2021 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: DNALC staff worked with the Downtown Brooklyn Partnership to develop street banners to promote DNALC NYC at City Tech. Double-sided banners were placed in four locations around the neighborhood.
Executive Director’s Report

Carrying on with COVID-19

A year into the COVID-19 pandemic, the DNA Learning Center (DNALC) continued to find ways to be a hands-on science center “without hands.” We converted all of our traditional lab field trips into virtual events, where students worked “live” with an online DNALC instructor, at home or in school. In the spring, we began to see a steady trickle of students coming for in-person instruction on school field trips, *Saturday DNA!*, and February winter break courses.

To allow for socially-distanced instruction, we initially operated labs at ¼ capacity—with only one student per lab bench! This was part of an extensive “COVID-19 Safety Net” that included daily student temperature monitoring and health screening, and twice-weekly testing for DNALC instructional staff.

Hoping to capitalize on pent-up demand for hands-on science experiences, we rebooted our in-person science camps for the summer season. This required new Internet infrastructure to securely collect required vaccine records or negative COVID-19 tests, 50% occupancy to allow for social distancing, and vaccination of all DNALC staff. This allowed us to operate the entire summer without any reported COVID-19 cases. Camps held at our new Brooklyn facility and with partner schools helped us to compensate for smaller classes and accommodate 751 in-person campers—so attendance actually equalled pre-COVID-19 numbers of summer 2019. With an additional 102 virtual campers, supported with mail-order kits, the total summer attendance topped 2019 by 14%! However, income just equaled 2019, due to significant numbers of scholarships for minority/disadvantaged students (85) and Cold Spring Harbor Laboratory (CSHL) and City University of New York (CUNY) employees (17).

So, it was clear that students were anxious to get back into the lab for the hands-on experiences they missed during the pandemic. However, with the advent of the Omicron variant, late fall proved disastrous, with most Long Island school districts halting out-of-school activities and New York City (NYC) public students prohibited from using public transport for field trips. Our new facility at Regeneron Pharmaceuticals remained shuttered until late fall.
The Long Road to Brooklyn

Postponed due to the pandemic, DNALC NYC officially opened on September 24th on the campus of the New York City College of Technology (City Tech) in downtown Brooklyn. With six teaching labs, two bioinformatics labs, exhibition, and lunchroom, the 17,500-square-foot facility is 25% larger than our flagship location in Cold Spring Harbor (CSH). At the opening ceremony, Bruce Stillman summarized CSHL’s historical association with Brooklyn: “130 years ago, the Brooklyn Institute of Arts & Sciences established a teaching facility at Cold Spring Harbor. This Brooklyn initiative evolved over the years to be the global epicenter of modern biology and genetics. Through the DNA Learning Center program, the latest in life science is shared with students in real-life experiences and experiments. Today’s event is a homecoming for Cold Spring Harbor Laboratory. We’re thrilled to be back in Brooklyn and we hope to continue to make Brooklyn proud!”

Many people helped us along the way to Brooklyn, including three who are no longer with us—Mary Jeanne Harris, Wendy van Der Poel Russell, and Arthur Spiro. In the 1970’s, Jim Watson said that he hoped for an angel who would help him save CSHL from bankruptcy; the DNALC’s angel and constant friend has been Laurie Landeau (speaking, at left). In her remarks, Laurie recalled the many fits, starts, properties visited, and grants gained and lost on the road to Brooklyn. Her faith in our venture never waned, and she proposed that “patience” is a missing virtue in philanthropy.

In founding the Harlem DNA Lab we were lucky to have the support of NYC Schools Chancellor Joel Klein. In opening the Brooklyn center, we have had the support of many within the CUNY System—most notably City Tech President Russ Hotzler, who has become a fast friend in the process. At the ceremony, CUNY Chancellor Felix Rodriguez noted this long-term collaborative and looked forward to engaging large numbers of undergraduate students in research experiences.

When we had the idea to open a center in NYC, we looked at over a dozen properties in Manhattan in 2014–15—just as the market rebounded and they became unaffordable. Considering the possibilities of the Borough of Brooklyn was a real eye opener—because it was becoming clear to everyone that it was emblematic of the “new” New York. As Borough President, keynote speaker Eric Adams had been the primary architect of the tremendous revival of Brooklyn. In his remarks, he stressed the need for collaboration between government, education, and business to stimulate continued innovation in science and technology. True to this ideal, the Office of the Brooklyn Borough President provided $750,000 for state-of-the art scientific and exhibit equipment for DNALC NYC at City Tech.
The long road to Brooklyn began in Cold Spring Harbor in 1985, when we developed simple methods to allow high school students to analyze DNA molecules. Long Island teachers were enthusiastic to learn this technology, so we came up with the idea of mobile vans full of equipment that could outfit any classroom for a gene cloning experiment. For a decade, we crisscrossed the country with two vans and trained thousands of teachers. In the meantime, in 1988, we started the DNALC at CSHL as the first science center devoted to public genetics education.

Over the next several decades we continued to develop lab and computer infrastructure that was used by hundreds of thousands of students per year. This supported the rapid growth of elective programs in biotechnology and student research. There are now convincing data that show that this approach works: students who have a significant research experience are 20 percent more likely to stay interested in science. They are also 20 percent more likely to graduate on time, which shows that thinking like a researcher has broad impacts on a person’s life. We call this *Research Ready*—in doing research students are not only ready to compete in science, but they are also ready for further education and careers—ready for research, ready for life.

Wealthy schools realize this. Virtually all of the 124 school districts on Long Island and many in the New York metropolitan area have elective biotechnology and research courses—these schools accounted for 20% of 2020 finalists in the prestigious Regeneron Science Talent Search. We even started a Partnership Program to help private schools in Manhattan keep up with the suburban schools. Our National Science Foundation (NSF) supported study of 2,200 biology teachers in 2018 showed that 2/3 of high schools with biotech electives were in zip codes with household incomes above the US median. The best schools also infuse inquiry labs and project-based learning into regular science courses. Students from science-active schools are competitive for admission to the best science universities. They arrive at college ready to participate in early research opportunities that drive further success—including course-based undergraduate research experiences (CUREs) that reach many freshman students. They also learn skills and competencies that prepare them for the jobs of the future.

However, our own surveys of teachers showed that these great experiences were mostly only available in wealthy high schools. Students from resource-poor schools are not prepared to compete with their peers from schools with active biotech research programs for college admission and jobs—and in life. This is reflected in the persistent underrepresentation of Blacks, Hispanics, and Native Americans at all levels of science education and the workforce.

It was becoming obvious that the entire infrastructure we developed over several decades had failed to solve the hardest problem in science education: to involve a diverse population of students in real science. We realized we could never hope to solve this problem from Long Island; we needed to set up shop in NYC. So, in 2008, we teamed with the NYC Department of Education (DOE) to set up a single DNA lab in a NYC public school in Harlem. Our experiment in Harlem worked—there we found that we could readily reach a natural clientele that is about two-thirds disadvantaged and underrepresented minority students.

We then launched a decade-long search that led to DNALC NYC. It’s the biggest physical infrastructure project we have tackled. Here, we will apply everything we have learned about science education over the last 35 years. Quite simply, we want to give to the students of NYC exactly the same practical and research experiences that Long Island students have enjoyed for decades.

DNALC NYC will bring *Research Ready* to level the biology playing field for URM and disadvantaged students through six major programs: 1) Broadly available enrichment for precollege students: field trips, summer camps, and intensive research experiences; 2) Virtual learning opportunities to reach more students in more situations; 3) Comprehensive college biology and life preparation; 4) Pathways to biology careers; 5) Course-based undergraduate
research experiences for CUNY students; and 6) Public exhibition on shared inheritance and social justice. All of these programs will help students to see themselves as people of science and to smoothly transition from high school to higher education and careers. This is especially important in NYC, where approximately two-thirds of public-school students are underrepresented minorities or from disadvantaged backgrounds and nearly 80% of freshman in the CUNY system are graduates of NYC public schools. In parallel with the renovation of the facility, we established an $11 million endowment to provide scholarships to at least half of all students attending academic year programs and to broadly support diversity, equity, and inclusion.

For the last 30 years, the DNALC has worked intensively with selected Long Island school districts and New York City Schools to develop strong, lab-based programs in modern biology. This begins with substantial genetics units in middle school, progresses to molecular genetics lab modules in Regents and Advanced Placement (AP) Biology courses, biotechnology electives, and culminates in capstone research programs in DNA sequencing. Through Research Ready, we will offer these same opportunities for under-resourced schools in New York City. First, we will work with school administrators and science teachers to develop a customized scope and sequence in biology, culminating in broadly available research experiences. Second, we will work with a selected group of motivated students to provide them a structured biology immersion over the last four years of high school—including summer and academic year courses and research experiences. Research mentors will guide these students and prepare them for college. An alumni network will support students, especially as they adjust in their college freshman year. College alumni will be welcomed back as peer mentors for subsequent years of the program.

What DNA Says About Our Past and Future

During the year, we made substantial progress on the permanent exhibition for the Brooklyn center, What DNA Says About Our Past and Future. Funded by a grant from CSHL Trustee Paul Taubman, the exhibit is the culmination of several decades of work to popularize “personal genetics” for students and to present a hopeful message of genetics in our lives. “DNA Past” will take a side door into issues of social justice by emphasizing that “knowledge of our shared genetic ancestry is the best inoculation against racism.” The DNA of any two people is 99.9% identical; racial and ethnic differences acquired as we peopled the globe are, indeed, only “skin deep.” By exploiting current interest in ancestry, we want to make DNALC NYC a destination for people who want to incorporate DNA into their family exploration. During the year we reached an agreement with scientists from 23andMe to have exclusive access to their DNA data from hundreds of thousands of people. These data will be displayed on the centerpiece of the exhibit—a 9 x 16 foot “video wall” provided by a grant from the Office of the Brooklyn Borough President. A floor-to-ceiling world map will allow visitors to see personal DNA as data points in reconstructing migrations and diaspora that mixed people and their genes throughout history.

The weeks leading up to the September opening were a flurry of activity, as the DNALC design team made ready the first component of our permanent exhibition, “Innovation and Gene Mixing in the Bronze Age.” Two case studies—Ötzi the Iceman, from 3300 BC, and the early Philistines, from 1200 BC—examine how innovations in agriculture, animal husbandry, international trade, and metallurgy mixed genes in Eurasia. First, we retrieved a 3D recreation of Ötzi from his storage container in the CSHL warehouse in Syosset. He had languished there since his completion in 2017, with his twin currently on display at the DNALC in Cold Spring Harbor. The making of this replica from CT scan data was the subject of the PBS special, “Iceman Reborn.” Ötzi lived in the Alps at the very beginning of the Bronze Age and illustrates the transition between hunting-gathering and farming. Although he had the tools of a hunter, his DNA type
originated in the Middle East—showing that he descended from early agriculturalists who brought farming to Europe. In addition to presenting an ancient murder mystery, Ötzi illustrates the antiquity of supposedly modern maladies. DNA analysis revealed that he carried the genome of *Borrelia*, which causes Lyme disease. Although Ötzi ate a healthy “Neo(lithic)” diet, he carried DNA markers for heart disease and had Atherosclerotic plaques in his major artery.

The second part of the exhibit revolves around events in Ashkelon, Israel at the end of the Bronze Age and into the ensuing Iron Age. The Leon Levy Foundation, an endowment fund contributor, introduced us to Daniel Master, of Wheaton College, and Adam Aja, of the Harvard Museum of the Ancient Near East. These archaeologists concluded 20 years of excavations at Ashkelon and uncovered the first Philistine cemetery. DNA analysis from graveyard skeletons validated oral tradition that the original Philistines were migrants from Minoan Crete. However, it also showed that the Philistines were genetically assimilated into the local Canaanite population within several hundred years of their arrival! Using 3D scans provided by Dr. Master, we worked with Blue Rhino Studios to recreate a Philistine burial from 900–750 BC. The authenticity of the display is heightened by eight pieces of Philistine pottery loaned from the Israel Antiquities Authority, shipped, and installed in time for the opening.
As the year ended, we began work with CSHL trustee Jeanne Moutoussamy-Ashe on a photo gallery that joins DNA past and future. “All the World in New York” will draw portraits from amateur photographers that highlight New York City as a modern melting pot—in the way the Middle East was during the Bronze Age. All people alive today are closely related by their common “DNA Past;” however, “DNA Future” points toward modern medicines that are tailored to the unique physical attributes of population groups and individuals. Among the DNA differences between any two people are mutations that make many diseases “personal.” For example, similar cancers may be caused by different mutations in different people. Personalized, or precision, medicine tailors treatment to the specific mutations that drive disease in a particular person.

“All New York Nobels” will highlight 35 Nobel laureates who graduated from NYC high schools and show what students visiting the DNALC can attain. A life-sized model of CSHL Nobel Laureate Barbara McClintock at work with her microscope is a hyper-local story of success in science—she grew up in Brooklyn and graduated from Erasmus Hall High School!

**High School DNA Barcoding Research Programs**

The DNALC continued to support authentic biodiversity research with high school students using DNA barcoding. *Barcode Long Island (BLI)*, funded by the National Institutes of Health (NIH), involves students in “campaigns” 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 Science Sandbox, involve students in NYC. Science teachers are mentors for BLI and UBP students, while scientists from NYC institutions mentor UBRP students.

During the final year of funding through the NIH Science Education Partnership Award (SEPA), BLI supported 102 students in 34 teams. Despite the pandemic, 72 sequences were published in GenBank with student authors, including two new barcode records and 18 variants. Over seven years (see table), the program trained 234 Long Island teachers and supported nearly 1500 high school students, resulting in 654 GenBank published barcodes—providing important diversity and range information for over 200 species. Although NIH funding ended, schools continue their involvement by covering costs or through scholarships.

The SEPA project had important impacts on students who could be our next generation of scientists. Students (n=428) reported increased knowledge of the principles and process of DNA barcoding (90%), indicated they were proud of their research (85%), learned a lot about conducting science (89%), and felt the problem-solving skills they learned would help in future courses (84%) and careers (75%). Many also reported increased interest in further pursuit of STEM (50%) and, despite its difficulty, bioinformatics (46%).

Ninety-six students working on 33 teams completed projects in the UBP and 34 students working on 19 teams completed projects in the UBRP. With many schools, DNALC facilities, and mentor lab spaces unavailable, 11 UBP and seven UBRP teams used at-home DNA extraction kits to complete their projects with assistance from DNALC staff or mentors. Four UBRP teams presented posters to peers and science professionals at the annual Science Research Mentoring Program (SRMP) Virtual Colloquium in June.

Combined, during the year, 75 participants in the three high school barcoding programs completed project exit surveys. They were overwhelmingly proud of their research (90.9%) and valued the problem-solving approaches they learned (87.9%). More than three quarters said they were more interested in continuing to study science (77.6%) and biology (73.0%)—impressive in this group of students who already chose to do science research.

The annual research symposium was held virtually for the second time in 2021. UBRP, UBP, and BLI students presented their research together with *Barcoding US Ants* participants on
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June 1st in a Gather Town space, allowing for both audio/visual and text-based interactions. Topics included wildlife across NYC and Long Island, biodiversity and trade, food fraud, and human health. Dr. Javier A. Izquierdo’s (Hofstra University) keynote address on understanding, deconstructing and rebuilding microbiomes to make a better world was streamed through YouTube.

**Barcoding US Ants**

The pilot cohort of *Barcoding US Ants*, our supplemental SEPA project that engages citizen scientists to identify and map ant species across the United States using DNA barcodes, wrapped up in January with a virtual mini-symposium. DNALC staff shared program results, including identification of 97 ant species from over 300 collected samples. Program entomologists Dr. Shawn Dash and Jeffry Petracca discussed how these specimens illustrate the gaps in knowledge of even familiar species and the importance of citizen science in presenting new data that can advance science. Participants from 13 of 26 teams shared their results and experiences during the symposium.

During the year, 274 GenBank records were published with citizen scientists as authors, which included 70 variable DNA sequences and 18 previously unpublished DNA sequences. Another 15 specimens could not be identified using a combination of DNA barcode sequence and morphology and are under further investigation. One hundred twenty-two staff from science and nature centers, members of conservation organizations, educators, students, and nature enthusiasts completed projects.

Following SEPA funding, 234 continuing or new participants investigate ant biodiversity through *Citizen DNA Barcode Network (CDBN)* or InnovATEBIO. Data analysis is ongoing.

**Citizen DNA Barcoding Network**

This year, the *Citizen DNA Barcode Network*, our SEPA project following BLI, completed its first full year of programming. The project organizes local and national DNA barcoding campaigns for “citizen scientists” at science centers and conservation organizations. The aim is to engage the public by having them learn about and contribute to range maps of diverse ants, beetles, and mosquitoes. These include vectors of human disease, invasive species, and economically important species whose ranges are shifting due to climate change.

Our collaborators at the New York Hall of Science (NYSCI) helped design, pilot, and refine retractable banners that introduce the public to DNA barcoding, orient participants in
We held a collection event for CDBN at Sweetbriar Nature Center in July where participants spent several hours learning sample collection techniques and gathering ant, beetle, and mosquito specimens.
their roles as citizen scientists, and generate interest in upcoming events. NYSCI hosted CDBN events for the public and NYSCI interns. After training, collaborators at the Sweet briar Nature Center (NY), the Long Island Aquarium (NY), the Cook Museum of Natural Science (AL), the HudsonAlpha Institute for Biotechnology (AL), and the Missoula Butterfly House and Insectarium (MT) also hosted public CDBN events. These activities included brief “tabletop” sessions introducing the use of DNA to identify species; partial- or full-day, hands-on labs; DNA barcoding training during internships; specimen collection events; and a multi-day DNA barcoding summer camp.

Despite limited facility access due to the pandemic and other natural disasters, the program supported over 1000 participants with a range of ages and skill levels. In total, 79 DNA barcodes were published to GenBank with citizen scientists as authors, including 22 previously unpublished barcode sequences and 24 new variants. Samples included a rare mosquito collected on Long Island (Anopheles barberi) whose larvae are generally sensitive to winter cold and a click beetle (Diplostethus texanus) collected outside of its known range in Louisiana.

**DNA Barcoding in Undergraduate Classes**

We continued to develop, disseminate, and assess DNA barcoding and metabarcoding as “formatted” solutions for post-secondary course-based research experiences through our $2 million NSF IUSE collaboration with James Madison University (JMU), CUNY City Tech, Bowie State University (BSU), and Austin Community College (ACC).

In June, we held a virtual five-day DNA Barcoding for CUREs workshop for 22 faculty from seven four-year universities, nine community colleges, and two high schools. Meeting our goal of reaching a diverse audience, 23% of participants were Black and 5% were Hispanic/Latino. The workshop covered the methods and logistics needed to teach DNA barcoding CUREs and included presentations by participants from the previous year’s workshop describing their implementations. Supplemental videos demonstrating biochemical steps ensured all participants could master the protocols. Fifteen participants completed these steps using materials supplied by the DNALC and submitted samples for sequencing, allowing them to analyze their results while learning the bioinformatics steps during the workshop.

We also held a virtual metabarcoding CURE workshop during the summer. The workshop included 41 educators from 25 four-year and 11 two-year colleges and universities, including 8% Black and 8% Hispanic/Latino participants. In June, sample collection methods, experimental design, and biochemistry were demonstrated, preparing participants to collect samples then isolate and amplify DNA. JMU supported participant sequencing using their MiniSeq for 270 samples. In late June, participants learned to analyze their microbiome data and began plans for implementing CUREs in the classroom. During the workshop, seven participants from the previous year shared their efforts, providing insights into how to successfully implement metabarcoding CUREs. Two CURE institutes were also held at BSU, introducing barcoding and metabarcoding CUREs to 42 faculty.

During the year, DNA barcoding was taught in 32 classes reaching 896 students, while 25 classes included metabarcoding—taught to 431 students. As with the high school DNA barcoding programs, participation in these CUREs had positive impacts: 64% of survey respondents felt they were capable of going further in science after the experience, while over half became more interested in technology, bioinformatics, and studying biology.
National Center for Biotechnology Education

The DNALC continued its work as a lead institution in the InnovATEBIO national biotechnology education center funded through NSF ATE, which supports training for America’s workforce. Last year, we realized that Goal 4 of InnovATEBIO included a disparate set of activities that defied cohesion. This led to the concept of hubs to harness resident expertise and provide that expertise to the biotech community.

This year, we reorganized key InnovATEBIO activities into hubs as a means to enhance service to the community. The hubs support alumni and teachers; career options and entrepreneurship; high school to college pathways; workforce development; undergraduate research; supply chain models for training; and emerging technologies, including the hub we host, genomics, and a new immunotherapy hub.

In the fall, we added pages for each of the hubs to the center’s website, aiming to position InnovATEBIO as a service organization that focuses on “What we can do for you.” In this context, hubs function as national resources, as opposed to the traditional concept of regional resources. Structured interviews with community college biotech faculty members validated hubs as a useful way to organize InnovATEBIO activities. Given the positive feedback, design for an improved, web-search optimized hubs site began at the end of the year.

Through the Genomics hub, we continued to assist educators implementing genomics experiments and CUREs by supplying them with reagents, free sequencing, and technical or pedagogical support. We also supported development of a Sanger Sequencing Service at Liberal Arts and Science Academy (LASA) High School, Austin, funded by an ATE grant to Joseph Oleniczak (LASA and ACC) and Kissau Tchedre (ACC). Students from LASA’s dual-credit biotechnology program perform DNA sequencing as a service, including for students at ACC, who visit the high school to learn Sanger sequencing.

Accessible Biomanufacturing to Teach Biotech Skills

In parallel to our work as part of InnovATEBIO, we started a new project to popularize the free isolation of Taq polymerase for classroom use in collaboration with Aron Kamajaya of Los Angeles Pierce College. Supporting the Center’s supply chain hub, this ATE project is developing a biomanufacturing curriculum on the manufacture of Taq polymerase. We optimized simple isolation protocols to increase yield and constructed a new plasmid, pSimpleTaq, allowing constitutive expression of Taq, and removing the complexity and expense of induction. Expressing, purifying, and assaying Taq polymerase will familiarize students with all aspects of product manufacturing and quality control. Providing a free product to high school “consumers” will make polymerase chain reaction accessible to many more students.

In late fall, Dr. Kamajaya piloted Taq isolation with 12 Pierce College Biotech interns at the Pasadena Bio Collaborative Incubator. The interns prepared enough Taq extract to support 10,000 PCR reactions, and then developed PCR protocols for use by students in a microbiology course in the coming term.

NSF CyVerse

Although online training was the only option for faculty and students in 2020, constant disruptions and uncertainties made the pivot to virtual less than seamless. After plummeting more than 40% last year, DNA Subway usage rebounded in 2021 with all-time peaks of 48,035 registered users (12% increase), 1.18 million page views (29% increase from 2019), and 38,059 student projects (28% increase from 2020).
In addition to analyses on DNA Subway lines, we created new teaching resources for the command line. Working with long-time collaborator and DNALC workshop attendee Ray Enke from JMU, we published A Fun Introductory Command Line Lesson: Next Generation Sequencing Quality Analysis with Emoji! in CourseSource, an online journal for biology and physics teaching. This lesson uses an application we developed on CyVerse to walk students through a quality control exercise analyzing next-generation DNA sequencing reads. Each DNA base sequenced is assigned a Phred score that indicates the probability it has been incorrectly called. A low score (e.g., 10) indicates a 1 in 10 chance of being wrong, and a high score (e.g., 40) indicates a 1 in 10,000 chance of being wrong—99.99% accurate. This fun lesson was developed as a Jupyter Notebook within the newly updated CyVerse Discovery Environment, allowing students to learn command line computing while working with real sequence data. Several of these notebooks and tools were also used by students in this year’s new Sequence a Genome! camp.

Finally, we continued our advanced training to cohorts of 130 graduate students, postdocs, and faculty in two 10-week online cohorts in our Foundational Open Science Skills course. We also reached another 363 faculty and students at various online training events and seminars including the International Society for Applied Microbiology Conference, North Carolina State Undergraduate Research Experience, James Madison University Center for Genome & Metagenome Studies workshop, and the NIH National Human Genomics Research Institute Short Course in Genomics.

**Licensed Centers**

With the continued closure of Regeneron’s Sleepy Hollow campus, field trips and summer camps in the Westchester area remained virtual for the majority of the year. After an extensive fall email campaign and several Open House events to reignite awareness of the new Regeneron DNALC, we hosted 260 students for in-person field trips. We also participated in a Virtual K-12 STEM Teacher Conference sponsored by Mercy College Center for STEM Education, where teachers were invited to learn more about DNALC programs in a virtual exhibition hall.

Campus restrictions prohibited the Notre Dame DNALC from conducting any in-person events through September. In summer, camps were offered virtually for 20 participants with materials kits shipped to students’ homes, and processing of returned student samples handled onsite by staff. In-person programs resumed in the fall with 150 participants who attended an event at a Football Saturday, and a limited number of field trips.

**International Partnerships**

**China**

Due to restricted international travel and leadership changes at Beijing No. 166 School in China, our collaboration was put on pause. Over the past three years, Barcode Beijing program students published 130 DNA sequences to GenBank, which included 122 species, and 23 new variants. We think this noteworthy accomplishment—made by a single secondary school in China—may encourage more schools in China to engage in our brand of hands-on science.

In an effort to support science education for international students during the pandemic, we launched Mentored On-Demand Camps. These camps are a combination of our Live Virtual camps (taught live, but remote) and On-Demand camps (pre-recorded instructional

In the hybrid camps, instruction is primarily through pre-recorded videos, but several in-person sessions with DNALC educators are built into the schedule to provide time for Q & A, troubleshooting, and engagement with an instructor. This summer, 16 students from Keystone Academy, Shenzhen International School, and Guangdong International School participated in Fun with DNA and DNA Barcoding Mentored On-Demand Camps. Three teachers from Keystone Academy, a private school in Beijing, were trained to teach the camps using our pre-recorded instructional videos and individually packed materials kits. Kit preparation and distribution was coordinated by DNALC Asia in Suzhou. One of the participating teachers reported, “The students were quite happy with the program and we were able to complete all experiments and activities.”

We also began to advertise International Partner Membership modeled after our successful partnerships with independent schools in the New York metro area. Four international schools—Beijing No. 5 School, Shuangliu School, Keystone Academy, and Tsinglan School—have expressed interest. When travel restrictions are lifted, we will be able to send instructors to International Partner schools and host their students in New York for camps.

Despite the challenges of the pandemic, DNALC Nigeria is now renovated and operating. Michael Okoro runs day-to-day operations and is supported by three teaching assistants and undergraduate interns who help deliver instruction.

More than 250 students and visitors attended workshops and research programs, including undergraduate courses and school visits. In January, the center hosted a metabarcoding workshop for students from Godfrey Okoye University, DNALC Nigeria’s host institution. The group sampled microbial soil from lakes on the Ugwuomu campus. A second cohort in March included postgraduate students and faculty from other Nigerian institutions. Through a grant from the US Consulate in Lagos, a series of DNA barcoding workshops kicked off in August. This program will ultimately reach 160 high school students and 40 teachers from Enugu State by its completion in March 2022. The center also participated in the DNALC Barcoding US Ants project and collected DNA from approximately 170 ant species in urban and rural parts of Southern Nigeria.

Through a grant from the British Council, DNALC Nigeria participates in the Innovation for African Universities program, which supports the creation of STEM business and entrepreneurship through student training.

Michael Okoro (right) and program participants at DNALC Nigeria (below).
Dissemination at Professional Meetings

As in previous years, we continued to disseminate our programs at meetings. DNALC staff presented DNA barcoding and metabarcoding at the CSHL Genome Informatics Conference and NIH SEPA SciEd Conference. Our data science programs were also presented at the International Applied Microbiology Conference, while our analysis of American Science Education was presented at Cell Bio Virtual 2021, an American Society for Cell Biology/European Molecular Biology Organization meeting.

Lab Instruction and Outreach

Mid-pandemic, 2021 programs began with a complete shift to virtual instruction. As schools struggled to adjust to schedule changes, staggered cohort instruction, and restrictive health and safety guidelines, in-person field trips and school visits were not permitted. We provided remote field trip experiences to 10,179 students through demonstrations and kit-based experiments.

In lieu of school field trips, we were able to begin providing safe, on-site instruction in winter—a nice change of pace for students who were limited to remote instruction at school. Sixteen students attended AP Biology prep courses on Saturdays to complete a series of labs that either are required by the College Board, or include techniques and concepts that are integral to the curriculum. Five other students attended a Saturday Green Genes series—one of the summer camps that could not be taught virtually. One hundred and ninety middle and high school students opted to forego their winter and spring breaks to participate in a series of fun and engaging daily lab sessions on topics including: DNA structure and function, industrial enzymology, genetic engineering, forensics, and GMOs.

September brought less restrictive distancing requirements and an optimistic return to in-person instruction. A total of 3,135 students attended in-person lab field trips at our four facilities: Dolan DNA Learning Center, Harlem DNA Lab, Regeneron DNALC, and DNALC NYC at City Tech, and in-school programs reached 1,789 students. Footlocker kits were used by 440 students, 64% of whom were conducting independent research through BLI, UBP, and UBRP.

Field trip scholarships were provided for 174 students from Uniondale School District, Ossining School District, Danbury School District in Connecticut, Kearsarge School District in New Hampshire, Passaic Academy of Science and Engineering, and Jack and Jill of Central New Jersey. An additional 326 sixth grade students from Central Islip School District participated in a kit-based series of virtual labs supported by a grant from the National Grid Foundation. This year, 292 (12%) of the students who attended in-person field trips and virtual programs at the Harlem DNA Lab and DNALC NYC at City Tech came from Title I schools that qualified for tuition assistance supported by the William Townsend Porter Foundation.

In summer, we returned to in-person camps at the Dolan and NYC locations. With COVID-19 guidelines that included fully-vaccinated instructors, distanced workstations, individual equipment, and daily health screening, we hosted 542
DNALC NYC held its inaugural summer of camps, welcoming students in 20 camps. (Above and right)

The STARS camp returned to in-person instruction for its third year. Dr. Lloyd Trotman and Dr. David Jackson spoke to the students about their research during the two-week program.
campers on Long Island, and 218 in NYC. We provided scholarships for 88 students. Another 26 campers participated in offsite workshops at Francis Lewis High School in Queens and Friends Academy in Locust Valley. One hundred and seventy two students attended Virtual Live or On-Demand camps, including 48 middle schoolers who attended through City Tech’s Bridging the Gap, a Science and Technology Entry Program (STEP) for pre-college students.

Now in its third year, the Science, Technology, and Research Scholars (STARS) program has become a community of young researchers from groups that have been traditionally underrepresented in STEM. This year we accepted 15 students from nine districts across Long Island and New York City for a two-week course in Cold Spring Harbor. Thanks to a donation from CSHL Trustee Laurie Landeau, half of our students benefitted from bussing provided by Suffolk Transportation. To kick things off, students and their families joined us for a Saturday afternoon orientation featuring STARS alumni joining via Zoom to present their summer research experiences.

This year Harrison Banks (2020) had a summer internship in Robert Martienssen’s Laboratory, and Diana Benedicto-Jimenez (2019) worked in Chris Vakoc’s lab as part of the CSHL Partners for the Future Program. STARS students also made their own contributions to the roll out of the COVID-19 vaccination effort. Students created more than three dozen videos—posted to YouTube and the DNALC website—on the science behind COVID-19 and historical healthcare inequities in minority communities. We also completed an assessment of the impact of STARS on the first two student cohorts. One hundred percent agreed that STARS helped them prepare for a future research experience, 94% agreed that they felt mentored by STARS instructors, and 87% agreed that STARS helped them set goals for their careers. Importantly, 84% agreed that STARS helped them find role models with whom they identified, and 83% reported doing some activity that follows up on their interest in STEM—including high school research internships, undergraduate STEM majors and research internships.

A new summer camp, Sequence a Genome!, brought students “into the genome age” by allowing them to fully sequence a genome using Oxford Nanopore DNA sequencing. In Nanopore sequencing, DNA is drawn through pores embedded in a membrane, generating an electrical signal that is reconstructed into DNA sequence. A single, handheld Nanopore device can generate billions of base pairs of DNA sequence in hours for about $1000. We chose to sequence a strain of Duckweed, *S. polyrhiza*, which has a relatively small 150 million base pair genome. This plant, commonly seen growing on ponds, is being studied by the CSHL Martienssen laboratory as a candidate for biofuel production and carbon sequestration. Guest lectures included Sara Goodwin from the CSHL Genome Center and Alex Harkess from the HudsonAlpha Institute for Biotechnology, who has sequenced other Duckweed strains. Students extracted DNA that was used to generate more than seven billion base pairs of sequence, and went on to do bioinformatics needed to analyze the data. Several continued to meet virtually in the fall to work towards completion of an entire assembly.

In partnership with CSHL Women in Science and Engineering (WiSE), we hosted the fifth annual WISE Fun with DNA summer camp. Ten young female science enthusiasts had the opportunity to meet and interact with engaging role models pursuing careers in the sciences. Each afternoon, the girls participated in WISE activities on cancer research, neuroscience, and gene expression. On the final day of camp, parents and campers were invited for a guided tour of the main CSHL campus, and an outdoor lab activity.
The Partner Member program continued to provide custom instructional sequences and advanced electives for six independent schools in New York City, including kit-based virtual instruction in spring for a fully remote hands-on experience.

- Research teams from Fontbonne Hall Academy used DNA barcoding to produce novel GenBank entries for flowering plants and snails. AP Biology students studied viruses, vaccines, and protein structure, and created 3D-printed models of the SARS-CoV-2 spike protein.
- At Marymount School of New York, genetics programs were incorporated as key parts of the biology curriculum at multiple grade levels. Students in Independent Student Research tested Loop-Mediated Isothermal Amplification (LAMP) PCR of the human PV92 Alu locus as a method for at-home PCR that doesn't require a thermal cycler.
- Sacred Heart Greenwich adopted a quarter membership with implementation of a DNA barcoding unit for its Science Research students.
- Lycée Français de New York implemented genetics programs in their AP Biology courses.
- The Chapin School coordinated genetics programs at several grade levels, including the advanced Molecular Genetics elective. Middle school students analyzed PCR product sizes from a mock locus to genotype a hypothetical family when studying a genetic disease.
- St. David’s School integrated basic genetics with existing curricula in grade five. Grade eight used DNA barcoding to survey the ants of Central Park.

With the success of the Partner Member program in New York City we updated our school membership programs to include three different options. Sustaining Members receive field trips, advance registration, priority reservations for teacher workshops and special events and opportunities to audit summer camps. Associate Members receive all the Sustaining benefits, with an additional ten days of customized instructional time for project-based research, research mentorship, enrichment of existing curricula, or focused faculty training. Finally, Partner Membership—for local and international schools—includes 20 days of customized instructional time that can include developing and co-teaching advanced electives, access to emerging DNALC projects that incorporate cutting edge techniques, and weeklong camps during school breaks. This year we were thrilled to add two new Partner Members from Long Island—Massapequa School District and Long Beach City School District—schools that have maintained sustaining membership for many years, and want to strengthen their science brand through increased exposure and opportunity. Glen Cove City School District, a first time DNALC member, joined as an Associate Member with the same goals.

As part of other ongoing local partnerships, the Molecular and Genomic Biology elective returned to Cold Spring Harbor High School after a pandemic hiatus. The 12 enrolled students spent the last two periods of every other school day at the DNALC, immersed in hands-on experiments in DNA barcoding, human and plant genomics, bacterial genetics and gene cloning and bioinformatics. Similarly, 13 students from St. Dominic High School in Oyster Bay participated in a half-year Molecular and Genomic Research elective taught at the DNALC. As part of their course requirements, all students in both classes participated in Barcode Long Island.

Our Ötzi the Iceman exhibition had 100 in-person visitors, and 870 attended virtual museum tours guided by educators remotely, while the DNALC Live pre-recorded Ötzi museum tour on YouTube had a whopping 1,755,340 views in the year! Nineteen Saturday DNA! sessions, both virtual and in-person, drew 200 participants. Virtually, participants used kits to extract DNA from strawberries and build their own gel electrophoresis chambers. They also explored how population size contributes to genetic drift and how our ancient ancestors contributed to modern human genetics. In-person participants learned about Mendel’s laws of heredity,
created works of art inspired by our beautiful Joe Rossano BOLD exhibition, and unraveled some forensic mysteries surrounding Ötzi the Iceman.

The “Meet a Scientist” remote lecture series continued to connect high school and public audiences with CSHL researchers, drawing 90 participants. Guest presenters shared their research, and stories of their journeys to becoming scientists. Dr. Lloyd Trotman presented his work on cancer metastasis and 3D analysis; Ph.D. student Miriam Ferrer Gonzalez talked to us about the whole-body response to cancer; graduate student Alexa Pagliaro delivered a talk on how maternal experience shapes brain activity; Dr. Hannah Mayer shared her work on how T-cells distinguish friend from foe in our immune systems; Dr. Peter Koo introduced his research understanding gene regulation through deep learning; Dr. Doreen Ware presented her research on maize and how plants manage fluid genomes to adapt and evolve; and Dr. Christopher Vakoc talked about inventing new cancer medicines. All of the presentations are available on the DNALC website.

This year our collaboration with the CSHL School of Biological Sciences was put on hold. As part of their required curriculum, first-year graduate students usually work with DNALC instructors to develop skills needed to communicate science to a variety of audiences. Students complete 12 half-day sessions in which they progress from observation to co-instruction, and then independent teaching of lab classes. The 2021 cohort will participate in training in 2022.

**BioMedia Visitation and Projects**

In 2021, 7.68 million visitors accessed our suite of multimedia resources, a 144% increase from the previous year! This rise is attributed to another stunning increase in visitation to our YouTube channel, which received 4,633,125 views—274.7% over 2020! Watch time increased to 505,648 hours (627%) and we added 22,721 (170%) new subscribers. Two videos recorded early in the pandemic went viral:

- “Museum Tour: Ötzi the Iceman” (1.8+ million lifetime views) presented by Amanda McBrien; and
- “What DNA Says About Our Human Family Episode II, Ancient Relatives: Neanderthals and Denisovans” (874+ thousand lifetime views) presented by Dave Micklos.

Google Analytics counted 2.6 million visits to DNALC websites, 84.6% of the prior year. With the end of support for Adobe Flash in all browsers at the end of 2020, we faced losing several of our content-based websites that were built using this technology. Fortunately, we were able to implement Ruffle, a Flash emulator that could be incorporated on some sites, including Inside Cancer, Your Genes, Your Health, and DNA Interactive. Some sites have been redirected to older non-Flash versions, such as the Eugenics Archive and Weed to Wonder. Unfortunately, Genes to Cognition and Lab Center are completely dependent on Flash and could not be revived. However, much of the content from these sites is available in alternative formats through our homepage’s media search.

In 2021, 439,672 3D Brain and Gene Screen smartphone/tablet apps were downloaded. The ten-year-old Weed to Wonder E-book for iPads has been removed from the Apple App Store since the software used to develop it can no longer be used to update the app.

With the opening of DNALC NYC and the distance at-home instruction placed between teachers and students, the time was right to revamp how we reach parents and students with our summer camps. We decided to work with a digital marketing company, WebFX, to develop a new online strategy. This included search engine optimization (SEO), which makes our website more “visible” to search engines by improving our ranking as an authoritative source and by optimizing for search terms people used to find us. WebFX has given us insight into
how ranking factors used by Google (e.g., page authority, domain authority) can be improved to improve site traffic. In addition to SEO, WebFX has significantly enhanced our ability to reach parents directly through Google Ads and Facebook. Since 2016, we have tracked new summer camp participants by asking, “How did you learn about DNA Learning Center camps?” Traditionally, only about 3% of new summer camp parents find out about us through internet ads and search. Our marketing efforts increased that to 22% this year. We also benefitted from an ongoing nonprofit Google Ads grant which generated 117,291 impressions and 12,349 clicks; the equivalent $19,546 in advertisement spending.
**Staff and Interns**

Congratulations are in order for DNALC staff! In April, DNALC Assistant Director Amanda McBrien was recognized by Crain’s New York Business 2021 list of Notables in Nonprofits and Philanthropy. This year’s list was “in celebration of 57 New York heroes who facilitated or led nonprofit work in the face of the pandemic.”

Our Executive Director Dave Micklos was named the winner of the 2021 Bruce Alberts Award for Excellence in Science Education by the American Society for Cell Biology. This prestigious award recognizes career-spanning achievements in biology education.

The opening of **DNALC NYC at City Tech** brought new staff to Brooklyn and the Dolan DNALC also saw some staff changes.

**Arden Feil** started in June. She has both a Bachelor’s and Master’s degree in Biology from Wesleyan University. Her research focused on how chromosomes interact and exchange genetic information during meiotic cell division. She also majored in Science in Society, which taught her to consider the cultural, social, and political significance of her science training. This combination cemented her interest in making science accessible and relatable to everyone. She participated in science outreach efforts, from mentoring students to teaching afterschool programs and summer camps in NYC. After graduating, she worked as a Research Specialist at the University of Chicago in a lab that studies cell signaling in tissue development. She realized that, although she loved the inquiry-driven, dynamic nature of lab work, she missed her favorite part of science—getting to share it with other people! Now, as an educator at **DNALC NYC**, she is excited to combine her research and teaching backgrounds to facilitate engaging learning experiences.

**Andréa Mahee** came aboard in June, as the **DNALC NYC Administrative Manager**. She brought to the table a myriad of skills including C-suite support; curating and managing special events; conducting workshops, meetings, and trainings; and is multilingual in French, Spanish, and Italian. She spent many years in the development arena; she was Chief of Staff at the Third Avenue Business Improvement District, executive assistant at the Bronx Council on the Arts, and development associate for the South Bronx Overall Economic Development Corporation.

In July, **Kelsie Anson** joined the Brooklyn team. Hailing from rural Wyoming, it was family trips to Yellowstone National Park that ignited her interest in science. She had a special interest in the thermophilic bacteria that lived in the hot springs in the park—where one of our important DNA engineering molecules, Taq polymerase comes from! She earned a degree in molecular biology from Colgate University, where her senior research project explored how genetics might dictate social behavior in an ant colony. After graduation, she worked as an analytical chemist for an environmental testing company then later took a research position at Rocky Mountain Laboratories in Montana, studying prion diseases—deadly brain diseases most common in elk herds in the Western US and Canada. In 2020, she was awarded her Ph.D. in biochemistry from the University of Colorado in Boulder. Her research used fluorescent sensors to measure fluctuations of zinc ions and determine the role these ions played in crucial cell signaling pathways. She also created an interactive teaching case study where undergraduates learned how to genetically engineer bacteria to break down environmental toxins. Kelsie also tutored middle schoolers on optical physics and occasionally starred on the college podcast, *Buffs Talk Science*.

In July, the DNALC welcomed **Donna Smith** to the administrative staff. A graduate of Harborfields High School, Donna received her Bachelor’s Degree in History from Moravian University, previously known as Moravian College in Bethlehem, Pennsylvania. Donna worked for 12 years at Akorn Pharmaceuticals as a Lab Clerk in the Quality Control Raw Materials Lab, working on file management for new drug submissions to the FDA; sample intake for in-house
testing; contract lab sample submissions for outside testing; and requisition creation for chemicals, standards, lab, and office supplies. Her duties at the DNALC include scheduling lab visits to the Regeneron DNALC, statistical record keeping, ordering office supplies, answering phones, and greeting visitors and students.

Anna Feitzinger started at DNALC NYC in August. After graduating with a degree in Chemistry from Hunter College, she worked as a research associate at the Skirball Institute at New York University in the developmental genetics department—gravitating to developmental and molecular biology. She never tired of imaging a glowing population of cells migrating across a live developing zebrafish embryo. It was this experience which prompted Anna to pursue a Ph.D. at the University of California, Davis where she joined an evolution of development lab in the evolution and ecology department. Her interests in quantitative and developmental biology were united as she worked on characterizing the natural variation of gene expression of early stage fruit fly embryos. While at UC Davis, she also worked as a teacher’s assistant for a genetics and molecular biology lab course. It gave her great joy to communicate science and guide students during their first DNA extractions, gel electrophoresis, cloning, and fruit fly crosses.

Kelly Eames joined the Dolan staff as an educator in August. She has her parents to thank for encouraging her scientific endeavors and introducing her to genetics and microbiology—and more importantly to the DNALC. As an alum of our summer camps and Saturday DNA! programs, Kelly applied skills learned at the DNALC in her college courses. In 2013, she earned a bachelor’s degree in biology and chemistry at Molloy College, then pursued a master’s degree at Trinity College in Dublin, Ireland. The program focused on biodiversity and wildlife conservation; her thesis examined the different educational methods used to teach visitors to zoos and aquaria about conservation and community action. Engaging guests in interactive learning exercises was shown to better their understanding, especially when compared to passive learning (such as reading or videos). Now, ten years after her last DNALC camp, Kelly works alongside some of the people who introduced her to these topics in high school. She is excited to offer the same opportunities to students today.
In November, Jack Kellogg joined the staff in preparation for reopening our Regeneron site. Growing up on farmland in a small rural town outside of Buffalo, NY, Jack loved exploring the woods and learning about the varied species of trees on their property. These explorations coupled with watching every episode of the nature docuseries, *Planet Earth*, sparked his fascination of the different behaviors, life histories, and morphologies of organisms. He attended Rutgers College, Newark, majoring in Biology. He had the privilege to join an insect evolution lab led by Dr. Jessica Ware. As an undergrad, he used computer vision to examine wing color patterns in tropical butterflies and investigated the effect major weather events have on dragonfly dispersal in New Jersey. He traveled to the Amazon as part of a field course focused on different methods in entomological research, including tree canopy surveys and bait traps. He and his group also did a small study related to butterfly mimicry. For his master’s thesis, he used DNA barcoding to study the population genetics of aquatic insect communities.

We say goodbye to a number of our staff who have moved on in 2021: from our administrative department, Mary Lamont and Colette Riccardi; educators Melissa Lee, Louise Bodt, and Lina Ruiz-Grajales; and senior programmer Cornel Ghiban.

In 2003, Mary Lamont began as an Administrative Assistant for DNALC West, located within a Northwell Health facility in Lake Success. In an office no bigger than a closet, she quickly rose to Administrative Manager and Manager of Offsite Programs. DNALC West field trips included a tour of the core blood testing facility, often led by Mary. With proficient politeness, a keen “no-nonsense” attitude, and outstanding communication, she built excellent relationships with the schools and teachers who booked classes through her and did a wonderful job supporting instruction at West. When not at the DNALC, she is a traveling country singer with her husband. After 18 years of loyalty and dedication, Mary retired to continue singing and enjoy being a grandmother.

Colette Riccardi joined the administrative staff as our receptionist in March 2018. Her duties included answering phones and greeting guests at the DNALC, ordering all office supplies and arranging repairs for office equipment, and entering and organizing data. As an “Excel champion,” she tackled complicated projects with ease. Her work ethic, dependability, and lovely personality also gave her an advantage when interacting with the public and forging relationships for the DNALC. Pregnant with her little boy, Leo (who was born in May), she decided to switch careers to full-time mom in February.

Harlem DNA Lab Manager Melissa Lee joined the DNALC family in 2011. She used her background in science education and lab management to deliver hands-on labs to thousands of students. Melissa managed the Harlem DNA Lab, taught high school and middle school classes, managed interns, and ran the footprint equipment rental program. She also played a large role in the set-up and management of the Regeneron DNALC. She directed NYC teacher training and worked with many of our partner schools. Melissa assisted in grant writing and in the execution of those grants, and she mentored students for symposiums and competitions. With a passion for outreach and research, she became immersed in UBP and UBRP. Through her tenure at the DNALC, she ardently and continuously promoted our mission across NYC. In June, she decided to put her smart board markers away to become a full-time mom to her one-year old son, Alex. We will miss her exuberant personality, her fine leadership skills, and her infectious enthusiasm.

Louise Bodt, a Brooklyn native, began her DNALC journey in August 2019 as an educator and UBP manager based out of our City Tech temporary lab. In addition to the instruction of high school and middle school students, she helped train and supervise interns in Brooklyn. She was the relationship manager for one of our partner schools, the Fontbonne Hall Academy for Girls in Brooklyn, as well as a UBP program manager. Louise also participated in grant writing for the UBP. At the onset of the pandemic, she helped to develop and promote virtual classes.
Although she left the DNALC before the opening of DNALC NYC, she played a large role in promotion and outreach. She left in June to pursue her Ph.D. in Evolutionary Biology in the graduate program at the University of Chicago.

Lina Ruiz-Grajales joined the DNALC in November 2019 as an instructor for Regeneron DNALC, which had its grand opening that December. In addition to teaching high school and middle school, her strong research background allowed her to shoulder much of the lab preparation needed at our brand-new facility. When the facility closed temporarily in March of 2020, Lina shifted her focus to the development of virtual lessons and protocols. She also participated in developing protocols and laboratory techniques for Barcoding US Ants. Lina left in August to pursue her Ph.D. in Biological Sciences at Columbia University.

Cornel Ghiban, our computer programmer, began his odyssey at the DNALC in late 2006. Prior to arrival from his home country of Romania, he did contract work for us developing the “back-end” of our websites. He became the DNALC’s “nervous system”; Cornel designed, updated, and maintained several tools used to engage students and researchers in biotechnology. He played a large role in creating and supporting new features for DNA Subway (maintaining the Blue Line databases and QIIME, adding new and updating old transcriptomes for the green line when necessary and making other changes as requested). As our enrollment increased, he developed online registration systems that could collect and update information from parents, teachers, students and researchers. He has also sustained our legacy websites, such as DNAi, Inside Cancer, and YGYH. When the pandemic hit, he facilitated our transition to virtual programming and helped us launch all of our virtual content—developing tools for the On-Demand program. Cornel is now working remotely as a software backend engineer for Vinli Inc. based in Dallas, Texas, a cloud-based data intelligence platform for mobility and transportation.

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. This year an amazing group of interns helped out, and we said farewell as others left for college:

**High School Interns**
Raymond Bailey, Longwood High School  
Raquel Belkin, Syosset High School  
Hayden Calabretta, Cold Spring Harbor High School  
Kevin Darcy, Longwood High School  
Lauren Graziosi, Syosset High School  
Min Hur, Jericho Senior High School  
Megan Jung, Jericho Senior High School  
Sandhya LoGalbo, St. Dominic High School  
Brianna MacDonald, Commack High School  
Rachel Morina, Huntington High School  
Maggie Wang, Northport High School  
Matthew Warner, Saint Mary’s High School

**High School Interns Departing for College**
Timothy Broadbent, Colby College  
Kaela Deriggi, The George Washington University  
Neal Mehta, Boston College  
Ethan McGuinness, Northeastern University  
Aveline Roderick, Boston College

**College Interns**
Taehwan Cha, New York University  
Christopher Cizmeciyan, Stony Brook University  
Isabella Martino, Stony Brook University  
Jillian Maturo, Boston College  
John O’Hara, University of Richmond  
Michael Stabile, Cornell University  
Nicholas Stabile, University of Notre Dame

David Micklos  
DNA Learning Center Executive Director
## 2021 Grants

<table>
<thead>
<tr>
<th>Grantor</th>
<th>Program</th>
<th>Duration of Grant</th>
<th>2021 Funding*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEDERAL GRANTS</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>National Institutes of Health</td>
<td><em>Citizen DNA Barcode Network</em></td>
<td>6/20–3/25</td>
<td>$252,292</td>
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<tr>
<td>National Science Foundation</td>
<td><em>Implementing DNA Barcoding for Course-Based Undergraduate Research Experiences</em></td>
<td>10/18–9/23</td>
<td>$262,922</td>
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<td>National Science Foundation</td>
<td><em>CyVerse: Cyberinfrastructure for the Life Sciences</em></td>
<td>8/18–7/23</td>
<td>$164,532</td>
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<td>National Science Foundation</td>
<td><em>RCN-UBE: Establishing a Genomics Education Alliance: Steps Towards Sustainability</em></td>
<td>9/18–8/22</td>
<td>$1,573</td>
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<td>National Science Foundation</td>
<td><em>InnovATEBIO National Biotechnology Education Center</em></td>
<td>10/19–9/24</td>
<td>$175,444</td>
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<tr>
<td>National Science Foundation</td>
<td><em>What Works in Workshops-Evolving Short Format Training to Serve Life Science STEM Professionals in the 21st Century</em></td>
<td>3/21–9/22</td>
<td>$14,051</td>
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<tr>
<td><strong>NON-FEDERAL GRANTS</strong></td>
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<tr>
<td>Beijing No. 166 High School</td>
<td><em>Chinese Collaboration Agreement</em></td>
<td>7/19–6/22</td>
<td>$0</td>
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<tr>
<td>Breakthrough Prize Foundation</td>
<td><em>Laboratory Design and Teacher Training for Breakthrough Junior Challenge Prize Winners</em></td>
<td>12/15–12/22</td>
<td>$18,224</td>
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<tr>
<td>Health Park</td>
<td><em>Health Park Agreement</em></td>
<td>12/15–12/22</td>
<td>$864</td>
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<tr>
<td>Pinkerton Foundation</td>
<td><em>Urban Barcode Research Program</em></td>
<td>1/21–5/22</td>
<td>$77,584</td>
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<tr>
<td>Richard Lounsbery Foundation</td>
<td><em>Developing Independent Student Marine Biodiversity Research Using eDNA</em></td>
<td>10/17–12/21</td>
<td>$2,513</td>
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<tr>
<td>Paul Taubman</td>
<td>Paul Taubman support for DNALC NYC at City Tech Exhibition Development</td>
<td>6/21–6/22</td>
<td>$113,396</td>
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<tr>
<td>The Simons Foundation</td>
<td><em>Urban Barcode Research Program</em></td>
<td>12/17–8/22</td>
<td>$18,992</td>
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<td>William Townsend Porter Foundation</td>
<td><em>Harlem DNA Lab for Underprivileged Students</em></td>
<td>1/20–1/22</td>
<td>$2,983</td>
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<tr>
<td>Office of Brooklyn Borough President</td>
<td><em>DNALC NYC at City Tech Video Wall</em></td>
<td>10/21–10/22</td>
<td>$87,010</td>
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<tr>
<td>Hudson River Park Trust</td>
<td>Environmental DNA Survey in Hudson River Park’s Estuarine Sanctuary</td>
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<td>$54,926</td>
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<tr>
<td>NY Harbor Foundation</td>
<td><em>Billion Oyster Project</em></td>
<td>6/20–12/21</td>
<td>$5,887</td>
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<tr>
<td>Department of Design and Construction</td>
<td><em>NYC-Department of Design &amp; Construction DNALC NYC</em></td>
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<td>$438,336</td>
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<td>National Grid Foundation</td>
<td>Genetics Education Program &amp; Advanced Genetics</td>
<td>9/20–9/21</td>
<td>$15,000</td>
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</tbody>
</table>

* Includes direct and indirect costs.
**School Membership Programs**

The following schools and school districts participated in these membership programs of the **Dolan DNALC**:

<table>
<thead>
<tr>
<th>Sustaining Memberships</th>
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</thead>
<tbody>
<tr>
<td>Bellmore-Merrick Central High School District</td>
</tr>
<tr>
<td>Elwood UFSD</td>
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<tr>
<td>Herricks Union Free School District</td>
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<tr>
<td>Huntington</td>
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<tr>
<td>Island Trees</td>
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<tr>
<td>Jericho High School</td>
</tr>
<tr>
<td>Levittown Union Free School District</td>
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<tr>
<td>North Shore Central School District</td>
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<tr>
<th>Associate Memberships</th>
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<tbody>
<tr>
<td>Glen Cove Central School District</td>
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<tr>
<td>St. Dominic High School</td>
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<tr>
<th>Partner Memberships</th>
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<tbody>
<tr>
<td>Cold Spring Harbor Central School District</td>
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<tr>
<td>Long Beach Central School District</td>
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The following schools participated in these membership programs of the **DNALC NYC at City Tech**:

<table>
<thead>
<tr>
<th>Sustaining Membership</th>
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<tbody>
<tr>
<td>Stuyvesant High School</td>
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<table>
<thead>
<tr>
<th>Associate Membership</th>
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<tbody>
<tr>
<td>Portfolio School</td>
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<table>
<thead>
<tr>
<th>Partner Memberships</th>
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<tbody>
<tr>
<td>The Chapin School</td>
</tr>
<tr>
<td>Lycée Français de NY</td>
</tr>
<tr>
<td>Marymount School of NY</td>
</tr>
<tr>
<td>St. David's School</td>
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<tr>
<td>Fontbonne Hall</td>
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</table>

The following school participated in this membership program of the **Regeneron DNALC**:

<table>
<thead>
<tr>
<th>Sustaining Membership</th>
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<tbody>
<tr>
<td>Archbishop Stepinac High School</td>
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</table>
## Sites of Major Faculty Workshops

<table>
<thead>
<tr>
<th>State</th>
<th>Institution</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIRTUAL</td>
<td>Host: Atlanta University Center Consortium, Atlanta, Georgia</td>
<td>2021</td>
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<tr>
<td></td>
<td>Host: Bowie State University, Bowie, Maryland</td>
<td>2020</td>
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<tr>
<td></td>
<td>Host: DNA Learning Center, New York</td>
<td>2020</td>
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<tr>
<td></td>
<td>Host: Harlem DNA Lab and Regeneron DNALC, Sleepy Hollow, New York</td>
<td>2020</td>
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<td>Co-host: James Madison University, Harrisonburg, Virginia</td>
<td>2020, 2021 (3)</td>
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<tr>
<td></td>
<td>Host: North Carolina State University, Raleigh, North Carolina</td>
<td>2021</td>
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<td></td>
<td>Co-hosts: University of Arizona, Tucson, Arizona &amp; DNA Learning Center, NY</td>
<td>2020</td>
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<td>Host: Quantitative Undergraduate Biology Education and Synthesis (QUBES) Project</td>
<td>2020</td>
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<tr>
<td>ALABAMA</td>
<td>University of Alabama, Tuscaloosa</td>
<td>1987–90</td>
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<td></td>
<td>Hudson Alpha Institute, Huntsville</td>
<td>2014</td>
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<td>ALASKA</td>
<td>University of Alaska, Anchorage</td>
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<td>University of Alaska, Fairbanks</td>
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<tr>
<td>ARIZONA</td>
<td>Arizona State University, Tempe</td>
<td>2009</td>
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<tr>
<td></td>
<td>Tuba City High School</td>
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<td></td>
<td>University of Arizona, Tucson</td>
<td>2011, 2019–20</td>
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<td></td>
<td>United States Department of Agriculture, Maricopa</td>
<td>2012</td>
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<tr>
<td>ARKANSAS</td>
<td>Henderson State University, Arkadelphia</td>
<td>1992</td>
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<tr>
<td></td>
<td>University of Arkansas, Fayetteville</td>
<td>2017, 2019</td>
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<tr>
<td></td>
<td>University of Arkansas, Little Rock</td>
<td>2012</td>
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<td>University of Arkansas for Medical Sciences, Little Rock</td>
<td>2019</td>
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<tr>
<td>CALIFORNIA</td>
<td>California State University, Dominguez Hills</td>
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<td>California State University, Fullerton</td>
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<td>California Institute of Technology, Pasadena</td>
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<td>Chan-Zuckerberg BioHub, San Francisco</td>
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<td></td>
<td>Canada College, Redwood City</td>
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<td>City College of San Francisco</td>
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<td>Foothill College, Los Altos Hills</td>
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<td>Harbor-UCLA Research &amp; Education Institute, Torrance</td>
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<td>Los Angeles Biomedical Research Institute (LA Biomed), Torrance</td>
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<td>Laney College, Oakland</td>
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<td>Lutheran University, Thousand Oaks</td>
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<td>Oxnard Community College, Oxnard</td>
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<td>Pasadena City College</td>
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<td></td>
<td>Pierce College, Los Angeles</td>
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<td>Salk Institute for Biological Studies, La Jolla</td>
<td>2001, 2008</td>
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<td>Santa Clara University</td>
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<td>Scripps Institute, San Diego</td>
<td>2019</td>
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<td>Southwestern College, Chula Vista</td>
<td>2014–15</td>
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<tr>
<td></td>
<td>Stanford University, Palo Alto</td>
<td>2012</td>
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<td>University of California, Berkeley</td>
<td>2010, 2012</td>
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<td>University of California, Davis</td>
<td>1986</td>
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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 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

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 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

St. John’s College, Annapolis 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, 2019

MONTANA

Montana State University, Bozeman 2012

NEBRASKA

University of Nebraska-Lincoln, Lincoln 2014

NEVADA

University of Nevada, Reno 1992, 2014

NEW HAMPSHIRE

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


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, 2018–19
Columbia University, New York 1993
Cornell University, Ithaca 2005
DeWitt Middle School, Ithaca 1991, 1993
DNA Learning Center West 2005
DNA Learning Center NYC 2019, 2021
Environmental Science Center, Bergen Beach, Brooklyn 2015–16
Fostertown School, Newburgh 1991
Harlem DNA Lab, East Harlem 2015–16
Huntington High School 1986
Irvington High School 1986
K-12 Summer Institute, Kerrville 2019
John Jay College of Criminal Justice 2009
Junior High School 263, Brooklyn 1991
Lindenhurst Junior High School 1991
Math for America 2017–19
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
Orchard Park Junior High School 1991
Plainview-Old Bethpage Middle School 1991
Regeneron Pharmaceuticals, Inc 2019
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
The Rockefeller University, New York 2003, 2015–16
The Rockefeller University, New York 2010
Titusville Middle School, 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
CIT 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
Austin Community College – Rio Grande Campus 2000

**TEXAS**

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, Brownsville 2010

**UTAH**

Brigham Young University, Provo 2012
University of Utah, Salt Lake City 1993

**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**

Shoreline Community College 2011, 2012
<table>
<thead>
<tr>
<th>Location</th>
<th>Institution</th>
<th>Years</th>
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<tr>
<td>WEST VIRGINIA</td>
<td>University of West Virginia</td>
<td>1989, 2003</td>
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<tr>
<td>WISCONSIN</td>
<td>Blood Center of Southeastern Wisconsin, Milwaukee</td>
<td>2003</td>
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<td></td>
<td>Marquette University, Milwaukee</td>
<td>1986–87</td>
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<td></td>
<td>University of Wisconsin, Madison</td>
<td>1988–89</td>
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<td>University of Wisconsin, Madison</td>
<td>2004, 2012</td>
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<tr>
<td>WYOMING</td>
<td>University of Wyoming, Laramie</td>
<td>1991</td>
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<td></td>
<td>University of Puerto Rico, Mayaguez</td>
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<td></td>
<td>University of Puerto Rico, Mayaguez</td>
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<td>University of Puerto Rico, Rio Piedras</td>
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<td></td>
<td>University of Puerto Rico, Rio Piedras</td>
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<td>University of Puerto Rico, San Juan</td>
<td>2019</td>
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<tr>
<td>AUSTRALIA</td>
<td>Walter and Eliza Hall Institute and University of Melbourne</td>
<td>1996</td>
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<td></td>
<td>EMBL/Australian Bioinformatics Resource, University of Melbourne</td>
<td>2016</td>
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<td></td>
<td>University of Western Australia, Perth</td>
<td>2018</td>
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<td>AUSTRIA</td>
<td>Vienna Open Lab, Vienna</td>
<td>2007, 2012</td>
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<td></td>
<td>Technical University of Graz</td>
<td>2019</td>
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<tr>
<td>CANADA</td>
<td>Red River Community College, Winnipeg, Manitoba</td>
<td>1989</td>
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<tr>
<td></td>
<td>University of Quebec, Montreal</td>
<td>2018</td>
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<tr>
<td>CHINA</td>
<td>Beijing No. 166 High School, Beijing</td>
<td>2013–19</td>
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<td></td>
<td>Ho Yu College, Hong Kong</td>
<td>2009</td>
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<td>DENMARK</td>
<td>Faroe Genome Project, Torshavn, Faroe Islands</td>
<td>2013</td>
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<tr>
<td>GERMANY</td>
<td>Urania Science Center, Berlin</td>
<td>2008</td>
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<tr>
<td>IRELAND</td>
<td>European Conference on Computational Biology/Intelligent System for Molecular Biology Conference, Dublin</td>
<td>2015</td>
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<tr>
<td></td>
<td>University College Dublin</td>
<td>2018</td>
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<td>ITALY</td>
<td>International Institute of Genetics and Biophysics, Naples</td>
<td>1996</td>
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<td>Porto Conte Research and Training Laboratories, Alghero</td>
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<td>MEXICO</td>
<td>ADN Mexico, Morelia</td>
<td>2016</td>
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<td>ASPB Plant Biology, Mérida</td>
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<td>Langebio/Cinvestav, Irapuato</td>
<td>2016</td>
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<td>NIGERIA</td>
<td>Godfrye Okoye University, Enugu, Nigeria</td>
<td>2013, 2018</td>
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<td>PANAMA</td>
<td>University of Panama, Panama City</td>
<td>1994</td>
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<td>PHILIPPINES</td>
<td>Eastern Visayas Campus, Philippine Science High School, Palo, Leyte</td>
<td>2017</td>
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<td>RUSSIA</td>
<td>Shemyakin Institute of Bioorganic Chemistry, Moscow</td>
<td>1991</td>
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<td>SINGAPORE</td>
<td>National Institute of Education</td>
<td>2001–05</td>
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<td>Singapore Science Center</td>
<td>2013</td>
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<td>SOUTH AFRICA</td>
<td>North-West University, Potchefstroom</td>
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<td>South African Bioinformatics Society, Durban</td>
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<td>SWEDEN</td>
<td>Kristineberg Marine Research Station, Fiskebackgkil</td>
<td>1995</td>
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<td>Uppsala University</td>
<td>2004</td>
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<td>THE NETHERLANDS</td>
<td>International Chromosome Conference, Amsterdam</td>
<td>2007</td>
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<td></td>
<td>Wageningen University and Research Center, Wageningen</td>
<td>2014</td>
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<td>UNITED KINGDOM</td>
<td>Earlham Institute, Norwich</td>
<td>2018</td>
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<td>The Genome Analysis Center, Norwich</td>
<td>2015</td>
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<td>University of York, York</td>
<td>2017</td>
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<td>Wellcome Trust Conference Center, Hinxton</td>
<td>2012–13</td>
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<tr>
<td></td>
<td>University of Warwick, Coventry</td>
<td>2013</td>
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</table>
Workshops, Meetings, Collaborations, and Site Visits

January 13  
Saturday DNA! “Virtual Lab: DNA Extraction from Strawberries,” DNALC
“Meet a Scientist: Dr. Lloyd Trotman,” Virtual Event, DNALC

January 16  
Saturday DNA! “Virtual Lab: DNA Extraction from Strawberries,” DNALC

January 20  
Saturday DNA! “Virtual Lab: As the worms turn,” DNALC

January 23  
Saturday DNA! “Virtual Lab: As the worms turn,” DNALC

January 26  
NIH Barcoding US Ants Mini Virtual Symposium, DNALC

January 27  
Saturday DNA! “Virtual Lab: Cracking the Code,” DNALC

January 28  

January 29  
NIH Citizen DNA Barcode Network Collaborator Virtual Workshop, DNALC

January 30  
Saturday DNA! “Virtual Lab: Cracking the Code,” DNALC
Green Genes Workshop, DNALC
AP Bio/Restriction Analysis Part I Workshop, DNALC

February 1  
NIH Citizen DNA Barcode Network Collaborator Virtual Workshop, DNALC

February 3  
Saturday DNA! “Virtual Lab: DIY Electrophoresis Chamber,” DNALC
NIH Citizen DNA Barcode Network Collaborator Virtual Workshop, DNALC

February 5  
NIH Citizen DNA Barcode Network Collaborator Virtual Workshop, DNALC

February 6  
Saturday DNA! “Virtual Lab: DIY Electrophoresis Chamber,” DNALC
Workshop, DNALC
AP Bio/Restriction Analysis Part II Workshop, DNALC

February 13  
Green Genes Workshop, DNALC
AP Bio/Bacterial Transformation Workshop, DNALC

February 16  
“DNA 101” Workshop, DNALC
Bacterial Transformation Workshop, DNALC
DNA Barcoding Virtual Workshop, DNALC

February 17  
“Got Lactase?” Workshop, DNALC
“Forensics: Trace Evidence,” Workshop, DNALC

February 18  
NIH Citizen DNA Barcode Network Collaborator Virtual Workshop, DNALC

February 19  
“Gene Therapy,” Workshop, DNALC
“Restriction Analysis,” Workshop, DNALC
DNA Barcoding Virtual Workshop, DNALC
NIH Citizen DNA Barcode Network Collaborator Virtual Workshop, DNALC

February 20  
Green Genes Workshop, DNALC
AP Bio/Human DNA Fingerprinting Workshop, DNALC

February 23  
DNA Barcoding Virtual Workshop, DNALC

February 25  
“DNA Fingerprinting,” Workshops, DNALC

February 26  
DNA Barcoding Virtual Workshop, DNALC

February 27  
Green Genes Workshop, DNALC
AP Bio/DNA Barcoding, Part I Workshop, DNALC

March 2  
DNA Barcoding Virtual Workshop, DNALC

March 3  
Saturday DNA! “Virtual Lab: Selection Detection,” DNALC

March 5  
DNA Barcoding Virtual Workshop, DNALC

March 6  
Saturday DNA! “Virtual Lab: Selection Detection,” DNALC
Green Genes Workshop, DNALC
AP Bio/DNA Barcoding, Part II Workshop, DNALC

March 9  DNA Barcoding Virtual Workshop, DNALC
March 11  “Meet a Scientist: Miriam Ferrer Gonzalez,” Virtual Event, DNALC
March 12, 16 DNA Barcoding Virtual Workshop, DNALC
March 17  NIH Barcode Long Island Virtual Open Lab, DNALC
March 19, 23, 26 DNA Barcoding Virtual Workshop, DNALC
March 23  DNA Barcoding Virtual Workshop, DNALC
March 26  DNA Barcoding Virtual Workshop, DNALC
March 27  AP Bio/Restriction Analysis, Part I Workshop, DNALC
March 29–April 2 Urban Barcode Research Program DNA Barcoding and Bioinformatics Virtual Workshop, DNALC
   NY at City Tech
   Spring Break Workshops, The Diversity of Life, Human Mitochondrial Sequencing: Part 1, Infectious Disease, Bacterial Transformation, Mendelian Genetics: Build a Creature, Restriction Analysis, Agar Art, Purification of Green Fluorescent Protein, Human Mitochondrial Sequencing, DNALC

April 3  AP Bio/Restriction Analysis, Part II Workshop, DNALC
April 7  Informational Session, Virtual, DNALC NY at City Tech
   DNA Barcoding Virtual Presentation for iNaturalist Discord Server Group, San Francisco, California, DNALC

April 8  “Meet a Scientist: Alexa Pagliaro,” Virtual Webinar, DNALC
April 10 AP Bio/Bacterial Transformation Workshop, DNALC
April 14–15 Informational Sessions, Virtual, DNALC NY at City Tech
April 16  NSF Northeast Big Data Innovation Hub, “Student Data Corps Data Science Career Panel,” Virtual Public Lecture, Data Science Institute, Columbia University, New York, New York
April 17  Saturday DNA! “Virtual Lab: History and Mystery of Cell Theory,” DNALC
   AP Bio/Human DNA Fingerprinting Workshop, DNALC
   NIH Barcode Long Island Virtual Open Lab, DNALC
   DNA Extractions at Brooklyn Outdoor Earth Day Event, Brooklyn, New York
April 19  Earth Day/March for Science Virtual Science Expo, New York, New York
April 21  Informational Session, Virtual, DNALC NY at City Tech
April 24  Saturday DNA! “Virtual Lab: Less is More: Population Size and Genetic Drift,” DNALC
   AP Bio/DNA Barcoding, Part I Workshop, DNALC
April 28  NIH Barcode Long Island Virtual Open Lab, DNALC
May 1    Saturday DNA! “Virtual Lab: Microbe Mania!” DNALC
   AP Bio/DNA Barcoding, Part II Workshop, DNALC
May 5    Informational Session, Virtual, DNALC NY at City Tech
May 8    Saturday DNA! “Virtual Lab: Ancient Ancestors & Me,” DNALC
May 13   “Meet a Scientist: Dr. Hannah Meyer,” Virtual Webinar, DNALC
May 14   Mystery of Anastasia Virtual Presentation for Siemens Healthineers, Malvern, Pennsylvania, DNALC
May 15   Saturday DNA! “Virtual Lab: EYE-volution!” DNALC

May 19–20 Informational Sessions, Virtual, DNALC NY at City Tech
May 20–21, CyVerse Data Carpentry Genomics Virtual Workshop, Atlanta University Center
   24–25   Consortium, Atlanta, Georgia, DNALC
May 26–27 Informational Sessions, Virtual, DNALC NY at City Tech
May 26–28 Introduction to Bioinformatics with CyVerse Virtual Workshop, North Carolina State University, Raleigh, North Carolina, DNALC
June 1  
*Urban Barcode Project/*Urban Barcode Research Program/*Barcode Long Island/*US Ants* DNA Barcoding Virtual Student Symposium, DNALC and *DNALC NYC* at City Tech

June 7–16  
*DNA Barcoding* for CURES Virtual Workshop, James Madison University, Harrisonburg, Virginia, DNALC

June 8  
International Applied Microbiology Virtual Conference 2021, “Introduction to RNA-Seq with the Kallisto and Sleuth Workflows,” Faculty/Student Workshop, Society for Applied Microbiology, London, United Kingdom

June 9–10  
NYC DOE STEM Virtual Conference, “The *Urban Barcode Project*—Hands-on Science at Home and in School,” Teacher Workshop, Expo Hall, Long Island City, New York

June 10  
“Meet a Scientist: Dr. Peter Koo,” Virtual Webinar, DNALC

June 17  
*DNA Barcoding* Training with Long Island Science Center, DNALC

June 21–25  
*DNA Metabarcoding for CURES* Virtual Workshop, James Madison University, Harrisonburg, Virginia

June 28–July 2  
*DNA Science Workshop*, DNALC  
*World of Enzymes Workshop*, DNALC  
*Green Genes Workshop*, DNALC  
*DNA Science Workshop*, DNALC  
*Fun with DNA Workshop*, DNALC  
*DNA Science Workshop, DNALC NYC* at City Tech  
*Fun with DNA Workshop, DNALC NYC* at City Tech  
*Forensic Detectives Workshop, DNALC NYC* at City Tech  
*Urban Barcode Project Teacher Training Workshop, DNALC NYC* at City Tech

June 29–July 1  
CGEMS 2021 – Getting Started with R and CyVerse Virtual Workshop, James Madison University, Harrisonburg, Virginia, DNALC

July 5–9  
*Genome Science Workshop*, DNALC  
*Fun with DNA Workshop, DNALC*  
*Forensic Detectives Workshop, DNALC*  
*World of Enzymes Workshop, DNALC*  
*Fun with DNA Workshop, DNALC NYC* at City Tech  
*World of Enzymes Workshop, DNALC NYC* at City Tech  
*Bridging the Gap STEP: Fun with DNA Virtual Workshop, DNALC*

July 12–16  
*DNA Science Workshop, DNALC*  
*Green Genes Workshop, DNALC*  
*Fun with DNA Workshop, DNALC*  
*Green Genes Workshop, DNALC*  
*BioCoding Workshop, DNALC*  
*DNA Science Workshop, DNALC NYC* at City Tech  
*Urban Barcode Research Program Conservation Genetics Workshop, DNALC NYC* at City Tech  
*Bridging the Gap Fun with DNA Virtual Workshop, Regeneron DNALC*  
*Bridging the Gap Forensic Detectives Virtual Workshop, Regeneron DNALC*  
*DNA Barcoding Workshop, Francis Lewis High School, Fresh Meadows, New York*

July 19–23  
*DNA Science Workshop, DNALC*  
*Forensic Detectives Workshop, DNALC*  
*World of Enzymes Workshop, DNALC*  
*Fun with DNA Workshop, DNALC*  
*Forensic Detectives Workshop, DNALC NYC* at City Tech  
*Fun with DNA Workshop, DNALC NYC* at City Tech  
*DNA Science Workshop, DNALC NYC* at City Tech  
*Urban Barcode Research Program Barcoding Workshop, DNALC NYC* at City Tech
Urban Barcode Research Program Conservation Genetics Workshop, Harlem DNA Lab
Bridging the Gap Forensic Detectives Virtual Workshop, Regeneron DNALC

July 26–30
DNA Science Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
DNA Barcoding Workshop, DNALC
Genome Science Workshop, DNALC NYC at City Tech
World of Enzymes Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Conservation Genetics Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Barcoding Workshop, Harlem DNA Lab
Genome Science Virtual Workshop, DNALC
Bridging the Gap STEP World of Enzymes Virtual Workshop, DNALC & Regeneron DNALC
BioCoding Virtual Workshop, DNALC

July 26
“Extending the Possibilities of Biology with Open Science,” Virtual Student Lecture, Prairie View A & M University College of Engineering, Prairie View, Texas, DNALC

July 30
NIH Citizen DNA Barcode Network Collection Event, Sweetbriar Nature Center, Smithtown, New York

August 2–6
Green Genes Workshop, DNALC
Genome Science Workshop, DNALC
Fun with DNA Workshop, DNALC
Citizen DNA Barcode Network Barcoding Workshop, DNALC
DNA Barcoding Workshop, DNALC NYC at City Tech
Green Genes Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Barcoding Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Conservation Genetics Workshop, Harlem DNA Lab
Genome Science Virtual Workshop, DNALC
Fun with DNA Virtual Workshop, Regeneron DNALC
Forensic Detectives Workshop, Friends Academy, Locust Valley, New York

August 3–5
DNA Metabarcoding for CURES Virtual Workshop, James Madison University Harrisonburg, Virginia, DNALC

August 9–13
DNA Science Workshop, DNALC
STARS DNA Barcoding Workshop, DNALC
Forensic Detectives Workshop, DNALC
World of Enzymes Workshop, DNALC
DNA Science Workshop, DNALC NYC at City Tech
Forensic Detectives Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Conservation Genetics Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Barcoding Workshop, Harlem DNA Lab
World of Enzymes Virtual Workshop, DNALC
Forensic Detectives Virtual Workshop, Regeneron DNALC

August 16–20
DNA Science Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
Fun with DNA Workshop, DNALC
STARS BioCoding Workshop, DNALC
Fun with DNA Workshop, DNALC NYC at City Tech
Genome Science Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Barcoding Workshop, DNALC NYC at City Tech
Workshops, Meetings, Collaborations, and Site Visits

August 23–27
DNA Barcoding Virtual Workshop, DNALC
Sequence a Genome! Workshop, DNALC
DNA Barcoding Workshop, DNALC
Forensic Detectives Workshop, DNALC
WISE Fun with DNA Workshop, DNALC
DNA Science Workshop, DNALC NYC at City Tech
World of Enzymes Workshop, DNALC NYC at City Tech
Urban Barcode Research Program Bootcamp Workshop, DNALC NYC at City Tech
Fun with DNA Virtual Workshop, DNALC
DNA Barcoding Virtual Workshop, DNALC

August 25
Site Visit by Eric Adams, Brooklyn Borough & Russ Hotzler, City Tech, DNALC NYC at City Tech

August 30–
DNA Science Workshop, DNALC

September 3
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
Green Genes Workshop, DNALC NYC at City Tech

September 2
Chan Zuckerberg Initiative Training and Education for Open Science Virtual Workshop, Redwood City, California, DNALC

September 13, 15
NSF Virtual Panel, Alexandria, Virginia

September 20
Site Visit by Greg Borman, Department of STEM, Office of Curriculum Instruction & Professional Learning, NYC Department of Education, & Sheldon Young, ACCESS Citywide, NYC Department of Education, New York, New York, DNALC NYC at City Tech

September 21, 23
NSF Virtual Panel, Alexandria, Virginia

September 24
DNALC NYC at City Tech Ribbon Cutting Event

September 29
American Society of Cell Biology Public Engagement Webinar, “Relevance and Rapport; Promoting Inclusion through Public Engagement,” Virtual Lecture Rockville, Maryland

September 30
Site Visit by Joseph Oleniczak and Kissaou Tchedre, Austin Community College, Austin, Texas, DNALC & DNALC NYC at City Tech

October 1
“A Day in the Life” Event, Massapequa High School, Massapequa, New York

October 5
Urban Barcode Research Program Student Orientation, Virtual and DNALC NYC at City Tech

October 8

October 16
STEM Teachers NYC Training “Intro to Biotech, Part 1,” DNALC NYC at City Tech

October 19
Site Visit by Nick Greiner and Maria Scoutas, Consul General’s Office of Australia, New York, New York, with Bruce Stillman, DNALC

October 20
Regeneron Virtual Training Session “Day for Doing Good,” DNALC

October 23
STEM Teachers NYC Training “Intro to Biotech, Part 2,” DNALC NYC at City Tech

Saturday DNA! “Tracking Traits,” DNALC

October 26

October 27
Massapequa School District Teacher Training Workshops, “Barcoding and Bioinformatics,” and “DNA Extraction, Mendelian Inheritance, Bacteria & Antibiotics,” & “Otzi the Iceman,” DNALC Fall Open House, DNALC NYC at City Tech

October 28
NIH Citizen DNA Barcode Network Meeting at Jones Beach Energy and Nature Center, Jones Beach State Park, Wantagh, New York

October 29
Site Visit by Doug Torre, CSHL, DNALC

Massapequa School District Teacher Training Workshops, “Restriction Analysis,” DNALC

October 30
STEM Teachers NYC Training “Intro to Biotech, Part 3,” DNALC NYC at City Tech

November 2
November 3–5  
*Urban Barcode Project* Training, Virtual Refresher Course, *DNALC NYC* at City Tech

November 4  
CSHL Genome Informatics Virtual Conference, “Tools to Facilitate Student Metabarcoding Research,” Poster Session, CSHL

November 4  

November 8  
Fall Open House, *DNALC NYC* at City Tech

November 9  
Math for America Teacher Training “Human Mitochondrial Sequencing Part 1,” *DNALC NYC* at City Tech

November 10  
Fall Open House, *Regeneron DNALC*

November 11  
*Ötzi the Iceman* Virtual Tour, DNALC

November 13  
*Saturday DNA!* “A BOLD Connection,” DNALC

November 15  
Long Beach School District Teacher Training Workshop, “Bacterial Transformation,” DNALC

November 15  
*Barcode Long Island* Virtual Teacher Training, “Bioinformatics,” DNALC

November 16  
Math for America Teacher Training “Human Mitochondrial Sequencing Part 2,” *DNALC NYC* at City Tech

November 18  
Fall Open House, *Regeneron DNALC*

November 19  
“Meet a Scientist: Dr. Doreen Ware,” Virtual Webinar, DNALC

November 19  
“Learning New Tricks—Career-spanning Learning in STEM,” Virtual Student Lecture, Engaged STEM Scholars Program, Barry University, Miami Shores, Florida

November 23  
Math for America Teacher Training “Human Mitochondrial Sequencing Part 3,” *DNALC NYC* at City Tech

November 30  
Site Visit & Tour by Justin Vázquez-Poritz, City Tech School of Arts and Sciences, Brooklyn, New York, *DNALC NYC* at City Tech

December 2  
“Asking the Wrong Questions About American Science Education,” Virtual Lecture, American Society for Cell Biology, Rockville, Maryland

December 2  
American Society for Cell Biology, Cell Bio Virtual 2021 Teacher Workshop, “Integrating Bioinformatics into Your Courses,” Rockville, Maryland

December 2–3  
Computing for Teaching and Learning with Jupyter Workshop, George Washington University, Washington D.C.

December 3  
Shelter Island High School Science Fair, Shelter Island, New York

December 7, 9  
Banbury Life Science Virtual Professional Development Conference, “Making Career-spanning Learning in the Life Sciences Inclusive and Effective for All,” CSHL

December 8  
Queensborough College Business Industry Leadership Team Kickoff Virtual Teacher Workshop, “Bringing Data into the Classroom,” Queens, New York

December 9  
CUNY TV Filming, *DNALC NYC* at City Tech

December 10  
Site Visit by Brooklyn North e-STEM Team, Brooklyn, New York, *DNALC NYC* at City Tech

December 11  
*Saturday DNA!* “A Day in the Life of the Iceman,” DNALC

December 14  
*Barcode Long Island* Open Lab, DNALC

December 16  
Site Visit by Jeremy Seto (CUNY NYCT) & City Tech Nursing Faculty, Brooklyn, New York, *DNALC NYC* at City Tech

November 10  
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“Meet a Scientist: Dr. Christopher Vakoc,” Virtual Webinar, DNALC
One Bungtown Road  
Cold Spring Harbor, NY 11724

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