The Dolan DNA Learning Center’s 20th birthday, on September 18, inevitably sparked some reverie about our origins. It all actually began in 1984 with an innocent enough phone call from Fran Roberts, the new superintendent of Cold Spring Harbor School District, inquiring how we might join forces to do something to improve local science education. That conversation led to a proposal to the National Science Foundation (NSF) to develop a course to train high school teachers to do recombinant DNA experiments. Dejected when our proposal was turned down, I turned to Mike Glennon, principal, and Ed Tronolone, science chairman, of the Wheatley School in East Williston. They had a simple solution: Just ask several local school districts to fund the project!

I doubt that this tactic could have worked anywhere except on Long Island’s North Shore, but by January 1985, eight local districts had contributed $10,000 apiece to purchase supplies and equipment. During the next several months, I spent spare moments in Rich Roberts’ lab, working with postdoctoral fellow Greg Freyer to develop a simple set of experiments that would allow high school students to get their hands dirty with recombinant DNA. The experiments, which were the basis of our *DNA Science* lab text, were first tested in summer 1985 at a teacher-student workshop at the Wheatley School.
In 1986, we obtained funding from Citibank to develop a mobile “Vector Van”—a Ford Econoline with a silver paint job and loaded to the ceiling with pipettes, centrifuges, and water baths. With independent funding from small foundations and biotech start-ups, we took our DNA show on the road, conducting week-long teacher workshops at six sites across the United States. On the last leg of the trip—from Milwaukee, Wisconsin, to Davis, California—the Vector Van was piloted by a German graduate student who had just received her driver’s license, with a high school intern as copilot. That same year, we initiated a cooperative agreement with Carolina Biological Supply Company to develop reagents and kits to accompany the DNA Science curriculum.

It is worth mentioning that I was hired by Jim Watson to start the CSHL public affairs and development efforts, so I regarded the burgeoning education program as an advanced form of public relations. Jim supported my moonlighting because he knew it was time for the Laboratory to take the lead in fostering “DNA literacy” among the general public—just as it had led the way with professional scientists. This was a bold move at a time when high-level scientists, here and elsewhere, were expected to concentrate solely on their research.

By fall of 1986, four staff members—myself, Sue Lauter, Ellen Skaggs, and Mark Bloom—were crammed into two offices on the main floor of Grace Auditorium (now the Meetings and Courses office), from which we ran a frenetic fusion of public affairs, development, and educational outreach. Our modicum of success was not lost on Jim, who concluded that the time had quickly come for the education program to conform to his dictum of organizational evolution: “You get bigger, or you get smaller.” He determined that we should take over an excessed elementary school on Main Street and convert it into a DNA museum. Of course, none of us really understood what this might entail, and I braced to answer tough questions when a proposal was brought to the Board of Trustees for discussion. But then Dave Botstein, outspoken chairman of biochemistry at Stanford University, rose to champion the proposal—and the scientific trustees...
fell in strongly behind him. However, the notion of a stodgy museum was roundly disdained, and all felt much better with the friendlier concept of a learning center.

With Fran Roberts paving the way with the Board of Education, we forged ahead with a lease/option to buy the neo-Georgian-style building from the Cold Spring Harbor School system. Beautiful on the outside, it had been subdivided into a warren of temporary offices. It charmingly retained all of the original features from its construction in 1925, including pint-sized toilets and a multipurpose auditorium with a proscenium stage and two basketball hoops. One small problem: We had no hard cash to pay the rent, let alone to convert this antique building into a habitat for high-level science.

With the help of CSHL Trustees, our luck turned in the spring of 1987. Mary Jeanne and Henry Harris called from a golf outing to say that they would make a major gift to help pay for the first six month’s rent. Dave Luke worked behind the scenes to help us obtain core support from the Josiah Macy Foundation. We also achieved our first National Science Foundation (NSF) grant, acquired a second Vector Van, and conducted summer workshops at 14 locations around the country.

In the fall of 1987, we began to renovate the building. Emblematic of our goal to be a “hands-on” science center, a 32-seat lab was the first space renovated. In the spring of 1988, we conducted the first lab field trips during which students cut and separated viral DNA or inserted an antibiotic resistance gene into bacteria. Soon, I was driving a 24-foot truck back and forth between Washington, D.C., loading and unloading pieces of an exhibit, “The Search for Life,” which we had borrowed from the Smithsonian Institution’s National Museum of American History. The exhibit’s intricate system of aluminum trusses and theatrical lights occupied the entire front hall, gym/auditorium, and two of four original classrooms. For a time, I had to crawl on all fours under exhibitry to get to my office. Then, there were artifacts ranging from Audrey, the man-eating plant from the Little Shop of Horrors, to a recreation of the lab bench at which Stanley Cohen constructed the first recombinant DNA molecule. Against all odds, everything was in place for the official opening of the DNA Learning Center on September 18, 1988.

The rest, as they say, is history. Since that initial grant in 1987, we have maintained continuous NSF support, and we have been lucky to have had the help of numerous prestigious funders—including the National Institutes of Health (NIH), Howard Hughes Medical Institute (HHMI), William Randolph Hearst Foundation, Dana Foundation, William & Flora Hewlett Foundation, Burroughs-Wellcome Fund, Amgen Foundation, OSI Pharmaceuticals, and Pall Corporation. Major private donors—notably Helen and Charles Dolan, Claire and Ralph Landau, Laurie Landeau, Edward Chernoff, Doris and Peter Tilles, Sandra and Stephen Lessing, and Joan and Arthur Spiro—provided funds to reconstruct every corner of our fine old building and to assemble our first endowment. Together, these people and institutions have provided more than $30 million in support.

During the last 20 years, the DNALC has conducted experiments with a third of a million students—without fanfare or incident—proving the safety of DNA manipulation methods. Our DNA Science curriculum and kits provided by the Carolina Biological Supply Company brought modern DNA manipulation to millions more high school and college students. The DNALC’s model for hands-on learning, Vector Vans, and local equipment-sharing have been replicated by numerous science centers, mobile vans, and “footlocker” programs in the United States and elsewhere. Thus, like its parent, Cold Spring Harbor Laboratory, the DNALC has projected a reputation that is considerably larger than its absolute size.

In retrospect, it seems improbable that we would have so successfully negotiated the risks of infancy and adolescence to emerge as a mature organization. Frankly, I doubt we could have reproduced this success elsewhere. Like others at CSHL, we clung tightly to the coattails of Jim Watson in the whirlwind of excitement he created for DNA, and we learned from Liz Watson that proper houses of science are rooted in our own history. Much of our success has flowed from the minds of Cold Spring Harbor Laboratory’s scientists, who have shared with us their labs, their methods, and their infectious optimism. With their continued help, I suppose that our little center will survive another 20 years.
BioMedia Studio

A two-storey addition, completed in spring 2001, more than doubled the size of the DNALC. Included in the addition is the BioMedia Center, on the second floor, which has provided a purpose-built space to develop internet materials for biology education. Unfortunately, money ran out on the construction project, so for 7 years the western end of the addition remained an unfinished “attic” clogged with broken computers, excess lab equipment, exhibit parts, and even a life-size model of a New Guinea tribesman. A gift from CSHL trustee Laurie Landeau has allowed us to clear out the attic and finally complete this 1000-square-foot studio space as originally intended. On November 1, we celebrated our 20th anniversary with the opening of the Laurie J. Landeau Multimedia Studio.

The DNALC internet sites are already distinguished from many other science content sites by their extensive use of video, totaling nearly 20 hours of interviews with more than 200 scientists. Two new internet projects—Genes to Cognition (G2C) Online and the iPlant Collaborative—incorporate an equal volume. Equipped with theatrical lighting and high-definition digital cameras, the Landeau Studio will increase the professionalism of the DNALC’s internet multimedia and allow us to embark on new productions. Two Sony XD-Cam high-definition video cameras record on a flash memory card and eliminate the time-consuming step of digitizing recordings made on digital video tape. A camera-mounted LiteRing and Chromatte are the latest advancements of “green-screen” technology, which allows us to edit a new background into the existing video recording. The studio provides three separately lit shooting locations: a desk for news productions, a coffee table and easy chairs for talk formats, and a lab table for experiment demonstrations.

With this infrastructure in place, we can now work with other CSHL departments to take fullest advantage of our unparalleled scientific resource—the more than 8,000 scientists who visit each year to attend meetings and courses. These thought leaders in basic and applied genetics research can be efficiently shuttled for interviews from the main campus or Banbury Center. In addition to adding high-quality video to DNALC and other CSHL internet sites, the studio will provide video-conferencing capability that can keep us in touch with the thousands of teachers who use DNALC methods. It also offers the potential to expand our DNA Today concept to provide regular podcasts, vodcasts, and news feeds for the cable industry.

The Landeau Studio also includes a video/sound editing room and a conference/green room. This reconfiguration allowed us to redevelop the former conference area as a “living room” for DNALC staff. This stylish space, with a central free-form concrete lunch counter, was conceived by DNALC multimedia designer Eun Sook Jeong, who also has a master’s degree in interior design. Together with the existing design bays and staff offices, the living room and Landeau Studio present a unified vision of a multimedia production facility for the 21st century.

iPlant Collaborative

During the past several years, the DNALC has worked with CSHL plant scientists to provide outreach components for a number of research projects funded by the NSF. Several of these projects came under the National Plant Genome Initiative to determine the entire sequence of corn and rice chromosomes. In February, this work culminated in the receipt of a $2.1 million subaward of a $50 million consortium grant with the University of Arizona. The project will develop a national computer infrastructure to support plant research. In an allusion to Apple’s success in making computing more personal, the iPlant Collaborative aims to develop tools and interfaces that will place large-scale plant data sets and high-powered informatics tools on any scientist’s computer desktop.
After a spring kickoff symposium at Cold Spring Harbor Laboratory, the iPlant Collaborative hosted a series of six workshops for plant and computation researchers to brainstorm “grand challenges” in plant science. These workshops were hosted at Biosphere II, in Arizona, and drew together a multidisciplinary group of computational scientists and researchers working at all levels of plant function and organization: molecular biology, genetics, genomics, biochemistry, cell biology, physiology, plant breeding, systematics, ecology, and evolutionary biology. Beginning in 2009, Grand Challenge Teams will work with computer scientists at the University of Arizona and CSHL to develop a cyberinfrastructure of Discovery Environments, where plant researchers can share and analyze data in an unprecedented fashion. As a member of the iPlant Education, Outreach, and Training (EOT) component, the DNALC will work with each project team to create educational interfaces to the scientific tools and databases. In this way, students and teachers can work with the same data, using the same tools, and at the same time as high-level plant researchers. This will enable students to literally look over the shoulders of plant researchers as they, for example, understand the mechanisms that could enable crop plants to rapidly respond to global climate changes.

DNALC multimedia staff embarked on an ambitious project to help publicize the iPlant project and to document the Grand Challenge development process. We set up a mini-video studio at the iPlant meeting at Cold Spring Harbor Laboratory, at each of six Grand Challenge workshops at Biosphere II, and at the American Society of Plant Biology Meeting in Merida, Mexico, conducting a total of 143 interviews with plant and computational biologists. From these, we extracted 538 video clips that present a range of viewpoints on challenges in plant biology, cyberinfrastructure, and education. A video header on the iPlant Internet site (www.iplantcollaborative.org/) randomly loads clips or allows one to select specific interviews.

At year’s end, we received approval from iPlant management to embark on an EOT demonstration project to develop an educational platform for gene annotation and comparison. Annotation is the process of discovering the biological information in a DNA sequence, viewing genes in the context of a chromosome, and relating them to other organisms. The analysis of DNA sequence entails a number of cumulative steps—assembling short sequences into “contigs,” predicting genes and other functional elements, and merging gene evidence from RNA and other species—which is termed a “pipeline” or “workflow.” Although masses of free DNA and gene data are available, each step of the workflow requires a different tool, and various tools and data sources often are not compatible. Our objective is to develop an easy-to-use interface that will allow students to easily find DNA data and seamlessly move it through several key stages of the annotation pipeline. We envision a desktop object that merges
attributes of our BioServers (www.bioservers.org) and Gene Boy (www.dnai.org/geneboy/) applications. Sarah Elgin (Washington University in St. Louis), Sue Wessler (University of Georgia), and Steve Slater (University of Wisconsin) are key collaborators on this project.

Genes to Cognition (G2C) Online

During the year, we pushed to complete Genes to Cognition (G2C) Online, our site on modern neuroscience research (www.g2conline.org). This site allows students to explore how thinking and disorders of thinking result from interactions at various levels of biological function—from genes, to biomolecules, cells, physiology, behavior, and environment. We completed 40 video interviews and demonstrations with neuroscience researchers from the United States and Europe, creating more than 300 new video clips and animations for launch in March 2009. A major goal of G2C Online is to increase understanding of the process of science. To this end, we collaborated with researchers at the National Institute of Mental Health to develop three video modules on neuroimaging based on fMRI, MEG, and PET technologies. In these demonstrations, researchers introduce the techniques, guide users through an experiment, and discuss data.

We continued to develop touchstone animations to highlight key concepts of brain science. Following up a recommendation from our Advisory Panel, we collaborated with AXS-3D, a Toronto-based animation studio, to develop a G2C 3-D Brain. This interface allows one to rotate a three-dimensional model to explore the structure and function of 29 parts of the human brain. Each structure or region includes information on associated disorders, brain damage, case studies, and links to contemporary research. Molecules for Memory was developed to supplement an interview with Nobel Laureate Eric Kandel. In this animation, users can trace the formation of a long-term memory from the generation of presynaptic action potentials, through protein–protein interactions in the postsynaptic neuron, to the formation of new synapses. This animation joins a series of high-value pieces, including the Neural Code, a proteomics demonstration; Memory Lanes, a demonstration of how cab drivers remember routes; Gene Knockout, an explanation of how to alter genes in mice; and the Fly School and Swimming Mice interactive experiments. In addition to animations and video clips, we have harvested an extensive library of articles from the Dana Foundation and a 300-word glossary.

We also collaborated with Seth Grant’s group at the Wellcome Trust Sanger Institute to develop a protein–protein interaction database (PPID) browser. This is a map tool that allows one to explore a network of 105 proteins involved in synaptic transmission. Clicking on any one of the proteins calls up a customized abstract with links to G2C Online content and detailed information (the Allen Brain Atlas, NCBI gene information, and Ensembl homology links). The browser bridges the gap between science and education, allowing researchers and students to toggle between technical and popular information about a particular protein.

G2C Online’s unique site architecture extends networking software developed at MIT’s Media Lab, which displays content as an interlinked network of dimensional content “atoms.” One can browse the network by zooming in and out, following links between adjacent atoms, and clicking on any atom to call up multimedia items. Our three-dimensional network is based on two-dimensional concept maps that were developed from interviews with leading neuroscience researchers. In 2008, we redeveloped our browser software as Simple Mapper, which allows users to build their own network maps and then link atoms to online content from G2C or other sources. In addition to creating striking network maps, Simple Mapper can also be used to generate concept maps to assess student learning.

In the spring, Amy Niselle, a doctoral student from the University of Melbourne, joined the G2C Online project to assist with program evaluation. She worked extensively with Danielle Sixsmith to conduct a detailed usability study with 48 Advanced Placement (AP) biology and psychology students. Data were collected on how students interacted with the site, how they accessed relevant content, and how the site helped or hindered learning. Insights from this study led to several important changes in site design and navigation. Notably, we enabled our Flash interface to be controlled by browser back/forward buttons (not a trivial project), and we streamlined text for easy browsing and skim reading.
Inside Cancer

With Phase I funding from an NIH Science Education Partnership Award (SEPA), we developed Inside Cancer (www.insidecancer.org), a multimedia internet resource for understanding the molecular genetic basis of cancer. By focusing on how researchers gain insights into the unseen world of genes and signaling molecules, Inside Cancer provides examples of the science process. With Phase II funding, we are implementing a number of improvements that support and extend syllabus-centered teaching. Notably, we disaggregated Inside Cancer content by breaking it into individual content “atoms.” Each atom was then entered into a content management system and annotated with metatags, including alignment with national and state educational standards. Using this system, a teacher can identify sets of atoms that illustrate particular content standards or, conversely, collect items that respond to various standards as they browse the site.

We also developed a companion Teacher Center that includes standards alignments, as well as a tool that allows teachers to create custom presentations with Inside Cancer content, and a wiki for developing and exchanging lesson plans. Faculty Fellows Naomi Cook (Horace Greeley High School), Sue Holt (Life Sciences Learning Center, University of Rochester), and Glen Cochrane (lead biology teacher, Half Hollow Hills High School) developed sample lessons to “seed” the wiki. Naomi spent an extended period at the DNALC adapting multimedia elements from other DNALC sites to expand content at Inside Cancer.

Maize Internet Sites

During the year, we collaborated with CSHL researchers Dick McCombie and Doreen Ware, and Rick Myers of Washington University in St. Louis to develop a mini-website describing the NSF-funded Maize Genome Sequencing Project (www.dnalc.org/maize/maize.html). The site features interviews with scientists involved in deciphering the information in the maize genome, a tour of the genome sequencing center at Washington University, an animation of the sequencing and assembly process, and a video tutorial for using the online maize sequence browser.

In the fall, our work in plant education was further bolstered with receipt of an outreach grant from the maize meristem collaboration between CSHL faculty member Marja Timmermans and
scientists at Cornell University. Under this project, the DNALC will
develop a multimedia internet site, *Weed to Wonder*. We will tell the
remarkable story of the corn plant’s amazing rise—from a common
weed, to staple food and religious icon of Native Americans, to modern
hybrid cultivar, to versatile and ubiquitous component of processed
food, to precursor of clothing and motor fuels, to pharmaceutical
factory. *Weed to Wonder* will celebrate this uniquely American success
story and provide a case study of the interaction among science,
technology, and society (STS). The site will open an internet window
on modern research on plant genomes, as well as a time machine back
into the social and scientific history of agricultural breeding. The goal
will be to show the continuity of research on corn—from Native
American agriculturalists to agricultural breeders, corn geneticists,
plant physiologists, and molecular biologists—that has culminated in the Maize Genome
Sequencing Project. In parallel with the story of human impact on the evolution of the corn plant,
we will also tell the story of corn’s impact on human culture.

*Weed to Wonder* will capitalize on the internet’s capacity to juxtapose different media,
providing options to engage people with different interests and learning styles (“intelligences”).
The major site will be complemented by serialized podcasts in audio and video formats. Video
interviews will provide contrasting vignettes of people involved with corn at various levels.
Researchers will provide understanding of the process of science, and interviews with farmers,
historians, and ethnographers will portray corn’s role in society. Animations will be especially
effective in describing experiments and bringing to life unseen molecular events. Multimedia
content will be integrated with online experiments and bioinformatics tools primarily developed
by the DNALC with previous NSF funding. A continuum of practical experiments will allow
middle school, high school, and beginning college students to progress from classical genetic
analysis of kernel traits, through molecular genetic and bioinformatic analysis of mutations, to
the examination of genome structure and evolution.

**Internet Visitation**

Visits to the DNALC’s family of internet sites decreased to 6.06 million in 2008—84% of the
previous year’s traffic. Although there were fewer visitors, those who came spent more time and
accessed more content than in the previous year. Ten of 12 sites saw increases in the average
viewing time and served nearly 4,000 gigabytes (4 terabytes) of data, a 23% increase over 2007.
*DNA Interactive*, our richest multimedia site, alone served a total of 1.3 terabytes.

As part of a concerted effort to improve visitation, we employed LunaMetrics, a company that
specializes in search engine optimization. After analyzing a representative internet site (*Inside
Cancer*), the consultants suggested ways to improve our metadata descriptions to make it easier
for search engines to index content. Because search engines give preferred rankings to sites with
frequent updating, the consultants also suggested adding blogs or news feeds to provide fresh
content. We have been using these and other insights to renovate older sites and to guide devel-
opment of new sites. Many of our popular sites have a linear story line, which makes it difficult
for users to find particular multimedia atoms (animations and videos) to answer a specific
question or instructional need. We are in the midst of a major project to disaggregate linear
content and provide improved metadata so that individual videos and animations can be retrieved
via a search, such as Google or Yahoo. Our new G2C Online site was specifically developed as a
nonlinear network of atoms with associated metadata.

We continue to get a boost from a grant from Google AdWords, a free advertising program
that displays sponsored links on Google’s search results page. Our AdWords account contains a
set of keywords for each DNALC website. A search for one of the keywords displays an ad for a
DNALC site as a user “impression,” and a “click-through” is logged when a link is followed. *DNA*
From the Beginning is our most successful site on AdWords, logging 5,587,424 impressions and 103,294 click-throughs. In total, DNALC sites registered 13,441,908 impressions and 175,161 click-throughs, valued at $113,224.

Faculty Training

During the year, more than 800 educators participated in professional development activities conducted at sites around the United States and Europe. With funding from the NSF, NIH, and the Hewlett Foundation, we collaborated with 14 host institutions to conduct 17 one- to five-day workshops on plant genomics, bioinformatics, cancer biology, RNA interference, and neurobiology. Five of these workshops were conducted at institutions with high proportions of underrepresented minorities, where 19% of participants were African American or Hispanic. Through our HHMI-sponsored collaboration with the New York City Department of Education, 105 teachers participated in workshops at the Harlem DNA Lab. An additional 428 educators attended workshops at professional meetings in the United States and Europe that covered topics including neurobiology, bioinformatics, the molecular genetics of taste and smell, detecting genetically modified foods by PCR, DNALC online tools for education, and DNA forensics.

At the end of July, 18 teachers from ten states attended the Amgen Leadership Symposium in Human and Genomic Biology. The first two weeks of the symposium included experiments and bioinformatics exercises on RNA interference (RNAi) and genetic modification of plants. Participants explored human genetics by genotyping polymorphic sites in their own DNA: (1) An Alu “jumping gene” insertion on chromosome 16 and single-nucleotide polymorphisms (SNPs) in the mitochondrial chromosome were used to study theories of human origins and ancient migration. (2) SNPs in a taste receptor were correlated with the ability to taste the bitter chemical phenylthiocarbamide (PTC). (3) Variations in a repeat region and analysis on a DNA chip illustrated state-of-the-art methods in forensic identification. In the final week, participants worked independently or in groups to develop lesson plans, optimize experimental methods for classroom instruction, screen supermarket foods for genetic modifications, expand bioinformatics exercises, and observe DNALC methods for instructing middle school students.
We continued to provide leadership training under our long-term collaboration with the Singapore Ministry of Education. Initiated in 2000 with a visit by Minister Teo Chee Hean, the collaboration established licensed DNA learning centers at the Singapore Science Center and National Institute of Education. Two junior college teachers and one high school teacher participated in the summer Leadership Symposium, and three elementary school teachers came in November for a 2-week stay. Besides hands-on lab work and preclass preparation, the November contingent observed and co-taught labs alongside DNALC instructors and visited a local elementary school. Each teacher developed a plan for translating their experience into hands-on instruction for Singaporean students.

Concluding Two Plant Outreach Projects

We concluded our collaboration with CSHL researcher Marja Timmermans and Cornell University’s Mike Scanlon to encourage underrepresented minorities to teach and study plant genomics. In past summers, two Faculty Fellows spent two weeks working in plant genome labs at CSHL or Cornell and one week working with us at the DNALC. In 2008, we conducted 1.5-day follow-up workshops hosted by Faculty Fellows Gokhan Hacisalihoglu and Diomede Buzingo at their home institutions—Florida Agricultural & Mechanical University (Tallahassee) and Langston University (Oklahoma). Of the 25 high school and college educators who participated in these workshops, 24% were African American or Hispanic, mirroring their proportion among American residents (2005 census figures). Building on previous three-day workshops at these sites, the follow-ups introduced educators to mobile “footlockers” that include PCR and electrophoresis equipment. Experiments use this equipment to test for genetically modified foods or analyze transposon polymorphisms in maize and Arabidopsis. Participants can borrow the equipment from host institutions for use in their classes, removing a major barrier to the implementation of modern experiments in plant molecular genetics. This project was summarized in an article written by Dr. Hacisalihoglu entitled An Innovative Plant Genomics and Gene Annotation Program for High School, Community College, and University Faculty (CBE Life Sci. Educ. 7: 310–316).

We also completed work with Lincoln Stein and Doreen Ware on their NSF-funded Gramene project, which provides informatics tools for analyzing and comparing grain genomes. During the project, we developed the internet site Dynamic Gene (www.dynamicgene.org) and trained 304 high school and college faculty to use the site to annotate rice genes in their classes. Animated tutorials in the site explain how DNA sequences encode information, how computers identify patterns that predict gene structures, and how experimental evidence complements computer predictions to
correctly identify genes. The Annotation section provides detailed instructions on how to analyze a predicted gene with Apollo, research software developed to analyze the Drosophila genome.

The Projects section allows students to download sections of rice chromosomes, annotate predicted genes, and upload their results to compare with classmates or share with researchers. This provides powerful opportunities for students to contribute to science by analyzing up-to-date biological data. This became evident during the fall of 2008, when we used the site with Cold Spring Harbor High School students enrolled in Genomic Biology, an advanced course offered at the DNALC. After five hours of instruction using Apollo and other online bioinformatics tools, student groups were charged with the task of identifying and evaluating genes in different regions of rice chromosome 1. By analyzing the available evidence, the 17 students were able to improve on the majority of computer-generated gene predictions and many previously annotated genes in a 400,000 base pair region. Remarkably, students were also able to identify four putative genes that had not previously been identified. Thus, we feel that certain novice high school and college students can contribute to our knowledge of gene structure, while gaining first-hand experience in modern bioinformatics.

Three New Teacher Training Workshops

RNA interference (RNAi) provides a powerful tool to move directly from DNA sequence to the analysis of gene function in living organisms. With Phase II funding from NSF’s Course, Curriculum, and Laboratory Improvement (CCLI) program, we expanded our efforts to bring compelling RNAi experiments into college classrooms. Five-day Silencing Genomes Workshops were conducted in summer 2008 at Rust College (Holly Springs, Mississippi), Austin Community College (Texas), and the Fralin Biotechnology Center at Virginia Tech (Blacksburg, Virginia). Sixty-three college instructors were trained to perform RNAi in the model eukaryotic organism Caenorhabditis elegans. After observing mutant phenotypes and learning basic worm “husbandry,” faculty used simple methods to induce RNAi and “single-worm PCR” to examine the mechanism of RNAi—comparing the DNA of worms with identical phenotypes induced by either RNAi or a mutation. They also learned open-ended methods to support student projects, using bioinformatics to identify a target gene and then develop their own RNAi reagents “from scratch.”

Using these methods, workshop participants collaborated to develop new targeting vectors designed to silence 40 C. elegans genes; these will be supplemented by another 60 vectors to be developed in workshops planned for the summer of 2009. Each vector has been entered into the Silencing Genomes Projects page and includes its own evolving record of how it was developed and how it is used by other students and teachers. A collection of bacterial and C. elegans strains, including these newly developed reagents, are freely available through our online strain order system. In 2008, 88 strains were sent to teachers in the United States, Thailand, Brazil, Poland, Singapore, and Spain to support teaching the Silencing Genomes curriculum, reaching an estimated 2,600 students.

Ninety-two high school and college faculty learned to use internet content on cancer cell biology in health, general biology, and AP biology classes at six Inside Cancer workshops. One-day workshops supported through the NIH SEPA program were held at Stowers Institute for Medical Research (Kansas City, Missouri), Midland College (Texas), Fred Hutchinson Cancer Research Center (Seattle, Washington), and Kimmel Cancer Center (Philadelphia, Pennsylvania). Two workshops were also conducted in conjunction with teacher professional conferences: National Association of Biology Teachers (Memphis, Tennessee) and Biolink Southwest Region (Albuquerque, New Mexico).

With the support of the Hewlett Foundation, we instituted a nationwide workshop program to disseminate G2C Online.
Workshops were held at the DNALC, the Stowers Institute (Kansas City, Missouri), Fred Hutchinson Center (Seattle, Washington), and St. Louis Science Center (Missouri); 61 high school and college educators participated in 1.5-day workshops introducing up-to-date neuroscience research, our library of multimedia items, and interactive experiments. Of these participants, 97% rated workshop content as excellent or good, and mean scores on pre- and post-knowledge tests rose from 6.57 to 8.91.

Harlem DNA Lab

In 2008, we fulfilled our long-held goal of developing a base of operations to provide underserved schools in New York City (NYC) enrichment opportunities identical to those offered to Long Island's affluent schools. In 2007, NYC Schools Chancellor Joel Klein provided us exclusive use of a 1200-square-foot classroom in the John S. Roberts Educational Complex (JHS 45) in East Harlem. Then, in winter 2007–2008, the Division of School Facilities renovated the space according to our specifications, including our signature student lab desks. With a $100,000 grant from the Jerome L. Greene Foundation, we purchased equipment for elementary through advanced experiments—from dissecting and compound microscopes to a fast PCR machine and three Agilent Bioanalyzers that allow us to type student polymorphisms in a single 3-hour lab. One area of the lab is specifically designed for assembling foot lockers and restocking reagent kits to be used in NYC schools.

Lab field trips began in the spring, and Harlem DNA Lab was dedicated on September 23rd by NYC Schools Chancellor Joel Klein, Howard Hughes Medical Institute (HHMI) Vice President Peter Bruns, and CSHL President Bruce Stillman. The event was covered in the New York Post, and a video piece on NY1 featured students from the Emily Carey School.

Located at John S. Roberts Middle School, at First Avenue and 120th Street, Harlem DNA Lab offers the same range of high school lab field trips as offered at our Cold Spring Harbor and Lake Success facilities: bacterial transformation, DNA restriction analysis, forensic DNA profiling, and human mitochondrial DNA sequencing. Just over 1,400 students participated in lab field trips in 2008. We extended our popular Genetics as a Model for Whole Learning (GMWL) to every John S. Roberts student, providing three labs for each of 375 students in grades 6–8. A grant from the William T. Porter Foundation provided scholarships for John S. Roberts students, as well as 812 students participating in field trips and summer camps.

The capstone event for Harlem DNA Lab was the two-week New York State Excelsior Scholars Program, which involved 39 8th graders from Manhattan, Queens, and the Bronx. Excelsior Scholars were selected based on standardized test scores that placed them in the top 10% of their science/math
classes, teacher recommendations, and personal statements. A week-long DNA Science camp provided intensive lab experience for 16 high school students from around New York City.

HHMI Teacher Professional Development

Harlem DNA Lab is also the site for a city-wide professional development program funded by HHMI. The goal is to develop a base of teachers who can competently introduce science students to six “targeted” experiments highlighting key techniques in genetics and biotechnology. The experiments embody key concepts and process skills of the New York City Scope and Sequence for Science, New York State Science Core Curriculum, AP Biology, and National Science Education Standards.

During the first year of the project, we developed a strong working group composed of DNALC and Department of Education staff, key advisors, and six Faculty Fellows: Greg Borman, lecturer in middle/secondary science education, City University of New York and former science coordinator, Henry Street Middle School, Manhattan; Caren Gough, New York State Science Mentor, consultant, and adjunct faculty, Stony Brook University; Dr. Dahlia McGregor, biology teacher, South Shore High School, Brooklyn; Adrienne Rubin, biology teacher, Eleanor Roosevelt School, Manhattan; Kathleen Rucker, biology teacher, Brooklyn International High School; Jerry Watkins, retired science teacher, Central Islip Union Free School District (UFSD), Long Island.

During the week of August 4–8, the Fellows convened at the DNALC to help develop Lab Center, an internet site that specifically supports instruction of the six “targeted labs.” Lab Center represents a virtual classroom into which a DNALC staff member enters to make a video introduction to each lab. By clicking on objects on the whiteboard and desk, students can access (1) interactive and PDF versions of each experiment, (2) follow-up activities, (3) scientist interviews, (4) animations, and (5) selected links. Fellows developed formatted lesson plans that include prelab student work, detailed teacher tips, a timeline to complete the lab in 40-minute periods, and creative postlab activities. Their input helps to ensure that each lab builds logical connections between concepts and anticipates use in a variety of classroom settings.

The HHMI project has the aggressive goal of providing 24 hours of certificate training to 200 teachers per year. Thus, in 2008, we devoted considerable effort to developing relationships with key individuals and networks that can help us to recruit teachers. Through our collaboration with the Department of Education, our training schedule and registration materials are posted on major NYC registries for teacher development activities.

Visitation and Student Instruction

Annual visitation reached a new high of 40,485 in 2008. This included 20,043 students who conducted experiments at the DNALC, DNALC West, or the Harlem DNA Lab, and 8,235 students who received in-school instruction by DNALC staff members. More than half of all experiments were conducted by middle school students under the banner of GMWL, which continues to offer quality field trip and in-school programs for students in grades 4–8. In 2008, more than 70 public and private schools were involved in the GMWL program.

Summer camps conducted at the DNALC, DNALC West, Harlem DNA Lab, Central Islip High School, and SUNY Old Westbury drew 921 students. We continued our collaboration with Project Grad Long Island, a nonprofit organization that works within economically disadvantaged students to increase high school graduation rates. Project Grad provided daily bussing for 22 high school students from the Westbury UFSD to attend a week-long camp at the SUNY Old Westbury campus. This course, which included hands-on experiments on advanced topics in DNA science and human and plant genomics, was supported by a grant from the Keyspan Foundation. Arrow Electronics provided scholarships for four 5th grade students from the Westbury UFSD to attend Fun with DNA camps at the DNALC. As part of a continuing collaboration with Central Islip School District, Bank of America Long Island funded a Fun with DNA camp for 18 students from the Charles Mulligan Elementary School.
In 2008, we continued the Great Moments in DNA Science tradition with 425 high school student participants. Dr. Lloyd Trotman talked about the impact of varying PTEN expression levels in mouse models for prostate cancer. Dr. Bill Tansey explained how proteolysis contributes to important events in the cell and how abnormal proteolysis contributes to cancer. Dr. Doreen Ware described her work in understanding plant genome organization, evolution, and diversity. *Saturday DNA* drew 272 student and adult participants for workshops such as *Survival of the Fittest, Cancer: Inside Out*, and *How to Solve a Crime*.

Our collaboration with the Watson School of Biological Sciences continued in 2008 with a large class of 14 graduate students. This rotation provided the graduate students an opportunity to learn skills for communicating with nonbiologists. During 12 half-day sessions, pairs of students worked with expert DNALC instructors to develop presentation methods that can help convey unfamiliar ideas to people of any age or background. In the first phase of training, each student pair “shadowed” a DNALC instructor as he/she taught a middle or high school lab and then developed a lesson plan that integrated their perspectives. In the second phase, each pair worked closely with DNALC instructors to co-teach several labs, developing communication skills and preparing them for independent instruction. During the final phase, each pair was responsible for teaching an entire lab, under the close observation of a DNALC staff member.

**DNA Sequencing Service**

A unique aspect of the DNALC’s educational portfolio is the free DNA Sequencing Service and bioinformatics tools that allow students to analyze a 440-nucleotide portion of their own mitochondrial chromosome. The mitochondrion, the organelle that produces energy for the cell, contains several copies of its own genome; moreover, there are hundreds to thousands of mitochondria per cell. This amplification and the fact that the noncoding (control) region of the mitochondrial genome accumulates mutations quickly make the control region ideal for studies of human evolution and diversity.

Using a kit distributed by Carolina Biological Supply Company, students isolate DNA from cheek cells and then use PCR to amplify the mitochondrial control region. The student samples are then sent by overnight mail to the DNALC, where they are prepared for sequencing by college interns Alina Duvall (Hofstra University) and Jennifer Aiello (Long Island University, C.W. Post Campus). The student samples then go to the CSHL Sequencing Shared Resource Facility in Woodbury, where they are sequenced on an Applied Biosystems 3730xi Genetic Analyzer. Finally, the sequences are uploaded to the Sequence Server database at our BioServers site (http://www.bioservers.org). There, students can view their sequences and use software to align them with mitochondrial sequences from modern humans, ancient humans, primates, and other animals. In this way, they can use their own DNA as a starting point to discover what DNA says about how humans evolved and migrated around the globe.

In 2008, we sequenced 7003 student DNA samples—a 10% increase from 2007. Samples were received from 145 high schools, 36 community colleges, and 71 universities. On average, results were posted on the BioServers site within 20 days of receipt. The free service is made possible by the donation of sequencing reagents by Applied Biosystems of Foster City, California.

**Staff and Interns**

In August, we said goodbye to high school instructor Brian Lang and middle school instructor Lauren Weidler. We will miss them both and wish them continued success as they teach biology—Brian in the North Shore School District and Lauren in the Plainview School District. Instructional vacancies were filled by Jason Williams and Tedi Setton, two Long Island natives. Jason has a bachelor’s degree in biology from SUNY Stony Brook. He worked at CSHL’s main campus, involved in the molecular genetics of plant development in Arabidopsis and cancer research. Tedi brings a wealth of knowledge from her undergraduate degree in biological sciences
from Wellesley College and her studies in forensic pathology at the Suffolk County Medical Examiner's Office. Having participated in a DNA Science summer workshop as a high school student, Tedi's education came full circle when she led DNA Science as an instructor!

In the fall, we were lucky to recruit Dr. Ileana Rios to head our new Harlem DNA Lab. Ileana brings an informed perspective to our effort to bring high-level science to underrepresented students in New York City. Born in Spanish Harlem, only a few blocks from the Harlem DNA Lab site, she went on to receive a B.A. in biology from Barnard, a B.S. in cytology from SUNY Health Science Center, and a Ph.D. in molecular biology from CUNY. Her work history spans research in cellular senescence and HIV vaccine development, as well as teaching at the elementary, secondary, and undergraduate levels.

We also welcomed back Dr. Uwe Hilgert after a year's assignment as Assistant Dean of the Watson School of Biological Sciences, where he eased a transition between Deans. Uwe returned to spearhead the DNALC component of the iPlant Collaborative and to resume his role as scheduling tsar, maintaining our increasingly complex schedule of teacher training workshops. As a microbiologist, Uwe brings to the iPlant position formal training in plant pathology/physiology from the Max-Planck Institute for Plant Breeding and the University of Arizona. He has practical expertise in bioinformatics education, having worked on high school and teacher training under HHMI and NSF grants. He had a key role in developing the DNALC’s Dynamic Gene Internet site, an interface that allows students to annotate the rice genome sequence. He also knows many of the players in the iPlant leadership, having spent his postdoctoral period at the University of Arizona before coming to CSHL in 2000.

Lauren Correri, our new Administrative Assistant, is a native Long Islander. After graduating from Adelphi University and working toward a master's degree at Sarah Lawrence College, she gained administrative experience at First Advantage, a firm specializing in insurance investigations. Her duties at the DNALC include greeting visitors, overseeing scheduling, collecting fees, and tracking visitation.

The internship program continues to draw some of Long Island's most talented high school and college students, engaging them in science research and providing practical laboratory experience. We were pleased to accept a large group of new high school interns this year: Dylan Assael (Syosset), Michelle Bobrow (Great Neck South), Nancy Desai (Hicksville), Utkarsh Sahay (North Shore), Yasmina Macer (Portledge), Andrew Malingren (Massapequa), Anastasia Minkin (Oyster Bay), Emily Troge (Our Lady of Mercy), Kaitlin Watrud (Commack), and Kevin Wu (Jericho). Returning interns were Charmaine Brown (Westbury), Rachel Gellerman (Cold Spring Harbor), Stephanie Parascandolo (Half Hollow Hills), and Arielle Scardino (Kings Park). Many of our interns continued to invest their DNALC experience in their own research. Arielle Scardino (Kings Park) worked with Jermel Watkins to explore how a decreased expression of certain mitochondrial genes can be used as a biomarker for neuromuscular dysfunction.

We bid farewell to interns Seth Schortz, who started at Emory University, and Benjamin Blond, who started at Yale University. Former high school interns Nick Wilkin (Ithaca College) and Janice Yong (Boston University) returned to help out during college breaks. Lauren Thompson (Barnard College) again returned to assist with summer workshops at DNALC West.

College intern Jennifer Aiello (C.W. Post University) continued to effectively manage our free DNA Sequencing Service. She also called on her major in forensic science to help create a popular family workshop for Saturday DNA!, Dig This!, a hands-on introduction to forensic anthropology.

David A. Micklos, Executive Director
## 2008 GRANTS

<table>
<thead>
<tr>
<th>Grantor Program</th>
<th>Duration of Grant</th>
<th>2008 Funding+</th>
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<tbody>
<tr>
<td><strong>FEDERAL GRANTS</strong></td>
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<tr>
<td>National Institutes of Health - Science Education Partnership Award (SEPA): Nationwide Dissemination of ‘Inside Cancer’</td>
<td>8/07-7/09</td>
<td>$140,653</td>
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<tr>
<td>National Science Foundation - Course, Curriculum, and Laboratory Instruction (CCLI) Program: Nationwide Dissemination of RNAi Curriculum</td>
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<td>$132,740</td>
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<td>National Science Foundation - Plant Genome Initiative Educational Outreach: Construction and Nationwide Dissemination of Dynamic Gene Internet Site</td>
<td>12/05-11/08</td>
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<td>AAAS/NSF - National Science Digital Library: Meta-tagging DNALC Internet Content for BiosciEdNet</td>
<td>10/05-9/09</td>
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<tr>
<td>Washington University/NSF - Plant Genome Initiative Educational Outreach: Multimedia Materials on Maize Genome Sequencing</td>
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<td>$15,611</td>
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<td>Cornell University/NSF - Plant Genome Initiative Educational Outreach: Minority Fellows &amp; Regional Plant Genomics Footlockers</td>
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<td>University of Arizona - Cyberinfrastructure for the Biological Sciences</td>
<td>2/08-1/09</td>
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<th><strong>NONFEDERAL GRANTS</strong></th>
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<tr>
<td>Amgen Foundation - Amgen Leadership Symposium</td>
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<tr>
<td>Dana Foundation - Genes to Cognition (G2C) Online Internet Site Development</td>
<td>10/04-12/08</td>
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<td>Dialog Gentechnik - DNALC Licensing</td>
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<tr>
<td>Hewlett Foundation - Genes to Cognition (G2C) Online Internet Site Evaluation</td>
<td>10/05-10/09</td>
<td>$86,702</td>
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<td>HHMI Foundation - Pre-College Science Education Initiative: NYC Teacher Training</td>
<td>9/07-8/09</td>
<td>$136,971</td>
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<td>New York State Education Department - Excelsior Scholars Program for 7th grade Math &amp; Science students</td>
<td>5/08-10/08</td>
<td>$42,794</td>
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<td>North Shore-LIJ Health System - DNALC West Operating Support</td>
<td>2008</td>
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<td>Porter Foundation - Scholarships for Minority and Disadvantaged Students</td>
<td>3/08-3/10</td>
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The following schools each contributed $1,000 or more for participation in the **Curriculum Study Program:**

- Bellmore-Merrick Central High SD 1,500
- Bethpage Union Free SD 1,500
- Commack Union Free SD 3,000
- East Meadow Union Free SD 1,500
- Elwood Union Free SD 1,500
- Garden City Union Free SD 1,500
- Great Neck Union Free SD 1,500
- Half Hollow Hills Central SD 3,000
- Harborfields Central SD 1,500
- Herricks Union Free SD 3,000
- Huntington Union Free SD 1,500
- Island Trees Union Free SD 1,500
- Jericho Union Free SD 1,500

The following schools each contributed $1,000 or more for participation in the **Genetics as a Model for Whole Learning Program:**

- Amityville Union Free SD 1,200
- Bay Shore Union Free SD 5,100
- Bellmore Union Free SD 2,000
- Bellmore-Merrick Central HS District 17,000
- Commack Union Free SD 5,875
- Deer Park Union Free SD 1,200
- East Meadow Union Free SD 2,550
- Elwood Union Free SD 4,200
- Floral Park – Bellerosa Union Free SD 6,750
- Friends Academy, Locust Valley 2,350
- Garden City Union Free SD 3,700
- Great Neck Union Free SD 16,500
- Grover Cleveland Middle School, NJ 1,200
- Half Hollow Hills Central SD 7,125
- Herricks Union Free SD 2,400
- Holy Family Regional School, Commack 1,500
- Huntington Union Free SD 6,800
- Kings Park Central SD 1,137
- Lindenhurst Union Free SD 1,000
- Locust Valley Central SD 11,650
- Long Beach City SD 1,200
- Merrick Union Free SD 2,700
- MS 447 Math and Science Exploratory School, NY 5,000

+ Includes direct and indirect costs
2008 Workshops, Meetings, and Collaborations

January 4  Site visit by Debra Berhans, Canisius College, Buffalo, New York
January 7  Site visit by Lee Brizuela, Agilent Technologies, Inc., Melville, New York
January 10  Watson School Orientation and Welcome Reception, DNALC
January 12  Saturday DNA!, “Survival of the Fittest” and “Blame it on the Brain,” DNALC
January 14  Meeting with Steve Barkanic, Gates Foundation, Washington, D.C.
January 16  Site visit by William Fair, Juliette Morgan, and Connie Hildesley, Alexandria Real Estate Equities, New York
January 17  Site visit by Scott Bronson, Mel Morris, and Ken White, Brookhaven National Laboratory, Upton, New York
January 18–19  NSF Dynamic Gene Workshop, Salk Institute for Biological Studies, San Diego, California
February 5  DNALC Education Committee Meeting, DNALC
February 6  Site visit by David Widmer, Long Island Radio Group, Farmingdale, New York
February 7  Site visit by Lorraine Aycock and Monica Cavallo, Bank of America, Melville, New York
February 7  BEN Collaborators Meeting, AAAS Headquarters, Washington, D.C.
February 8  Site visit by David Widmer, Long Island Radio Group, Farmingdale, New York
February 9  Saturday DNA!, “Superbugs Uncovered” and “Immuno Exploration,” DNALC
February 11  Site visit by G2C Online Fellow Laura Maitland, AP psychology Consultant
February 19  Site visit by G2C Online Fellow Laura Maitland, AP psychology Consultant
February 21  Site visit by G2C Online Fellow Caren Gough, Education Consultant
February 27  Human DNA Fingerprinting Laboratory, members of DNALC Corporate Advisory Board, DNALC
March 5  Science Fair at John S. Roberts Educational Complex, East Harlem, New York
March 5  Site visit by Marilyn Simons and staff, Simons Foundation, New York
March 6  Site visit by Gail Bennington, Garden City Science Curriculum Coordinator; Adele Cacotti, AP Teacher, Garden City High School; Steve Gordon, Science Research Teacher; and 25 Singaporean research students
March 7  Meeting with Bill Fair and Connie Hildesley, Alexandria Real Estate Equities, New York
March 7–8  WNYC and WLIW Teaching and Learning Celebration, New York
March 11  Meeting with Phillip Griffiths, Carnegie Corporation of New York and Institute for Advanced Study
March 12–13  Hewlett Foundation Grantee Meeting, Carnegie Mellon University, Pittsburgh, Pennsylvania
March 13  New York Department of Education Science Leadership Team Meeting, CUNY, New York
March 15  Saturday DNA!, “Living in the Gene Age: Chronicles & Frontiers” and “Gram-asticl!,” DNALC
March 17  Meeting for Science Supervisors’ Association of New York City, American Museum of Natural History, New York
March 19  Meeting with Richard Kahan, Urban Assembly, and Mort Slater, Gateway Institute for Higher Education, New York
March 19  Site visit by Babylon High School science faculty
March 21  Site visit by G2C Online Fellow Caren Gough, Education Consultant
March 21  Site visit by Bob Wheeler, Pine Creek High School, Colorado Springs, Colorado, and Brenda Dempsey, Castle View High School, Castle Rock, Colorado
March 21–22  NSF Plant Molecular Genetics and Genomics Follow-up Workshop, Florida Agricultural & Mechanical University, Tallahassee, Florida
March 25  Westbury School District teacher training, DNALC
March 26  Site visit by Alister Jones and Bronwen Cowie, School of Education, University of Waikato, New Zealand
March 27  Open House, Harlem DNA Lab, East Harlem, New York
March 27–29  National Science Teachers Association Workshops, Boston, Massachusetts
April 7–9  NSF iPlant Collaborative interviews at the iPlant Inaugural Conference: Bringing Plant and Computing Scientists Together to Solve Grand Challenges, CSHL
April 7–June 13  Internship by Amy Niselle, graduate student, Melbourne, Australia, DNA Interactive & G2C Online, DNALC
April 11  NIH Inside Cancer Workshop, Biolink Southwest Regional Meeting, Albuquerque, New Mexico
April 12  Saturday DNA!, “The Mystery of Anastasia Romanov” and “Inside Cancer,” DNALC
April 12  Science Council of New York City Conference, Stuyvesant High School, Brooklyn, New York
April 15  Open House, Harlem DNA Lab, East Harlem, New York
April 14–16  Westbury School District teacher training, Westbury, New York
April 17  G2C Online interview with Josh Dubnau, CSHL
April 18  Site visit by Lucio Pinto, Director, Tronchetti Foundation, Milan, Italy
April 22  Wellcome Trust Sanger Institute review of National Science Learning Center, York, United Kingdom
April 24  Site visit to Wellcome Trust Sanger Institute, Cambridge, United Kingdom
April 25  Site visit by Lorraine Aycock, Tar Heel Science, NC ScienceFest Science Festival winner, Gloria Schramm
April 29  Great Moments in DNA Science Honors Seminar: “Mutate Me Once, Permit a Tumor; Mutate Me Twice, Inhibit,” Lloyd Trotman, CSHL
May 1  Site visit by Hisao Izawa, President, Nikon Instruments Worldwide; Lee Shuett, CAB Board Member, Executive VP Nikon; and Yoichi Kasahara, Planning General Manager, Nikon
May 8  Site visit by Ann McDermott-Kaye, Director, OSI Foundation; Morgan Browne, Chairman, OSI Foundation; and David Epstein, DNALC CAB member and OSI vice president of oncology
May 8  
**G2C Online Interview with Josh Dubnau, CSHL**

May 8–9  
**NSF Dynamic Gene Workshop in Gene Annotation, Harlem DNA Lab, East Harlem, New York**

May 10  
**Saturday DNAI, “Survival of the Fittest” and “A Billion Little Pieces,” DNALC**

May 13  
**Great Moments in DNA Science Honors Seminar: “Protein Demolition: Taking Control by Taking Apart,” Bill Tansey, CSHL**

May 17  
**Oyster Bay Health and Science Fair, Oyster Bay, New York**

May 19–21  
**NIH SEPA Principal Investigators Meeting, Rockville, Maryland**

May 27  
**Great Moments in DNA Science Honors Seminar: “Genotype to Phenotype: A Closer Look at Plant Genomics,” by Doreen Ware, CSHL**

May 27  
**Site visit by Amy Sanders, Project Manager, Darwin 200, Wellcome Trust**

May 28  
**Site visit by Vintord Mentar, JP Morgan Chase Global Philanthropy, New York**

June 2–6  
**NSF Silencing Genomes Workshop, Rust College, Holly Springs, Mississippi**

June 4  
**Site visit by Grey Ruegamer, New York Giants football team**

June 7  
**Howard Hughes Medical Institute Fellows Meeting, DNALC**

June 9  
**Site visit by Kidgie Williams, Hospitality Committee for United Nations Delegations, Inc., and United Nations delegates’ family members, New York**

June 9–13  
**Site visit by G2C Online Fellow Caren Gough, Education Consultant**

June 11  
**Site visit by Rut Premssrirut, CSHL, and Michael Rialdy, Indonesia**

June 12  
**Site visit by G2C Online Fellow Laura Maitland, AP psychology Consultant**

June 12  
**Site visit by Tom Burrish, Provost, University of Notre Dame; William Doyle, Sr., Director of Development; Tom Gibbons, Regional Director of Development, New York Metro; and John Passarelli, Notre Dame Alumni and Board Member, DNALC**

June 14  
**Saturday DNAI, “Cancer: Inside Out” and “Human Evolution and mtDNA,” DNALC**

June 17  
**Fifteenth Annual Golf Tournament, Piping Rock Country Club, Locust Valley, New York**

June 20–21  
**NSF Plant Molecular Genetics and Genomics Follow-up Workshop, Langston, Oklahoma**

June 26  
**Site visit by Alfred Goldberg, Professor, Harvard Medical School and former CSHL URP (1961), of the Porter Foundation**

June 27–July 2  
**American Association of Plant Biologists, Plant Biology 2008, Mérida, Mexico**

June 30–July 3  
**Fun with DNA Workshop, DNALC**

July 1  
**Site visit by Miriam Cortes-Caminero, Director of Marketing, Laboratory Technologies, Inc., Maple Park, Illinois**

July 2–8  
**G2C Online interviews with Jeff Lichtman, Harvard University; Ken Kosic, University of California, Santa Barbara; James Eberwine, University of Pennsylvania; Rusty Lansford, California Institute of Technology; and Pierre Marie Lledo, Pasteur Institute, Paris, France, CSHL**

July 7–11  
**Fun with DNA Workshop, DNALC**

July 11–15  
**International Congress of Genetics, Berlin, Germany**

July 14  
**G2C Online interviews with Anil Malhotra, North Shore Long Island Jewish Hospital, and David Skuse, University College, London, England, CSHL**

July 14–18  
**World of Enzymes Workshop, DNALC**

July 21–25  
**G2C Online interview with Thomas Insel, National Institute of Mental Health, Bethesda, Maryland**

July 24  
**Site visit by Allen Moore, University of Exeter, England; Christian Keysers, BCN Neuroimaging Center, Groningen, The Netherlands; and Larry Young, Emory University, Atlanta, Georgia, CSHL**

July 24  
**G2C Online interview with Wayne Drevets, National Institute of Mental Health, Bethesda, Maryland**

July 24  
**G2C Online interviews with Kay Redfield Jamison and James Potash, Johns Hopkins University, Baltimore, Maryland**

July 25  
**G2C Online interviews with Johan Jansma, Richard Coppola, and Wayne Drevets, National Institute of Mental Health, Bethesda, Maryland**
July 28–August 1 Fun with DNA Workshop, DNALC West
World of Enzymes Workshop, DNALC
Green Genes Workshop, DNALC
August 4–8 Fun with DNA Workshop, DNALC
World of Enzymes Workshop, DNALC West
Genetic Horizons Workshop, DNALC
DNA Science Workshop, DNALC
August 4–8 Site visit by HHMI Fellows Caren Gough, Jerry Watkins, Greg Borman, Dahlia McGregor, Kathleen Rucker, and Adrienne Rubin for Harlem Professional Development
August 4–8 NSF Silencing Genomes Workshop, Fralin Biotechnology Center, Virginia Tech, Blacksburg, Virginia
August 7 Site visit by Zaven Khachaturian, Ph.D., President and CEO, and Ara Khachaturian, Ph.D., Chief Program Officer, Lou Ruvo Brain Institute & Keep Memory Alive, Las Vegas, Nevada
August 7 Site visit by 17 math and science teachers, The New York Center for Teacher Development, Inc.
August 11–15 World of Enzymes Workshop, DNALC
Genetic Horizons Workshop, DNALC
DNA Science Workshop, DNALC
DNA Science Workshop, DNALC West
Excelsior Scholars Workshop, Harlem DNA Lab
August 13–15 NSF Course, Curriculum, and Laboratory Improvement Program, Principal Investigators Conference, Washington, D.C.
August 15 G2C Online Presentation, American Psychological Association, Boston, Massachusetts
August 18–22 Fun with DNA Workshop, DNALC
Genetic Horizons Workshop, DNALC
DNA Science Workshop, DNALC
Human Genomics Workshop, DNALC West
Excelsior Scholars Workshop, Harlem DNA Lab
August 18–22 NSF Silencing Genomes Workshop, Biolink Texas (Austin Community College), Austin, Texas
August 22 Site visit by Taiwan Delegation: Fuh-Sheng Shieu, Huan-Shyang Lin, Sue-Joan Chang, Horn-Jiunn Sheen, Ching-Yang Chou, Yu-Chie Wang, Tsang-Ming Wu, Sung-Tao Li, Ching-Mei Tang, Yen-Hung Pan, and Ching-Jiun Lee
August 25–29 World of Enzymes Workshop, DNALC
Green Genes Workshop, DNALC
Genetic Horizons Workshop, DNALC West
DNA Science Workshop, DNALC
DNA Science Workshop, Harlem DNA Lab
August 26 Site visit by Adele Smithers-Fornaci, President, The Christopher D. Smithers Foundation, Inc., Mill Neck, New York
August 29 Site visit by Richard Gelfond, President of IMAX; Pamela Gelfond, Yale graduate; and Claudia Gelfond, Dalton School graduate
August 29 Site visit by William Mak, Hong Kong Biotechnology Education Resource Center, Hong Kong University
September 4–5 NSF Review, Research Coordination Network, Arlington, Virginia
September 14–15 Site visit to Genome Sequencing Center, Washington University, St. Louis, Missouri
September 17–18 Site visit by Martha Narro and Lisa Howells, NSF iPlant Collaborative
September 18–19 G2C Online Workshop, Stowers Institute for Medical Research, Kansas City, Missouri
September 20 NIH Inside Cancer Workshop, Stowers Institute for Medical Research, Kansas City, Missouri
September 23 Dedication of Harlem DNA Lab, East Harlem, New York
September 24 G2C Online interviews with Ellen Leibenluft, Danny Pine, Judy Rapaport, and Phil Shaw, National Institute of Mental Health, Bethesda, Maryland
September 25 Site visit and presentation of grant award by Lorraine Aycock, Vice President, Market Development Manager, and Monica Cavallo, Market Development Specialist, Bank of America of LI
September 25 Presentation of Harlem DNA Lab programs, NYC Department of Education’s Citywide Science Leadership Team, Wave Hill, Bronx, New York
September 25 Presentation of Harlem DNA Lab programs, NYC Department of Education’s Citywide Science Leadership Team, Wave Hill, Bronx, New York
September 26 Site visit by G2C Online Teaching Fellow Bob Kellos
September 27 HHMI Professional Development Program for NYC DOE Teachers, seminar on “DNA Structure and Isolation,” Harlem DNA Lab, East Harlem, New York
Sept 30–Oct 3 NSF iPlant Collaborative Grand Challenge Workshops Mechanistic Basis of Plant Adaptation and Impact of Climate Change on Plant Productivity Biosphere 2, University of Arizona, Tucson
October 3–4 G2C Online Workshop, DNALC
October 4 HHMI Professional Development seminar “Transformation and Protein Isolation,” Harlem DNA Lab, East Harlem, New York
October 8 Cold Spring Harbor High School Partnership Program commences
October 9 Public School meeting, McMain Secondary School, New Orleans, Louisiana
October 10–11 G2C Online Fellows Meeting, DNALC
October 14 HHMI Professional Development seminar, “Transformation and Protein Isolation,” Harlem DNA Lab, East Harlem, New York
October 15 NIH Inside Cancer Workshop, National Association of Biology Teachers Professional Development Conference, Memphis, Tennessee
October 16 Site visit by Piero Benedittti and 18 students, Natural Science Museum, Sardinia, Italy
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<tr>
<td>October 16</td>
<td>G2C Online Presentation, National Association of Biology Teachers Professional Development Conference, Memphis, Tennessee</td>
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<td>October 18</td>
<td>NIH Inside Cancer Workshop, Midland College, Midland, Texas</td>
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<td>October 24</td>
<td>Site visit and tour for Dorota Koczewska, Director of Mathematics and Science, District 75/Citywide Program, New York</td>
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<tr>
<td>October 25</td>
<td>HHMI Professional Development Seminar, “DNA Analysis and Forensics,” Harlem DNA Lab, East Harlem, New York</td>
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<td>October 29</td>
<td>NY1 Interview by health reporter Kafi Drexel of Emily Carey School of students visiting Harlem DNA Lab, East Harlem, New York</td>
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<td>Oct 31-Nov 1</td>
<td>G2C Online Workshop, Fred Hutchinson Cancer Research Center, Seattle, Washington</td>
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<td>November 1</td>
<td>Dedication of The Laurie J. Landau Multimedia Studio and DNALC 20th Anniversary Celebration, DNALC</td>
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<tr>
<td>November 2</td>
<td>NIH Inside Cancer Workshop, Fred Hutchinson Cancer Research Center, Seattle, Washington</td>
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<td>November 4</td>
<td>HHMI Professional Development Seminar, “Using Genetics to Engage and Accelerate Student Learners,” Harlem DNA Lab, East Harlem, New York</td>
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<td>Site visit by Caren Gough, Teaching Fellow, G2C Online</td>
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<td>November 7</td>
<td>NIH Inside Cancer Workshop, Kimmel Cancer Center, Philadelphia, Pennsylvania</td>
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<td>November 7-10</td>
<td>NSF iPlant Collaborative Grand Challenge Workshop, Developing Common Mechanistic Models for the Plant Sciences, Biosphere 2, University of Arizona, Tucson</td>
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<td>November 8</td>
<td>HHMI Professional Development Seminar, “Variability &amp; Inheritance,” Harlem DNA Lab, East Harlem, New York</td>
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<td>November 10</td>
<td>HHMI Professional Development Seminar, “DNA Analysis &amp; Forensics,” Harlem DNA Lab, East Harlem, New York</td>
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<td>November 14</td>
<td>HHMI Professional Development Seminar, “PCR and Human DNA Variations, Part One,” Harlem DNA Lab, East Harlem, New York</td>
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<td>November 14-15</td>
<td>G2C Online Workshop, St. Louis Science Center, St. Louis, Missouri</td>
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<td>November 15</td>
<td>Saturday DNAI, “GMO IQ,” DNALC</td>
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<td>November 16-18</td>
<td>G2C Online Interviews with Rene Anand, Ohio University; Brian Bacsakai, Harvard University; Randy Blakely, Vanderbilt University; Kalanit Grill-Spector, Stanford University; Todd Sacktor, State University of New York Downstate Medical Center, Brooklyn; Donna Wilcock, Duke University; Abraham Zangen, Weismann Institute of Science, Israel; Tallie Z. Baram and Nicole Gage, University of California, Irvine; John J. Mann, Columbia University; Lisa Monteggia, University of Texas Southwestern Medical Center; Dennis Selkoe, Harvard University; Guil Dolen, Massachusetts Institute of Technology; Helen Myberg, Emory University; Bruce McEwen, The Rockefeller University; and Simona Spinelli, National Institute of Health, at The Society for Neuroscience Annual Meeting, Washington, D.C.</td>
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<td>November 19-23</td>
<td>NSF iPlant Collaborative Grand Challenge Workshop, Assembling the Tree of Life to Enable the Plant Sciences, Biosphere 2, University of Arizona, Tucson</td>
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<td>November 20</td>
<td>G2C Online Presentation, National Science Teachers Association Meeting, Portland, Oregon</td>
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<td>November 22</td>
<td>HHMI Professional Development Seminar, “PCR and Human DNA Variations, Part One,” Harlem DNA Lab, East Harlem, New York</td>
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<td>November 24</td>
<td>Team Temasel, Singapore, hosted by Briarcliff Manor High School, Harlem DNA Lab, East Harlem, New York</td>
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<td>Nov 30-Dec 13</td>
<td>Singapore Primary Teachers Attachment, DNALC</td>
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<td>December 1</td>
<td>G2C Online Advisory Panel Meeting, DNALC</td>
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<td>Site visit by Andrew Tasker, Champalimaud Foundation, Lisbon, Portugal</td>
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<td>HHMI Professional Development Seminar, “PCR and Human DNA Variations, Part Two,” Harlem DNA Lab, East Harlem, New York</td>
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<td>December 8</td>
<td>Site visit by Belgian Delegation: Geert Schelstraete, Decuyper, Sofie Stoop, Ja De Wachter, Imke Debecker, Ann Van Gysel, and Jan Wauters</td>
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<td>December 10</td>
<td>Cold Spring Harbor High School Partnership Program Student Debate, DNALC</td>
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<td>HHMI Professional Development Seminar, “Engaging Level One and Level Two Student Learners,” Harlem DNA Lab, East Harlem, New York</td>
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<td>Saturday DNAI, “Dig This,” DNALC</td>
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<td>December 15-17</td>
<td>NSF iPlant Collaborative Grand Challenge Workshop, Computational Morphodynamics, Biosphere 2, University of Arizona, Tucson</td>
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<td>Site visit by Mike Scanlon, Cornell University, Ithaca, New York</td>
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<td>December 18</td>
<td>NYC DOE Science Specialists, Harlem DNA Lab, East Harlem, New York</td>
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<td>December 30</td>
<td>Site visit by NAACP ACT-SO (Afro-Academic, Cultural, Technological, and Scientific Olympics)</td>
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## Sites of Major Faculty Workshops 1985–2007

**Key:**  
Middle School | High School | College
--- | --- | ---

### 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
- **California State University, Fullerton** | 2000
- **California Institute of Technology, Pasadena** | 2007
- Canada College, Redwood City | 1997
- City College of San Francisco | 2006
- Contra Costa County Office of Education, Pleasant Hill | 2002
- **Foothill College, Los Altos Hills** | 1997
- Harbor-UCLA Research & Education Institute, Torrance | 2003
- **Los Angeles Biomedical Research Institute (LA BioMed), Torrance** | 2006
- Laney College, Oakland | 1999
- Lutheran University, Thousand Oaks | 1999
- **Pierce College, Los Angeles** | 1998
- Salk Institute for Biological Studies, La Jolla | 2001, 2008
- **San Francisco State University** | 1991
- **San Jose State University** | 2005
- University of California, Davis | 1986
- **University of California, Northridge** | 1993
- **United States Air Force Academy, Colorado Springs** | 1995
- University of Colorado, Denver | 1998

### Colorado
- Aspen Science Center | 2006

### Connecticut
- Choate Rosemary Hall, Wallingford | 1987

### Florida
- Armwood Senior High School, Tampa | 1991
- Florida Agricultural & Mechanical University, Tallahassee | 2007–2008
- North Miami Beach Senior High School | 1991
- University of Miami School of Medicine | 2000
- University of Western Florida, Pensacola | 1991

### Georgia
- Fernbank Science Center, Atlanta | 1989, 2007

### Hawaii
- Kamehameha Secondary School, Honolulu | 1990

### Idaho
- University of Idaho, Moscow | 1994

### Illinois
- Argonne National Laboratory | 1986–1987
- **University of Chicago** | 1992, 1997

### Indiana
- Butler University, Indianapolis | 1987

### 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
- Foundation for Blood Research, Scarborough | 2002

### Maryland
- Annapolis Senior High School | 1989
- Frederick Cancer Research Center, Frederick | 1995
- McDonogh School, Baltimore | 1988
- Montgomery County Public Schools | 1990–1992
- National Center for Biotechnology Information, Bethesda | 2002
- **St. John’s College, Annapolis** | 1991
- **University of Maryland, School of Medicine, Baltimore** | 1999
- Beverly High School | 1986
- Biogen, Cambridge | 2002
- **Boston University** | 1994, 1996
- CityLab, Boston University School of Medicine | 1997
- Dover-Sherborn High School, Dover | 1989
- **Florida Agricultural & Mechanical University, Tallahassee** | 1991

### Massachusetts
- **University of Massachusetts, Amherst** | 1986
- Amherst College | 1990

### Michigan
- **University of Michigan** | 1989
- Eastern Michigan University, Ypsilanti | 1996
- University of Michigan, Ann Arbor | 2006

### Missouri
- **University of Missouri, Columbia** | 2000
- Western Missouri University | 1993
- Southeast Missouri State University, Cape Girardeau | 1997

### Montana
- **University of Montana, Missoula** | 1989
- Montana State University, Bozeman | 1992

### Nebraska
- University of Nebraska | 1987
- University of Nebraska-Lincoln | 1992
- University of Nebraska Omaha | 2007

### Nevada
- University of Nevada, Las Vegas | 1989

### New Hampshire
- **New England College, Manchester** | 1991
- University of New Hampshire, Durham | 1996

### New Jersey
- **Rutgers University, New Brunswick** | 1989
- Stevens Institute of Technology, Hoboken | 1991

### New Mexico
- University of New Mexico, Albuquerque | 1987
- University of New Mexico, Gallup | 1995

### New York
- **Cornell University** | 1990
- Cooper Union for the Advancement of Science and Art, New York | 1992
- Bard College, Annandale-on-Hudson | 2002

### North Carolina
- Wake Forest University, Winston-Salem | 1993
- University of North Carolina, Chapel Hill | 2006

### North Dakota
- University of North Dakota, Grand Forks | 1995

### Ohio
-**Ohio State University** | 2000
- Kent State University, Kent | 1992

### Oklahoma
- Oklahoma State University, Stillwater | 1987

### Oregon
- Oregon State University, Corvallis | 1991
- Portland State University, Portland | 1997

### Pennsylvania
- Temple University, Philadelphia | 1991

### Rhode Island
- Brown University, Providence | 1989

### South Carolina
- University of South Carolina, Columbia | 1992

### South Dakota
- University of South Dakota, Vermillion | 1990

### Tennessee
- University of Tennessee, Knoxville | 1989
- University of Tennessee, Martin | 1990

### Texas
- Texas A&M University, College Station | 1989
- University of Texas, Austin | 1990

### Utah
- University of Utah, Salt Lake City | 1992

### Vermont
- **Middlebury College** | 1990

### Virginia
- Virginia Commonwealth University, Richmond | 1990

### Washington
- Whitman College, Walla Walla | 1991

### Wisconsin
- University of Wisconsin-Madison | 1987

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**Note:** The list includes sites of major faculty workshops from 1985 to 2007, with locations and years specified for each entry.
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<tr>
<th>State</th>
<th>Institution/Location</th>
<th>Year(s)</th>
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<td>MISSISSIPPI</td>
<td>St. Louis Science Center, St. Louis</td>
<td>2008</td>
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<td></td>
<td>Stowers Institute for Medical Research, Kansas City</td>
<td>2002, 2008</td>
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<tr>
<td></td>
<td>Washington University, St. Louis</td>
<td>1989, 1997</td>
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<tr>
<td>MICHIGAN</td>
<td>Athens High School, Troy</td>
<td>1989</td>
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<tr>
<td>MINNESOTA</td>
<td>University of Minnesota, St. Paul</td>
<td>2005</td>
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<tr>
<td>MISSISSIPPI</td>
<td>Mississippi School for Math &amp; Science, Columbus</td>
<td>1990–1991</td>
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<tr>
<td>MICHIGAN</td>
<td>Athens High School, Troy</td>
<td>1989</td>
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<tr>
<td>OHIO</td>
<td>University of Nevada, Reno</td>
<td>1992</td>
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<tr>
<td>NEW HAMPSHIRE</td>
<td>New Hampshire Community Technical College, Portsmouth</td>
<td>1999</td>
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<td>NEW JERSEY</td>
<td>Cornell Institute for Medical Research, Camden</td>
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<tr>
<td>NEW MEXICO</td>
<td>Biolink Southwest Regional Meeting, Albuquerque</td>
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<td>NEW YORK</td>
<td>DNA Learning Center</td>
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<td>DNA Learning Center West</td>
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<td>Harlem DNA Lab, East Harlem</td>
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<td>Junior High School 263, Brooklyn</td>
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<td>Lindenhurst Junior High School</td>
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<td>Mt. Sinai School of Medicine, New York</td>
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<td>2007</td>
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<td>TENNESSEE</td>
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<td>AUSTRIA</td>
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<td>RUSSIA</td>
<td>Shemyakin Institute of Bioorganic Chemistry, Moscow</td>
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<td>SINGAPORE</td>
<td>National Institute of Education</td>
<td>2001–2005</td>
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<td>SWEDEN</td>
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<td>2000</td>
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<td>Uppsala University, Uppsala</td>
<td>2000</td>
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</table>
Expert Advisors and Corporate Support

We are lucky to have high-level support from two advisory bodies: the Education Committee and the Corporate Advisory Board (CAB). The Education Committee formulates policy and assists with strategic planning, whereas the CAB provides a liaison to the Long Island business community. The CAB conducted its annual fund campaign and golf tournament, raising $275,000.

DNALC Education Committee
Chairperson: Laurie Landeau, V.M.D.

Lori Bressler  Suzanne Leeds  Arthur M. Spiro
Edward A. Chernoff  Peter Quick  Peter Tilles
Lola N. Grace  Lawrence Scherr, M.D.  Edward Travaglanti
Suzanne Kleinknecht  Arthur Smithers  Marianne Dolan Weber

Corporate Advisory Board
Chairperson: Edward A. Chernoff, Motors & Armatures Inc.
CSHL Trustee Liaison: Laurie Landeau, V.M.D.

Michael Aboff, Aboff’s Inc.
Paul Amoruso, Oxford & Simpson Realty
Rocco S. Barrese, Dilworth & Barrese
Edward Blaskey, TD Bank
Thomas J. Calabrese, Daniel Gale Sothebys International Realty
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