



ANNUAL REPORT 2013



CSH Cold Spring Harbor Laboratory
DNA LEARNING CENTER

The DNA Learning Center is an operating unit of Cold Spring Harbor Laboratory, extending its traditional research and postgraduate education mission to the college, pre-college, and public levels. Founded in 1988, the DNALC is the world's first science center devoted entirely to genetics education.

The mission of the DNA Learning Center is to prepare students and families to thrive in the gene age. We envision a day when all elementary students are exposed to principles of genetics and disease risk; when all high school students have the opportunity to do hands-on experiments with DNA; and when all families have access to genetic information they need to make informed health care choices.

DNA LEARNING CENTER EXECUTIVE DIRECTOR'S REPORT

Preparing students and families to thrive in the gene age

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The DNA Learning Center (DNALC) originated the concept of providing lab experiences in genetics and biotechnology to large numbers of biology students. During the year, we touched base with 13 programs worldwide that were developed under licensing agreements with the DNALC, were initiated by DNALC staff or kick-off events, or claim they were directly modeled after us. Together with us, these programs provide hands-on experiments to more than 150,000 students per year. In addition, 25 kits developed with Carolina Biological Supply Company are used by 200,000 students annually. Likely a similar number of students do labs based on our three textbooks and eight experiment websites.

Worldwide Genetics and Biotech Lab Exposures at Programs Modeled on the DNALC

Program	Location	Year Founded	# Labs	Yearly Student Exposure	Cumulative Student Exposure
DNA Learning Center, Cold Spring Harbor Laboratory	Cold Spring Harbor, NY, USA	1988	6	31,900	475,580
Biotechnology Teaching Center at Stony Brook University	Stony Brook, NY, USA	1995	3	4,610	75,950
Bay Area Biotechnology Education Consortium (BABEC)	San Francisco Bay, CA, USA	1996	Distributed	45,500	200,000
Ecole de l'ADN ("DNA School"), Museum of Nimes	Nimes, France	1998	9		35,000
Glases Labor ("Visible Lab"), GmbH Campus Berlin-Buch	Berlin-Buch, Germany	1999	3	10,045	122,000
Gene Technology Access Centre (GTAC)	Melbourne, Australia	2000	2	11,020	61,430
Life Learning Center, University of Bologna	Bologna, Italy	2000	4	12,910	103,230
Biogen-Idec Community Laboratory	Cambridge, MA, USA	2002	2	2,480	25,430
Lifelab, Life Science Centre	Newcastle upon Tyne, UK	2002	1	3,320	42,430
DNA Learning Lab, Science Centre Singapore	Singapore	2003	3	24,140	214,270
South Carolina DNA Learning Center, Clemson University	Clemson, SC, USA	2006	2	1,560	11,740
Vienna Open Lab	Vienna, Austria	2006	1	5,050	29,790
Sackler Educational Lab, American Museum of Natural History	New York, NY, USA	2007	1	3,800	21,330
College of Science, University of Notre Dame	South Bend, IN, USA	2013	1		
			38	156,335	1,418,180
DNALC Kits, Carolina Biological Supply Company	Burlington, NC, USA	1986		200,000	
				356,335	

In 2008, we collaborated with the New York City (NYC) Department of Education (DOE) to open *Harlem DNA Lab*, which is located in the John S. Roberts Educational Complex on 1st Avenue and 120th Street, owned by the DOE. During five years of operation, *Harlem DNA Lab* has fulfilled our goal of providing underserved schools in NYC identical enrichment opportunities that we offer to Long Island's affluent schools. More than 15,400 students have done hands-on experiments at the facility; 75% were Hispanic or African American. The same proportion of students was from Title I schools, at which 40% or more of students are designated as low-income. *Harlem DNA Lab* was the site of a Howard Hughes Medical Institute (HHMI) teacher-training program, which we administered in collaboration with the NYC DOE. Over the five-year term of the grant, 835 NYC teachers completed an average of 15 hours of training.

The success of *Harlem DNA Lab* has proven that we can find our way in the megalithic NYC school system, draw significant numbers of underrepresented minority (URM) students, and have a measurable impact on student achievement. With no long-term contract with the DOE, use of the *Harlem DNA Lab* is on a year-to-year basis. Evening, weekend, or holiday access requires permits for each activity. Furthermore, in the last two years there have been several instances of gun violence in the neighborhood, which have caused the facility to be "locked down" and discouraged some schools from attending labs there.

DNA Center NYC

Emboldened by our success, but sobered by the limitations in Harlem, in 2013 we took major steps toward achieving our long-held goal of having our own, dedicated center in Manhattan. *DNA Center NYC* will further extend the DNALC "brand" to NYC, using a successful educational formula perfected over 25 years: academic year lab field trips for 5th through 12th grade students, in-school instruction with mobile experiment "footlockers," intensive summer DNA camps, and teacher training and follow-up support for effective hands-on science learning.

DNA Center NYC will be a 7,000–10,000 square-foot facility, administering a full program of student enrichment for students from the five boroughs of NYC. Its mission is to be the "go-to" place for DNA education and information from the world's top-rated molecular biology and genetics research institution. *DNA Center NYC* will be a vibrant hub of hands-on explorations of the DNA world and its relationship to inheritance and health. *DNA Center NYC* envisions a day when all NYC students will have the opportunity to look at their own DNA – to better understand their uniqueness, the implications of personalized medicine, and their shared genetic heritage with other people in America's melting pot. *DNA Center NYC* will leverage the DNALC's leadership to create a unique environment in which students can ask questions and do hands-on science experiments.

Each year, we anticipate providing hands-on labs for 27,500 students, as well as supporting a network of 200 students and mentors involved in extended research projects in DNA barcoding, microbiomes, and genome sequencing. We also plan to train 100 5th–12th grade teachers and provide equipment footlockers to support 2,000 in-school student labs. We will continue to encourage participation of URM. To aid recruitment, we will deepen relationships with leaders and programs serving these populations and have budgeted funds to provide scholarships to 50% of all students attending programs at *DNA Center NYC* who are URM and/or from Title I schools.

Because *Harlem DNA Lab* is convenient to students commuting from northern Manhattan and the Bronx, we intend to continue to operate this facility along with the new *DNA Center NYC*. The two facilities will offer the same lab programs, allowing us to serve the broadest



Concept illustrations of *DNA Center NYC* developed by Centerbrook Architects and Planners.

possible population. We anticipate that a proportion of *Harlem DNA Lab's* natural clientele—for example, some schools in the Bronx—will opt to travel to the larger *DNA Center NYC*. However, our 10 years of experience with an analogous situation on Long Island with the Dolan DNALC and DNALC *West* shows that a smaller satellite facility can operate at capacity due to the strong demand for our programs.

Building out and equipping three teaching labs, an exhibit, a bioinformatics/multimedia classroom, a lunchroom, and staff offices will cost \$2.7 million. Annual operating costs—including salaries for three administrative staff, six instructional staff, and two interns—are estimated at \$2 million. Expected revenues from student labs, interpretive programs, teacher training, and memberships can only generate about half of this amount. Federal and private foundation grants currently supply the difference between operating income and total DNALC operating costs. In light of the decreasing availability of grants and increased funding gaps caused by vagaries of the federal budget process, we have adopted a plan to cover additional operating costs from endowment.

The Cold Spring Harbor Laboratory (CSHL) Board of Trustees has included \$25 million for *DNA Center NYC* in its \$250 million capital campaign to commemorate the institution's 125th anniversary in 2015. Building on a lead gift of \$6 million from CSHL Trustee Laurie Landeau, the campaign gained momentum in the fall. In October we received a \$10 million gift from the Thompson Family Foundation whose namesake, Wade Thompson, founded Thor Industries as one of the world's largest manufacturers of recreational vehicles—including the flagship Airstream. This was followed by a \$3 million grant from the Alfred P. Sloan Foundation, prompting CSHL President Bruce Stillman to officially announce the project at the annual Double Helix Medals Dinner on November 4th.

The Sloan Foundation grant provided start-up funds to initiate a three-phase development timetable. By year's end we had launched Phase I—working with Cushman & Wakefield Realtors, we began our search for a suitable lease property with good street visibility and ready access to the NYC subway. At the same time, members of a newly-formed *DNA Center NYC Council* are introducing the project to companies, foundations, and individuals capable of making major gifts to close out the \$25 million capital campaign. We intend to begin Phase II facility development in summer 2014, with design and construction to be complete in 2015. We have developed a financial plan in which the Sloan grant will fund renovation and staff recruitment in Phases I and II. Then, income from a \$22 million endowment will supplement tuition income in Phase III, producing a sustainable, balanced budget. During Phase III, we will open *DNA Center NYC* and scale up to full operation in 2016.

DNALC Licensing

Beginning with a 2002 agreement with the North Shore-Long Island Jewish (NS-LIJ) Health System that founded DNALC *West*, the licensing program has provided an efficient mechanism for institutions to develop science centers based on the DNALC model. This formal relationship provides transparent access to teaching methods and intellectual property (“know-how”) developed over a 25-year period at a cost of more than \$40 million.

On September 28th the DNA Learning Center at the University of Notre Dame was dedicated, becoming the sixth licensed DNALC operation. The collaboration was made possible by CSHL friend and Notre Dame Alumnus, John Passarelli. A 36-seat lab, which makes use of the DNALC's distinctive lab “islands,” will be located in the new Jordan Hall of Science. The facility was blessed by a Notre Dame priest; but the football team had no such help when they lost to Oklahoma that afternoon!

By year's end we also had a draft licensing agreement with Beijing No. 166 High School, a public school with 2,000 students in grades 7–12. Beijing No. 166 is the top rated of about 30 high schools in the Dongcheng District in the heart of old Beijing, just one mile from the Forbidden City and Tiananmen Square. Founded in 1864 as China's most prestigious girls' school, Beijing No. 166 became coeducational after the Cultural Revolution. With training in biology, Principal Wang Lei has recently developed Beijing No. 166 as the only designated high school of biology in the capital. The school has major partnerships with the Genetics Society of China and the Beijing Genomics Institute (BGI), whose Chairman, Henry Yang, introduced DNALC Executive Director Dave Micklos to China in 2003.



Beijing No. 166 students pose with DNALC instructional staff following summer workshops.

Our collaboration began in 2011, with 20 students attending a three-week summer workshop at the DNALC. We continued summer workshops in 2012–13 and added a winter internship for select students. We were lucky to catch the beginning of the wave of precollege Chinese students visiting the US, driven by the desire of many top Chinese students to attend US universities and affluent parents who are able to focus resources on a single child. Travel visas have become easier to obtain, and travel agencies are catering to the demand.

The formal collaboration will begin in spring 2014 with funding by the Dongcheng District. Under terms of the agreement, we will create a co-branded DNALC at

Beijing No. 166 as a resource for Dongcheng public schools, which serve 100,000 students. A well-equipped biology lab, completed during the renovation of the school in 2013, will be dedicated to providing academic-year field trips and summer camps. The DNALC will provide 260 student weeks of workshops at Cold Spring Harbor, as well as four weeks of student/faculty training in Beijing.

New Program on Next-Generation Sequencing

Since the advent of so-called “next-generation sequencing” (NGS) in 2005, the cost of DNA sequencing has decreased 10,000-fold (imagine anything in your lifetime that has decreased by even two-fold!). Coupled with free online analysis tools, NGS offers the promise to make genome analysis an egalitarian pursuit open to virtually anyone. Indeed, recent DNALC surveys of attendees at scientific meetings and training workshops suggest that 96% of researchers are currently, or soon will be, using large sequence datasets.

Raw DNA and RNA sequences are becoming the currency of modern biology, and easy access to genome information is leading a paradigm shift in biology. Throughout history, biologists have worked lifetimes attempting to amass enough data to support their ideas, with the effect that hypotheses were usually under-supported by data. Today, NGS has created a virtually data-unlimited paradigm in which hypotheses are often derived from the sequence data itself. This whole genome paradigm will dominate the biological landscape for students seeking future careers in biomedical and agricultural research.

Against this backdrop, in the fall the DNALC was awarded a \$537,000 grant from the National Science Foundation (NSF) to develop “Infrastructure and Training to Bring NGS Analysis into Undergraduate Education.” This three-year project will assist undergraduate faculty in integrating NGS analysis into course-based and independent student research. Participating faculty will develop a total of 30 RNA sequence (RNA-Seq) datasets that bear on novel research problems in eukaryotic genomics. Following refinement of a biochemical and bioinformatics workflow by project staff, a Working Group retreat will be conducted at CSHL in June 2014 with 11 faculty. In subsequent years, regional and virtual workshops will be held for 80 faculty representing diverse institutions and areas of the country. About 25% of faculty will be from minority-serving institutions with the objective of reaching African American, Hispanic, and Native American faculty and students.

Analysis will use large-scale data storage and bioinformatics workflows provided by the *iPlant Collaborative*, an NSF-supported cyberinfrastructure for biological research. The project will provide faculty at predominately undergraduate institutions (PUI) the first easy access to high performance computing through the NSF's Extreme Science and Engineering Discovery Environment (XSEDE). Advanced applications, including command line customization, are supported in the research-grade *Discovery Environment*.

Using the visual metaphor of a subway map, the *DNA Subway* educational platform bundles research-grade bioinformatics tools and databases into intuitive workflows and presents them in an easy-to-use interface. Each of four *DNA Subway* lines focuses on different problems in genome analysis, organizing bioinformatics tools at “stops” along branches off a main track. The Green Line is an educational workflow specifically designed to support student analysis of RNA-Seq data sets. It integrates all tools needed to assemble millions of RNA sequences into a transcriptome – the entire set of genes active under different conditions or in different cell types (such as normal vs tumor cells). The Green Line articulates directly with high-performance clusters at the Texas Advanced Computing Center – providing what we believe

to be the first simple biological on-ramp to the national supercomputing highway. This infrastructure will make it possible to broadly disseminate on-demand experiments using RNA-Seq in undergraduate settings.

During the grant, training will transition from in-person workshops to online webinars and self-paced learning via a dedicated website—providing a sustainable method to introduce large numbers of faculty to NGS analysis. Participants will also share instructional strategies and solve analysis problems during regular webinars and video conferences broadcast from the DNALC's Laurie J. Landeau Multimedia Studio. A multi-faceted evaluation program will assess effects on student learning, interests, and attitudes across a variety of classroom and student research settings.

This project operates on the continuum of biology research and education. It recognizes that many college faculty would like to bring NGS to bear on a problem of their own interest—and invite students as co-investigators in class-based and independent projects. The program will prepare faculty to operate in the new, sequence-driven paradigm and empower them to guide students in novel genome explorations.

iPlant Collaborative

In September we learned the NSF had approved an additional five years of funding for the *iPlant Collaborative*. The renewal proposal received an extremely rigorous review—including an anonymous panel of peers, a “reverse” site visit with NSF program officials, and approval by NSF division directors—culminating in a final nod from the National Science Board, NSF's governing body. Considering the federal sequester and general uncertainty of research funding, the renewal of this project for \$50 million was a vote of confidence in this collaboration between CSHL, The University of Texas, and the University of Arizona.

Over the first five years of the project, the DNALC successfully expanded its role to become the leader of Education, Outreach, and Training (EOT). This ramped up funding to nearly \$800,000 per year, or about one quarter of the DNALC's \$3.2 million operating budget. So we heaved a sigh of relief at the renewal. Notably, *iPlant* support allowed the DNALC to recruit two high-level computer programmers, who worked to consolidate our leadership in educational bioinformatics. We focused much effort on *DNA Subway*, finalizing the Green Line in time for the NGS program. With nearly 6,000 registered users, *DNA Subway* continues to fulfill our mission of bringing cyberinfrastructure into the classroom—making it easy for students to work with the same data and bioinformatics tools as high-level researchers.

The Blue Line articulates with a complete set of lab materials for DNA barcoding and is the basis of the successful *Urban Barcode Project (UBP)*, which has involved over 400 students in examining biodiversity in NYC. Students analyze and compare DNA barcode sequences, and construct phylogenetic trees. An export feature simplifies barcode sequence submissions to GenBank and has been used to publish over 100 novel DNA sequences, with students as authors.

We are currently upgrading the existing Red Line annotation workflow to incorporate JBrowse and WebApollo, a user-friendly rewrite of the Apollo annotation editor. The Red Line will enable an easy annotation “round trip,” as locally generated RNA-Seq data is automatically transferred from the Green Line as annotation evidence. The workflow will readily accept any type of GFF file – including output from Maker and evidence from other genome resources. This seamless integration will create a “power desktop” that allows faculty and students to explore large-scale variation in gene expression and genome structure on their personal computers. We believe that the Green and Red Lines of *DNA Subway* will be the most user-friendly workflows

available to support distributed annotation of newly sequenced and re-sequenced genomes. The maize genome is specifically being developed as the first use case.

Also in light of the renewal, we designed a refreshed *iPlant* website, which features the variety of *iPlant* platforms and tools, and user success stories to highlight the research problems *iPlant* can help solve. The DNALC will also continue the development of the *iPlant Learning Center*, where users can access *Quick Start* or in-depth tutorials online.

Throughout 2013 we continued to deliver *iPlant* workshops for researchers and faculty. We trained 283 researchers at eight *Tools & Services Workshops* and 38 faculty at *Genomics in Education Workshops*. While workshops and conferences continue to be an important component of reaching and training new *iPlant* users, we anticipated reaching many more people virtually. In 2013 we launched a series of webinars, described further in our *BioMedia* section below. We can achieve an extended reach through webinars—for example, a workshop attended by 27 researchers at CSHL had 316 “virtual” webinar attendees! In total, we reached an additional 405 researchers and faculty virtually in 2013.

Longitudinal evaluation continues to guide and inform EOT efforts and document our success in reaching our intermediate audience of biological researchers who do not have specialized expertise in computation. Workshop follow-up surveys show that 60% of *Tools & Services Workshop* attendees actively use the *iPlant* platform to analyze their data, and 72% say that they introduced their colleagues to *iPlant*. *Genomics in Education Workshops* also had significant impact, with faculty reporting more than 24,000 student exposures to *iPlant* bioinformatics exercises as a result.



At left: The *iPlant Collaborative* website was redesigned during the year, and is set to launch in early 2014. Junior Designer Chris Weidler created the look of the new site.

Below: The *Tools & Services Workshop* at CSHL in December was also broadcast using Adobe Connect and Livestream. Watch it here: <http://new.livestream.com/cshl-dnalc/cshl-tsw>.



Genomic Approaches in BioSciences Workshops

This year was the final year of our NSF Advanced Technological Education (ATE) grant, which reached 258 biotechnology educators at 12 week-long workshops conducted at community colleges nationwide. The curriculum covers four key technologies—PCR, DNA sequencing, RNA interference (RNAi), and bioinformatics. In 2013, the last five workshops were held at Tulsa Community College (Tulsa, OK), City College San Francisco (San Francisco, CA), Minneapolis Community and Technical College (Minneapolis, MN), Seminole State College (Sanford, FL), and Nassau Community College (Garden City, NY). Of 103 participants in 2013, 53% were from two-year colleges, 18% four-year colleges or universities, and 28% high schools, with 30% URM. We conducted follow-up workshops in the spring for 21 educators who attended workshops in 2012.

The workshops increased educator knowledge and confidence to teach both labs and bioinformatics. Pre-workshop (n=258) and post-workshop (n=245) survey data showed that before the workshop only 10% of participants knew “a lot” about the key genomic concepts compared with 37% afterwards. Participants also felt more confident in teaching the genomics labs (16% to 41%) and bioinformatics (8% to 32%). In long-term follow-up surveys (n=98), 89% of workshop alumni had implemented course materials at schools with an average of 35% URM students. Educators taught DNA barcoding (52%), PCR (54%), RNAi (25%), bioinformatics (50%), and careers modules (70%), with an annual student exposure of 9,768 wet labs, 5,582 bioinformatics exercises, and 5,304 biotech careers activities.

In January, four case studies were conducted with 2011 workshop alumni. The case studies involved classroom observation of PCR and DNA barcoding (n=64 students; 22% URM), student focus groups (n=28; 25% URM), and educator interviews (n=5) at a rural high school, and suburban two- and four-year colleges. College faculty discussed using the curricula as an “enabler” to link subjects, make best use of faculty expertise and equipment, and increase student interest. For example, biotechnology students used DNA barcoding to help ecology students map campus biodiversity. Two courses were implemented as a direct result of our training program. The aim of the ATE program is to “prepare tomorrow’s biotechnology workforce,” and this was illustrated by one case study student participant: *“We’ve had a lot of interesting classes but Biotech is the only one where we’ve learned stuff that we can apply when we got a job... where I feel a little more confident... I could be without supervision.”*

Our evaluation data consistently show that bioinformatics is challenging to teach and learn. Both educators and students feel more comfortable and engaged when bioinformatics exercises are incorporated into relevant, personalized curricula, such as our human mitochondrial DNA, DNA barcoding, and RNAi labs. At the least complex end of the spectrum, students use their own mitochondrial DNA sequences to discover principles of human evolution through database searches for similar sequences and alignment to the sequences of other people, primates, and even extinct hominid ancestors. Of medium complexity, DNA barcoding allows students to conduct field work, then use DNA sequences to search databases and build phylogenetic trees to answer questions about species diversity and conservation. In more complex experiments, students use bioinformatics to identify homologs of human disease genes in *C. elegans*, then design targeting vectors to disrupt these genes using RNAi.

In 2013 we secured additional funding to extend the NSF ATE grant and test our “train-the-trainer” model of instruction. Community college co-hosts from the original 2011–13 grant now instruct *Genomic Approaches in BioSciences Workshops* at their colleges. The first “extension” workshop was held at Madison Area Technical College (Madison, WI) with local faculty teaching the program under DNALC supervision. These workshops will continue in 2014, and we will compare outcomes for extension workshop participants with the original cohort.

Professional Meetings

The DNALC delivered five presentations at the 2013 National Association of Biology Teachers (NABT) conference in Atlanta, Georgia, continuing our partnership with Carolina Biological Supply Company to significantly expand our presence at teacher professional meetings. Carolina has distributed DNALC experiment kits to science teachers since 1986, and this year we co-sponsored a DNA barcoding workshop, based on the Carolina kit, demonstrating all facets from sample collection, DNA isolation and amplification, gel electrophoresis, through sequencing and bioinformatic analysis. We presented on the power of DNA barcodes and the use of DNA barcoding to drive independent research in the classroom, and we promoted the new DNALC *Genome Science* text book and laboratory manual for advanced secondary and post-secondary education. The textbook combines approachable narrative with extensively tested lab exercises that illustrate key concepts of genome biology in humans, invertebrates, and plants. Attendees learned about human mitochondrial DNA sequencing, detecting epigenetic DNA methylation in *Arabidopsis thaliana*, and using *DNA Subway*. The presentations emphasized how *Genome Science* provides a historical and conceptual framework to enhance existing courses, start new courses, and support student research projects.

DNA Barcoding

The second year of the *UBP* came to a successful conclusion in June. Fifty-three teams competed – 144 students from 12 public and seven private high schools across NYC, with 24% URM. Teachers and students attended 20 *Open Lab* sessions at the *Harlem DNA Lab* after school and on weekends, equipment footlockers were used by an additional 93 students, and DNALC staff conducted five school visits to help teams with their experiments and phylogenetic analyses on *DNA Subway*. Students collected over 1,000 samples for DNA sequencing with over 2,500 single sequences provided by GENEWIZ, Inc. Importantly, teams discovered 35 novel DNA sequences, which are being published to GenBank with student authors, making the data freely available for use by other researchers.



At left: *UBP* participants presented research results in a poster session. At right: Hostos-Lincoln Academy of Science students Hillary Ramirez (left) and Kavita Bhikhi, pictured with teacher Allison Granberry (center), won the grand prize.

Forty-one teams presented research posters at the American Museum of Natural History (AMNH) on May 29th. The projects mapped NYC wildlife, detected food fraud, determined biodiversity of traded species, identified exotic and/or invasive species, and explored the effects of biodiversity on human health. A jury of 27 experts selected the top six finalist teams (15 students) who gave oral presentations at the AMNH on June 5th. George Amato, Director of the Sackler Institute for Comparative Genomics at AMNH, gave the keynote address: “DNA Barcoding of Endangered Species, From Central African Forests to Restaurants in Manhattan.” The grand prize winners were Hostos-Lincoln Academy of Science students Kavita Bhikhi and Hillary Ramirez. Their project, *Using DNA Barcodes to Identify Ant Biodiversity in St. Mary’s Park, Bronx, New York*, identified seven ant species and found evidence for population structure within the ant species *Tetramorium caespitum*. Kavita and Hillary built on their research from the 2011–12 *UBP*, for which they earned fourth prize. This was also mentor Allison Granberry’s second *UBP* victory, and her experience is featured in the February 2014 *Carolina Tips*.

Program evaluation highlighted two main barriers to students completing their *UBP* projects: some teachers were limited in their ability to mentor students through all phases of their research and students lacked specific training. Therefore we expanded the program to offer select students a more in-depth experience and direct student-scientist mentoring. We partnered with The Pinkerton Foundation to establish the *Urban Barcode Research Program (UBRP)*. All *UBRP* students take introductory courses on DNA barcoding, conservation biology or genetics, proposal writing, and laboratory safety, and an expert scientific mentor works directly with each team. *UBRP* students commit 100+ hours to the program, half of which is directed research with their scientist mentor.

In 2013, 126 NYC students completed preparatory *UBRP* workshops at the *Harlem DNA Lab*, AMNH, and the Gateway Institute for Pre-College Science Education at Benjamin N. Cardozo High School in Queens, NY. Students were recruited from DNALC summer camps at *Harlem DNA Lab* in collaboration with the NYC DOE, and through the Gateway Institute. At the beginning of the 2013–14 academic year, 40 of these students were accepted into the first *UBRP* cohort, with 50% URM or disadvantaged students. Teams of two students were paired with scientist mentors from collaborating institutes—such as Rockefeller University, Columbia University, and New York Botanical Garden—to guide them through the research process: preparing a proposal, collecting samples, isolating and amplifying DNA, analyzing data, and preparing a scientific poster.

Both cycles of the *UBP* and *UBRP* continue into 2014, with a total of 55 student teams participating—153 students, 20 teachers and 20 scientists from 33 different NYC high schools and institutions. The students will present their findings at symposia in spring 2014.

To assess the impact of our NYC barcoding programs, all students complete pre- and post-surveys, and we interview a sub-cohort of students and teachers. When asked to compare DNA barcoding with other research experiences, students felt that the *UBP* provided more “real world” science (81% of students), more chance for hands-on experience (69%) and to learn science (76%), more opportunity to develop critical thinking (83%) and independent inquiry skills (70%), and more understanding of the scientific process (68%). DNA barcoding increased the students’ interest in studying science or pursuing a career in science (83%), while still being more fun than other research experiences (84%).

In line with the primary mission of the DNALC, students consistently cited hands-on lab experiences as the most unique, rewarding, and inspiring aspect of the DNA barcoding programs. As one student commented,

“It really shows you what every day scientists actually do. They take an unanswered question, they get their hypothesis and they test it and they come up with an answer that nobody knows.”



Antonia Florio (top left picture, far left) leads *DNA Barcoding Research Workshop* students on a specimen collection trip on the CSHL campus.

Whereas previous projects that I've done... you usually know the expected outcome because so many people have done this experiment over and over again." Victoria, 10th grade

We held several DNA barcoding summer camps this year, including basic and advanced research workshops. We expanded DNA barcoding to middle school students with great success; 48 students attended the new *Backyard Barcoding* camp, and students worked in groups to identify plants and fish samples. Thirty-nine local and international students completed the advanced high school workshop, *DNA Barcoding Research*. Students explored the biodiversity of the intertidal zone of Cold Spring Harbor and compared DNA isolation methods to identify the efficiency of in-house DNA isolations. Students collected and analyzed more than 150 samples that produced 43 novel sequences to be published to GenBank. Most of the barcoding sequences came from small aquatic invertebrates, species that are hard to classify using traditional taxonomy, highlighting the power of DNA barcoding.

Building on the work of the summer campers, we compared existing and new barcoding methods to identify the most robust, cost-efficient DNA isolation and amplification methods equivalent to commercial kits. We determined silica resin is the best medium, being inexpensive (<\$0.30/sample, which is a fraction of the cost of commercial kits) and reproducible with almost any plant, fungus, or animal specimen. For DNA amplification, we found that NEB *Taq* 2X Master Mix (12.5 μ L) is comparable to Ready-To-Go PCR Beads at a much lower cost (\$0.55/sample vs. \$1.60/sample), but requires access to a stable -20°C freezer. Updated protocols with information on reagents, primers, and amplification methods are available on our barcoding website, www.dnabarcoding101.org.

The DNA barcoding program also extended beyond the US in 2013, when we took the curriculum and materials to Africa, Europe, and Asia! In January, Dave co-taught a DNA barcoding course to 10 students at Godfrey Okoye University in Nigeria, identifying several novel sequences of dragonflies. In March he presented the curricula at the *Genetics Education for the 21st Century Workshop* in Utrecht, the Netherlands. He then co-convened a meeting on DNA barcoding across European science centers at the Wellcome Trust Sanger Institute, Cambridge, also facilitating a workshop to 100 students while there. During a trip to China in November, as part of our ongoing collaboration with Beijing No. 166 High School, he led students in investigating local Beijing biodiversity. In addition, Oscar Pineda-Catalan and Christine Marizzi taught the curriculum to 23 teachers and 80 students in Malaysia and Singapore. The bioinformatics analysis of many of these international samples continues back at the DNALC.



Students and faculty of Godfrey Okoye University in Nigeria.

High School Research Programs

Our partnership with Cold Spring Harbor High School (CSHHS) continued, offering the *Molecular and Genomic Biology* “capstone” college-level laboratory course. Co-instructed by DNALC staff and CSHHS faculty Jaak Raadsepp, students devote two classes per day to the year-long course. The 2012–13 cohort, our eighth class, focused on hands-on experimentation and independent projects across a range of biological systems. The course included units on eugenics, DNA barcoding, RNAi, human genome analysis, bioremediation, and protein modeling. Highlights were student essays on modern parallels to the eugenics movement of the early 20th century, after students visited CSHL Research Archives to examine historical documents; testing the ability of bacteria to bioremediate various substrates; and 3D printing of cancer proteins with guest lecturer, Joan Kiely, of Stony Brook University’s Biotechnology Teaching Center. The students presented their work during a poster session at the CSHL “Cancer Biology & Therapeutics” meeting on April 24th.

We also continued our successful partnership with St. Dominic High School in Oyster Bay, offering a five-month course for students in *Molecular and Genomic Biology*. The course capitalized on St. Dominic’s new science building, made possible through a parishioner’s generosity. In collaboration with science teacher Teresa Kuehhas, DNALC staff introduced students to experimental methods for future independent projects: species diversity using DNA barcoding, gene function using RNAi in *C. elegans*, and human variation using PCR.

In the fall Long Island's first regional Doshi Science, Technology Engineering and Math (STEM) high school opened. The Doshi STEM program partnered with Brookhaven National Laboratory and the DNALC to prepare students for the competitive and evolving high-tech science arena. The first 20 ninth graders were selected by their school districts based on academic performance, recommendations, and core interest in STEM. The DNALC collaboration provided hands-on, inquiry-based science experiments to enhance student understanding of the scientific method while exploring and solving problems. The Doshi students applied these new skills on their first independent research projects, examining biodiversity of Caumsett State Historic Park, Garvies Point Museum and Preserve in Glen Cove, a field by Southampton Hospital, a cranberry bog in Amagansett, and parks in Greenport and Cutchogue. The students collected and analyzed 50 samples using DNA barcoding, which will culminate in a symposium in early 2014.



Bruce Nash (top left) meets with Doshi STEM collaborators and Brooke Roeper (bottom left) demonstrates pipetting technique to Doshi students.

Student Programs

This year, 20,962 students attended field trips at our three facilities: Dolan DNALC, DNALC *West*, and *Harlem DNA Lab*. We reached a further 10,200 students through in-school instruction by DNALC staff and 1,641 through in-school lab exposures by DNALC-trained teachers with footlocker kits. GENEWIZ, Inc. processed a total of 17,632 sequencing samples (8,030 mitochondrial control region sequences and 8,401 DNA barcodes) from students at 194 high schools and 105 colleges and universities.

Seventy percent of the students who visited *Harlem DNA Lab* received scholarships from the William Townsend Porter Foundation. Two schools co-located within the John S. Roberts Educational Complex also received instruction: the Coalition School for Social Justice students participated in three high school biotechnology laboratories, and MS 45 students enjoyed six introductory genetics laboratories. Students performed DNA extractions at the *STEM Careers EXPO Fair for English Language Learners* in the Armory on the Hudson, and observed mutant fruit flies at the New York Public Library Youth STEM Fair. Through continued collaboration with the NYC DOE Office of School Programs and Partnerships, we held a five-day *DNA Science* camp during spring break. Twenty-seven budding scientists gave up well-deserved vacation to be immersed in the lab. The highlight of the week was a visit by Dennis Walcott, the former Chancellor of the NYC DOE.



Christine Marizzi (left) and Melissa Lee (right) speak with Dennis Walcott at the *Harlem DNA Lab*.

The *Harlem DNA Lab* continued its footlocker kit rental program by providing HHMI-trained teachers with equipment and materials for genetics and biotechnology labs. In 2013, footlocker kits resulted in 1,566 total student exposures. Seventy-four percent of these students were URM, and most teachers received the kit free of charge or were charged only minimal restocking fees. In addition, the *Harlem DNA Lab* continued to be the central hub of the *UBP*.

Additional grants from Bank of America and the National Grid Foundation supported programs for over 3,000 underserved students from Long Island school districts including the Brentwood, Uniondale, William Floyd, Central Islip, and Valley Stream public schools. As part of an ongoing collaboration with Central Islip Union Free School District (UFSD), we provided in-school labs for every sixth grader as part of the district's new *Exploration Academy Campus*. A customized sequence of labs was presented for both the *Forensic and Legal Sciences* and *Health and Medical Sciences* academies at the Charles Mulligan and Ralph Reed

middle schools. The program culminated with a visit from Bob Keller, Executive Director of the National Grid Foundation, and Craig Carr, Superintendent of the Central Islip UFSD, to celebrate their accomplishments in the lab.

We continued to work with Charter Member schools. The Chapin School introduced an advanced science elective, *Molecular Genetics*. The course curriculum, based on our *Genome Science* textbook, is implemented with the assistance of DNALC instructors. The Convent of the Sacred Heart School in Greenwich, Connecticut, continued field trips to the DNALC, in-school instruction, summer camps, and expanded its research programs. St. David's School in Manhattan joined this year with a focus on enriching the fifth grade science curriculum through field trips and in-school instruction for a genetics unit that culminates in a DNA barcoding project and a school science fair.

This summer, a record 1,241 students participated in 60 week-long camps held at nine locations: Dolan DNALC, DNALC West, Stony Brook University, and Brookhaven National Laboratory (Long Island); *Harlem DNA Lab*, The Chapin School and New World Prep Charter School (NYC); Convent of the Sacred Heart (CT); and The Roxbury Latin School (MA).

The summer roster was enhanced by the addition of our new *BioCoding* camp. The DNALC has a long interest in bringing bioinformatics education to students. Since 1998 students have used our websites like *BioServers* to analyze their own mitochondrial DNA sequence, simulate genetic drift, and investigate other areas of computational biology. With cheap DNA sequencing now a reality, bioinformatics skills—the ability to manipulate software and computational resources to unlock the meaning of sequence—are now the bottleneck to discovery. This course was pioneered by DNALC programmers Sheldon McKay and Mohammed Khalfan, along with Jason Williams. While the world of bioinformatics is intimidating (even to many biologists today), 82% of the students who attended had little or no coding experience. Our summer camp increased 91% of students' interest in coding, with 73% very likely to now take a science or computer science elective at school. We are confident our camp prepares students for an academic world where, to quote one famous CSHL bioinformatician, Lincoln Stein, “if you can't do bioinformatics, you can't do biology.”

In 2013 the DNALC helped establish the i2 (“iNVENT and iNSPIRE”) summer camps in NYC and Boston. Founded by Ethan Berman, the objective of the i2 camps is to broaden students' exposure to STEM with a wide variety of new, hands-on and innovative courses not seen in traditional middle school science education. As part of i2, The Roxbury Latin School and The Chapin School offered three DNALC middle school programs: *Fun with DNA*, *World of Enzymes*, and *Forensic Detectives*. Each course was taught by a DNALC lead teacher, an associate local teacher, and a high school student acting as a “near peer.” Our programs reached 73 students and feedback was overwhelmingly positive. i2 plans to continue this collaboration by offering DNALC summer camps in additional national and international locations next summer.

Each year we collaborate with the NS-LIJ health system to give students the opportunity to step into biotechnology teachers' shoes. The I.S. 059 Springfield Gardens School in Jamaica, Queens, sends select 8th–11th grade students to DNALC West, located in the NS-LIJ core laboratory at Lake Success, to learn the latest biotechnology and bioinformatics techniques. Those “seed students” then teach their classmates back at I.S. 059. Since 2008, 125 students have been through the program, with 16 attending in 2013. “We had tons of fun—learned, taught. Thanks for giving us gifts that will keep on giving,” (Marcia Young, I.S. 059 science teacher). The larger aim of the program is to allow less-fortunate students an opportunity to experience the laboratory environment and gain exposure to a variety of career choices, and we are tracking program alumni.

Monthly *Saturday DNA!* sessions drew 221 participants, with parents and grandparents joining children to learn about forensics, cholesterol, human origins, genetic traits, the Romanov family mystery, genes for bioluminescence, and DNA barcoding. An additional 3,426 visitors viewed films in the multitorium, including Cablevision's multimedia presentation *Long Island Discovery*, and/or viewed the exhibition *The Genes We Share*. The annual *Great Moments in DNA Science* seminar series drew 126 top Long Island high school students for three presentations by CSHL researchers. Dr. Jaclyn Novatt showed how basic research on nuclear pores is improving drug production; Dr. Aman Husbands talked about his research on plant leaf architecture and cell differentiation; and Dr. Dennis Eckmeier discussed how mice rely on scent during social interactions.

Renovations to our exhibit space continued as we updated "Our Common Origins" to showcase the latest fossil finds, including *Ardipithecus ramidus*, or "Ardi," which is over four million years old. We redesigned the skull wall and displayed a phylogenetic tree behind the skulls, describing genetic and morphological relationships between species leading to modern man (shown at right). Over a hundred classes per year take an instructor-guided tour of our museum, so we updated the accompanying booklet that helps them on their journey and teachers use to extend field trips back in the classroom.



Graduate Training

Through our collaboration with CSHL's Watson School of Biological Sciences, graduate students develop presentation methods that can be used with any audience. The spring rotation includes teaching both middle school and high school students at the DNALC. While under the guidance of experienced DNALC instructors, graduate students work in pairs to complete twelve half-day teaching sessions, learning how to assess an audience quickly and build quality instruction accordingly.

We continue to collaborate with the New York Academy of Sciences (NYAS), one of the oldest scientific institutions in the US and a leading organizer of scientific meetings. DNALC instructors trained 56 mentors in effective strategies to deliver hands-on genetics activities and forensics training in after-school settings for the NYAS science mentoring program.

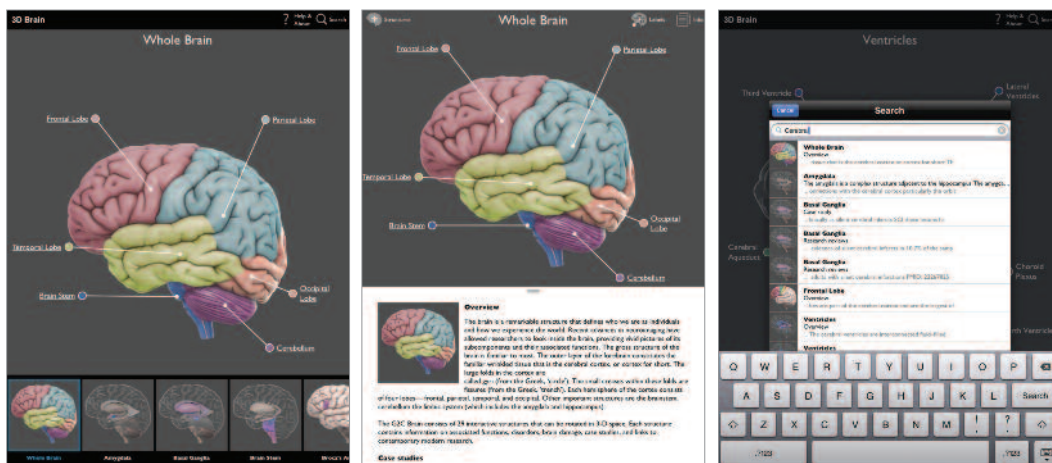
BioMedia Visitation and Projects

We had a record number of visitors to our suite of multimedia resources in 2013. *Google Analytics* counted 4,861,670 visits to 22 DNALC websites, our *YouTube* videos received 823,400 views, and the *3D Brain*, *Weed to Wonder*, and *Gene Screen* apps were downloaded 579,163 times. Therefore total website, *YouTube*, and smartphone/tablet apps visitation was 6.26 million, an 11% increase over 2012.

If you blinked or went to the kitchen, you may have missed it, but the DNALC's *3D Brain* app was featured in Apple ads that aired during the Academy Awards. Developed under a grant from the Dana Foundation, the Apple iOS app has been downloaded 1.6 million times and is one of the most highly rated education apps on iTunes.

Since its launch in 2009, *3D Brain* has proved to be one of the most successful resources we've ever produced. Adding Windows and Android to the iOS downloads, there have been 2.2 million downloads to date worldwide! Reviews show that the app is used primarily by teachers and students, as intended, but also by health professionals, patients, and the public: *"As a psych student this info is constantly brought up in lectures and tutorials—it's great [I can use] this without Internet access! Great on-hand app!"* and *"This is a fantastic app, possibly the best medical/anatomy app I have seen. As a nurse it has been very helpful for me when I work with patients with acquired brain injuries."*

In October we released an update for the iOS version of the *3D Brain* with current information for all 29 brain structures. The update was installed on 485,000 devices, showing that *3D Brain* was still being used by 29% of people who had downloaded it to an Apple device. We took the opportunity to offer users an "in-app" purchase of *3D Brain HQ*, which includes higher resolution images and a redesigned user interface for \$0.99. Despite an increasing percentage of free apps in app stores, at year's end we tallied a respectable 11,322 in-app purchases of the *HQ* version. Proceeds from in-app purchases support the educational programs of the DNALC.



In 2013 we moved into live streaming media and webinars to more fully utilize the DNALC's Laurie J. Landeau Multimedia Studio. We upgraded our capabilities with an all-in-one portable live production switcher, called the Livestream HD 500, which is built to television standards. This portable PC CPU/monitor enables real-time switching between multiple cameras (for example, between a wide shot and close-ups of laboratory bench techniques), the presenter's computer screen, a video clip, and graphics overlay titles. We can simultaneously stream and record high-definition video, whether in the studio or on the road. The streaming video is distributed to end users via a DNALC Adobe Connect "meeting room" for events with less than 50 participants, or the DNALC web page on the Livestream server for larger events. Adobe Connect features a customizable meeting space for document downloads and live chat. The recorded events are then posted to the relevant DNALC websites, Livestream page, and YouTube channel.

Our first live event was the *UBP Award Ceremony* on June 5th. The event included a keynote address, student presentations, and awards. On August 9th, we broadcast *"DNA for Short": The Story of a Most Important Discovery, A Conversation with Dr. James D. Watson*. Dr. Watson met with middle school students attending a *Fun with DNA* summer camp at the Dolan DNALC, and told them the story of the discovery of the structure of DNA. Campers' parents and invited

guests watched from the DNALC Multitorium, and 175 people viewed the event on Livestream.

In the fall we presented a series of 11 webinars. The inaugural webinar was follow-up to a high school human mitochondrial DNA laboratory Dave taught in the Faroe Islands, off the northwest coast of Denmark! He reminded 41 students of the theory behind the lab, then walked them through their results and analyses using the *BioServers* and *DNA Subway* websites. The next series of webinars were targeted at *iPlant* users and educators doing DNA barcoding, and included introductory tutorials as well as refresher courses in wet labs and bioinformatics, with 88 participants, many of them repeat attendees. In 2014 we will expand our webinars to include "virtual" follow-ups for field trips and summer camps.

To promote our expanding international programs, we also produced three videos in Chinese, summarizing the history of CSHL and the DNALC, our mission to be a pioneer in genetics education, and providing case studies of students from Beijing No. 166 High School attending summer workshops.



Top: James Watson and *Fun with DNA* campers pose following the *DNA for Short* live broadcast. Bottom: Jermel Watkins demonstrates the updated barcoding silica DNA isolation technique during an *iPlant* webinar. Chun-hua Yang (at right) is manning the close-up camera, and the Livestream HD 500 switcher is shown at left.

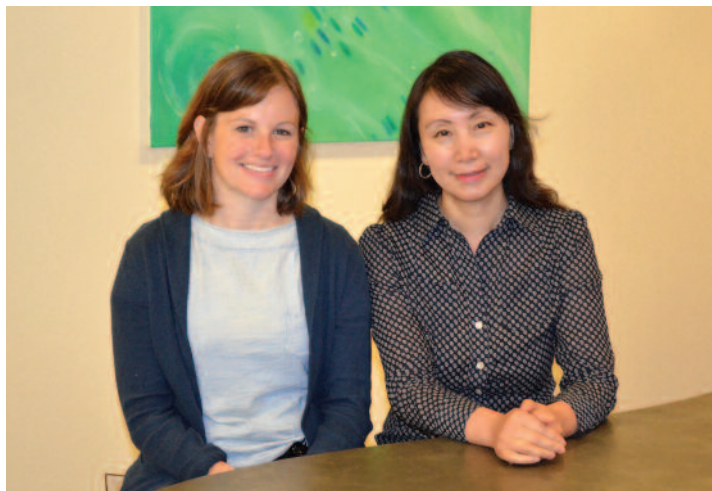
Staff and Interns

There were many staff changes in 2013. We are pleased to say that our staff family has grown and evolved but are also sad to see some of our colleagues move on to other opportunities.

Dr. Oscar Pineda-Catalan joined the DNALC in 2011 as *UBP* Manager, founding the competition. He also developed and taught innovative barcoding programs for both teachers and high school students at the DNALC and offsite. Oscar moved on in the spring, becoming Manager of the Science Research Mentoring Program at AMNH.

Oscar recommended his AMNH colleague, Dr. Antonia Florio, as his replacement, and she filled the role of Conservation Genetics instructor in March. Growing up, Antonia had two mantras: "animals are cool," and "being outside is fun," which spawned her love for biology and the natural world. She received her undergraduate degree at Macauley Honors College (CUNY City College), doing research in the Galapagos, French Guiana, and South Africa. She then completed her doctorate in comparative biology of Madagascan chameleon species at AMNH.

2013 new DNALC employees
Antonia Florio (left) and
Catherine Zhang.



Antonia manages and provides instruction for both NYC-based DNA barcoding projects (the *UBP* and *UBRP*), and assists with lab instruction at all three DNALC teaching facilities.

Cornel Ghiban, Computer Programmer, left in the spring to join Estée Lauder as a Perl programmer. Even before he was hired in 2006 and came to the US from Romania, he did contract work for us developing the “back end” of websites. While at the DNALC he developed and maintained the expanding suite of existing DNALC websites and applications and worked on *DNA Subway*. Cornel continues a working relationship with us on development of *DNA Subway*.

We also bid farewell to computer programmer, Sheldon McKay, who joined us in 2011, moving from *iPlant* in Tucson, Arizona. He developed and taught advanced-level bioinformatics and *iPlant* cyberinfrastructure, and managed EOT activities. Sheldon now works with former CSHL scientist Lincoln Stein for the Ontario Institute for Cancer Research, working with the Reactome database for metabolic pathways and biochemical reactions.

A new position was created for Dr. Xiaoqun Catherine Zhang as Manager of International Collaborations. After receiving her medical degree at Xian Medical University, China, in 1995, she received a Master of Science from Johns Hopkins University in Baltimore, majoring in biotechnology and bioinformatics. Prior to joining our team, Catherine was an oncology research associate in CSHL Professor Nicholas Tonks’ lab and helped organize the first two Beijing No. 166 High School summer camps in 2011 and 2012. Catherine develops collaborations with several groups in China and is also a high school instructor.

In the fall Tony Biondo, our Junior Programmer, moved on to law school at St. Johns University, NY. Tony assisted with the back end of many DNALC websites, and continues to help us occasionally with some projects. Also this year, one of our longest-serving interns, Christian Weidler, was promoted to Junior Designer in the *BioMedia* Group after receiving his Bachelor of Technology in Visual Communications from Farmingdale State College.

Since opening in 1988, we have successfully integrated high school and college interns into every aspect of our day-to-day operations. Over the course of a paid internship, students progress from preparing reagents for middle school labs, to preparing DNA samples for sequencing and maintaining a worldwide catalogue of orders for RNAi projects. In addition to prep work, interns may take on independent or team projects mentored by DNALC staff

members, which translate current research into classroom labs. The *BioMedia* department also welcomes interns for summer or longer-term roles. An internship offers students the unique opportunity to gain real laboratory or design experience in an educational environment. Former intern Sophie said, "*The skills I gained from working at the DNALC have definitely proved valuable in college.*" Joseph agreed, "*The Learning Center was an amazing opportunity for me to become familiar with a professional lab setting, and I really appreciated my time there.*"

Interns also conduct external research, such as the study of the environmental management of *Alliaria petiolata*, an invasive species of garlic mustard, conducted by Robert Scott (Sage College). Robert placed third in the New York State *Science & Engineering Intel Competition*. Brittany Coscio (St. Anthony's High School) completed research on the effect of multitasking on students' performance. Arielle Bryan (City College of NY) also completed an honors thesis analyzing the *Drosophila melanogaster* cactus protein via allele sequencing.

We gathered an amazing group of interns this year, and said farewell as others left for college:

Interns

*Joseph Babinski, Northeastern University, Chemical Engineering**
 Kayla Bianco, St. Anthony's High School
 Gabriella Blazich, Our Lady of Mercy High School
*Kalliopi Chatzis, New York Institute of Technology, Doctor of Osteopathy**
 Brittany Coscio, St. Anthony's High School
*Paul Donat, SUNY Geneseo, Biochemistry**
 Kenny Escobar, Freeport High School*
Nella Hauser, Stony Brook University, Biology
*Julie Hemphill, Penn State University, Neuroscience**
Ashleigh Jackobel, Farmingdale State College, Biosciences
 Jungseo (Joe) Kim, Locust Valley High School*
 Michaela Lee, Syosset High School
 William Manolarakis, Chaminade High School*
 Jack Manzi, Kings Park High School
 Anant Mehrotra, Oyster Bay High School
 Giovanni Sanchez, Jericho High School*
*Shenika Shah, Fordham University, Natural Sciences**
Katherine Villalon, John Jay College of Criminal Justice, Forensics
*Isabell Whiteley, *Boston University, Neuroscience*

Departing for College

Matt Angeliadis, University of Connecticut, Molecular & Cell Biology
 Katie Belissimo, College of New Jersey, Biology
 Anne Bode, Notre Dame University, Biological Sciences
 Arielle Bryan, City College of New York, Biology
 David Dopfel, Stony Brook University, Biomedical Engineering
 Magdalene Economou, Georgetown University, Biology
 Pauline McGlone, University of Delaware, Medical Diagnostics
 Sophie Podhurst, Northeastern University, Chemical Engineering
 Daliah Ross, New York University, Neuroscience
 Robert Scott, Sage College of Albany, Clinical Biology
 Sulaiman Usman, New York Institute of Technology, Life Sciences
 Lina Marie Varghese, Stony Brook University, Biology

* Summer only.

College students in italics.

2013 Workshops, Meetings, Collaborations, and Site Visits

January 4	Feinstein Institute, "DNA Learning Center" Presentation, Manhasset, New York
January 4–5	Godfrey Okoye University, "DNA Barcoding and <i>DNA Subway</i> " Workshop, Enugu, Nigeria
January 7–8	Lone Star College CyFair, "DNA Barcoding" Workshop, Kingwood, Texas
January 11	International Plant and Animal Genome XXI Conference 2013, pre-PAG Half-Day, NSF <i>iPlant Collaborative Tools & Services</i> Workshop, Town and Country Convention Center, San Diego, California
January 12	<i>Saturday DNA!</i> "Bad Cholesterol!," DNALC STEM Mentor Training, New York Academy of Sciences, New York, New York
January 19	The New York Academy of Sciences, <i>Fun with DNA</i> and <i>Enzyme Labs for Middle School Instruction</i> Workshops, Albany, New York
January 21	"DNA Learning Center" and "DNA Barcoding" Presentations, Singapore Science Center, Jurong East, Singapore
Jan 23–Feb 1	"Nobel Mindset Program" Workshop, National University of Malaysia, Kuala Lumpur, Malaysia
Jan 25–Feb 6	Visiting student internships, Beijing No. 166 High School, Beijing, China, DNALC
January 29	Site visit by John Ettinger and Betsy Fader, Helmsley Trust, New York, New York
February 1	Nassau County Science Supervisors Meeting, "DNALC Education Programs" Presentation, Nassau County BOCES, Garden City, New York
February 2	<i>Saturday DNA!</i> "CSI Chapters: The Science of Blood Spatter," DNALC <i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 7	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 13	<i>Urban Barcode Project</i> Open Lab, Brooklyn Technical High School, Brooklyn, New York
February 14	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 16	National Biotechnology Education Conference, DNA Barcoding and <i>DNA Subway</i> " Workshop, Santa Clara University, Santa Clara, California
February 19	Site visit by Sir William and Renice Castell, Wellcome Trust Sanger Institute, Hinxton, England
February 21	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 23	<i>Human Mitochondrial Sequencing</i> Workshop, Center for Work Education, City University of New York, New York, New York
February 26	Site visit by Jeanne Garbarino, The Rockefeller University, New York, New York
March 2	NSF ATE Professional Development <i>Genomic Approaches in Biosciences</i> Follow-up Workshop, Austin Community College, Austin, Texas <i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 4–12	Visiting student internship, Godfrey Okoye University, Enugu, Nigeria, DNALC
March 5	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 7	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 9	<i>Saturday DNA!</i> "Exploring Human Origins—What DNA Says About Our Ancestry," DNALC <i>Saturday DNA!</i> Third Grade Program, CSHL <i>Urban Barcode Project</i> Open Lab, Trinity School, New York, New York <i>Urban Barcode Project</i> Open Lab, The Chapin School, New York, New York
March 12	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 14	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 14–17	NSF <i>iPlant Collaborative Tools & Services</i> Workshop, Maize Genetics Conference, St. Charles, Illinois
March 19	<i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 21	<i>Great Moments in DNA Science</i> Honors Seminar, "Learning From Nature: Making Filters by Copying Nature's Nuclear Pore Complex," Jaclyn Novatt, CSHL, DNALC <i>Urban Barcode Project</i> Open Lab, <i>Harlem DNA Lab</i>
March 21–22	Wellcome Trust Sanger Institute, <i>DNA Barcoding and DNA Subway</i> Workshop, Hinxton, England
March 23	New York Public Library Youth STEM Fair, "Fruit Flies" Presentation Booth, Schomburg Center for Research in Black Culture, New York, New York
March 25–29	<i>DNA Science</i> Workshop, <i>Harlem DNA Lab</i>
March 29	Site visit by Dennis Walcott, New York City Department of Education, <i>Harlem DNA Lab</i>

April 4	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 6	North Carolina Academy of Science, University of North Carolina, "Engineering Society: The American Eugenics Movement" Seminar, Pembroke, North Carolina North Carolina Academy of Science, University of North Carolina, "iPlant Collaborative Project," Seminar, Pembroke, North Carolina <i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 8	National Association for Research in Science Teaching, "Bioinformatics Tools and Databases in the Biology Classroom" Seminar, Rio Grande, Puerto Rico
April 8–19	Visiting student internship, Godfrey Okoye University, Enugu, Nigeria, DNALC
April 9	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 10	Site visit by Noah Heller, Math for America, New York, New York, <i>Harlem DNA Lab</i>
April 11	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 16	Site visit by Lydia Begley, Nassau County BOCES, Garden City, New York <i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 18	<i>Great Moments in DNA Science Honors Seminar, "The Curious Case of Developmental Biology, Or: Why Do Organisms Always Become What They Are Supposed To?"</i> Aman Husbands, CSHL, DNALC <i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 19	"DNA Extraction" Workshop, STEM Careers EXPO Fair for English Language Learners, Armory on the Hudson, New York, New York
April 20	<i>Saturday DNA! "Mendel, Mendel, How Does Your Garden Grow?,"</i> DNALC Stony Brook Science and Arts EXPO, "Banana DNA Extraction," Stony Brook University, Stony Brook, New York
April 23	Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York
April 24	Site visit by Keith W. Jones, Brookhaven National Laboratory, Upton, New York
April 25	Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York "DNA Detectives" Course, Lehman College, New York, New York
April 26	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
April 27	NSF ATE <i>Genomic Approaches in Biosciences</i> Follow-up Workshop, Bluegrass Community and Technical College, Lexington, Kentucky NSF ATE, <i>Genomic Approaches in Biosciences</i> Follow-up Workshop, Southern Maine Community College, South Portland, Maine
April 30	<i>Great Moments in DNA Science Honors Seminar, "Learning to Smell Each Other?,"</i> Dennis Eckmeier, CSHL, DNALC Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York <i>DNA Detectives</i> Course, Lehman College, New York, New York
May 3	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
May 6	Site visit by Sherry Zhang, Medical College of Wisconsin, Milwaukee, Wisconsin
May 9	Site visit by Tatiana Nikolenko, Rusnano, Moscow, Russia
May 10	Site visit by Theodore Muth, Brooklyn College, Brooklyn, New York
May 11	<i>Saturday DNA! "DNA: Innocent or Guilty?,"</i> DNALC
May 13	Site visit by Marino Golinelli, Life Learning Center and Fondazione Marino Golinelli, Bologna, Italy
May 13–14	Site visit by delegation from University of Notre Dame, Notre Dame, Indiana
May 13–17	NSF ATE <i>Genomic Approaches in Biosciences</i> Workshop, Tulsa Community College, Tulsa, Oklahoma
May 16	Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York <i>DNA Detectives</i> Course, Lehman College, New York, New York
May 21	Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York <i>DNA Detectives</i> Course, Lehman College, New York, New York
May 23	Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York <i>DNA Detectives</i> Course, Lehman College, New York, New York
May 28	Pinkerton <i>DNA Barcoding</i> Course, American Museum of Natural History, New York, New York

- May 28 *DNA Detectives* Course, Lehman College, New York, New York
- May 29 *Urban Barcode Project* Symposium Poster Session, American Museum of Natural History, New York, New York
- May 30 Site visit by Alan Siegel, Thompson Family Foundation, Dallas, Texas
DNA Detectives Course, Lehman College, New York, New York
- June 2–3 World Science Festival Presentation, “Pocket Service: *Gene Screen* and *3D Brain*,” New York, New York
- June 4 Bio-Link Summer Fellows Forum, University of California, Berkeley, “DNA Barcoding in the Classroom,” Berkeley, California
Site visit by Christian Anieke, Christian Okeke, Obiora Ike, Godfrey Okoye University, Enugu, Nigeria
- June 5 *DNA Detectives* Course, Lehman College, New York, New York
Urban Barcode Project Symposium Awards Ceremony, American Museum of Natural History, New York, New York
- June 6 *DNA Detectives* Course, Lehman College, New York, New York
- June 8 *Saturday DNA!* “The Mystery of Anastasia,” DNALC
- June 10 Site visit by David Heller, Allan Morrison, Phil Ferralli, and Beth Paine, Carolina Biological Supply Company, Burlington, North Carolina
- June 10–14 *Fun with DNA* Workshop, Convent of the Sacred Heart, Greenwich, Connecticut
Forensics Workshop, Convent of the Sacred Heart, Greenwich, Connecticut
- June 11 Site visit by Allan Dobrin, Gillian Small, Iris Weinsall, and Alexandra Logue, City University of New York, New York, New York
20th Annual Golf Outing, Piping Rock Club, Locust Valley, New York
- June 17–21 *Fun with DNA* Workshop, Roxbury Latin School, Boston, Massachusetts
NSF ATE *Genomic Approaches in Biosciences* Supplemental Workshop, Madison Area Technical College, Madison, Wisconsin
- June 19–25 *Fun with DNA* Workshop, The Chapin School, New York, New York
- June 21 Site visit by Harriett Copel, Long Island Matrix of Science and Technology, Upton, New York; Ken White, Brookhaven National Laboratory, Upton, New York; Tom Rogers and Lydia Begley, Nassau BOCES; and Scott and Leena Doshi, Doshi Family Foundation
- June 24–28 *World of Enzymes* Workshop, Roxbury Latin School, Boston, Massachusetts
Pinkerton Conservation Genetics Workshop, *Harlem DNA Lab*
DNA Science Workshop, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
Fun with DNA Workshop, DNA Learning Center West
- June 26–July 2 *World of Enzymes* Workshop, The Chapin School, New York, New York
- July 1–5 *DNA Barcoding Research* Workshop, DNALC
Forensic Detectives Workshop, DNALC
World of Enzymes Workshop, DNALC
World of Enzymes Workshop, DNA Learning Center West
- July 8–12 NSF ATE *Genomic Approaches in Biosciences* Workshop, City College of San Francisco, San Francisco, California
Forensics Workshop, Roxbury Latin School, Boston, Massachusetts
Forensics Workshop, The Chapin School, New York, New York
DNA Barcoding Research Workshop, DNALC
DNA Science Workshop, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
DNA Science Workshop, DNA Learning Center West
- July 9 Advanced Placement Biology Institute, Rice University, “Human Evolution and Population Genetics” Workshop, Houston, Texas
- July 15–19 *BioCoding* Workshop, DNALC
Fun with DNA Workshop, DNALC
Silencing Genomes Workshop, DNALC
World of Enzymes Workshop, DNALC

- July 16 Advanced Placement Biology Institute, "Human Evolution and Population Genetics" Workshop, West Lake High School, Denver, Colorado
Green Genes Workshop, DNA Learning Center West
- July 20–24 American Association of Plant Biologists, Plant Biology 2013, "*iPlant Collaborative: A Unified Cyberinfrastructure for a Unified Research Paradigm*" Seminar, Providence, Rhode Island
- July 22–26 Pinkerton *DNA Barcoding* Workshop, *Harlem DNA Lab*
DNA Barcoding Workshop, The Rockefeller University, New York, New York
DNA Science Workshop, DNALC
Forensic Detectives Workshop, DNALC
Green Genes Workshop, DNALC
Fun with DNA Workshop, DNA Learning Center West
Fun with DNA Workshop, New World Preparatory School, Staten Island, New York
- July 28 Botanical Society of America, Botany 2013, *Genomics in Education* Workshop and NSF *iPlant Collaborative Tools & Services* Workshop, New Orleans, Louisiana
- July 29–Aug. 2 *Backyard Barcoding* Workshop, DNALC
Fun with DNA Workshop, DNALC
World of Enzymes, DNALC
DNA Science Workshop, DNA Learning Center West
- August 5–9 Pinkerton *Conservation Genetics and DNA Barcoding* Workshops, *Harlem DNA Lab*
DNA Science Workshop, DNALC
Forensic Detectives Workshop, DNALC
Fun with DNA Workshop, DNALC
DNA Science Workshop, Stony Brook University, Stony Brook, New York
NSF ATE *Genomic Approaches in Biosciences* Workshop, Minneapolis Community and Technical College, Minneapolis, Minnesota
- August 12–16 *Backyard Barcoding* Workshop, DNALC
DNA Science Workshop, DNALC
World of Enzymes Workshop, DNALC
Genome Science Workshop, DNA Learning Center West
DNA Science Workshop, *Harlem DNA Lab*
Fun with DNA Workshop, Brookhaven National Laboratory, Upton, New York
NSF ATE *Genomic Approaches in Biosciences* Workshop, Seminole State College, Sanford, Florida
- August 16 Pinkerton *Urban Barcode Project Grant Writing* Workshop, *Harlem DNA Lab*
- August 19–23 *Fun with DNA* Workshop, DNALC
Genome Science Workshop, DNALC
Green Genes Workshop, DNALC
Silencing Genomes Workshop, DNALC
World of Enzymes Workshop, DNA Learning Center West
World of Enzymes Workshop, Brookhaven National Laboratory, Upton, New York
- August 19–23 NSF ATE *Genomic Approaches in Biosciences* Workshop, Nassau Community College, Garden City, New York
- August 26–30 *Backyard Barcoding* Workshop, DNALC
DNA Science Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
Forensic Detectives Workshop, DNA Learning Center West
- August 26 Pinkerton *Urban Barcode Project Grant Writing* Workshop, *Harlem DNA Lab*
- August 27 National University of Malaysia Delegation, "DNA Barcoding: DNA Isolation and PCR" Workshop, DNALC
- August 30 National University of Malaysia Delegation, "DNA Barcoding and Bioinformatics" Workshop, New York Academy of Sciences, New York, New York
- Sept 17–20 NSF *iPlant Collaborative Professional Development Tools & Services* Workshop, "Data Mining with *iPlant*," University of Warwick, Coventry, England
- September 18 FarGen Summit, "Human DNA Polymorphisms" Workshop, Torshavn, Faroe Islands, Denmark
- September 20 FarGen Summit, "Coming Into the Genome Age: The FarGen Exploration," Torshavn, Faroe

	Islands, Denmark
Sept 23–24	NSF <i>iPlant Collaborative Tools & Services</i> Workshop, Texas A&M University, College Station, Texas
Sept 26–27	NSF <i>iPlant Collaborative Genomics in Education</i> Workshop, Prairie View Texas A&M University, Prairie View, Texas
October 1	FarGen Summit “Human DNA Polymorphisms” Follow-up Webinar, DNALC
October 3	NSF <i>iPlant Collaborative Tools & Services</i> Workshop, New York Botanical Garden, Bronx, New York
October 3–4	Site visit by Stanley Xu and Lin Xu, Taurus Education, Shanghai, China
October 11	NSF <i>iPlant Collaborative</i> Webinar co-taught with Carol Lushbough from University of South Dakota, “RNA-Seq & BioExtract,” DNALC
Oct 16, 17, 18	NSF <i>iPlant Collaborative</i> “Reconnecting with iPlant” Webinar Series, DNALC
October 19	<i>Saturday DNA!</i> “Glowing Genes,” DNALC Ant Collection Workshop, Pleasantville Community Garden, East Harlem, New York
October 21	Site visit by Bruno Strasser, University of Geneva, Geneva, Switzerland
October 22	Site visit by Vicky Han, China Service Center for Educational Exchange, Beijing, China
Oct 23, 24, 25	NSF <i>iPlant Collaborative</i> , “Introduction to <i>iPlant</i> ” Webinar Series, DNALC
Oct 28–29	NSF <i>iPlant Collaborative</i> Professional Development <i>Tools & Services</i> Workshop, Colorado State University, Fort Collins, Colorado
Oct 28, 29, 30	NSF <i>iPlant Collaborative</i> “DNA Barcoding for Educators” Webinar Series, DNALC
October 29	Site visit by Sean B. Carroll, Howard Hughes Medical Institute, Chevy Chase, Maryland
November 2	<i>Urban Barcode Project</i> Teacher Training, <i>Harlem DNA Lab</i>
November 4–5	Site visit by Brent Buckner, Truman State University, Kirksville, Missouri
November 8	Site visit by Regeneron Pharmaceuticals, Tarrytown, New York and Laura Woznitski, BioMed Realty, San Diego, California
November 9	<i>Saturday DNA!</i> “Botanical Barcoding,” DNALC
November 12	“What DNA Says About Our Human Family” Seminar, Beijing No. 166 High School, Beijing, China
November 12–14	“Human DNA Polymorphisms, Evolution, and Population Genetics” Workshop, Beijing No. 166 High School, Beijing, China
November 20–23	National Association of Biology Teachers 2013 Professional Development Conference: “Detecting Epigenetic DNA Methylation in <i>Arabidopsis thaliana</i> ,” “What’s in My Sushi? Unlocking the Power of DNA Barcoding,” “DNA Subway: Cutting-edge Bioinformatics for the Classroom,” “Genome Science: Biology in the Post-Genome Age,” “DNA Barcoding: Independent Research in the Classroom,” Atlanta, Georgia
December 4	NSF <i>iPlant Collaborative Tools & Services</i> Workshop, Cold Spring Harbor Laboratory, Cold Spring Harbor, New York NSF <i>iPlant Collaborative</i> Seminar, “A Unified Cyberinfrastructure for Plant Science,” Cold Spring Harbor Laboratory, Cold Spring Harbor, New York
December 7	<i>Saturday DNA!</i> “Dust Away Crime: The Truth About Fingerprints,” DNALC
December 18	Site visit by Noah Fuller, New York University, New York, New York

Sites of Major Faculty Workshops 1985–2013

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

ALABAMA	University of Alabama, Tuscaloosa	1987–90
ALASKA	University of Alaska, Anchorage	2012
	University of Alaska, Fairbanks	1996
ARIZONA	Arizona State University, Tempe	2009
	Tuba City High School	1988
	University of Arizona, Tucson	2011
	United States Department of Agriculture, Maricopa	2012
ARKANSAS	Henderson State University, Arkadelphia	1992
	University of Arkansas, Little Rock	2012
CALIFORNIA	California State University, Dominguez Hills	2009
	California State University, Fullerton	2000
	California Institute of Technology, Pasadena	2007
	Canada College, Redwood City	1997
	City College of San Francisco	2006
	City College of San Francisco	2011, 2013
	Contra Costa County Office of Education, Pleasant Hill	2002, 2009
	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
	Oxnard Community College, Oxnard	2009
	Pasadena City College	2010
	Pierce College, Los Angeles	1998
	Salk Institute for Biological Studies, La Jolla	2001, 2008
	San Francisco State University	1991
	San Diego State University	2012
	San Jose State University	2005
	Santa Clara University	2010
	Stanford University, Palo Alto	2012
	University of California, Berkeley	2010, 2012
	University of California, Davis	1986
	University of California, Davis	2012
	University of California, Northridge	1993
	University of California, Riverside	2011
	University of California, Riverside	2012
COLORADO	Aspen Science Center	2006
	Colorado College, Colorado Springs	1994, 2007
	Colorado State University, Fort Collins	2013
	United States Air Force Academy, Colorado Springs	1995
	University of Colorado, Denver	1998, 2009–10
CONNECTICUT	Choate Rosemary Hall, Wallingford	1987
DISTRICT OF COLUMBIA	Howard University, Washington	1992, 1996, 2009–10
FLORIDA	Armwood Senior High School, Tampa	1991
	Florida Agricultural & Mechanical University, Tallahassee	2007–08
	Florida Agricultural & Mechanical University, Tallahassee	2011
	North Miami Beach Senior High School	1991
	Seminole State College, Sanford	2013
	University of Miami School of Medicine	2000
	University of Western Florida, Pensacola	1991

GEORGIA	Fernbank Science Center, Atlanta	1989, 2007	
	Gwinnett Technical College, Lawrenceville	2011, 2012	
	Morehouse College, Atlanta	1991, 1996–97	
HAWAII	Spelman College, Atlanta	2010	
	Kamehameha Secondary School, Honolulu	1990	
ILLINOIS	University of Hawaii at Manoa	2012	
	Argonne National Laboratory	1986–87	
	iBIO Institute/Harold Washington College, Chicago	2010	
	Illinois Institute of Technology, Chicago	2009	
INDIANA	University of Chicago	1992, 1997, 2010	
	Butler University, Indianapolis	1987	
IDAHO	Purdue University, West Lafayette	2012	
IOWA	University of Idaho, Moscow	1994	
KANSAS	Drake University, Des Moines	1987	
KENTUCKY	University of Kansas, Lawrence	1995	
	Bluegrass Community & Technical College, Lexington	2012–13	
	Murray State University	1988	
	University of Kentucky, Lexington	1992	
	Western Kentucky University, Bowling Green	1992	
LOUISIANA	Bossier Parish Community College	2009	
	Jefferson Parish Public Schools, Harvey	1990	
	John McDonogh High School, New Orleans	1993	
	Southern University at New Orleans	2012	
MAINE	Bates College, Lewiston	1995	
	Southern Maine Community College	2012–13	
MARYLAND	Foundation for Blood Research, Scarborough	2002	
	Annapolis Senior High School	1989	
	Bowie State University	2011	
	Frederick Cancer Research Center	1995	
	McDonogh School, Baltimore	1988	
	Montgomery County Public Schools	1990–92	
	National Center for Biotechnology Information, Bethesda	2002	
	<i>St. John's College, Annapolis</i>	1991	
	University of Maryland, School of Medicine, Baltimore	1999	
	Arnold Arboretum of Harvard University, Roslindale	2011	
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
		Schoolcraft College, Livonia	2012
MINNESOTA	Minneapolis Community and Technical College	2009	
	Minneapolis Community and Technical College, Madison	2013	
	University of Minnesota, St. Paul	2005	
	University of Minnesota, St. Paul	2010	
MISSISSIPPI	Mississippi School for Math & Science, Columbus	1990–91	
	Rust College, Holly Springs	2006–08, 2010	
MISSOURI	St. Louis Science Center	2008–10	
	Stowers Institute for Medical Research, Kansas City	2002, 2008	
	University of Missouri, Columbia	2012	

	Washington University, St. Louis	1989, 1997, 2011
MONTANA	Montana State University, Bozeman	2012
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	1986–87
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, New York	2007
	Bronx High School of Science	1987
	Canisius College, Buffalo	2007
	Canisius College, Buffalo	2011
	City College of New York	2012
	Cold Spring Harbor High School	1985, 1987
	Columbia University, New York	1993
	Cornell University, Ithaca	2005
	<i>DeWitt Middle School, Ithaca</i>	1991, 1993
	Dolan DNA Learning Center	1988–95, 2001–04, 2006–09
	Dolan DNA Learning Center	1990, 1992, 1995, 2000–11
	<i>Dolan DNA Learning Center</i>	1990–92
	DNA Learning Center West	2005
	<i>Fostertown School, Newburgh</i>	1991
	<i>Harlem DNA Lab, East Harlem</i>	2008–09, 2011–13
	Huntington High School	1986
	Irvington High School	1986
	John Jay College of Criminal Justice	2009
	<i>Junior High School 263, Brooklyn</i>	1991
	<i>Lindenhurst Junior High School</i>	1991
	Mount Sinai School of Medicine, New York	1997
	Nassau Community College, Garden City	2013
	New York Botanical Garden, Bronx	2013
	New York City Department of Education	2007, 2012
	New York Institute of Technology, New York	2006
	New York Institute of Technology, New York	2006
	<i>Orchard Park Junior High School</i>	1991
	<i>Plainview-Old Bethpage Middle School</i>	1991
	State University of New York, Purchase	1989
State University of New York, Stony Brook	1987–90	
Stuyvesant High School, New York	1998–99	
The Rockefeller University, New York	2003	
The Rockefeller University, New York	2010	
<i>Titusville Middle School, Poughkeepsie</i>	1991, 1993	
Trudeau Institute, Saranac Lake	2001	
Union College, Schenectady	2004	
United States Military Academy, West Point	1996	
Wheatley School, Old Westbury	1985	
NORTH CAROLINA	CIIT Center for Health Research, Triangle Park	2003
	North Carolina Agricultural & Technical State University, Greensboro	2006–7, 2009–11
	North Carolina School of Science, Durham	1987
	North Carolina State University, Raleigh	2012
NORTH DAKOTA	North Dakota State University, Fargo	2012
OHIO	Case Western Reserve University, Cleveland	1990

	Cleveland Clinic	1987
	Langston University, Langston	2008
	North Westerville High School	1990
OKLAHOMA	Oklahoma City Community College	2000
	Oklahoma City Community College	2006–07, 2010
	Oklahoma Medical Research Foundation, Oklahoma City	2001
	Oklahoma School of Science and Math, Oklahoma City	1994
	Tulsa Community College	2009
	Tulsa Community College	2012–13
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	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	2007–09, 2013
	Austin Community College – Round Rock Campus	2012
	Houston Community College Northwest	2009–10
	J.J. Pearce High School, Richardson	1990
	Langham Creek High School, Houston	1991
	University of Lone Star College, Kingwood	2011
	Midland College	2008
	Southwest Foundation for Biomedical Research, San Antonio	2002
	Taft High School, San Antonio	1991
	Texas A & M University, AG Research and Extension Center, Weslaco	2007
	Texas A & M University, College Station, TX	2013
	Prairie View A & M University, Prairie View, TX	2013
	Trinity University, San Antonio	1994
	University of Texas, Austin	1999, 2004, 2010, 2012
	University of Texas, Brownsville	2010
UTAH	Brigham Young University, Provo	2012
	University of Utah, 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
	Virginia Polytechnic Institute and State University, Blacksburg	2005, 2008–09
WASHINGTON	Fred Hutchinson Cancer Research Center, Seattle	1999, 2001, 2008
	Shoreline Community College	2011, 2012
	University of Washington, Seattle	1993, 1998, 2010
WEST VIRGINIA	Bethany College	1989
WISCONSIN	Blood Center of Southeastern Wisconsin, Milwaukee	2003
	Madison Area Technical College	1999, 2009, 2011–13
	Marquette University, Milwaukee	1986–87
	University of Wisconsin, Madison	1988–89
	University of Wisconsin, Madison	2004, 2012
WYOMING	University of Wyoming, Laramie	1991

PUERTO RICO	Universidad del Turabo, Gurabo, Puerto Rico	2011, 2012
	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Rio Piedras	1993
	University of Puerto Rico, Rio Piedras	1994
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AFRICA	Godfrye Okoye University, Enugu, Nigeria	2013
AUSTRALIA	Walter and Eliza Hall Institute and University of Melbourne	1996
AUSTRIA	Vienna Open Lab	2007, 2012
CANADA	Red River Community College, Winnipeg, Manitoba	1989
CHINA	Beijing No. 166 High School, Beijing	2013
	Ho Yu College, Hong Kong	2009
DENMARK	Faroe Genome Project, Torshavn, Faroe Islands	2013
GERMANY	Urania Science Center, Berlin	2008
ITALY	International Institute of Genetics and Biophysics, Naples	1996
	Porto Conte Research and Training Laboratories, Alghero	1993
MEXICO	ASPB Plant Biology, Merida	2008
PANAMA	University of Panama, Panama City	1994
RUSSIA	Shemyakin Institute of Bioorganic Chemistry, Moscow	1991
SINGAPORE	National Institute of Education	2001–05
	Singapore Science Center	2013
SWEDEN	Kristineberg Marine Research Station, Fiskebackskil	1995
	Uppsala University	2000
THE NETHERLANDS	International Chromosome Conference, Amsterdam	2007
UNITED KINGDOM	Wellcome Trust Conference Center, Hinxton, UK	2012–13
	University of Warwick, Coventry	2013

2013 Grants and Funding

Grantor	Program	Duration of Grant	2013 Funding⁺
FEDERAL GRANTS			
National Institutes of Health, University of California, Berkeley	Enhancing the GMOD Suite of Genome Annotation and Visualization Tools	6/12–5/14	39,330
National Science Foundation, North Carolina State University	GEPR: Epigenome Dynamics During DNA Replication	3/11–2/13	7,617
National Science Foundation, University of Arizona	Educational Outreach for <i>iPlant Collaborative: A Cyberinfrastructure for Plant Sciences</i>	2/08–7/13	397,011
National Science Foundation, University of Arizona	<i>iPlant Collaborative: Cyberinfrastructure for Plant Sciences</i>	9/13–8/18	363,220
National Science Foundation	Infrastructure and Training for Next-Generation Sequence (NGS) Analysis in Undergraduate Education	9/13–8/16	13,752
National Science Foundation	Advanced Technology Education (ATE) Program: <i>Genomic Approaches in BioSciences</i>	4/11–3/14	255,955
NON-FEDERAL GRANTS			
The Pinkerton Foundation	<i>Urban Barcode Research Program</i>	1/13–12/14	112,315
ENDOWMENT FUNDS			
Alfred P. Sloan Foundation	<i>DNA Center NYC</i> Start-up	12/13–11/16	3,000,000
Thompson Family Foundation	<i>DNA Center NYC</i> Capital Campaign	12/13–12/15	10,000,000

+ Includes direct and indirect costs.

PROGRAM MEMBERSHIP

The following schools and school districts each contributed \$1,000 or more for participation in the *Curriculum Study* program:

Bellmore-Merrick Central High School District	1,500	Massapequa Union Free School District	1,500
East Meadow Union Free School District	1,500	North Shore Central School District	3,000
Elwood Union Free School District	1,500	North Shore Hebrew Academy	3,000
Fordham Preparatory School	1,500	Oceanside Union Free School District	1,500
Garden City Union Free School District	1,500	Oyster Bay-East Norwich Central School District	3,000
Great Neck Union Free School District	1,500	Plainedge Union Free School District	1,500
Green Vale School	3,000	Plainview-Old Bethpage Central School District	1,500
Half Hollow Schools Central School District	1,500	Portledge School	1,500
Harborfields Central School District	1,500	Port Washington Union Free School District	1,500
Herricks Union Free School District	1,500	Ramaz Upper School	1,500
Huntington Union Free School District	1,500	Roslyn Union Free School District	3,000
Island Trees Union Free School District	1,500	Syosset Central School District	3,000
Jericho Union Free School District	1,500	West Hempstead Union Free School District	3,000
Levittown Union Free School District	1,500	Yeshiva University High School for Girls	1,500
Locust Valley Central School District	1,500		

The following schools and school districts each contributed \$1,000 or more for participation in the *Genetics as a Model for Whole Learning* program:

Alpine Public Schools, NJ	1,300	JHS 226, Queens	1,193
Bellmore Union Free School District	2,400	Lawrence UFSD	11,100
Bellmore-Merrick Union Free School District	9,875	Locust Valley Central School District	11,841
Bethpage Union Free School District	2,500	Merrick Union Free School District	3,400
Cold Spring Harbor Central School District	14,400	M.S. 447, Brooklyn	1,450
Commack Union Free School District	6,100	North Bellmore Union Free School District	1,900
East Meadow Union Free School District	4,012	North Shore Central School District	1,750
East Williston Union Free School District	2,900	North Shore Hebrew Academy	1,050
Elwood Union Free School District	3,375	Oceanside Union Free School District	1,625
Floral Park - Bellerose Union Free School District	7,800	Oyster Bay-East Norwich Central School District	2,575
Friends Academy	3,300	Passaic Charter School, NJ	1,300
Friends Seminary of New York	1,078	Port Washington Union Free School District	5,500
Garden City Union Free School District	10,355	Rockville Centre Union Free School District	6,240
Great Neck Union Free School District	10,150	Roslyn Union Free School District	3,675
Half Hollow Hills Union Free School District	16,450	Saint Dominic Elementary School	4,550
Hebrew Academy of Nassau County	1,700	Scarsdale Union Free School District	12,600
Herricks Union Free School District	2,975	Smithtown Union Free School District	1,680
Hofstra STEP	1,050	Syosset Union Free School District	38,800
Holy Child Academy	3,200	Three Village Central School District	6,300
Huntington Union Free School District	11,600	Trinity School	2,400
Jericho Union Free School District	7,950	Yeshiva Darchei Torah	2,760

DNA LEARNING CENTER

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