarded a grant for the *Curriculum Study* Program:

Commack Union Free School District	$1,100
East Meadow Union Free School District	$1,100
East Woods School	$1,500
Friends Academy	$1,500
Garden City Union Free School District	$1,100
Great Neck Union Free School District	$1,100
Half Hollow Hills Central School District	$2,200
Harborfields Central School District	$2,100
Herricks Union Free School District	$1,100
Island Trees Union Free School District	$1,100
Jericho Union Free School District	$1,100
Lawrence Union Free School District	$2,200
Levittown Union Free School District	$1,100
Locust Valley Central School District	$1,100
Long Beach City School District	$1,100
North Shore Central School District	$1,100
Oceanside Union Free School District	$1,500
Plainedge Union Free School District	$1,100
Plainview-Old Bethpage Central School District	$1,100
Portledge School	$1,100
Port Washington Union Free School District	$1,100
Ramaz School	$1,100
Roslyn Union Free School District	$1,100
Syosset Central School District	$1,100
West Hempstead Union Free School District	$1,100

The following schools each awarded a grant for the *Genetics as a Model for Whole Learning* Program:

East Meadow Union Free School District	$4,025
East Woods School	$730
Elwood Union Free School District	$2,850
Garden City Public School	$6,535
Great Neck Union Free School District	$4,860
Green Vale School	$3,550
Harborfields Central School District	$8,800
Half Hollow Hills Central School District	$2,875
Intermediate School 59	$350
Jericho Union Free School District	$6,950
LaSalle Regional	$125
Lawrence Union Free School District	$6,650
Locust Valley Central School District	$13,650
Northport-East Northport Union Free School District	$1,650
NYC Community School District 17	$365
Plainedge Union Free School District	$1,075
Port Jefferson Union Free School District	$250
Port Washington Union Free School District	$3,600
Old Westbury School of the Holy Child	$1,775
South Huntington Union Free School District	$16,970
St. Dominic Elementary School	$3,175
Syosset Central School District	$23,625

1999 Workshops, Meetings, and Collaborations

January 9–11	Department of Energy ELSI Workshop, *The Science and Issues of Human DNA Polymorphisms*, California Lutheran University, Thousand Oaks
January 12–16	Department of Energy Contractor-Grantee Meeting, Oakland, California
January 21–22	National Human Genome Research Institute ELSI Project, *Eugenics Image Archive*, collection visit to American Philosophical Society Library, Philadelphia, Pennsylvania
January 26	National Human Genome Research Institute ELSI Project, *Eugenics Image Archive*, and *DNAFTB* collection visit to Rockefeller University Archive Center, Tarrytown, New York
January 28–29	Site visits to DNA Lab Schools, New York, New York
March 8–10	National Human Genome Research Institute ELSI Project, *Eugenics Image Archive*, collection visit to the Harry Laughlin Archives, Truman State University, Kirksville, Missouri
March 26–28	Department of Energy ELSI Workshop, *The Science and Issues of Human DNA Polymorphisms*, Fred Hutchinson Cancer Research Center, Seattle, Washington
March 30	*DNA from the Beginning* interview, Frank Stahl, University of Oregon, Eugene
April 3	Laboratory for Rampart and Sierra High Schools, Colorado Springs, Colorado
April 5	Site visit by Marie-Luce Vignais, Institut de Génétique Moléculaire, Montpellier, France
April 13	*DNA from the Beginning* interview, Joshua Lederberg, Rockefeller University, New York, New York
April 15–17	National Human Genome Research Institute ELSI Project, *Eugenics Image Archive*, Editorial Advisory Panel Meeting, Banbury Center
April 20	Site visit by Donna DeSoto, Cablevision
April 26	*DNA from the Beginning* interview, Marshall Nirenberg, National Institutes of Health, Bethesda, Maryland
April 27	*Great Moments in DNA Science* Honors Students Seminar, CSHL
April 28	*DNA from the Beginning* interview, Paul Zamecnik, Harvard University, Boston, Massachusetts
May 4	*DNA from the Beginning* interview, Phillip Sharp, Massachusetts Institute of Technology, Boston *Great Moments in DNA Science* Honors Students Seminar, CSHL
May 5	*DNA from the Beginning* interview, Richard Roberts, New England Biolabs, Beverly, Massachusetts
May 6	*DNA from the Beginning* interview, Matthew Meselson, Harvard University, Boston, Massachusetts
May 7	*DNA from the Beginning* interview, Mahlon Hoagland, Thetford, Vermont
May 11	*Great Moments in DNA Science* Honors Students Seminar, CSHL
May 24–27	National Science Foundation ATE Project, *Genomic Biology*, Editorial Advisory Board Meeting, DNALC
June 1	Site visit to Long Island Children's Museum, Garden City, New York
June 2	Site visit by Victor Albert, New York Botanical Garden, Bronx
June 3	Site visit by June Osborn, Josiah Macy, Jr., Foundation, New York, New York
June 4	Site visit by Mark Hertle, Howard Hughes Medical Institute, Chevy Chase, Maryland
June 7	National Institutes of Health ELSI Review Panel, Bethesda, Maryland
June 9	National Science Foundation ATE Biotechnology Fellows Workshop, San Francisco, California
June 14–19	National Science Foundation Workshop, *Genomic Biology*, Madison Area Technical College, Wisconsin
June 17	Site visit by Seyed Hasnain, Centre for DNA Fingerprinting and Diagnosis, Hyderbad, India
June 21–26	National Science Foundation Workshop, *Genomic Biology*, University of Texas, Austin
June 28–July 2	*Fun With DNA* Workshop, DNALC *DNA Science* Workshop, DNALC

June 28–July 9	*Genomic Biology and PCR* Minority Workshop, Central Islip High School, New York
July 6–9	*World of Enzymes* Workshop, DNALC
	Green Genes Workshop, DNALC
July 12–16	*Fun With DNA* Workshop, DNALC
	Fun With DNA Minority Workshop, Intermediate School 59, Springfield Gardens, New York
	DNA Science Workshop, DNALC
	DNA Science Minority Workshop, John F. Kennedy High School, Bronx, New York
July 19–23	*Fun With DNA* Workshop, DNALC
	Fun With DNA Minority Workshop, Intermediate School 59, Springfield Gardens, New York
	DNA Science Minority Workshop, Brooklyn Technical High School, New York
July 26–30	*Fun With DNA* Workshop, DNALC
	Genomic Biology and PCR, DNALC
July 29	Site visit by Shozo Enokita, The Institute of Physical and Chemical Research, Saitama, Japan
August 2–6	*World of Enzymes* Workshop, DNALC
August 2–7	National Science Foundation Workshop, *Genomic Biology*, University of Maryland, School of Medicine, Baltimore
August 9–13	*Genetic Horizons* Workshop, DNALC
	DNA Science Workshop, DNALC
August 9–14	National Science Foundation Workshop, *Genomic Biology*, New Hampshire Community Technical College, Portsmouth
August 16–20	*Fun With DNA* Workshop, Section I and II, DNALC
August 23–27	*World of Enzymes* Workshop, DNALC
	DNA Science Workshop, DNALC
August 30-Sept 3	*Genomic Biology and PCR* Workshop, DNALC
October 1–3	National Human Genome Research Institute ELSI Project, *Eugenics Image Archive*, Editorial Advisory Panel Meeting, Banbury Center
October 7–8	Site visit to Carolina Biological Supply Company, Burlington, North Carolina
October 11–13	Howard Hughes Medical Institute Director's Meeting, Chevy Chase, Maryland
October 20	Tour of DNALC and luncheon for educators from Queens District 29
October 22–23	National Science Foundation ATE Principal Investigator Meeting, Alexandria, Virginia
October 25	Site visit by Fiona Cunningham, Murdoch Institute, Melbourne, Australia
October 28	Site visit and laboratory for participants in Federal Judicial Center workshop, *Basic Issues of Science*
October 28–31	National Association of Biology Teachers Annual Meeting, Fort Worth, Texas
November 4–7	*Science Education Website Developers* Meeting, Eccles Institute of Human Genetics, Salt Lake City, Utah
November 15	Site visit by Robert Vizza, The Dolan Foundation
December 3–5	Department of Energy Workshop, *The Science and Issues of Human DNA Polymorphisms*, Laney College, Oakland, California
December 11	Biology Education Workshop at the Annual American Society for Cell Biology Meeting, Washington, D.C.
December 15	Site visit and seminar by Dr. Carey Phillips, Bowdoin College, Brunswick, Maine
December 30	Site visit by John Watson, European Initiative for Biotechnology Education, Luxembourg

Sites of Major Faculty Workshops 1985–1999

Key: High School **College** *Middle School*

ALABAMA	University of Alabama, Tuscaloosa	1987–1990
ALASKA	University of Alaska, Fairbanks	1996
ARIZONA	Tuba City High School	1988
ARKANSAS	Henderson State University, Arkadelphia	1992
CALIFORNIA	**Foothill College, Los Altos Hills**	**1997**
	University of California, Davis	1986
	San Francisco State University	**1991**
	University of California, Northridge	**1993**
	Cañada College, Redwood City	1997
	Pierce College, Los Angeles	**1998**
	California Lutheran University, Thousand Oaks	1999
	Laney College, Oakland	1999
COLORADO	Colorado College, Colorado Springs	1994
	United States Air Force Academy, Colorado Springs	**1995**
	University of Colorado, Denver	1998
CONNECTICUT	Choate Rosemary Hall, Wallingford	1987
DISTRICT OF COLUMBIA	**Howard University**	**1992, 1996**
FLORIDA	North Miami Beach Senior High School	1991
	University of Western Florida, Pensacola	1991
	Armwood Senior High School, Tampa	1991
GEORGIA	Fernbank Science Center, Atlanta	1989
	Morehouse College, Atlanta	**1991, 1996**
	Morehouse College, Atlanta	1997
HAWAII	Kamehameha Secondary School, Honolulu	1990
ILLINOIS	Argonne National Laboratory	1986, 1987
	University of Chicago	**1992, 1997**
INDIANA	Butler University, Indianapolis	1987
IDAHO	University of Idaho, Moscow	1994
IOWA	Drake University, Des Moines	1987
KANSAS	University of Kansas, Lawrence	1995
KENTUCKY	Murray State University	1988
	University of Kentucky, Lexington	1992
	Western Kentucky University, Bowling Green	1992
LOUISIANA	Jefferson Parish Public Schools, Harvey	1990
	John McDonogh High School, New Orleans	1993
MAINE	Bates College, Lewiston	1995
MARYLAND	Annapolis Senior High School	1989
	Frederick Cancer Research Center, Frederick	1995
	McDonogh School, Baltimore	1988
	Montgomery County Public Schools	1990–1992
	St. John's College, Annapolis	*1991*
	University of Maryland, School of Medicine, Baltimore	1999
MASSACHUSETTS	Beverly High School	1986
	CityLab, Boston University School of Medicine	1997
	Dover-Sherborn High School, Dover	1989
	Randolph High School	1988
	Winsor School, Boston	1987
	Boston University	**1994, 1996**
MICHIGAN	Athens High School, Troy	1989
MISSISSIPPI	Mississippi School for Math and Science, Columbus	1990, 1991
MISSOURI	Washington University, St. Louis	1989
	Washington University, St. Louis	**1997**

NEW HAMPSHIRE	St. Paul's School, Concord	1986, 1987
	New Hampshire Community Technical College, Portsmouth	1999
NEVADA	University of Nevada, Reno	1992
NEW YORK	Albany High School	1987
	Bronx High School of Science	1987
	Columbia University, New York	1993
	Cold Spring Harbor High School	1985, 1987
	DeWitt Middle School, Ithaca	*1991, 1993*
	DNALearning Center	1988–1995
	DNA Learning Center	**1990, 1992, 1995**
	DNA Learning Center	*1990–1992*
	Fostertown School, Newburgh	*1991*
	Huntington High School	1986
	Irvington High School	1986
	Junior High School 263, Brooklyn	*1991*
	Lindenhurst Junior High School	*1991*
	Mt. Sinai School of Medicine, New York	1997
	Orchard Park Junior High School	*1991*
	Plainview-Old Bethpage Middle School	*1991*
	State University of New York, Purchase	1989
	State University of New York, Stony Brook	1987–1990
	Titusville Middle School, Poughkeepsie	*1991,1993*
	Wheatley School, Old Westbury	1985
	U.S. Military Academy, West Point	**1996**
	Stuyvesant High School, New York	1998, 1999
NORTH CAROLINA	North Carolina School of Science, Durham	1987
OHIO	Case Western Reserve University, Cleveland	1990
	Cleveland Clinic	1987
	North Westerville High School	1990
OKLAHOMA	School of Science and Mathematics, Oklahoma City	1994
PENNSYLVANIA	Duquesne University, Pittsburgh	1988
	Germantown Academy	1988
SOUTH CAROLINA	Medical University of South Carolina, Charleston	1988
	University of South Carolina, Columbia	1988
TEXAS	J.J. Pearce High School, Richardson	1990
	Langham Creek High School, Houston	1991
	Taft High School, San Antonio	1991
	Trinity University, San Antonio	**1994**
	University of Texas, Austin	1999
UTAH	University of Utah, Salt Lake City	1993
	University of Utah, Salt Lake City	**1998**
VERMONT	University of Vermont, Burlington	1989
VIRGINIA	Eastern Mennonite University, Harrisonburg	1996
	Jefferson School of Science, Alexandria	1987
	Mathematics and Science Center, Richmond	1990
	Mills Godwin Specialty Center, Richmond	1998
WASHINGTON	**University of Washington, Seattle**	**1993, 1998**
	Fred Hutchinson Cancer Research Center, Seattle	1999
WEST VIRGINIA	Bethany College	1989
WISCONSIN	Marquette University, Milwaukee	1986, 1987
	University of Wisconsin, Madison	1988, 1989
	Madison Area Technical College	1999
WYOMING	University of Wyoming, Laramie	1991

AUSTRALIA	Walter and Eliza Hall Institute and University of Melbourne	1996
CANADA	Red River Community College, Winnipeg, Manitoba	1989
ITALY	Porto Conte Research and Training Laboratories, Alghero	1993
	International Institute of Genetics and Biophysics, Naples	1996
PANAMA	**University of Panama, Panama City**	**1994**
PUERTO RICO	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Mayaguez	**1992**
	University of Puerto Rico, Rio Piedras	**1993**
	University of Puerto Rico, Rio Piedras	1994
RUSSIA	Shemyakin Institute of Bioorganic Chemistry, Moscow	1991
SWEDEN	Kristineberg Marine Research Station, Fiskebackskil	1995