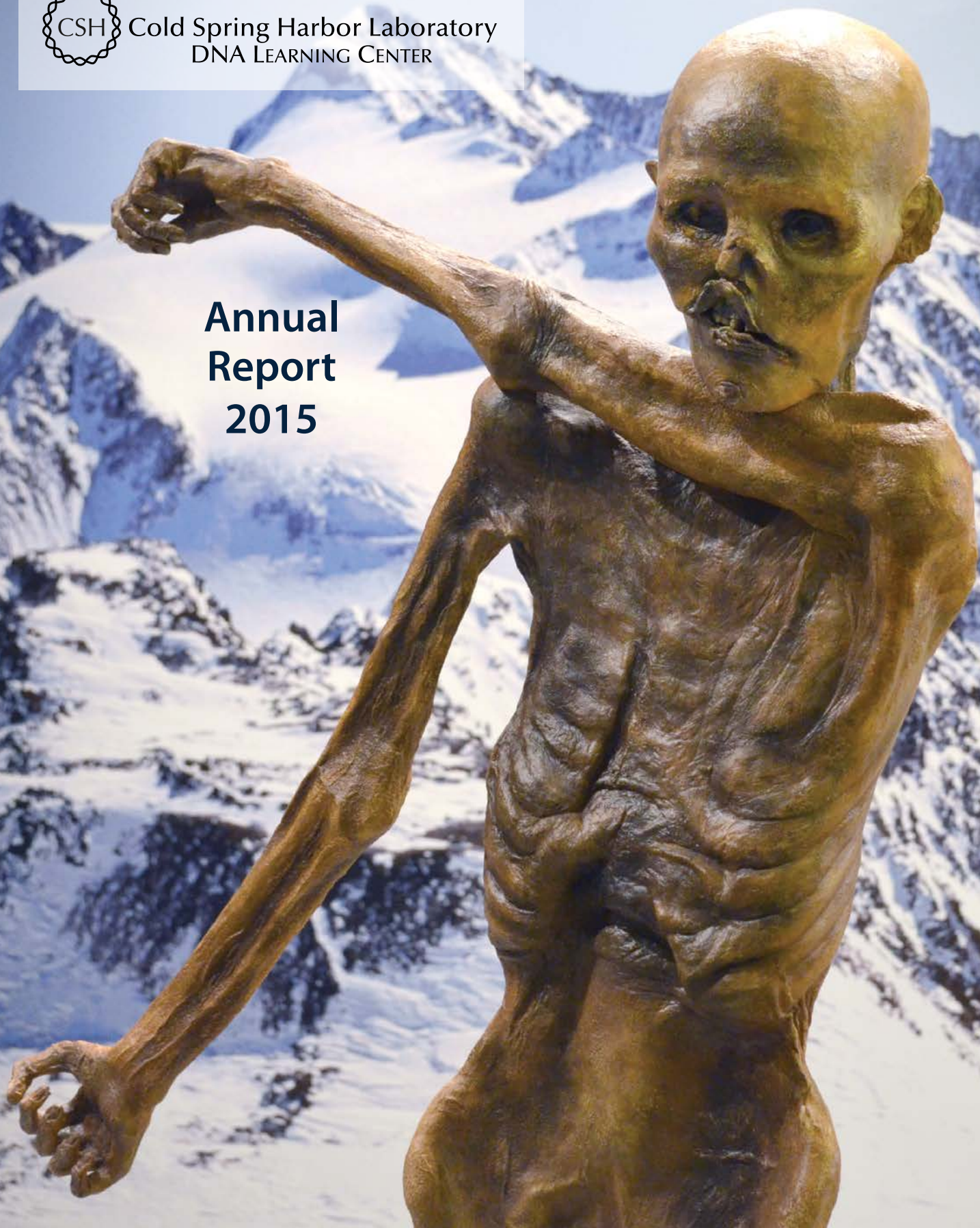




Cold Spring Harbor Laboratory
DNA LEARNING CENTER

**Annual
Report
2015**



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

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

Executive Director's Report

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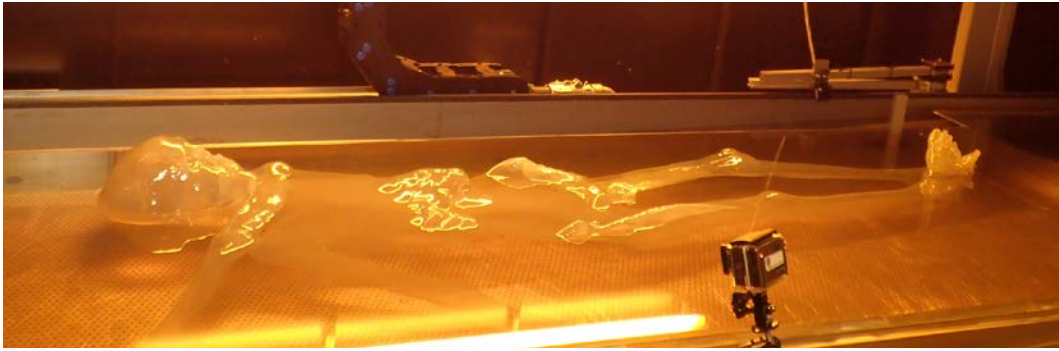
In summer, a life-size replica of Ötzi “the Iceman” arrived at the DNALC. He became the newest member of a cast of prehistoric characters we use to interest students in human evolution. These include an articulated Neanderthal skeleton and burial cast; a bust recreation of *Homo erectus*; and skulls *Australopithecus afarensis* (“Lucy”), *Homo habilis* (“Handy Man”), *Homo floresiensis* (the “Hobbit”), and other ancient hominids. These exhibits are designed to complement experiments, pioneered by the DNALC, in which students use their own DNA as an entrée to the study of human origins.

Ötzi took the center stage in the DNALC’s main exhibit hall, backed by a wall-sized graphic of the mountainous site in the Ötztal Alps where he was discovered in 1991. The Ötzi installation—which includes recreations of clothing, weapons, and other artifacts discovered along with the mummy—is funded by a grant from the Long Island Real Estate Group.

Like our hugely successful interpretive program, “Mystery of Anastasia,” Ötzi provides a fascinating exploration of forensic science. On one level, Ötzi has the classic elements of a murder mystery: an arrow point entered through his shoulder blade, severing his subclavian artery and causing him to bleed to death in several minutes. What was he doing at 10,500 feet on the mountain? Who followed him to that altitude and shot him from behind? Whose blood was found on his clothes? What were they fighting about?

On another level, Ötzi tells stories about human evolution. He is dated to 5,300 years before present, a time when agriculture was sweeping through Europe. The basic DNA types he inherited on his maternal and paternal sides originated in western Asia, and spread through Europe with farmers who carried farming out of the Fertile Crescent. Analysis of his stomach contents showed that Ötzi’s last meal included unleavened bread made with cultivated einkorn wheat, which had arrived in northern Italy from its origin in southeastern Turkey about 2,000 years before Ötzi’s time. However, Ötzi did not have the gene mutation that helps adults digest milk sugar, which moved south from its origin in northern Europe.

After a year of negotiations, the DNALC received exclusive rights to display 3D replicas of Ötzi at the Dolan DNALC and in its future center in New York City. These will be the only authorized replicas to be displayed outside of Ötzi’s home in the South Tyrol Museum in Bolzano, Italy. The replicas were produced by Gary Staab (www.staabstudios.com), the leading artist specializing in natural history and prehistoric life models for museums. Raw data from a full body CT scan was used to develop a three-dimensional representation of the surface of Ötzi’s body. Then, in February, these data were used to make a 3D print on a mammoth stereolithography machine at Materialise in Leuven, Belgium. The print was then shipped to Staab Studios in Kearney,



The 3D print rises from the stereolithography machine (top), Staab adds final touches to the texture (left), detail of the hip with individually applied muscle and tendon "tissue" (above), and the sculpture during the painting process (below).

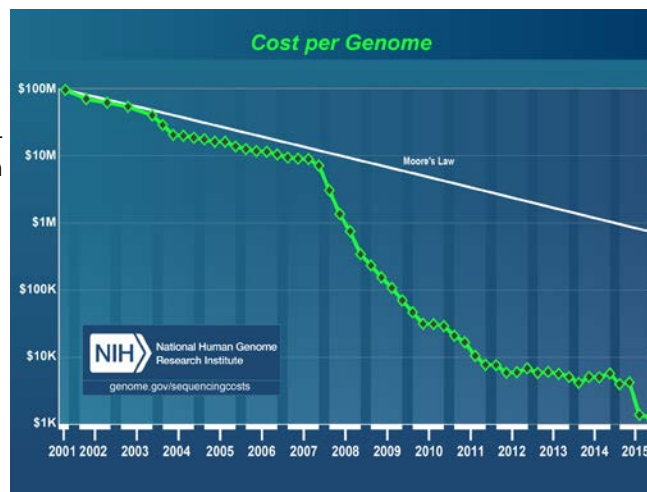


Missouri, for finishing. Although the 3D printing was highly accurate, it did not have enough resolution to define skin texture and features; these were painstakingly added by hand with reference to a photographic atlas. Using the “lost wax” process, a rubber mold was created from which durable resin casts were made. Gary then hand painted the entire cast to add skin details, including a number of tattoos.

CyVerse (iPlant Collaborative)

CyVerse, a contraction of “cyber universe,” is the new name for the National Science Foundation project that began as the *iPlant Collaborative* in 2008. *CyVerse* provides researchers and educators the high-performance computing, databases, software, cyberinfrastructure to store, share, and analyze the ever-growing “big data” of biology. The DNALC-led Education, Outreach, and Training (EOT) component of *CyVerse* focuses on bringing data science into classrooms and laboratories. Data science is an interdisciplinary field where raw data from multiple sources is integrated and transformed into knowledge. It is used in many fields and increasingly affects our daily lives. For instance, data analysis from multiple sources informs shopping recommendations and provides real-time traffic alerts.

Data science also improves health outcomes and allows researchers to study diverse biological problems—including the relationships between genotype and phenotype, gene networks, or entire ecosystems. Building the DNALC’s investment in computation, we hired Joslynn Lee as our first data science educator. With a Ph.D. in computational chemistry, Dr. Lee guides biologists and biology educators as they enter the powerful, but often daunting, world of data science.



Bringing Data Science to Biology: We continued to work with Software Carpentry (www.software-carpentry.org), a non-profit organization of volunteer instructors whose mission is to teach basic computing skills to scientists and students. Jason Williams is a certified Software Carpentry instructor and member of their 2015 Steering Committee. We also worked with Data Carpentry (www.datacarpentry.org), which started as collaboration between NSF-funded Bio Centers, including *CyVerse*. Data Carpentry teaches skills and best practices of data science in biology. Lessons from both projects are integrated into our *CyVerse* training.

Use of *DNA Subway*, our classroom-friendly gateway for gene and genome analysis, increased substantially. Visits increased 26% to 55,755 sessions, new user registrations climbed 13% to 3,983, and new projects increased 13% to 28,938. This year, the Green Line (RNA-Seq) was updated to use *CyVerse*’s new API *Agave*, the interface to high-performance computing resources for data science. While initial testing was promising, heavy usage and slow-downs during summer workshops revealed the need for further improvement. At the close of 2015, we started exploring seamless access to supercomputers at the Texas Advanced Computing Center (TACC) and *Amazon Web Services* for the Green Line, with the aim of supporting large numbers of simultaneous projects without disruption. Planning also began on a new classroom-friendly workflow for metagenomics and microbial genomes. This workflow will allow students to barcode complex mixtures, rather than single species, using next-generation sequencing (NGS) to generate sequences of ribosomal 16s RNA.

Workshops, Training, and Events: In 2015 we held six two-day *Tools and Services Workshops*, attended by 185 researchers, three two-day *Genomics in Education Workshops* for 54 educators, and a *Train-the-Trainers Workshop* for 25 participants from the USDA Agricultural Research Service. In March, the DNALC hosted a Data Carpentry hackathon on “Genomics Lessons and Assessment” at CSHL. Twenty-six participants, including beginners and experts from the U.S. and abroad, worked for three days on lessons designed to introduce scientists to genomics. These lessons teach bioinformatics skills while emphasizing how to avoid common pitfalls that thwart biologists new to computational projects. They were introduced at Data Carpentry workshops held at the American Society of Plant Biology’s annual meeting in Minneapolis, University of California Davis, and Stony Brook University. We had our biggest showing ever at the 23rd International Plant and Animal Genome meeting in San Diego with an outreach booth and nine sessions and workshops attended by more than 500 visitors. As a kickoff to working with *iPlant UK* (a collaboration between the Universities of Warwick, Liverpool, Nottingham, and The Genome Analysis Centre), we hosted a workshop in the United Kingdom. We also presented at the Bioinformatics Open Source Conference, as well as at the concurrent Conference on Intelligent Systems for Molecular Biology (ISMB) and European Conference on Computational Biology. These international collaborations point to the global success of *CyVerse* and the scope of its outreach programs, including *DNA Subway*. With our help, 62% of workshop attendees hear about *CyVerse* from their colleagues. *CyVerse* has now surpassed the 30,000-user mark.

We have continued to complement in-person workshops with virtual training and outreach. Through Livestream, our online broadcast of *Tools and Services Workshops* had 1,247 views, while our live monthly *Get Started with CyVerse* webinars attracted 146 participants. Our recorded workshops, webinars, and tutorials on YouTube increased 53% to 16,252 views (more than 1,202 hours of content viewed).

Bringing RNA Sequence Data Analysis into the Undergraduate Classroom

Not all genes are transcribed into RNA all the time: only a subset is expressed in any cell at any given time. For instance, changes in gene expression can change a normal to a disease state. Therefore, determining which RNAs change expression level—differential gene expression—is critical information for researchers trying to unravel many biological questions. The latest technology to determine the transcriptome—the expression level and identity of RNAs in a sample—is RNA sequencing (RNA-Seq).

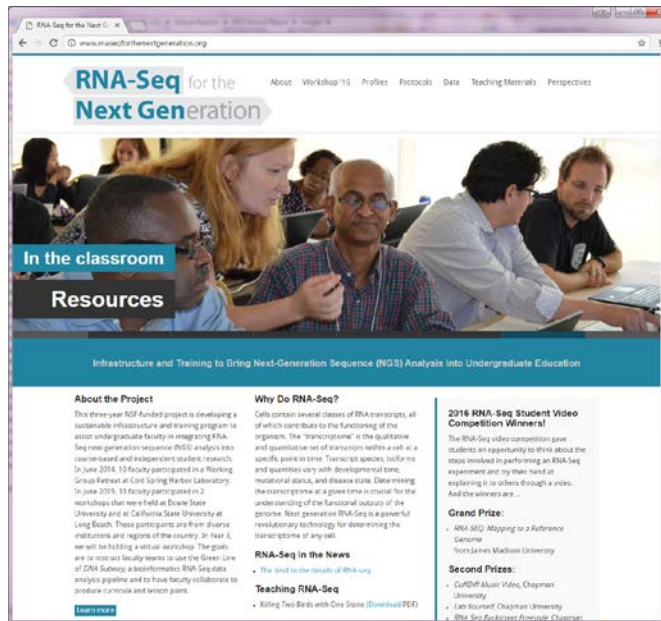
Unfortunately, most faculty members at primarily undergraduate institutions (PUIs) hope to teach about and use RNA-Seq, but lack the training and resources to do so. In 2014, we launched a three-year, \$537,000 NSF-funded project, “Infrastructure and Training to Bring NGS Analysis into Undergraduate Education” to support training and implementation of RNA-Seq by PUI faculty. The project supplies faculty otherwise cost-prohibitive sequencing and leverages free access to supercomputing power and data storage through the “Green Line” of *DNA Subway* and *CyVerse* resources.

We hosted our first workshop in 2014, when ten Working Group members learned to analyze RNA-Seq data and helped develop an RNA-Seq curriculum. Building on these efforts in 2015, we trained 33 faculty members, from 32 PUIs in 18 different states, at regional workshops held at Bowie State University in Maryland and California State University at Long Beach. Each five-day workshop included seminars and computer demonstrations that introduced RNA-Seq experimental goals and data analysis theory, while participants planned and conducted bioinformatics analyses with assistance from DNALC staff and expert guest lecturers.

A major benefit for program participants was the acquisition of novel RNA-Seq data supporting their research interests. Twenty-five participants collectively received a total of 2.9 billion

76-basepair paired-end DNA sequencing reads covering 100 transcriptomes for 12 different eukaryotic species. Their diverse projects include characterization of gene expression changes upon exposure of *S. cerevisiae* to copper, during differentiation of human leukemia cells, and in *Drosophila* embryonic central nervous system in response to trauma. To accommodate data analysis, ten new species' reference genomes were added to the Green Line, which includes genomes from model genetic organisms, such as mouse and *Arabidopsis*, and many non-model organisms, including lizard, honeybee, and chicken. During the workshops, 1,800 data analysis jobs were processed on up to 12 processors each, consuming 38,400 CPU hours.

To date, over 400 students were taught RNA-Seq by program participants in courses including genetics, developmental biology, cell and molecular biology, and horticulture. Project goals and data were also disseminated through oral and poster presentations by participating faculty and their students at 18 national or regional scientific conferences.



We also added content to our popular (7,639 visitors in 2015) *RNA-Seq for the Next Generation* website (www.rnaseqforthenextgeneration.org). This website features a dedicated page for each faculty member involved in the project, including a description of their research area, links to their RNA-Seq data, and educational resources they have developed.

Genomic Approaches in Biosciences: Final Year

The year saw the completion of the last two workshops for our NSF Advanced Technological Education (ATE) faculty training program—one at University of California, San Francisco led by Bruce Nash, and one at Southwestern College in Chula Vista, California, led by Thomas Tubon, from Madison Area Technical College. During the project, 302 faculty members attended week-long workshops on key technologies of modern biology conducted by DNALC instructors, while 126 attended workshops led by community college faculty who were trained by DNALC staff.

Preliminary results of longitudinal evaluations designed to assess the long-term impact of the program were presented at ATE's annual Principal Investigator meeting in Washington, D.C. In addition to pre- and post-workshop surveys for 2015 attendees, 9-12 month and long-term 15+ month follow-up surveys were administered to previous workshop participants, revealing that the vast majority of participants (92.7%) have used the materials as background information or student resources, to train fellow faculty, and for teaching. Respondents reported student exposures to labs (21,861), bioinformatics exercises (11,287), and biotech careers modules (8,185) in schools with an average of 40% students from ethnic groups underrepresented in sciences.

We also aimed to measure the relative effectiveness of DNALC staff and instructors we trained. When compared, responses to the long-term follow-up surveys show no significant differences

with respect to participant confidence in teaching the lab and bioinformatics methods learned in the workshops whether taught by DNALC staff or local faculty. This confirms the usefulness of our “train-the-trainer” model, supporting continued training of educators who can broaden the impact of our programs by training their peers.

New Developments Around the World

DNALC Asia

On February 13, we successfully concluded negotiations to develop a DNA Learning Center Asia in Suzhou Industrial Park (SIP), outside of Shanghai, China. SIP Administrative Committee (SIPAC) Chairman Zhiping Barry Yang signed the agreement, with John Maroney representing CSHL (at right and left respectively in photo).

The objective is to offer the same hands-on lab experiences in Suzhou as offered at the DNALC in Cold Spring Harbor. This feeds on Chinese brand consciousness and the interest in preparing students for science study at American universities.

The agreement is a product of the DNALC licensing program that began in 2002. The idea of capitalizing on DNALC intellectual property was first championed by CSHL Trustee Arthur Spiro, who brokered the first licensed center, DNALC *West* at North Shore-LIJ Healthcare System (2002), and another at Clemson University (2006). Licensed centers since were developed with the Singapore Ministry of Education (2003), University of Vienna (2006), Notre Dame University (2103), Beijing 166 High School (2014), and Mexico City Health Park (2014). During this period, the licensing program has generated over \$1.2 million in license fees, and \$1.9 million in operating income.



The 10-year contract will provide significant core support to the DNALC—a \$1 million signing incentive plus \$225,000 in annual license fees. In addition, SIP will provide \$2.5 million for facility renovation and equipment, and \$2.5 million operating support to support DNALC Asia in its first five years. Our business plan anticipates that the center will be generating a surplus of revenue over expenses in Year 6. Under terms of the agreement, DNALC Asia is registered as a domestic non-governmental organization (NGO) sponsored by CSH Asia Conferences.

The Chinese government issued the “Certificate of NGO Registration” on July 14. It is an “internal” NGO, sponsored by an organization operating in China and has a Chinese legal representative, as opposed to an “external” NGO, such as UNICEF, Doctors Without Borders, or the Red Cross. The NGO is governed by a nine-member council comprised of four SIPAC and four CSHL representatives, as well as the CEO of Cold Spring Harbor Asia Conferences, Maoyen Chi, who also serves as the Council Secretary General, the NGO Chairman, and the first-term Director of DNALC Asia. The first council meeting was held in Suzhou on October 21. During the first year, the NGO will share core management and accounting services with CSH Asia Conferences.

DNALC Asia occupies modern “pod-like” buildings in SIP’s Biobay in Dushu Lake Science & Education Innovation District, with a land area of 270,000 square feet. In the first phase, one 20,000 square foot two-story pod is being built out with eight teaching labs to accommodate 224 students—twice the capacity of the Dolan DNALC. An exhibition hall and cafeteria are also included in the total renovation area of more than 30,000 square feet to be completed in spring 2016. The facility is being renovated to our specifications, including signature DNALC

Dave Micklos visited Suzhou in June 2015 (right). Construction began in the fall (right, below from December).



lab benches that encourage educator and student interaction. To provide an “American” lab experience, each large Chinese class will be split into two groups. The business plan calls for bringing the second pod on line in Year 4.

In July, a small SIPAC delegation visited the Dolan DNALC. The group included: Fang Xia, Vice Chairman of SIPAC, Shaojie Xu, Deputy Director of the Education Bureau, and Jianguo Yin, Deputy Chief of the International Cooperation Division of Science & Technology Development Bureau. In addition to meetings on DNALC operations and the proposed 3D Cellarium exhibition as rendered by Centerbrook Architects and Planners, the group observed summer camps for local and Beijing 166 students and met Dr. Watson. We also hosted a group of sixteen tenth grade students (plus two adults) from SIP schools as part of a two-week U.S. summer study program. This collaborative initiative was organized by Suzhou Dushu Lake Science & Education Development Company and authorized by the SIPAC Education Bureau. The group performed a DNA fingerprinting lab and joined a talk with Dr. Watson at the DNALC, then toured the CSHL campus.

Recruitment of two international and three domestic Chinese instructors for DNALC Asia started in late April. We advertised the International Faculty Teaching Fellowships primarily by email, targeting young post-docs. Newly hired faculty will be trained at the DNALC in early 2016, prior to the anticipated opening of DNALC Asia in spring. In addition, Lilly Wang, DNALC Asia Promotion Manager and Dorothy Zhang, DNALC Asia Operations Manager, spent time at the DNALC in July and December respectively, to be trained in DNALC programming, school recruitment, and administration.

Beijing No. 166 School

The importance of quality science education in China was highlighted this year by recommendations from the Beijing Education department to increase middle school science content. The licensed DNA Learning Center at Beijing No. 166 School will enrich experiences for students and teachers from the entire Dongcheng District as they implement mandated lab experiments for seventh and eighth grade students and a required biology course for ninth graders. Plans to use the lab space as a hub for teacher training, footlocker kit rental, student field trips, and a Beijing DNA Barcode Project were developed this year, while contracted DNALC exchange programs for the students of Beijing No. 166 School continued.

Two cohorts of Beijing students came to the DNALC for workshops in the winter and summer. In February, 38 high school students attended two week-long courses. In *DNA Science* they learned basic techniques of recombinant DNA in bacteria. During week two, they progressed to biochemical and computer methods to analyze DNA barcodes of plants and animals. Two students from the group were selected to conduct a two-week independent research internship with DNALC staff, during which they designed and conducted projects to study their own microbiomes using DNA barcoding and traditional microbiology techniques. The experience culminated with oral presentations of research findings and laboratory experiences. In July, 38 middle school students visited for three weeks and completed labs from popular middle school camps *Fun with DNA*, *World of Enzymes*, *Green Genes*, and *Forensic Science*. The students were immersed in hands-on activities and laboratory experiments designed to increase genetic literacy, encourage critical and creative thinking, and spark interest in the field of biotechnology. At the same time, four middle school science teachers from Beijing 166 began training in basic lab techniques, including DNA barcoding.



In February, Beijing No. 166 School students met with Dr. Watson and performed DNA barcoding laboratories in the Hershey teaching lab on the CSHL campus.



During the spring and fall, DNALC staff visited Beijing to conduct in-school workshops. In April, 175 high school students and 30 high school science teachers from the Beijing area extracted and amplified their DNA to detect the presence of an Alu insertion as part of a *Human DNA Fingerprinting* workshop. In October, 32 middle school students completed labs on inheritance and variability, DNA structure and isolation, DNA transformation and protein isolation, and DNA restriction analysis in the *Introduction to Genetics and Biotechnology* Workshop. In addition, a

workshop for 24 teachers introduced 24 Beijing high school science teachers to DNA barcoding research, and 24 ninth grade students completed a short *DNA Barcoding Research* course. DNALC teaching activities in Beijing were reported by Chinese newspapers and TV, promoting the “learn by doing” style of DNALC programs. Our collaboration with Beijing No. 166 School provides a template as we bring Beijing to the forefront of biology education in China.

Regeneron

Regeneron Pharmaceuticals Inc. is planning to open a licensed DNA Learning Center in a new building at their Tarrytown biotech complex. Founding Scientist and Chief Scientific Officer of Regeneron Pharmaceuticals Inc. and President of Regeneron Laboratories, Dr. George Yancopoulos, joined the CSHL Board of Trustees in November. With his research team, Dr. Yancopoulos developed Eylea, a treatment for wet, age-related macular degeneration. Eylea has since become a “blockbuster” drug, generating over \$1 billion in sales for the company. With a commitment to investment in the community, Regeneron plans to use the proposed on-site DNALC to support its own outreach initiatives and a robust school-based field trip program operated by the DNALC. If all goes according to plan, contracts will be signed in 2016, with an opening in 2017.

Notre Dame

The DNA Learning Center at Notre Dame—made possible by CSHL friend and Notre Dame Alumnus, John Passarelli—is a 36-seat lab in the Jordan Hall of Science. Over 1,300 students in grades 5-12 participated in hands-on labs either at the Center or in their classrooms, some from as far as Alaska! Summer camps for 130 students in grades 6–10 included residential and day programs with an average satisfaction rating of 9.5/10 for campers and parents. Capitalizing on the college campus location, over 50 undergraduate and graduate volunteers were invited to assist at DNA Learning Center functions, including a DNA day essay contest with prizes at the elementary, middle, and high school level, and as judges at local, regional and state level science competitions. Led by Director Amy Stark, the staff doubled this year with the addition of Linda Rock as administrator and second teacher.

DNA Center NYC

This year brought us closer to achieving the ongoing goal of a dedicated center in New York City (NYC). We have been working toward a Memorandum of Understanding (MOU) with the City University of New York (CUNY) for rights to develop a DNALC location at the NYC College of Technology (City Tech) in Brooklyn. The 17,500 square-foot space is located on the second floor of the Pearl Street Building, on the corner of Adams and Tillary Streets. The DNALC would have a separate dedicated entrance and lobby on Tillary Street, with elevator and stairway access. We expect the site to become available for renovation in 2017, with operations commencing in 2018. Under terms of the MOU, we expect to obtain the space lease-free for 30 years. The DNALC would operate two teaching labs for the exclusive use of CUNY students. These labs would support course-based undergraduate research experiences (CUREs) and honors classes on the DNALC's published curricula *DNA Science* and *Genome Science*, which would serve approximately 500 CUNY students per year.

CSHL would benefit from shared use of CUNY facilities (such as large auditoriums and conference spaces), maintenance, and security. The City Tech property fulfills CSHL's key requirements of visibility and ready access to the student populations of NYC. With signage on the façade of the building, the DNA Learning Center brand will be immediately visible to all traffic coming off the Brooklyn Bridge. Downtown Brooklyn is one of the most accessible parts of NYC, and there are eight subway lines within several blocks of City Tech. There is ample room for bus drop off on both Tillary and Adams Streets.



This location would provide a local audience for summer camps, a crucial component of the DNALC NYC business model; it is also easily accessed by public transportation by students throughout NYC. Brooklyn is the fastest growing of the five boroughs and has the largest population of school-age children (~400,000) and students enrolled in public school (~300,000). Brooklyn has the greatest number of charter schools and highest charter school enrollment (~18,000). To support programs in NYC, including at our new location, we finalized a business contract with the NYC Department of Education (NYCDOE). This Multiple Task Award Contract (MTAC) allows us to provide field trips, in-school instruction, summer camps and professional development as a vetted contractor, removing the lengthy bidding process usually required for vendors in NYC. We also aim to provide programs for students attending independent schools near the proposed location, which include St. Ann's School, Packer Collegiate Institute, Brooklyn Friends School, Berkeley Carroll School, and Poly Prep Country Day School.

DNA Barcoding

The DNALC's three DNA barcoding programs continue to enable authentic research by students while contributing to our knowledge of biodiversity: the National Institutes of Health (NIH)-funded *Barcode Long Island (BLI)* enables students to study the biodiversity of Long Island with teachers as mentors; the *Urban Barcode Project (UBP)* similarly supports student teams in NYC; and the *Urban Barcode Research Program (UBRP)*, supported by the Pinkerton Foundation, trains students in conservation biology and DNA barcoding and then pairs them with scientists who mentor their research.

A measure of the success of these programs is the effect on the attitudes of participants. For example, interviews conducted with *BLI* students highlighted the hands-on nature of the activities and the discovery qualities inherent in doing "real science." One *BLI* student said, "I think my favorite part was going out and actually collecting the lichens and getting some hands-on experience rather than just learning about it in the classroom." Another student told interviewers, "It was nice to make our own science project rather than do a lab in a classroom where it is set, and you know the results at the end. We're basically like scientists and making our own procedure." The interviews also illuminated some of the challenges of *BLI* and broader lessons: "This is going to help me in the future because I feel that it teaches me to continue on even though sometimes you

might fail at first, or a second time, or a third time, you keep on continuing because eventually you get some good results."

To better understand the trends among our DNA barcoding students, data for all three programs (*BLI*, *UBP*, *UBRP*) were combined and analyzed. Among students with other research or science competition experiences (n=83), the majority (57.8%) felt that the DNA barcoding programs provided *much more* "real world" science and chances for hands-on experiences than their previous experiences had. These students also indicated that they had many more opportunities to find out something new (42.2%), and to develop critical thinking and understanding of the scientific process (34.9%)—while being more fun than other research experiences (34.9%). More than half of students from all three programs expressed an increased interest in a career in science, with *UBRP* students having the highest level of increased interest (87% for *UBRP* versus 68% for *UBP* and 50% for *BLI*). As a whole, these results suggest that DNA barcoding research programs are more effective than other popular research experiences, especially when students are mentored by experts.

DNALC barcoding mentors, whether teachers or researchers, enjoyed working with high school students. As one *UBRP* mentor noted, *"The most enjoyable aspect of the Urban Barcode Research Program was working with and learning from young bright, enthusiastic students working within a lab environment and applying real world solutions to real questions. Even negative results are results and thus a learning experience."* Many mentors indicated their experience had a positive impact on their professional development; assisting students with proposals (73%) and completing bioinformatics exercises (81%) were perceived to be of great professional benefit.

To support student efforts and archive their findings, we continued to improve our barcoding websites, which include background information, proposal submission guidelines, and portals for projects. We improved the content of *DNA Barcoding 101* (www.dnabarcoding101.org), including detailed instructions, background, and support materials on DNA barcoding. We enhanced the proposal submission, review, revision, and acceptance system—features necessary to make large-scale, distributed student DNA barcoding feasible. The sites now handle teacher requests for reagents and equipment, announcements and registration for training and "Open Labs," and directions for the Survey of Undergraduate Research Experiences (SURE-III) student survey, encouraging participation in our assessment of the programs. The barcoding sample database was also enhanced to allow students to upload multiple pictures of samples, sampling area, and PCR results. A system for reviewing PCR results and sequencing requests was also automated. At year's end, we began discussions to merge our DNA barcoding websites with the aim of producing a scalable platform to support and host student DNA barcoding programs beyond the region.

The Blue Line of *DNA Subway*, which integrates tools for DNA barcoding analysis in a simple, accessible workflow continued to be optimized to support DNA barcoding. The Blue Line workflow was enhanced by adding outgroups to phylogenetic analyses, while dedicated support for fungal (ITS) and microbial (16S ribosomal RNA hypervariable region) barcodes is currently being developed and will be available in early 2016.

Barcode Long Island: Exploring Biodiversity in a Unique Urban Landscape is funded by a \$1.2 million NIH Science Education Partnership Award. The project provides teacher training, reagents, equipment, and technical support for students to carry out DNA barcoding research at their own schools or during Open Labs held at DNALC (7), BNL (4), and SBU (3). In the spring, 78 students in 29 teams supported by 22 teachers from 20 schools in Nassau, Suffolk, and Queens Counties completed projects and presented results at the inaugural *BLI* Symposium in June. An average of 20 DNA barcoding samples was processed by each team, yielding 467 barcodes for projects on plant (50%), lichen (13%), invertebrate (33%), and fungal (4%) biodiversity.

A planning meeting for all collaborators and stakeholders was held at CSHL on June 5th. Collaborators from Stony Brook University (SBU), Brookhaven National Lab (BNL), the American Museum of Natural History (AMNH), Dowling College, Molloy College, Brandeis University, Brooklyn College, Genspace Community Biolab, and Suffolk County Water Authority were joined by teacher fellows and DNALC project staff. In addition to supporting teams directly at SBU and BNL, scientists at SBU, the AMNH, Malloy College, and Dowling College are helping to identify species using traditional taxonomic methods. The AMNH has agreed to archive invertebrate specimens with novel barcodes and Brooklyn Botanic Garden scientists are considering archiving plant specimens.



From left: Lisa Daniels of Roslyn High School, Caren Gough and Daniel Moloney of SBU, Patricia Bussett of Nassau BOCES, and Scott Bronson of BNL during a discussion at the June *BLI* planning meeting.



DNALC's Amanda McBrien, Larry Wangh of Brandeis University, Mark Stoeckle of The Rockefeller University, and George Amato of AMNH during a light moment.

In the summer, 93 teachers were trained during three five-day workshops held at the DNALC, SBU, and BNL, and a one-day workshop at the DNALC in the fall. Of the 144 teachers trained in the first two years of the project, 41 are now mentoring 105 teams comprised of 329 students representing 34 public Long Island schools. At the close of 2015, this second cohort of students is studying diverse ecosystems and taxa, including terrestrial and aquatic animals, plants, fungi and lichens across Long Island.

Meanwhile, in NYC, the *Urban Barcode Project* remains strong. On May 27th, 50 teams presented project findings at a poster session at the AMNH. Research included mapping wildlife in NYC, detecting food fraud, determining biodiversity of NYC green spaces, identifying traded plant and animal species, and exploring the effects of biodiversity on human health. A jury of 29 experts in biodiversity, conservation biology, DNA barcoding, and education selected seven finalist teams who gave oral presentations at the AMNH on June 8th. Susan Perkins, Curator and Professor at the Sackler Institute for Comparative Genomics and Division of Invertebrate Zoology at the AMNH, gave the keynote talk "Meet Malaria's Mates: The Use of DNA Data to Discover and Describe New Species of Parasites." *UBP* grand-prize winners Armani Khan and Jessica Kuppan, mentored by Karen Wong, are from the High School for Construction Trades, Engineering, and Architecture in Queens. They used DNA barcodes to identify macroinvertebrate bio-indicators in Queens Parks and plan further research on how to conserve and rehabilitate natural areas. In the fall, 70 student proposals were submitted and 55 teams—175 students—have been accepted into the program for the 2015-16 academic year.

The *Urban Barcode Research Program* symposium was held on June 15th at the AMNH, and 20 teams comprised of 39 students presented posters and gave oral presentations. These students were selected from 130 high-achieving NYC high school students who completed *UBRP* preparatory courses. The students worked with 19 scientist mentors from 14 NYC institutions, including the AMNH, NYU, CUNY, Fordham University, and Albert Einstein Medical Center. *UBRP*

projects spanned studies of food fraud, biodiversity, conservation genetics, phylogenetics (evolution), forensics, and metabarcoding. Example projects included assessing the diversity of aquatic plants and invertebrates in freshwater ecosystems of Staten Island and investigating *Salmonella* bacteria in captive reptiles and amphibians found in NYC. The students' projects were remarkably sophisticated and mentors indicated that data from at least 11 of these studies will either contribute to, or result in, publications. This year's student cohorts represented 30 public and ten private high schools from the New York metropolitan area. Nearly one-third of participants were African American or Latino, groups underrepresented in science.

Sixty-seven students attended *Open Lab* sessions at the *Harlem DNA Lab* or Genspace in Brooklyn, and 95 students used borrowed equipment footlockers to complete their research. Teams collected and processed over 1,200 samples for DNA sequencing—an average of 17 samples per team—with over 1,600 single sequences provided by GENEWIZ, Inc. and one million reads produced by next-generation sequencing. Importantly, *UBP* and *UBRP* students produced 35 novel DNA barcodes. These are being published with the students as authors in the international database, GenBank, to make the data available for use by other researchers.

Outside of these large programs, we continued our partnership with the NYC DOE to offer a two-week DNA barcoding course at the Environmental Study Center (ESC) in Brooklyn, where teams from four public high schools assessed the biodiversity of Brooklyn's Marine Park. The students collected 92 samples, with six novel sequences published to GenBank. Most of the barcoding sequences were from plants, ants, and aquatic invertebrates. One team continued research in the *UBP* during the academic year to further study ants and macroinvertebrate biodiversity in Queens' salt marshes. Five of nine teachers trained through this collaboration at ECS have continued as mentors, either as part of the *UBP* or through sponsorship of afterschool programs on DNA barcoding at their schools.

This summer, 37 middle school students attended *Backyard Barcoding*, a one-week introduction to DNA barcoding and how it can be used to identify species. An additional 13 students attended the two-week DNA Barcoding Research camp, where students design their own research projects to study biodiversity.

Student Programs

In 2015, 20,570 students attended field trips at our three facilities: Dolan DNALC, DNALC West, and *Harlem DNA Lab*. An additional 8,908 students completed labs in-school led by DNALC staff, and 1,348 students attended week-long summer camps.

Grants from Bank of America and National Grid Foundation supported programs for over 2,500 underserved students from Long Island public school districts including Brentwood, Uniondale, William Floyd, Central Islip, and Valley Stream. An additional 17 students from the ZION STEM Academy of Elmont and 24 students from New World Prep Charter School in Staten Island received scholarships to attend the *Fun with DNA* camp in NYC. Fifteen students from IS 59 in Queens also participated in an ongoing collaboration with Northwell Health (formerly North Shore-LIJ Health System) at DNALC West, which was showcased during NYC DOE's STEMtastic event at the New York Hall of Science.

Seventy-three percent of the 2,722 students who visited the *Harlem DNA Lab* received scholarships partially funded by the William Townsend Porter Foundation, including two schools co-located within the John S. Roberts Educational Complex, the Coalition School for Social Justice and Harlem Village Academy Leadership School. The NYC DOE's Office of School Programs and Partnerships subsidized camps at the *Harlem DNA Lab* and Environmental Study Center serving 72 students.

The NYC Partner Membership Program grew in 2015 with the addition of the Lycee Francais

and Riverdale Country Schools. The eighth grade research students at Lycee Francais conducted independent research using DNA barcoding to investigate food fraud, followed by a small poster session for classmates and parents. Riverdale Country School plans to offer lab sequences for seventh, ninth, and eleventh grade students in spring 2016. The Chapin School and Marymount School of New York continued to offer the advanced elective *Molecular Genetics*, which is co-taught by DNALC instructors. In addition, lab sequences based on scientific inquiry have been implemented in the sixth, seventh, and ninth grade science classes. St. David's School completed its second year of membership with a fifth grade genetics program, eighth grade independent DNA barcoding projects, and a forensics summer camp in June. Science Research students at the Convent of the Sacred Heart in Greenwich continued DNA barcoding projects with some teams planning to perform microbiome analysis in spring 2016. Additionally, Convent of the Sacred Heart continued to offer lab sequences for middle school and high school life science, Biology, Advanced Placement Biology, and Environmental Science courses.

The college-level course *Molecular and Genomic Biology*, co-instructed by DNALC staff and Cold Spring Harbor High School faculty Jaak Raudsepp, continued as part of a long-standing collaboration with the CSH Central School District. Enrolled students spend two periods a day immersed in hands-on experimentation and independent projects, primarily at the DNALC. The 2015 cohorts—our tenth and eleventh classes in this program—have completed units in bacterial genetics, DNA barcoding, bioinformatics, RNAi, eugenics, human and plant genomics, and microbiomes.

St. Dominic High School's elective course, *Molecular and Genomic Biology Research*, continued in spring with independent projects for the third cohort of high school juniors. Some projects used DNA barcoding to study local biodiversity, while others chose to work with *C. elegans*. The fourth cohort started the five month instructional portion of the course in September with lab-based introductions to bacterial genetics, DNA barcoding, RNAi, and human genomics.

The Nassau BOCES STEM Institute (formerly Doshi STEM School) finished year two by presenting DNA barcoding posters at the *BLI* symposium. The school welcomed its third cohort of students in September. As part of an initiative to encourage independent research, a small set of tenth graders began experiments using RNAi to investigate gene function in *C. elegans*.

The footlocker kit program supporting teachers as they lead student research continued to grow in 2015. The program provides equipment and reagents to implement activities including genetics, biotechnology, and DNA barcoding. Footlocker kits were used by 1,741 students, 166 of whom were conducting independent research through *UBP*, *UBRP*, or *BLI*; over 50% were underrepresented minorities.

Monthly *Saturday DNA!* sessions drew 229 participants, with parents and grandparents joining children for classes on natural selection and the senses, cloning, bacteria and antibiotics, Gram staining, gel electrophoresis, genetic engineering, crime scene investigation, plant biology, and Ötzi the Iceman. An additional 5,421 visitors viewed the DNALC museum exhibition and/or viewed films, including Cablevision's multimedia presentation *Long Island Discovery*.

Graduate Training

Our collaboration with the Watson School of Biological Sciences provides graduate students with the opportunity to learn skills necessary for communicating with non-biologists. Watson students work with seasoned DNALC instructors to develop presentation methods that can convey unfamiliar ideas to people of any age or background. When the graduate students have completed all three phases of the training, they are prepared to quickly assess audience knowledge and structure and deliver quality lessons.

During the first training phase, Watson students observe a DNALC instructor teaching a laboratory class. Following observation, the graduate students organize a lesson plan that incorporates their knowledge into the class material. In the second phase of training, the graduate students co-teach the class they observed. DNALC instructors provide the Watson students with feedback, discussing strengths and appropriate preparation for the final phase: teaching the lesson independently under DNALC instructor observation. After completing middle school and high school rotations, Watson students select three additional lessons to demonstrate their new teaching skills. Although graduate students are well versed in their specialties, few have ever presented material to young students; the DNALC supports them as they do.

BioMedia Visitation and Projects

We again had a record number of visitors to our suite of multimedia resources in 2015. Google Analytics counted 5,460,083 visits to 24 DNALC websites. YouTube videos received 881,079 views, and the *3D Brain*, *Weed to Wonder*, and *Gene Screen* apps were downloaded 1,186,319 times. Total website, YouTube, and smartphone/tablet app visitation reached 7.52 million, an 11% increase over 2014. In-app purchases of *3D Brain HQ* netted nearly \$10,000 in 2015. We worked with the Einstein Victor Center for Jewish Genetic Diseases to give our *Gene Screen* app an interface facelift and to update it to fit on all iOS device sizes. *Gene Screen* was very popular in 2015 with 413,107 downloads, more than four times the prior year.

The *BioMedia* Group supports the DNALC's educational programs with website development and maintenance; videography and post production; program promotion through email campaigns; flyer, poster, and backdrop design; museum development; photo documentation of events and barcoding specimens; and social media management. 2015 saw an increase in development of architectural concept plans for DNALC venues and institutions adding DNALC-style laboratory classrooms. Our concept plans are often the first visualization of a potential lab or new DNALC licensed venue; this year we worked on:

- DNALC Asia: DNALC concept plans were used to solicit design and construction bids prior to renovation that started in October. The plan included eight teaching labs, two bioinformatics labs, prep labs, and offices in a two-story circular building, as well as an exhibition hall in all glass dome building, and a separate cafeteria, all covering more than 30,000 square feet. We also worked closely with Centerbrook Architects to develop a 3D concept plan of the interior of a cell displayed in the all glass dome building; the plan was proposed to the SIP Advisory Committee at a visit to CSHL in July.
- Potential DNALC at CUNY in Brooklyn: We created a plan for about 25,000 square feet of space, then Centerbrook Architects and Planners designed and created a 3D rendering with four teaching labs, two research labs, two bioinformatics classrooms, offices, lunch, and exhibition space.
- Beijing 166 High School, including two laboratory classrooms to accommodate up to 45 students.
- Godfrey Okoye University, Nigeria: the proposed plan included three DNALC signature teaching labs, research lab, prep lab, bioinformatics lab, 1,000 square foot exhibition gallery, conference room, and office space.
- North Royalton High School, winner of the Breakthrough Junior Challenge Prize: We are working with school staff to help develop a DNALC signature teaching lab and prep area adjacent to typical classroom space.

BOLD (named for the acronym for the Barcode of Life Data Systems), an art exhibition by Seattle-based artist Joseph Rossano, was installed in the front and side halls of the DNALC in



Above: Dave Micklos (left), artist Joseph Rossano, and guests chat during the reception.

Left: Daniel Janzen presents his talk in Grace Auditorium.

September 2014. For the artwork in *BOLD*, Rossano partnered with biologists to engage the public around the science of DNA barcoding and how it is being used to catalog the world's vast and threatened biodiversity. During the year, the *BioMedia* Group developed a *BOLD* website to provide a deeper understanding of the species featured in the artwork; the site is directly linked through QR codes on the labels adjacent to each work (<http://museum.dnalc.org/bold/>). On the site, Rossano provides a video introduction to each series in the show and viewers can link to the BOLD database entry for the organism depicted in the art. We also worked with DNALC educators to develop a student guide for the art exhibit, and collaborated with Rossano, researchers, and art critics to develop a catalog booklet for the show.

In September, we hosted an event for *BOLD*. Guests began the evening viewing the artwork at a reception at the DNALC, and then moved to Grace Auditorium on the CSHL campus for a talk by Dr. Daniel Janzen from the Area de Conservación Guanacaste (ACG) in Costa Rica and Professor of Biology at the University of Pennsylvania. Janzen's work, as well as that of researchers from

the University of California, Berkeley Moorea Biocode Project at the Richard B. Gump South Pacific Research Station in Moorea, served as inspiration for Rossano's art. Janzen's talk, "Exploring the world from its insides out, as well as outsides in; how to really save tropical biodiversity" focused on how he employs local parataxonomists in Costa Rica to aid in his conservation and research efforts in ACG.

The *BioMedia* Group played a significant role in the development of the Ötzi display. We cooperated with the CSHL facilities department to transform the exhibit space into the Italian Alps over the summer, including a full-wall



mural of the Ötztal Mountains where the mummy was found in 1991. A majority of the space was completed in time to welcome a NOVA film crew working on the *Iceman Reborn* documentary being produced by BSquared Media. The crew filmed sculptor Gary Staab (in blue to the right of Ötzi) with the Ötzi replica and fielding question with students attending our summer camps (see photo); interviewed Dr. Watson, director Dave Micklos, and educator Elna Carrasco; and shot lots of "B-roll" footage at the DNALC and on the CSHL campus. Through the fall, content for the interpretive labels was developed working with DNALC educators, an all-glass case arrived to house Ötzi, and finishing touches were put on the exhibit space. NOVA *Iceman Reborn* will air on PBS in February 2016.

Staff and Interns

In 2015 we said goodbye to several staff members. In January, Mohammed Khalfan accepted a position as a Bioinformatics Specialist at the Center for Genomics and Systems Biology at New York University. He joined the DNALC as a computer programmer in 2010 and worked on many projects including DNA Subway.

Brooke Roeper Hohman began with our teaching team in 2012. With a background in education she was a perfect fit to our instructional family, teaching mostly high school and some middle school classes. Shortly after her wedding in the spring, she accepted a position at Evolution Health as manager of Outcomes and Epidemiology, which relocated her to her roots in Ohio.

Antonia Florio began with us in 2013, as a Conservation Genetics instructor, and was promoted to Manager, Research in 2014. She assumed a pivotal role as manager of UBP and UBRP, which included the assessment of project proposals, arranging for the evaluations, planning/organizing project symposiums, and lab instruction at all three DNALC facilities. She was also responsible for applying for funding, facilitating student evaluation, and guiding new staff heading BLI. In August, she left the DNALC for a full-time professorship at Saint Francis College in Brooklyn and is teaching Introduction to Cell Biology and Forensics.

Hired as a college intern in 2013, Ashleigh Jackobel was promoted to Lab Instructor the following year. Her enthusiasm and skill allowed her to make the transition from lab to classroom flawlessly. She was adept at teaching both middle and high school classes, helped with lab prep, and worked with interns. In the fall, she left to pursue a graduate degree at SUNY Upstate Medical University in Syracuse, NY.

A technician in Greg Hannon's lab, Emily Harrison became a part-time Middle School Instructor in 2014. While honing her skills as a teacher, she applied and was accepted into U.C. Berkeley's Science Education Ph.D. program.

Shreya Shah began in 2014 as a high school educator and an assistant manager for BLI. When her husband was hired for a teaching position at Westchester University in Pennsylvania, she had the opportunity to join him there as adjunct faculty in the summer.

With several positions to fill, two educators joined the DNALC in June. Sharon Peppenella stepped in as a High School Educator after over a decade studying in western New York. She completed a Bachelor of Science from SUNY Geneseo, moving on to earn a Ph.D. in biochemistry from the University of Rochester. Her research focused on the histone protein H4 tail domain and its contributions to the formation of chromatin structure. Her teaching experience includes hands-on science education with elementary school students, as well as mentoring and tutoring undergraduate and graduate students. Sharon is co-managing *Barcode Long Island* and also oversees laboratory prep and troubleshooting.

Cristina Fernandez-Marco of Santander, Spain joined the DNALC as a high school educator after studying the molecular genetics of plant development on the CSHL campus. Before coming to

the US, Cristina received her Ph.D. in Plant Biology from the Spanish National Research Council. Cristina co-manages BLI and is also developing labs for student research programs.

Paul Donat, college intern since 2012, was hired as our first full time lab technician in 2015. After graduating SUNY Geneseo with a B.S. in Biochemistry, he moved back to Long Island just as we found ourselves requiring more help in the lab, so we created a new position for him. Paul assisted with training college interns and organizing prep for all of our onsite and offsite courses, international collaborations, teacher trainings, BLI open labs and footlockers, and developed a new organization system for our equipment. In June, Paul was promoted to full-time high school educator.

Emtiaz Uddin started in June, replacing Paul as lab technician. A recent graduate of Stony Brook University with a Bachelor's degree in Biology, he is currently working on a Master's Degree in Health Administration at Hofstra University. Emtiaz was born and raised in Elmont, New York and enhanced his experience in the sciences through an internship with the North Shore Long Island Jewish medical system.

Pan Teng joined the DNALC as a bioinformatician. Originally from Xi'an, Shaanxi, China, she completed a Master of Science degree in Bioinformatics at the University of Delaware. Her role as a Research Assistant exploring cellular function at the University of Delaware strengthened her knowledge in the field of bioinformatics, making her a valuable addition to the team at the DNALC. Pan helps build and maintain the DNALC websites and develop software.

After more than a year without a Program Evaluator, we were thrilled to welcome Lindsay Barone of Oregon, WI in November. She received a Master of Science and a Ph.D. in Anthropology from the University of Wisconsin-Milwaukee. She also earned minor degrees in museum studies and biological sciences. Before joining the DNALC, Lindsay worked as an adjunct professor, lab instructor, and intern at several institutions, including the American Museum of Natural History. Lindsay will be evaluating several projects at the DNALC including RNA-Seq for the Next Generation, *iPlant*, and DNALC collaborations in China.

Joslynn Lee started in a new position, Data Science Educator, just after Thanksgiving. Originally from Upper Fruitland, NM, Joslynn completed a Bachelor of Science in Chemistry at Fort Lewis College in Durango, CO and became a research associate in bioanalytical chemistry for Vertex Pharmaceuticals, Inc. in Cambridge, MA. She went on to pursue a Ph.D. in Chemistry from Northeastern University in Boston. Joslynn joins the DNALC after completing her postdoctoral research at the University of Minnesota Medical School in Duluth. She will develop course content and lead training workshops on bioinformatics and data science for *iPlant Collaborative*.



New to the DNALC in 2015: Sharon Pepenella, Cristina Fernandez-Marco, Emtiaz Uddin, Pan Teng, Lindsay Barone, and Joslynn Lee.

Since the DNALC opened, we have relied on high school and college interns to support our day-to-day operations. The *BioMedia* Group also welcomes interns for summer or longer-term roles. An internship offers students the unique opportunity to gain real laboratory or design

experience in an educational environment. We gathered an amazing group of interns this year and said farewell as others left for college:

High School Interns

Brady Anna, St Anthony's High School	Gabrielle Nagel, Friends Academy
Alyssa DiArrigo, Bethpage High School	Gabrielle Ramirez, Walt Whitman High School
Juliana Eastment, Oyster Bay High School	Rahul Ranjan, Hicksville High School
Alec Haber, Syosset High School	Ben Rhee, Syosset High School
Kimberly Ho, Stuyvesant High School	Melissa Troy, Burbank High School
Derek Lee, Elwood-John H. Glenn High School	Maria Urbina, Oyster Bay High School
John Messina, Chaminade High School	Scott Venturino, Huntington High School
Stefanie Montalbano, Our Lady of Mercy Academy	Bijia Wang, Syosset High School
	GraceAnne Woods, Glen Cove High School

High School Interns Departing for College

Kayla Bianco, Bucknell University	Lenni Joya Amaya, Marist College
Abigail Buckley, Dartmouth College	Thomas Kontos, SUNY at Buffalo
Kenneth Collado, Stony Brook University	Nicholas Nicolio, Fordham University
Liam Gensel, SUNY at Buffalo	Gavrielle Rood, Cornell University
Omotayo Ikuomenisan, Hunter College	Breanna Tahany, SUNY at Binghamton
Aiseosa Irowa	Blakelee Woods, Columbia University

College Interns

Kathryn Bellissimo, The College of New Jersey	Ryan Lauter, Maryland Institute College of Art
Gabrielle Blazich, Fordham University	Michaela Lee, SUNY at Oneonta
Brittany Coscio, College of the Holy Cross	William McBrien, Suffolk Community College
Ariana Forohar, University of California, Los Angeles	Pauline McGlone, Hunter College
Nella Hauser, Stony Brook University	Stephen Shybunko, Stony Brook University
Marie Jean Francois, CUNY City College	Keil Thomas, New York University

David Micklos
DNA Learning Center Executive Director

2015 Grants

Grantor	Program	Duration of Grant	2015 Funding+
<i>FEDERAL GRANTS</i>			
National Institutes of Health	<i>Barcode Long Island</i>	7/14–3/19	207,159
National Science Foundation	<i>Infrastructure and Training to Bring Next-generation Sequence (NGS) Analysis into Undergraduate Education</i>	9/13–8/16	179,676
National Science Foundation, University of Arizona	<i>iPlant Collaborative: Cyberinfrastructure for the Life Sciences</i>	9/13–8/16	788,133
National Science Foundation	<i>Advanced Technology Education (ATE) Genomic Approaches in BioSciences</i>	4/11–3/16	129,235
<i>NON-FEDERAL GRANTS</i>			
Albert Einstein Healthcare Network	<i>Gene Screen App</i>	9/15–8/16	11,500
Alfred P. Sloan Foundation	<i>DNA Center NYC Start-up</i>	12/13–11/16	116,994
Bank of America Charitable Foundation	<i>Genetics and Biotechnology Lab</i>	11/14–11/16	25,000
Beijing No. 166 High School	<i>Chinese Collaboration Agreement</i>	5/14–4/16	120,026
National Grid Foundation	<i>Scholarships for Minority and Underserved Students in the Central Islip Union-Free School District</i>	10/14–10/16	15,000
Pinkerton Foundation	<i>Urban Barcode Research Program</i>	1/13–5/16	110,695
William Townsend Porter Foundation	<i>Harlem DNA Lab for Underprivileged Students</i>	4/14–3/16	13,500

+ Includes direct and indirect costs.

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

Bellmore-Merrick Central High School District	1,500	Long Beach City School District	1,500
East Meadow Union Free School District	1,500	Massapequa Union Free School District	1,500
East Williston Union Free School District	2,250	North Shore Central School District	1,500
Elwood Union Free School District	1,500	North Shore Hebrew Academy	1,500
Fordham Preparatory School	1,500	Oceanside Union Free School District	1,500
Garden City Union Free School District	1,500	Plainedge Union Free School District	1,500
Half Hollow Schools Central School District	1,500	Plainview-Old Bethpage Central School District	1,500
Harborfields Central School District	1,500	Portledge School	1,500
Herricks Union Free School District	1,500	Port Washington Union Free School District	1,500
Island Trees Union Free School District	1,500	Ramaz Upper School	1,500
Jericho Union Free School District	3,000	Syosset Central School District	1,500
Levittown Union Free School District	1,500	Yeshiva University High School for Girls	3,000
Locust Valley Central School District	1,500		

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

Bellmore Union Free School District	2,400	Laurel Hill School	1,300
Berkeley Carroll School	1,300	Lawrence Union Free School District	2,100
Bethpage UFSD	1,300	Lindenhurst Union Free School District	1,000
Cold Spring Harbor Central School District	10,800	Locust Valley Central School District	8,950
Commack UFSD	1,300	Merrick Union Free School District	3,400
East Meadow Union Free School District	3,295	Mott Hall II, NYC	1,400
East Williston Union Free School District	1,575	North Bellmore Union Free School District	2,600
Eastwoods School	2,700	Northport-East Northport UFSD	1,000
Elwood Union Free School District	7,425	Oceanside Union Free School District	1,625
Floral Park–Bellerose Union Free School District	7,800	Oyster Bay–East Norwich Central School District	2,400
Garden City Union Free School District	17,180	Port Washington Union Free School District	10,300
Great Neck Union Free School District	8,250	PS 144, NYC	2,600
Half Hollow Hills Union Free School District	7,875	Rockville Centre Union Free School District	6,240
Herricks UFSD	1,400	Roslyn Union Free School District	5,250
Hicksville Public Schools	1,400	Saint Dominic Elementary School	3,750
Hofstra STEP	1,500	Saint Patrick School, Huntington	1,300
Horace Mann School	2,400	Smithtown Union Free School District	4,800
Huntington Union Free School District	8,350	Syosset Union Free School District	38,550
Incarnation School, NYC	1,950	Three Village Central School District	4,550
Island Park Public Schools	3,900	Trevor Day School	1,050

Sites of Major Faculty Workshops

Program Key: *Middle School* High School College

State	Institution	Year(s)
ALABAMA	University of Alabama, Tuscaloosa	1987–90
	Hudson Alpha Institute, Huntsville	2014
ALASKA	University of Alaska, Anchorage	2012
	University of Alaska, Fairbanks	1996
ARIZONA	Arizona State University, Tempe	2009
	Tuba City High School	1988
	University of Arizona, Tucson	2011
	United States Department of Agriculture, Maricopa	2012
ARKANSAS	Henderson State University, Arkadelphia	1992
	University of Arkansas, Little Rock	2012
CALIFORNIA	California State University, Dominguez Hills	2009
	California State University, Fullerton	2000
	California State University, Long Beach	2015
	California Institute of Technology, Pasadena	2007
	Canada College, Redwood City	1997
	City College of San Francisco	2006
	City College of San Francisco	2011, 2013
	Community College of Denver	2014
	Contra Costa County Office of Education, Pleasant Hill	2002, 2009
	Foothill College, Los Altos Hills	1997
	Harbor-UCLA Research & Education Institute, Torrance	2003
	Los Angeles Biomedical Research Institute (LA Biomed), Torrance	2006
	Laney College, Oakland	1999
	Lutheran University, Thousand Oaks	1999
	Oxnard Community College, Oxnard	2009
	Pasadena City College	2010
	Pierce College, Los Angeles	1998
	Salk Institute for Biological Studies, La Jolla	2001, 2008
	San Francisco State University	1991
	San Diego State University	2012
	San Jose State University	2005
	Santa Clara University	2010
	Southwestern College, Chula Vista	2014, 2015
	Stanford University, Palo Alto	2012
	University of California, Berkeley	2010, 2012
	University of California, Davis	1986
	University of California, Davis	2012, 2014, 2015
	University of California, Long Beach	2015
	University of California, Northridge	1993
	University of California, Riverside	2011
	University of California, Riverside	2012
	University of California, San Francisco	2015
COLORADO	Aspen Science Center	2006
	Colorado College, Colorado Springs	1994, 2007
	Colorado State University, Fort Collins	2013
	Community College of Denver	20140

	United States Air Force Academy, Colorado Springs	1995
	University of Colorado, Denver	1998, 2009–10
CONNECTICUT	Choate Rosemary Hall, Wallingford	1987
DISTRICT OF COLUMBIA	Howard University, Washington	1992, 1996, 2009–10
FLORIDA	Armwood Senior High School, Tampa	1991
	Florida Agricultural & Mechanical University, Tallahassee	2007–08
	Florida Agricultural & Mechanical University, Tallahassee	2011
	Florida SouthWestern State University, Fort Myers	2015
	North Miami Beach Senior High School	1991
	Seminole State College, Sanford	2013-14
	University of Miami School of Medicine	2000
	University of Western Florida, Pensacola	1991
GEORGIA	Fernbank Science Center, Atlanta	1989, 2007
	Gwinnett Technical College, Lawrenceville	2011, 2012
	Morehouse College, Atlanta	1991, 1996–97
	Spelman College, Atlanta	2010
	University of Georgia, Athens	2015
HAWAII	Kamehameha Secondary School, Honolulu	1990
	University of Hawaii at Manoa	2012
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
INDIANA	Butler University, Indianapolis	1987
	Purdue University, West Lafayette	2012
IDAHO	University of Idaho, Moscow	1994
IOWA	Drake University, Des Moines	1987
KANSAS	University of Kansas, Lawrence	1995
KENTUCKY	Bluegrass Community & Technical College, Lexington	2012–14
	Murray State University	1988
	University of Kentucky, Lexington	1992
	Western Kentucky University, Bowling Green	1992
LOUISIANA	Bossier Parish Community College	2009
	Jefferson Parish Public Schools, Harvey	1990
	John McDonogh High School, New Orleans	1993
	Southern University at New Orleans	2012
MAINE	Bates College, Lewiston	1995
	Southern Maine Community College	2012–13
	Foundation for Blood Research, Scarborough	2002
MARYLAND	Annapolis Senior High School	1989
	Bowie State University	2011, 2015
	Frederick Cancer Research Center	1995
	McDonogh School, Baltimore	1988
	Montgomery County Public Schools	1990–92
	National Center for Biotechnology Information, Bethesda	2002
	<i>St. John's College, Annapolis</i>	1997
	University of Maryland, School of Medicine, Baltimore	1999
MASSACHUSETTS	Arnold Arboretum of Harvard University, Roslindale	2011
	Beverly High School	1986

	Biogen Idec, Cambridge	2002, 2010
	Boston University	1994, 1996
	CityLab, Boston University School of Medicine	1997
	Dover-Sherborn High School, Dover	1989
	Randolph High School	1988
	The Winsor School, Boston	1987
	Whitehead Institute for Biomedical Research, Cambridge	2002
MICHIGAN	Athens High School, Troy	1989
	Schoolcraft College, Livonia	2012
MINNESOTA	American Society of Plant Biologists, Minneapolis	2015
	Minneapolis Community and Technical College, Madison	2009
	Minneapolis Community and Technical College, Madison	2013
	University of Minnesota, St. Paul	2005
	University of Minnesota, St. Paul	2010
MISSISSIPPI	Mississippi School for Math & Science, Columbus	1990–91
	Rust College, Holly Springs	2006–08, 2010
MISSOURI	St. Louis Science Center	2008–10
	Stowers Institute for Medical Research, Kansas City	2002, 2008
	University of Missouri, Columbia	2012
	Washington University, St. Louis	1989, 1997, 2011
MONTANA	Montana State University, Bozeman	2012
NEBRASKA	University of Nebraska-Lincoln, Lincoln	2014
NEVADA	University of Nevada, Reno	1992, 2014
NEW HAMPSHIRE	Great Bay Community College, Portsmouth	2009
	New Hampshire Community Technical College, Portsmouth	1999
	St. Paul's School, Concord	1986–87
NEW JERSEY	Coriell Institute for Medical Research, Camden	2003
	Raritan Valley Community College, Somerville	2009
NEW MEXICO	Biolink Southwest Regional Meeting, Albuquerque	2008
	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
	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, 2015
	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
	Dolan DNA Learning Center	1990, 1992, 1995, 2000–11
	<i>Dolan DNA Learning Center</i>	1990–92
	DNA Learning Center West	2005
	Environmental Science Center, Bergen Beach, Brooklyn	2015
	<i>Fostertown School, Newburgh</i>	1991
	<i>Harlem DNA Lab, East Harlem</i>	2008–09, 2011–13
	Harlem DNA Lab, East Harlem	2015
	Huntington High School	1986

	Irvington High School	1986
	John Jay College of Criminal Justice	2009
	<i>Junior High School 263, Brooklyn</i>	1991
	<i>Lindenhurst Junior High School</i>	1991
	Mount Sinai School of Medicine, New York	1997
	Nassau Community College, Garden City	2013
	New York Botanical Garden, Bronx	2013
	New York City Department of Education	2007, 2012
	New York Institute of Technology, New York	2006
	New York Institute of Technology, New York	2006
	<i>Orchard Park Junior High School</i>	1991
	<i>Plainview-Old Bethpage Middle School</i>	1991
	State University of New York, Purchase	1989
	State University of New York, Stony Brook	1987-90, 2015
	State University of New York, Stony Brook	2014
	Stuyvesant High School, New York	1998-99
	The Rockefeller University, New York	2003, 2015
	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
NORTH DAKOTA	North Dakota State University, Fargo	2012
OHIO	Case Western Reserve University, Cleveland	1990
	Cleveland Clinic	1987
	Langston University, Langston	2008
	North Westerville High School	1990
OKLAHOMA	Oklahoma City Community College	2000
	Oklahoma City Community College	2006-07, 2010
	Oklahoma Medical Research Foundation, Oklahoma City	2001
	Oklahoma School of Science and Math, Oklahoma City	1994
	Tulsa Community College, 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	2007-09, 2013

	Austin Community College – Roundrock Campus	2012
	Houston Community College Northwest	2009–10
	J.J. Pearce High School, Richardson	1990
	Langham Creek High School, Houston	1991
	University of Lone Star College, Kingwood	2011
	Midland College	2008
	Southwest Foundation for Biomedical Research, San Antonio	2002
	Taft High School, San Antonio	1991
	Texas A&M University, College Station	2013
	Texas A&M University, Prairie View	2013
	Texas A & M, AG Research and Extension Center, Weslaco	2007
	Trinity University, San Antonio	1994
	University of Texas, Austin	1999, 2004, 2010, 2012
	University of Texas, Brownsville	2010
UTAH	Brigham Young University, Provo	2012
	University of Utah, Salt Lake City	1993
	University of Utah, Salt Lake City	1998, 2000
	Utah Valley State College, Orem	2007
VERMONT	University of Vermont, Burlington	1989
VIRGINIA	Eastern Mennonite University, Harrisonburg	1996
	Jefferson School of Science, Alexandria	1987
	Mathematics and Science Center, Richmond	1990
	Mills Godwin Specialty Center, Richmond	1998
	Virginia Polytechnic Institute and State University, Blacksburg	2005, 2008–09
WASHINGTON	Fred Hutchinson Cancer Research Center, Seattle	1999, 2001, 2008
	Shoreline Community College	2011, 2012
	University of Washington, Seattle	1993, 1998, 2010
WEST VIRGINIA	Bethany College	1989
WISCONSIN	Blood Center of Southeastern Wisconsin, Milwaukee	2003
	Madison Area Technical College/Madison Area College	1999, 2009, 2011–14
	Marquette University, Milwaukee	1986–87
	University of Wisconsin, Madison	1988–89
	University of Wisconsin, Madison	2004, 2012
WYOMING	University of Wyoming, Laramie	1991
PUERTO RICO	Universidad del Turabo, Gurabo, Puerto Rico	2011, 2012, 2014
	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Mayaguez	1992
	University of Puerto Rico, Rio Piedras	1993
	University of Puerto Rico, Rio Piedras	1994
AUSTRALIA	Walter and Eliza Hall Institute and University of Melbourne	1996
AUSTRIA	Vienna Open Lab, Vienna	2007, 2012
CANADA	Red River Community College, Winnipeg, Manitoba	1989
CHINA	Beijing No. 166 High School, Beijing	2013, 2014, 2015
	Ho Yu College, Hong Kong	2009
DENMARK	Faroe Genome Project, Torshavn, Faroe Islands	2013
GERMANY	Urania Science Center, Berlin	2008
IRELAND	European Conference on Computational Biology/Intelligent System for Molecular Biology Conference, Dublin	2015
ITALY	International Institute of Genetics and Biophysics, Naples	1996
	Porto Conte Research and Training Laboratories, Alghero	1993
MEXICO	ASPB Plant Biology, Merida	2008

NIGERIA	Godfrye Okoye University, Enugu, Nigeria, Africa	2013
PANAMA	University of Panama, Panama City	1994
RUSSIA	Shemyakin Institute of Bioorganic Chemistry, Moscow	1991
SINGAPORE	National Institute of Education	2001–05
	Singapore Science Center	2013
SWEDEN	Kristineberg Marine Research Station, Fiskebackskil	1995
	Uppsala University	2000
THE NETHERLANDS	International Chromosome Conference, Amsterdam	2007
	Wageningen University and Research Center, Wageningen	2014
UNITED KINGDOM	The Genome Analysis Center, Norwich	2015
	Wellcome Trust Conference Center, Hinxton	2012–13
	University of Warwick, Coventry	2013

Workshops, Meetings, Collaborations, and Site Visits

January 5–9	NSF ATE Professional Development <i>Genomic Approaches in BioSciences</i> Workshop, Southwestern College, Chula Vista, California
Jan 6–Feb 12	Pinkerton <i>Urban Barcode Research Project, Conservation Genetics</i> Workshop (Tuesdays and Thursdays), American Museum of Natural History, New York, New York
January 10	<i>Saturday DNA!</i> “The Eyes Have It,” DNALC
January 11–14	International Plant & Animal Genome XXIII Conference 2015, Bioinformatic Ice Cream Social, San Diego, California
January 13	<i>Urban Barcode Project/Urban Barcode Research Project</i> Open Lab, <i>Harlem DNA Lab</i>
January 15	NSF <i>iPlant Collaborative</i> Webinar, “Getting Started with <i>iPlant</i> ,” DNALC
January 15	<i>Urban Barcode Project/Urban Barcode Research Project</i> Open Lab, Genspace, Brooklyn, New York
January 22	Site visit by Dr. J. Armando Barriguete and Alonso Sanz, Mexico City, Mexico
January 22	Site visit by Dr. Ben Dubin-Thaler, <i>Harlem DNA Lab</i>
January 29–30	NSF <i>iPlant Collaborative</i> Professional Development <i>Tools & Services</i> Workshop, Clemson University, Clemson, South Carolina
February 2	Center for Education Innovation – Public Education Association Professional Development Short DNA Fingerprinting Workshop, <i>Harlem DNA Lab</i>
February 2–6	<i>DNA Science</i> Workshops with students from Beijing No. 166 School, Beijing, China, CSHL
February 3	<i>Urban Barcode Project/Urban Barcode Research Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 3	CSHL <i>Gramene: A Resource for Comparative Plant Genomics</i> Webinar, DNALC
February 6	Site visit by Lilly Wang and Jun Go, State University of New York at Albany, Albany, New York
February 6	NSF <i>Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education</i> Video Conference, DNALC
February 7	<i>Saturday DNA!</i> “Gram-tastic!” DNALC
February 9–13	DNA Barcoding Workshops with students from Beijing No. 166 School, Beijing, China, CSHL
February 11	NSF <i>iPlant Collaborative</i> Webinar, “Getting Started with <i>iPlant</i> ,” DNALC
February 12	<i>Urban Barcode Project/Urban Barcode Research Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 17–20	Pinkerton <i>Urban Barcode Research Project, Conservation Genetics</i> Workshop, The Rockefeller University, New York, New York
February 24	<i>Urban Barcode Project/Urban Barcode Research Project</i> Open Lab, <i>Harlem DNA Lab</i>
February 24	CSHL <i>Gramene: A Resource for Comparative Plant Genomics</i> Webinar, DNALC
Feb 24–April 2	Pinkerton <i>Urban Barcode Research Project, DNA Barcoding</i> Workshop (Tuesdays and Thursdays) American Museum of Natural History, New York, New York

- February 28 The Brearley School STEAM Event Presentation, "The DNALC," The Brearley School, New York, New York
- March 5 *Urban Barcode Project/Urban Barcode Research Project Open Lab, Harlem DNA Lab*
- March 6–8 NSF *iPlant Collaborative* Software Carpentry Workshop, New York Academy of Science, New York, New York
- March 8–14 *DNA Barcoding Workshop*, Environmental Science Center, Bergen Beach, Brooklyn, New York
- March 10 *Urban Barcode Project/Urban Barcode Research Project Open Lab, Harlem DNA Lab*
- March 10 NIH *Barcode Long Island* Presentation, "A Day in the Life..." Brookhaven National Laboratory, Upton, New York
- March 11 NSF *iPlant Collaborative* Webinar, "Getting Started with *iPlant*," DNALC
- March 12 *DNA Barcoding* Presentation, Bronx Community College, Bronx, New York
- March 14 *Saturday DNA!* "Cauliflower Cloning," DNALC
- March 14 NIH *Barcode Long Island* Workshop, DNALC
- March 17 CSHL *Gramene: A Resource for Comparative Plant Genomics* Webinar, DNALC
- March 19 *Urban Barcode Project/Urban Barcode Research Project Open Lab, Harlem DNA Lab*
- March 19 "The American Eugenics Movement" Seminar, New Canaan Library, New Canaan, Connecticut
- March 21 NIH *Barcode Long Island* Workshop, DNALC
- March 23–26 NSF *iPlant Collaborative* Data Carpentry Hack-a-thon Workshop, CSHL
- March 23–27 NSF ATE Professional Development Genomic Approaches in BioSciences Workshop, University of California, San Francisco, California
- March 24 NIH *Barcode Long Island* Open Lab, DNALC
- March 25 Site visit by Diego Ulibarri, A.D.N. Mexico, Morelia, Mexico
- March 25–27 Site visit by Andrea Jimenez Garcia, Mexico City, Mexico
- March 28 Science Council of New York City Conference, "DNA Barcoding," Stuyvesant High School, Brooklyn, New York
- March 30 Site visit by David Manning, Scott Bronson, and Ken White, Brookhaven National Laboratory, Upton, New York
- April 6–10 Pinkerton *Urban Barcode Research Project, DNA Barcoding* Workshop, Rockefeller University, New York, New York
- April 7 CSHL *Gramene: A Resource for Comparative Plant Genomics* Webinar, DNALC
- April 8 NSF *iPlant Collaborative* Webinar, "Getting Started with *iPlant*," DNALC
- April 9 Pinkerton *Urban Barcode Research Project* Informational Presentation: "Presenting at a Symposium," Irondale Theater Company, Brooklyn, New York
- April 10 Site visit by Bill Schierberl with Ivory Coast Education Committee, Universite de Cocody, Abidjan, Ivory Coast, Africa
- April 13–15 *DNA Fingerprinting* Workshops, Beijing No. 166 School, Beijing, China
- April 14 NSF *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education* Video Conference, DNALC
- April 16 Site visit by Paul Orselli, Paul Orselli Workshop, Baldwin, New York
- April 16 NIH *Barcode Long Island* Open Lab, DNALC
- April 16 Math for America Learning Center, *DNA Barcoding* Information Session, New York, New York
- April 17 Site visit by Russell Holtzer, Gillian Small, Alan Dobrin, and Judy Bergtraum, City University of New York, New York, New York
- April 17–22 *DNA Fingerprinting* Workshops at Beijing 166 School, Beijing, China
- April 18 NIH *Barcode Long Island* Workshop, DNALC
- April 19–22 NSF *iPlant Collaborative* Train-the-Trainers Workshop, United States Department of Agriculture/Agricultural Research Service, "Big Data: Variant Analysis," CSHL
- April 25 *Saturday DNA!* "Bacteria and Antibiotics," DNALC
- April 25 NIH *Barcode Long Island* Workshop, DNALC
- April 27 Site visit by Yaqin Xu, Weill Cornell Medical College, New York, New York

- April 27–28 Cold Spring Harbor First Grade Science Fair, “DNA Extraction & Better Milk for Cats,” CSHL
- May 1 Site visit by Dr. Julian Rayner, Wellcome Trust Genome Campus, Hinxton, England
- May 2 NIH *Barcode Long Island* Workshop, DNALC
- May 4 NSF *iPlant Collaborative* Webinar, “Getting Started with *iPlant*,” DNALC
- May 5 Studio recording of talk by Michael Wigler of CSHL for Karolinska Institutet in Stockholm, Sweden, “Spontaneous Mutations for Autism Spectrum Disorders,” DNALC
- May 7–8 NSF *iPlant Tools & Services* Workshop, University of Georgia, Athens, Georgia
- May 9 NIH *Barcode Long Island* Workshop, Stony Brook University, Stony Brook, NY
- May 11 National Research Council Meeting: Integrating Discovery-based Research into the Undergraduate Curriculum, “Workflows, Scalable Infrastructure, and the Challenges of Biological Big Data,” National Academy of Sciences, Washington, D.C.
- May 14 “Professor for a Day,” Yeshiva University, CSHL
- May 15 Site visit by Dr. Ben Dubin-Thaler, BioBus, New York, New York
- May 16 *Saturday DNA!* “The Genetic Engineering Toolbox,” DNALC
- May 18–19 NSF *iPlant Collaborative Tools & Services* Workshop, Santa Fe Community College, Santa Fe, New Mexico
- May 19 CSHL *Gramene: A Resource for Comparative Plant Genomics* Webinar, DNALC
- May 19 Site visit by Instructional Group, Lycee Francais, New York, New York
- May 21–22 NSF *iPlant Collaborative Genomics in Education* Workshop, Santa Fe Community College, Santa Fe, New Mexico
- May 23 NIH SEPA SciEd Conference, “Sustainability: Capitalize on Your Intellectual Property,” Washington, D.C.
- May 27 *Urban Barcode Project* Poster Session, American Museum of Natural History, New York, New York
- May 28–29 American Society for Microbiology Conference for Undergraduate Education, “The *Urban Barcode Research Project*,” Austin, Texas
- May 29 NSF *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education* Webinar, DNALC
- May 30 World Science Festival, “Glowing Genes,” New York, New York
- June 3 NSF *iPlant Collaborative* Webinar, “Getting Started with *iPlant*,” DNALC
- June 3 NSF *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education* Video Conference, DNALC
- June 4 Center for Education Innovation – Public Education Association Professional Development Workshop, “Restriction Analysis,” *Harlem DNA Lab*
- June 5 NIH *Barcode Long Island* Symposium, DNALC
- June 6 CSHL 125th Anniversary Open House, “DNA Extraction & Observing Mutant Organisms,” CSHL
- June 6 *Saturday DNA!* “Going the Distance!” DNALC
- June 6 The New York City Biome Map Bacterial Printing Workshop, Genspace, Brooklyn, New York
- June 8 *Urban Barcode Project* Symposium, American Museum of Natural History, New York, New York
- June 8 New York City Department of Education STEMtastic Event, “Observing Mutant Organisms,” New York Hall of Science, New York, New York
- June 8–12 NSF Professional Development *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education* Workshop, Bowie State University, Bowie, Maryland
- June 8–12 *Fun with DNA* Workshop, Convent of the Sacred Heart, Greenwich, Connecticut
- June 15 Pinkerton *Urban Barcode Research Project* Symposium, American Museum of Natural History, New York, New York
- June 15–16 NSF *iPlant Tools & Services* Workshop, South Dakota State University, Brookings, South Dakota
- June 15–19 Forensics Workshop, St. David’s School, New York, New York

- June 15–19 *World of Enzymes Workshop*, Convent of the Sacred Heart, Greenwich, Connecticut
- June 18–19 NSF *iPlant* Genomics in Education Workshop, South Dakota State University, Brookings, South Dakota
- June 22 NSF *iPlant Collaborative Webinar*, “Getting Started with *iPlant*,” DNALC
- June 22 CSHL *Gramene: A Resource for Comparative Plant Genomics Webinar*, DNALC
- June 22–26 *Fun with DNA Workshop*, Marymount School, New York, New York
- June 22–26 NSF Professional Development *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education Workshop*, California State University, Long Beach, California
- June 29–July 2 *Forensic Detectives Workshop*, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
- June 29–July 2 Pinkerton *Urban Barcode Research Project Conservation Genetics Workshop*, *Harlem DNA Lab*
Fun with DNA Workshop, DNALC West
- June 29–July 3 *DNA Science Workshop*, DNALC
- June 29–July 17 NSF *Applied Biotechnology Initiative*, Bowie State University Faculty and Student Training, DNALC
- June 30 NSF *iPlant Collaborative Webinar*
- July 2–3 NSF *iPlant Collaborative Tools & Services Workshop*, The Genome Analysis Center, Norwich, United Kingdom
- July 6–10 *DNA Science Workshop*, DNALC
Fun with DNA Workshop, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
World of Enzymes Workshop, DNALC West
DNA Barcoding Workshop, *Harlem DNA Lab*
- July 7–8 Lightning Talk: “NSF *iPlant Collaborative Resources for Science*,” Galaxy Community Conference, Norwich, United Kingdom
- July 11–14 NSF *iPlant Collaborative Half Workshop*, “Using Biological Cyberinfrastructure to Scale Science and People – Applications in Data Storage, HPC, Cloud Analysis, and Bioinformatics Training,” Applied Knowledge Exchange Session, European Conference on Computational Biology/Intelligent Systems for Molecular Biology Conference, Dublin, Ireland
- July 13–17 *Forensic Detectives Workshop*, DNALC
Fun with DNA/World of Enzymes Workshop with Beijing No. 166 School students, DNALC
Genome Science Workshop, DNALC
DNA Science Workshop, DNALC West
DNA Science Workshop, *Harlem DNA Lab*
- July 14 CSHL *Gramene: A Resource for Comparative Plant Genomics Webinar*, DNALC
- July 15 NIH *Barcode Long Island Workshop*, Brookhaven National Laboratory, Upton, New York
- July 20–24 NIH *Barcode Long Island Workshop*, DNALC
- July 20–24 *Forensics Workshop* with Beijing No. 166 School students, DNALC
Green Genes Workshop, DNALC
World of Enzymes Workshop, DNALC
Green Genes Workshop, DNALC West
- July 22 NSF *iPlant Collaborative Webinar*, “Getting Started with *iPlant*,” DNALC
- July 26–30 American Society of Plant Biologists *Plant Biology 2015 Conference*, Minneapolis, Minnesota
- July 27–31 Pinkerton *Urban Barcode Research Project DNA Barcoding Workshop*, *Harlem DNA Lab*
- July 27–31 *DNA Barcoding Research Workshop*, DNALC
Forensics Workshop with Beijing No. 166 School students, DNALC
Green Genes Workshop, DNALC (two sessions)
Fun with DNA Workshop, DNALC West

- August 3–6 Pinkerton *Urban Barcode Research Project* Conservation Genetics Workshop, *Harlem DNA Lab*
 August 3–7 NIH *Barcode Long Island* Workshop, Stony Brook University, Stony Brook, New York
 August 3–7 *Fun with DNA* Workshop, DNALC
DNA Science Workshop, DNALC West
- August 3–7,10–14 *DNA Barcoding* Workshops, Environmental Study Center, Brooklyn, New York
 August 10–14 NIH *Barcode Long Island* Workshop, Brookhaven National Laboratory, Upton, New York
 August 10–14 *DNA Science* Workshop, DNALC
Fun with DNA Workshop, DNALC (two sessions)
Backyard Barcoding Workshop, DNALC West
- August 11 NSF *iPlant Collaborative* Webinar, “Getting Started with *iPlant*,” DNALC
 August 11–12 *Urban Barcode Project* DNA Barcoding Teacher Training Workshop, *Harlem DNA Lab*
 August 17 NSF *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education* Webinar, DNALC
- August 17–21 *Fun with DNA* Workshop, DNALC
Green Genes Workshop, DNALC
Silencing Genomes Workshop, DNALC
World of Enzymes Workshop, DNALC
DNA Science Workshop, Beckman Laboratory, CSHL
Genome Science Workshop, DNALC West
- August 18 NSF *iPlant Collaborative* United States Department of Agriculture/Agricultural Research Service Workshop, University of Georgia, Athens, Georgia
- August 18 CSHL *Gramene: A Resource for Comparative Plant Genomics* Webinar, DNALC
 August 19–20 NSF *iPlant Collaborative* Genomics in Education Workshop, Florida SouthWestern State University, Fort Myers, Florida
- August 20–21 *DNA Barcoding* Teacher Training Workshop, *Harlem DNA Lab*
- September 4 World Science Festival 2015, “The DNALC” Lecture, Vienna, Austria
 September 8 Vienna Open Lab and Science Centre Network, Vienna, Austria
 September 9 NSF *iPlant Collaborative* Webinar, “Getting Started with *iPlant*,” DNALC
 September 17 Pinkerton *Urban Barcode Research Project* Informational Presentation: “Presenting at a Symposium,” Irondale Theater Company, Brooklyn, New York
- September 18 The Icahn School of Medicine at Mount Sinai Science Education & Outreach Post-Doc Symposium Presentation, “The DNALC,” The Icahn School of Medicine at Mount Sinai, New York, New York
- September 21–23 NSF *iPlant Tools & Services* Workshop, University of California, Davis, California
 September 25 BOLD Art Exhibit Reception and Daniel Janzen talk, DNALC & CSHL
 October 7 NSF *iPlant Collaborative* Webinar, “Getting Started with *iPlant*,” DNALC
 October 9 NSF *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education* Webinar, DNALC
- October 13–15 *Introduction to Genetics and Biotechnology* Workshop, Beijing No. 166 School, Beijing, China
 October 17 *Saturday DNA!* “Biological Evidence,” DNALC
 October 17–21 *DNA Barcoding* Workshops, Beijing No. 166 School, Beijing, China
 October 20 CSHL *Gramene: A Resource for Comparative Plant Genomics* Webinar, DNALC
 October 24 NIH *Barcode Long Island* Open Lab, Stony Brook University by Dan Maloney, Stony Brook, New York
- October 24 NIH *Barcode Long Island* Open Lab, DNALC West
 October 27 Simons Foundation *Math and Science Education* Workshop, New York, New York
- November 3 NIH *Barcode Long Island* Workshop, DNALC
 November 3 NIH *Barcode Long Island* Information Session, Brookhaven National Laboratory, Upton, New York
- November 3 Center for Education Innovation – Public Education Association Professional Development Workshop, “Bacterial Transformation Lab,” *Harlem DNA Lab*

- November 4 NSF *iPlant Collaborative Webinar, "Getting Started with iPlant,"* DNALC
- November 7 *Saturday DNA! "Seeds of Success,"* DNALC
- November 7 NIH *Barcode Long Island Open Lab*, Stony Brook University, Stony Brook, New York
- November 12 Regeneron Pharmaceuticals Inc. Celebration, Tarrytown, New York
- November 14 NIH *Barcode Long Island Open Lab*, DNALC
- November 17 CSHL *Gramene: A Resource for Comparative Plant Genomics Webinar*, DNALC
- November 18 NIH *Barcode Long Island Open Lab*, DNALC West
- November 18, 19 NSF *Infrastructure and Training Bringing Next-generation Sequence (NGS) Analysis into Undergraduate Education Video Conference*, DNALC
- November 19 Site visit by Hala Mirza, Potoula Gjidia and Representative Team, Regeneron Pharmaceuticals Inc., Tarrytown, New York, DNA Learning Center West
- November 19 Award presentation to Christine Marizzi, AgarArt Gallery event, American Society of Microbiology, Washington, D.C.
- November 21 NIH *Barcode Long Island Open Lab*, DNALC
- December 1 NIH *Barcode Long Island Open Lab*, DNALC
- December 2 NSF *iPlant Collaborative Genome Assembly, Annotation, and RNA-Seq Half-day Workshop*, CSHL
- December 2 Pinkerton *Urban Barcode Research Project Open Lab*, American Museum of Natural History, New York, New York
- December 5 *Saturday DNA! "The Iceman Cometh,"* DNALC
- December 5 *Urban Barcode Project/Urban Barcode Research Project Open Lab, Harlem DNA Lab*
- December 5 NIH *Barcode Long Island Open Lab*, Stony Brook University, Stony Brook, New York
- December 5 Commencement, Godfrey Okoye University, Enugu, Nigeria
- December 8 *Urban Barcode Project/Urban Barcode Research Project Open Lab, Harlem DNA Lab*
- December 9 Site Visit by Parker Antin, *iPlant Collaborative*, University of Arizona
- December 12 *Urban Barcode Research Project activities*, Irondale Theatre Company, Brooklyn, New York
- December 12 NIH *Barcode Long Island Open Lab*, DNALC
- December 14 Site Visit by Dr. Russel Hotzler, Gustavo Ordonez, Meghan Mulgrew, City University of New York, Brooklyn, New York
- December 15 NIH *Barcode Long Island Open Lab*, Brookhaven National Laboratory, Upton, New York
- December 15 NSF *iPlant Collaborative Webinar, "Getting Started with iPlant,"* DNALC
- December 15 CSHL *Gramene: A Resource for Comparative Plant Genomics Webinar*, DNALC
- December 15–23 Site Visit by Dorothy Zhang, CSHL Asia and DNALC Asia, Suzhou, China
- December 16 NIH *Barcode Long Island Open Lab* hosted by Aleida Perez, Brookhaven National Laboratory, Upton, New York
- December 18 Site visit by Kristina and Peter Liu, WI Harper Group, San Francisco, California



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