DNA LEARNING CENTER
EXECUTIVE DIRECTOR’S REPORT

Preparing students and families to thrive in the gene age

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Just as a unique pattern of bars in a universal product code (UPC) identifies each item for sale in a store, a DNA barcode is a DNA sequence that uniquely identifies each living species. This simple premise was galvanized into action during meetings held in 2003 at Cold Spring Harbor Laboratory’s (CSHL) Banbury Center and funded by the Alfred P. Sloan Foundation. At these meetings, scientists agreed to use short, standard DNA sequences to classify all living species and launched the International Barcode of Life Project (iBOL).

Operating under the iBOL banner, collaborators from more than 150 countries are involved in “campaigns” to census diversity in different plant, fungal, and animal groups, including ants, bees, butterflies, fish, birds, mammals, fungi, and flowering plants, and within ecosystems, including the seas, poles, rainforests, and coral reefs. The 10-year Census of Marine Life announced in October the first comprehensive list of more than 190,000 marine species, involving 2700 scientists and identifying 6000 potentially new species.

DNA barcoding is also important in detecting food fraud and products taken from conserved species. In advance of formal DNA barcoding, in 1996, Rob DeSalle of the American Museum of Natural History (AMNH) used related methods to find that five of 23 samples of caviar purchased in New York City (NYC) were mislabeled and included three samples from threatened sturgeon species. The Congressional Research Service recognizes that more than a dozen commercial fish are often mislabeled, passing off cheaper fish for expensive varieties. In 2008, Trinity High School students worked with Mark Stoeckle of The Rockefeller University and George Amato of the AMNH to show the pervasiveness of fish fraud in NYC. They found that 25% of 60 seafood items purchased in grocery stores and restaurants were mislabeled as more expensive species. One mislabeled fish was an endangered species, the Acadian redfish.

Urban Barcode Project
DNA barcoding came full circle to New York, when in December we received a $300,000 grant from the Sloan Foundation for the Urban Barcode Project, a science competition spanning the five boroughs of NYC. Student research teams will use DNA barcoding to explore biodiversity in the city environment, including:

• Sampling biodiversity in a park, garden, office, or school.
• Checking for invasive plant or animal species.
• Monitoring animal movements or migrations.
• Identifying exotic or endangered food products in markets.
• Detecting food or product fraud.

The competition is open to NYC high school students enrolled in grades 9–12. Teams of two to four students will work with a teacher sponsor to submit a project proposal for a June or October 2011 deadline. Proposals will be judged for originality, creativity, relevance, plausibility, and scientific merit. The top 100 teams will be invited to compete in the Urban Barcode Project. Teams must complete their projects by the spring of 2012 and will present their work at a project symposium. The best overall project will win the Grand Prize of $10,000, and an additional $10,000 in runner-up prizes will be awarded.

Sponsoring teachers must participate in a 6-hour training session, which will dovetail with our existing training program sponsored by the Howard Hughes Medical Institute (HHMI). Each successful team will have free access to everything needed for their DNA barcode experiments, including equipment, protocols, and reagents. Five equipment footlockers will be available for use by individual schools or for groups of nearby schools to share. During the term of the project, we expect to process ~10,000 DNA sequences. Teams may work on their projects at summer workshops and Open Lab days at designated locations.

Teams will be assigned a mentor from a NYC university, museum, or other scientific institution to answer technical questions and provide advice. Many mentors will be drawn from five NYC institutions that are collaborating on the project: AMNH, New York Academy of Sciences, New York Botanical Garden, Prospect Park Zoo, and The Rockefeller University. The project’s scientific advisor, Mark Stoeckle, is a member of The Rockefeller Program for the Human Environment. In addition to demonstrating the educational promise of DNA barcoding, Dr. Stoeckle was one of the organizers of the 2003 Banbury meeting that launched the field of DNA barcoding and serves on iBOL’s Scientific Steering Committee.

A dedicated Internet microsite (www.urbanbarcodeproject.org) supports all phases of the project. This “online lab notebook” includes a video introduction to the barcode experiment, downloadable PDF lab protocols, teacher preparation, bioinformatics tools, and multimedia resources. Video interviews with scientists, animations, and video podcasts (vodcasts) describe the science and applications of DNA barcoding, and an active news feed and a link to Dr. Stoeckle’s Barcode Blog provide up-to-date perspectives on DNA barcoding. Student DNA sequences are automatically uploaded to the “Blue Line” of DNA Subway, an online tool for DNA barcode and phylogenetic analysis developed as part of the National Science Foundation (NSF)-funded iPlant Collaborative. A Google Maps utility will track biodiversity discovered by student experiments, and students will highlight their projects through the social networking website, Facebook.
Student DNA Sequencing

A decade ago, the DNALC developed a similar program—with simplified biochemistry and a bioinformatics work flow—to allow students to analyze a portion of their own mitochondrial (mt) chromosome. Using a kit distributed by Carolina Biological Supply Company, students isolate DNA from cheek cells and then use polymerase chain reaction (PCR) to amplify the mitochondrial control region. Student samples are sent by overnight mail to the DNALC, where student interns prepare them for sequencing. The processed samples are then sent to the CSHL Sequencing Facility in Woodbury, and finished DNA sequences are uploaded to the Sequence Server database at our BioServers website. There, students visualize their sequences and use software to align them with mitochondrial sequences from modern humans and extinct hominids to explore human genetic diversity and evolution.

The donation of sequencing reagents by Applied Biosystems of Foster City, California has made it possible to provide students this Sequencing Service free of charge. Since 1998, a total of 49,217 student DNA samples have been sequenced, and 1.3 million students and teachers have used the supporting BioServers website. We continued the Sequence Service in 2010, processing 7128 student DNA samples received from 93 high schools and 57 colleges and universities.

The cost of commercial sequencing, however, has decreased so dramatically during the last year that in December, we ceased sequencing on site and shifted all sequencing to Genewiz, a global contract research organization with expertise in sequencing. We negotiated a much-reduced price of $3.00 per sample, which is less than our cost of sequencing with free reagents and student labor! This arrangement anticipates the increased volume of sequencing demanded by our Urban Barcode Project, as well as growing interest in using DNA sequencing in education. Student sequences are uploaded to our server within 48 hours of receipt by Genewiz, a dramatic improvement over the 2-week turnaround we were previously able to provide.

iPlant Collaborative

The iPlant Collaborative is a consortium headed by the University of Arizona and CSHL to develop a computer (cyber) infrastructure to support plant research. iPlant aims to develop tools and interfaces that will provide scientists with easy access to large-scale plant data sets and high-powered informatics tools. Working Groups composed of iPlant staff and plant community members are currently building “discovery environments” to help plant scientists solve two “grand challenges”: (1) produce an iPlant Tree of Life (iPToL) encompassing ~500,000 plant species and (2) explore the genotype-to-phenotype continuum in plants (iPG2P).

Education, outreach, and training (EOT) is integral to iPlant’s mission of helping plant scientists make the best use of computer infrastructure to solve biological problems. During the first 2 years of the project, EOT worked in parallel with the Grand Challenge teams to create an educational Discovery Environment that allows students and teachers to work with the same data and use the same tools at the same time as high-level plant researchers. This culminated in the release in March of DNA Subway, a student-centered platform for gene annotation and comparison.

DNA Subway uses the metaphor of a subway map as an appealing interface to sophisticated informatics tools. “Riding” on either of the initial lines, students can predict and annotate genes in up to 150 kb of DNA (Red Line) or identify homologous, or related, sequences in whole genomes (Yellow Line). By year’s end, a third “Blue Line” to analyze DNA barcodes and other short DNA sequences was mostly complete. This line offers the types of sequence analysis that precedes the massive tree construction envisioned by the iPToL.
Grand Challenge, simplifying sequence alignment and construction of phylogenetic trees. The Blue Line will support the Urban Barcode Project in NYC and a nationwide iPlant program to encourage students to identify plants using the barcode region of the rbcl gene found in chloroplasts. Thus, DNA Subway provides opportunities for students to discover basic principles of genome biology while embarking on independent research. By December 2010, the site had 742 registered users and had received 14,535 unique visits.

Acting on recommendations of an NSF site visit in 2010, EOT began to expand its role and became a Working Group analogous to those within the iPToL and iPGE P Grand Challenges. The EOT Working Group (EOTWG) includes core iPlant staff, collaborators, and community members from each of the Grand Challenge areas. The EOT Working Group also aims to increase the number of scientists who use and contribute to iPlant Discovery Environments and tools. Toward this goal, we are extending our successful workshop program to high-level researchers and are encouraging participants to bring their own data to analyze at workshops. This collaborative effort will help us to develop case studies of interesting research questions that can be addressed with iPlant Discovery Environments.

As part of this expanded role, EOT multimedia staff at the DNALC took on the task of redesigning the iPlant website to increase its appeal and utility (www.iplantcollaborative.org). This included the development of podcasts that introduce iPlant and the significance of the two Grand Challenges. The podcasts are available at the iPlant and DNALC websites and on YouTube. In the coming year, we will develop intuitive interfaces to data sets and simplified work flows that make iPlant cyberinfrastructure available to a wide range of users. One project will repackag e the iPGE P work flow for high-throughput sequencing as a “Green Line” on DNA Subway, allowing analysis of RNA data, including transcriptome and RNA-Seq data. We will also develop an Orphan Data interface that will match underworked data sets with students and faculty who would like to contribute to original research.

Harlem DNA Lab

Genetics and biotechnology occupy major parts of required science courses and exams taken by virtually all NYC students in the eighth through tenth grades. However, teachers have received little training and few resources to deliver hands-on labs that could make these topics come alive for students. Thus, the objective of our HHMI program is to use our expertise to prepare NYC teachers to teach a set of six labs that target key genetics and biotechnology concepts: DNA Structure and Isolation, Variability and Inheritance, Bacterial Transformation, Protein Isolation, DNA Analysis and Forensics, and Analysis of Human DNA Variations by PCR.

The lab program is supported by an Internet microsite, Lab Center, which is a virtual classroom into which a DNALC staff member enters to make a video introduction for each lab. By clicking on various objects on the whiteboard and desk, students can access (1) interactive and PDF versions of the experiment, (2) follow-up activities, (3) scientist interviews, (4) animations, and (5) selected links. In 2010, we began development of the final element of Lab Center: a series of vodcasts to highlight how each of the target labs relates to research done at New York–area institutions. Each New York Story will be largely produced by a team of NYC students. The initial vodcast, on green fluorescent protein (GFP) and bacterial transformation, was developed by a six-student team from Brooklyn International School and organized by HHMI Teacher Fellow and Assistant Principal
Kathleen Rucker and science teacher David Conneely. In parallel with a DNALC videographer, students used flip cameras to record in their school and at locations at Columbia University, where they interviewed Nobel laureate Martin Chalfie.

During the year, we also implemented an important new element of in-school support for NYC teachers. A grant from the Lounsbery Foundation supported the purchase of equipment to outfit 15 biotechnology footlockers that contain all of the equipment and expendable supplies needed to teach each target lab. The kits are available to any teacher who has undergone HHMI training. At $50 per class of 32 students, each footlocker is less than half the cost of a commercial kit. In their inaugural year, the kits extended lab experiences to 1455 students, about half the number accommodated in field trips to the Harlem DNA Lab. To accelerate footlocker use, we waived the restocking fee for most schools and provided free footlocker shipping. To further support teachers as they implement the labs, we recruited a part-time instructor at year’s end to accompany footlockers to schools and help set up the equipment or coteach the lab activities.

We also tore a page out of the DNALC’s own play book when we created a Charter Membership Program for Harlem DNA Lab. The DNALC was started in 1985 with multiyear memberships from local Long Island school districts. Adopting this model in the spring, we welcomed Trinity School and The Chapin School as Charter Members of our Manhattan operation. Each school receives an exclusive set of benefits to develop a sequenced program of accelerated science opportunities for students. The program launched in June, with in-school Fun with DNA, DNA Science, and Human Genomics workshops taught by DNALC instructors. The collaboration continued through the academic year with focused faculty development, field trips to the DNALC, and assistance with student research.

Although Harlem DNA Lab prospered in the face of the recession, we became increasingly concerned with the continued devolvement of the NYC Department of Education (DOE). In the spring, the DOE quietly disbanded its entire science supervisory department, with whom we and other organizations collaborated to enrich science programs. It has also reassigned key science discretionary funds to English and math, for which student test scores are closely tracked for federal aid. The administration has pushed responsibility for science advancement onto loosely allied networks of schools, expecting them to self-organize without access to funds. This explains why it is difficult for teachers to find even the modest funds needed to take a field trip to the Harlem DNA Lab or to restock reagents for a footlocker kit that they can borrow from us.

Our host school, the John S. Roberts Educational Complex, is emblematic of the instability faced by many schools in NYC. It has been adversely affected by administrative shuffling, with two schools phased out and two schools phased in during our tenancy. Simple tasks, such as securing resources and teacher cooperation, have become more difficult. Student discipline and security have become major concerns as enrollment increases in each of the tenant schools. These situations impact the field trip experience for our visitors.

**Reaching Underrepresented Minorities**

It is a sad fact that Hispanic and African Americans perform poorly in science and are underrepresented in scientific fields when compared with Caucasians. Hispanic and African Americans perform
-20% lower in science than Caucasians on the International Assessment of Education Progress, a respected benchmark for student achievement. This disparity holds true in grades 4, 8, and 12. According to the National Science Board, these groups are underrepresented in postsecondary science education and science careers compared to their proportion of the overall U.S. population (24%). Underrepresented minorities received 17% of bachelor’s degrees, 13% of master’s degrees, and 7% of doctorates in science and engineering fields in 2007. They accounted for only 10% of college-educated persons employed in science and engineering occupations and received salaries that averaged 25% less than those of Caucasian workers.

The National Science Education Standards and other studies emphasize that students need to be engaged in the process of science, asking questions, forming hypotheses, designing experiments, collecting data, analyzing results, and forming conclusions. Underrepresented minorities—who are concentrated in low-achieving schools and who may receive less science “boosting” at home—have less access to hands-on experiences that help them to learn about science in the same way as scientists.

The DNALC takes seriously the challenge of increasing minority representation in science. The Urban Barcode Project and our Harlem DNA Lab were established for the express purpose of providing minority and disadvantaged students—and their teachers—the same opportunities for laboratory-based learning as those offered students in wealthy suburban school districts. Statistics for 2010 show that our Manhattan operation is reaching this target audience. Hispanic and African Americans made up 69% of students visiting the Harlem DNA Lab and 41% of teachers trained under our HHMI program. The strong Harlem numbers, combined with a policy of conducting many teacher-training workshops at institutions serving minorities, maintained underrepresented minorities at 25% of 696 teachers trained at 1–10-day workshops.

Doing the best job in science education for underrepresented minorities also requires that an institution practice what it preaches—and provide role models for students to emulate. Thus, during the last several years, the DNALC has hired four exemplary African American and Latino educators, who now compose 33% of the instructional staff. Jermel Watkins, Ph.D., began his science career as a DNALC intern and completed his graduate training at Stony Brook University. Jason Williams moved into education after research stints in two CSHL laboratories. Ileana Rios, Ph.D., attended elementary school several blocks away from the Harlem DNA Lab and completed her graduate training at City University of New York. Our newest staff member, Kerri-Ann Matthews, brings experience as an informal science educator with the New York Hall of Science and other science exhibitions.

Internet Strategies and Visitation

The September issue of Wired magazine ran the full-page headline, “The Web is Dead.” The lead article made the point that the World Wide Web (WWW)—navigated by browsers such as Explorer, Firefox, Safari, and Chrome—now accounts for less than 25% of total Internet traffic. The vast majority of Internet bandwidth is consumed by other types of communication, notably, e-mail, virtual private networks (VPNs), voice-over Internet, music and video sharing, and active gaming. The article also referred, metaphorically, to the struggle between the chaotic, “everything-all-the-time (from-everyone)” world of websites—dominated by search engines such as Google—and the “what-you-need-when-you need-it (from-someone-you-trust)” world of cell phone applications (apps) and social media—dominated by sharing software such as Facebook and Apple iTunes. The DNALC now finds itself in this struggle to adapt to the changing Internet landscape.

The DNALC benefited from its early entry into the Internet world. At a time when there were only 10–25 million active websites on the Internet, websites we developed in the late 1990s and early 2000s rapidly built audiences. Overall visitation increased steadily, peaking at 7.1 million in 2007. However, our visitation declined and then leveled at ~6 million in 2008–2009. In less than 5 years,
the web had grown to more than 100 million active sites; the DNALC and other small-content providers now found it increasingly difficult to build and maintain audiences.

In the face of an exponentially crowded web, search engines such as Google became the primary arbiters of website visitation. We therefore embarked on an ambitious program to redesign our older websites to make them more “visible” to search engines, a process called search engine optimization (SEO). DNALC.org, the home site from which all other DNALC websites are reached, was the first to be revamped according to SEO principals. Relaunched in September 2009, it saw a 24% increase in visitation in 2010. DNA from the Beginning, our first major website, is now undergoing an even more extensive SEO makeover, and we anticipate a similar bump in visitation when it is relaunched in spring 2011.

In parallel with SEO, we have turned to other channels—applications for handheld devices (“apps”) and social media—to broaden the audience for our multimedia products. Our 3D Brain—a detailed rendering of the human brain that can be rotated and explored in three dimensions—provides a remarkable example of the way in which rechanneling content can increase viewership. Originally developed as part of the website Genes to Cognition (G2C) Online, which debuted in spring 2009, 3D Brain was later launched as a stand-alone iPhone, iPod, and iPad application. It rose to number seven of 7,100 education apps and number one among 250 iPad apps. In 2010, the web version of 3D Brain received 54,868 visits, and the app version had 413,874 downloads! Feedback on the iTunes site shows, as one would expect, strong use by college students and faculty. However, it is also used by medical professionals: “Excellent! I use this with clients to help them see where some of their PTSD (posttraumatic stress disorder) symptoms are coming from. Has been very helpful for them.”

During the year, we continued an aggressive program to develop a DNALC channel on YouTube, the site where most people find and share videos. Visitation surged following the addition of nearly 100 new videos, including a collection of three-dimensional molecular animations created for the DNA Interactive website by 2010 McArthur Prize–winner Drew Berry. Our collection of 184 videos received 280,503 views in 2010. Blogs, supporting each of our major content sites, generated an additional 283,843 web visits.

As a result of the SEO makeover for the DNALC homepage plus aggressive moves into apps, YouTube, and blogs, Internet visitation rose 14% to 7.1 million in 2010, equaling the 2007 peak. App downloads, YouTube views, and blog views contributed 933,220 visits, or 13% of total Internet traffic. The amount of data served by DNALC websites surged 35% in 2010, to 6669 gigabytes (GB), or 6.5 terabytes (TB). DNALC.org accounted for 43% of all data served.
Visitation was also augmented by a grant from Google AdWords, through which we receive free “sponsored” links on Google searches. The AdWords account contains a set of keywords for each DNALC website. When someone searches for one of the keywords, an ad for the related DNALC site is displayed and logged as an “impression”; a “click-through” is logged when the link is followed. (Each click results in a visit to one of our websites.) AdWords generated 20,185,997 impressions of DNALC ads, resulting in 133,034 website visits. This advertising is valued at $99,438. 

**G2C Online** is our most successful AdWords campaign, with two-thirds of 62,952 click-throughs resulting from searches for “brain.”

**Teacher Training**

Since trekking from New York to California in our mobile *Vector Van* in the summer of 1986, the DNALC has maintained a unique ability to provide sophisticated lab and computer training at essentially any site around the world. The year 2010 was the zenith of off-site training, with 940 high school and college faculty participating in professional development activities conducted at 27 sites across the United States and Canada. (For a complete list of training activities and host sites, see the tables at the back of this report: “2010 Workshops, Meetings, and Collaborations.”)

With funding from HHMI, and in collaboration with the NYC Department of Education, 290 teachers participated in 52 workshops conducted at the Harlem DNA Lab. Ease of scheduling and quick completion of P-Credits (graduate equivalent) and Professional Development hours (required to maintain a New York State teaching license) made the summer workshops more popular than those held during the academic year.

In our role as education lead of the *iPlant Collaborative*, we introduced DNA Subway to 187 college teachers at 10 2-day workshops hosted at academic institutions around the country. An additional 188 educators learned about DNA Subway at short courses and demonstrations at the meetings of the American Society of Plant Biologists, Botanical Society of America, DOE’s Joint Genome Institute, *iPlant Collaborative*, National Association of Biology Teachers, and USDA Plant and Animal Genome research program.

With funding from NSF’s Course, Curriculum, and Laboratory Improvement (CCLI) program, we continued our effort to bring compelling RNA interference (RNAi) experiments into college classrooms via an experiment- and bioinformatics-rich curriculum. In 2010, 54 faculty attended follow-up workshops designed to increase confidence with our RNAi curriculum and update participants on new developments in the field. The training program is supported by the *Silencing Genomes* website that includes all experiments and reagent recipes, and a free biological library, that includes all needed bacterial and *C. elegans* strains and more than 100 vectors developed by workshop participants to silence worm homologs of human genes. To date, more than 1500 strain orders have been filled and have been used with a reported 12,500 students. Two stand-alone kits derived from the program have been released by Carolina Biological Supply Company, with a third to be released early in 2011.

With support from the National Institutes of Health (NIH) Science Education Partnership Award (SEPA) and the Hewlett Foundation, we continued to disseminate two large-scale Internet sites at 1- to 2-day workshops. Under the SEPA program, 71 high school and college faculty attended five workshops to learn how to use the *Inside Cancer* website to enhance teaching of cancer cell biology in health, general biology, and advanced biology classes. In addition, 18 Regional Fellows taught 228 educators at 22 second-round workshops. Five workshops on our Hewlett-sponsored website, *G2C Online*, drew 88 high school and college educators.

Continuing our long-term relationship with the Singapore Ministry of Education, two Singaporean biology teachers participated in HHMI Leadership training in July. Then, in the fall, we hosted four primary school teachers (grades 4–6). During their 2-week attachment, they observed and cotaught student field trips and in-school programs. They were also immersed in the *Fun with*
DNA and World of Enzymes curricula during small workshop sessions with DNALC instructors. Each of the teachers developed a plan for sharing their new knowledge when they returned home.

Program Evaluation

In 2010, we initiated nationwide experimental studies to evaluate how two of our websites contribute to science instruction in the classroom. The Inside Cancer website explores the molecular basis of cancer. The evaluation study, funded by an NIH SEPA Phase II grant, involved four teachers who used the website to teach topics such as the cell cycle, mutations, and genetic disease to 199 students in Illinois, Missouri, and Maryland. The G2C Online website explores the molecular basis of brain function and dysfunction. In the evaluation, funded by the Dana and Hewlett Foundations, five teachers used G2C Online to teach nervous system function and psychiatric disorders to 146 students in Missouri, Minnesota, New York, and North Carolina. (An additional 12 teachers and more than 900 students will participate in both studies in 2011.)

Pre- and posttest surveys—used by students across all study sites—measure changes in basic genetics literacy and attitudes toward science. Content tests, developed locally by each teacher, measure specific knowledge gained. To control for differences between teachers and students, we used a repeated measures study design, where a participating faculty member teaches the same topic to two different classes—one class receives classroom instruction only (control) and the other receives classroom instruction plus supplementary use of the website (treatment). For a second topic, the classes switch roles as treatment and control. Students were also asked questions to determine whether they prefer to explore information as network-related items or follow a suggested linear “story.”

Considerable effort has focused on evaluating Silencing Genomes. With a response rate of 75%, follow-up surveys show that the majority of 262 college faculty who received workshop training completed Silencing Genome labs in their classrooms, reaching 3926 students and sharing them with 156 other teachers. An in-school study is matching experimental classes that do RNAi laboratories with control classes that learn equivalent topics without labs. Pre- and posttests measure changes in student attitudes, genetic literacy, and detailed knowledge of RNAi. To date, six teachers and 76 students have participated, with an additional 10 teachers and more than 400 students expected in 2011. Preliminary analyses are encouraging, with experimental students showing significant gains in knowledge of RNAi (12.0%, p = .0003).

Student Programs

In 2010, we continued to be the world’s largest provider of hands-on learning in genetics and molecular biology. Twenty thousand students performed experiments at the Dolan DNALC, DNALC West, and the Harlem DNA Lab, and 10,856 students received in-school instruction by DNALC staff. High school students composed 31% of lab visitors (9417). Most of the 21,442 middle school visitors participated in our Genetics as a Model For Whole Learning Program. A grant from the William Townsend Porter Foundation provided scholarships for 1057 Hispanic and African America students to attend labs at Harlem DNA Lab. Grants from Bank of America, TD Bank, and National Grid provided lab visits and in-school instruction for 2349 students from underserved schools in Queens and on Long Island.

Summer camps drew 908 students to the Dolan DNALC, DNALC West, and Harlem DNA Lab, and to The Trinity and Chapin Schools, with two new workshops proving to be popular. DNALC staff member Jen Aiello drew on her recent undergraduate degree in forensic science to develop Forensic Detectives. This intermediate-level course for eighth and ninth graders includes labs on fingerprinting, forensic anthropology, toxicology, ballistics, and criminalistics. Silencing Genomes is a spin-off of the NSF teacher-training program of the same name, initiated by DNALC instructor
Participants in a World of Enzymes summer camp

Bruce Nash. This course introduces the Nobel Prize–winning technology of RNAi in the model organism *Caenorhabditis elegans.*

*Great Moments in DNA Science* Honors Seminars, conducted in the spring, drew 211 top high school students from Long Island for three in-depth presentations of current biological research. Dr. Chih-Shan Jason Chen of Memorial Sloan-Kettering Cancer Center presented his research on the genetics of *Dermatofibrosarcoma protuberans* (DFSP), an aggressive soft tissue tumor that often relapses after treatment. Dr. Damon Love of Weill Cornell College of Medicine discussed his work with a protein called Chibby, which is required for proper lung development in the fetus. Dr. Zuzana Zachar of Stony Brook University discussed recent discoveries in cancer cell metabolism and introduced “thioctans,” a new class of chemotherapeutic agents that target cancer cells while sparing healthy ones.

The *Harlem DNA Lab* participated in several science education events around NYC. Children and parents extracted DNA from bananas at our booth at the World Science Festival in Washington Square Park and at the Morningside Area Alliance 2010 STEM Expo in Harlem. With support from the Porter Foundation, high school students from the *Mentoring in Medicine* program attended a week-long *DNA Science* camp. Founded by Dr. Lynne Holden, the program seeks to improve diversity in medicine by providing academic opportunities to underrepresented minority students.

*Saturdays DNA!* drew 203 participants to monthly events held during the fall, winter, and spring. Two-hour sessions were offered at two age levels: one for children ages 10–13 with an accompanying adult and one for ages 14 and above. Topics presented by the DNALC’s education and scientific staff covered such diverse topics as DNA barcoding and the genetic basis of smell.

**Partnerships and Graduate Training**

In the spring, we graduated our fourth class of *Genome Science,* our partnership with Cold Spring Harbor High School (CSHHS). Coconstructed by DNALC staff and CSHHS biology teacher Martin Glynn, this college-level course brings students to the DNALC for their final two class periods each day. As in previous years, the course emphasized critical thinking and included experiments and independent projects across a range of biological systems. One unit looked for evidence of genetic modification in common foods and annotated newly sequenced genes in rice. Another unit used students’ own DNA to explore the molecular basis of simple traits and trace human origins. The final unit used RNAi to turn off genes in the roundworm *C. elegans* and study worm equivalents of genes involved in human diseases.
In the fall, the fifth year of *Genome Science* began under the tutelage of DNALC staff along with a new CSHHS staff member, Jaak Raudsepp. This was a comfortable change because Jaak is a graduate of our former Leadership Institute, the rigorous 3-week program for the nation’s best biology teachers. Always a proving ground for our latest experiments, the CSHHS students were the first to use DNA barcoding to identify plants collected in the local area. In preparing essays on modern parallels to the eugenics movement of the early 20th century, students also visited the CSHL Research Archives to examine historical documents remaining from the former Eugenics Record Office.

As part of a reinvigorated collaboration with the Center for Science and Mathematics Education (CESAME) at Stony Brook University, CSHHS students completed a module on protein modeling. Using methods developed by Tim Herman at the Milwaukee School of Engineering, students developed three-dimensional molecular models to illuminate how chemotherapeutic drugs interact with protein receptors on the surface of cancer cells. Using data from primary research papers, students identified important parts of the drugs and receptors. They then used three-dimensional modeling software to highlight key atoms involved in molecular interactions. The modified structure files were sent to CESAME, where detailed atomic resolution models of the proteins were manufactured on state-of-the-art prototyping printers. (These machines are essentially laser printers that layer droplets of polymer resin in three dimensions.) Students will present their models and explanatory posters at the spring 2011 CSHL meeting, “The Biology of Cancer.”

During their second semester, graduate students at the CSHL Watson School of Biological Sciences work under the guidance of experienced DNALC instructors. The graduate students work in pairs during 12 half-day sessions, learning from and leaning on one another as they develop effective teaching techniques. During the first phase of training, students observe a DNALC staff member teaching a laboratory class and then organize a lesson plan that integrates their own perspectives. During the second phase, students join the DNALC staff member to coteach parts of a laboratory class. After critiques of their lesson plans and coteaching experience, the students move on to independently teach an entire lesson. After completing rotations with middle- and high-school-level experiments, students deliver three additional lessons to demonstrate mastery of teaching and class management skills.

In October, we began a collaboration with the New York Academy of Sciences (NYAS), one of the oldest scientific institutions in the United States and a leading organizer of scientific meetings. The NYAS developed a new science mentoring program in which graduate students and postdoctoral researchers from NYC research institutions present science activities to students in grades K–12. DNALC instructors trained 22 mentors in effective strategies to deliver hands-on genetics activities in after-school settings.

**Staff and Interns**

We were sad when Dr. John Connolly left in February to evaluate clinical trials at the Center for Applied Genomics, Children’s Hospital of Philadelphia. After receiving a Ph.D. in neuropsychology at Trinity College, Dublin, John came to the DNALC in 2005 to develop our innovative website *G2C Online*, for which he interviewed more than 80 scientists. As Multimedia Coordinator, he became indispensable in managing many aspects of our Internet venture—developing the Landeau Multimedia Studio and launching regular blogs for each of our major content sites. Notably, he moved us into the world of apps with his spectacularly successful *3D Brain*. We will miss his Irish brogue, which often lightened the office atmosphere.

The multimedia staff returned to full force in November, with the arrival from “down under” of Multimedia and Evaluation Manager Dr. Amy Nisselle. After attending the DNALC’s presentation at the 19th International Congress on Human Genetics in Melbourne in 2003, Amy decided to pursue her Ph.D. in multimedia genetics education. In 2008, she spent 3 months at the DNALC, evaluating the *G2C Online* website as part of her thesis research. In addition to managing multimedia
projects, Amy will also increase our academic profile in the world of science and technology education.

Our growing involvement in the *iPlant Collaborative* led to the recruitment in November of Computer Programmer Mohammed Khalfan. After receiving a B.S. degree from the University of Toronto, he received a Master’s degree in bioinformatics and computational biology at the University of Newcastle upon Tyne, United Kingdom. His initial projects include building the “Blue Line” (phylogenetics) of *DNA Subway* and redeveloping the *iPlant* website in Drupal, an open source content management system (CMS).

Our multimedia group also benefited from fresh ideas from young people. In the fall, we welcomed Todd Rocheford as Design Assistant and Videographer. Todd has an undergraduate degree in video production from the University of Canberra, Australia. We met Todd through his father, Torbert, a Purdue geneticist who developed vitamin-A-fortified corn. After filming a documentary on his father’s work in Africa, Todd realized that he wanted to develop educational videos, leading to his position at the DNALC. Undergraduate intern Tony Biondo was promoted to Junior Programmer, based largely on the initiative that he took in developing an Android version of our *3D Brain* app. Tony is a sophomore majoring in computer science at Stony Brook University. An active supporter of open-source software, he won the Student Cluster Competition of the 2009 International Conference on High-Performance Computing at Portland, Oregon. Chris Weidler (Farmingdale State College) continues to support the *BioMedia* Group and was especially productive on the *DNA from the Beginning* upgrade.

Our internship program continued 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 several new high school interns this year: Devika Gupta (Farmingdale), Jueng Woen Kim (Hauppauge), Yasin Muhammad (Lawrence Woodmere Academy), H. Alan Phipps (Portledge School), David Streitman (Syosset), and Young Joon Suh (John Glenn). The new hires joined a dedicated group of returning interns: Laura Bergsten (Cold Spring Harbor), George Economou (Syosset), Jack Greenfield (Oyster Bay), Lindsay Hochberg (Oyster Bay), Max Vaysman (Commack), and Pamela Wax (Harborfields). We bid farewell to a number of high school interns as they left for their freshman year at college: Anouva Kalra-Lall (Case Western Reserve University), Emily Troge (Brandeis University), Sara Wienclaw (University of Delaware), and Kevin Wu (New York University).

In addition to regular prep duties, college interns help to fulfill requests from faculty nationwide for student DNA sequencing and RNAi targeting vectors. Three former high school interns returned to assist with summer workshops: Kaitlin Watrud (Gettysburg College), Arielle Scardino (City College of New York), and Seth Shortz (Emory University). New college interns starting in 2010 were David Dopfel (Stony Brook), Sarah Justvig (Georgetown), Sulaiman Usman (New York Institute of Technology), Lina-Mari Varghese (Stony Brook), and Katherine Villalon (John Jay). Annie Laurie Benzie (Adelphi University) left the DNALC for an internship at Bellevue Hospital.

Many of our high school interns are involved in science research and compete in state and nationwide science competitions. Anouva Kalra-Lall was an Intel semifinalist and a top-four finalist for the Neuroscience Research Prize. Young Joon Suh took first place in chemistry at the New York State Science and Engineering Fair. Laura Bergsten was accepted into the CSHL Partners for the Future Program.

Additionally, DNALC staff served as mentors to local high school students working on independent projects. Elliot Horlick (Cold Spring Harbor) worked on two projects with Dr. Jermel Watkins: sunblock (SPF) protection against UV-induced DNA damage in yeast and the protein complement (proteome) of squamous cell carcinoma. Daniel Krumholz (Oyster Bay) worked with
Dr. Bruce Nash to use RNAi to “knock down” genes in *C. elegans* that are homologous to human genes involved in serotonin signaling.

**Expert Advisors and Corporate Support**

We are fortunate to have high-level support from two advisory bodies: the DNALC Committee and the Corporate Advisory Board (CAB). The DNALC Committee consists of community leaders and members of CSHL senior management and the Board of Trustees, who oversee strategic development including capital funding and the evolution of satellite locations in North America and beyond. The CAB provides liaison to the Long Island and NYC business communities; its annual fund campaign and golf tournament contributed $155,000 in 2010.

**DNALC Committee**

Chairperson: Laurie Landeau, VMD, Trustee, CSHL

Edward A. Chernoff, President, Motors & Armatures, Inc.
Maria DeLesseps
Lola N. Grace, Sterling Grace Capital Management
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Lori Homer
Suzanne Kleinknecht
Suzanne Leeds

Peter Quick
Adele Smithers
Arthur Spiro
Peter Tilles
Edward Travaglianti, President, TD Bank Long Island
Marianne Dolan Weber, Chairman, Dolan Foundations

**Cold Spring Harbor Laboratory Ex-Officio Members**

W. Dillaway Ayres, Jr., Chief Operating Officer
David A. Micklos, Executive Director, DNA Learning Center

Bruce Stillman, President and Chief Executive Officer
Karen Orzel, Senior Development Officer

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CSHL Trustee Liaison: Laurie Landeau, VMD

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Marian Conway, New York Community Bank Foundation
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David Epstein, Ph.D., OSI Pharmaceuticals, Inc.
Candido E. Fuentes-Felix, M.D., F.A.C.S.
David Garbus, Huntington Business Products Centre
Lawrence Goodman, Curtis, Mallet-Prevost, Colt & Mosle LLP
Mary Jane Helenek, Luitpold Pharmaceuticals
Arthur D. Herman, Herman Development Corporation
Diana Hoadley, JP Morgan
Robert Isaksen, Bank of America
Neil M. Kaufman, Davidoff, Malito & Hutcher
John C. Kean III, Kean Development Corporation
Norman Kelker, Enzo Life Sciences
Robert Keller, National Grid Foundation
James E. Martutat, Ingleside Investors, Inc.
John Molloy, H2M
John Passarelli, M.D.
Patricia Petersen, Daniel Gale Sothebys Real Estate
Frank Posillico, Alliance Real Estate Corp
Christiaan B. Reynolds
William D. Roche
Raju Sarwal, M.D.
Charles R. Schueler, Cablevision
Lee Shuett, Nikon Instruments
Kurt Timmel, Marsh USA
Jeffrey K. Tupper, U.S. Trust Company of New York
Robert Van Nostrand
Hans Zobel, Ziehm Medical LLC
2010 Workshops, Meetings, and Collaborations

January 5
Site visit by William Mak, Hong Kong Biotechnology Education Resource Center and Mobile Lab, Hong Kong University, Pokfulam

January 12
Site visit by Denise Philpotts, Trinity School, Harlem DNA Lab

January 14
NSF Plant Collaborative, Genotype 2 Phenotype Steering Committee Meeting, San Diego, California

January 16
HHMI Professional Development Workshop, "PCR and Human DNA Variations, Part 2," Harlem DNA Lab

January 22
Site visit by Hans Bosch and Laura Savini, WLIW, New York

January 23
Saturday DNA! "Express Yourself!" DNALC

January 29
Site visit by Marilyn Parks, Life Technologies Foundation, Carlsbad, California, and Randi Spatz, Invitrogen, Carlsbad, California

February 4
HHMI Professional Development Workshop, "DNA Structure and Isolation," Harlem DNA Lab

February 27
Saturday DNA! "Composting 101," DNALC

March 3
Site visit to Carolina Biological Supply Company, Burlington, North Carolina

March 10
Oyster Bay Rotary Club Meeting Luncheon presenting DNALC programs and events, Oyster Bay, New York

March 12
G2C Online Workshop, Santa Clara University, Santa Clara, California

March 13
NIH Inside Cancer Workshop, Santa Clara University, Santa Clara, California

March 17
HHMI Professional Development Workshop, "Variability and Inheritance," Harlem DNA Lab

March 20
Saturday DNA! "Explore the Realm of Your DNA," DNALC

March 20–21

March 24–26
Joint Genome Institute User Meeting, Walnut Creek, California

March 26
G2C Online Workshop, Oklahoma City Community College, Oklahoma City

March 27
NIH Inside Cancer Workshop, Oklahoma City Community College, Oklahoma City

April 7
HHMI Professional Development Workshop, "Bacterial Transformation and Protein Isolation," Harlem DNA Lab

April 9
Site visit by graduate students from Molloy College, Rockville Centre, New York

April 10
HHMI Professional Development Workshop, "Bacterial Transformation and Protein Isolation," Harlem DNA Lab

April 11–14
NIH SEPA Principal Investigators Meeting, Birmingham, Alabama

April 13
Great Moments in DNA Science Honors Seminar: "Dead End! Not Anymore! Molecular Targeted Therapy for Skin Cancer," Dr. Chih-Shan Jason Chen, Memorial Sloan-Kettering Cancer Center, New York

April 16
G2C Online Workshop, iBio Institute, Harold Washington College, Chicago, Illinois

April 17
NIH Inside Cancer Workshop, iBio Institute, Harold Washington College, Chicago, Illinois

April 17
Saturday DNA! "The Insomniac’s Guide to Wildlife," DNALC

April 20
Site visit by Debby Hirshman, Victor Centers for Jewish Genetic Diseases, Philadelphia, Pennsylvania

April 21
HHMI Professional Development Workshop, "DNA Analysis and Forensics," Harlem DNA Lab

April 23
CSHL Association Directors, viewing of "Naturally Obsessed: The Making of a Scientist," DNALC

April 23–24
NSF iPlant Collaborative Genomics in Education Workshop, Spelman College, Atlanta, Georgia

April 24
HHMI Professional Development Workshop, "DNA Analysis and Forensics," Harlem DNA Lab

April 26
Site visit by Kevin Shine, Verizon Communications, New York

April 29
G2C Online Workshop, Biogen Idec, Cambridge, Massachusetts

Great Moments in DNA Science Honors Seminar: "The Role of Wnt/β-catenin Antagonist chibby in Lung Development," Dr. Damon Love, Weill Cornell College of Medicine, New York

Site visit by Jackie Dorrance, Beckman Foundation, Irvine, California

Site visit by Robert Iaiken and Lorraine Aycock, Bank of America Long Island, Melville, New York

Site visit by Judy Calabrese and Maureen Laness, CSHL Directors, Harlem DNA Lab

NIH Inside Cancer Workshop, Biogen Idec, Cambridge, Massachusetts

May 3
Meeting with Minister of Higher Education, Sheikh Nahyan binMubarak Al Nahyan, Abu Dhabi, United Arab Emirates

May 7–8
NSF iPlant Collaborative Genomics in Education Workshop, University of Texas, Austin

May 8
HHMI Professional Development Workshop “DNA Isolation, Inheritance, and Variability,” Harlem DNA Lab

May 12
Site visit by Roland Jimenez, Community Bank, Hauppauge, New York

May 14–15
HHMI Professional Development Workshop, "PCR, Part 1," Harlem DNA Lab

May 15
Saturday DNA! "Walking Whales and Genetic Tales," DNALC

May 17
Site visit by Srinivasa Rao, Indian Institute of Biotechnology, Hyderabad, India

May 18
Great Moments in DNA Science Honors Seminar: "Thioctans: A Novel Approach to Cancer Chemotherapy," Dr. Zuzana Zachar, Stony Brook University, New York

May 21
HHMI Professional Development Workshop, "PCR, Part 2," Harlem DNA Lab

G2C Online Workshop, University of Colorado, Aurora
Workshops, Meetings, and Collaborations

May 21–22
NSF iPlant Collaborative Genomics in Education Workshop, Lawrence Berkeley National Laboratory, Berkeley, California

May 22
NIH Inside Cancer Workshop, University of Colorado, Aurora

May 22
HHMI Professional Development Workshop, "PCR, Part 2," Harlem DNA Lab

May 22

May 24–26
NSF iPlant Collaborative 2010 Conference, Las Vegas, Nevada

May 26
NSF iPlant Collaborative, DNA Subsysy Workshop, Las Vegas, Nevada

June 4
Site visit by Kidgie Williams, Hospitality Committee for United Nations Delegations, Inc., and United Nations delegates’ family members, New York

June 4–5
NSF Silencing Genomes Follow-up Workshop, St. Louis Science Center, Missouri

June 6
World Science Festival, "Banana DNA Extraction," New York

June 8
17th Annual Golf Outing, Piping Rock Club, Locust Valley, New York

June 11–12
NSF iPlant Collaborative Genomics in Education Workshop, Howard University, Washington, D.C.

June 12
NSF Silencing Genomes Follow-up Workshop, Rust College, Holly Springs, Mississippi

June 12
Saturday DNA! “Solved! The Mystery of Anastasia Romanov,” DNALC

June 14–18
DNA Science Workshop, Harlem DNA Lab
DNA Science Workshop, Trinity School, New York
Fun with DNA Workshop, Trinity School, New York

June 17–18
NSF Silencing Genomes Follow-up Workshop, North Carolina Agricultural & Technical State University, Greensboro

June 18
Site visit by Mike Scanlon, Cornell University, Ithaca, New York

June 20–25
Milwaukee School of Engineering Workshop, SMART protein modeling training, New York

June 21–22

June 21–25
Fun with DNA Workshop, The Chapin School, New York
Human Genomics Workshop, The Chapin School, New York

June 22
Site visit by Therese Chilianis, Michael Lardner, and Phil Summers, MSG Varsity, Woodbury, New York

June 23–24

June 24–25
NSF Silencing Genomes Follow-up Workshop, Pasadena City College, California

June 25–26
NSF iPlant Collaborative Genomics in Education Workshop, The Rockefeller University, New York

June 28
HHMI Professional Development Workshop, “DNA Transformation and Protein Isolation,” Harlem DNA Lab

June 28–July 2
DNA Science Workshop, DNALC
Fun with DNA Workshop, DNALC
World of Enzymes Workshop, DNALC
Fun with DNA Workshop, DNALC West

June 29
HHMI Professional Development Workshop, “DNA Analysis and Forensics,” Harlem DNA Lab

June 29–30
NSF Silencing Genomes Follow-up Workshop, Howard University, Washington, D.C.

June 30
HHMI Professional Development Workshop, "PCR and Human DNA Variation, Part 1" Harlem DNA Lab

July 1
HHMI Professional Development Workshop, "PCR and Human DNA Variation, Part 2," Harlem DNA Lab

July 6
HHMI Professional Development Workshop, "DNA Structure and Isolation," Harlem DNA Lab

July 6–9
Green Genes Workshop, DNALC
Plant Genomics Workshop, DNALC
World of Enzymes Workshop, DNALC West

July 7
HHMI Professional Development Workshop, "Variability and Inheritance," Harlem DNA Lab

July 8
HHMI Professional Development Workshop, "DNA Transformation and Protein Isolation," Harlem DNA Lab

July 8–9
NSF iPlant Collaborative Genomics in Education Workshop, University of Chicago, Illinois

July 9
HHMI Professional Development Workshop, "DNA Analysis and Forensics," Harlem DNA Lab

July 12
HHMI Professional Development Workshop, "DNA Transformation and Protein Isolation," Harlem DNA Lab

July 12–16
DNA Science Workshop, DNALC
Human Genomics Workshop, DNALC
World of Enzymes Workshop, DNALC West
DNA Science Workshop, DNALC West

July 13
HHMI Professional Development Workshop, "DNA Analysis and Forensics," Harlem DNA Lab

July 14
HHMI Professional Development Workshop, "PCR and Human DNA Variation, Part 1," Harlem DNA Lab

July 15
HHMI Professional Development Workshop, "PCR and Human DNA Variation, Part 2," Harlem DNA Lab

July 16
Site visit by Suzi Lewis, University of California, Berkeley

July 19–23
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
Silencing Genomes Workshop, DNALC
Green Genes Workshop, DNALC West
July 19–30  HHMI New York Leadership Symposium, Harlem DNA Lab
July 20  Site visit by Rafael Palacios, Universidad Nacional Autónoma de México, Cuernavaca Center for Genomic Sciences, Cuernavaca, Mexico
July 26–30  DNA Science Workshop, DNALC
Genetic Horizons Workshop, DNALC
World of Enzymes Workshop, DNALC
Genetic Horizons Workshop, DNALC West
July 29  Site visit by Mort Slater, Gateway to Higher Education, New York, and Arthur Registre, Uniondale High School, New York
July 31  Botanical Society of America, DNA Subway Hands-on Workshop, Providence, Rhode Island
August 2  HHMI Professional Development Workshop, “DNA Transformation and Protein Isolation,” Harlem DNA Lab
August 2–6  Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
Human Genomics Workshop, DNALC
Fun with DNA Workshop, DNALC West
August 3  HHMI Professional Development Workshop, “DNA Analysis and Forensics,” Harlem DNA Lab
August 4  HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 1,” Harlem DNA Lab
August 5  HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 2,” Harlem DNA Lab
August 6  HHMI Professional Development Workshop, “Genetically Modified Foods,” Harlem DNA Lab
August 9  HHMI Professional Development Workshop, “DNA Transformation and Protein Isolation,” Harlem DNA Lab
August 9–13  DNA Science Workshop, DNALC
Genetic Horizons Workshop, DNALC
World of Enzymes Workshop, DNALC
World of Enzymes Workshop, DNALC West
August 10  HHMI Professional Development Workshop, “DNA Analysis and Forensics,” Harlem DNA Lab
August 11  HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 1,” Harlem DNA Lab
August 12  HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 2,” Harlem DNA Lab
August 16–20  Forensic Detectives Workshop, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
DNA Science Workshop, DNALC
DNA Science Workshop, Mentors in Medicine, Harlem DNA Lab
August 17  Site visit by Esther Baena, Harvard Medical School, Cambridge, Massachusetts
August 18  Site visit by Ted Scovell and Mark Stoeckle, The Rockefeller University, New York
August 19–20  NSF Silencing Genomes Follow-up Workshop, Houston Community College, Texas
August 23–27  DNA Science Workshop, DNALC
Fun with DNA Workshop, DNALC
World of Enzymes Workshop, DNALC
Human Genomics Workshop, DNALC West
Aug. 30–Sept. 3  DNA Science Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
Green Genes Workshop, DNALC West
September 2  Site visit by Pauline Charman, University of Western Australia, Perth
September 14  Eugenics Exhibit, Holocaust Memorial and Tolerance Center, Glen Cove, New York
September 15  Site visit by Torbert Rocheford, Purdue University, West Lafayette, Indiana
September 16–17  NSF iPlant Collaborative Genomics in Education Workshop, University of Washington, Seattle
September 17  Site visit by Anne and Walter Meier, The Robertson Foundation for Government, Juno Beach, Florida
September 25  HHMI Professional Development Workshop, “DNA Structure and Isolation, Part 2,” Harlem DNA Lab
October 5  Site visit by Denise Smith, Vincent Torri, and Rick Garrett, Saint Dominic’s Church and Schools, Oyster Bay, New York
October 15  HHMI Professional Development Workshop, “Inheritance and Variability,” Harlem DNA Lab
October 16  HHMI Professional Development Workshop, “Inheritance and Variability,” Harlem DNA Lab
New York Academy of Sciences Graduate Training, New York
Saturday DNA! “Classify Me” DNALC
October 18–19  NIH SEPA Grant Review, Bethesda, Maryland
October 22  HHMI Professional Development Workshop, “Bacterial Transformation and Protein Isolation,” Harlem DNA Lab
October 23  HHMI Professional Development Workshop, “Bacterial Transformation and Protein Isolation,” Harlem DNA Lab
November 2–3  NSF iPlant Collaborative Genomics in Education Workshop, University of Minnesota, Saint Paul
Workshops, Meetings, and Collaborations

November 4
Site visit by Paula Olsiewski, Alfred P. Sloan Foundation, Harlem DNA Lab

November 5
Site visit by Verizon Fios One MYLITV for filming

November 8
iPlant Collaborative NSF site visit, Tucson, Arizona

November 8–9
Science Teachers Association of New York State Conference, presentations on DNALC family of websites, Rochester, New York

November 12
HHMI Professional Development Workshop, “DNA Analysis and Forensics,” Harlem DNA Lab

November 13
HHMI Professional Development Workshop, “DNA Analysis and Forensics,” Harlem DNA Lab Saturday DNA! “DNA Barcoding,” DNALC

November 22
Baruch College, “iPlant Collaborative, DNA Subway,” New York

Marcus Foundation “Gene Screen,” Victor Centers for Jewish Genetic Diseases, Albert Einstein Medical Center, Philadelphia, Pennsylvania

November

November 29–Dec. 11
Singapore Primary Teachers Attachment, DNALC

December 3
Site visit by Mohammad Alshehri, King Saud University, and Talal Al-Malki, Taif University, Saudi Arabia

HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 1,” Harlem DNA Lab

December 4
HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 1,” Harlem DNA Lab

December 9
Site visit by Suzanne Sunshine, S. Sunshine & Associates, New York

December 11
HHMI Professional Development Workshop, “PCR and Human DNA Variation, Part 2,” Harlem DNA Lab Saturday DNA! “What Does Your Nose Know?” DNALC

December 14–15
Site visit by Steve Goff and Eric Lyons, iPlant Collaborative, Tucson, Arizona

December 15–16
NSF iPlant Collaborative Genomics in Education Workshop, University of Texas, Brownsville and Texas Southmost College, Brownsville

December 16
Site visit by James Jorasch and Megan Kingery, Science House, Harlem DNA Lab
### Sites of Major Faculty Workshops 1985–2010

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

<table>
<thead>
<tr>
<th>State</th>
<th>Location</th>
<th>Year(s)</th>
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<tbody>
<tr>
<td>Alabama</td>
<td>University of Alabama, Tuscaloosa</td>
<td>1987–1990</td>
</tr>
<tr>
<td>Alaska</td>
<td>University of Alaska, Fairbanks</td>
<td>1996</td>
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<tr>
<td>Arizona</td>
<td>Arizona State University, Tempe</td>
<td>2009</td>
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<tr>
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<td>Tuba City High School</td>
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<td>Arkansas</td>
<td>Henderson State University, Arkadelphia</td>
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<tr>
<td>California</td>
<td>California State University, Dominguez Hills</td>
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<td>California State University, Fullerton</td>
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<td>California Institute of Technology, Pasadena</td>
<td>2007</td>
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<td></td>
<td>Cañada College, Redwood City</td>
<td>1997</td>
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<td></td>
<td>City College of San Francisco</td>
<td>2006</td>
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<td></td>
<td>Foothill College, Los Altos Hills</td>
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<td>Harbor–UCLA Research &amp; Education Institute, Torrance</td>
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<tr>
<td></td>
<td>Los Angeles Biomedical Research Institute (LA Biomed), Torrance</td>
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<td>Laney College, Oakland</td>
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<td>Lutheran University, Thousand Oaks</td>
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<td>Oxnard Community College, Oxnard</td>
<td>2009</td>
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<td>Pasadena City College, Pasadena</td>
<td>2010</td>
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<td>Pierce College, Los Angeles</td>
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<td>Salk Institute for Biological Studies, La Jolla</td>
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<td>San Jose State University</td>
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<td>University of California, Berkeley</td>
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<td>Colorado</td>
<td>Aspen Science Center</td>
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<td>Connecticut</td>
<td>United States Air Force Academy, Colorado Springs</td>
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<td>Florida</td>
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<td>Armwood Senior High School, Tampa</td>
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<td>Florida Agricultural &amp; Mechanical University, Tallahassee</td>
<td>2007–2008</td>
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<td>North Miami Beach Senior High School</td>
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<td>University of Miami School of Medicine</td>
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<td>University of Western Florida, Pensacola</td>
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<td>Georgia</td>
<td>Fernbank Science Center, Atlanta</td>
<td>1989, 2007</td>
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<td>Spelman College, Atlanta</td>
<td>2010</td>
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<td>Hawaii</td>
<td>Kamehameha Secondary School, Honolulu</td>
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<td>Idaho</td>
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<td>Illinois</td>
<td>Argonne National Laboratory</td>
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<td>iBio Institute/Harold Washington College, Chicago</td>
<td>2010</td>
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<td></td>
<td>Illinois Institute of Technology, Chicago</td>
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<td>Louisiana</td>
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<td>Jefferson Parish Public Schools, Harvey</td>
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<td>John McDonogh High School, New Orleans</td>
<td>1993</td>
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<td>Maine</td>
<td>Bates College, Lewiston</td>
<td>1995</td>
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<td></td>
<td>Foundation for Blood Research, Scarborough</td>
<td>2002</td>
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</table>
MARYLAND
- Annapolis Senior High School 1989
- Frederick Cancer Research Center, Frederick 1995
- McDonough 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

MASSACHUSETTS
- Beverly High School 1986
- Biogen Idec, Cambridge 2002, 2010
- Boston University 1994, 1996
- CityLab, Boston University School of Medicine 1997
- Dover-Sherborn High School, Dover 1989
- Randolph High School 1988
- The Winsor School, Boston 1987
- Whitehead Institute for Biomedical Research, Cambridge 2002

MICHIGAN
- Athens High School, Troy 1989

MINNESOTA
- Minneapolis Community and Technical College 2009
- University of Minnesota, St. Paul 2005
- University of Minnesota, St. Paul 2010

MISSISSIPPI
- Mississippi School for Math & Science, Columbus 1990–1991

MISSOURI
- St. Louis Science Center, St. Louis 2008–2009, 2010
- Stowers Institute for Medical Research, Kansas City 2002, 2008
- Washington University, St. Louis 1989, 1997

NEVADA
- University of Nevada, Reno 1992

NEW HAMPSHIRE
- Great Bay Community College, Portsmouth 2009
- New Hampshire Community Technical College, Portsmouth 1999
- St. Paul’s School, Concord 1986–1987

NEW JERSEY
- Coriell Institute for Medical Research, Camden 2003
- Raritan Valley Community College, Somerville 2009

NEW MEXICO
- Biolink Southwest Regional Meeting, Albuquerque 2008

NEW YORK
- Albany High School 1987
- American Museum of Natural History 2007
- Bronx High School of Science 1987
- Canisius College, Buffalo 2007
- Columbia University 1993
- Cornell University, Ithaca 2005
- DeWitt Middle School, Ithaca 1991, 1993
- Dolan DNA Learning Center 1990–1992
- DNALC West 2005
- Fostertown School, Newburgh 1991
- Harlem DNA Lab, East Harlem 2008–2009
- Huntington High School 1986
- Irvington High School 1986
- John Jay College of Criminal Justice 2009
- Junior High School 263, Brooklyn 1991
- Lindenhurst Junior High School 1991
- Mt. Sinai School of Medicine 1997
- New York City Department of Education 2007
- New York Institute of Technology 2006
- New York Institute of Technology 2006
- 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
Stuyvesant High School 1998–1999
The Rockefeller University 2003
The Rockefeller University 2010
Tunisville Middle School, Poughkeepsie 1991, 1993
Trudeau Institute, Lake Saranac 2001
Union College, Schenectady 2004
United States Military Academy, West Point 1996
Wheatley School, Old Westbury 1985

NORTH CAROLINA
CITT Center for Health Research, Triangle Park 2003
North Carolina School of Science, Durham 1987

OHIO
Case Western Reserve University, Cleveland 1990
Cleveland Clinic 1987
Langston University, Langston 2008
North Westerville High School 1990

OKLAHOMA
Tulsa Community College, Tulsa 2009

OREGON
Kaiser Permanente-Center for Health Research, Portland 2003

Pennsylvania
Duquesne University, Pittsburgh 1988
Germantown Academy 1988
Kimmel Cancer Center, Philadelphia 2008

RHODE ISLAND
Botanical Society of America, Providence 2010

SOUTH CAROLINA
Clemson University, Clemson 2004
Medical University of South Carolina, Charleston 1988
University of South Carolina, Columbia 1988

TENNESSEE
NABT Professional Development Conference, Memphis 2008

TEXAS
Austin Community College–Rio Grande Campus 2000
Austin Community College–Eastview Campus 2007–2009
Houston Community College Northwest, Houston 2009, 2010
J.J. Pearce High School, Richardson 1990
Langham Creek High School, Houston 1991
Midland College, Midland 2008
Southwest Foundation for Biomedical Research, San Antonio 2002
Taft High School, San Antonio 1991
Texas A&M, AG Research and Extension Center, Weslaco 2007
Trinity University, San Antonio 1994
University of Texas, Austin 1999, 2004, 2010
University of Texas, Brownsville 2010
University of Texas, Salt Lake City 1993
University of Utah, Salt Lake City 1998, 2000
Utah Valley State College, Orem 2007

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

WASHINGTON, D.C.

WEST VIRGINIA
Bethany College 1989

WISCONSIN
Blood Center of Southeastern Wisconsin, Milwaukee 2003
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<td>Madison Area</td>
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<td>Marquette University, Milwaukee</td>
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<td>PUERTO RICO</td>
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<td>University of Melbourne</td>
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<td>AUSTRIA</td>
<td>Vienna Open Lab</td>
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<td>Manitoba</td>
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<td>CHINA</td>
<td>Ho Yu College, Hong Kong</td>
<td>2009</td>
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<td>GERMANY</td>
<td>Urania Science Center, Berlin</td>
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<td>ITALY</td>
<td>Porto Conte Research and Training</td>
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<td>Laboratories, Alghero</td>
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<td>International Institute of Genetics and</td>
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<td>Biophysics, Naples</td>
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<td>ASPB Plant Biology, Merida</td>
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<td>Chemistry, Moscow</td>
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<td>SINGAPORE</td>
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