

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 Assistant Director Amanda McBrien signs off at the conclusion of a *DNALC Live* virtual laboratory early in the COVID-19 pandemic lock down.

Executive Director's Report

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BIOMEDIA

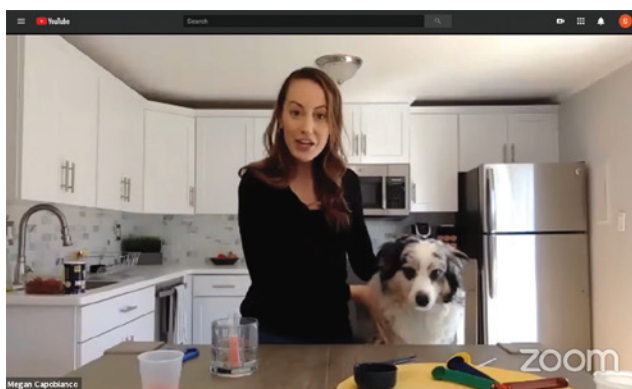
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Coping with COVID-19

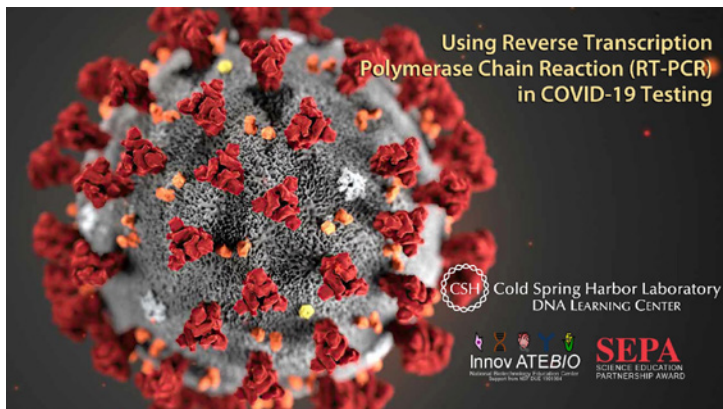
On March 16th, the DNALC closed to the public, and we began to rethink how to operate a hands-on science center with no hands. Our experience in multimedia production and computer infrastructure, backed by the resources of the Landeau Multimedia Studio, allowed us to quickly transition to online-only teaching within a week of the most restrictive phase of the New York State shelter-in-place order. Although we knew that web traffic would increase during the pandemic stay-at-home, we also knew that competition for audience attention would also increase. Faced with this challenge, and to keep our staff of instructors productive, we took a disciplined approach to aggressively expand the DNALC's online footprint.

On March 20th, we launched "DNALC Live" with a weekly schedule of 10–12 events. Online labs, with moderated chat and follow-along worksheets, stood in for our daily lab field trips. Other events included multi-part courses on bioinformatics and human evolution, interactive museum tours, interviews with local scientists, and chats for students and teachers. Most events were broadcast from instructors' homes—with some using lab equipment brought from the DNALC and some using "kitchen science" adaptations. All events premiered live on YouTube, which has no viewer limits. Recordings remain available and searchable on the DNALC YouTube channel. Analysis of YouTube logs showed that viewership of live events was low, with most viewers watching the archived recordings. Like others, we also needed to contend with the fact that viewers don't stay long. So, we shifted emphasis to five to ten minute presentations, called "DNALC Shorts." In April, we initiated virtual lab field trips, private events for individual classes to interact online with a DNALC educator.

In two months, we uploaded more than 120 new videos to YouTube—many more than were posted during this period by Liberty Science Center (49), the Museum of Natural History (16), or New York Hall of Science (0). Our efforts were rewarded. From March 20 to May 17, YouTube views more than doubled compared to the same



DNALC instructor Megan Capobianco does kitchen science with "Chief."



The ubiquitous Centers for Disease Control and Prevention SARS-CoV-2 virus illustration is featured on the opening screen of the COVID-19 testing animation.

period in 2019; new subscribers and watch time more than tripled. Engagement with YouTube content skyrocketed, from 24 comments in 2019 to 4,427 this year. By year's end, materials developed during this fruitful period had gained 363,413 views and 34,853 hours of watch time. Most popular was an animation on RNA-based testing for COVID-19 (<https://dnalc.cshl.edu/resources/covid-19.html>), with 127,293 views.

Then we steeled ourselves for a season of summer camps in the year without a summer. We developed abbreviated versions of six popular DNALC camps, and campers received kits containing reagents and supplies needed to perform labs at home alongside instructors. Advanced camps on human genomics and DNA barcoding involved careful scheduling to allow participants to complete a complex analysis in real time—beginning with isolating their own DNA or DNA from a plant or insect at home, returning it to the DNALC for processing, and then analyzing DNA sequences together online. This was supported by a tremendous development effort to simplify DNA biochemistry so that parts of sophisticated experiments could be performed at home. We worked hard to further simplify DNA extraction from plant and animal tissue—getting good results from baby shampoo, Shout, or Chelex resin; hot water; and a bit of filter paper. Our efforts paid off. Operating entirely virtually, we served 409 virtual campers—about half of our normal number—and also rescued part of our most important source of earned income.



The lunchroom and computer lab were converted into supply storage and kit packing headquarters throughout the camp season.

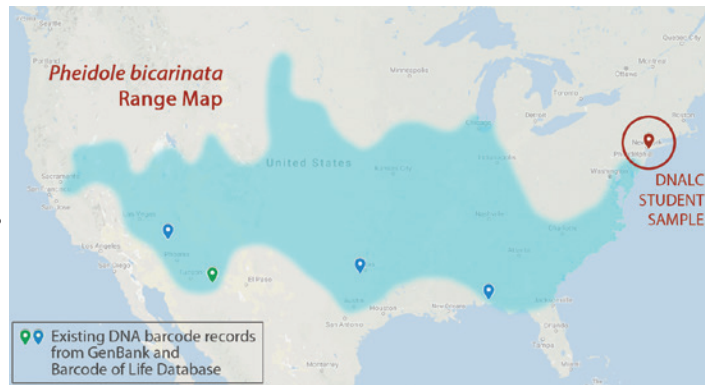


Ants for Citizen Science

With supplemental funding from the NIH Science Education Partnership Award (SEPA), over the summer we embarked on a pilot project that adapts our school-based DNA barcoding infrastructure to home-based citizen science. It was also our first attempt at a large-scale distributed project to collect data from a wide geographical area. Funded by the National Institutes of Health's Science Education Partnership Award (SEPA), *Barcoding US Ants* aims to show the feasibility of citizen scientists using DNA barcodes to identify and map the ant species of the United States. Just as a universal product code (UPC) identifies each commercial product, a DNA barcode can potentially identify each species of ant.

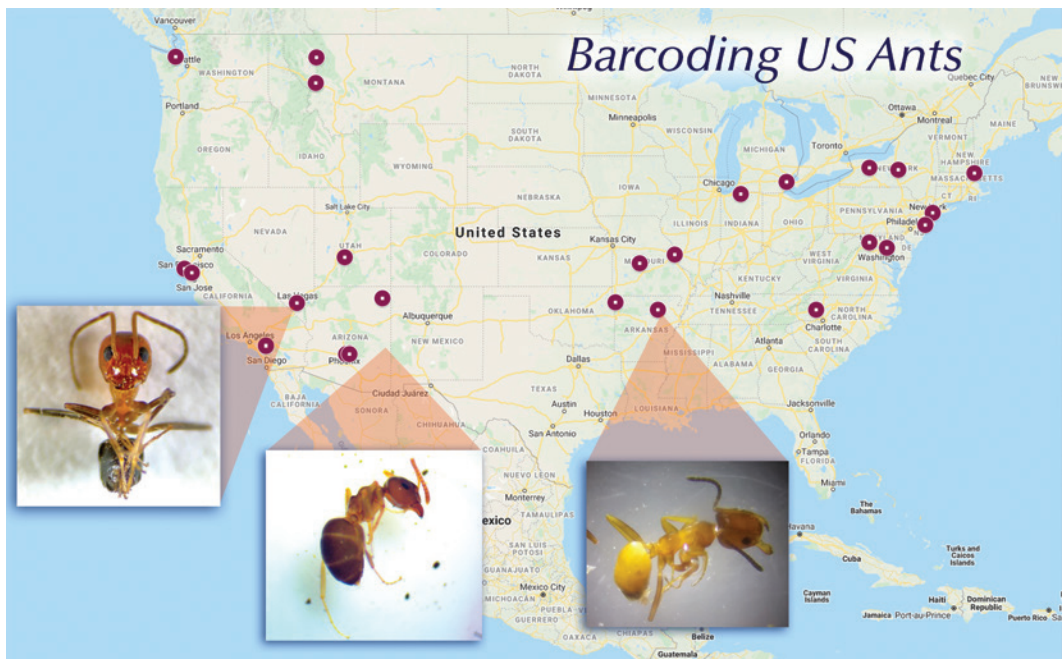
Even though ants seem so familiar, we know relatively little about them. There are about 900 species of ants in the US, but observational records are sparse for many species. Approximately half do not have published DNA barcodes in GenBank, the authoritative DNA database! So, our objective is to publish, with citizen co-authors, several hundred ant DNA barcodes to GenBank. We expect that some will be the first barcode records submitted to GenBank, but all samples will provide valuable data to document ant species at specific locations in the US.

This will improve range maps that show boundaries of where these species live and how they may be moving in response to climate change and habitat loss. For example, students participating in our previous SEPA project, *Barcode Long Island*, documented the ant *Pheidole bicarinata* approximately 50 miles north of its predicted range on the eastern seaboard—likely a result of global warming.



Using mailing lists of teachers we have trained—plus lists of local chapters of the Audubon Society, Nature Conservancy, Sierra Club, and Isaac Walton League—we recruited 39 teams located near diverse habitats in 22 states and Puerto Rico. Our resident ant expert, Shawn Dash, of Hampton University, explained methods to find and trap ants, and provided regional “hit lists” of ants without published DNA barcodes. Each team received an “at-home” kit to extract and amplify DNA from ten or more ants. Many teams, with science teacher members, had equipment available for PCR amplification and gel electrophoresis, while other teams received mini-equipment sets to do these steps. The amplified DNA was then sent for DNA sequencing, and preserved ants were sent to Dr. Dash and DNALC staff member Jeff Petracca for positive identification. We then worked with each team to analyze their DNA barcodes, using our simple *DNA Subway* tool, and to publish their barcode sequences in GenBank.

US Ants teams collected 380 specimens representing 97 ant species. Each of these confirmed sightings adds a new data point to range maps. Thus far, 274 GenBank records have been published with citizen scientists as authors. Importantly, the summer collections yielded 18 novel barcode sequences, the majority of which mark the first GenBank record identified to the species level. We are also left with 15 specimens that could not be identified using a combination of DNA barcode sequence and physical features (morphology). In most cases, there is too much sequence difference (3–5%) between a collected ant and its species as identified by morphology to make an accurate identification. Some of the discrepancies are in ant groups whose taxonomy is still unsettled. Most likely, however, these are subspecies or



Locations of *US Ants* participants with photos and locations of potentially undescribed ant specimens.

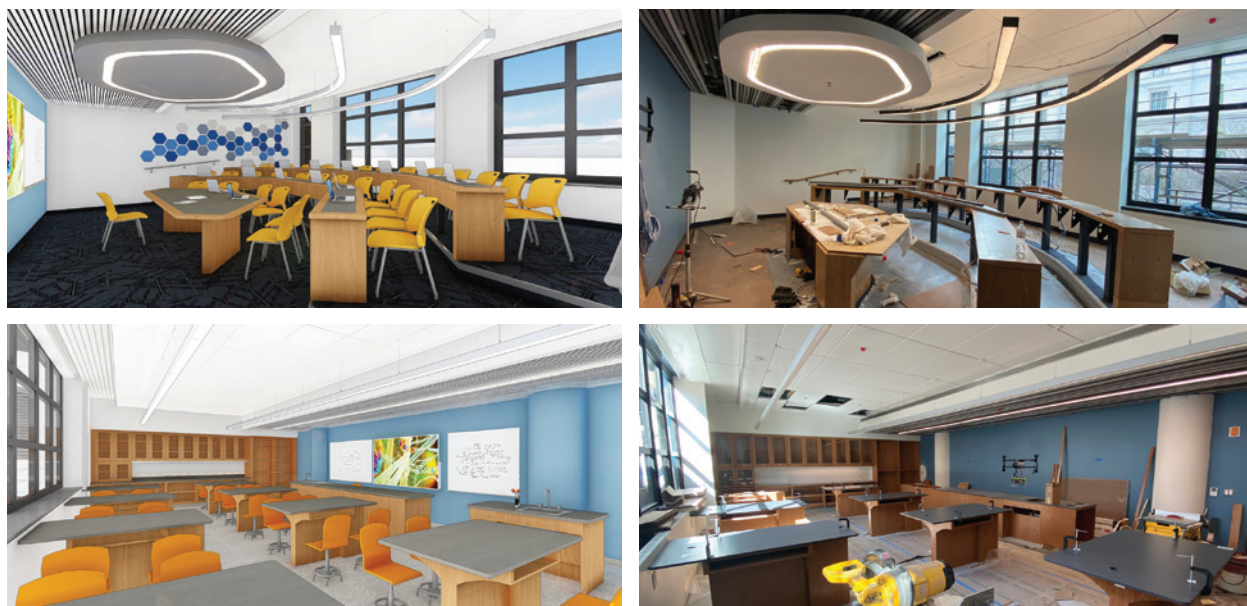
possibly new species who's small but diagnostic morphological differences have not yet been discerned. These specimens illustrate the gaps in knowledge of even familiar species and the importance of citizen science in presenting new data that can advance science.

This demonstration project laid the groundwork for our next SEPA project, *Citizen DNA Barcode Network*, which began in October. In this five-year, \$1.2 million project, we are working with the New York Hall of Science, Long Island chapters of the Audubon Society (Garvies Point Museum and Preserve), and Nature Conservancy (Mashomack Preserve) to perfect methods to work with citizen scientists in informal settings and to develop a mobile exhibit on DNA barcoding and biodiversity. We are already developing a parallel program with the HudsonAlpha Institute for Biotechnology and the Cook Museum of Natural Science Huntsville/Decatur, Alabama. Subsequently, we will extend these methods to science centers and citizen conservation groups across the country. In addition to ants, this distributed biodiversity "campaign" will focus on beetles, which are abundant indicators of ecosystem change, and mosquitoes, which are important vectors of human disease.

The COVID-19 Factor in Brooklyn

While COVID-19 was a bust for in-person education, ironically it proved a boon to the development of our new 17,500 square-foot facility in downtown Brooklyn. Renovations to the City Tech building began in February, but the site was closed in March. Our initial plans dictated that noisy demolition and drilling from the first floor be done at night or on weekends when student classes were not in session. However, by the time construction re-commenced in April, the City Tech campus was permanently closed to students. This meant that construction resumed unabated and without need for costly overtime. So, by year's end the project was on schedule and under budget—a rarity in New York City. The space that had always been alive in my imagination, or in architectural conceptualizations, was finally becoming a reality.

The COVID-19 lockdown also proved almost miraculous to our fundraising effort. A gift by CSHL trustee Laurie Landeau in 2012 led to the formal launch of a \$25 million campaign for *DNALC NYC* in 2013. After early gifts by the Alfred P. Sloan Foundation and Thompson Family Foundation, and several other New York foundations, the fund drive stalled at \$18 million as we looked for an appropriate site and then entered into several years of contract negotiations for the City Tech site. Then, in the depths of COVID-19 pandemic, CSHL board president Marilyn Simons joined with Laurie to reconstitute the DNALC committee—with the mission to support the DNALC through fundraising, outreach, and expansion of the brand. Board members Casey Cogut, Howard Morgan, Jeanne Moutoussamy-Ashe, and Doug Schloss rounded out the committee, along with business leaders MaryAnne Gilmartin (L&L MAG) and Yolanda Lyle (Pfizer). In less than a year, this miracle group raised nearly \$10 million, pushing the campaign over its initial goal. With construction and exhibit estimated to close out at \$18 million, this will leave \$10 million to endow operating costs and student scholarships.



DNALC NYC concept renderings (left) and year-end photos (right) of a computer classroom (top) and a laboratory classroom (bottom).

High School DNA Barcoding Research Programs

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 independent research of biodiversity in NYC. Science teachers are mentors for *BLI* and *UBP* students, while scientists from NYC institutions mentor *UBRP* students.

The *BLI* program was on track to support 212 students, but the pandemic reduced the number completing projects to 124 students working in 45 teams. Fifteen percent of completing students were African American, Latino, or Native American. Three teams used high-throughput sequencing to perform metabarcoding studies on microbiomes from plants and invertebrates. Over 200 samples were processed, resulting in over 340 sequencing reads and over one million NGS reads. We published 125 sequences in GenBank, including five new barcode sequences and 34 with sequence polymorphisms. The pandemic reduced *UBP* and *UBRP* participants from 190 to 150 students, working in 44 teams. Some collected data they were able to analyze and

present, while others shifted gears and analyzed existing data sets. One *UBP* team published a manuscript in the *Journal of Emerging Investigators* on using DNA barcoding to identify plant species and create a phenology trail in Central Park. Two *UBRP* teams presented posters to peers and science professionals at the annual Science Research Mentoring Program (SRMP) Virtual Colloquium in June.

The annual research symposium was held virtually for the first time in 2020. *UBRP*, *UBP*, and *BLI* students presented their research together on June 4th, resulting in a total of 239 participants on a Slack workspace. Topics included wildlife across NYC and Long Island, biodiversity and trade, food fraud, and human health. Several teams completed non-barcoding projects—including tracking the SARS-CoV-2 virus and analyzing gene expression data from a mouse model. Dr. Rebecca Johnson (Smithsonian National Museum of Natural History) and Dr. Corrie Moreau (Cornell University) gave keynote addresses streamed through YouTube on wildlife genomic research and ant microbiome evolution, respectively.

This year, 74 students across all three barcoding programs (*BLI*, *UBP*, and *UBRP*) completed surveys as a part of our ongoing effort to monitor the impact of participation in science research. Participants were asked about their experiences in the programs, how much they had learned, and how they felt about science. The students were overwhelmingly proud of the research they had done (90.7%) and felt that problem-solving approaches learned during their research would be helpful in future science courses (93.9%) and careers (80%). More than three-quarters (83.1%) said they were more interested in continuing science study and, specifically, biology (80%). Overall, our results suggest that DNA barcoding demystifies the process of science research and encourages students to continue on STEM pathways.

The screenshot shows a Slack channel named "#bli_team48" with a URL "https://dnabarcoding101.org/symposium/details/2877". A pinned message by Sharon Pepenella - BLI (8:18 PM) displays a student poster titled "Mosquito & Flying Insect Biodiversity" by Jordan Moses & Samantha Rosenbaum. The poster includes an introduction, materials & methods, and results sections, along with images of insects. Two video insets are visible: one of Dr. Rebecca Johnson (left) and one of Dr. Corrie Moreau (right). Below the poster, a chat history shows several messages:

- Allison Mayle (she/her) - UBRP (6:09 PM): Great work! Do you think there's anything you could do differently to attract more mosquitoes in the future?
- Jordan Moses (6:11 PM): Thank you! Yeah, I think we could set traps in more locations across our city. That would give us more mosquitoes and a larger geographic representation.
- Sharon Pepenella - BLI (6:11 PM): Hi team! A novel sequence...very cool! You found what many teams find when they use mosquito traps - that what students believe to be mosquitoes are in fact highly diverse crane flies! Why do you think it's important for people to be able to distinguish crane flies from mosquitoes?
- Megan Capobianco - DNALC (6:13 PM): Going off of Sharon's comment, I also found it very interesting that you may have found a novel species based on your inconclusive sequencing. In the chance that it is not novel, do you have a guess as what species it could be?
- Jordan Moses (6:13 PM): I think the ability to distinguish between crane flies and mosquitoes is important because crane flies do not carry disease nor do they sting or bite. Mosquitoes, on the other hand, can be vectors.
- Robert Bolen (6:15 PM): It is so exciting to have a potentially novel sequence. Great work! It would be important to know if any other samples of *Aedes vexans* show up in future collections.
- Jordan Moses (6:15 PM): We don't really have that great of a guess what it could be, since after inputting the data into the database, there were a lot mismatches in the sequence. The closest match had almost 70 mismatches, and was to an Asian insect.

An example of a student poster presentation shown in the Slack workspace. Insets are the *BLI* keynote speaker Dr. Rebecca Johnson (left), and the *UBP/UBRP* speaker Dr. Corrie Moreau.

DNA Barcoding in Undergraduate Classes

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

In June 2020, we held a virtual 5-day “DNA Barcoding for CUREs” online workshop for 11 four-year college, eight two-year college, and three high school faculty. Twenty-nine percent of participants were Black and 10% were Hispanic/Latino. We limited the number of contact hours and used a “flipped classroom”, maximizing the amount of time for questions and discussions. The spaced training allowed participants to review materials and try bioinformatic steps, allowing them to discuss any concerns or questions during online sessions. The workshop covered the methods and logistics needed to implement DNA barcoding CUREs and included presentations by participants from the previous year’s workshop describing their implementations.

In preparation for the main workshop, an online pre-workshop session covered sample collection and the DNALC’s rapid DNA isolation protocol, preparing those who were interested and able to carry out DNA isolations and DNA barcode amplification. Working on diverse aquatic and terrestrial samples, participants completed the biochemistry with reagents provided by the DNALC, then submitted samples for sequencing directly with DNALC support, allowing them to analyze their own data during the workshop.

After piloting metabarcoding classes at JMU, BSU, and City Tech, the first faculty metabarcoding CURE workshop was held during the summer. The online workshop included 56 educators from seven countries and four continents, including 14% Black and 9% Hispanic/Latino participants. Participants included six high school, 15 two-year, and 33 four-year faculty. The two-week layout provided time for sample collection, processing, and pedagogical discussions. Almost all faculty were unable to process samples and most had no in-person labs in the fall. Despite this, many chose to collect and submit samples so that they could build their expertise and have relevant datasets to enable student metabarcoding analyses. Over 400 samples from participants and 150 samples from JMU and BSU metabarcoding CUREs were sequenced to create datasets for fall implementations. Combined, the 2020 barcoding and metabarcoding workshops reached 64 educators from 54 institutions.

In the spring, implementation by faculty was heavily impacted by the pandemic, with only 55 students completing barcoding research in six classes. In the fall, implementation levels improved, with ten faculty implementing DNA barcoding CUREs with 254 students, while five faculty working with 83 students implemented DNA metabarcoding CUREs.

National Center for Biotechnology Education

The DNALC is a lead institution in the InnovATE*BIO* national biotechnology education center. The center is funded through NSF Advanced Technological Education (ATE), which supports training for America’s workforce. The ATE program focuses almost exclusively on two-year colleges, but also aims to increase the size and talent of the workforce by encouraging high school students to pursue careers as technicians. Our long-time collaborator, Linnea Fletcher at Austin Community College, leads the project team. Our role is to develop a New York City Genomics Hub to support genome-based experiments in two-year colleges and to work nationally to support the establishment of other Hubs to support biotechnician training. The Hub will be based at the new DNALC NYC at City Tech in Brooklyn and will complement a Tissue Engineering & Stem Cells Hub at Madison College in Madison, Wisconsin, and a Cell

Therapy & Immunology HUB at Shoreline Community College in Washington State. Plans for Agricultural Biotechnology and Diversity & Inclusion Hubs are also underway.

We are developing a supply chain model that will dramatically reduce DNA sequencing costs and allow an unprecedented number of students to participate in authentic research. The genomics supply chain will entail lab, quality assurance, data science, and “soft” skills that will prepare students for successful careers in biotechnology. Through this model, students at community colleges learn key technical and “corporate” skills as they produce products and services, distribute kits for students in other community colleges and high schools, or support “clients” as they learn biochemistry, bioinformatics, and logistics. Toward these goals, a new collaboration with Los Angeles Pierce College aims to provide student manufactured DNA polymerase in a new biomanufacturing program, while the Bay Area Bioscience Education Community (BABEC) is leading college efforts to provide reagents for DNA isolations. As part of our pandemic response, 28 teachers in InnovATEBIO's teacher mentor network were trained in DNA barcoding during online summer sessions. Through InnovATEBIO's network, we also offered support for barcoding or metabarcoding research, with 23 community college faculty planning to implement programs in the new year. Finally, InnovATEBIO and our DNA barcoding and metabarcoding approaches were presented to teachers who use Carolina Biological's kits as part of Carolina's launch of new biotech products in the fall.

NSF CyVerse

Bioinformatics and data science were hot topics since many researchers outside of biomedicine were locked out from laboratory spaces. We completely redesigned our *Foundational Open Science Skills (FOSS)* course which focuses on skill building across a variety of computational tools. We structured the course into eight, two-hour sessions run from July–November. Lab weeks were alternated with “office hour” weeks, allowing participants to try out materials in class and work through problems with guidance as needed during the office hour. Course curriculum progressed from data management and command line computing, to developing reproducible workflows using tools like Docker—which “containerizes” software to allow researchers to migrate workflows and tools easily. A key problem for modern scientific computing is that analyses done on one computing system may fail to reproduce on another computing system. The skills covered in this course help researchers understand how to minimize this and other problems. The ability to do research using these advanced tools is increasingly required as NSF and other scientific funders impose mandates for data sharing and reproducibility. We received more than 90 applications—including from graduate students, postdoctoral fellows, and faculty—and 70 successfully completed the course.

There were a number of challenges for both high school and undergraduate educators using web-based tools like *DNA Subway* during the pandemic. For one, *Subway* activities are linked with wet lab exercises. In addition, the unpredictability of class schedules meant many planned activities were shifted or eliminated. Predictably, we saw significant decreases in *Subway* usage. In 2020, *DNA Subway* had a total of 42,559 registered users, 55,657 visits (~12% decrease from 2019), and 91,045 page views (~23% decrease from 2018). Students created 28,475 projects (41% decrease from 2019) across the five *Subway* lines. Still, there were opportunities to work with educators who were newly looking to develop web-based bioinformatics to supplement lost lab sessions. We participated in the Cultivating Scientific Curiosity BIOME summer institute hosted by the QUBES (Quantitative Undergraduate Biology Education and Synthesis) project. More than 38 faculty attended workshops featuring CyVerse infrastructure, including *DNA Subway* and *Jupyter Notebooks*, to develop RNA-Seq lessons. A QUBES faculty mentoring network was later formed to further help faculty develop the use of these tools and curriculum.

NSF MaizeCODE

The first Virtual Maize Annotation Jamboree was held in four, three-hour sessions on March 10, 12, 18, and 20, 2020. In total, 20 qualified applicants were selected to participate in this four-day event. They were affiliated with thirteen institutions across the United States, including University of Georgia, Iowa State University, Augustana University, Whitman College, Delaware Valley University, Penn State University, University of Florida, Purdue University, University of Missouri Columbia, University of California San Diego, Cornell University, Clemson University, and the University of Toledo.



Instead of being held in-person in Hawaii, the MaizeCODE Annotation Jamboree that began on March 10th became our first event that transitioned to a virtual format.

Two webinars were offered prior to the jamboree to introduce the material and give more background to the participants. During the four days of the jamboree, participants learned about curation resources. Over 600 gene structures were examined using the gene tree tool and 50 gene models were curated using Apollo. Jamboree participants invested a total of 13 hours between the webinars and workshop. A final survey helped us to identify topics for future virtual jamborees.

Licensed Centers

In its first months of operation, the *Regeneron DNA Learning Center* was a field trip destination for 436 students, representing a broad range of public and private schools from Westchester, Rockland and Orange counties in New York, in addition to New Jersey and Connecticut. With the closure of Regeneron campuses in March 2020, field trip reservations for 984 students in spring 2020 were cancelled. One hundred students from the Westchester area participated in virtual lab field trips. In fall 2020 we partnered with Mercy College Center for STEM Education and offered a virtual Saturday STEM Academy course in DNA Fingerprinting for 20 high school students, the majority of whom were underrepresented minorities.

In 2020, 264 students participated in hands-on molecular biology labs supported by DNALC Notre Dame (DNALC-ND) prior to campus closure in March. Due to University restrictions and the ongoing pandemic, all spring and summer programs were cancelled. In fall, DNALC-ND hosted a limited number of virtual classroom visits with pre-college students.

In February 2020, DNALC administrators and staff visited Passaic County Community College (PCCC) to explore the potential for establishing a *DNALC New Jersey*. A proposed \$30 million facility jointly administered by PCCC and the Passaic County Vocational School District (PCVSD) for a Career Technical Education program in Biotechnology will include a DNALC with two dedicated science laboratories, a bioinformatics laboratory, and a student supply chain incubator. The proposed *DNALC NJ* will complement the existing DNALC network in Long Island, New York City, and Westchester, allowing diverse and often underserved populations in New Jersey to directly access our programs.

After 18 years, we temporarily bid farewell to DNALC *West* in Nassau County. Our collaboration with Northwell Health allowed DNALC *West* to thrive as a unique education resource, improving DNA science education for over 45,000 middle and high school students who attended lab programs. Visitors also enjoyed a guided tour of the Northwell Core Lab, which provided an introduction to possible STEM careers that many may never have considered. DNALC *West* also

proudly extended free lab visits to underserved Long Island schools, providing opportunities to students who would not otherwise have access to a professional science lab experience, representing 15% of its attendance. An announcement of the location of a new DNALC *West* has been delayed due to the current Coronavirus pandemic. We look forward to continuing this valued collaboration.

International Partnerships

DNALC Asia, Suzhou, China

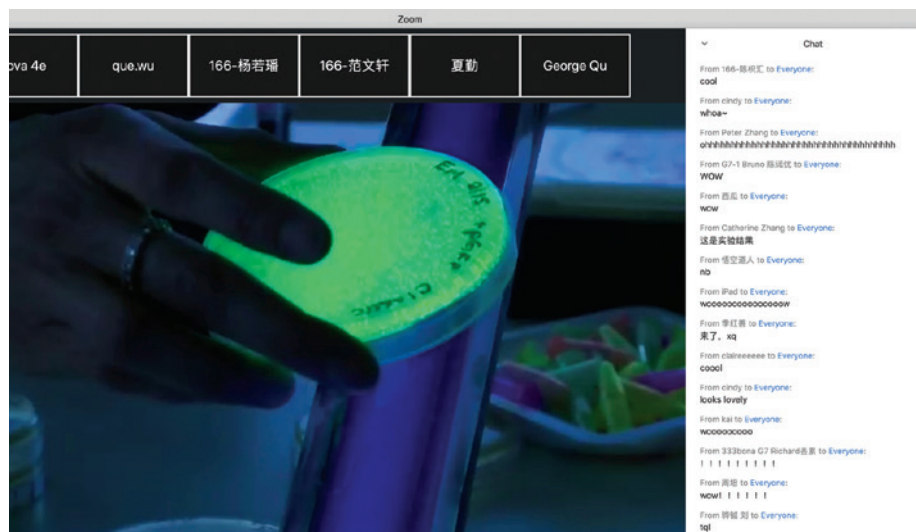
Although China was the epicenter of the pandemic, strict lockdown measures contributed to *DNALC Asia* being the earliest to return to in-person instruction. *DNALC Asia's* lockdown started in late January. Early on, they participated in the webinars we delivered in February. As we developed our *DNALC Live* content, it served as a training opportunity for their instructors to acquaint themselves with labs *DNALC Asia* does not currently offer. In April, *DNALC Asia* participated in a series of calls we organized with collaborators that included international partners in Singapore, Australia, Italy, Vienna, Switzerland, and France. These calls were an opportunity to learn how different countries in different stages of the pandemic were being impacted and finding solutions to deliver instruction.

DNALC Asia staff were able to return to work in-person in April and by summer were able to host 258 students for camps, only slightly less than the 337 in 2019. By the fall, their Innovative Biology Education Program (IBEP) visited four high schools and engaged 1,528 students in bacterial transformation, restriction enzyme digestion, PCR, and agarose gel electrophoresis. *DNALC Asia* also developed specialized programming on virology including a lecture "The big battle against the little virus" delivered to more than 2,000 students in person to schools in Suzhou, the Learning Center, and online to schools outside of Suzhou. They also developed a Virus Model competition involving 1,175 submissions from 29 area schools where each student built a virus model and wrote a public education article about their chosen virus. Finally, Building B, which was unused since *DNALC Asia's* opening, was remodeled and now contains a new lecture hall that holds 120 people and two new labs that hold 28 and 40 students. That space is now being equipped to be ready for use in 2021.

Beijing 166, China

Due to the pandemic, we were unable to host students and teachers from our partner school in Beijing (BJ 166) or, conversely, visit them in China in 2020. To stay connected with our international collaborators at this challenging time, we presented two hour-long virtual classes for students and teachers who had already been in quarantine for over a month. In addition

The "wow" moment in an online bacterial transformation when students in China saw glowing bacteria!



to BJ 166 and *DNALC Asia*, we included guests from seven international schools in China for a total of 1,437 participants. The recordings produced from these two virtual classes—*Bacterial Transformation* and *Restriction Analysis*—have received over 34,000 views on YouTube. The classes were well received, and BJ 166 reported this event in the local news. For most of the attendees, these virtual labs were the first DNALC class they had ever experienced. We conducted a short survey that showed more than 93% of the participating students were now interested in the possibility of attending classes in New York. This data strongly supports our plans to expand DNALC school partnership programs in China. As a first step, at the end of the year we announced that *Mentored On-Demand Virtual Science Camps* were available, with kit distribution and sample processing help from *DNALC Asia*.

DNA Learning Center Nigeria

In late 2019, *DNA Learning Center Nigeria (DNALC Nigeria)* was officially launched at Godfrey Okoye University (GOU), Enugu State, Nigeria. In January of 2020, we were able to use unrestricted funds to help complete the equipping and renovation of two DNALC-style teaching laboratories with the capacity to accommodate 20 and 30 workshop participants respectively. Renovations included a prelab space, administrative office, and restrooms. Equipment for our molecular labs included thermocyclers, centrifuges, micropipettes, and freezer. In addition to the original building and land, Godfrey Okoye University donated a vehicle, hired two permanent laboratory technicians to support the Center, and pledged to provide basic amenities like water and electricity.

Michael Okoro, who completed his master's degree during his time interning with us in NY, now works as the Center's Assistant Director and principal educator, and long-time DNALC collaborator, George Ude, serves as its Director. Despite starting during a challenging year, *DNALC Nigeria* hosted its first undergraduate student's hands-on laboratory training for more than 30 students from Godfrey Okoye University Biotechnology, Microbiology, and Applied Biochemistry departments.



DNALC Nigeria at the Godfrey Okoye University Campus.

Later in the year, *DNALC Nigeria* hosted high school students from several schools in the City of Enugu for a "Day of DNA World" course. Towards the end of 2020, the DNALC Nigeria staff invested time for promotional activities involving visits to high school principals and college deans to share the teaching and learning opportunities that exist at the Center and enhance STEM research experiences. The vision for 2021 is to continue to update the Center's infrastructure, increase the number of workshops, and enhance its promotional efforts.

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 American Fisheries Society Conference, the Central Pine Barrens Cooperators Meeting, Community College Undergraduate Experience Summit, NIH SEPA SciEd Conference, and Biodiversity Genomics 2020 Conference. Our data science programs were also presented at the International Plant and Animal Genome Conference, the Allied Genetics Conference, National Academies of Science Kavli Frontiers of Science Symposium, and Biological Data Science Meeting.

Lab Instruction and Outreach

This year began as usual, with in-person field trips and in-school instruction. Before we were challenged in March to pivot to a virtual platform, 4,416 students attended in-person lab field trips at our five facilities: Dolan DNA Learning Center, DNALC West, Harlem DNA Lab, Regeneration DNALC, and DNALC NYC at City Tech, and in-school programs reached 3,691 students.

Our virtual programs reached an additional 5,745 students through remote lab demonstrations and kit-based experiments, including 1,437 students from China who participated in our first live stream lab demonstrations in February. Five hundred and ninety-eight students attended virtual adaptations of our week-long camps, either live on Zoom or on-demand with pre-recorded video instruction, including 119 from out of state and three international. Footlocker kits were used by 639 students, 127 of whom were conducting independent research through *UBP*, *UBRP*, or *BLI*.



Left: Locust Valley Central School District's website featured students who extracted DNA with virtual instruction from the DNALC. Right: Educator Brittany Johnson pressed on with summer camp instruction during a power outage following Tropical Storm Isaias in August.

Scholarships were provided to support 425 students from the Central Islip and Malverne school districts on Long Island, Passaic Public Schools in New Jersey, and Danbury Public Schools in Connecticut. This year 404 (27%) of the students who attended field trips at *Harlem DNA Lab* and *DNALC NYC* at City Tech, came from Title I schools that qualified for tuition assistance. The William Townsend Porter Foundation subsidized 40% of student scholarships for students visiting the *Harlem DNA Lab*.

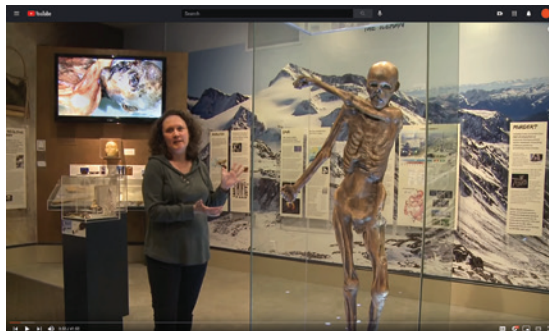
The Partner Member Program continued to provide custom science sequences and advanced electives for seven independent schools, including kit based virtual programming for a fully remote hands-on experience beginning in spring.

- Research teams from Fontbonne Hall Academy used DNA barcoding to create novel GenBank entries for flowering plants. Multiple courses implemented genetics programs, including AP Biology.
- Grace Church School incorporated human DNA analysis into their 9th grade biology course, as well as an independent student research project. An independent student research project from 2018-2019 was written up and posted to bioRxiv.
- At Marymount School of New York, genetics programs were incorporated as key parts of the biology curriculum at multiple grade levels. Students in molecular biology continued projects to analyze environmental DNA (eDNA) from NYC Parks and the Hudson River.

- Sacred Heart Greenwich adopted a quarter membership with implementation of a DNA barcoding unit for its Science Research students.
- Lycée Français de New York continued to refine the 8th grade forensics elective and piloted the DNALC's virtual *Human Genomics* camp in summer.
- The Chapin School implemented genetics programs at several grade levels, including the advanced Molecular Genetics elective.
- St. David's School integrated basic genetics with existing curricula in grade five. Grade eight piloted the DNALC's remote DNA barcoding instruction, with 40 students using individual kits to isolate DNA at home from 80 samples in May.

As part of ongoing local partnerships, 14 students from St. Dominic High School received customized virtual instruction from DNALC staff. Students enrolled in the *Molecular and Genomic Biology Research* course participated in hands-on, at-home, and in-person lab experiences in DNA barcoding, as well as DNA and genome science, designed to fit their hybrid class schedule. All students also participated in the *Barcode Long Island* research program. Due to difficulties caused by pandemic-related scheduling and sudden school closures, the *Molecular Genetics* elective at Cold Spring Harbor High School was cancelled for the 2020-21 school year.

This year we had 1,049 visitors to the *Ötzi the Iceman* exhibit, either on its own or as part of an in person or virtual field trip. As part of our shift to remote instruction, we recorded a museum tour for *DNALC Live* in the spring, which had over 53,000 views on YouTube in 2020, with over 7,500 hours of watch time! Five *Saturday DNA!* sessions drew 109 participants who learned about the *Mystery of Anastasia*, *Ötzi the Iceman*, microbiology, bacterial genetics, and



lactose intolerance. In addition, DNALC staff presented as part of the Bronx Center for Science and Mathematics Career Fair, Central Pine Barrens Cooperators Meeting, *Structural Biology Behind Disease Transmission and Drug Design* panel discussion with Brookhaven National Laboratory, Student Makers Camp, and the Science Council of New York City (SCoNYC).

A new program, "Meet a Scientist" is an effort to offer *DNALC Live* content in the tradition of CSHL professors and graduate and Ph.D. students presenting their work to high school audiences at the DNALC. The idea is to give students a chance to interact in real-time with an inspiring researcher—learning about their work and their journeys to becoming scientists. We evolved the format into a short event (30 minutes) that fits the modern science communication style popular on social media. We also decided on afterschool timing to avoid conflicting with an already chaotic school day. The series launched in November with CSHL plant researcher Dr. David Jackson who delivered a talk on plant stem cells, followed by Dr. Camila dos Santos who in December shared her work on pregnancy and breast cancer risk. As virtual becomes part of the new normal, we hope to grow the monthly event as a way to get students connected to the larger impact of skills they encounter in DNALC training. Additional sessions are scheduled into June, 2021.

As part of our ongoing partnership with CSHL Women in Science and Engineering (WiSE), we hosted the fourth annual *WiSE Fun with DNA* summer camp. Held virtually, 20 young female science enthusiasts had the opportunity to meet and interact with engaging role models pursuing careers in the sciences. Each afternoon, the girls met new scientists and participated

in kit-based WiSE activities on neuroscience, gene expression, and protein modeling. On the final day of camp, a panel of WiSE representatives joined the class to interact with students and parents and answer questions about their own journeys in science.

In its second year, the Science, Technology, and Research Scholars (STARS) program faced the same challenges as other DNALC camps in both recruiting students and planning as interactive an experience as possible. Despite this, we recruited more students (25 total) from more school districts (23 total) than we did in 2019. Although we performed fewer lab activities, we were again able to host talks from CSHL and Stony Brook University faculty and experience a virtual college tour. In some ways the increased familiarity of students with Zoom online learning was a good impetus for our plans to extend the STARS experience into the school year. As a result, we have been regularly following up with 2019 and 2020 attendees through monthly online meetups. These discussions take the form of skill building sessions with topics such as asking for letters of recommendation, crafting a CV for college applications, and applying for summer research experiences. In addition, some students were mentored in independent DNA barcoding research and participated in other DNALC virtual programs to help them extend their learning.

2020 was also a year that centered on social justice and the need to support underrepresented minorities in STEM. Therefore, the Lab committed to expanding the DNALC's efforts to prepare minority students for STEM, and this commitment was publicly announced at the Lab's annual Double Helix medal presentation in November. Although we are still in the development stage, longtime DNALC supporter and CSHL Trustee Laurie Landeau provided a \$30,000 donation to support our efforts. This generous support will make a difference for students who want to participate, especially on Long Island where transportation is a key barrier to connecting students in underserved districts with the DNALC.

Our collaboration with the CSHL School of Biological Sciences continued, but was cut short in March. As part of their required curriculum, first-year graduate students 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 classroom observation, to co-instruction, and then lesson planning and independent teaching of lab classes. Through this classroom exposure, they learn classroom management skills, including how to quickly assess an audience, and customize a presentation accordingly. This year's cohort was able to complete at least half of the required curriculum prior to school closures.

BioMedia Visitation and Projects

In 2020, 5.3 million visitors accessed our suite of multimedia resources, a 2% increase over the previous year. The increase can primarily be attributed to a stunning increase in views to our YouTube videos, which received 1,686,771 views—190.8% over 2019! Watch time increased to 69,569 hours (202%) and we added 8,414 (147%) new YouTube subscribers in 2020. Google Analytics counted 3.08 million visits to DNALC websites, and 566,000 *3D Brain*, *Weed to Wonder*, and *Gene Screen* smartphone/tablet apps were downloaded.

For the *BioMedia* team, our 2020 work revolved around coping with the impact of the COVID-19 pandemic, beginning with the virtual labs in February for our collaborators in China who faced school closures without any forewarning. After the DNALC closed to the public in March, *BioMedia* staff continued to come to the DNALC to facilitate delivery of virtual instruction under the state allowance for essential workers.

We took steps to equip our educators for teaching from home; computer lab laptops were updated and relevant software was installed (Zoom, smart notebook, etc.) for educator use. Programmers tapped into our existing content management system so educators and designers could work together to stream virtual classes live and quickly post 10–12 *DNALC Live* events per week to the DNALC website. *DNALC Live* includes 128 videos totaling 71 hours!



Allison Mayle in DNALC's Lab 4, our go-to "studio" for filming *On-Demand* summer camps in June and field trips in the fall.

Once the decision was made for DNALC summer camps to be delivered virtually, we ordered equipment to supplement existing studio equipment, including conference cameras, webcams, additional lighting, and microphones, much of which was on backorder for weeks. When virtual camp instruction was underway, *BioMedia* staff provided daily support for educators instructing live camps from two lab "studios" at the DNALC. To serve students who could not connect to camps live, we filmed educators teaching five camps to be delivered on-demand. The resulting 29 hours of edited videos are hosted from a custom web interface.

With the success of the virtual camps, at the start of the school year in September—when schools were either held in person, virtually, or a combination of both—we decided to make a subset of field trips available on-demand as well. We filmed educators teaching 15 field trips, totaling 23.5 hours of video. Once again, programmers developed a custom interface for school teachers to register, pay, and provide student access for *On-Demand* Field Trips.



Staff and Interns

DNALC Assistant Director Jason Williams received two honors this year. He received the Meritorious Prize in the NSF 2026 *Idea Machine* competition, which was created to solicit input on topics to be engaged as future NSF priorities and "help set the US agenda for fundamental research in science and engineering." Jason's idea, *Reinventing Scientific Talent*, was a call to action to expand and improve professional development opportunities for researchers and educators to achieve career-spanning learning. In addition to the \$11,000 prize, he has been funded to pursue this work in a future Banbury conference on improving professional development in the life sciences. Jason was also named by the National Academy of Sciences as a Kavli Frontiers of Science Fellow. The fellowship, which centers around a symposium series, is described as the National Academies' "premiere activity for distinguished young scientists."

Not only was the pandemic difficult on a global scale, it also shook the ranks of the DNALC as well. We said goodbye to educators Lina Bader, Erin McKechnie, and Michael Paul as they pursued new challenges. Lina Bader joined the DNALC as an instructor at the *Regeneron DNALC* in December 2019. Due to the pandemic, she left in May to move back to her family in

Pennsylvania. Shifting away from science teaching, she was accepted into Boston University's School of Law for the class of 2023.

Michael Paul began as a laboratory technician in June of 2017. His chemistry degree from Bowdoin College and natural teaching ability led to his transition to instructor and manager of college interns before the end of that year. He tackled every challenge thrown his way, teaching both middle and high school classes and continuing to manage our intern program, all while completing an MBA in Finance at Hofstra University. He left the DNALC in May and accepted a position at the Dwight Preparatory School in New York City, teaching high school chemistry and biology. He was accepted into a Master's program at Columbia University to receive his chemistry teaching certification and will start in the fall of 2021.

Erin McKechnie (néé Maroney) began her journey at the DNALC in 2002 after receiving a degree in plant and soil science from the University of Vermont. For her, no class was too "difficult" and no student was "unteachable." In addition to teaching, Erin shared responsibility for administering middle school program, purchased supplies for all DNALC labs, and even stocked an entire lab in the Philippines. Her love of teaching science to special education classes inspired her to pursue a Psy.D. in Psychology at Hofstra University, and she left the DNALC in September to concentrate on her studies full time. She was accepted for an internship at Zucker Hillside Hospital in Glen Oaks, NY working in the OCD/Bipolar track. Her legacy will be hard to follow.

Lindsay Barone left at the beginning of the year to do evaluation consulting in her home state of Wisconsin, where she continued to work on DNALC projects. Lindsay joined the DNALC in 2015 to evaluate our large portfolio of federal and private grants. Her perspective was influenced by her Ph.D. training in anthropology at the University of Wisconsin-Milwaukee. Lindsay was passionate about human evolution, and she developed a popular summer camp, *Being Human*, that focused on physical anthropology. We will miss her lively discussions on news of the latest hominid fossil find.

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. Prior to the shut down in March, an amazing group of interns helped out, and we said farewell as others left for college:

High School Interns

Sita Camara, Frederick Douglass Academy	Ethan McGuinness, Huntington High School
Kaela Deriggi, St. Anthony's High School	Aveline Roderick, St. Anthony's High School
Aminata Fadiga, Frederick Douglass Academy	

High School Interns Departing for College

Jacqueline Albert, Duke University	Jack O'Hara, University of Richmond
Christopher Catalano, University of Southern California	Julia Padro, Smith College
Christopher Cizmeciyan, Stony Brook University	Mina Samaras, Brown University
Thomas Kamara, University of Connecticut	Esha Sharma, Hofstra University
Sarah Nace, Rensselaer Polytechnic Institute	Michael Stabile, Cornell University
	Nicholas Stabile, University of Notre Dame

College Interns

Nadia Alomari, New York City College of Technology	Isabella Martino, Stony Brook University
Taehwan Cha, New York University	Katherine Parra, New York City College of Technology
Naomi Cheri, New York City College of Technology	
Omotayo Ikuomenisan, Hunter College	

David Micklos
DNA Learning Center Executive Director

2020 Grants

Grantor	Program	Duration of Grant	2020 Funding ⁺
<i>FEDERAL GRANTS</i>			
National Institutes of Health	<i>Citizen DNA Barcode Network</i>	6/20–3/25	\$50,016
National Institutes of Health	<i>Barcode Long Island</i>	7/14–3/21	\$98,547
National Science Foundation	Implementing DNA Barcoding for Course-Based Undergraduate Research Experiences	10/18–9/23	\$373,265
National Science Foundation	<i>CyVerse: Cyberinfrastructure for the Life Sciences</i>	8/18–7/23	\$159,863
National Science Foundation	<i>RCN-UBE: Establishing a Genomics Education Alliance: Steps Towards Sustainability</i>	9/18–8/20	\$37,800
National Science Foundation	InnovATEBIO National Biotechnology Education Center	10/19–9/24	\$177,239
<i>NON-FEDERAL GRANTS</i>			
Alfred P. Sloan Foundation	<i>DNA Center NYC Start-up</i>	6/18–5/20	\$11,548
Beijing No. 166 High School	Chinese Collaboration Agreement	7/19–6/22	\$756
Breakthrough Prize Foundation	Laboratory Design and Teacher Training for Breakthrough Junior Challenge Prize Winners	12/15–12/21	\$55,809
Health Park	Health Park Agreement	12/15–12/20	\$222
Pinkerton Foundation	<i>Urban Barcode Research Program</i>	1/20–5/21	\$75,816
Richard Lounsbery Foundation	Developing Independent Student Marine Biodiversity Research Using eDNA	10/17–12/21	\$451
The Simons Foundation	<i>Urban Barcode Research Program</i>	12/17–8/21	\$85,200
William Townsend Porter Foundation	<i>Harlem DNA Lab for Underprivileged Students</i>	1/20–1/21	\$11,220

+ Includes direct and indirect costs.

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

Bellmore-Merrick Central High School District	\$3,000	Oyster Bay-East Norwich Central School District	\$3,000
East Meadow Union Free School District	\$3,000	Plainview-Old Bethpage Central School District	\$3,000
Fordham Preparatory School	\$3,000	Portledge School	\$3,000
Herricks Union Free School District	\$3,000	Port Washington Union Free School District	\$3,000
Levittown Union Free School District	\$3,000	Roslyn Union Free School District	\$3,000
Long Beach Union Free School District	\$3,000	Syosset Central School District	\$3,000
North Shore Central School District	\$1,750	Yeshiva University High School for Girls	\$3,000
Oceanside Union Free School District	\$3,000		

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

Baldwin Union Free School District	\$4,125	Kings Park Union Free School District	\$3,150
Berkeley Carroll School	\$3,000	Laurel Hill School	\$1,500
Cold Spring Harbor Central School District	\$12,347	Locust Valley Central School District	\$4,880
Commack Union Free School District	\$2,000	Merrick Union Free School District	\$3,800
East Meadow Union Free School District	\$2,650	North Bellmore Union Free School District	\$3,800
Elwood Union Free School District	\$5,550	New York City Department of Education	\$3,300
Floral Park- Bellerose Union Free School District	\$2,750	Port Washington Union Free School District	\$5,500
Garden City Union Free School District	\$4,125	Syosset Union Free School District	\$6,600
Huntington Union Free School District	\$4,125	Three Village Central School District	\$7,175
Jericho Union Free School District	\$6,525	Wantagh Union Free School District	\$2,800

Sites of Major Faculty Workshops

Program Key: *Middle School* High School College

State	Institution	Year(s)
VIRTUAL	Host: Bowie State University, Bowie, Maryland	2020
	Host: DNA Learning Center, New York	2020
	Host: <i>Harlem DNA Lab and Regeneron DNALC, Sleepy Hollow, New York</i>	2020
	Host: James Madison University, Harrisonburg, Virginia	2020
	Co-hosts: University of Arizona, Tucson, Arizona & DNA Learning Center, NY	2020
	Host: Quantitative Undergraduate Biology Education and Synthesis (QUBES) Project	2020
ALABAMA	University of Alabama, Tuscaloosa	1987–90
ALASKA	Hudson Alpha Institute, Huntsville	2014
	University of Alaska, Anchorage	2012
ARIZONA	University of Alaska, Fairbanks	1996
	Arizona State University, Tempe	2009
	Tuba City High School	1988
ARKANSAS	University of Arizona, Tucson	2011, 2019–20
	United States Department of Agriculture, Maricopa	2012
	Henderson State University, Arkadelphia	1992
	University of Arkansas, Fayetteville	2017, 2019
	University of Arkansas, Little Rock	2012
CALIFORNIA	University of Arkansas for Medical Sciences, Little Rock	2019
	California State University, Dominguez Hills	2009
	California State University, Fullerton	2000
	California State University, Long Beach	2015
	California Institute of Technology, Pasadena	2007
	Chan-Zuckerberg BioHub, San Francisco	2018
	Canada College, Redwood City	1997
	City College of San Francisco	2006
	City College of San Francisco	2011, 2013
	Contra Costa County Office of Education, Pleasant Hill	2002, 2009
	Foothill College, Los Altos Hills	1997
	Harbor-UCLA Research & Education Institute, Torrance	2003
	Los Angeles Biomedical Research Institute (LA Biomed), Torrance	2006
	Laney College, Oakland	1999
	Lutheran University, Thousand Oaks	1999
	Oxnard Community College, Oxnard	2009
	Pasadena City College	2010
	Pierce College, Los Angeles	1998
	Salk Institute for Biological Studies, La Jolla	2001, 2008
	San Francisco State University	1991
San Diego State University	2012	
San Jose State University	2005	
Santa Clara University	2010	
Scripps Institute, San Diego	2019	
Southwestern College, Chula Vista	2014–15	
Stanford University, Palo Alto	2012	
University of California, Berkeley	2010, 2012	
University of California, Davis	1986	
University of California, Davis	2012, 2014–15	

	University of California, Long Beach	2015
	University of California, Northridge	1993
	University of California, Riverside	2011
	University of California, Riverside	2012
	University of California, San Francisco	2015
COLORADO	Aspen Science Center	2006
	Colorado College, Colorado Springs	1994, 2007
	Colorado State University, Fort Collins	2013, 2018
	Community College of Denver	2014
	United States Air Force Academy, Colorado Springs	1995
	University of Colorado, Denver	1998, 2009–10
CONNECTICUT	Choate Rosemary Hall, Wallingford	1987
	Jackson Laboratory, Farmington	2016
DELAWARE	University of Delaware, Newark	2016
DISTRICT OF COLUMBIA	Howard University, Washington	1992, 1996, 2009–10
FLORIDA	Armwood Senior High School, Tampa	1991
	Florida Agricultural & Mechanical University, Tallahassee	2007–08
	Florida Agricultural & Mechanical University, Tallahassee	2011
	Florida SouthWestern State University, Fort Myers	2015
	North Miami Beach Senior High School	1991
	Seminole State College, Sanford	2013–14
	University of Florida, Gainesville	1989
	University of Miami School of Medicine	2000
	University of Western Florida, Pensacola	1991
GEORGIA	Fernbank Science Center, Atlanta	1989, 2007
	Gwinnett Technical College, Lawrenceville	2011–12
	Morehouse College	1991, 1996
	Morehouse College	1997
	Spelman College, Atlanta	2010
	University of Georgia, Athens	2015
HAWAII	Kamehameha Secondary School, Honolulu	1990
	University of Hawaii at Manoa	2012
IDAHO	University of Idaho, Moscow	1994
ILLINOIS	Argonne National Laboratory	1986–87
	iBIO Institute/Harold Washington College, Chicago	2010
	Illinois Institute of Technology, Chicago	2009
	Kings College, Chicago	2014
	University of Chicago	1992, 1997, 2010
	University of Southern Illinois, Carbondale	2016
INDIANA	Butler University, Indianapolis	1987
	Purdue University, West Lafayette	2012
IOWA	Drake University, Des Moines	1987
KANSAS	University of Kansas, Lawrence	1995
KENTUCKY	Bluegrass Community & Technical College, Lexington	2012–14
	Murray State University	1988
	University of Kentucky, Lexington	1992
	Western Kentucky University, Bowling Green	1992
LOUISIANA	Bossier Parish Community College	2009
	Jefferson Parish Public Schools, Harvey	1990
	John McDonogh High School, New Orleans	1993
	Southern University at New Orleans	2012

	University of New Orleans	2018
MAINE	Bates College, Lewiston	1995
	Southern Maine Community College	2012–13
	Foundation for Blood Research, Scarborough	2002
MARYLAND	Annapolis Senior High School	1989
	Bowie State University	2011, 2015
	Frederick Cancer Research Center	1995
	McDonogh School, Baltimore	1988
	Montgomery County Public Schools	1990–92
	National Center for Biotechnology Information, Bethesda	2002
	<i>St. John's College, Annapolis</i>	1991
	University of Maryland, School of Medicine, Baltimore	1999
MASSACHUSETTS	Arnold Arboretum of Harvard University, Roslindale	2011
	Beverly High School	1986
	Biogen Idec, Cambridge	2002, 2010
	Boston University	1994, 1996
	CityLab, Boston University School of Medicine	1997
	Dover-Sherborn High School, Dover	1989
	Randolph High School	1988
	The Winsor School, Boston	1987
	Whitehead Institute for Biomedical Research, Cambridge	2002
MICHIGAN	Athens High School, Troy	1989
	Schoolcraft College, Livonia	2012
MINNESOTA	American Society of Plant Biologists, Minneapolis	2015
	Minneapolis Community and Technical College, Madison	2009
	Minneapolis Community and Technical College, Madison	2013
	University of Minnesota, St. Paul	2005
	University of Minnesota, St. Paul	2010
MISSISSIPPI	Mississippi School for Math & Science, Columbus	1990–91
	Rust College, Holly Springs	2006–08, 2010
MISSOURI	St. Louis Science Center	2008–10
	Stowers Institute for Medical Research, Kansas City	2002, 2008
	University of Missouri, Columbia	2012
	Washington University, St. Louis	1989
	Washington University, St. Louis	1997, 2011, 2019
MONTANA	Montana State University, Bozeman	2012
NEBRASKA	University of Nebraska-Lincoln, Lincoln	2014
NEVADA	University of Nevada, Reno	1992, 2014
NEW HAMPSHIRE	Great Bay Community College, Portsmouth	2009
	New Hampshire Community Technical College, Portsmouth	1999
	St. Paul's School, Concord	1986–87
NEW JERSEY	Coriell Institute for Medical Research, Camden	2003
	Raritan Valley Community College, Somerville	2009
NEW MEXICO	Biolink Southwest Regional Meeting, Albuquerque	2008
	Los Alamos National Lab	2017
	New Mexico State University, Las Cruces	2017
	Santa Fe Community College, Santa Fe	2015
NEW YORK	Albany High School	1987
	American Museum of Natural History, New York	2007, 2015
	Bronx High School of Science	1987
	Brookhaven National Laboratory, Upton	2015–18
	Canisius College, Buffalo	2007

	Canisius College, Buffalo	2011
	City College of New York	2012
	Cold Spring Harbor High School	1985, 1987
	Cold Spring Harbor Laboratory	2014–15, 2018–19
	Columbia University, New York	1993
	Cornell University, Ithaca	2005
	<i>DeWitt Middle School, Ithaca</i>	1991, 1993
	Dolan DNA Learning Center	1988–95, 2001–04, 2006–09, 2015–19
	Dolan DNA Learning Center	1990, 1992, 1995, 2000–11
	<i>Dolan DNA Learning Center</i>	1990–92
	DNA Learning Center West	2005
	<i>DNA Learning Center NYC</i>	2019
	Environmental Science Center, Bergen Beach, Brooklyn	2015–16
	<i>Fostertown School, Newburgh</i>	1991
	<i>Harlem DNA Lab, East Harlem</i>	2008–09, 2011–13, 2016–19
	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
	<i>Junior High School 263, Brooklyn</i>	1991
	<i>Lindenhurst Junior High School</i>	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
	<i>Orchard Park Junior High School</i>	1991
	<i>Plainview-Old Bethpage Middle School</i>	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
	Stuyvesant High School, New York	1998–99
	The Rockefeller University, New York	2003, 2015–16
	The Rockefeller University, New York	2010
	<i>Titusville Middle School, Poughkeepsie</i>	1991, 1993
	Trudeau Institute, Saranac Lake	2001
	Union College, Schenectady	2004
	United States Military Academy, West Point	1996
	Wheatley School, Old Westbury	1985
NORTH CAROLINA	CIIT Center for Health Research, Triangle Park	2003
	North Carolina Agricultural & Technical State University, Greensboro	2006–07, 2009–11
	North Carolina School of Science, Durham	1987
	North Carolina State University, Raleigh	2012, 2018
NORTH DAKOTA	North Dakota State University, Fargo	2012
OHIO	Case Western Reserve University, Cleveland	1990

	Cleveland Clinic	1987
	Langston University, Langston	2008
	North Westerville High School	1990
	The Ohio State University, Wooster	2016
OKLAHOMA	Oklahoma City Community College	2000
	Oklahoma City Community College	2006–07, 2010
	Oklahoma Medical Research Foundation, Oklahoma City	2001
	Oklahoma School of Science and Math, Oklahoma City	1994
	Tulsa Community College, Tulsa	2009
	Tulsa Community College, Tulsa	2012–14
OREGON	Kaiser Permanente-Center for Health Research, Portland	2003
	Linfield College, McMinnville	2014
PENNSYLVANIA	Duquesne University, Pittsburgh	1988
	Germantown Academy	1988
	Kimmel Cancer Center, Philadelphia	2008
RHODE ISLAND	Botanical Society of America, Providence	2010
SOUTH CAROLINA	Clemson University	2004, 2015
	Medical University of South Carolina, Charleston	1988
	University of South Carolina, Columbia	1988
SOUTH DAKOTA	South Dakota State University, Brookings	2015
TENNESSEE	NABT Professional Development Conference, Memphis	2008
TEXAS	Austin Community College – Rio Grande Campus	2000
	Austin Community College – Eastview Campus – Roundrock Campus	2007–09, 2013
	Austin Community College – Roundrock Campus	2012
	Austin Community College - Austin	2018
	Houston Community College Northwest	2009–10
	J.J. Pearce High School, Richardson	1990
	Langham Creek High School, Houston	1991
	University of Lone Star College, Kingwood	2011
	Midland College	2008
	Southwest Foundation for Biomedical Research, San Antonio	2002
	Taft High School, San Antonio	1991
	Texas A&M University, College Station, TX	2013
	Texas A&M University, Prairie View, TX	2013
	Texas A & M, AG Research and Extension Center, Weslaco	2007
	Trinity University, San Antonio	1994
	University of Texas, Austin	1999, 2004, 2010, 2012
	University of Texas, Brownsville	2010
UTAH	Brigham Young University, Provo	2012
	University of Utah, Salt Lake City	1993
	University of Utah, Salt Lake City	1998, 2000
	Utah Valley State College, Orem	2007
VERMONT	University of Vermont, Burlington	1989
	Champlain Valley Union High School	1989
VIRGINIA	Eastern Mennonite University, Harrisonburg	1996
	James Madison University, Harrisonburg	2017
	Jefferson School of Science, Alexandria	1987
	Mathematics and Science Center, Richmond	1990
	Mills Godwin Specialty Center, Richmond	1998
	Virginia Polytechnic Institute and State University, Blacksburg	2005, 2008–09
WASHINGTON	Fred Hutchinson Cancer Research Center, Seattle	1999, 2001, 2008
	Shoreline Community College	2011, 2012

	University of Washington, Seattle	1993, 1998, 2010
WEST VIRGINIA	Bethany College	1989
WISCONSIN	Blood Center of Southeastern Wisconsin, Milwaukee	2003
	Madison Area Technical College/Madison Area College	1999, 2009, 2011–14
	Marquette University, Milwaukee	1986–87
	University of Wisconsin, Madison	1988–89
	University of Wisconsin, Madison	2004, 2012
WYOMING	University of Wyoming, Laramie	1991
PUERTO RICO	Universidad del Turabo, Gurabo, Puerto Rico	2011, 2012, 2014
	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Rio Piedras	1993
	University of Puerto Rico, Rio Piedras	1994
	University of Puerto Rico, San Juan	2019
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AUSTRALIA	Walter and Eliza Hall Institute and University of Melbourne	1996
	EMBL/Australian Bioinformatics Resource, University of Melbourne	2016
	University of Western Australia, Perth	2018
AUSTRIA	Vienna Open Lab, Vienna	2007, 2012
	Technical University of Graz	2019
CANADA	Red River Community College, Winnipeg, Manitoba	1989
	University of Quebec, Montreal	2018
CHINA	Beijing No. 166 High School, Beijing	2013–19
	Ho Yu College, Hong Kong	2009
DENMARK	Faroe Genome Project, Torshavn, Faroe Islands	2013
GERMANY	Urania Science Center, Berlin	2008
IRELAND	European Conference on Computational Biology/Intelligent System for Molecular Biology Conference, Dublin	2015
	University College Dublin	2018
ITALY	International Institute of Genetics and Biophysics, Naples	1996
	Porto Conte Research and Training Laboratories, Alghero	1993
MEXICO	ADN Mexico, Morelia	2016
	ASPB Plant Biology, Mérida	2008
	Langebio/Cinvestav, Irapuato	2016
NIGERIA	Godfrye Okoye University, Enugu, Nigeria	2013, 2018
PANAMA	University of Panama, Panama City	1994
PHILIPPINES	Eastern Visayas Campus, Philippine Science High School, Palo, Leyte	2017
RUSSIA	Shemyakin Institute of Bioorganic Chemistry, Moscow	1991
SINGAPORE	National Institute of Education	2001–05
	Singapore Science Center	2013
SOUTH AFRICA	North-West University, Potchefstroom	2016
	South African Bioinformatics Society, Durban	2016
SWEDEN	Kristineberg Marine Research Station, Fiskebackgkil	1995
	Uppsala University	2004
THE NETHERLANDS	International Chromosome Conference, Amsterdam	2007
	Wageningen University and Research Center, Wageningen	2014
UNITED KINGDOM	Earlham Institute, Norwich	2018
	The Genome Analysis Center, Norwich	2015
	University of York, York	2017
	Wellcome Trust Conference Center, Hinxton	2012–13
	University of Warwick, Coventry	2013

Workshops, Meetings, Collaborations, and Site Visits

- January 6 Site visit by Cindy Lawrence, MoMath, New York City, New York
- Jan 6–Feb 24 *Urban Barcode Research Program Conservation Genetics Workshop, DNALC NYC at City Tech*
- January 10 The Central Pine Barrens Cooperators Meeting, Hyatt Place Long Island/East End, Riverhead, New York
- January 11 *Saturday DNA! "Bacteria: Friend and Foe," DNALC*
- January 11–13 International Plant and Animal Genome XXVIII Conference 2020, "Making Sense of a New Genome: Finding and Fixing Errors through Community Curation," "Reproducibility in the Clouds - Harnessing the in nube Paradigm," "CyVerse - Software, Tools, and Services for Data-Driven Discovery and Learning," Advanced Computational Methods – Machine Learning, Containers, and Clouds," "Tools and Approaches for Making Bioinformatics Work in the Classroom," San Diego, California
- January 21 Site visit by United Nations delegates, United Nations, New York, New York
- January 24 Site visit by Peter Klein, Claire Friedlander Foundation, Huntington, New York
- January 25 NIH *Barcode Long Island* Open Lab, Brookhaven National Laboratory, Upton, New York
- February 4 NSF 2020 Idea Machine Award Ceremony, "Reinventing Scientific Talent," Virtual
- February 7 Site visit by Aleida Perez and Scott Bronson, Office of Educational Programs at Brookhaven National Laboratory, Upton, New York and Chris Schubert, Ronald Busciolano, and Shawn Fisher, US Geological Survey New York Water Science Center, Coram, New York
- February 8 *Ötzi the Iceman* Tour, DNALC
Saturday DNA! "Got Lactase?" DNALC
- February 11 *Urban Barcode Project* Open Lab, *Harlem DNA Lab*
- February 18 NIH *Barcode Long Island* Open Lab, DNALC
- Feb 18–21 Pinkerton *Urban Barcode Research Program Conservation Genetics Workshop, Harlem DNA Lab*
- Feb 19–21 NSF CyVerse FOSS Workshop, University of Arizona, Tucson, Arizona
- February 22 NIH *Barcode Long Island* Open Lab, DNA Learning Center West
- March 2 NIH *Barcode Long Island* Open Lab, DNALC
- March 2–April 6 *DNA Barcoding and Bioinformatics* Training Workshop, DNALC NYC at City Tech
- March 7 *Urban Barcode Project* Open Lab, *Harlem DNA Lab*
Saturday DNA! "Plasmid Manipulation," DNALC
Ötzi the Iceman Tour, DNALC
- March 10–12 NSF MaizeCODE Maize Annotation Jamboree, Virtual
- March 21 NIH *Barcode Long Island* Open Lab, Brookhaven National Laboratory, Upton, New York
- March 24 The Allied Genetics Conference, The Genomics Education Alliance "Scalable, Sustainable Infrastructure for Undergraduate CUREs," Virtual
- March 20 *DNALC Live* "Barcoding Bioinformatics Part I," DNALC
- March 24 *DNALC Live* "DNA Extraction from Wheat Germ," DNALC
- March 25 *DNALC Live* "Bacterial Transformation," DNALC
- March 26 *DNALC Live* "Mutant Organisms," Webinar, DNALC
- March 27 *DNALC Live* "Barcoding Bioinformatics Part II," DNALC
DNALC Live "DNA Fingerprint," DNALC
- March 30 *DNALC Live* "Kitchen Science-DNA Extraction from Cheek Cells," DNALC
DNALC Live "What DNA Says About Our Human Family Tree, Part I," DNALC
DNALC Live "DNA Models," DNALC
- March 31 *DNALC Live* "Restriction Analysis," DNALC
DNALC Live "The Mystery of Anastasia," DNALC
- April 1 *DNALC Live* "What DNA Says About Our Human Family Tree, Part II," DNALC
DNALC Live "Kitchen Science: Baggie Cell Models," DNALC
- April 2 *DNALC Live* "Rapid DNA Isolation for DNA Barcoding," DNALC

- DNALC Live* "Meet the DNALC Teacher: Barcoding in Conservation Biology and Zoology," DNALC
DNALC Live "Lactose Intolerance," DNALC
 April 3 *DNALC Live* "Barcoding Bioinformatics," DNALC
DNALC Live "What DNA Says About Our Human Family Tree, Part III," DNALC
DNALC Live "Bacteria and Antibiotics," DNALC
 April 6 *DNALC Live* "Detecting Genetically Modified Foods, Part I," DNALC
DNALC Live "Kitchen Science: DNA Extraction from Fruit," DNALC
 April 7 *DNALC Live* "Detecting Genetically Modified Foods, Part II," DNALC
DNALC Live "Kitchen Science: Bubbling Liver," DNALC
 April 8 *DNALC Live* "DNA Barcoding Part II: Electrophoresis & PCR," DNALC
DNALC Live "Industrial Enzymology: Making Juice & Cheese," DNALC
 April 9 *DNALC Live* "Museum Tour: Ötzi the Iceman," DNALC
DNALC Live "DNA Barcoding in Conservation Biology and Zoology," DNALC
 April 10 *DNALC Live* "Bioinformatics," DNALC
DNALC Live "Pollen Tells a Story: Ötzi the Iceman," DNALC
DNALC Live "RNA-Seq on *DNA Subway*, Part I" DNALC
 April 13 *DNALC Live* "Short FP - Forensic DNA Analysis," DNALC
DNALC Live "Species Shorts: Welcome to the Tribe," DNALC
 April 14 *DNALC Live* "Diversity of Life: Plant and Animal Cells," DNALC
 April 15 *DNALC Live* "Invertebrate Zoology: Social Insects," DNALC
DNALC Live "Species Shorts: *Sahelanthropus tchadensis*," DNALC
DNALC Live "RNA Transcription," DNALC
DNALC Live "Protein Purification, Part I," DNALC
 April 17 *DNALC Live* "RNA-Seq with *DNA Subway*, Part II," DNALC
DNALC Live "Species Shorts: *Ardipithecus ramidus*," DNALC
DNALC Live "Protein Purification, Part II," DNALC
 April 18 CURE Panel, "DNA Isolation and Blue Line," Dutchess Community College, Poughkeepsie, New York
 April 20 *DNALC Live* "Species Shorts: *Australopithecus afarensis*," DNALC
DNALC Live "DNA Restriction Analysis, In Silico," DNALC
 April 21 *DNALC Live* "Online tools to explore COVID-19 evolution and movement," DNALC
DNALC Live "Intro to Mendelian Genetics and Punnett Squares," DNALC
 April 22 *DNALC Live* "Species Shorts: *Paranthropus aethiopicus*," DNALC
DNALC Live "Kitchen Science: Mendelian Inheritance: Build a Creature," DNALC
 April 23 *DNALC Live* "Invertebrate Biology: Plant - Insect Interactions," DNALC
DNALC Live "Human Traits and Variation," DNALC
 April 24 *DNALC Live* "RNA-Seq on *DNA Subway*, Part III," DNALC
DNALC Live "Species Shorts: *Homo habilis*," DNALC
DNALC Live "DNA Sequence - Paper Chain Activity," DNALC
 April 27 *DNALC Live* "DNALC Short: Why Do Cells Have Different Shapes?" DNALC
DNALC Live "Species Shorts: *Homo erectus*" DNALC
 April 28 *DNALC Live* "DNALC Short: Plant and Animal," DNALC
DNALC Live "DNA Barcoding Part III," DNALC
 April 29 *DNALC Live* "DNALC Short: The Mitochondria," DNALC
DNALC Live "Species Shorts: *Homo antecessor*" DNALC
DNALC Live "Sickle Cell Bioinformatics," DNALC
DNALC Live "DNALC Short: Neurons," DNALC
 April 30 *DNALC Live* "DNALC Short: The Dynamic Membrane," DNALC
 May 1 *DNALC Live* "DNALC Short: Neurons - Action Potentials," DNALC
DNALC Live "Species Shorts: *Homo heidelbergensis*" DNALC

	<i>DNALC Live</i> "Using a Single Nucleotide Polymorphism (SNP) to Predict Bitter Taste Ability, Part I," DNALC
May 4	<i>DNALC Live</i> "Species Shorts: <i>Homo neanderthalensis</i> ," DNALC <i>DNALC Live</i> "Museum Tour - Our Genome," DNALC <i>DNALC Live</i> "Backyard Bugs - The Amazing Ants," DNALC
May 5	<i>DNALC Live</i> "DNALC Short: Transcription and Translation," DNALC <i>DNALC Live</i> "Using a Single Nucleotide Polymorphism (SNP) to Predict Bitter Taste Ability, Part II," DNALC
May 6	<i>DNALC Live</i> "DNALC Short: DNA Folding," DNALC <i>DNALC Live</i> "Species Shorts: <i>Homo sapiens</i> ," DNALC <i>DNALC Live</i> "Meet the Scientist: Semir Beyaz, CSHL," DNALC
May 7	<i>DNALC Live</i> "Invertebrate Biology Part V: Coral Reefs," DNALC <i>DNALC Live</i> "Using a Single Nucleotide Polymorphism (SNP) to Predict Bitter Taste Ability, Part III," DNALC
May 8	<i>DNALC Live</i> "Intro to RNA-Seq with Jupyter Notebook, Part I," DNALC <i>DNALC Live</i> "DNALC Short: DNA Methylation," DNALC
May 11	<i>DNALC Live</i> "DNALC Short: Restriction Enzymes," DNALC <i>DNALC Live</i> "DNALC Short: GFP," DNALC
May 12	<i>DNALC Live</i> "DNALC Short Technique: Micropipetting," DNALC <i>DNALC Live</i> "DNALC Short Technique: Preparing an Agarose Gel," DNALC <i>DNALC Live</i> "DNALC Short Technique: Agarose Gel Electrophoresis," DNALC
May 13	<i>DNALC Live</i> "DNALC Short: CRISPR," DNALC <i>DNALC Live</i> "Jumping Genes Lead the Way," DNALC
May 14	<i>DNALC Live</i> "DNALC Short: Imaging," DNALC <i>DNALC Live</i> "Invertebrate Biology," DNALC
May 15	<i>DNALC Live</i> "RNA-Seq with Jupyter Notebooks, Part II," DNALC <i>DNALC Live</i> "Forensic DNA Profiling, Part I," DNALC
May 18	<i>DNALC Live</i> "DNALC Short: Let's Give it a Whorl: Fingerprint Analysis," DNALC <i>DNALC Live</i> "Pollen Tells a Story," DNALC
May 19	<i>DNALC Live</i> "Forensic DNA Profiling, Part II," DNALC
May 20	<i>DNALC Live</i> "DNALC Short: Using Luminol to find Biological Evidence," DNALC
May 21	<i>DNALC Live</i> "DNALC Short: Why Soap Works - A Basic Look at Macromolecules in SARS-CoV-2," DNALC <i>DNALC Live</i> "Forensic DNA Profiling, Part III," DNALC
May 22	<i>DNALC Live</i> "Mystery of Anastasia," DNALC <i>DNALC Live</i> "DNALC Short: Kitchen Science: Finger Painting with Fingerprints," DNALC
May 26	<i>DNALC Live</i> "DNALC Short: New York Stories Part I: Martin Chalfie," DNALC <i>DNALC Live</i> "Bubbling Liver," DNALC
May 27	<i>DNALC Live</i> "DNALC Short: New York Stories Part II: DNA Fingerprint," DNALC <i>DNALC Live</i> "Lactose Intolerance," DNALC
May 28	<i>DNALC Live</i> "Vertebrate Biology," DNALC <i>DNALC Live</i> "Industrial Enzymology," DNALC
May 29	<i>DNALC Live</i> "DNALC Short: DNA Methylation: Enzymes or DNA Methyltransferases," DNALC <i>DNALC Live</i> "Meet the Scientist: Interview with Kim Kessler, Genetic Counselor at Northwell," DNALC
June 1	<i>DNALC Live</i> "DNALC Shorts: Backyard Bugs: Carpenter Bees," DNALC
June 2	<i>DNALC Live</i> "DNALC Shorts: NY Stories, The Fly Room," DNALC
June 3	<i>DNALC Live</i> "The Case of the Missing Chromosome," DNALC
June 4	<i>DNALC Live</i> "Detecting GMOS, Part I," DNALC

- Urban Barcode Project/Pinkerton Urban Barcode Research Program/NIH Barcode Long Island Virtual Symposium, DNALC*
- June 5 *DNALC Live "DNALC Shorts: NY Stories, Restriction Enzyme Analysis," DNALC*
DNALC Live "Detecting GMOS, Part II," DNALC
- June 8–19 *Genome Science Virtual Workshop, Lycée Français, New York, New York*
- June 15–19 NSF IUUSE, "Virtual DNA Barcoding for CURES Workshop," DNALC
- June 22–26 NSF IUUSE, "Virtual DNA Metabarcoding for CURES," DNALC
- Jun 29–Jul 3 *Fun with DNA Virtual Workshop, DNALC*
Forensic Detectives Virtual Workshop, DNALC
- Jun 29–Jul 10 *DNA Barcoding and Bioinformatics, UBP Teacher Virtual Workshop, NYC*
DNA Barcoding Virtual Workshop, DNALC
Genome Science Virtual Workshop, DNALC
- July 6–10 *Fun with DNA Virtual Workshop, DNALC*
World of Enzymes Virtual Workshop, DNALC
Forensic Detectives Virtual Workshop, DNALC
BioCoding Virtual Workshop, DNALC
- July 13–17 *Fun with DNA Virtual Workshop, DNALC*
World of Enzymes Virtual Workshop, DNALC
Forensic Detectives Virtual Workshop, DNALC
BioCoding Virtual Workshop, DNALC
Pinkerton Urban Barcode Research Program Conservation Genetics Virtual Workshop, NYC
- July 13–24 *DNA Barcoding Virtual Workshop, DNALC*
Genome Science Virtual Workshop, DNALC
- July 16 InnovATEBIO High School Summer Series, "DNA Barcoding," DNALC
- July 20–24 *Forensic Detectives Virtual Workshop, DNALC*
BioCoding Virtual Workshop, DNALC
Pinkerton Urban Barcode Research Program DNA Barcoding & Bioinformatics Virtual Workshop, NYC
- July 21 National Academies of Science Kavli Frontiers of Science Symposium, "Computational Learning, Thinking, and Doing in 21st Century Biology," Virtual
- July 27–31 *World of Enzymes Virtual Workshop, DNALC*
Pinkerton Urban Barcode Research Program Conservation Genetics Virtual Workshop, NYC
- July 27–Aug 7 *DNA Barcoding Virtual Workshop, DNALC*
Genome Science Virtual Workshop, DNALC
- July 28 Cultivating Scientific Curiosity BIOME Teacher's Summer Institute, "RNA-Seq and Jupyter - Bringing Genomics into the Classroom," Virtual
- July 28-30 NSF IUUSE, "Virtual DNA Metabarcoding for CURES," DNALC
- Jul 28–Nov 12 CyVerse Foundational Open Science Skills Online Course, "CyVerse Foundational Open Science Skills Online Course," Virtual
- July 29 Plant Biology 2020, "Reproducible Analyses with Jupyter and R on CyVerse," Virtual
- August 3–7 *Fun with DNA Virtual Workshop, DNALC*
World of Enzymes Virtual Workshop, DNALC
Forensic Detectives Virtual Workshop, DNALC
Pinkerton Urban Barcode Research Program DNA Barcoding & Bioinformatics Virtual Workshop, NYC
- August 6 Cultivating Scientific Curiosity BIOME Teacher's Summer Institute, "RNA-Seq and Jupyter - Bringing Genomics into the Classroom," Virtual
- August 10–14 *World of Enzymes Virtual Workshop, DNALC*
Forensic Detectives Virtual Workshop, DNALC
Pinkerton Urban Barcode Research Program Conservation Genetics Virtual Workshop, NYC
- August 10–21 *DNA Barcoding Virtual Workshop, DNALC*

- Genome Science Virtual Workshop*, DNALC
 STARS STEM Program for Minority Students “*DNA Barcoding Virtual Workshop*,” “*BioCoding*, Virtual Workshop”, DNALC
- August 17–21 *Fun with DNA Virtual Workshop*, DNALC
World of Enzymes Virtual Workshop, DNALC
 Pinkerton *Urban Barcode Research Program Conservation Genetics Virtual Workshop*, NYC
- August 24–28 *WiSE Fun with DNA Virtual Workshop*, DNALC
World of Enzymes Virtual Workshop, DNALC
Forensic Detectives Virtual Workshop, DNALC
- Aug 24–Sep 3 *Genetics & Biotechnology Virtual Teacher Workshop*, DNALC
- Aug 24–Sep 4 *DNA Barcoding Virtual Workshop*, DNALC
- October 5 *Biodiversity Genomics 2020 Conference*, “*DNA Barcoding - Infrastructure for Students and Citizen Science*,” Virtual Poster Session
- October 6 *Barcoding US Ants Wet Lab Open Lab*, Virtual
- October 8 *Barcoding US Ants Wet Lab Open Lab*, Virtual
- October 13 Graduate Seminar - Carnegie Mellon University, “*Cultivating Pre-College Biology Students in the 21st Century*,” Virtual
- October 14 *Barcoding US Ants Wet Lab Open Lab*, Virtual
- October 15 *Barcoding US Ants Wet Lab Open Lab*, Virtual
- October 20 *Barcoding US Ants Wet Lab Open Lab*, Virtual
- October 22 *Barcoding US Ants Wet Lab Open Lab*, Virtual
- October 28 *Bridging the Gap Virtual Presentation*, “*Citizen Science DNA Barcoding: Moving from Classrooms to Homes*,” DNALC
- Nov 4–6 *Biological Data Science Meeting “Undergraduate Curation Projects to Improve Gene Annotation in Maize*,” Virtual
- Nov 6–11 *UBP Oyster Research Station Teacher Training*, Virtual & Oyster Site, Lower Manhattan, New York
- November 12 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- November 18 Graduate Seminar - University of Arizona, “*Cultivating Pre-College Biology Students in the 21st Century*,” Virtual
- November 17 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- November 19 *NIH Citizen DNA Barcode Network Collaborator Training*, “*DNA Barcoding*,” Virtual
Barcoding US Ants Data Analysis Open Lab, Virtual
Meet a Scientist: David Jackson, “*How studying stem cells in plants can improve crop yields*” Virtual Event, DNALC
- November 20 Site visit by Linda Johnson, Brooklyn Public Library, Brooklyn, New York
- November 21 *NIH Citizen DNA Barcode Network Focus Group with NY Hall of Science members*, Virtual
- November 23 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- December 1 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- December 3 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- December 4 *CyVerse Webinar Series*, “*Introduction to RNA-Seq with Kallisto and Sleuth*,” Virtual
- December 10 *Barcoding US Ants Data Analysis Open Lab*, Virtual
Meet a Scientist: Camila dos Santos, “*The impact of pregnancy on breast cancer risk*” Virtual Event, DNALC
- December 12 *Saturday DNA!* “*Virtual Museum Tour: Ötzi the Iceman*,” DNALC
Saturday DNA! “*The Mystery of Anastasia*,” DNALC
- December 15 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- December 16 *Saturday DNA!* “*The Mystery of Anastasia*,” DNALC
- December 17 *Barcoding US Ants Data Analysis Open Lab*, Virtual
- December 19 *Saturday DNA!* “*Virtual Lab: Pollen Tells a Story*,” DNALC



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