



Cold Spring Harbor Laboratory
DNA LEARNING CENTER



**2018
ANNUAL
REPORT**

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.

Executive Director's Report

ADMINISTRATION

Lindsay Barone
Lauren Corrieri
Mary Lamont
Valerie Meszaros
David Micklos
Collette Riccardi

INSTRUCTION

Megan Capobianco
Elna Carrasco
Heather Cosel-Pieper
Alison Cucco
Cristina
Fernandez-Marco
Melissa Lee
Christine Marizzi
Allison Mayle

Amanda McBrien
Pauline McGlone
Erin McKechnie
Bruce Nash
Michael Okoro
Michael Paul
Sharon Pepenella
Xiaoqun Catherine
Zhang

BIOMEDIA

Cornel Ghiban
Susan Lauter
Jason Williams
Chun-hua Yang

Our education projects in Beijing and Suzhou, China, have matured to the point that they are now at the leading edge of biology lab instruction at the high school level.

Secondary education in China is ruled by the omnipresent Gaokao, an extremely high-stakes exam taken in the 12th grade that determines a student's college placement. The rote memorization of facts required by this exam has made science labs a luxury throughout China



Top: Dave with Principal Wang Lei at Beijing 166. Bottom: Visiting Beijing students during the *Forensic Detectives* summer camp.

and relegated what little practical work is done to after-school clubs. This was the case when, in 2011, we began working with Beijing 166 School, a large public school located within a mile of the Forbidden City and Tiananmen Square in the central district of Dongcheng. With training in biology, Principal Wang Lei was determined to live up to Beijing 166's new designation the city's only "beacon" school in biology. She began by sending students for three weeks of summer workshops at the DNALC.

In 2014, we established a licensed DNALC at Beijing 166 with continuing grants from the Dongcheng Education Commission. The year-round licensed program now provides training for 275 students and 40 teachers per year: 1) Two-week winter workshops for students on DNA science and DNA barcoding, conducted at the DNALC; 2) Two-day spring workshops on human genetics and barcoding projects for students and teachers, at Beijing 166; 3) Three-week summer workshops on genetics, cloning, and forensic biology for students, at the DNALC; and 4) Two-day fall workshops on genome science for students and teachers at Beijing 166. In 2018, Beijing 166 also fulfilled its role as a beacon school by providing hands-on training for 63 teachers and webinar training for several thousand teachers from around China.

We are now seeing encouraging results from this long-term collaboration, with more than 900 students currently taking required biology courses into which

DNALC labs have been integrated. In addition, like the best high schools in the US, Beijing 166 now offers a research course in DNA barcoding. With 20 students, this class meets two hours per week during the regular school day. This is to our knowledge the first elective lab science course in any high school in China.



The research course is complemented by *Barcode Beijing*, which is modeled after our *Urban Barcode Project* and is beginning to draw participants from around Beijing. Students have published 23 sequences in GenBank, the authoritative international database of DNA sequences. One Beijing 166 research team won first prize in the *Deng Feng Cup National High School Science and Technology Innovation Competition*, which is considered the most prestigious

STEM award in China. Another BJ 166 team won second place in the *Beijing Youth Science and Technology Innovation Competition*—Guo Li won the Intel Young Talent award, and Xiaoqiu An won the *Future Little Scientist* title.

Established in 2016 at the Suzhou Industrial Park (SIP), *Cold Spring Harbor Asia (CSHA) DNALC* is now delivering quality education programs. Under the leadership of American scientist Jessica Talamas, 31 lab field trips, six summer camps, and two semester-long projects were completely translated for delivery in Chinese. In the past year, over 8,500 people participated in science fairs and events at the DNALC; 2,683 students participated in lab field trips, and 221 students participated in week-long summer and winter camps.

During the year, *CSHA DNALC* assumed an important role in reforming the Gaokao curriculum. Jiangsu Province—which includes Suzhou, Shanghai, and Nanjing—has the authority to administer its own Gaokao exam. This year the provincial government created a new biology major—counting 100 of 700 Gaokao points—to emphasize the importance of biotechnology in the Jiangsu economy. The DNALC collaborated with the SIP Bureau of Education and SIP Teacher Development Center to develop a set of molecular genetics labs to accompany the Gaokao. This is analogous to when the CSHL DNALC led in the incorporation of molecular genetics labs into Advanced Placement Biology, which catalyzed biotech lab teaching in the US.

During the fall semester, an experiment was conducted at Soochow University High School: 100 students took the traditional curriculum, and 100 students took the integrated lab curriculum along with an intensive DNALC camp. Comparing pre- and post-scores on questions from previous Gaokao exams, students in experimental classes raised their scores 15% higher than students in the traditional classes. This is especially significant because most Chinese believe that time away from rote drilling will actually decrease performance.



Above: *CSHA DNALC* Education Director Jessica Talamas, Ph.D.
Right: Teacher training at *CSHA DNALC*.



The sorts of classroom experiments being done at Beijing 166 and Soochow University High School have been absent from Chinese secondary education to date. We are beginning to see some data that show doing DNA labs can actually improve student Gaokao results, perhaps even beyond biology. The average Gaokao score of the Beijing 166 Life Science class, which receives intensive exposure to hands-on instruction, has increased in each of the last three years.

During the year, we also continued negotiations with officials in Guangzhou to develop a branded DNALC. Guangzhou, formerly known as Canton, is the capital of Guangdong Province, which has the fifth largest gross domestic product in the world. The Guangzhou center would be a hybrid of current Chinese licenses—located at a secondary school and serving local students, like Beijing 166, and providing field trips and summer camps for students throughout Guangdong Province, similar to *CSHA DNALC*.

DNA Barcoding and Metabarcoding

The DNALC administers three distinct programs for using DNA barcoding in high school research. *Barcode Long Island (BLI)*, funded by the National Institutes of Health (NIH) Science Education Partnership Award (SEPA), involves students in “campaigns” to compare biodiversity across Long Island. The *Urban Barcode Project (UBP)*, funded by the Thompson Family Foundation, and *Urban Barcode Research Program (UBRP)*, funded by matching grants from the Pinkerton Foundation and Simons Foundation, involve students in independent research of biodiversity in New York City (NYC). *BLI* and *UBP* students are mentored by classroom science teachers, while *UBRP* students are mentored by scientists from NYC research institutions.

We continued to move students into the realm of “big data” by expanding our microbiome and environmental DNA (eDNA) efforts. Building off of our NIH Big Data to Knowledge supplement efforts to adapt microbiome research for high school students, we started supporting fish eDNA experiments through a one-year grant from the Lounsbery Foundation. In this pilot project, seven mentors worked with 11 teams to analyze fish diversity in the Hudson and East Rivers, eDNA degradation rates in response to increased levels of salinity, and effects of shoreline habitat, oyster beds, or eelgrass density on fish biodiversity. Like microbiome analyses, fish eDNA uses next-generation sequencing (NGS) to analyze thousands of DNA sequences representing the biodiversity in an environmental sample. DNA isolated from water is amplified by PCR to a variable region, and NGS reads identify the variety and abundance of microbial species from different locations.

For both eDNA and microbiome research, we are working to optimize and reduce the cost of DNA isolation, amplicon indexing, and sequencing library cleanup. An important component of these efforts is reducing the cost of indexing. Millions of metabarcoding sequences from hundreds of student samples can be sequenced together in one NGS run, theoretically making this research scalable and affordable. This kind of multiplex sequencing is made possible by attaching unique “index” sequences to the DNA in each sample, and allows all of the DNA sequences to be assigned to samples. We are developing an inexpensive quadruple index system that builds indexes into PCR primers in a two-step process, aiming to reduce the total cost of microbiome sequencing from about \$50 to \$10-15 per sample.

In our previous microbiome workflow, students struggled to complete analyses. To make analysis more accessible, we developed a new Purple Line of *DNA Subway*, our online bioinformatics platform developed through CyVerse. The Purple Line is a very approachable, browser-based graphical user interface for QIIME2, a microbiome analysis workflow. Data can be uploaded to CyVerse and analyzed using this web-based implementation. Importantly, the Purple Line has been modified to handle marine vertebrate eDNA, expanding the “traditional” use of QIIME2 and letting us support students who want to study microbes or fish.



Nineteen Long Island teachers attended a week-long workshop in July to be trained to lead student teams conducting metabarcoding projects.



During the summer, 19 *BLI* faculty mentors received training in metabarcoding research, covering project design and sample collection, biochemistry, and data analysis. As the year ends, twelve teams participating in *BLI* are working on metabarcoding projects, including microbiome (four teams, nine students) and eDNA (eight teams, 21 students) research, while two teams with six students are continuing work on eDNA research in New Jersey, extending their efforts as part of the Lounsbery grant, which ended in September.

The 2018 *BLI* program included 382 students doing traditional DNA barcoding and microbiome projects. *BLI* teams represented 39 public and private high schools from Suffolk, Nassau, Kings, and Queens Counties; 13% of participants were African American or Latino. To complete their research in time for the annual research symposium, 151 students from 55 teams attended 15 open lab sessions held at the Dolan DNALC, DNALC *West*, Stony Brook University (SBU), or Brookhaven National Laboratory (BNL), while 187 students from 64 teams borrowed equipment footlockers for use at school. Teams processed over 1,200 samples, resulting in over 1,900 sequencing reads. Students published 285 sequences in GenBank, including 30 novel barcode sequences and 52 with sequence polymorphisms.

One-hundred and nine DNA barcoding and microbiome projects were presented at the annual *BLI* research symposium on June 5, 2018, at CSHL and included biodiversity studies of plants, invertebrates, fungi, algae, and lichens, plus microbiome studies of water, soil, invertebrates, plants, and vectors for disease. Dr. George Amato of the Sackler Institute for Comparative Genomics at the American Museum of Natural History gave the keynote address on interesting applications of DNA barcoding. *BLI* students received a number of awards, including top honors at the Long Island Science and Engineering Fair (LISEF) and the Long Island Science Congress (LISC), in addition to awards at numerous other competitions. Two teams from William Floyd High School have accepted manuscripts in the *Journal of Emerging Investigators* (JEI) on their microbiome project data; a third team has a manuscript in preparation. Additionally, *BLI*



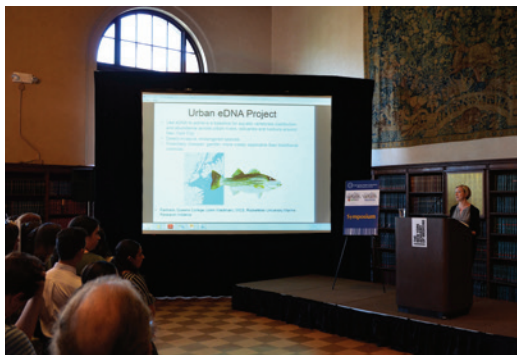
mentors John Halloran from Connetquot High School and Daniel Williams from Shelter Island High School presented their students' DNA barcoding and microbiome results and experiences as mentors in the program at the NIH SEPA SciEd Conference—John attended on a scholarship awarded by the NIH SEPA program.

The 2018 *UBP* and *UBRP* programs included 200 students working in 74 teams and represented 35 public and eight private high schools from NYC. *UBP* students made ample use of DNALC resources: 142 students from 23 teams attended open lab sessions at *Harlem DNA Lab*, while 120 students from 40 teams borrowed equipment footlockers for use at school. Teams collected and processed over 1,320 samples for DNA sequencing, resulting in over 3,200 single sequences and 100 million NGS reads, and produced 22 new GenBank entries. The annual research symposium on May 24, 2018 at the New York Academy of Medicine showcased 74 projects and included a keynote speech by Dr. Elizabeth Alter, York University, on most recent molecular approaches to surveying aquatic biodiversity in urban habitats. Two *UBRP* teams were recognized with an outstanding poster award at the event, one for the discovery of a novel RNA virus found in arthropods in the New York area they named "Jiminy Cricket" virus, and another project that used DNA barcoding to reclassify American sidewinders. The winners for the *UBP* examined the relationship between water quality at various locations of Van Cortlandt Park and the species of snail present. Results indicate that all locations investigated contained many more pollution-resistant lunged snails than pollution-sensitive gilled snails.

Several scientific, peer-reviewed publications have been co-authored by citizen scientists participating in DNALC's signature DNA barcoding programs in the last year. Twenty students were co-authors of a "bioblitz" study of the plants and animals of Marine Park, published in PLOS ONE. Three *UBRP* teams published studies about fraudulent herbal medicines and other marketplace replacements in Open Life Sciences, the Finger Lakes Journal for Secondary Science, and MDPI Foods. This demonstrates that the established DNA barcoding workflow can be used to teach molecular techniques and bioinformatics in a contextual situated learning design that is relevant personally as well as to the scientific community.

This year, 186 students across all three barcoding programs (*BLI*, *UBP*, and *UBRP*) took surveys as a part of our ongoing effort to monitor the impact of participation in science research. Participants were asked about their experiences in the programs, how much they had learned, and how they felt about science. The students were overwhelmingly proud of the research

Left: Dr. George Amato speaks to *BLI* Symposium attendees. Right: Dr. Bruce Stillman talks to *BLI* participants at their poster.



Above: Dr. Elizabeth Alter addresses *UBP* and *UBRP* student researchers who later shared project results at a poster session (right).



they had done (92.6%) and felt that the approach to problem-solving they learned through DNA barcoding research would be helpful in future science courses (92%) and careers (86.9%). They also reported that research participation had altered their desire to pursue science in the future, with 83% indicating they were more interested in continuing to study science and a slightly higher proportion of students were interested in studying biology specifically (87.1%). Overall, our results suggest that DNA barcoding effectively demystifies the process of science research and encourages students to continue pursuing science as a potential career path.

New NSF Faculty Training Program

In October we began a new DNA barcoding project with \$2 million funding from the National Science Foundation (NSF) Improving Undergraduate STEM Education (IUSE) program. The goal of this five-year project is to move educators along a continuum of increasing expertise and broader student involvement in DNA barcoding Course-based Undergraduate Research Experiences (CUREs). Simultaneously, we will develop advanced CUREs in microbiome and environmental DNA analysis to introduce students to next generation sequencing and data science. Project co-PIs have each implemented DNA barcoding in a range of undergraduate institutions: James Madison University (JMU), a public four-year institution; City Tech, a dual two- and four-year urban university serving black and Hispanic students; Bowie State University (BSU); a historically black institution; and Austin Community College (ACC), a



Above: JMU students and faculty swabbed snakes to collect microbiomes as part of the DNA barcoding CURE at JMU.

two-year, Hispanic-serving institution. JMU has built a model DNA barcoding CURE serving 500 students per semester as a replacement for freshman biology. Building on this experience and strength in diversity, our IUSE project will disseminate and evaluate DNA barcoding as a flexible platform for scaling CUREs in a variety of contexts.

At the outset of the project, the partner institutions will test new technology to substantially simplify DNA barcoding and reduce the cost of metabarcoding. They will also develop mentoring strategies by helping one another along the CURE continuum. A series of summer workshops will provide intensive training for 80 faculty from around the country. Then extensive mentoring, available DNA sequencing, and "extended collaborative support" (borrowed from the computational realm) will

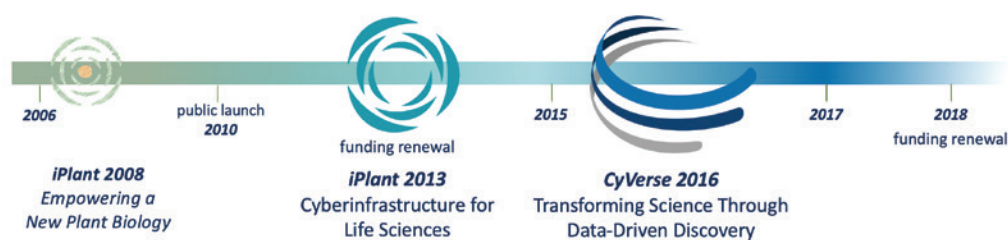
help ensure broad and lasting implementation. As faculty gain expertise, they will be invited to mentor other faculty with less experience, expanding the reach of the project.

This project will also increase our understanding of the impact of CUREs on student self-confidence and persistence in STEM. We will compare DNA barcoding CUREs with an established Howard Hughes Medical Institute program and the Freshman Research Initiative at UT-Austin to determine if different types of CUREs achieve similar student outcomes. By comparing these programs, we also hope to determine which of the key research elements—engaging in scientific practices, collaborating, examining relevant problems, exploring questions with unknown answers, and re-iterating experiments—most closely correlates with positive student outcomes. This could help provide a “prescription” for the most time- and cost-effective CUREs.

NSF CyVerse

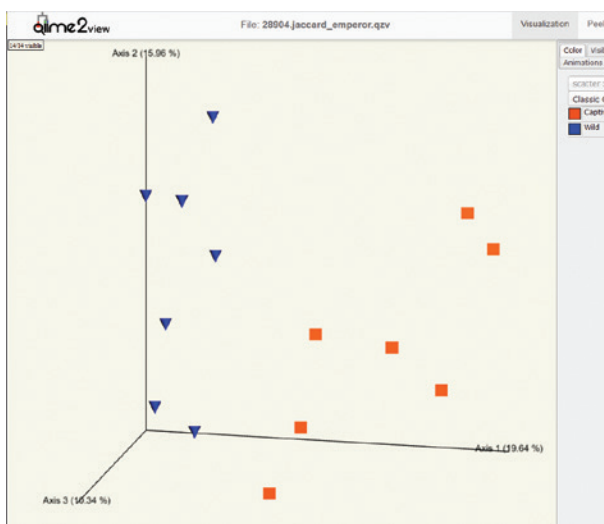
2018 marks ten years of the CyVerse project, which was originally funded in 2008 as the *iPlant Collaborative* to bring plant biology into the era of genomics and big data. In our original proposal to the National Science Foundation, the DNALC was tasked with developing audio and video podcasts to communicate about the “Grand Challenges” of data-driven plant science and develop a nationwide workshop program to train 1,000 science teachers on the use of *iPlant*. Since that time, we have provided intensive two-day training workshops on computational tools and data science for research and education to more than 3,446 participants. The DNALC shaped this project in significant ways—most prominently through the development of *DNA Subway*, which provides perhaps the most popular interface available to high-performance and cloud computing for biology education and course-based research.

As a rule, NSF does not fund projects for more than 10 years—however, the success of CyVerse was recognized as integral to the life science community. As a result, another 5-year award to the project was made in September. While this continuing award was a reduction in scope, the decision was made to strengthen DNALC’s involvement by formally making DNALC Executive Director Dave Micklos a co-principal investigator (although he previously served on the Executive Team for the project). The additional \$800,000 award to the DNALC allows us to continue our education and outreach role with an increasing focus on data science education and course-based research, complementing many of our existing programs.

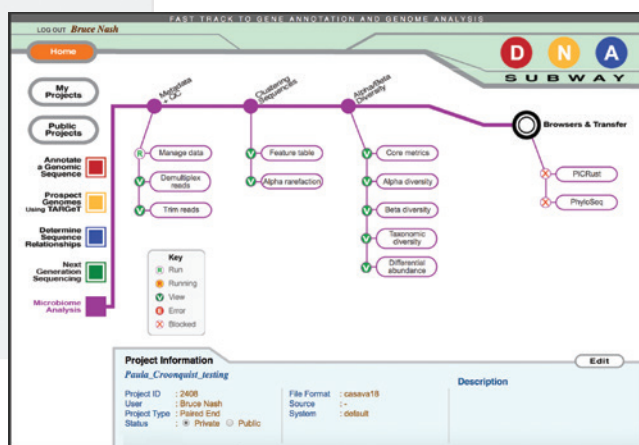


In 2018, *DNA Subway* had 30,563 registered users, 66,157 visits (~8% increase from 2017), and 1.25 million page views (~15% increase from 2017). Students created 39,283 projects (~7% increase from 2017) across the five *Subway* lines. A particular highlight for *DNA Subway* development was the completion of upgrades to the RNA-Seq Green Line. The Green Line now implements Kallisto, one of the fastest and most accurate methods for quantifying transcript abundance, as well as Sleuth, which calculates differential abundance of transcripts and presents the results in a fully-interactive R-Shiny app (including interactive tables and plots). Workflows that could take more than a week (mostly spent waiting on high-performance computing queues), now can be done in hours using cloud resources. We also implemented

design upgrades to improve Green Line's user interface. These design improvements will also be carried over to the Purple Line eDNA/metabarcoding workflow which was premiered this year with a workshop for 29 educators at the American Society for Microbiology's Conference on Undergraduate Education (ASMCUE) in Austin, Texas. In addition, we reached 336 researchers and educators at 12 two-day workshops across nine institutions and 1,550 attendees at ten conferences and other training events.



Purple Line tools show microbiome samples from wild (blue triangles) and captive (red squares) wolves. This beta diversity principle component analysis shows that the two groups have different microbiomes, although both sets of wolves also vary within their group.



NSF MaizeCODE

In MaizeCODE is a collaboration between researchers at CSHL and New York University to create a comprehensive reference encyclopedia of DNA sequences that control transcription in maize and its wild ancestor, teosinte. MaizeCODE is developing data that will provide an important resource for breeders and plant scientists to improve crop traits such as disease resistance, drought tolerance, and yield by providing high quality genome sequences paired with diverse molecular data. As outreach lead on this project, we continued our work to develop a simple system to allow students to participate in the annotation of the maize genome.

The sophistication of gene prediction programs and the abundance of RNA-based evidence for the maize genome would lead one to believe that manual curation of gene models is no longer necessary. However, we used a quality metrics algorithm to identify 17,225 of 130,330 (13%) protein-coding transcripts in the current maize reference genome that have discrepancies with available biological evidence. Also surprising, despite the fact that the maize genome is in its fourth version since its publication a decade ago, prior to our work only several hundred maize genes had been manually curated by a human being.

Over the year, we worked with eight graduate students to curate 86 transcript models flagged by quality metrics and a complementary method using the Gramene gene tree visualizer. All of the triaged models had significant errors—including missing or extra exons, non-canonical splice sites, and incorrect UTRs. We then used a graphical annotator, Apollo, to edit the gene models and display the corrected ones to Gramene. A correct transcript model existed for about 60% of genes (or transcripts) flagged by quality metrics; we attribute this to the convention of elevating the transcript with the longest coding sequence (CDS) to the canonical, or first,

position. The remaining 40% of flagged genes resulted in novel annotations and represent a manual curation space of about 10% of the maize genome (~4,000 protein-coding genes).

We presented the preliminary results the MaizeCODE annotation project at the 60th Maize Genetics Conference in Saint-Malo, France (March) and the 60th American Society of Plant Biologist meeting in Montreal, Canada (July). We are now working to simplify the workflow so that our double triage system can be used to support the community curation of eukaryotic genomes by scientists, students, and potentially even citizen scientists.

Biotechnology in American High Schools: Then and Now

In 2017, we received NSF funding to administer a survey to 12,773 biology faculty—approximately one-quarter of active high school biology faculty in the country. The survey was based on work done by the DNALC through an early grant from NSF's Advanced Technological Education (ATE) program to measure the integration of biotechnology into American classrooms. By comparing responses, we were able to measure changes in teacher attitudes and training, teaching constraints, and student exposures to molecular biology techniques in the classroom, focusing our lab questions on six key techniques: transformation, restriction analysis, PCR, DNA sequencing, DNA recombination, and plasmid isolation.

Our preliminary analysis highlighted a number of important findings. Molecular biology labs are being integrated across the curriculum, most often in AP Biology (54% of the 2018 teachers), but increasingly in general biology courses as well (28% today vs. 21% in 1998). There has also been a major increase in schools offering biotechnology-based elective courses: 35% of today's teachers have some type of biotechnology elective in their schools (vs. 16% in 1998).

Teacher preparation and professionalization has changed, too. Today's teachers feel there are fewer opportunities to obtain biotechnology training at workshops and summer institutes than teachers in 1998, and there's been a large shift in the number of teachers who rely on formal graduate coursework to develop expertise (41% today vs. 24% in 1998). Teachers now are less likely to belong to any professional organizations, and rarely attend professional meetings. Teachers are also less likely to engage with students in extracurricular science activities, including after-school research and science fairs and competitions.

Overall, the results of this project highlight a set of challenges for the future. An additional layer of analysis is set to be completed in 2019, when we enhance the dataset with survey responses collected between 1987 and 1993 at our *DNA Science Workshops*. This third time point has a set of semantic differentials—which provide a unique way to measure attitudes. Teachers rated their reactions to “recombinant DNA, biotechnology” and “myself as a biology teacher” on 18 scales of polar adjectives (“important-unimportant,” “messy-neat,” “dangerous-safe,” etc.). This was repeated in the 2018 survey and will enable a longer perspective on shifts in teacher attitudes that may impact their ability or willingness to implement new and challenging materials in their classrooms.

Expanding our Footprint in New York

During the year we continued on our long, and sometime tortuous, path to establish a *DNALC NYC* at City Tech in Brooklyn. After a year of back and forth between lawyers, the contract for a 30-year, no-cost lease of 17,500 square feet of space at City Tech was finished in September and sent to the Dormitory Authority of New York (DASNY) in Albany. In the meantime, Centerbrook Architects pushed toward finishing construction documents for a fantastic plan with six teaching labs, two bioinformatics labs, and an exhibit gallery.

When open sometime in 2020, *DNALC NYC* will run a full schedule of activities like those currently available at the Dolan DNALC—academic year lab field trips, summer DNA camps,

and weekend family activities. The no-cost lease means that all money raised for operating costs or endowment will go toward programs. Our business plan provides scholarships for at least 50% of students taking academic year field trips.

City Tech President Russ Hotzler continued to encourage us and provided a temporary teaching lab in the Pearl Street Building, just two floors above our future permanent space. With City Tech faculty member Jeremy Seto as co-principal investigator of our new NSF program on DNA barcoding, we are establishing collaborations that will support a very large program to provide course-based undergraduate research experiences. With two labs dedicated to student research, we anticipate at least 500 CUNY students per year will make use of the DNALC's integrated systems for DNA barcoding, microbiomes, RNA sequence analysis, and genome annotation.

As we continued to face hurdles in Brooklyn, our project to develop a licensed DNALC at Regeneron Pharmaceuticals gained new momentum. Although the Regeneron Board formally approved the deal in June 2017, space designated for the center on its Tarrytown campus was taken over for mission-critical research. The project got back on track in October, when space was identified on their new administrative campus in a former IBM building in Sleepy Hollow. BAM architects then got busy on a lovely design for a 4,500 square foot facility, with two teaching labs and a large prep lab with space for assembling footlocker kits. Firmly on schedule to open in November 2019, the *Regeneron DNALC* center will serve Westchester, Rockland, Putnam, and Fairfield Counties—which are demographically similar to Long Island.

International Partnerships

As we continued our quixotic quest for permanent space for a licensed DNALC in Mexico City, the symposium of the first Mexico City Urban Barcode Project was held in Mexico City in May 2018. The event was organized by Central DNA Company, Ministry of Agriculture (SAGARPA), National Institute of Genomic Medicine, and National Committee for the Knowledge and Use of Biodiversity (CONABIO). DNALC educator Cristina Fernandez Marco presented the keynote address. Eight schools fielded 23 teams with 68 students and 14 mentors. Student projects examined questions of ecology, biodiversity, physiology, medicine, and health—with three quarters of barcodes done for plants or insects. The winning project was “Micro-inhabitants of the Soil of Mexico City,” and the honorable mention was “Study of Rhizobacteria to Promote Plant Growth.” Members of the winning teams and their teachers won free tuition to a *DNA Science Workshop* at the DNALC in August:

Plantel Vallejo (UNAM), Escuela Nacional Colegio de Ciencias y Humanidades:

Students: Ximena Mendoza Tepach, Melanie Jimenez Lojero, Itzel Analí Sánchez Aguilar
Mentor: Sra. Issis Yolotzin Alvarado Sanchez

Universidad Nacional Autónoma de México:

Students: Raul Motte Nava, Agustin Celestino Lopez, Jonathan Perez Gonzalez, Marco Soriano Pimentel, Alejandro Gonzalez de la Luz
Mentor: Professor Monica Perez Ibarara

In February, Dave returned to Nigeria with our colleague George Ude to receive an honorary degree during commencement at Godfrey Okoye University (GOU). Several years ago we worked with George to set up a modern biotech lab at this tiny Catholic university in the southeastern part of the country. While there, we taught a course in DNA barcoding and looked at a site for a DNALC on the university's new campus in Iguomo. Campus development is awaiting a tarmac access road, which will put it within 15 minutes of the international airport.

At year's end we bid farewell to Michael Okoro, who came to the DNALC first as a GOU student in 2013 to do his senior thesis on barcoding indigenous medicinal plants of Nigeria. After

finishing his government service as a biology teacher in the unsettled north of the country, he returned in 2016 as our first DNALC Fellow—with the objective of preparing him for graduate school in the US. Our plan worked, and in November of that year we learned that Michael had been accepted into the master's program at New York University! However, Michael hadn't realized the enormity of the tuition—he had misconstrued the per credit cost as the cost for an entire semester. At the same time, I realized that he had absolutely no resources to support this venture. The winter semester was to begin in six weeks, and we were both crestfallen.

Then someone had the brilliant idea to apply for a supplement to the MaizeCODE project. Program officer Diane Okamura suggested that Mike's college work would fit joint funding from the Gates Foundation's *Bread for the World* program. We put together a quick application, and before leaving for Christmas we got word that the supplement to support Michael's fees and living expenses on the CSHL campus would be funded. It was truly a miracle. The rest, as they say, is history. Michael worked hard and finished his degree in molecular biotechnology in just 18 months, leaving time in the summer to take the CSHL course in *Frontiers and Techniques in Plant Science* and to work in the corn field with Dave Jackson's group. During the upcoming year, he will continue his fellowship at GOU as he does the legwork to set up a satellite DNALC there.



Michael Okoro soon after arriving in New York in 2013 and in May at his graduation from NYU.



Dissemination at Professional Meetings

As in previous years, we disseminated our programs through numerous presentations at meetings. At NABT, our new Ötzi the Iceman activity was introduced along with presentations on DNA barcoding and personalized medicine. Our DNA barcoding approach was also presented at the Austrian Citizen Science Conference, Long Island Natural History Conference, Biocódigos de Barras Urbanas CDMX Symposium in Mexico City, and NIH SEPA SciEd Conference.

Our data science programs were presented at the International Plant and Animal Genome Conference (PAG), Bioinformatics Open Source Conference, and Biological Science Data Meeting, while our work on improving genome annotation with students, developed through MaizeCODE, was presented at the American Society of Plant Biology and Maize Genetics Conferences. Finally, our metabarcoding programs were presented at the American Fisheries Society Meeting, National Conference on Environmental Marine DNA, SciEd, and PAG.

Lab Instruction and Outreach

In 2018, 21,176 students attended lab field trips at our three facilities: Dolan DNA Learning Center, DNALC *West*, and *Harlem DNA Lab*. In-school instruction programs reached 7,905 students and 1,347 students attended week-long camps, including several from abroad, as part of collaborations in Mexico and Italy. Footlocker kits were used by 1,983 students, including 307 who conducted independent research through *UBP*, *UBRP*, or *BLI*.

Our instructional reach is increased by international licenses in China, discussed previously, as well as a license to the University of Notre Dame. In 2018, 1,275 students from 25 different schools participated in hands-on molecular biology labs supported by the DNALC at Notre Dame (DNALC-ND). Under the leadership of director Dr. Amy Stark, instructional programs included lab field trips to the DNALC-ND, in-school instruction, and engagement at regional and state-level science fairs. Over 100 students from around the world participated in week-long residential and day camps, and a new advanced workshop.

Grants from TEVA Pharmaceuticals and National Grid Foundation provided field trip and in-school instruction scholarships for over 2,800 students from Long Island public school districts—including Amityville, Brentwood, Central Islip, Malverne, Roosevelt, Uniondale, and Valley Stream. The William Townsend Porter Foundation provided scholarships for a portion of the 2,451 students (75% of total students) from Title I schools who visited the *Harlem DNA Lab* for field trips. An additional 15 students from IS 59 in Queens received sequential lab instruction at DNALC *West* as part of an ongoing collaboration with Northwell Health.

The *Partner Member Program* continued to provide custom science sequences and advanced electives for eight schools (primarily independent) in the tri-state region.

- Our newest member, Grace Church School, offered a summer program that included using DNA barcoding to survey biodiversity of the East River.
- At Marymount School of New York, *Genome Science* experiments were incorporated as key parts of the biology curriculum, and students in molecular biology started a new project to analyze environmental DNA (eDNA) from NYC Parks and the Hudson River.
- Research teams from Sacred Heart Greenwich used DNA barcoding to identify macro-invertebrates in the Gowanus canal, and assess the biodiversity of ants in both urban and suburban locations, and eDNA to identify fish species in the Mianus River.
- Lycée Français de New York continued to use DNA barcoding in research, developed a new forensics elective, and offered *Human Genomics* and *Green Genes* camps.
- The Chapin School implemented genetics programs at several grade levels, including the advanced Molecular Genetics elective.
- St. David's School integrated basic genetics and DNA barcoding programs with existing curricula in grades five and eight.

St. David's School students take advantage of field trips at the DNALC as well as in school. Images courtesy St. David's School.



As part of ongoing partnerships, select students from Cold Spring Harbor High School and St. Dominic's High School received daily instruction by DNALC educators. Students enrolled in genomic and molecular biology electives visited the DNALC each afternoon for customized lab sequences in DNA and genome science, DNA barcoding, RNA interference, and gene expression. For the first time, all of the students in both classes presented posters at the annual *Barcode Long Island Symposium*.

We had 5,244 visitors to the *Ötzi the Iceman* exhibit, including the general public or as part of a field trip. This year we began to redesign the rest of our outdated exhibit space. The new exhibit—slated to open in 2019—will feature a look at the history of life on Earth and some of the key developments that have allowed life to flourish on our planet. The exhibit will explore the processes and outcomes of evolution, showcasing several interesting human evolution stories. A touchscreen and interactive chromosome map will allow students to explore various parts of the human genome. Finally, a human variation wall will highlight how traits manifest themselves in different people—holding a literal mirror up to our visitors and allowing them to explore some of their own traits.

Nine *Saturday DNA!* sessions drew 238 participants. Through short hands-on labs, participants explored DNA isolation techniques, crime scene analysis, gel electrophoresis, the genetics of lactose intolerance, microscopy, genetic engineering, Mendelian inheritance, and industrial enzymology. Two microbial masterpieces created at our Agar Art session won the American Society for Microbiology (ASM) Agar Art contest in the Agar Art Kids and Agar Art Maker segments. In these workshops, participants learned how laboratory techniques that scientists commonly use to study the living world could also be used to create unique works of art. To further leverage this STEAM activity, ASM invited Christine Marizzi to co-author a publication titled "The Many Dimensions of Microbial Art," which was published in the December issue of *SciArt Magazine*. In addition, DNALC staff presented student activities as part of Biodiversity Day at the Browning School in NYC and the SUBMERGE Science Festival at Hudson River Park.



Left: We offered an agar art session in the fall *Saturday DNA!* series.

Right: 10-year-old Kate Lin's piece "The Magnificent Butterfly" was the 1st place winner in the Agar Art Kids segment of the ASM contest.



Amanda McBrien leads WiSE young women at the *Fun with DNA* camp held on the CSHL campus.

As part of our ongoing partnership with CSHL Women in Science and Engineering (WiSE), we hosted the second WiSE *Fun with DNA* summer camp. Held on the main campus of CSHL in Delbrück Laboratory, 20 young female science enthusiasts enjoyed the standard *Fun with DNA* lab content, but also had the opportunity to meet and interact with enthusiastic female role models pursuing careers in the sciences. Each afternoon, the girls participated in WiSE activities on herd immunity, neuroscience, and astrophysics. They also took a “field trip” to Uplands Farm, toured the greenhouses, and learned about current CSHL plant research.

Our collaboration with the Watson School of Biological Sciences (WSBS) continued with the training of graduate students in the development of skills needed to communicate science to all audiences. As part of the required curriculum, first-year graduate students work with DNALC instructors to complete 12 half-day teaching sessions designed to prepare them to quickly assess an audience and subsequently customize a presentation accordingly. Graduate students interact equally with both middle and high school students during their required rotations, then choose three elective workshops to implement their new skills. This year, several WSBS students presented DNA extractions at the annual *Science Day* at Sagamore Hill.

BioMedia Visitation and Projects

In 2018 5,617,903 visitors accessed our suite of multimedia resources. Google Analytics counted 4,044,799 visits to DNALC websites, our YouTube videos received 911,378 views, and the *3D Brain*, *Weed to Wonder*, and *Gene Screen* smartphone/tablet apps were downloaded 661,726 times. In-app purchases of *3D Brain HQ* netted \$7,060 for the year. As in the previous year, visitation to DNALC educational media decreased; in 2018 we started redesign of the DNALC.org site and began systematically updating the remainder of our online content. Over the next couple of years, the DNALC website will merge with the Cold Spring Harbor Laboratory (www.cshl.edu) site. We met with CSHL’s team on that initiative several times during the year. The new dnlc.org under development will serve as an interim site until the final merger.

The *BioMedia Group* continues to support the initiatives of the DNALC through web and print design, photography, videography, exhibition development, and lab classroom layout planning for collaborators around the world. 2018 highlights include:

- Design work continued on the *DNA Subway* Purple Line and Green Line.
- At the annual *UBP*, *UBRP*, and *BLI* barcoding symposia student teams were photographed and video interviews were filmed of several groups of student participants.
- We initiated a video story on Michael Okoro.
- Design is under way on new displays for the rear gallery.

Staff and Interns

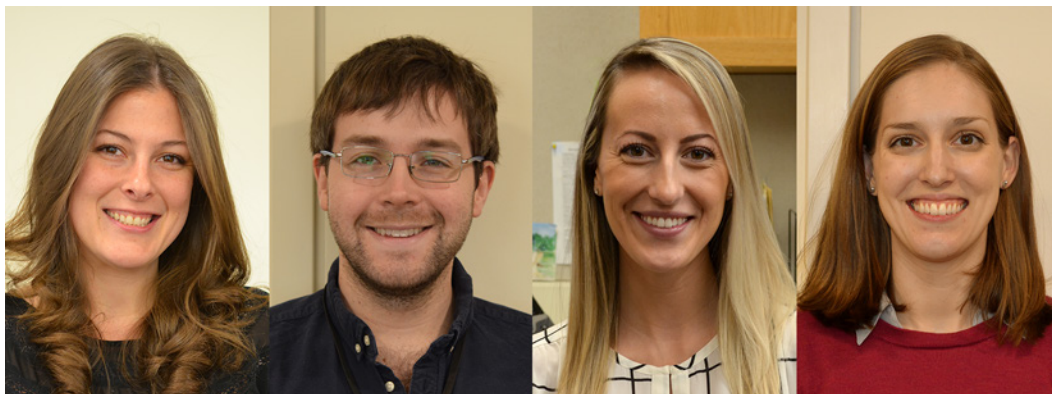
DNALC staff was strengthened by the addition of Colette Riccardi to administration, and Jeffry Petracca, Megan Capobianco, Allison Mayle, Ph.D., to the instructional team.

Colette joined the administrative staff as our receptionist in March. A New Jersey native, she received her bachelor's degree in fine arts from Fairleigh Dickenson University, where she met her future husband, who happened to be a DNALC alumnus! Upon graduation, she worked in merchandising, marketing, and email marketing. Colette relocated to Long Island where she and her husband settled into a 100-year old house in Huntington. Looking for a change of pace, Colette decided to switch from full- to part-time work. Not wanting just any job, she held out for something special, keeping CSHL at the top of her choices. When our receptionist position opened up, she knew it would be the right fit for her!

Jeffry's journey with the DNALC began in 2017, when he was called in as a taxonomy consultant for *BLI* to identify insects, spiders, and marine invertebrates. His talent was valued and he was offered an educator position and he joined the team part-time in March, spending the balance of his time as the Curator of Entomology at the Long Island Aquarium's Butterfly Exhibit and Insect Zoo in Riverhead. At 12 years old, Jeff began to fulfill his dreams of becoming an entomologist by volunteering at the Sweetbriar Nature Center's butterfly exhibit in Smithtown where he spent ten years teaching about butterflies, insects, and spiders, while using school breaks and weekends to volunteer for the butterfly exhibit at the American Museum of Natural History. He went on to graduate from Cornell University's School of Agriculture and Life Sciences in 2011 with a B.S. in Entomology, Plant Sciences, Neurobiology and Behavior, and Biological Statistics.

Inspired by the hit BBC TV series, "Planet Earth," narrated by David Attenborough, Megan became fascinated by the environment, biology, and evolution. She graduated from SUNY Geneseo with a bachelor's in Childhood and Special Education with a minor in Environmental Science. She gained experience and a love for teaching as a middle school science teacher in Miami. While getting her master's in Environmental Policy and Management at Florida International University, she surveyed juvenile striped bass in the western bays of Long Island, including Cold Spring Harbor, with the NYS Department of Environmental Conservation. In addition to teaching, Megan will also be taking on management of the *BLI* footlocker program, and preparing equipment and reagents for offsite student use.

Allison joins our NYC team as we prepare to open our new location in Brooklyn. Passionate for scientific inquiry since childhood, she attended Michigan State University where she could do research starting as a freshman through the Professorial Assistantship program. While receiving her Ph.D. at Baylor College of Medicine in Houston, she learned techniques such as CRISPR and studied the processes that control stem cell self-renewal, and how these processes go awry in blood cancers. During her time in Houston she volunteered for programs that introduced high school students to careers in science and medicine. At the Health Museum in the DeBakey Cell Lab, she guided visitors through a variety of science experiments. These interactions fired



From left: Colette Riccardi, Jeffrey Petracca, Megan Capobianco, and Allison Mayle joined the DNALC staff in 2018.

up her passion for teaching. She moved on to a postdoc position at Memorial Sloan Kettering Cancer Center, where she continued to use CRISPR and study leukemia. She learned about CSHL from her postdoc advisor, saw there were openings for educators in NYC, and she applied. She started in December of this year.

We said goodbye to three staff members in 2018: bioinformatics researcher Jorge Pérez de Acha Chavez; genetics educator Keil Thomas; and Nigerian exchange student Michael Okoro.

Jorge joined the DNALC's multimedia department as a Bioinformatics Researcher in 2017. During his tenure at the DNALC, Jorge made significant updates to *DNA Subway's* Green Line for RNA-Seq analysis and began development of a new Purple Line for metabarcode analysis. These updates became available in the fall. In September, he accepted a position as an associate computational biologist at Broad Institute and Harvard.

Keil's first "real" science camp was *Fun with DNA* in fifth grade. It made such an impression that he returned in 2015 as a college intern. The lab experience he gained as an intern allowed him to teach scientific techniques to his college colleagues, making complex topics understandable for them. He was promoted to Middle School Educator after graduating with a bachelor's degree in Biomolecular Science from the NYU School of Engineering in 2016. During three years of teaching, he also managed the *BLI* footlocker program, equipment repair and supplies, purchasing, and all-around troubleshooting. In the fall, he moved on to the SUNY Stony Brook Biochemistry Department as the lab support technician.

Michael, native of Nigeria, was the DNALC's first exchange student, spending three weeks here in 2013 to complete a project on DNA barcoding of indigenous plants of Nigeria. We invited Michael back in 2016 as our first DNALC Fellow, with the objective of further developing his lab and teaching skills to prepare him for entry into a US graduate program. Michael arrived in spring and by fall we had achieved our objective: Michael was accepted to the graduate program in molecular biotechnology at New York University (NYU), which he completed in 2018, achieving his master's degree. He returned to Godfrey Okoye University in Nigeria this fall with plans to take the lead on starting up the first Africa-based DNA Learning Center.

Since the DNALC opened, we have relied on high school and college interns to support our day-to-day operations. An internship offers students the unique opportunity to gain real laboratory or design experience in an educational environment. The *BioMedia* Group and *Barcode Long Island* program also welcome interns for summer or longer-term roles. We gathered an amazing group of interns this year, and said farewell as others left for college:

High School Interns

Elijah Calle, Hempstead High School	Jack O'Hara, St. Anthony's High School
Gavin Calabretta, Cold Spring Harbor High School	Mina Samaras, Plainedge High School
Christopher Catalano, Garden City High School	Michael Stabile, Plainedge High School
Erika Mosso, Aquinas High School	Nicholas Stabile, Plainedge High School
Sibelle O'Donnell, Cold Spring Harbor High School	

High School Interns Departing for College

Duardo Akerle, New York University	Brianna Hines, Tulane University
Cassidy Alvarez, University of Delaware	George Homenides, State University of New York at Albany
Randy Diaz Arias, University of Rochester	Brady Lyons, College of the Holy Cross
Megan Erhardt, University of New Haven	Jillian Maturo, Boston College
Matthew Finkelberg, University of Massachusetts, Amherst	Jon Triscari, University of Rochester

College Interns

Gabrielle Blazich, Fordham University	Omotayo Ikuomenisan, Hunter College
Juliana Eastment, University of Richmond	William McBrien, Stony Brook University

David Micklos
DNA Learning Center Executive Director

2018 Grants

Grantor	Program	Duration of Grant	2018 Funding ⁺
<i>FEDERAL GRANTS</i>			
National Institutes of Health	<i>Barcode Long Island</i>	7/14–3/20	252,346
National Science Foundation	<i>Biotechnology in American High Schools: Then and Now</i>	9/17–8/18	33,733
National Science Foundation	<i>Biotechnology in American High Schools: Continuing Research</i>	9/18-1/19	21,884
National Science Foundation	<i>Implementing DNA Barcoding for Course-Based Undergraduate Research Experiences</i>	10/18-9/23	37,744
National Science Foundation	<i>MaizeCODE: An Initial Analysis of Functional Elements in the Maize Genome</i>	6/16-5/19	215,716
National Science Foundation	<i>CyVerse: Cyberinfrastructure for the Life Sciences</i>	8/18-7/23	49,744
National Science Foundation	<i>The iPlant Collaborative: Cyberinfrastructure for the Life Sciences</i>	9/13-8/19	467,517
National Science Foundation	<i>RCN-UBE: Establishing a Genomics Education Alliance: Steps Towards Sustainability</i>	9/18-8/20	12,359
<i>NON-FEDERAL GRANTS</i>			
Alfred P. Sloan Foundation	<i>DNA Center NYC Start-up</i>	12/13–6/19	31,208
Beijing No. 166 High School	Chinese Collaboration Agreement	5/14–6/19	23,902
Breakthrough Prize Foundation	Laboratory Design and Teacher Training for Breakthrough Junior Challenge Prize Winners	12/15–12/18	43,384
Ashley and Frank O’Keefe	Support for Eastwood School and Greenvale School	12/16–12/18	5,000
Health Park	Health Park Agreement	12/15-12/20	17,315
National Grid Foundation	Genetics Education Program	9/16-1/19	12,000
Pinkerton Foundation	<i>Urban Barcode Research Program</i>	1/13–5/19	95,863
Richard Lounsbery Foundation	Developing Independent Student Marine Biodiversity Research Using eDNA	10/17-10/19	90,513
Teva Pharmaceuticals	The DNALC Stem Access Fund to Support Usage of the DNALC by Under-Represented Minorities and Disadvantaged Students	10/16-10/19	10,000
The Simons Foundation	<i>Urban Barcode Research Program</i>	12/17-8/20	112,841
William Townsend Porter Foundation	<i>Harlem DNA Lab for Underprivileged Students</i>	4/16–1/19	13,500

+ Includes direct and indirect costs.

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	\$2,100	Long Beach Union Free School District	\$3,150
East Meadow Union Free School District	\$2,100	Massapequa Union Free School District	\$3,150
East Williston Union Free School District	\$3,150	North Shore Central School District	\$2,100
Elwood Union Free School District	\$2,100	Oceanside Union Free School District	\$2,100
Fordham Preparatory School	\$2,100	Oyster Bay-East Norwich Central School District	\$2,100
Half Hollow Schools Central School District	\$2,100	Plainedge Union Free School District	\$2,100
Harborfields Central School District	\$2,100	Plainview-Old Bethpage Central School District	\$2,100
Herricks Union Free School District	\$2,100	Portledge School	\$3,150
Island Trees Union Free School District	\$2,100	Port Washington Union Free School District	\$2,100
Jericho Union Free School District	\$2,100	Roslyn Union Free School District	\$3,150
Levittown Union Free School District	\$2,100	Syosset Central School District	\$2,100
Locust Valley Central School District	\$2,100	Yeshiva University High School for Girls	\$2,100

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

Bayshore Union Free School District	\$2,695	Massapequa Union Free School District	\$1,000
Berkeley Carroll School, Brooklyn	\$4,280	North Bellmore Union Free School District	\$3,850
Cold Spring Harbor Central School District	\$15,260	Northport-East Northport Union Free School District	\$1,100
Commack Union Free School District	\$2,530	Oceanside Union Free School District	\$1,800
East Williston Union Free School District	\$1,347	Our Lady of the Hamptons regional Catholic School, Southampton	\$1,440
Elwood Union Free School District	\$9,537	Oyster Bay-East Norwich Central School District	\$1,320
Floral Park- Bellerose Union Free School District	\$8,250	Port Washington Union Free School District	\$6,820
Garden City Union Free School District	\$12,600	PS-15 178, Queens	\$1,600
Great Neck Union Free School District	\$12,700	Rockville Centre Union Free School District	\$11,880
Green Vale School, Old Brookville	\$1,662	Roslyn Union Free School District	\$5,775
Greenwich Country Day School, CT	\$5,280	Scarsdale Union Free School District	\$6,924
Half Hollow Hills Central School District	\$11,070	School of the Holy Child, Rye	\$1,555
Hicksville Union Free School District	\$1,540	Smithtown Union Free School District	\$8,800
Hofstra University Science and Technology Entry Program	\$2,200	South Huntington Union Free School District	\$7,315
Holy Child Academy, Old Westbury	\$1,800	St. Patrick's School, Huntington	\$2,160
Huntington Union Free School District	\$2,880	Syosset Union Free School District	\$46,255
Island Park Union Free School District	\$2,160	Three Village Central School District	\$3,190
Kings Park Central School District	\$3,300	Wantagh Union Free School District	\$3,140
Locust Valley Central School District	\$8,817		

Sites of Major Faculty Workshops

Program Key: *Middle School* High School College

State	Institution	Year(s)
ALABAMA	University of Alabama, Tuscaloosa	1987–90
	Hudson Alpha Institute, Huntsville	2014
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, Fayetteville	2017
	University of Arkansas, Little Rock	2012
CALIFORNIA	California State University, Dominguez Hills	2009
	California State University, Fullerton	2000
	California State University, Long Beach	2015
	California Institute of Technology, Pasadena	2007
	Chan-Zuckerberg BioHub, San Francisco	2018
	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
	Southwestern College, Chula Vista	2014–15
	Stanford University, Palo Alto	2012
	University of California, Berkeley	2010, 2012
	University of California, Davis	1986
	University of California, Davis	2012, 2014–15
	University of California, Long Beach	2015
	University of California, Northridge	1993
	University of California, Riverside	2011
	University of California, Riverside	2012
	University of California, San Francisco	2015
COLORADO	Aspen Science Center	2006
	Colorado College, Colorado Springs	1994, 2007
	Colorado State University, Fort Collins	2013, 2018
	Community College of Denver	2014
	United States Air Force Academy, Colorado Springs	1995
	University of Colorado, Denver	1998, 2009–10

CONNECTICUT	Choate Rosemary Hall, Wallingford	1987
	Jackson Laboratory, Farmington	2016
DELAWARE	University of Delaware, Newark	2016
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
	Florida SouthWestern State University, Fort Myers	2015
	North Miami Beach Senior High School	1991
	Seminole State College, Sanford	2013–14
	University of Florida, Gainesville	1989
	University of Miami School of Medicine	2000
	University of Western Florida, Pensacola	1991
GEORGIA	Fernbank Science Center, Atlanta	1989, 2007
	Gwinnett Technical College, Lawrenceville	2011–12
	Morehouse College	1991, 1996
	Morehouse College	1997
	Spelman College, Atlanta	2010
	University of Georgia, Athens	2015
HAWAII	Kamehameha Secondary School, Honolulu	1990
	University of Hawaii at Manoa	2012
IDAHO	University of Idaho, Moscow	1994
ILLINOIS	Argonne National Laboratory	1986–87
	iBIO Institute/Harold Washington College, Chicago	2010
	Illinois Institute of Technology, Chicago	2009
	Kings College, Chicago	2014
	University of Chicago	1992, 1997, 2010
	University of Southern Illinois, Carbondale	2016
INDIANA	Butler University, Indianapolis	1987
	Purdue University, West Lafayette	2012
IOWA	Drake University, Des Moines	1987
KANSAS	University of Kansas, Lawrence	1995
KENTUCKY	Bluegrass Community & Technical College, Lexington	2012–14
	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
	University of New Orleans	2018
MAINE	Bates College, Lewiston	1995
	Southern Maine Community College	2012–13
	Foundation for Blood Research, Scarborough	2002
MARYLAND	Annapolis Senior High School	1989
	Bowie State University	2011, 2015
	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
MASSACHUSETTS	Arnold Arboretum of Harvard University, Roslindale	2011
	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	American Society of Plant Biologists, Minneapolis	2015
	Minneapolis Community and Technical College, Madison	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
	Washington University, St. Louis	1997, 2011
MONTANA	Montana State University, Bozeman	2012
NEBRASKA	University of Nebraska-Lincoln, Lincoln	2014
NEVADA	University of Nevada, Reno	1992, 2014
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
	Los Alamos National Lab	2017
	New Mexico State University, Las Cruces	2017
	Santa Fe Community College, Santa Fe	2015
NEW YORK	Albany High School	1987
	American Museum of Natural History, New York	2007, 2015
	Bronx High School of Science	1987
	Brookhaven National Laboratory, Upton	2015–18
	Canisius College, Buffalo	2007
	Canisius College, Buffalo	2011
	City College of New York	2012
	Cold Spring Harbor High School	1985, 1987
	Cold Spring Harbor Laboratory	2014–15, 2018
	Columbia University, New York	1993
	Cornell University, Ithaca	2005
	<i>DeWitt Middle School, Ithaca</i>	<i>1991, 1993</i>
	Dolan DNA Learning Center	1988–95, 2001–04, 2006–09, 2015–18
	Dolan DNA Learning Center	1990, 1992, 1995, 2000–11
	<i>Dolan DNA Learning Center</i>	<i>1990–92</i>
	DNA Learning Center <i>West</i>	2005

	Environmental Science Center, Bergen Beach, Brooklyn	2015–16
	<i>Fostertown School, Newburgh</i>	1991
	<i>Harlem DNA Lab, East Harlem</i>	2008–09, 2011–13, 2016–18
	Harlem DNA Lab, East Harlem	2015–16
	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
	Math for America	2017–18
	Michel J. Petrides School, Staten Island	2018
	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 City Technical College (City Tech)	2018
	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
	School of Visual Arts, New York	2017
	State University of New York, Purchase	1989
	State University of New York, Stony Brook	1987–90, 2015–18
	State University of New York, Stony Brook	2014, 2016
	Stuyvesant High School, New York	1998–99
	The Rockefeller University, New York	2003, 2015–16
	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	2006–07, 2009–11
	North Carolina School of Science, Durham	1987
	North Carolina State University, Raleigh	2012, 2018
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
	The Ohio State University, Wooster	2016
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, Tulsa	2009
	Tulsa Community College, Tulsa	2012–14
OREGON	Kaiser Permanente-Center for Health Research, Portland	2003
	Linfield College, McMinnville	2014
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, 2015
	Medical University of South Carolina, Charleston	1988
	University of South Carolina, Columbia	1988
SOUTH DAKOTA	South Dakota State University, Brookings	2015
TENNESSEE	NABT Professional Development Conference, Memphis	2008
TEXAS	Austin Community College – Rio Grande Campus	2000
	Austin Community College – Eastview Campus – Roundrock Campus	2007–09, 2013
	Austin Community College – Roundrock Campus	2012
	Austin Community College - Austin	2018
	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, College Station, TX	2013
	Texas A&M University, Prairie View, TX	2013
	Texas A & M, AG Research and Extension Center, Weslaco	2007
	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
	Champlain Valley Union High School	1989
VIRGINIA	Eastern Mennonite University, Harrisonburg	1996
	James Madison University, Harrisonburg	2017
	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/Madison Area College	1999, 2009, 2011–14
	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, 2014
	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

AUSTRALIA	Walter and Eliza Hall Institute and University of Melbourne EMBL/Australian Bioinformatics Resource, University of Melbourne University of Western Australia, Perth	1996 2016 2018
AUSTRIA	Vienna Open Lab, Vienna	2007, 2012
CANADA	Red River Community College, Winnipeg, Manitoba University of Quebec, Montreal	1989 2018
CHINA	Beijing No. 166 High School, Beijing Ho Yu College, Hong Kong	2013–18 2009
DENMARK	Faroe Genome Project, Torshavn, Faroe Islands	2013
GERMANY	Urania Science Center, Berlin	2008
IRELAND	European Conference on Computational Biology/Intelligent System for Molecular Biology Conference, Dublin University College Dublin	2015 2018
ITALY	International Institute of Genetics and Biophysics, Naples Porto Conte Research and Training Laboratories, Alghero	1996 1993
MEXICO	ADN Mexico, Morelia ASPB Plant Biology, Mérida Langebio/Cinvestav, Irapuato	2016 2008 2016
NIGERIA	Godfrye Okoye University, Enugu, Nigeria	2013, 2018
PANAMA	University of Panama, Panama City	1994
PHILIPPINES	Eastern Visayas Campus, Philippine Science High School, Palo, Leyte	2017
RUSSIA	Shemyakin Institute of Bioorganic Chemistry, Moscow	1991
SINGAPORE	National Institute of Education Singapore Science Center	2001–05 2013
SOUTH AFRICA	North-West University, Potchefstroom South African Bioinformatics Society, Durban	2016 2016
SWEDEN	Kristineberg Marine Research Station, Fiskebackgkil Uppsala University	1995 2004
THE NETHERLANDS	International Chromosome Conference, Amsterdam Wageningen University and Research Center, Wageningen	2007 2014
UNITED KINGDOM	Earlham Institute, Norwich The Genome Analysis Center, Norwich University of York, York Wellcome Trust Conference Center, Hinxton University of Warwick, Coventry	2018 2015 2017 2012–13 2013

Workshops, Meetings, Collaborations, and Site Visits

- January 6 NIH *Barcode Long Island* Open Lab, Brookhaven National Laboratory, Upton, New York
 NIH *Barcode Long Island* Special Open Lab, Stony Brook University, Stony Brook, New York
- January 8–10 NSF INCLUDES Summit, “Broadening Participation with Bioinformatics, Big Data, and Data Science,” Alexandria, Virginia
- January 10 Lounsbery Fish eDNA Orientation Meeting, *Harlem DNA Lab*
- January 11 NSF CyVerse Webinar Series, “Get Started with CyVerse,” DNALC
- January 12 Professional Development Workshop, “Bacterial Transformation,” Michael J. Petrides School, Staten Island, New York
- January 13 NIH *Barcode Long Island* Open Lab, DNA Learning Center *West*
Ötzi the Iceman Tour, DNALC
Saturday DNA! “Isolation Optimization,” DNALC
Urban Barcode Project Open Lab, *Harlem DNA Lab*
- January 13–17 International Plant and Animal Genome XXVI Conference 2018, CyVerse Education Session: “Educational Workflows in Metagenomics: Microbiomes and Environmental (e)DNA,” “Scaling Genomics and Data Science for the Biology Classroom,” San Diego, California
- January 17 Site visit by Xu Xun, Guangzhou Development District, Guangzhou, China
- January 18 *Urban Barcode Project* Open Lab, *Harlem DNA Lab*
- January 20 NIH *Barcode Long Island* Open Lab, DNALC
 NIH *Barcode Long Island* - Microbiome Project Open Lab, DNALC
- January 23 *Urban Barcode Project* Open Lab, *Harlem DNA Lab*
- Jan 29-Feb 9 *DNA Science, DNA Barcoding and Research* Workshops, Beijing 166 School, DNALC
- February 1–3 Austrian Citizen Science Conference 2018, “Publishing with Citizen Scientists - Mission Impossible?” and “DNA Barcoding,” University of Salzburg, Salzburg, Austria
- February 5 Vienna Open Lab and Open Science at Vienna Biocenter, “DNA Barcoding,” Austria
- February 7 NSF CyVerse Webinar Series, “Get Started with CyVerse,” DNALC
- February 7–8 *DNA Barcoding* Workshop, Godfrey Okoye University, Enugu, Nigeria
- February 8 *Urban Barcode Project* Open Lab, *Harlem DNA Lab*
- February 10 NIH *Barcode Long Island* - Microbiome Project Open Lab, DNALC
Ötzi the Iceman Tour, DNALC
Saturday DNA! “Who Dunnit?” DNALC
Urban Barcode Project Open Lab, *Harlem DNA Lab*
- February 13 *Urban Barcode Project* Open Lab, *Harlem DNA Lab*
- February 16 Microbiome eDNA Teacher Workshop, *Harlem DNA Lab*
- February 19–23 *Urban Barcode Research Program, Conservation Genetics* Workshop, *Harlem DNA Lab*
- February 20 *Ötzi the Iceman* Tour, DNALC
- February 21 Site visit by Thomas Parsons, International Commission on Missing Persons, The Hague, The Netherlands
- February 22 NIH *Barcode Long Island* - Bioinformatics Open Lab, DNALC
Ötzi the Iceman Tour, DNALC
- February 23 *Ötzi the Iceman* Tour, DNALC
- February 26 *CSH Asia DNA Learning Center* Council Meeting, Suzhou Industrial Park, China
- February 27 Site visit by Heather Savarese and Lauren Slaven, Cold Spring Harbor Educational Foundation, Cold Spring Harbor, New York
CSHL Gramene: A Resource for Comparative Plant Genomics Webinar, DNALC
Urban Barcode Project Open Lab, *Harlem DNA Lab*
- February 28 Meeting with Guangzhou Development District, Guangzhou, China
- March 2 *Urban Barcode Research Program* Update Event, The Irondale Center for Theater, Education, and

- Outreach, Brooklyn, New York
- March 2–3 *DNA Barcode Workshop*, Science Center, Singapore
- March 3 *NIH Barcode Long Island Open Lab*, Stony Brook University, Stony Brook, New York
- March 5 Site visit by Mingdi Yang, *Front Vision Magazine*, New York, New York
- March 6 *Urban Barcode Project Open Lab, Harlem DNA Lab*
- March 7–8 *NSF CyVerse Genomics Data Carpentry Workshop*, North Carolina State University, Raleigh, North Carolina
- March 9 *NSF CyVerse Tools and Services Workshop*, North Carolina State University, Raleigh, North Carolina
- March 10 *NIH Barcode Long Island Open Lab, DNALC*
Ötzi the Iceman Tour, DNALC
Saturday DNA! “Agar Art,” DNALC
- March 14 *NSF CyVerse Webinar Series, “Get Started with CyVerse,” DNALC*
- March 14–18 *NABT 2018 Professional Development Conference Presentations, “Sense in Molecules: Modeling Personalized Medicine,” and “DNA Barcoding - Independent Research for All,” Georgia World Conference Center, Juniper, Georgia*
- March 15 *Urban Barcode Project Open Lab, Harlem DNA Lab*
- March 16 *Professional Development Workshop, “Bacterial Transformation,” Michael J. Petrides School, Staten Island, New York*
- March 20 *Urban Barcode Project Open Lab, Harlem DNA Lab*
- March 22 *NSF CyVerse Webinar Series, “Get Started with CyVerse,” DNALC*
- March 22–25 *Maize Genetics Conference, “Maize Tools & Resources,” Saint-Malo, France*
- March 23 *Long Island Natural History Conference, Brookhaven National Laboratory, Upton, New York*
Simons Foundation Science Outreach Working to Inspire the Next Generation (SOWING) Event, “Glowing Genes: Add Some DNA to Your Day,” Caveat, New York, New York
- March 24 *NIH Barcode Long Island - Microbiome Project Bioinformatics Refresher, DNALC*
NIH Barcode Long Island Open Lab, Stony Brook University, Stony Brook, New York
Urban Barcode Research Program, Mercy College, Dobbs Ferry, New York
- March 24–26 *American Society of Plant Biologists Southern Section Regional Meeting, “Data, Data Everywhere, nor Any a Drop to Drink,” New Orleans, Louisiana*
- March 26 Site visit by Caren Gough Master Teacher Group, Science Education Group, Stony Brook University, Stony Brook, New York
- March 26–27 *Cold Spring Harbor Laboratory First Grade Science Fair Judging, CSHL*
- March 27 *Ötzi the Iceman Tour, DNALC*
William Floyd Expo STEM Symposium, “DNA Extraction/DNA Barcoding,” William Floyd Elementary School, Shirley, New York
- March 29 *NIH Barcode Long Island - Bioinformatics Open Lab, DNALC*
NIH Barcode Long Island Special Open Lab, Stony Brook University, Stony Brook, New York
- April 2–6 *Urban Barcode Research Program, DNA Barcoding Workshop, Harlem DNA Lab*
- April 2–3 *eDNA Bioinformatics Training Workshop, City Tech, Brooklyn, New York*
- April 3 *Ötzi the Iceman Tour, DNALC*
- April 5 *Ötzi the Iceman Tour, DNALC*
- April 7 *NIH Barcode Long Island Open Lab, DNA Learning Center West*
- April 11–12 *NSF CyVerse Genomics Data Carpentry Workshop, Chan-Zuckerberg BioHub, San Francisco, California*
- April 13 *American Association of Physical Anthropologists 2018 Panel, “The Anthropologist’s Academic Taboo II: Discussing Alternative Opportunities to Traditional R1 Anthropology Faculty Positions,” Austin, Texas*
- April 14 *NIH Barcode Long Island Open Lab, DNALC*

- Urban Barcode Project Open Lab, Harlem DNA Lab
- April 18 Site visit by Richard Baccari, Churchill & Banks, Providence, Rhode Island
Webinar for Front Vision Magazine, New York, New York
- April 18 DNA Barcoding Research Webinar for Parents and Students, Beijing, China
NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
- April 19 Urban Barcode Project Open Lab, Harlem DNA Lab
- April 21 NIH Barcode Long Island Open Lab, Brookhaven National Laboratory, Upton, New York
Saturday DNA! "Enzyme Explosion," DNALC
- April 24 Urban Barcode Project Open Lab, Harlem DNA Lab
- April 25 Virtual Lab: DNA Extraction from Wheat Germ, DNALC
- May 1–2 NOAA/Norwegian Institute of Marine Research eDNA Workshop, "Fish DNA and Student Research," Northeast Fisheries Science Center, Woods Hole, Massachusetts
- May 3–4 Site visit to Centre for Interdisciplinary Science and Education, QuyNhon, Vietnam
Beijing 166 Student Workshop, Human Genome Science, Beijing 166 School, Beijing, China
- May 5 NIH Barcode Long Island Open Lab, DNALC
- May 6 Beijing 166 Teacher Workshop Mentoring DNA Barcoding Research Projects, Beijing 166 School, Beijing, China
- May 7–8 Beijing 166 Teacher Workshop, Human Genome Science, Beijing 166 School, Beijing, China
- May 8 NIH Barcode Long Island - Bioinformatics Open Lab, DNALC
Beijing 166 Student Workshop, DNA Barcoding Research Follow-Up, Beijing 166 School, Beijing, China
- May 9 Site visit by Jyothi Nayar, Illumina, San Diego, California
Site visit to Jade Spring School, Guangzhou, China
- May 10–11 Site visit to CSH Asia DNA Learning Center, Suzhou Industrial Park, China
- May 12 Biocodigos de Barras Urbanos CDMX Symposium, "DNA Barcodes: Genetic Challenges for Citizen Science," Mexico City, Mexico
NIH Barcode Long Island Open Lab, Stony Brook University, Stony Brook, New York
Saturday DNA! "Molecular Detectives," DNALC
Ötzi the Iceman Tour, DNALC
- May 16–17 NSF CyVerse Genomics Data Carpentry Workshop, University of New Orleans, New Orleans, Louisiana
- May 18 NSF CyVerse Tools and Services Workshop, University of New Orleans, New Orleans, Louisiana
- May 19 NIH Barcode Long Island Open Lab, Brookhaven National Laboratory, Upton, New York
- May 24 Urban Barcode Project/Pinkerton Urban Barcode Research Program Symposium, New York Academy of Medicine, New York, New York
- May 25 Amazon Research Conference, "Scaling Science by Scaling People, Purpose-built Cyberinfrastructure for the Life Sciences," Amazon Research Development Center, Cambridge, UK
- May 28–29 NSF CyVerse Genomics Data Carpentry Workshop, University College Dublin, Ireland
- May 29–June 1 NIH SEPA SciEd Conference, "Barcode Long Island: Exploring Biodiversity in a Unique Urban Landscape," Washington, D.C.
- June 2 Saturday DNA! "Got Lactase?" DNALC
Ötzi the Iceman Tour, DNALC
- June 4 ECSA Conference 2018, "Participatory Research/DNA Barcoding," Maison Communale de Plainpalais, Geneva, Switzerland
- June 5 NIH Barcode Long Island Student Symposium, CSHL
- June 7 Oyster Bay Historical Society, "Barcode Long Island," Oyster Bay, New York
- June 7–9 ECSITE Annual Conference 2018, "DIY Bio at Science Centers and Museums," Natural History

- Museum of Geneva, Geneva, Switzerland
- June 11-15 *Human Genomics* Workshop, Lycée Français, New York, New York
World of Enzymes Workshop, St. David's School, New York, New York
Genome Science Workshop, Lycée Français, New York, New York
- June 12 *Ötzi the Iceman* Tour, DNALC
- June 14–29 *DNA Barcoding and Bioinformatics* Workshops, Grace Church High School, New York, New York
- June 20 NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
- June 21 *Ötzi the Iceman* Tour, DNALC
 Eastport-South Manor Science Symposium, Eastport-South Manor High School, Manorville, New York
- June 22 Enhancing the STEM Pipeline through Bioinformatics and Genomics Conference, Panels:
 "Introductory Bioinformatics/Genomics for High School Students, Community College and Undergraduate," "Bioinformatics/ Genomics Curriculum and Research Opportunities," "The Formation of Partnerships for Bioinformatics and/or Genomics STEM Outreach," and Poster: "Barcoding and Metabarcoding for Independent Student Research Incorporating Bioinformatics," University at Buffalo, New York
- June 22–24 NSF CyVerse *Genomics Data Carpentry* Workshop, Cold Spring Harbor Laboratory, New York
- June 25–29 NIH *Barcode Long Island* Workshop, Brookhaven National Laboratory, Upton, New York
DNA Science Workshop, DNALC (2 sessions)
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
Fun with DNA Workshop, DNA Learning Center West
Genome Science Workshop, Grace Church High School, New York, New York
Forensic Detectives Workshop, CSH Asia DNA Learning Center, Suzhou, China
- June 25–30 Bioinformatics Open Source Conference/Galaxy Community Conference, "Improving the Undergraduate Bioinformatics Curriculum," Reed College, Portland, Oregon
- June 26 Site visit by Ana Jara Ettinger and Salvador Jara, Mexico City, Mexico
- June 28 Bioinformatics Open Source/Galaxy Community Conference, "Improving the Undergraduate Bioinformatics Curriculum," Reed College, Portland, Oregon
- July 2 NSF CyVerse *Genomics Data Carpentry* Course, CSHL Frontiers and Techniques in Plant Science, Cold Spring Harbor Laboratory, New York
- July 2–3 *Genome Science* Workshop, Grace Church High School, New York, New York
- July 2–6 *Forensic Detectives* Workshop, DNALC
Fun with DNA Workshop, DNALC
Genome Science Workshop, DNALC
World of Enzymes Workshop, DNALC
World of Enzymes Workshop, DNA Learning Center West
Forensic Detectives Workshop, CSH Asia DNA Learning Center, Suzhou, China
 Pinkerton *Urban Barcode Research Program*, *Conservation Genetics* Workshop, DNALC NYC at City Tech, Brooklyn, New York
- July 9–12 NIH *Barcode Long Island eDNA* Workshop, DNALC
- July 9–13 *DNA Science* Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
DNA Science Workshop, DNA Learning Center West
DNA Science Workshop, CSH Asia DNA Learning Center, Suzhou, China
 Pinkerton *Urban Barcode Research Program*, *DNA Barcoding and Bioinformatics* Workshop, DNALC NYC at City Tech, Brooklyn, New York

- July 14 American Society of Plant Biology 2018 Conference, Teacher Workshop “Finding and Fixing Genome Annotation Errors with MaizeCODE,” Montreal, Canada
- July 16–20 *Fun with DNA/World of Enzymes* Workshop, Beijing 166, DNALC (2 sessions)
DNA Barcoding Workshop, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNA Learning Center West
DNA Science Workshop, *CSH Asia* DNALC, Suzhou, China
 Pinkerton *Urban Barcode Research Program*, *Conservation Genetics* Workshop, DNALC NYC at City Tech, Brooklyn, New York
- July 19 NSF CyVerse Genomics Data Carpentry Workshop, “RNA Tutorial,” Plant Biology 2018, University of Québec, Montreal, Canada
- July 20 Agar Art activity and lecture, *CSH Asia* DNALC, Suzhou, China
- July 21 *Ötzi the Iceman* Tour with *DNA Extraction* Workshop, DNALC
- July 23–27 *Forensic Detectives* Workshop, Beijing 166, DNALC
Green Genes Workshop, Beijing 166, DNALC
BioCoding Workshop, DNALC
DNA Science Workshop, DNALC
World of Enzymes Workshop, DNALC
Fun with DNA Workshop, DNA Learning Center West
 Pinkerton *Urban Barcode Research Program*, *DNA Barcoding* Workshop, DNALC NYC at City Tech, Brooklyn, New York
- July 30–31 NSF CyVerse Genomics in Education Workshop, “*DNA Subway* and *Microbiome* Workshop,” Austin Community College, Austin, Texas
- July 30–August 3 *Forensic Detectives* Workshop, Beijing 166, DNALC
Green Genes Workshop, Beijing 166, DNALC
DNA Barcoding Workshop, DNALC
Fun with DNA Workshop, DNALC
DNA Science Workshop, DNA Learning Center West
 Pinkerton *Urban Barcode Research Program*, *Conservation Genetics* Workshop, DNALC NYC at City Tech, Brooklyn, New York
- August 6–9 *DNA Barcoding and Bioinformatics* Workshop, Toms River High School East, Toms River, New Jersey
- August 6–10 *BioCoding* Workshop, DNALC
DNA Science Workshop, DNALC
Fun with DNA Workshop, Peter Wang Chinese Group, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
Forensic Detectives Workshop, DNA Learning Center West
 Pinkerton *Urban Barcode Research Program* and *Science Sandbox DNA Barcoding and Bioinformatics* Workshop, DNALC NYC at City Tech, Brooklyn, New York
- August 7 Site visit by Kristen Wolslegel, Bay Area Bioscience Education Community, San Francisco, California
Ötzi the Iceman Tour, DNALC
- August 8–24 *Urban Barcode Project* Teacher Training Workshop, *DNA Barcoding*, DNALC NYC at City Tech, Brooklyn, New York
- August 13–15 NSF CyVerse Data Carpentry Workshop and *Tools and Services* Workshop, Colorado State University, Fort Collins, Colorado
- August 13–17 NIH *Barcode Long Island* Teacher Workshop, Stony Brook University Institute for STEM Education, Stony Brook, New York

- Being Human* Workshop, DNALC
DNA Science Workshop, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
Green Genes Workshop, DNA Learning Center West
- August 17 Site visit by John Tuke, Hotchkiss School, Salisbury, Connecticut
 August 19–23 American Fisheries Society Meeting, “Independent Student Research Using eDNA Metabarcoding to Track Marine Fish,” Atlantic City, New Jersey
 August 20–24 *DNA Science* Workshop, DNALC
Forensic Detectives Workshop, DNALC
Genome Science Workshop, DNALC
World of Enzymes Workshop, DNALC
Fun with DNA Workshop, DNA Learning Center West
Urban Barcode Project, DNA Barcoding Teachers Workshop, DNALC NYC at City Tech, Brooklyn, New York
- August 22 Site visit by Alan Goldberg and family, Lindsay Goldberg LLC., New York, New York
 August 23 Site visit by Janice Rolf and grandson, ALS Ride for Life, Stony Brook, New York
 August 24 Site visit by Dr. Susan Bachle, Addgene, Watertown, Massachusetts
 August 27–31 *DNA Science* Workshop, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
WiSE Fun with DNA Workshop, CSHL
World of Enzymes Workshop, DNA Learning Center West
- August 28 *Ötzi the Iceman* Tour, DNALC
- September 19 DNA Barcoding Presentation, Leave No Trace Group, Brookhaven, New York, DNALC
 September 22 Site visit by Guangzhou Delegation, Guangzhou, China
 Hudson River Park Trust SUBMERGE Science Festival, “Marine Diversity and Environmental DNA,” Pier 84, New York, New York
- September 24 *Human DNA Fingerprint: Genotyping a “Jumping Gene”* Teacher Workshop, Math for America, New York, New York
 September 27 “Urban Barcode Research,” Kickoff Event, The Irondale Center for Theater, Education, and Outreach, Brooklyn, New York
- October 4 Science Outreach Conference 2018, “Models, Methods, and Measures,” “BioArt as a Medium of Scientific Storytelling,” Rockefeller University, New York, New York
 October 8–19 *Genome Science* Student and Teacher Workshops, Beijing 166 School, Beijing, China
 October 13 *Saturday DNA!* “The Magic of Microscopes,” DNALC
Ötzi the Iceman Tour, DNALC
DNA Barcoding Teacher Workshop, Beijing 166 School, Beijing, China
- October 15 *Human DNA Fingerprint: Genotyping a “Jumping Gene”* Teacher Workshop, Math for America, New York, New York
 October 16 4th Regional NY/NJ eDNA Discussion Meeting, “Metabarcoding,” Hudson River Foundation, New York, New York
- October 24 Site visit by Dennis Liu, Wilson Biodiversity Foundation, Durham, North Carolina
 October 24–26 2018 ATE Principal Investigators Conference, “Using a Supply Chain Model to Recruit and Educate Students” and “Models for Developing Faculty Leaders” poster, Omni Shoreham Hotel, Washington, D.C.
 October 29 *Human DNA Fingerprint: Genotyping a “Jumping Gene,”* Teacher Workshop, Math for America, New York, New York

- October 31 Site visit by Becky Gilmore, Wellcome Trust Genome Campus, Cambridge, England
- Oct 31-Nov 5 Meetings with Armando Barriguete and Hugo Scherer, Mexico DNA Learning Center Development, Mexico City, Mexico
- November 4–6 Midwest Big Data Hub Meeting, Case Western Reserve University, Cleveland, Ohio
- November 6 NIH *Barcode Long Island* Mentor Update and Bioinformatics Refresher Meeting, DNALC
- November 7 Site visit by Regeneron, Tarrytown, New York, DNA Learning Center *West*
- November 7–9 Biological Science Data Meeting Poster Presentation, “Improving the Bioinformatics Curriculum,” CSHL
- November 10–11 Genomics Education Alliance Meeting, St. Louis, Missouri
- November 12 Site visit by Kiryn Hoffman, Margaret Honey, Elsbeth Pancrezi, and Sylvia Perez, The New York Hall of Science, Corona, New York
- Nov 29-30 EMBL-Australian Bioinformatics Resources All Hands & CyVerse Webinar, University of Melbourne, Australia
- Nov 29–30 National Conference on Environmental Marine DNA, “Building and Implementing a Biochemical and Bioinformatic Workflow to Enable Authentic Student eDNA Research,” Rockefeller University, New York, New York
- December 4 NSF CyVerse BioInfo Summer Workshop, “Introduction to RNA-Seq with the Kallisto and Sleuth Workflows,” “Improving the Bioinformatics Curriculum,” University of Western Australia, Perth, Australia
- Erase Racism lecture, “Eugenics,” Riverhead Senior Center, Riverhead, New York
- December 8 Austrian Embassy Invitation to Austrian Research and Innovation Talks (ARIT), Poster Session, “BioArt as a Medium for Scientific Storytelling,” Washington, D.C.
- December 10 Erase Racism lecture, “Eugenics,” Radisson Hotel, Hauppauge, New York
- December 10-12 NSF CyVerse United Kingdom Workshop, “RNA Sequencing,” Earlham Institute, Norwich, England
- December 12 *Urban Barcode Research Program* Holiday Event, The Irondale Center for Theater, Education and Outreach, Brooklyn New York
- December 14 Site visit by William Harsh, New York, New York
- December 19 DNALC Collaboration Visit to New York Hall of Science, Corona, New York



One Bungtown Road
Cold Spring Harbor, NY 11724

Located at 334 Main Street (Route 25A)
in Cold Spring Harbor Village

Phone 516-367-5170
Fax 516-367-5182
Email dnalc@cshl.edu

Visit us online at
www.dnalc.org