



Cold Spring Harbor Laboratory
DNA LEARNING CENTER

2017 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.

Front cover: In the *Being Human* summer camp, students use anatomical, biochemical, fossil, and cultural evidence to build a picture of how humans evolved.

Executive Director's Report

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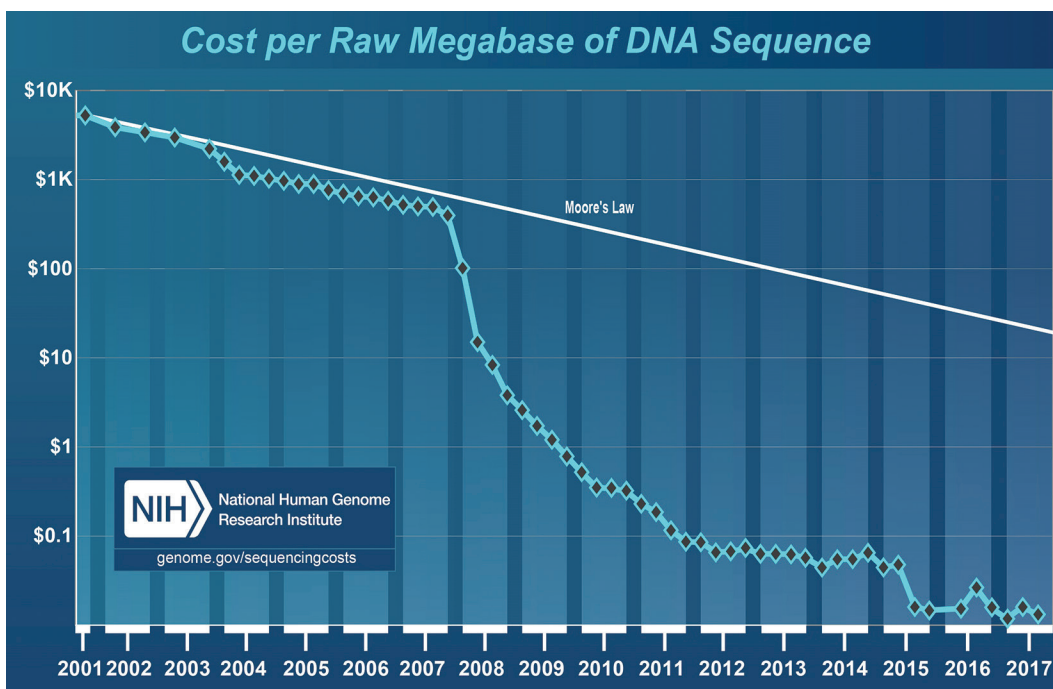
"Big data" is a common theme of much of the work at CSHL and throughout biology. This is driven, in large part, by a 50,000-fold reduction in the cost of DNA sequencing over the last decade. To put this in perspective, Moore's Law states that the number of transistors on a computer chip—and, roughly, the corresponding amount of data accumulating—doubles approximately every two years. In comparison, the amount of raw data submitted to the National Center for Biotechnology Information (NCBI) doubled approximately every seven months over the last decade.

Beyond DNA and RNA sequence data, big data are flooding biology from all quarters—phenotype (trait) data from agricultural field trials, patient medical records, and clinical trials; image data from microscopy, medical scanning, and museum specimens; interaction data from biochemical, cellular, physiological, and ecological systems—as well as an influx of data from translational fields such as bioengineering, materials science, and biogeography.

As part of our educational role in CyVerse, a major NSF computer infrastructure for bioscience research, the DNALC has surveyed over 1,000 attendees at major professional meetings about their big data needs. Consistently, and across different conference audiences, 94% of students, faculty, and researchers said that they currently use large data sets in their research or think they will in the near future. Even so, 47% rated their bioinformatics skill level as "beginner," 35% rated themselves "intermediate," and 6% said they have never used bioinformatics tools; only 12% rate themselves "advanced." Fifty-eight percent felt their institutions do not provide all the computational resources needed for their research.

In October, we followed up on this work with a publication in *PLoS Computational Biology*, "Unmet Needs for Analyzing Biological Big Data: A Survey of 704 NSF Principal Investigators (PIs)" (<https://doi.org/10.1371/journal.pcbi.1005755>). This study gives a human face to the data revolution in biology by assessing the computational needs of active, competitive researchers who had received grants from the Biological Sciences (Bio) Directorate of the National Science Foundation (NSF).

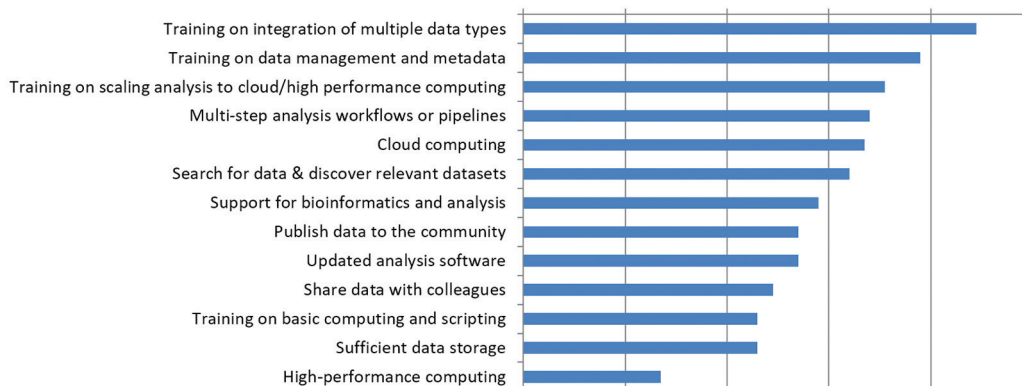
Consistent with our previous studies, nearly 90% of BIO PIs said they are currently or will soon be analyzing large data sets. Not surprisingly, biological sequences topped the list of data types used by the PIs, followed by images, phenotype, ecological, and microscopic data. The BIO PIs considered a range of computational needs important to their work—including high performance computing (HPC), bioinformatics support, multi-step workflows, updated analysis software, and the ability to store, share, and publish data. However, a majority of PIs—across bioinformatics/other disciplines, large/small research groups, and four NSF BIO programs—said their institutions are not meeting nine of 13 needs.



Hardware is not the problem. BIO PIs ranked availability of data storage and high-performance computing (HPC) lowest on their list of unmet needs. This provides strong evidence that the NSF and individual universities have succeeded in developing a broadly available infrastructure to support data-driven biology. Training on integration of multiple data types (89%), on data management and metadata (78%), and on scaling analysis to cloud/HP computing (71%) were the three greatest unmet needs. BIO PIs saw training as the most important factor limiting their ability to use big data and to integrate data obtained from different kinds of experiments and computational platforms. This sort of integration will be required for a deeper understanding of “the rules of life”—notably genotype-environment-phenotype interactions that are essential to predicting how agricultural plants and animals can adapt to changing climates.

Thus, our study identified a growing gap between the accumulation of many kinds of data—and researchers’ knowledge about how to use it effectively. Funding agencies need to recognize that significant new investments in training are now required to make best use of the biological data infrastructures they have helped establish over the last decade.

Unmet needs of BIO PIs. Percent who said a need was not met by their institution.



DNA Barcoding and Microbiomes

The DNALC administers three programs that demonstrate different models for using DNA barcoding in high school research. *Barcode Long Island (BLI)*, funded by the National Institutes of Health (NIH), involves students in collaborative “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, involves students in independent projects to explore biodiversity in New York City (NYC). *BLI* and *UBP* students are mentored by classroom science teachers, while *UBRP* students are mentored by scientists from different NYC research institutions.

We moved our DNA barcoding work into the realm of big data when we received a supplemental grant from the NIH *Big Data to Knowledge* Program to adapt microbiome research for high school students. Whereas DNA barcoding examines a DNA sequence from a single organism, studying microbiomes uses next generation sequencing (NGS) to analyze hundreds of thousands of DNA sequences representing complex mixtures of microbes found in environmental samples. In a typical experiment, DNA is isolated from water or soil samples taken from different environmental locations, PCR is used to amplify a variable region of the 16S ribosomal RNA gene, and NGS reads identify the variety and abundance of microbial species from different locations.

During the summer, twelve *BLI* faculty mentors received eight days of training in microbiome research, covering project design and sample collection, biochemistry, and data analysis. With support, these mentors guided 61 students on 22 teams as they produced and analyzed over 11 billion nucleotides of sequence from DNA isolated from 220 samples. To facilitate analysis using the command-line program QIIME (Quantitative Insights into Microbial Ecology), we introduced faculty to Jupyter Notebooks, which combine live computer code with explanatory text and visualizations to create re-usable workflows. Highlights of the preliminary analyses included finding microbes related to eel grass wasting disease in the Great South Bay, identifying human pathogens in Long Island ticks, and finding arsenic-tolerant microbes in cemeteries of the Civil War era, when arsenic was used for embalming.



Joslynn Lee, Bruce Nash, and Sharon Peppenella (left to right at far right of image) lead students through microbiome analyses using Jupyter notebooks.

In addition to microbiome research, the 2017 *BLI* program included 251 students doing traditional DNA barcoding projects. *BLI* teams represented 30 public and private high schools from Suffolk, Nassau, and Queens; 17% of participants were African American, Latino, and Native American. To complete their research in time for the annual research symposium, 130 students from 47 teams attended 13 open lab sessions held at the Dolan DNALC, DNALC West, Stony Brook University (SBU), or Brookhaven National Laboratory (BNL). Teams processed over 1,400 samples, resulting in over 1,600 sequencing reads. Students published 24 sequences in GenBank, including 11 novel barcode sequences.

Eighty-five DNA barcoding and 21 microbiome projects were presented at the annual *BLI* research symposium on June 7, 2017 at CSHL and included biodiversity studies of plants, invertebrates, fungi, algae, and lichens, plus microbiome studies of water, soil, invertebrates,



The *Barcode Long Island Symposium* was held on the CSHL campus in the Nicholls-Biondi Hall above, as well as Bush Lecture Hall and Grace Auditorium in June.

plants, and vectors for disease. Dr. Jeremy Seto of the New York City College of Technology gave the keynote address on microbiome analyses. *BLI* students received a number of awards at the Long Island Science Congress competition. Nathalia Reis from William Floyd High School, under the mentorship of teacher Victoria Hernandez, was also awarded first place in the Junior Biological Science Division at the NYS Science and Technology Entry Program (STEP), and Elizabeth Scianno of William Floyd High School was invited to present her research at the NIH Citizen Science Symposium in Bethesda, Maryland.

The 2017 *UBP* and *UBRP* programs included 178 students, 27% of whom were African American, Latino, or Native American, and represented 28 public and 16 private high schools from NYC. *UBP* students made ample use of DNALC resources: 68 students from 23 teams attended open lab sessions at *Harlem DNA Lab* or Genspace, while 98 students from 34 teams borrowed equipment footlockers for use at school. Teams collected and processed over 1,170 samples for DNA sequencing, resulting in over 1,900 single sequences and one million NGS reads—and produced ten new GenBank entries. The annual research symposium on May 25, 2017 at the New York Academy of Medicine showcased 62 projects and included a keynote speech by Jesse H. Ausubel, of Rockefeller University, on the history of DNA barcoding. The winning *UBRP* team built a system of reference DNA barcodes for fish species in the Bronx River and identified one sample as American Plaice (*Hippoglossoides platessoides*), a species that is not known to occur in the Bronx River. The winners for *UBP* assessed plant biodiversity of the Thain Family Forest in the Bronx; about a quarter of barcoded roots found in soil samples were from the invasive Eurasian grass *Poa annua*.



Top: The New York Academy of Medicine provided a beautiful space for *UBP* and *UBRP* students to present research posters. Right: Jesse Ausubel (second from left) speaks with students during the symposium.

This year, 221 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 they had done (88.7%) and felt that the approach to problem-solving they learned through DNA barcoding research would be helpful in future science courses (83.7%) and careers (76.8%). They also reported that research participation had altered their desire to pursue science in the future, with two-thirds indicating they were more interested in studying science in the future (67.9%) and, specifically, studying biology (67.2%). 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.

CyVerse and MaizeCODE Projects

The DNALC leads the outreach effort for these two major National Science Foundation research projects. CyVerse (Cyber Universe) is a 10-year, \$100 million collaboration between CSHL, the University of Arizona, and the Texas Advanced Computing Center to develop a national computer infrastructure to support biological research. The mission of CyVerse Education, Outreach, and Training (EOT) is to empower biologists at all levels of professional preparation to effectively use computer infrastructure to unlock the value of biological data for research and teaching. The annual training effort reached 268 researchers and educators at ten workshops in the U.S. and U.K., while monthly introductory webinars reached 78 virtual attendees. As part of our commitment to diversity, CyVerse also supported workshops at the annual meeting of the *Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)*. *DNA Subway*, a set of classroom-friendly interfaces to bioinformatics workflows, drew 61,286 visitors—who created 36,696 new projects, viewed 1.08 million pages, and spent an average of 19 minutes using the site. There were 5,905 new *DNA Subway* registrations, which accounted for more than half of new CyVerse accounts. Visiting bioinformatics researcher Jorge Pérez de Acha Chavez made significant updates to *DNA Subway's* Green Line for RNA-Seq analysis and began development of a new Purple Line for metabarcode analysis. Both are to be released in 2018.

MaizeCODE is a collaborative effort between researchers at CSHL and New York University to create a comprehensive reference encyclopedia of DNA sequences that control transcription in maize and teosinte. MaizeCODE data 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. To prepare for the outreach program, we conducted a survey of participants at the Maize Genetics Conference in St. Louis, to clarify how the maize community intends to use the MaizeCODE datasets in research and education. Notably, 60% of participants (n = 112) said they would participate in annotating a gene family of interest or evaluating community annotations and about 40% said they would annotate a gene family for a class project.

Against this backdrop, we began to re-develop the *DNA Subway* Red Line for the community annotation of the maize genome. Crucially, we upgraded to WebApollo, which works transparently with JBrowse and is a great improvement over the previous desktop version. We tested this workflow at a two-day “Annotation Jamboree” conducted in December at CSHL with graduate students representing eight maize and sorghum research groups. The participants worked in groups to check the accuracy of the automated gene models in the maize reference genome (B73v4) from five gene families: *PIN*, *GH3*, *ABC*, *TCP*, and *ORC*. Suspicious annotations were identified based on low scores on annotation edit distance (AED) and quality index (QI), which gauge how well a gene model is supported by available RNA evidence. About 20% of genes needed manual curation, whether they were flagged or not. Improvements included setting exon boundaries, identifying non-canonical splice sites, and adding missing exons



Left: CSHL CyVerse and MaizeCODE staff led a half-day “Bioinformatics Workshop for Plant Genomics” prior to CSHL’s *Plant Genomes & Biotechnology* meeting in December. Right: During the *Annotation Jamboree* following the meeting, Dr. Monica Munoz-Torres of Phoenix Bioinformatics gave an introduction on the importance of community-curation efforts and an in-depth demonstration of Apollo’s capabilities.

or UTRs. Approximately 70% of genes tagged by AED/Q112 metrics required corrections to the primary gene model. Disagreements between annotators were few, and mainly involved isoforms or UTR length. Interestingly, three of the flagged genes had been correctly annotated in the earlier version of the maize genome (B73v3), showing that this method readily catches discrepancies between genome versions.

Biotechnology in American Schools: Then and Now

During the summer we received a discretionary grant from NSF program officer Celeste Carter to conduct a longitudinal survey of high school biology teachers. As part of an early grant from the NSF’s Advanced Technological Education (ATE) Program, we conducted a nationwide survey of 4,100 high school biology teachers. This purposive sample took a snapshot of biotechnology/molecular genetics instruction in American high schools in 1998. The new survey will repeat that study to see where biotechnology instruction stands two decades later. The survey will compare lab instruction and student exposures to four major techniques of biotechnology and molecular genetics that were measured in the original survey: bacterial transformation, DNA restriction analysis, polymerase chain reaction (PCR), and DNA sequencing. Responses will be compared across a range of teaching constraints, demographic, and behavioral variables in the original study.

To increase the historical base, we will add data from at least 600 teachers trained at week-long workshops conducted from 1987–1996. These surveys had identical or comparable questions to the nationwide survey, but also included 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.). Responses cluster in dimensions of potency, activity, and evaluation—providing a validated way to track shifts in teacher attitudes. Participants at each time point will be sorted into matched groups based on school and teacher demographics.

Our 1998 study showed that the early adoption of biotechnology lab instruction was concentrated in schools located in high wealth suburban zip codes. It is important to see if, today, hands-on biotech instruction has broadened to include poorer and more diverse urban populations. We also hope to correlate changes in teacher attitudes and behavior with funding and educational trends over this period of time—including NSF’s shift away from teacher

training institutes and the increased standardized testing under *No Child Left Behind*. In this way, the study results can provide insights for educational policy.

The DNALC possesses unique datasets from the 1980s and 1990s. Many of the teachers represented in those surveys have since retired. So this longitudinal survey offers the rare opportunity to compare two generations of biology teachers. The previous generation pioneered the introduction of new labs that illustrated the basic concepts of molecular genetic manipulation, mostly using the microbial model *E. coli*. The current generation of teachers faces the challenge of bringing biology instruction into the age of whole-genome analysis of humans and other organisms. This survey will help us see how far biology instruction has come over the last 30 years, and where it needs to point for the next 30 years.

Breakthrough Junior Challenge

In 2015, we began a collaboration with the *Breakthrough Junior Challenge*, a global competition in which precollege students produce short videos explaining an important science concept. Funded by Mark Zuckerberg, Priscilla Chan, and Yuri and Julia Milner, the *Junior Challenge* is a complement to the prestigious *Breakthrough Prize*, designed to inspire creative thinking about fundamental concepts in the life sciences, physics, or mathematics. Winning students receive a \$250,000 scholarship, while their school receives \$100,000 to renovate and equip a state-of-the-art *Breakthrough Science Lab*. The DNALC works with the school principal and science faculty to design the lab and acts as purchasing agent to procure quality equipment and supplies at CSHL's negotiated rates. DNALC staff members then provide on-site training for school faculty to implement labs from its *DNA Science*, *Genome Science*, and *DNA Barcoding 101* curricula.

The first two *Breakthrough Science Labs* were completed in 2017: one for 2015 winner Ryan Chester at North Royalton High School, Ohio, and one for 2016 Winner Hillary Andales at the Philippine Science High School of Eastern Visayas. Although in totally different settings, each lab follows the blueprint of DNALC's teaching labs—including our signature lab bench. Establishing the Philippines lab was especially significant, because the Eastern Visayas campus was severely damaged by the first landfall of Super Typhoon Yolanda (Haiyan) in November, 2013. The 13-foot storm surge obliterated large sections of the local city, Tacloban, and was responsible for 2,300 deaths. The Science High School provided temporary housing for 3,000 displaced persons, and students had to be relocated to other campuses.



Hillary Andales & Dave Micklos.

Working with contractors and shipping agents to complete a lab over a distance of 13,000 miles proved challenging. Erin McKechnie worked with Michael Marchesiello and Liz Janow of the CSHL Procurement Department to ship several pallets full of equipment and supplies to the school in time for a teacher training workshop scheduled for November. However, when Dave Micklos arrived in the Philippines the weekend before the workshop, the equipment was lost in transit, and two importers were arguing about which Filipino airport had impounded the goods. There seemed little chance that the equipment would arrive in time for the workshop to begin on Monday. Miraculously, the entire shipment arrived at the Science High School on Sunday at 4:30 pm, filling an entire flatbed truck. Then commenced a mad dash to unload the equipment and ready the lab for the next day.

The workshop was a great success, with teachers representing most of the country's network of science high schools. In addition to labs on bacterial and human genetics, the teachers also used DNA barcoding to conduct a mini-biodiversity study of a mangrove nature preserve. We



The laboratory for Eastern Visayas Campus of the Philippine Science High School was completed just before the school year. The large shipment of equipment arrived in time for a workshop for local teachers, which included a trip to a mangrove preserve to collect barcoding specimens.

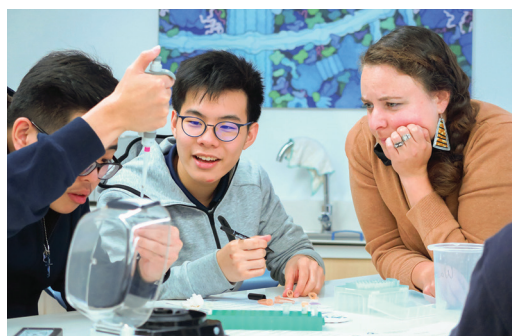
hope to set up a footlocker system for sharing equipment among the science high schools to mount a national DNA barcoding campaign. This effort will be strengthened by the fact that Hillary Andales also won the 2017 Breakthrough Junior Challenge, providing the Philippine Science High School with a second lab and additional teacher training to focus on DNA barcoding.

Licensed DNALC Centers

Cold Spring Harbor Asia DNALC is a collaboration between CSHL and the Suzhou Industrial Park (SIP) with the mission of bringing interactive, American-style biology instruction to Chinese students. Started as a non-governmental organization (NGO) in 2015, the project faced no shortage of challenges—including managing lab logistics 7,000 miles away and navigating the complexities of the Chinese educational system. The project made great strides in 2017; under the leadership of Education Director Dr. Jessica Talamas and her Chinese counterpart, Director Melissa Du, lab instruction expanded to reach 2,961 students. To accomplish this, a core set of DNALC labs was adapted for Chinese students and translated into Mandarin, and abbreviated versions of *DNA Science* and *Genome Science* books were created and updated for use in five-day summer camps. Extensive work was also done to adapt and troubleshoot protocols, as many American reagents are unavailable or prohibitively expensive in China.

DNALC at Beijing No.166 School was founded in 2014 with funding from the Dongcheng Education Commission. Since that time about 800 students and 500 teachers have participated in workshops and training courses in New York or Beijing. In 2017 we signed a new three-year contract, with the objective of establishing Barcode Beijing to involve middle and high school students in independent research projects to study biodiversity in Beijing. In winter 2017, 31 Beijing 166 students took *DNA Science* and *DNA Barcoding* courses in New York. In summer, 48 students came to CSHL and completed labs from the middle school camps *Fun with DNA*, *World of Enzymes*, *Green Genes*, and *Forensic Detectives*. Students also met Dr. James Watson and attended science seminars given by CSHL scientists. DNALC staff also conducted *Human Genome Science*, *Genome Science*, and *DNA Barcoding* workshops for 122 students and 70 teachers in Beijing.

In 2017, 2,660 students participated in programs sponsored by the DNALC at the University of Notre Dame, under the leadership of Dr. Amy Stark. School-year instruction included field trips to the DNALC, in-school programs, and staff participation in local, regional and state-level science fairs. Students from around the country also attended Notre Dame summer programs that included week-long residential and day camps, single-day DNA workshops, and a new two-day introductory course for elementary students.



Left, top: Melissa Du participated in the *Saturday DNA!* “Dust Away Crime: The Truth about Fingerprints” session during her visit in October.

Left, bottom: Jessica Talamas (right) oversees students at the Cold Spring Harbor Asia DNA Learning Center in Suzhou.

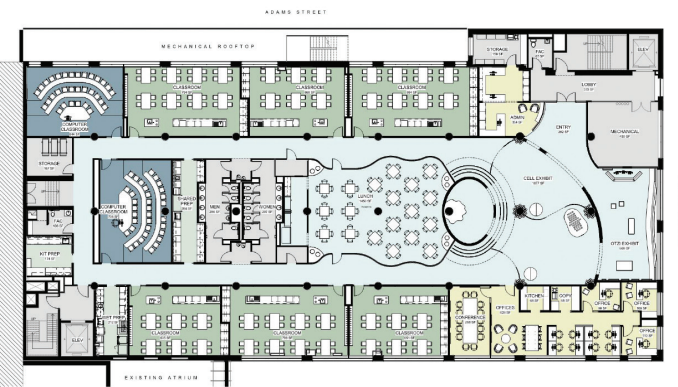
Above: The *DNALC Asia* teaching labs feature the same unique lab benches designed for the CSHL DNALC.

DNALC @ City Tech

The project to develop a permanent DNALC presence in New York City made great strides in 2017. During the summer, the Boards of Trustees of CSHL and the City University of New York (CUNY) approved a memorandum of understanding that included the terms of a 30-year, no-cost lease of the second-floor space at CUNY College of Technology (City Tech). With this approval in hand, Centerbrook Architects and Planners began developing advanced conceptual designs for the 17,500 square foot space, which occupies the entire second floor of the City Tech building on the corner of Tillary and Adams Streets in downtown Brooklyn. The plan includes:

- six windowed lab classrooms around the building perimeter,
- an internal “core” with exhibit, lunchroom, and rest rooms,
- two computer labs,
- three prep labs, and
- administrative offices.

When open in 2019, we anticipate the DNALC @ City Tech 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. As an institution that offers both four-year and two-year degrees, City Tech will benefit from the DNALC's grant-funded programs for college faculty and students. This includes our active involvement in the NSF Advanced Technological Education (ATE) Program, which focuses on improving science instruction at community colleges. As part of our commitment to collegiate education, two labs will be dedicated to course-based research—allowing at least 500 CUNY students per year to make use of the DNALC's integrated programs in DNA barcoding, microbiomes, RNA sequence analysis, and genome annotation.



Lab Instruction and Public Outreach

In 2017, 21,007 students attended lab field trips at our three facilities: Dolan DNA Learning Center, DNALC West and Harlem DNA Lab. In-school lab instruction was provided for 9,358 students and 1,411 students attended week-long winter and summer camps. An additional 2,054 students used footlocker kits, including 360 conducting independent research through *UBP*, *UBRP*, or *BLI*.

Grants from Bank of America, TEVA Pharmaceuticals, and the National Grid Foundation provided field trip scholarships for 1,850 students from Long Island public schools—including Brentwood, Uniondale, William Floyd, Central Islip, Roosevelt, and Valley Stream. The William Townsend Porter Foundation provided scholarships for 1,890 students at Harlem DNA Lab (65% of total students). Forty students from the New World Prep Charter School received scholarships for *Fun with DNA* and *World of Enzymes* summer camps held on the school campus in Staten Island, and 15 students from IS 59 in Queens participated in an ongoing collaboration with Northwell Health at DNALC West.

The Partner Member Program continued to provide custom science sequences and advanced electives for eight schools (primarily independent) in the tri-state region. New member Grace Church School offered a three-week summer program that combined *Genome Science* with DNA barcoding to survey biodiversity of the Hudson Estuary. At Marymount School of NY, middle school students received more inquiry-based instruction, while high school students continued to do *Genome Science* and DNA barcoding experiments as key parts of a molecular genetics elective. A barcoding team from Sacred Heart Academy (formerly Convent of the Sacred Heart) joined the *Billion Oyster Project*, which is devoted to restoring the oyster population in the Hudson Estuary. Eighth grade research students at Lycée Français de New York continued to use DNA barcoding to detect food fraud and survey the biodiversity of NYC. Riverdale Country School offered ninth and eleventh grade labs on gel electrophoresis and PCR. Chapin School added an agar art component to an existing microbiome study. St. David's School continued 5th and 8th grade programs, including a *Forensic Detectives* summer camp. As part of our continued collaboration with Long Island schools, two classes were co-taught by DNALC staff and school faculty. Students taking molecular and genomic biology electives at Cold Spring Harbor High School and St. Dominic High School received daily lab instruction from DNALC staff members.

During the year, our Ötzi the Iceman exhibition drew 6,100 visitors. Some were students performing activities developed by our instructors; some were the general public taking self-guided tours. An additional 170 visitors registered for interpretive tours. Many were drawn to the exhibit after viewing the NOVA special *Iceman Reborn* that documents the creation of the 3D replica of the Ötzi mummy in our exhibit. We developed a new middle school lab to coordinate with the exhibit. In this ancient forensic mystery, students identify types of pollen found in different parts of Ötzi's intestinal tract to deduce where he spent the last few days of his life. This lab is being developed as a commercial kit, under our long-term contract with Carolina Biological Supply Company (CBSC). We are also upgrading kits to meet Advanced Placement Biology standards to encourage students to



For the partial eclipse on August 21st, DNALC educators provided summer campers with eclipse-viewing glasses so they could step out of the lab classrooms at peak viewing time.



Cold Spring Harbor High School *Molecular and Genomic Biology* course participants visit Ötzi.



Students and parents dust for fingerprints during a *Saturday DNA!* session.

test hypotheses about the mechanics of key labs on bacterial transformation and restriction analysis. Kits developed under the CBSC are used by approximately 300,000 students annually, significantly extending the DNALC's reach.

Eight *Saturday DNA!* sessions drew 247 participants. Participants learned about lactose intolerance, identified an inherited transposon in their own DNA, compared their own mitochondrial DNA to modern humans and ancient relatives, and investigated the forces behind evolutionary change. They designed experiments to extract DNA from a variety of fruits and vegetables, and purified a fluorescent protein from genetically engineered bacteria. Two forensics sessions included fingerprint analysis and solving the *Mystery of Anastasia*.

Several new programs were presented in collaboration with the CSHL Women in Science and Engineering (WiSE) group. "Be WiSE about Neuroscience" included a talk and panel discussion with CSHL researcher Dr. Camila DosSantos for parents, and hands-on activities with TENS (transcutaneous electrical nerve) stimulators for children. A *WiSE Fun with DNA* summer camp for girls included special activities presented by enthusiastic young role models pursuing careers in science including a lab on herd immunity, Bollywood-style dancing to simulate mitosis, and an explanation of CRISPR gene editing technologies. Parent Day included student presentations and walking tours of CSHL.

We partnered with the American Society of Microbiology (ASM) to host several Agar Art workshops for the general public. Pieces completed at these workshops were automatically eligible for submission to the ASM Agar Art 2017 contest. Jenny Xu, a student from Chapin School in NYC, won this year's DNALC partner contest and was featured at the ASM Microbe conference for her submission "Blooming Microbes."

Our collaboration with the Watson School of Biological Sciences continued to train graduate students in skills needed to communicate science to almost any audiences. Graduate students work with DNALC instructors to complete 12, half-day teaching sessions, which are designed to prepare graduate students to quickly assess an audience and customize a presentation accordingly. After completing both middle and high school rotations, graduate students chose three elective workshops to implement the skills they developed.

BioMedia Visitation and Projects

In 2017, 6.4 million visitors accessed our suite of multimedia resources. Google Analytics counted 4,661,735 visits to DNALC websites, our YouTube videos received 942,861 views, and the *3D Brain*, *Weed to Wonder*, and *Gene Screen* smartphone/tablet apps were downloaded 816,669 times. In-app purchases of *3D Brain HQ* netted \$7,687 for the year. Visitation to DNALC websites has decreased, partly due to changing technology and partly due to content “aging out” (several of our websites were launched more than 15 years ago). We are forming new strategies to cope with these changes.

In developing our first interactive website in 1998, *DNA from the Beginning (DNAftB)*, we were among the first groups to make extensive use of Macromedia Flash, a cutting-edge media integration program now owned by Adobe. Flash technology allowed us to create additional innovative sites with major federal and private funding, including *Inside Cancer* and *DNA Interactive*. Although Flash allowed animations and video to run smoothly on web browsers, it began to fall out of favor with the rise of smart phones and tablets—which do not support the technology. In several years, Flash will no longer be supported in browsers on computers.

So, we now face the challenge of recreating our sites using newer HTML5 technology. This entails editing each Flash animation, testing interactivity programming, and repackaging the new HTML5 animation in a reconfigured website. We used this conversion process in 2017 to successfully update *DNAftB*, which has 41 “concepts”, or chapters—each with introduction, animation, gallery, videos, biographies, problem animation, and links. The animation and problem sections used Flash, so a total of 82 interactive files required conversion. After several months of testing and debugging, the smart device-friendly site launched in November.

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. 2017 highlights include:

- Collaboration on an exhibition with conceptual artist Joseph Rossano, *Conservation from Here*, at the Oyster Bay Historical Society and Sagamore Hill National Historic Site.
- An NSF MaizeCODE project website that provides researchers access to genome data for the maize inbred lines B73 and NC350.
- Design work on the *DNA Subway Purple Line*.
- Designs for *Breakthrough Junior Challenge* labs, as well as production of a video featuring biodiversity barcoding at the Philippine Science High School.
- Video interviews of student research teams from *Barcode Long Island* and the *Urban Barcode Project*.
- Enhanced design of the *Mystery of Anastasia* interactive to take full advantage of the new, higher resolution laptops in the Bioinformatics Laboratory.

Staff and Interns

The ranks of the instructional team were bolstered when Pauline McGlone, college intern, and Michael Paul, laboratory research technician, were promoted to genetics educators. Pauline began as a high school intern in 2012, and then returned while a student at Hunter College. In addition to teaching, Pauline manages our high school interns. Michael Paul joined the staff as our laboratory research technician in June. Michael's background in chemistry from Bowdoin College and natural teaching ability led to his transition to instructor and manager of college interns.

Jorge Pérez de Acha joined the DNALC's multimedia department as a Bioinformatics Researcher. Born and raised in Mexico City, Jorge attended a high school of fine arts in Boston, Massachusetts

with the intention of becoming an opera singer. However, a stint in his uncle's tax consulting firm piqued his interest in computer engineering, which he studied at the Instituto Tecnológico Autónomo de México. Jorge is working on enhancing our bioinformatics analysis tools.

We said goodbye to four staff members in 2017: administrative manager Carolyn Reid Faughnan; data science educator Joslynn Lee; genetics educator Katie McAuley; and lab technician Emtiaz Uddin. Carolyn became part of the DNALC's administrative team in 2003, rising to organize the entire administrative operation—including academic year field trips, summer camp programs, visitation statistics, and so much more. Carolyn retired at year's end to enjoy her extended family and some well-deserved rest and relaxation. "Ya'at'eeh! Shi éi Joslyn Lee yinishyé," was Joslynn's way of introducing herself in Navajo when she became the first Native American DNALC staff member. With a background in computational chemistry, she led the development of metagenomics analysis for CyVerse and *Barcode Long Island*. Joslynn left CSHL to become a science education fellow at Howard Hughes Medical Institute. Katie joined the DNALC in 2012, managing interns, overseeing footlocker preparation, and training DNALC Asia staff in Suzhou, in addition to instructing middle and high school labs. She left in September to teach forensic science, living environment, and earth science at Patchogue-Medford High School. With the expansion of our barcoding programs, Emtiaz became the DNALC's first full-time lab technician in 2015. He left early in 2017 to begin a career in mental health services administration.

Since the DNALC opened, we have relied on high school and college interns to support day-to-day operations. An internship offers each student the unique opportunity to gain real laboratory or design experience in an educational environment. The *BioMedia* Group also welcomes 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

Duardo Akerle, Half Hollow Hills High School	Alyssa Lugo-Mercado, West Hempstead High School
Caroline Ambriano, Cold Spring Harbor High School	Brady Lyons, St. Dominic's High School
Elijah Calle, Hempstead High School	Jillian Maturo, Syosset High School
Randy Diaz Arias, New Heights Academy Charter School	Natalie McCann, Huntington High School
Megan Erhardt, Huntington High School	Erika Mosso, Aquinas High School
Matthew Finkelberg, Syosset High School	Salvatore Salerno, Bethpage High School
Brianna Hines, Our Lady of Mercy Academy	Jon Triscari, St. Anthony's High School
George Homenides, Commack High School	Nathaniel Wang, Northport High School

High School Interns Departing for College

Alyssa D'Arrigo, Stony Brook University	Rahul Ranjan, Stony Brook University
Alec Haber, Washington University in St. Louis	Ben Rhee, Harvard University
Derek Lee, Cornell University	Bijia Wang, Emory University
Daniella Pillco, State University of New York at Buffalo	GraceAnne Woods, Stony Brook University

College Interns

Kathryn Bellissimo, The College of New Jersey	William McBrien, Stony Brook University
Gabrielle Blazich, Fordham University	Alec Micklos, Baruch College
Juliana Eastment, University of Richmond	Andrew Micklos, Lackawanna College
Marie Jean Francois, City University of New York at City College	Stefanie Montalbano, Fairfield University
Omotayo Ikuomenisan, Hunter College	Breanna Tahany, State University of New York at Binghamton
Michaela Lee, State University of New York at Oneonta	Maria Urbina, Tufts University

David Micklos
DNA Learning Center Executive Director

2017 Grants

Grantor	Program	Duration of Grant	2017 Funding ⁺
<i>FEDERAL GRANTS</i>			
National Institutes of Health	<i>Barcode Long Island</i>	7/14–3/19	279,365
National Science Foundation	<i>TRPGR; Maize Cell Genomics: Resources for Visualizing Promoter Activity and Protein Dynamics using Fluorescent Protein Lines</i>	10/14–9/18	66,480
National Science Foundation	<i>MaizeCODE—An Initial Analysis of Functional Elements in the Maize Genome</i>	6/16–5/19	183,073
National Science Foundation	<i>Biotechnology in American High Schools: Then and Now</i>	9/17 – 8/18	15,934
<i>NON-FEDERAL GRANTS</i>			
Alfred P. Sloan Foundation	<i>DNA Center NYC Start-up</i>	12/13–6/19	62,457
Bank of America Charitable Foundation	Genetics and Biotechnology Lab	11/15–11/17	5,000
Beijing No. 166 High School	Chinese Collaboration Agreement	5/14–6/18	30,246
Breakthrough Prize Foundation	Laboratory Design and Teacher Training for Breakthrough Junior Challenge Prize Winners	12/15–12/17	187,232
Ashley and Frank O'Keefe	Support for Eastwood School and Greenvale School	12/16–12/17	5,000
Pinkerton Foundation	<i>Urban Barcode Research Program</i>	1/13–5/18	116,645
William Townsend Porter Foundation	<i>Harlem DNA Lab for Underprivileged Students</i>	4/17–3/18	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	2,000	Long Beach Union Free School District	3,000
East Meadow Union Free School District	3,000	Massapequa Union Free School District	3,000
East Williston Union Free School District	1,500	North Shore Central School District	2,000
Elwood Union Free School District	2,000	Oceanside Union Free School District	2,000
Fordham Preparatory School	2,000	Oyster Bay-East Norwich Central School District	2,000
Half Hollow Schools Central School District	2,000	Plainedge Union Free School District	2,000
Harborfields Central School District	2,000	Plainview-Old Bethpage Central School District	2,000
Herricks Union Free School District	2,000	Portledge School	3,000
Huntington Union Free School District	2,000	Port Washington Union Free School District	2,000
Island Trees Union Free School District	2,000	Ramaz Upper School	2,000
Jericho Union Free School District	2,000	Roslyn Union Free School District	2,000
Levittown Union Free School District	2,000	Syosset Central School District	3,000
Locust Valley Central School District	2,000	Yeshiva University High School for Girls	2,000

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

Adelphi Science and Technology Entry Program	\$1,540	Jericho Union Free School District	\$7,232
Bellmore Union Free School District	\$10,420	Kings Park Union Free School District	\$3,630
Bethpage Union Free School District	\$5,235	Lawrence Union Free School District	\$5,390
Cold Spring Harbor Central School District	\$15,840	Locust Valley Central School District	\$11,072
Commack Union Free School District	\$2,530	Merrick Union Free School District	\$7,055
East Williston Union Free School District	\$2,117	Mott Hall II, New York	\$1,155
Edgemont Union Free School District	\$3,462	North Bellmore Union Free School District	\$4,250
Elwood Union Free School District	\$3,960	Northport - East Northport Union Free School District	\$1,100
Evangelical Lutheran Church of the Redeemer, Glendale	\$1,440	Oceanside Union Free School District	\$1,800
Floral Park- Bellerose Union Free School District	\$8,580	Oyster Bay- East Norwich Central School District	\$2,640
Garden City Union Free School District	\$10,872	Plainedge Union Free School District	\$1,155
Great Neck Union Free School District	\$9,075	Port Washington Union Free School District	\$10,560
The Green Vale School	\$1,622	PS 144, Forest Hills	\$5,280
Greenwich Country Day School	\$9,240	Rockville Centre Union Free School District	\$10,824
Half Hollow Hills Central School District	\$1,040	Roslyn School District	\$5,775
Hicksville Union Free School District	\$1,540	Scarsdale Public Schools	\$6,924
Hofstra STEP	\$1,650	Smithtown Union Free School District	\$8,350
Holy Child Academy	\$1,705	St. Patrick's School, Huntington	\$2,160
Horace Mann School	\$2,640	Syosset Union Free School District	\$44,385
Huntington Union Free School District	\$2,880	Three Village Central School District	\$3,080
Island Park Public Schools	\$2,160	Trevor Day School	\$1,155

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
	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
	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 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, Atlanta	1991, 1996–97
	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
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>	1997
	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, 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	2015–17
	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
	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, 2015–17
	Dolan DNA Learning Center	1990, 1992, 1995, 2000–11
	<i>Dolan DNA Learning Center</i>	1990–92
	DNA Learning Center West	2005
	Environmental Science Center, Bergen Beach, Brooklyn	2015–16
	<i>Fostertown School, Newburgh</i>	1991

NEW YORK, cont.	<i>Harlem DNA Lab</i> , East Harlem	2008–09, 2011–13, 2016, 2017
	<i>Harlem DNA Lab</i>, East Harlem	2015–16
	Huntington High School	1986
	Irvington High School	1986
	John Jay College of Criminal Justice	2009
	<i>Junior High School 263</i> , Brooklyn	1991
	<i>Lindenhurst Junior High School</i>	1991
	Math for America	2017
	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
	School of Visual Arts, New York	2017
	State University of New York, Purchase	1989
	State University of New York, Stony Brook	1987–90, 2015–17
	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</i> , Poughkeepsie	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
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
	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
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	1996
	EMBL/Australian Bioinformatics Resource, University of Melbourne	2016
AUSTRIA	Vienna Open Lab, Vienna	2007, 2012
CANADA	Red River Community College, Winnipeg, Manitoba	1989
CHINA	Beijing No. 166 High School, Beijing	2013, 2014–17
	Ho Yu College, Hong Kong	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	2015
ITALY	International Institute of Genetics and Biophysics, Naples	1996
	Porto Conte Research and Training Laboratories, Alghero	1993
MEXICO	ADN Mexcio, Morelia	2008
	ASPB Plant Biology, Merida	2016
	Langebio/Cinvestav, Irapuato	2016
NIGERIA	Godfrye Okoye University, Enugu, Nigeria	2013
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	2001–05
	Singapore Science Center	2013
SOUTH AFRICA	North-West University, Potchefstroom	2016
	South African Bioinformatics Society, Durban	2013
SWEDEN	Kristineberg Marine Research Station, Fiskebackgkil	1995
	Uppsala University	2000
THE NETHERLANDS	International Chromosome Conference, Amsterdam	2007
	Wageningen University and Research Center, Wageningen	2014
UNITED KINGDOM	The Genome Analysis Center, Norwich	2015
	University of York, York	2017
	Wellcome Trust Conference Center, Hinxton	2012–13
	University of Warwick, Coventry	2013

Workshops, Meetings, Collaborations, and Site Visits

January 5	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
January 11	NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
January 14	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
January 14–18	International Plant and Animal Genome XXV Conference 2017, CyVerse Education Session: <i>DNA Subway, Data Science, and Microbial Genomics</i> ; "Data Science Challenges and Solutions for Student Microbiome Research," "Student DNA Genotyping by Mass Spectrometry: An Affordable Look into DNA Ancestry," "Planning, Executing and Cultivating Broader Impact Programs: Tools, Communities and Resources to Get Organized, Get Connected, Get Noticed and Get Funded," San Diego, California
January 17	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i> <i>Urban Barcode Project Open Lab, Genspace, Brooklyn, New York</i>
January 21	NIH <i>Barcode Long Island</i> , Microbiome Project Open Lab, Brookhaven National Laboratory, Upton, New York
January 25	<i>Ötzi the Iceman Tour</i> , DNALC Site visit by Karen Scharbach, Jim Medina, Paul Paino, Don Corrao, and Clifford Packingham, St. Anthony's High School, South Huntington, New York
January 26	Site visit by Donna Moro, Jack Abrams STEM School, Huntington, New York
January 27	Cold Spring Harbor High School, <i>Marine Biology/DNA Barcoding Teacher Workshop</i> , DNALC
January 28–29	NIH <i>Barcode Long Island</i> , Microbiome Project Bioinformatics Refresher, DNALC
January 29–30	"Meet the Scientist," St. David's School, New York, New York
January 31	<i>Urban Barcode Project Open Lab, Genspace, Brooklyn, New York</i> NIH <i>Barcode Long Island Open Lab</i> , DNALC
February 2	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
February 3 & 5	ASM Agar Art Teacher Workshop, Part 1, School of Visual Arts, New York, New York
February 4	<i>Saturday DNA! "Mitochondrial DNA Analysis," DNALC</i> <i>Ötzi the Iceman Tour</i> , DNALC <i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
February 6–17	<i>DNA Barcoding, DNA Science, and Research Student Workshops</i> , Beijing 166 School, DNALC
February 7	CSHL <i>Gramene: A Resource for Comparative Plant Genomics Webinar</i> , DNALC
February 8	NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
February 10	<i>Urban Barcode Research Program Student Mixer</i> , The Irondale Center for Theater, Education, and Outreach, Brooklyn, New York
February 13–14	NIH <i>Virtual Train the Trainers Workshop</i> , DNALC
February 14	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i> <i>Urban Barcode Project Open Lab, Genspace, Brooklyn, New York</i>
February 17	NSF CyVerse site visit by Parker Antin, University of Arizona, Tucson, Arizona
February 18	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
February 21	<i>Ötzi the Iceman Tour</i> , DNALC
February 21–24	<i>Urban Barcode Research Program Conservation Genetics Workshop, Harlem DNA Lab</i> <i>Urban Barcode Research Program Conservation Genetics Workshop</i> , Rockefeller University, New York, New York
February 23	<i>Ötzi the Iceman Tour</i> , DNALC Site visit by Nurit Bar-Shai and Franklin Adams, GenSpace, Brooklyn, New York
February 25	<i>Saturday DNA! "Enzymes in Action," DNALC</i>
February 28	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i> <i>Urban Barcode Project Open Lab, Genspace, Brooklyn, New York</i>
March 4	NIH <i>Barcode Long Island Open Lab</i> , DNALC
March 8	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i> NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC

March 9	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
March 10–13	Data Collection from Maize Community for MaizeCODE Project at Maize Genetic Conference, St. Louis, Missouri
March 11	<i>Saturday DNA! “Driving Evolution,” DNALC</i>
March 14	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
March 17	<i>Ötzi the Iceman Tour, DNALC</i>
March 18–19	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
March 20–21	NIH Barcode Long Island Open Lab, Brookhaven National Laboratory, Upton, New York NSF CyVerse Researchers Workshop, “Overview of CyVerse,” University of York, York, United Kingdom
March 23	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i> Long Island Science and Engineering Fair, Inc. Judging, Plainview, New York
March 25–26	NIH Barcode Long Island Open Lab, DNALC
March 27–30	<i>DNA Science/DNA Barcoding/Independent Research Internship Teacher Workshop, Beijing 166 School, Beijing, China</i>
March 28	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
March 29	<i>Ötzi the Iceman Tour, DNALC</i>
April 1	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
April 4	<i>Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
April 5	NSF CyVerse Webinar Series, “Get Started with CyVerse,” DNALC
April 6	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
April 11	CSHL Gramene: A Resource for Comparative Plant Genomics Webinar, DNALC
April 13–14	Big Data Literacy Workshop, New York Hall of Science, Queens, New York
April 18	2017 LI STEM Hub Annual Celebration and Industry & Student Showcases, Brookhaven National Laboratory, Upton, New York
April 18–19	AgBioData Meeting, “CyVerse Overview,” Salt Lake City, Utah
April 20	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i> “Native American Role Model Speaker Series,” Northern Arizona University, Flagstaff, Arizona Site visit by Raymond Loverso and Syosset High School science faculty members, DNALC
April 20–21	Site visit by Mexican Delegation: Mauricio Hernandez, former Director National Public Health Institute and former Vice Minister of Health; Liliana Hernandez, IAP, Mexico; and Armando Barriguete, Coordinator, DNALC Mexico
April 21	<i>Barcode Long Island at Suffolk Teachers Association of New York State</i> STEM Conference, Brookhaven National Laboratory, Upton, New York
April 22	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i> <i>Saturday DNA! “DNA on the Go,” DNALC</i> <i>Ötzi the Iceman Tour, DNALC</i> NIH Barcode Long Island Open Lab, Brookhaven National Laboratory, Upton, New York <i>Science March for Earth Day, New York, New York</i>
April 26	<i>Ötzi the Iceman Tour, DNALC</i>
April 29–30	NIH Barcode Long Island Open Lab, DNALC
May 2	<i>Urban Barcode Project Open Lab, Harlem DNA Lab</i>
May 4	<i>DNA Subway Open Lab, DNALC</i> <i>Ötzi the Iceman Tour, DNALC</i>
May 6	<i>Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
May 6–7	NIH Barcode Long Island Open Lab, Stony Brook University, Stony Brook, New York
May 9	<i>Urban Barcode Project/Urban Barcode Research Program Open Lab, Harlem DNA Lab</i>
May 10	NSF CyVerse Webinar Series, “Get Started with CyVerse,” DNALC <i>Urban Barcode Research Program Student Mixer, The Irondale Center for Theater, Education, and Outreach, Brooklyn, New York</i>
May 12	CUNY Advanced Science Research Center Urban Collaborative Day, New York, New York

- Site visit by Julie Horvath, North Carolina Museum of Natural Sciences, Raleigh, North Carolina
- May 13 *Saturday DNA!* “Be WiSE about Neuroscience,” DNALC
NIH *Barcode Long Island* Open Lab, Roslyn High School, Roslyn, New York
DNA Subway Open Lab, DNALC
- May 16 NIH *Barcode Long Island*, Shoreham-Wading River High School STEM Symposium, Wading River, New York
- May 15–17 NIH *Microbiome Hackathon*, DNALC
- May 20 NIH *Barcode Long Island* Open Lab, Brookhaven National Laboratory, Upton, New York
Banana DNA Extraction Exhibition, Super Saturday STEM Expo, Harlem Children’s Zone Armory, New York, New York
- May 22–26 NSF *CyVerse Genome Science and Leadership* Workshop, Durango, Colorado
- May 24 *Ötzi the Iceman* Tour, DNALC
- May 25 *Urban Barcode Project/Pinkerton Urban Barcode Research Program* Symposium, New York Academy of Medicine, New York, New York
- May 30 *Urban Barcode Research Program* at High School for Environmental Studies Science Fair, New York, New York
- May 31 NIH *Barcode Long Island*, 2017 Open Space Stewardship Celebration/Symposium, Brookhaven National Laboratory, Upton, New York
Urban Barcode Project at Tenaflly Science Fair, Tenaflly, New Jersey
- June 2 “Approaches to Evaluating Authentic Science Research,” NIH SciEd Conference 2017, Metro Center, Washington, D.C.
- June 3 *Saturday DNA!* “The Extraction Attraction,” DNALC
- June 6 “DNA Barcoding,” Genspace, Brooklyn, New York
NSF *CyVerse Tools and Services* Workshop, University of Arkansas, Fayetteville, Arkansas
- June 7 *Barcode Long Island* Student Symposium, CSHL
NSF *CyVerse* Webinar Series, “Get Started with *CyVerse*,” DNALC
- June 7–8 NSF *CyVerse Genomics Data Carpentry* Workshop, University of Arkansas, Fayetteville, Arkansas
Science Research Mentoring Program Colloquium with *UBRP* students, American Museum of Natural History, New York, New York
- June 9 *Urban Barcode Project/Urban Barcode Research Program* at Youth Educational Seining Symposium, Brooklyn Bridge Park and St. Francis College, Brooklyn, New York
- June 10 Cold Spring Harbor Laboratory Open House, CSHL
- June 10–11 NSF *CyVerse Genomics in Education* Workshop, James Madison University, Harrisonburg, Virginia
- June 12 NSF *CyVerse Tools and Services* Workshop, James Madison University, Harrisonburg, Virginia
- June 12–16 *Forensic Detectives* Workshop, St. David’s School, New York, New York
Green Genes Workshop, Lycée Français, New York, New York
Human Genomics Workshop, Lycée Français, New York, New York
- June 15–16 ECSITE Conference, “Having Fun With Classification,” “Collective Therapy Parody,” and “Unleashing Citizen Contributions to Science for All,” European Citizen Science Association Working Group, Interdisciplinary Centre of Marine and Environmental Research, Natural History and Science Museum of the University of Porto, Porto, Portugal
- June 14 *Ötzi the Iceman* Tour, DNALC
- June 15–26 *DNA Barcoding* Workshop, Grace Church High School, New York, New York
- June 16 Site visit by Bruce Ratner, Forest City New York, Brooklyn, New York
- June 19 Site visit by Sam Janis, Project Lead of Billion Oysters Project, *Harlem DNA Lab*
- June 20 *Urban Barcode Research Program*, Pinkerton Youth Council, American Museum of Natural History, New York, New York
- June 22 Exhibited at the Long Island Invasive Species Management Area Conference, Sisters of St. Joseph, Brentwood, New York

	Ötzi the Iceman Tour, DNALC
June 23	Site visit by Mike and Lois O'Brien and Ebby Gerry, <i>Mary Harriman and Eugenics</i> , DNALC
June 26	NSF CyVerse, Plant Biology 2017, Honolulu, Hawaii
June 26–30	NIH <i>Barcode Long Island</i> Workshop, Brookhaven National Laboratory, Upton, New York
	<i>Genome Science</i> Workshop, DNALC Asia, Suzhou, China
	<i>DNA Science</i> Workshop, DNALC (2 sessions)
	<i>Fun with DNA</i> Workshop, DNALC
	<i>Green Genes</i> Workshop, DNALC
	<i>Fun with DNA</i> Workshop, DNA Learning Center West
June 27–July 8	<i>Genome Science</i> Workshop, Grace Church High School, New York, New York
July 3–7	<i>Forensic Detectives</i> Workshop, DNALC
	<i>Fun with DNA</i> Workshop, DNALC
	<i>Genome Science</i> Workshop, DNALC
	<i>World of Enzymes</i> Workshop, DNALC
	<i>World of Enzymes</i> Workshop, DNA Learning Center West
July 3–7	<i>Fun with DNA</i> Workshop, DNALC Asia, Suzhou, China
July 6	NIH CyVerse <i>Tools and Services</i> Workshop, University of Arkansas, Fayetteville, Arkansas
July 7	<i>Alu Lab</i> , Study @ Dushu Lake Tour from Suzhou, China, DNALC
July 7–8	NIH CyVerse <i>Genomics Data Carpentry</i> Workshop, University of Arkansas, Fayetteville, Arkansas
July 10	Ötzi the Iceman Tour, DNALC
	<i>Alu Lab</i> , Study @ Dushu Lake Tour from Suzhou, China, DNALC
July 10–14	<i>Barcode Long Island</i> Workshop, DNALC
	<i>DNA Science</i> Workshop, DNALC
	<i>Green Genes</i> Workshop, DNALC
	<i>World of Enzymes</i> Workshop, DNALC
	<i>DNA Science</i> Workshop, DNA Learning Center West
	Pinkerton <i>Urban Barcode Research Program</i> Conservation Genetics Workshop, <i>Harlem DNA Lab</i>
	<i>World of Enzymes</i> Workshop, DNALC Asia, Suzhou, China
July 13	"Barcode Long Island: Infrastructure for Citizen Science," DIYbio—DC Genomics Meetup, NIH, Bethesda, Maryland
July 14	"DNA Barcoding: Infrastructure for Citizen Science," Citizen Science Working Group, NIH, Bethesda, Maryland
July 17–21	Pinkerton <i>Urban Barcode Research Program</i> DNA Barcoding Workshop, <i>Harlem DNA Lab</i>
	<i>Fun with DNA/World of Enzymes</i> Workshops, Beijing 166 School, DNALC
	<i>DNA Barcoding</i> Workshop, DNALC
	<i>Fun with DNA</i> Workshop, DNALC
	<i>Green Genes</i> Workshop, DNA Learning Center West
July 19	NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
July 24	Ötzi the Iceman Tour, DNALC
July 24–28	<i>Forensics</i> Workshop, Beijing 166 School, DNALC
	<i>Green Genes</i> Workshop, Beijing 166 School, DNALC
	<i>BioCoding</i> Workshop, DNALC
	<i>DNA Science</i> Workshop, DNALC
	<i>World of Enzymes</i> Workshop, DNALC
	<i>Fun with DNA</i> Workshop, DNA Learning Center West
July 25	Ötzi the Iceman Tour, DNALC
	Professional Development Workshop, "Bacterial Transformation and Protein Purification," <i>Harlem DNA Lab</i>
July 26	Professional Development Workshop, "Restriction Analysis," <i>Harlem DNA Lab</i>
July 27	Professional Development Workshop, "DNA Fingerprinting—Detecting <i>Alu</i> Mutation by

	PCR," <i>Harlem DNA Lab</i>
July 28	Professional Development Workshop, "Human Mitochondrial Sequencing," <i>Harlem DNA Lab</i> Presentation, Shanghai Business School and Shanghai Finance University, CSHL
July 31	<i>Ötzi the Iceman</i> Tour, DNALC
July 31–Aug. 4	<i>Forensics</i> Workshop, Beijing 166 School, DNALC <i>Green Genes</i> Workshop, Beijing 166 School, DNALC <i>DNA Barcoding</i> Workshop, DNALC <i>Fun with DNA</i> Workshop, DNALC <i>DNA Science</i> Workshop, DNA Learning Center West <i>DNA Science</i> Workshop, <i>Harlem DNA Lab</i> <i>Fun with DNA</i> Workshop, New World Preparatory Charter School, Staten Island, New York
August 7	<i>Ötzi the Iceman</i> Tour, DNALC
August 7–11	<i>DNA Science</i> Workshop, DNALC <i>Fun with DNA</i> Workshop, DNALC <i>Green Genes</i> Workshop, DNALC <i>World of Enzymes</i> Workshop, DNALC <i>Forensic Detectives</i> Workshops, DNA Learning Center West Pinkerton <i>Urban Barcode Research Program Conservation Genetics</i> Workshop, <i>Harlem DNA Lab</i> <i>Barcode Long Island</i> Workshop, Stony Brook University, Stony Brook, New York
August 9	NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
August 14	<i>Ötzi the Iceman</i> Tour, DNALC Site visit by Jenny Negrom, Pinkerton Foundation, <i>Harlem DNA Lab</i>
August 14–18	<i>DNA Science</i> Workshop, DNALC <i>Fun with DNA</i> Workshop, DNALC <i>Genome Science</i> Workshop, DNALC <i>Green Genes</i> Workshop, DNALC <i>Green Genes</i> Workshop, DNA Learning Center West <i>World of Enzymes</i> Workshop, New World Preparatory Charter School, Staten Island, New York Pinkerton <i>Urban Barcode Research Program</i> DNA Barcoding Workshop, <i>Harlem DNA Lab</i>
August 15	Site visit by Carlos Sierra Sanchez, Columbia University, New York, New York, <i>Harlem DNA Lab</i>
August 16	Site visit by Guangzhou Delegation, Zhou Yawei, standing member of the CPC Guangzhou Committee and Director-General of Guangzhou Development District Administrative Committee, and Sherry Liu, Guangzhou, China
August 21	Site visit by Martin Elias of Elias Properties and family
August 21–25	<i>Being Human</i> Workshop, DNALC <i>DNA Science</i> Workshop, DNALC <i>Forensic Detectives</i> Workshop, DNALC <i>World of Enzymes</i> Workshop, DNALC <i>Fun with DNA</i> Workshop, DNA Learning Center West <i>DNA Barcoding</i> Teacher Workshop, <i>Harlem DNA Lab</i>
August 22	Eugenics Interview, <i>White Supremacy, Eugenics, and the History of Selective Breeding</i> , NBC Left Field, CSHL
August 24–25	<i>Software Carpentry</i> Workshop, Los Alamos National Lab, New Mexico
August 28–29	NSF CyVerse <i>Genomics Data Carpentry</i> Workshop, New Mexico State University, Las Cruces, New Mexico
Aug. 28–Sept. 1	<i>DNA Science</i> Workshop, DNALC <i>Fun with DNA</i> Workshop, DNALC <i>Green Genes</i> Workshop, DNALC <i>World of Enzymes</i> Workshop, DNALC <i>WiSE Fun with DNA</i> Workshop, CSHL <i>World of Enzymes</i> Workshop, DNA Learning Center West

- August 30 NSF CyVerse *Data Carpentry* Workshop, New Mexico State University, Las Cruces, NM
- September 11 Site visit by Hannah Meagher and Mark Mannucci, PBS American Masters series, to film Dr. James Watson, DNALC
- September 13 NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
- September 16 Pine Barrens Discovery Day Event, Wertheim Wildlife Refuge, Shirley, New York
- September 19 *Ötzi the Iceman* Tour, DNALC
- Site visit by Brett Curlew, BNL/BOCES and OceansWide, DNALC
- September 21 *Ötzi the Iceman* Tour, DNALC
- October 3 *Urban Barcode Research Program* Cohort 5 Mentor Matching Event, The Irondale Center for Theater, Education, and Outreach, Brooklyn, New York
- October 6 Site visit by Jeff Chen, Suzhou High School of Jiangsu Province, Suzhou, China
"The *Urban Barcode Research Program*," CUNY City College, New York, New York
- October 14 *Saturday DNA!* "Dust Away Crime—The Truth About Fingerprints," DNALC
- October 15 *Ötzi the Iceman* Tour, DNALC
- October 16–17 *Human DNA Fingerprint: Genotyping a "Jumping Gene"* Teacher Workshop, Math for America, New York, New York
- PTC/GMO* Workshop, Beijing 166 School, Beijing, China
- October 18 NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
- October 19 *Ötzi the Iceman* Workshop, Michael J. Petrides School, Staten Island, New York
- October 18 & 20 *PTC/GMO* Workshop, Beijing 166 School, Beijing, China
- October 21 Sagamore Hill STEM Festival Event, *DNA Extractions*, Oyster Bay, New York
- October 23 Site visit by Jeffry Petracca, Long Island Aquarium, Riverhead, New York
- October 23–24 *PTC/GMO* Workshop, Beijing 166 School, Beijing, China
- October 24 Site visit by Beverly Lee-Wo, The Nature's Bounty Company, Ronkonkoma, New York
- October 26 *Urban Barcode Research Program*, Austrian Research and Innovation Talks (ARIT), Palm Door on Sixth, Austin, Texas
- DNA Barcoding* Teacher Workshop, Beijing 166 School, Beijing, China
- November 2 *DNA Barcoding* Teacher Workshop, Beijing 166 School, Beijing, China
- November 3 Site visit by Suzhou Industrial Park Administrative Committee Education Bureau Delegation, Suzhou, China
- November 4 *Saturday DNA!* "Glowing Genes," DNALC
- November 10–11 *Ötzi the Iceman* Tour, DNALC
- "Forensic Analysis of *Ötzi the Iceman*," "Sense in Molecules: Modeling Personalized Medicine," and "DNA Barcoding—Independent Research in the Classroom," NABT—2017 Professional Development Conference, St. Louis, Missouri
- November 13–17 *Breakthrough Junior Challenge* Teacher Training Workshop, Palawan, Philippines
- November 14 Site visit by Allison Slabaugh, Mary Galvin, and Amy Stark, Notre Dame University, South Bend, Indiana
- November 15 NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
- November 18 NIH *Barcode Long Island* Open Lab, DNALC
- November 21 *Ötzi the Iceman* Tour and Film, Members of "The Transition Network," New York, DNALC
- November 29 "The Bioinformatics Training Landscape," Toronto Area Bioinformatics User Group (TorBUG), University of Toronto, Toronto, Canada
- December 2 NIH *Barcode Long Island* Open Lab, DNALC
- December 9 *Saturday DNA!* "A Royal Ruse," DNALC
- December 13 NSF CyVerse Webinar Series, "Get Started with CyVerse," DNALC
- December 16 NIH *Barcode Long Island* Open Lab, Stony Brook University, Stony Brook, New York
- December 21 Site visit by Dr. Armando Mansilla Olivares and family, Mexican National Academy of Medicine and Armando Barriguete, Mexico City, Mexico
- December 27 *Ötzi the Iceman* Tour, DNALC
- December 28 *Ötzi the Iceman* Tour, DNALC



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