

periodiCALS

THE MAGAZINE OF CORNELL UNIVERSITY'S COLLEGE OF AGRICULTURE AND LIFE SCIENCES

VOL. 10 • ISSUE 1 • 2020

GENETIC INGENUITY

Scientists transform traits to put new produce on your plate

A DECADE OF IMPACT | Kathryn J. Boor, the Ronald P. Lynch Dean



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LEFT: Cornell's taiko drumming team, Yamatai, performs on the Ag Quad at the second CALS Day event in April 2019. CALS Day celebrates the interdisciplinary achievements and diversity of the college community.

COVER: CALS plant breeders are supporting potato growers and producers by developing varieties that store longer and are less likely to darken when made into potato chips.

Photos: This page, Chris Kitchen. Cover, Allison Usavage

dean's message



Photo: Chris Kitchen

Kathryn J. Boor, the Ronald P. Lynch Dean, spends time with students at Cornell Homecoming 2019.

As I complete my tenure as the Ronald P. Lynch Dean of the College of Agriculture and Life Sciences (CALs) this year after serving two five-year terms, I'm struck by the trajectory of change that has marked the past decade.

CALs has driven change since its founding. We have an enduring commitment to direct our research, teaching and extension programs to address the evolving needs of our time. And as global challenges become increasingly complex, our approaches, by necessity, are increasingly collaborative and cross-disciplinary.

The stories in this issue of *periodiCALs* highlight some of our programs that reflect our commitments to change.

For example, you'll read about our new Department of Global Development, which offers multidisciplinary approaches to preparing students for our interconnected world. You'll also read about the investments we're making in our Master of Professional Studies program to meet the needs of today's professionals who strive to advance their careers by attaining new, specialized skill sets.

From our researchers, you'll read about the evolution in breeding techniques that has yielded innovative new varieties of fruits and vegetables—including tomatoes, squash and apples—for which our plant scientists are world famous.

This issue also provides an update on our forward-looking initiative focused on digital agriculture, which is inspiring

research collaborations across Cornell that defy the boundaries of traditional disciplines. For example, you'll read about a partnership between CALs and Cornell's College of Engineering to develop new technologies to help grape growers.

Also changing is the range of CALs' research and extension programming in New York City, which continues to expand in support of President Martha E. Pollack's One Cornell visioning initiative. You'll read about three newly funded CALs projects based there. One will focus on racial inequality and health care, another will study soil health in urban environments, and the third project will develop online food safety programs through a partnership with our Cornell Food Venture Center and eCornell.

As Cornellians, we see life as an ongoing journey of exploration driven by change. I'm inspired daily by the new areas of inquiry that emerge and motivate our students, faculty and staff. It is the work of a lifetime.

As always, thank you for your ongoing support and partnership. Please keep in touch.

Kathryn J. Boor

Ronald P. Lynch Dean of the College of Agriculture and Life Sciences

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THE RONALD P. LYNCH DEAN
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Samara A. Sit

**ASSOCIATE DEAN OF ALUMNI AFFAIRS
AND DEVELOPMENT**
Sharon L. Detzer '88

EDITOR
Jana Wiegand

CONSULTING EDITOR
Jenny Barnett

PRODUCTION MANAGER
Jenny Stockdale

COPY EDITOR
Hope M. Dodge

DESIGNER
Cristina Eagan

periodiCALs ONLINE
Laura Caruso
Hillary Creedon

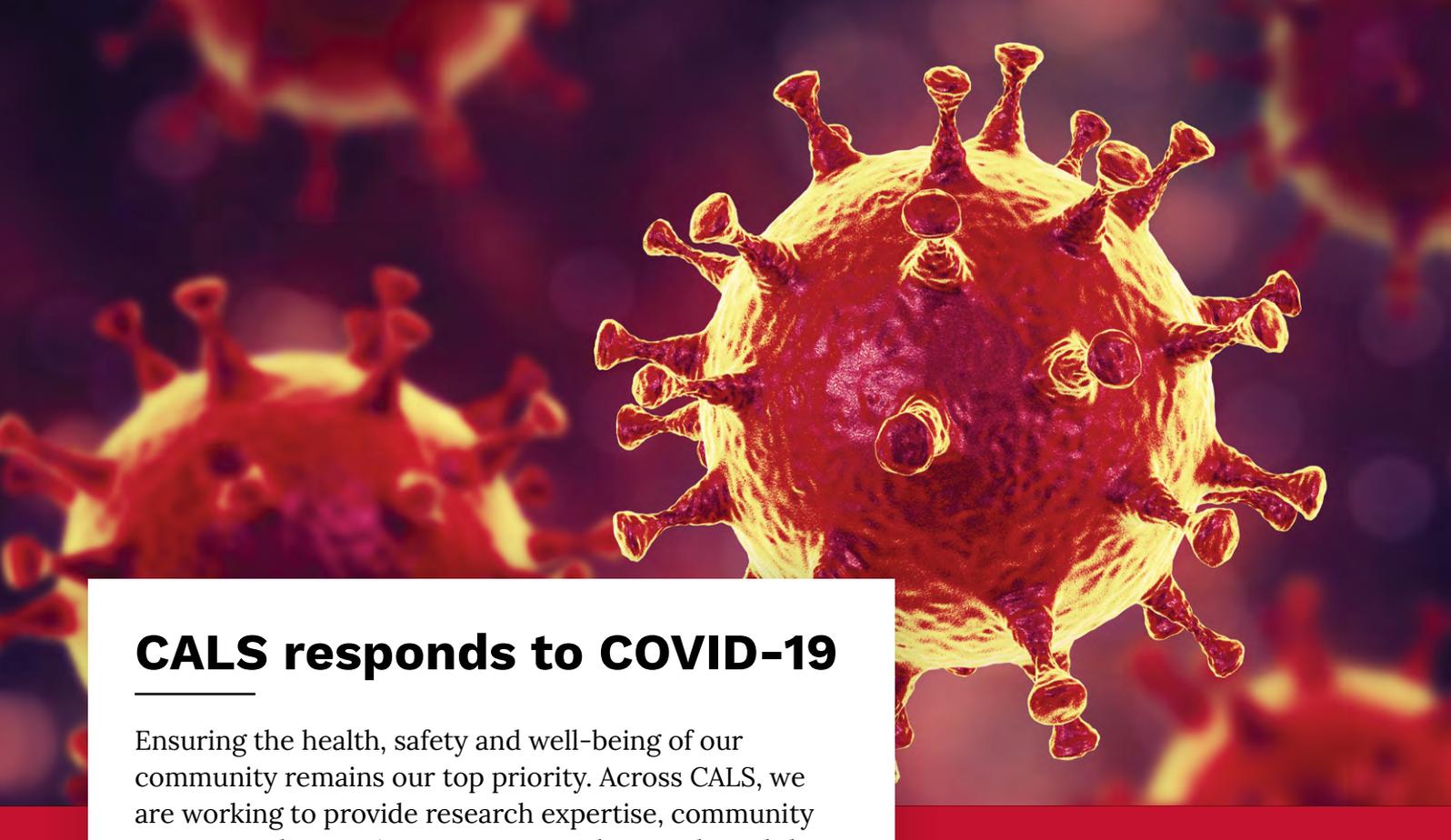
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CALS responds to COVID-19

Ensuring the health, safety and well-being of our community remains our top priority. Across CALS, we are working to provide research expertise, community support and extension resources to the people and the industries affected by the novel coronavirus.

Visit cals.cornell.edu/covid-19-response for up-to-date information:

- Find food safety tips and resources for agricultural businesses
- Read about how we're supporting communities across New York state
- Discover financial, mental and physical health resources
- Learn about virtual trainings for adapting to remote work and education
- See our experts respond to COVID-19 in national media outlets
- Connect to campus with live web cams and video tours

“In the midst of undoubtedly difficult times, one positive conclusion is clear: our mission matters. By working together—and inspired by your generous support—we will ensure a path forward for the greater good.”

—Kathryn J. Boor,
the Ronald P. Lynch Dean



around the quad



Left: Ann Vegdahl, extension associate, operates the Brooklyn office of the Cornell Food Venture Center, where she is helping develop the new certificate program for food entrepreneurs. Right: An urban garden run by North Brooklyn Farms offers an opportunity for people to access sustainably grown produce in New York City.

CALS IN NEW YORK CITY

Supporting cross-campus research partnerships

In June 2019, CALS awarded approximately \$500,000 in grants to three innovative New York City-based projects.

RACIAL INEQUALITY AND HEALTH CARE

Neil Lewis, Jr., assistant professor of communication, is collaborating with Weill Cornell Medicine to address racial inequality and access to health care.

“Not only are people from racial-ethnic minorities and low-income backgrounds less likely to have access to health information, [but] when they do have access, they are [also] less likely to pay attention to it,” Lewis said.

The team is developing a user-friendly digital platform that organizes content according to what patients want to know, rather than what information experts have. The team will test the platform at minority-serving clinics to see how patients absorb information and evaluate implications for the broader health care system.

HEALTHY SOILS FOR HEALTHY COMMUNITIES

Jenny Kao-Kniffin, associate professor of horticulture, and Jonathan Russell-Anelli, senior extension associate, are leading a team to address challenges in urban agriculture—including food availability, human health, environmental contamination and economic opportunity.

After surveying existing urban agriculture sites in New York City, the

team will develop a mobile app to give growers information tailored to their needs. This “internet of things” communication bridges the gap between initial soil health assessments and how crops respond to changing urban conditions.

FOOD SAFETY TRAINING PROGRAM

The Cornell Food Venture Center (CFVC) is developing an online certificate program called Science and Business of Food Innovation.

Grant funding will enable the CFVC to hire a full-time extension associate who will create and implement the program in collaboration with eCornell. The training will provide entrepreneurs and students with knowledge of food safety, product development, regulatory agencies and market research.

EDUCATION WITH IMPACT

Department of Global Development embraces active learning

CALS is marshaling resources and talent to address some of the biggest challenges facing humanity. The new Department of Global Development, which began operations in January, draws faculty from across the college and emphasizes real-world engagement.

“This instinct for education with impact goes right to the heart of the CALS mission and our legacy

of championing agriculture and development around the world,” said Max J. Pfeffer, CALS executive dean.

The department is prioritizing active learning opportunities that connect students with interdisciplinary faculty and experiences. Students in two existing majors—international agriculture and rural development, and development sociology—will have the option of joining a new major or completing their current program. The first class is expected to be admitted in 2022.

At home and abroad, the program aims to address issues such as agricultural production, climate change and demographic dynamics, including gender and wealth inequality.

“Global problems are becoming more interconnected as the world gets more complex,” said Parfait Eloundou-Enyegue, professor in the Department of Global Development. “The new department will prepare students to interpret problems, clarify solutions, develop leadership and actually change the world for the better.”

RADICAL COLLABORATION

Digital agriculture project supports grape growers

Two Cornell researchers are using 21st-century tools to tackle the age-old problem of forecasting the grape harvest.

Justine Vanden Heuvel, associate professor of horticulture, and Kirstin Petersen, assistant professor of electrical and computer engineering, came together thanks to the Cornell Initiative for Digital Agriculture (CIDA). Their team received seed funding for one of six initial projects in 2017.

CIDA supports cross-discipline, radical collaborations that are working to solve the biggest challenges in agriculture and food systems. It funded nine new projects in 2019.

Petersen said, “It’s an incredible collaboration because the person you’re working with is not aware of the boundaries that exist in your discipline—they can see beyond those.”

Their work is a perfect example of what the initiative hopes to accomplish. After preliminary research, the two received

a \$1.19 million grant from the National Institute of Food and Agriculture to keep developing their ideas and test them in working vineyards.

Vanden Heuvel and Petersen are also collaborating with Amit Lal, professor of electrical and computer engineering, to develop soft robots armed with high-resolution sensors. These tools perform ultrasounds on growing grapes, looking for varying sugar content and berry firmness, and the presence of fungal spores.

“We need professors from software programming, robotics and system analytics to be brought into the agricultural system,” said Tim Vanini ’91, former managing director of CIDA. “And we need those people partnered with the experts who know what the problems are and where solutions need to be deployed.”

FARM TO FORK

New course broadens students’ perspectives of food systems

Less than 2% of Americans are directly involved in agricultural production, but thanks to a new class, CALS gives students the opportunity to understand the complex dynamics that factor into those systems. The course, Just Food: Exploring the Modern Food System, benefits from an interdisciplinary pair of instructors: Rachel Bezner Kerr, professor in the Department of Global Development, and Frank Rossi, associate professor of horticulture in the School of Integrative Plant Science.

“This course helps students think critically and systematically about food—where it comes from and how it is produced—and the social, political, historical, economic, health and environmental impacts,” Bezner Kerr said. “We also expose students to a range of alternatives to the dominant ways that food is produced to address issues of environmental stewardship, social justice and food security.”

First offered in fall 2019, the course was designed to challenge students’ perspectives of controversial and nuanced issues, such as meat production, genetically modified crops and prevailing malnutrition.



Sam Epps, head chef and co-owner of Gola Osteria, provides a tour of the kitchen to students in the Just Food course. Professor of Global Development Rachel Bezner Kerr (right) helps guide discussion about how Epps sources ingredients for the restaurant’s dishes.

The class regularly takes students to spaces where they can witness parts of the production pipeline first-hand. “The excursions provided a tangible example of the global food system in diversity and scale,” Rossi said. “Being in the space where cows are milked and meat is processed—institutions where

vegetables are bred, and food is stored and prepared—engaged more senses in the learning process. We needed more time for discussion!”

Bezner Kerr and Rossi hope to offer the course every fall, continuing in the long tradition of agricultural education at CALS.

DIVERSITY AND INCLUSION

New leadership drives initiatives at CALS

On July 1, 2019, Chelsea Specht, a Barbara McClintock Professor of Plant Biology in the School of Integrative Plant Science, took on an additional role as the inaugural associate dean for diversity and inclusion. The two-year position was designed to lead college-wide diversity initiatives, including recruiting faculty, supporting scholarships, advising leadership and generally improving the climate of inclusion at CALS.

Specht met with partners across the university to understand the scope of existing projects. For example, incoming Cornell freshmen can participate in the Prefreshman Summer Program, which provides classes and enrichment opportunities to students from different backgrounds and ethnicities. The program's goal is to help bridge the gap between students' high school and college experiences. Within CALS, Sue Merkel, associate director of academic programs, oversees a peer mentoring program for first generation college students.

Given the success of those initiatives, Specht turned to other key areas. "My two major initiatives are focusing on faculty recruitment and graduate admissions," Specht said. "I want to really empower people who are already thinking about diversity and inclusion throughout these processes and make sure they have the language, skill sets and leverage they need to implement change."



Chelsea Specht, associate dean for diversity and inclusion, talks with plant biology students Jesús Martínez-Gómez (left) and Qianxia Yu (right) about their research on the evolution of floral form.

Specht also works closely with Sarah Evanega, recently elected faculty chair of the CALS Diversity and Inclusion Committee, which builds initiatives that link with campus-wide programs and address college-specific issues. Evanega said, "I'm especially looking forward to listening and responding to the needs of students, as well as tackling the challenges of inequity and lack of access with some concrete actions."

EASTERN BROCCOLI PROJECT

Researchers develop market for local produce

The Eastern Broccoli Project began in 2010 with the goal of growing a \$100 million broccoli industry in the eastern United States in 10 years. Currently valued at around \$90 million, researchers say they are on schedule to make their mission happen.

This project is no small undertaking. One of the challenges stems from the fact that broccoli was originally cultivated for Mediterranean climates, so growing it in the U.S. confuses the plant's developmental cues.

Broccoli flower buds and heads often grow unevenly on the East Coast, and, while they are perfectly edible, they do not look the same as West Coast broccoli, which is the standard across the U.S. "It's not at all marketable—you would never see it in a store," said Thomas Björkman,



Agricultural economics professor Miguel Gómez explains how the market for East Coast broccoli has changed. He worked with horticulture professor Thomas Björkman to capitalize on consumers' preference for locally grown food.

Ph.D. '87, professor of horticulture and project director.

But over the years, Björkman and his collaborators identified the genetic markers needed to grow a more uniform-

looking plant in the Eastern climate.

To understand how to fuel the East Coast market, Björkman partnered with Miguel Gómez, associate professor of agricultural economics in the Charles H. Dyson School of Applied Economics and Management, to see what appealed to both wholesale buyers and to average consumers.

Björkman and Gómez wanted to know whether consumers' growing appetite for local foods could outweigh the differences in appearance between the Eastern and Western varieties.

Their survey found that consumers rated Western broccoli higher than Eastern—if the vegetable was unlabeled. "But as soon as you tell them it's local, they like it better—not only how it looks but also how it tastes," Gómez said.

For food retail and service industries, the results of this survey highlight the importance of communicating that a product is locally grown.

EXPLORING LANDSCAPE ARCHITECTURE IN NEW YORK CITY

Summer course dives into urban redevelopment

Built in 1922 as part of the Erie Canal network, the Red Hook Grain Terminal in Brooklyn was once a bustling industrial hub. Now the abandoned site sits in an area of prime real estate. It presents thorny redevelopment issues regarding historic contamination, financing and evaluating what's best for the community.

Cornell students addressed some of these questions in a groundbreaking, eight-week urban landscape architecture design studio and seminar taught exclusively in New York City.

"Landscape architecture is a crucial discipline in cities," said Jennifer Birkeland, assistant professor of landscape architecture, who taught the inaugural course. "We deal with issues of social justice, such as making sure all communities have access to open space



Lyuxiao Liu, MLA '20, presents her group's redevelopment design of Brooklyn's abandoned Red Hook Grain Terminal to a panel of professional landscape architects in New York City.

and recreation."

Students visited redevelopment sites and landscape architecture firms, where they spoke with Cornell alumni. Master's student Sage Taber, MLA '20, said the program "exceeded all of my hopes and defined my professional interests." She is particularly interested in exploring the relationship between nature and human infrastructure, including how spaces can

be designed to cope with climate change.

According to Tim Baird, chair of the Department of Landscape Architecture, the new course "is in perfect alignment" with President Martha E. Pollack's commitment to advancing the Ithaca-New York City relationship. Baird said, "This intensive on-the-ground experience is an unparalleled opportunity for our students."

ECONOMIC GROWTH AND FOOD INNOVATION

Center of Excellence helps startups take off

When Andrea Ippolito '06 gave birth in February 2018, she wanted to breastfeed because of the health benefits it offered her newborn daughter. But like 12% of mothers, Ippolito experienced a form of lactation dysfunction—in her case, not producing enough milk. "While formula had everything she needed to thrive and grow, it didn't have everything we wanted for her," said Ippolito, a lecturer in the Engineering Management Program at Cornell.

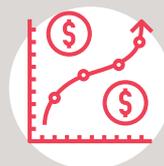
In summer 2019, she launched SimpliFed, a startup company whose mission is to provide more nutritious options for infants. The startup is one of more than 75 small, New York state-based companies supported by Cornell AgriTech's Center of Excellence for Food and Agriculture (COE).

"Our purpose is to cultivate economic growth and job creation opportunities by connecting entrepreneurs to the resources they need to thrive," said COE's executive director, Cathy Young. "It's an exciting time in the food, beverage and agriculture industries—there's an incredible amount of innovation, and much of it is consumer-driven."

Since COE's launch in September 2018, the companies working with the center have raised \$25 million to grow their

businesses. For SimpliFed, support has included reviewing pitches, sharing funding opportunities and connecting with food science professionals and other experts for product development. Ippolito said CALS' expertise has been instrumental. "All the plane parts are in the hangar, and the Center of Excellence connects those parts to help startups like ours take off."

**SINCE SEPTEMBER 2018,
THE CENTER OF EXCELLENCE:**



Helped raise
\$25 million

Provided
1,000+
mentorship
hours



Supported
75+
companies

YI ATHENA REN

Specializing in reproductive biology and integrative endocrinology, Yi Athena Ren, Ph.D. '11, recently joined CALS as an assistant professor in the Department of Animal Science.

How did you become interested in reproductive biology?

It all started when I attended a lecture by a well-respected reproductive biology professor at my undergraduate university in China. I was dabbling in research at that time, and his lecture on the dynamics of ovarian follicle growth wowed me. The more I learned about reproductive biology, particularly in females, the more fascinated I became. What other system in our body goes through such periodic and dynamic changes during adult life?

What have been a few of the biggest takeaways from your work?

The first is the importance of development and developmental programming. We were studying a mouse model in which a specific cell-signaling pathway was disrupted and those females were infertile. We then discovered that the ovaries of these mice had started to develop abnormally before they were even born.

The second insight is that very often diseases in one organ are caused by problems in seemingly unrelated cells or organs. So when things go wrong, treating the symptom is not enough—we need to find the initial trigger. When things go really wrong, perhaps the structure of communication between different systems is malfunctioning, then we need to rebuild the linkage between those systems. It is challenging because there are a lot of variables to control for, like solving a four-dimensional puzzle.

What do you think is important for people to understand about your field?

Reproductive biology is fun! It is also one of the most important subjects, as it will literally influence generations to come. Yet federal funding has been very limited and support for reproductive biology has been disproportionately



small. This echoes with a general view of the subject: "People are having babies with no problem, so why do we still need to study reproductive biology?" Well, about one in eight couples in the U.S. suffers from infertility, and the cause is often unclear. This means we do not yet understand enough to treat infertility.

What makes the matter more complicated are issues like obesity, environmental pollutants and increasingly delayed first childbirth. Through sperm and eggs, the negative impact of these factors can be passed on and impact the health of our children and future generations. This applies to other species too.

We live in an age of both innovative research breakthroughs and profound human and environmental challenges. How do you think our understanding of biology could shape the world by 2100?

There are profound societal and environmental challenges, but I'm optimistic that, overall, human society is on an upward trajectory. I think a major societal challenge is that, for the first time in human history, kids are growing up surrounded by electronics and social media, and we don't know what the consequences will be. In the

long term, with advancing technological breakthroughs, especially in artificial intelligence, I think it is plausible that our society will someday be dominated by artificial intelligence as depicted in many works of science fiction. Perhaps it is time to re-emphasize the pursuit of "full humanness" as espoused by the ancient Greeks—to experience and express fully what it means to be a human being. Automation is powerful, but let's not automate ourselves!

As we gain a better understanding of reproductive biology and technology, what kind of framework should we have to make ethical decisions?

I think we should always ask ourselves not just, "Can we?" but also, "Should we?" At the societal level, it is often difficult to predict all the consequences of a new technology. Reproductive choices are very personal but, cumulatively, have a profound societal impact, spanning generations. So, transparency and accessibility of information in reproductive biology and technology should be achieved at individual, political and societal levels.

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Meet our new 2019 faculty:
cals.cornell.edu/fall-2019-faculty

CALS in quotes

“So many things in agriculture and farming are beyond one farmer’s control—the stress, the weather. Working with family is hard. The government regulations are hard. All those little things add up.”

—**Kate Downes**, outreach director at NY FarmNet, speaks to Spectrum News about new initiatives to address stress on farms and reduce the rate of farmer suicides.

“Our study suggests that, although there is a universal ancestor to life on Earth, small modifications were critical in specific adaptations.”

—**Anurag Agrawal**, James A. Perkins Professor of Environmental Studies in the Department of Ecology and Evolutionary Biology, tells Business Standard about using CRISPR to reconstruct how monarch butterflies developed an immunity to toxins.

“The fungus grows and clogs the branches that bring water into the tree until, eventually, the tree dies.”

—**Nina Bassuk**, horticulture professor in the School of Integrative Plant Science, talks to USA Today about how Dutch elm disease is affecting the trees lining the National Mall in Washington, D.C.

“There is no silver bullet.”

—**Todd Schmit**, associate professor in the Charles H. Dyson School of Applied Economics and Management, says to the Times Herald-Record that there are many reasons why people choose to shop at farmers’ markets.

“Genetic engineering isn’t going to be the only tool, but it’s a good one. To not use it is like asking a plant breeder to use an abacus instead of a calculator.”

—**Sarah Evanega**, director of the Cornell Alliance for Science, explains to Bloomberg why genetically modified food is necessary to feed Earth’s growing population.

“Ages below 10, with their smaller ear canals, are in danger for sure.”

—**Sunghwan Jung**, associate professor in the Department of Biological and Environmental Engineering, tells Medium how the sudden acceleration involved in shaking water out of the ear could expose small children to brain damage.

“The very limiting portrayals of gender, which have sustained the advertising industry for well over a century, no longer resonate with our social world.”

—**Brooke Erin Duffy**, associate professor in the Department of Communication, talks with Vox about the United Kingdom’s decision to ban gender stereotypes from ads.



Kathryn sits in the corridor of Stocking Hall, home to the Department of Food Science. She played a key role in the building's renovation and expansion project, which was completed in 2015.

A DECADE OF IMPACT

KATHRYN J. BOOR, THE RONALD P. LYNCH DEAN

Kathryn J. Boor grew up on her family's dairy farm in Horseheads, New York, which her grandfather purchased in 1926. As a teenager, she honed her leadership skills as an active member of 4-H, part of Cornell Cooperative Extension. She first visited Cornell as a New York State 4-H Congress delegate, and her lifelong dedication to the College of Agriculture and Life Sciences was born.

Kathryn graduated from Cornell as a food science major in 1980 and then spent two years doing graduate research in Maseno, Kenya, focused on improving nutritional outcomes for rural children. At the time, western Kenya was experiencing rapid population growth, the shrinking size of family farms and increasing malnutrition. What she witnessed there, coupled with her knowledge of microbiology, profoundly influenced her career trajectory and inspired her work to ensure that parents can trust the safety of the food they give their children.

When she returned to CALS in 1994, Kathryn became the food science department's first tenured female faculty member. Later, she became the department's first female chair, and in July 2010, she took the helm from former dean Susan Henry as the second female Ronald P. Lynch Dean of CALS. As dean, Kathryn has served as the chief academic and administrative officer for the college, a role that serves both internal and external stakeholders. This year will



Kathryn, front right, stands with other members of the New York State 4-H Congress Chemung County delegation at Cornell in 1974.

mark the end of her second and final term as dean.

Kathryn's career has embodied the Land-Grant principles of supporting knowledge with public purpose and the application of agriculture and life sciences to solve real-world problems. As a microbiologist and an academic administrator, her scientific accomplishments and public service continue to improve the health and well-being of individuals and communities in New York state, across the U.S. and around the world. »

EXPANDING CALS EXPERTISE

The highest priority during Kathryn J. Boor's deanship has been recruiting and retaining top faculty. Since 2010, she has hired 130 tenure-track faculty, keeping CALS at the forefront of scientific inquiry and keeping pace with retirements.

Including ongoing searches in spring 2020, 43% of the college's faculty population will have been refreshed in the last 10 years. Kathryn has also invested resources to strengthen faculty grant proposals, which has helped CALS faculty achieve the highest research expenditure total on the Ithaca campus for the past four fiscal years. We see the success of this effort in many ways, including in our top ranking in the 2020 Wall Street Journal/Times Higher

Education College Rankings, which listed Cornell as No. 1 for agriculture, agriculture operations and related sciences.

As our world works to build a sustainable and renewable food supply, the college continues to develop more innovative pathways to address the challenges of our time. To improve our world-class teaching, research and extension efforts, Kathryn initiated critical reviews of the organization and academic offerings of CALS, which led to streamlined academic departments and merged units between our Ithaca and Geneva campuses.

A key achievement was the 2014 launch of the School of Integrative Plant Science (SIPS), which encouraged greater collaboration among our scientists from multiple disciplines. SIPS encompasses five sections of previously separate academic departments. Since revitalizing the plant sciences curricula, SIPS has seen a 50% increase in course enrollment.

One of the great hallmarks of Cornell University, and of CALS, is our ethos of collaboration—to work across disciplinary boundaries and to apply new perspectives to produce new solutions. As CALS tackles the world's most pressing issues, Kathryn has championed a coalition of scientists that coalesced into the Cornell Initiative for Digital Agriculture (CIDA) in 2017. CIDA projects use emerging technologies to create more profitable, efficient and sustainable agricultural practices—critical for supporting modern agriculture and food systems. With more than 100 affiliated faculty across Cornell, CIDA has funded 15 innovative projects and hosts regular hackathons, lectures and workshops.



Kathryn talks with members of Hortus Forum, an undergraduate horticulture club, at the inauguration festival for President Martha E. Pollack in 2017.

SUPPORTING STUDENTS

Kathryn has also thought critically about creating new opportunities for today's undergraduates as tomorrow's global citizens. Curricular offerings and majors have expanded, including the interdisciplinary environment and sustainability major, which includes the best features from two previous majors. First-year student application rates to this major more than doubled one year after its 2013 launch.

Within our classrooms, Kathryn has championed a technique called active learning, in which faculty replace traditional lectures with hands-on learning and responsive technologies. With this transformed in-class experience, CALS students sharpen their critical-thinking skills and become better-equipped to tackle scientific problems in real-world scenarios.

The college also has created new experiential learning opportunities for our students, thanks to Kathryn's support. Between 2010 and 2018, CALS saw a 15% increase in undergraduate participation in domestic internships and a 7% increase in international internships. And since its inception in 2016, the Global Fellows program has provided nearly 100 CALS students with internship and intercultural immersion opportunities across six continents. CALS also continues to lead the university in faculty-led international course trips.



Kathryn talks with members of the CALS community at Confections and Conversation with the Dean in September 2017. This recurring event provides an opportunity for students, staff and faculty to meet with the dean in an informal setting.

New York State Department of Agriculture and Markets Commissioner Richard Ball and Kathryn participate in the ribbon-cutting ceremony for the Cornell Food Venture Center in 2018. Based at Cornell AgriTech, the state-of-the-art facility supports more than 500 companies and helps bring approximately 2,000 products to market each year.

IMPROVING OUR SPACES

At our 116-year-old college, the process of maintaining and improving our facilities is a crucial and complex task—one that Kathryn has stewarded conscientiously and sustainably. In the past 10 years, we invested nearly \$254 million to upgrade CALS facilities, including rebuilding the Dimock Nematode Research Lab, expanding greenhouses and upgrading faculty research labs. Additionally, Kathryn has cut the ribbon on the renovations of Fernow Hall, Warren Hall, a renovated Ag Quad and Stocking Hall.

The four-year Stocking Hall renovation project was a major focus of Kathryn's food science chairship. It modernized classrooms, installed cutting-edge laboratories and updated the beloved Cornell Dairy Bar. The pilot facility helped forge collaboration with food and dairy industries, giving public and private entrepreneurs the resources and faculty expertise to help them develop and test new products prior to market. The dairy plant also expanded Cornell's 51-year role in training dairy and food inspectors from the New York State Department of Agriculture and Markets.

In Geneva, New York, where Cornell AgriTech fuels agricultural scientific progress and economic development for the state and beyond, the 140-year-old campus has benefitted from Kathryn's strategic guidance and ability to draw public

and private funding. Two highlights are the High-Pressure Processing Validation Center, launched in 2017 as the nation's first commercial-scale validation facility, and the Cornell Food Venture Center Pilot Plant, which reopened in October 2018 after a \$13 million renovation to better meet the needs of food entrepreneurs and businesses in New York state.

Back on the Ithaca campus—as Kathryn's deanship draws to a close—she is laying the foundation for a major renovation of our plant science facilities, which will include portions of Emerson Hall, Mann Library, Bradfield Hall and the Plant Science Building. »

During her deanship, Kathryn has raised more than \$340 million from college donors, including donations to the Charles H. Dyson School of Applied Economics and Management from 2011 to 2016.



From left: Sen. Charles Schumer, D-N.Y., Ithaca Mayor Svante Myrick '09, and President Martha E. Pollack join Kathryn at a press event in 2017, where Schumer announced a \$400,000 grant to upgrade the Federal Golden Nematode Laboratory at Cornell. The facility is developing strategies for managing golden and pale cyst nematodes—microscopic worms that threaten New York state's \$73 million potato industry.

STRENGTHENING PARTNERSHIPS

During her deanship, Kathryn has propelled our venerable institution to new heights, attracting capital investments, exceptional faculty, and renewed interest from elected officials and news media. Thanks to her strategic relationship-building skills, state decision-makers view CALS as an essential partner in addressing both long-standing and emerging concerns. Such partnerships often bring about new funding and research opportunities.

For example, at a state hemp summit in July 2017, Gov. Andrew Cuomo announced research investments to help New York state and Cornell become national leaders in hemp production. This support allowed us to continue existing research trials and expand partnerships with growers.

Our college also benefits from strong partnerships in Washington, D.C. In February 2019, Sen. Charles Schumer, D-N.Y., announced a \$68.9 million plan to build a new grape genetics research lab at Cornell AgriTech, which will house U.S. Department of Agriculture scientists who work closely with our faculty, extension associates and graduate students.

Undergraduate applications to CALS, including the Charles H. Dyson School of Applied Economics and Management, are at record highs. From 2010 to 2019, the number more than doubled—from 5,185 to 10,636.



Economics Professor Christopher Barrett (left) and David Brown, then professor of development sociology, join Kathryn in the rededication ceremony for Warren Hall in 2015. The building houses the Charles H. Dyson School of Applied Economics and Management, and Kathryn's leadership ensured the successful transformation of the Dyson School into a shared unit between CALS and the SC Johnson College of Business in 2016. Kathryn's firm commitment to the school built upon the investments of former dean Susan Henry, which helped the school achieve top 10 rankings, international accreditation and global recognition.

Photos: left, Jason Koski; right, Matt Hayes

BEYOND CALS: SERVICE AND RECOGNITION

On behalf of the university, Kathryn has participated in numerous committees and task forces, notably chairing the search that brought Ryan Lombardi to Cornell as vice president for student and campus life in 2015. Beyond campus, Kathryn served as an inaugural member of the board of directors for the Foundation for Food and Agriculture Research—an independent nonprofit that has partnered with more than 340 organizations to expand national research into food, agriculture and related sciences since its creation under the 2014 U.S. Farm Bill.

Peer institutions and organizations have repeatedly recognized Kathryn for her insightful research, which continues to shed light on the roles that bacteria play in food safety. Over the past 25 years, her lab has investigated two main areas: the persistence and genesis of the bacterial pathogen *Listeria monocytogenes* and preventing bacterial contamination in fluid

milk. One of her most prominent academic accolades is a 2016 honorary degree from Harper Adams University in England, which recognized her contributions to food science research as well as her impact on higher education.

Under Dean Kathryn J. Boor's extraordinary 10-year leadership, CALS has successfully grown the diversity and vibrancy of the student and faculty populations and gained the unwavering support of private and public entities. She has worked tirelessly to perfectly position CALS to fulfill our Land-Grant commitment to New York state and the world for years to come. We are thankful to the 4-H Congress that first brought Kathryn to the College of Agriculture and Life Sciences, and we wish her continued success in both her Stocking Hall laboratory and wherever life takes her next.

—SAMARA A. SIT



Kathryn walks with fellow deans at the inauguration of President Martha E. Pollack in 2017.



BRAVE NEW BREEDING WORLD

What does it take to put
produce on your plate?

Walk into the produce section of any grocery store and you'll see dozens of signs labeling the fruits and vegetables. Most simply indicate the common name, such as broccoli or bananas, but for apples, the signs help you zero in on specific varieties like Empire, Fuji and Gala. However, if you were on Cornell's Ithaca campus last fall, you might have found a few cafés with wooden crates full of fruit simply labeled "Apple A." These apples have distinctive red, russeted skin dotted with white spots. Take a bite and you'll get a complex, nutty sweetness that's not quite like any apple you've ever tasted.

So why does it have such an unremarkable name? The short answer is that Apple A isn't ready for the broader market yet. Breeding, licensing and retailing new produce are all complicated processes, and convincing consumers to trade their favorites for something new isn't any easier.

A LEGACY OF BETTER BREEDING

CALS researchers are known for their innovative work in producing new varieties of fruits and vegetables—ones that taste better, have longer growing seasons and are more resistant to threats from diseases, insects and weather. The varieties they meticulously breed over the years give farmers, producers and consumers more options that better fit their needs.

But developing new produce comes with a daunting list of criteria, and it can be tough to balance the different needs of so many stakeholders. Now the bar is moving even higher, said Phillip Griffiths, associate professor in the horticulture section of the School of Integrative Plant Science (SIPS). "When I started here in 1999, our efforts were focused almost exclusively on disease resistance, yield and the other things growers wanted," he said. "But in recent

years, there's been more interest in developing products that are aimed at what consumers want too." This shift has opened the door for CALS breeders to show the creative side of their expertise. "Right now, the food system is wide open to change, unlike at any point in my lifetime," Griffiths said. "Anything can happen."

SPINNING THE WHEEL OF TRAITS

Back in 2004, Griffiths decided to grow new varieties of tomatoes that would give consumers more diverse color and flavor profiles. "I was originally interested in coming up with a finger-shaped tomato that could be a substitute for baby carrots," he said. But when he took this idea to the greenhouse, the new fruit didn't grow quite the way he was hoping.

When researchers cross-breed plants to enhance or minimize certain traits, it's a genetic gamble to land the winning combination of characteristics. A plant with one desirable quality, like taste, that is crossed with a plant that has another ideal trait, like texture, might produce offspring that has both, one or neither of those qualities. Further complicating the breeding process, traits can skip generations and reappear months or years later. "By combining different shapes, I eventually developed tomatoes that looked exactly like chili peppers," Griffiths said. But he wasn't discouraged by the odd shape. He was inspired. "Since tomatoes and chili peppers are two of the most popular foods in the world, I thought it might have a lot of appeal."

This variety still needs a few more years to ensure that offspring remain stable from generation to generation, so that farmers and consumers receive a predictable product. From idea to market, this will amount to some 15 years of breeding work—not unusual



CALS HAS PRODUCED

290+ FRUIT VARIETIES,
including apple rootstock
and grapevines

**165+ VEGETABLE
VARIETIES,**
in addition to thousands
of improved breeding lines

for scientists like Griffiths. As a rule of thumb, adding a new trait can double the timeline for successful cross-breeding, said Julie Dawson '03. She later conducted postdoctoral work at CALS before becoming an associate professor at the University of Wisconsin, Madison, in 2013. "Everyone wants to breed something that tastes good, but there are as many as 20 or more other traits that are important," Dawson said. "If a squash is going to rot before it reaches sellers or is easily damaged, it's not going to fly with growers no matter how great it tastes." »

WHAT'S IN A NAME?

Marketing a new creation also presents a substantial challenge. Michael Mazourek, Ph.D. '08, associate professor in the plant breeding and genetics section of SIPS, is another researcher coming up with novel varieties, and he's taken an unconventional approach for getting his produce on consumers' plates.

One of the biggest obstacles for breeders looking to develop specialty crops, Mazourek explained, is simply getting them recognized as unique products—both in the food production pipeline and among consumers. "I could rattle off 50 different cultivars of butternut squash, but most are sold under the commodity name of 'butternut squash,'" he said. "You can come up with a better variety, but if people don't recognize it, you can be stuck clawing for traction and impact in the market."

Part of the problem is that most breeders' efforts tend to be invisibly absorbed in the commercial food chain. The term cultivar refers to the result of "improved breeding lines," in which genetic changes have been made to an existing variety. They generally leave Cornell as seeds, destined for companies that will then grow and cross-breed the CALS material with their own varieties and improved breeding lines. This allows commercial growers to tailor varieties to meet the needs of customers in different markets—in the U.S. and around the world, said Mary Kreitinger, executive director of the Vegetable Breeding Institute in the plant breeding and genetics section of SIPS.

Researchers might give their budding varieties unique names, "But unless a seed company markets our variety by name, we usually have no way to track it and don't know how or where it gets to consumers," said Kreitinger. Seed companies often treat their products as proprietary and don't disclose the vegetables' origins. That policy can give businesses a competitive edge, but it leaves consumers in the dark.

Moreover, potato growers and producers, for example, care more about a variety's overall traits than about its name. Developed at CALS, Lamoka is the most popular, publicly available potato for making potato chips in the U.S. But because farms plant multiple varieties throughout the growing season, and because large-scale producers source potatoes from different farms, you'll never know whether you're eating a CALS variety the next time you pop a bag of chips.

Mazourek broke through the anonymity barrier when he sought a new model for how vegetable varieties could gain more traction. His specialties are squash, peppers, cucumbers and snow peas, and he ended up partnering with Manhattan chef Dan Barber and grower Matthew Goldfarb to co-found Row 7 Seed Company. Their goal is to create opportunities for bringing diverse produce to farms and consumers by working with chefs who embrace new ingredients. "I did it to fill a void in the market," said Mazourek, who gets no money from or equity in the company. "I like to create things that stand out, and we use enjoyment of flavor to drive change." And now, Honeynut squash—a smaller, more flavorful variety of butternut squash that Mazourek helped develop—has earned name recognition on the national market. »



Photo: Row 7 Seed Company



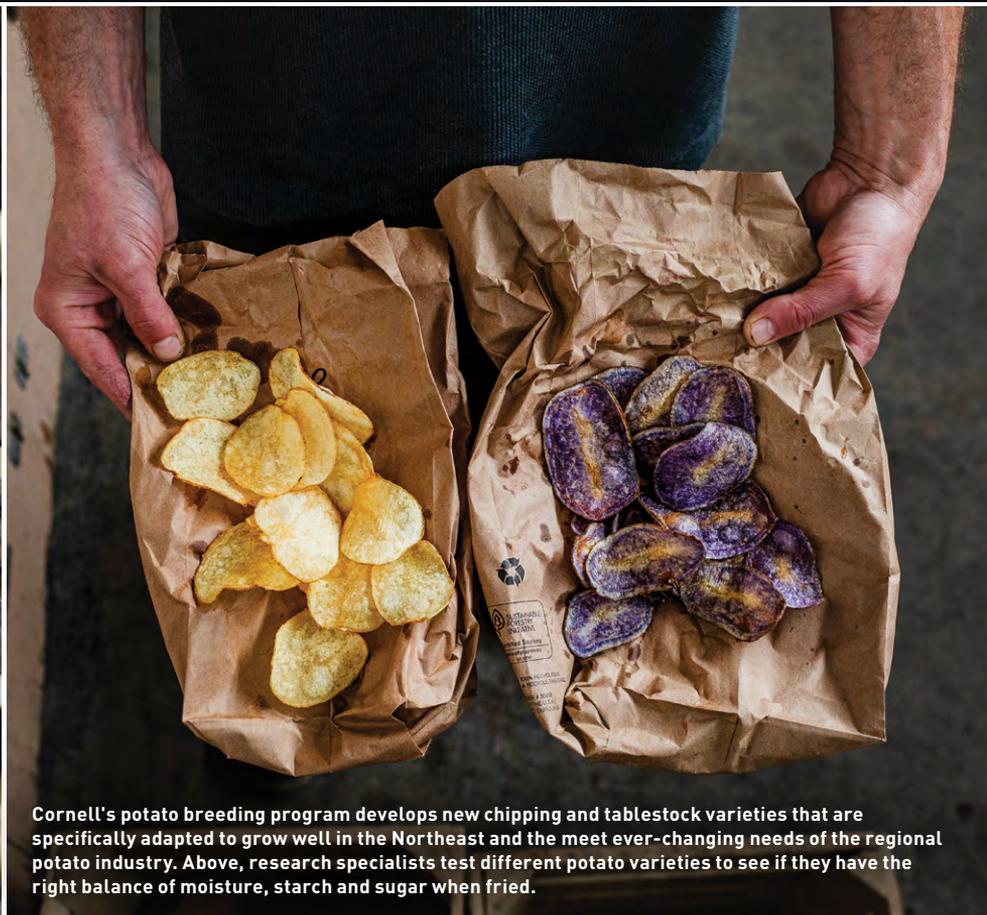
“You can come up with a better variety, but if people don’t recognize it, you can be stuck clawing for traction and impact in the market.”

—Michael Mazourek,
associate professor of plant
breeding and genetics

Left: Different breeding lines of butternut squash are cut open before testing their performance in the oven.



Cornell's apple breeding program works to develop new varieties that are easy for growers to manage in the orchard and that are appealing to a broad base of consumers, combining unique flavors, textures and other attributes, including nutrition.



Cornell's potato breeding program develops new chipping and tablestock varieties that are specifically adapted to grow well in the Northeast and the meet ever-changing needs of the regional potato industry. Above, research specialists test different potato varieties to see if they have the right balance of moisture, starch and sugar when fried.



**NEW YORK STATE
RANKS NO. 2
IN THE UNITED STATES
for apple production**

Has a
\$262 MILLION
apple industry

Produces
1.4 BILLION POUNDS
of apples

[Source: 2018 Census of
Agriculture, USDA National
Agriculture Statistics Service]



Susan Brown, the Herman M. Cohn Professor of Agriculture and Life Science, holds a sample of pollen from apple trees used in her breeding collection. She uses the different types to cross-hybridize apple trees in the orchards at Cornell AgriTech, where she is growing and testing new varieties of apples.

BREEDING FOR THE NEW CONSUMER

In theory, fruits should have an easier time making a name for themselves. Since apples and berries are perennials, researchers typically stabilize the traits themselves and release varieties that are already branded for market. With apples, the stabilization process can take decades, and producers don't have the luxury of spending time on additional improvements because they need to focus on current market trends. However, for annuals like cucumber, squash and kale, seed companies can mix and match traits from different cultivars relatively quickly. This is why it can be to a vegetable breeder's benefit to focus on a handful of desired traits, rather than the complete package.

Establishing a new variety in the marketplace is still an uphill battle, and not always in a breeders' best interests, said Jessica Lyga, senior licensing and business development officer at Cornell's Center for Technology Licensing. "We do market research to see if the new variety would be just another entry among 200

in a commodity market or a shining star that's clearly better than what's out there," she said.

It takes more than just catching consumers' eyes, said Susan Brown, the Herman M. Cohn Professor of Agriculture and Life Science and head of Cornell's apple breeding program. Many consumers are willing to try a new type of apple once, she explained, but repeat sales determine if a new apple can make a dent in an already competitive market. For SnapDragon, one of Brown's most well-known apple varieties, the decision to go big wasn't that hard. "The first time I bit into it, I said, 'Oh my gosh,' and everyone who tried it agreed," she said. "I've never been so confident in a fruit."

The apple was released in 2015, following the 2014 release of another variety called RubyFrost. Crunch Time Apple Growers, a cooperative open to all growers in New York state, formed a partnership with Cornell and licensed the rights to grow and sell both of Brown's varieties. Crunch Time then leveraged social media to generate interest among

its audiences. In 2018, the company doubled the volume of SnapDragon sold over the previous year, and it's on track to double again, with RubyFrost also recording strong, steady growth. SnapDragon has also been a hit on the international market, including in Canada, Israel and Vietnam.

The enormous respect for CALS breeders doesn't come from sales figures alone. Their mission is to help New York state farmers thrive—advancing the sustainability of crops and improving the diversity of produce available to growers and consumers, said Mazourek. He added that CALS researchers work closely with farmers on every aspect of the crop selection and growing process. "As academics, we want to help understand the world more clearly," Mazourek said. "But in the end, we want our work to translate into better lives."

Still, the occasional consumer hit is welcome. Perhaps the next one is sitting in a wooden crate labeled Apple A.

—DAVID H. FREEDMAN

STREET SMARTS

Cornell paves the way for safer roads in New York state

Chase Winton knew he had a problem.

A half-mile snippet of Albro Road, a sleepy byway in Sherburne, New York, had severe cracks in its pavement. They made for a teeth-chattering ride. “I don’t think you’d want to have an open coffee cup in your hand,” said Winton, Sherburne’s highway superintendent.

Underneath the road, sheets of concrete had broken apart at the seams, leaving a series of large rectangular cracks in the top layer of asphalt. Every winter, water seeping into the crevices would freeze and make the cracks grow wider. Winton worried the only solution was to start over. “I was thinking, jeez, what am I going to do?” he said. “I’ve got to tear that road all out, get all the concrete out of there, which is expensive.” Repairing that half-mile section of the road would have cost about \$60,000, taking a 20% bite out of his \$300,000 budget.

Last spring, Winton found a solution through the Cornell Local Roads Program—which improves the quality and safety of New York’s local roads by offering free and low-cost services to the 1,500 officials who maintain them. At a Local Roads workshop on pavement maintenance, Winton learned about a trademarked process called FiberMat. It smooths existing cracks and prevents new ones from forming. “The light bulb kind of came on. I thought, ‘I have a place for that,’” he said. “It’s probably going to save us \$40,000 in repairs to that road.”

A MISSION TO EDUCATE

The roots of the Cornell Local Roads Program date back to Feb. 15, 1915, when Cornell President Jacob Gould Schurman welcomed 280 highway officials to the university’s inaugural Good Roads Week. The current program is housed in CALS’ Department of Biological and Environmental Engineering.

“The role of the highway official essentially is to keep those



Chase Winton checks out recent paving work in Sherburne, New York.

local roads in good shape—keep the farmer out of the mud, allow the bus to take kids to school safely,” said Director David Orr ’87, Ph.D. ’05, a licensed engineer and former deputy highway superintendent for Yates County. “Local Roads is helping them do that, with training, technical assistance, facilitating meetings—whatever method we need to use to help people help themselves.”

He and two staff engineers distill the latest research “into what folks on the ground need,” Orr said. They create training materials and lead 50 to 60 workshops per year. Topics range from the latest money-saving pothole remedies to the most efficient ways to move traffic through work zones. “If I can have each person take home one thing and change a practice, try something out—I have had a good day,” he said.

CREATING A GAME PLAN

Before Winton was elected highway superintendent in 2014, he ran his own excavation company. He was familiar with big equipment—but not with how to manage an entire road system. “For me, coming into this new, it was a little bit overwhelming,”



More online at
cals.cornell.edu/street-smarts

he said. “We have 64 miles of road, and it seemed like every mile needed something. So how do you prioritize?”

Through Local Roads, Winton discovered project planning software called the Cornell Asset Management Program. An intern inventories a municipality’s roads, assesses their condition and traffic volume, and inputs that data into the software. The highway superintendent then adds the budget and types of repairs, and the intern calculates the costs. After inputting all those factors, the program produces a detailed plan, good for three to five years, outlining which roads to repair, as well as how and when to do the work. “The idea is to take your good roads and keep them good,” Winton said. “Then for the roads that need complete reconstruction, it will defer until the funds are available. It’s a win-win.”

RESEARCH IN ACTION

Rebecca Schneider, Ph.D. ’94, has focused much of her academic career on something most people notice only if they drive into it: the roadside drainage ditch. As an associate professor of natural resources, Schneider wants to improve the quality of New York’s water. But two factors can make or break that proposition: ditches and highway officials. “We have inadvertently replumbed our entire watershed with ditches for over 100 years, without having any idea of their effect,” she said.

Deep ditches that are scraped clean of vegetation send sediment, road salt and pollutants directly into the water supply. They increase flooding by dumping water into streams so quickly that it can’t be absorbed. They also contribute to drought. “I needed to get to the highway guys,” Schneider said. “They really are our water stewards across the landscape.”

Over the last 10 years, thanks to Schneider’s collaboration with the Local Roads Program, Orr said some highway officials have started changing the way they manage their ditches. Winton is one of them, and his recent efforts scraping and reseeded ditches are already preventing additional erosion.

—SUSAN KELLEY



“We have inadvertently replumbed our entire watershed with ditches for over 100 years, without having any idea of their effect.”

—Rebecca Schneider, Ph.D. ’94, associate professor
in the Department of Natural Resources

CATCHING UP WITH ANTIBIOTIC RESISTANCE

Scientists are hot on the trail of a newly discovered, highly spreadable gene

While sifting through the bacterial genome of *Salmonella*, Cornell food scientists discovered *mcr-9*, a new, stealthy jumping gene so diabolical that it resists one of the world's few last-resort antibiotics.

Doctors deploy colistin, an antibiotic, when all other options are exhausted. But resistance to colistin has emerged around the globe. "This last-resort antibiotic has been designated a highest-priority antibiotic by the United Nations' World Health Organization, and the *mcr-9* gene causes bacteria to resist it," said Martin Wiedmann, the Gellert Family Professor in Food Safety. "In treatments, if colistin does not work, it literally could mean death for patients. If colistin resistance spreads, a lot of people will die."

Laura Carroll, a computational biologist and doctoral candidate, found *mcr-9* in the genome of a strain of the bacterium *Salmonella*. Because the DNA sequence of the *mcr-9* gene was similar to other genes that could cause bacteria to resist colistin, Carroll suspected that the *Salmonella* strain, which carried *mcr-9*, was colistin-resistant.

Knowing that the *mcr-9* gene could jump to other bacteria or organisms, Carroll asked microbiologist Ahmed Gaballa to insert the gene into a strain of the bacterium *E. coli* to see what happened. "When Ahmed cloned it into an *E. coli* host, he was able to find that the gene could confer resistance to colistin," said Carroll. They found that, like one bad apple spoiling the barrel, the gene could readily transfer its antibiotic resistance to other bacteria—in food and in people.

Originally discovered in 2015, *mcr-9* is the latest addition to a new series of mobilized colistin-resistance (*mcr*) genes. The National Institutes of Health has added details about this new gene to its database so that medical and food safety professionals can identify *mcr-9* in bacteria and keep it from spreading. Sharing information about identifying *mcr-9* and how it spreads enables scientists across the globe to develop better prevention and treatment. Wiedmann said, "This improves our ability to get an early warning."

Bacteria isolated from food products can now be tested for



"In a hospital setting, being able to screen a patient for resistance allows doctors and nurses to isolate the patient and maintain biosecurity."

—Martin Wiedmann, Gellert Family Professor in Food Safety

mcr-9, and patients can be screened for colistin-resistant bacteria that possess *mcr-9*. "If you go to a hospital and this gene is floating around, that can be trouble. The gene is moveable. It jumps," Wiedmann said. "In a hospital setting, being able to screen a patient for resistance allows doctors and nurses to isolate the patient and maintain biosecurity."

Wiedmann also pointed out that while his lab is dedicated to food safety, the collaboration among different fields made the discovery possible. "In this age of complicated problems, we need the computational bioinformatics approach to find solutions," he said. "Standard biological research and standard tests would not necessarily have found this gene." Carroll added: "It takes a village of a computational biologist, a microbiologist and a molecular biologist to make this sort of scientific discovery happen."

—BLAINE FRIEDLANDER



More online at
cals.cornell.edu/ccbi

Edmond Guidalt, technician at the Cornell Craft Beverage Institute, pours a sample of a light beer for testing.

TAPPING INTO CALS EXPERTISE

Across the state, breweries turn to the Cornell Craft Beverage Institute for support

In a former pickle processing plant in Brooklyn, the Strong Rope Brewery offers patrons an array of beers crafted with New York state ingredients: Seeds of Love and Outrage, Backroad Odysseys and Lazy Lollygagger.

Brewery owner Jason Sahler knows his way around the taps. But when he has a technical question—like the oil composition of a particular variety of hops—he turns to industry experts 275 miles away at the Cornell Craft Beverage Institute at Cornell AgriTech. “By using the Hops Analysis Lab at the institute to understand the complex fruity, citrusy or piney oils, New York’s brewers can understand the capability of ingredients better,” Sahler said.

The Cornell Craft Beverage Institute—the new umbrella name that encompasses the Cornell Enology Extension Laboratory, the Craft Beverage Analysis Laboratory and the Cornell Brewing Extension Laboratory—is a one-stop shop for fermented beverage expertise. And for complex problems, extension staff visit farms and processing facilities across the state.

“We work with both new and experienced beverage makers whose problems range from fairly simple to technical and complex,” said Anna Katharine Mansfield, associate professor of enology in the Department of Food Science.

Solutions to those problems translate into big business for New York’s 1,156 licensed craft beverage manufacturers. In 2018, the New York State Brewers Association reported that the craft beer industry had a total economic impact of \$5.4 billion.

The year before, the state’s wine industry generated \$13.8 billion in economic activity, according to a National Association of Wineries report.

Within the institute, resources for brewers include the Hops Analysis Lab and the new brewery pilot plant, which opened in early 2020. The hops lab tests moisture content, storage ability and bitterness potential. Before it debuted in 2018, New York state hop growers had to mail samples across the country to labs already overwhelmed with requests. Now, local growers can benefit from fast, accurate results. In its first year, the Cornell lab tripled its workload, expanding services to growers and institutions along the East Coast. The pilot plant will provide them with more precision and processing tools.

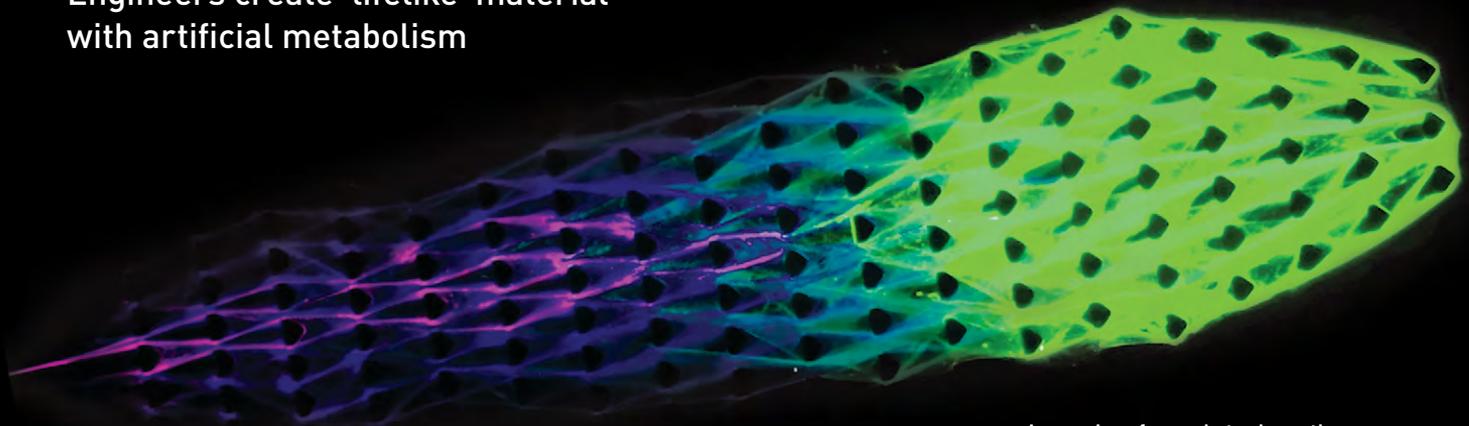
For extension associate Chris Gerling, who handles wine, cider and spirits, the phone rings off the hook. A current trend in the hard cider industry is using easy-open cans for packaging, instead of breakable glass bottles, he said. However, hard apple cider can re-ferment and if there is too much sugar or yeast, the can could explode. “Cans are all the rage. It’s a consumer’s dream and a producer’s nightmare,” Gerling said. “We do microbiological tests and help out cideries with day-to-day tests.”

At Treasury Cider in the Hudson Valley, cider maker Stacy Dedring said, “Having this wonderful group of scientists to contact when we run into an issue is invaluable. After all, making cider is a science and an art.”

—BLAINE FRIEDLANDER

A NEW FRONTIER FOR ROBOTICS

Engineers create 'lifelike' material with artificial metabolism



An overlay of snapshots shows the biomaterial's progression over the course of an hour, moving from left to right.

As a genetic material, DNA is the foundation for all known life. By tapping into its unique molecular nature, two engineers have used biomaterials to create simple machines that share some of the same properties as living things.

Using a process called DNA-based assembly and synthesis of hierarchical materials (DASH), the team constructed a biomaterial with three key traits: metabolism, self-assembly and organization. "We are introducing a brand-new, lifelike material concept powered by its very own artificial metabolism," said Dan Luo, professor of biological and environmental engineering. "We are not making something that's alive, but we are creating materials that are much more lifelike than have ever been seen before."

For any living organism to maintain itself, it needs a system to manage change: new cells must be generated while old cells and waste are swept away. Organisms depend on metabolism for energy conversion and for sustaining essential chemical processes to maintain form and function. With DASH, the engineers created a biomaterial that autonomously emerged from nanoscale building blocks and arranged itself. After the biomaterial multiplied hundreds of thousands of times, the engineering

team had chains of repeating DNA a few millimeters in length. But they still needed to keep the reaction in motion, so they injected a liquid flow of matter and energy. As the flow washed over the material, new DNA strands were synthesized. The front end continued to build upon itself while the tail end degraded, allowing the material to creep forward against the flow.

After the material achieved independent travel, the researchers decided to race one set against another. Even with two sets of identical material, randomness in the environment allowed one body to eventually gain an advantage and cross the finish line first. "Even from a simple design, we were able to create sophisticated behaviors like racing. Artificial metabolism could open a new frontier in robotics," said Shogo Hamada, lecturer and research associate in Dan Luo's lab. "The designs are still primitive, but they showed a new route to create dynamic machines from biomolecules. We are at a first step of building lifelike robots by artificial metabolism."

The team is currently exploring ways to have the material recognize and respond to stimuli—avoiding harmful cues and seeking out helpful ones, such as from light or food. The key to future

"Life began billions of years ago from perhaps just a few kinds of molecules. This might be the same."

—Dan Luo, professor of biological and environmental engineering

innovation lies in the ability to embed DNA materials with a programmed metabolism. This would give the DNA the instructions it would need to start regenerating. After that, it would be on its own. Luo said, "Life began billions of years ago from perhaps just a few kinds of molecules. This might be the same."

Currently, the material that Luo and Hamada created—which has a patent pending with the Center for Technology Licensing—can last for two cycles of synthesis and degradation before it expires, but they think they'll be able to extend the material's longevity. Hamada said, "Ultimately, the system may lead to lifelike, self-reproducing machines."

—MATT HAYES

OPENING THE DOOR TO DAIRY

Youth development program supports the next generation of industry leaders

For farm owners, an ongoing priority is attracting young people to the dairy field and developing future industry leaders. The Junior Dairy Leader (JDL) program, Cornell PRO-DAIRY's flagship initiative, has built enthusiasm for the industry through personal and professional development for over 20 years.

Alfredo Resendiz '19, the first member of his family born in the United States and the first to go to college, developed a passion for agriculture through JDL. "These types of programs do have impact, especially within schools that have no agriculture at all and for youth like me who do not come from a farm," he said. After completing the JDL program, Resendiz went on to apply to CALS, where he majored in animal science and minored in business. He is now pursuing a career dealing with agricultural commodity markets and risk management.

As part of JDL, high school students have the opportunity to participate in eight hands-on, interactive workshops over the course of a year. They tour different kinds of farms and attend the National 4-H Dairy Conference and World Dairy Expo in Madison, Wisconsin. Each program culminates in a graduation ceremony at Empire Farm Days in August, where students give presentations on their experiences.

Resendiz's parents emigrated from Mexico in the 1980s and received citizenship through naturalization. His father, a pastor, taught himself English and also worked his way up to the position of herd manager at Will-O-Crest



Participants in the Junior Dairy Leader program tour farms and production facilities across New York state.

Farm in Clifton Springs, New York. The younger Resendiz began showing cows with Will-O-Crest owners when he was 9 years old. Five years later, he started working for neighboring Willow Bend Farm. During high school, he advanced from crop and calf work to assisting the herdsman. And when Resendiz was accepted at Cornell, the farm gave him a \$1,500 scholarship. "Junior Dairy Leader is a huge exposure tool," said co-owner John Mueller '86. "It's a hook to get youth excited about the industry and open their eyes to the possibilities, so you're getting the best and brightest staying in the industry."

While at CALS, Resendiz continued to work for Willow Bend Farm in addition to participating in the Cornell Farmworker Program, which is dedicated to improving the living and working conditions of farmworkers and their families. "I will always be grateful for the JDL experience. I saw many things that I had never seen before, including milking robots. When it came time to apply to Cornell, I knew the campus already, and it motivated me to pursue agriculture as a career," Resendiz said. "Junior Dairy Leader creates youth who are passionate about the industry and the program."

—JULIE BERRY

JUNIOR DAIRY LEADER PROGRAM HIGHLIGHTS

468 PARTICIPANTS SINCE 1999

APPLICANTS FROM:

- New York
- New Jersey
- Pennsylvania
- Vermont

OF SURVEYED GRADUATES:

96%

said JDL influenced their decision to pursue a dairy or agricultural career

77%

learned technical skills for production management

58%

chose a dairy or agricultural career path after previously being undecided



More online at
cals.cornell.edu/berry-team

FROM ALL ANGLES

Scientists join forces to protect the New York state berry industry

Dale Ila Riggs knew the pests were coming for her berries. It was summer 2012, and Riggs watched as spotted wing *Drosophila* (SWD), an invasive fruit fly, descended on her 230-acre farm in eastern New York. “The only reason we didn’t lose all of our raspberry crop was because I was in our raspberry tunnel spraying every three to four days. We had never sprayed before; we never had to,” Riggs said. “This changed everything.”

Cornell researchers discovered SWD in New York state in fall 2011. By the next year, insects swarmed the fields. Growers lost up to 80% of their blueberry crop, and nearly all raspberry and blackberry crops were destroyed.

PROTECTING A VITAL INDUSTRY

Berry production is a \$20 million industry in New York, with strawberries leading the charge. But the first brush with SWD in 2012 cost New York farmers about \$5 million. “Collaboration was essential for fast progress,” said Juliet Carroll, fruit coordinator for the New York State Integrated Pest Management Program.

To protect the economic livelihood of growers—and the sweet rewards for consumers—CALs researchers came together to form the only comprehensive berry team in the Northeast. Their expertise spans horticulture, entomology, plant pathology, agricultural economics, plant breeding and management practices. “Within one year, our berry team turned the tide on SWD so that berry production could continue to be a viable industry in New York,” Carroll said.

ATTACKING PESTS

The spread of SWD forced growers to confront a challenge they didn't expect—and weren't prepared for. "Prior to SWD," Carroll said, "many growers had never applied pesticides; they didn't even own a sprayer." So she started workshops to train growers on management practices that would help them cope with the new pest.

She also began to test the idea of using hummingbirds to fight SWD—since hummingbirds can eat up to 2,000 insects per day. In initial trials, Carroll saw up to a 59% reduction of SWD in traps when there were 25 hummingbird feeders per acre of land.

The invasive insect attacks fruit just as it's beginning to ripen. Females lay their eggs in soft-skinned fruits, especially berries and cherries. Within a few days, fruit begins to wrinkle and crater as larvae feed and grow.

Greg Loeb, professor of entomology, is working to understand the biology of SWD, how it survives winters, how it zeros in on host plants, and what odors it might find repellant. "Climate change is pushing pests into new territory," Loeb said. "Southern pest problems are becoming problems here in New York and the Northeast, and it's only going to get worse."

EXTENDING THE SEASON

The average size of a berry farm in New York state is a mere 5 acres. "[Yet] growers don't need a whole lot of acreage to make a lot of money," said Marvin Pritts, professor in the horticulture section of the School of Integrative Plant Science (SIPS).

"Strawberries produce 15,000 pounds per acre, and a grower can sell a pound for \$3." However, most grocery chains aren't interested in buying local strawberries if they can only get them for three weeks out of the year. So Pritts started growing strawberries under low tunnels, and the results have been stunning. While traditional strawberries grown in New York bloom only through June, some varieties grown under tunnels are now producing fruit through November.

The tunnels help regulate temperature, wind, rain and weeds. Raspberries, which are delicate and mold easily in the open, grow taller in high tunnels, are more productive and see little mold. Blackberry plants, which typically can't survive cold Northeastern winters, can be overwintered under tunnels and produce fruit again the next year. However, tunnels aren't the perfect solution. While they reduce pressure from many pests and pathogens, they provide an ideal habitat for spider mites, which feed on the liquid inside plant leaves. But Pritts and Loeb are working together to see if predatory mites might provide a solution.

COMBATING PLANT DISEASE

Tunnels also have the potential to help growers combat threats from plant diseases. But in the field, growers must be vigilant to keep them that way. For example, anthracnose, a group of fungal diseases, creates sunken lesions on fruit with spores in a pink slimy mass. And gray mold, which looks as bad as it sounds, is a constant concern.

"Berries often require experience and optimization to work well in New York's wet, temperate climate," said Kerik Cox, associate professor in plant pathology and plant-microbe



Opposite: Black raspberries grow in a high tunnel at Cornell AgriTech. Above: Entomology professor Greg Loeb and graduate student Samantha Willden examine arthropods from a strawberry field in Geneva, New York.

biology. He's also collaborating with Pritts to study how berry plants grow under the cover of plastic tunnels. "Once you get the rain off, disease pressure automatically eases," Cox said.

BREEDING BERRIES FOR NEW YORK

Courtney Weber, associate professor in the horticulture section of SIPS, is trying to develop new varieties that combine the best traits of New York and California berries. "The varieties developed for California wintertime production were bred to be firm and hardy, so they can tolerate being shipped across the country," Weber said. "Our New York berries are a little softer, a little juicier and more flavorful." Weber's breeding program involves cross-pollinating two varieties of the same plant that have genetically appealing traits. Then he looks for offspring that carry on the best traits of both parent plants. This research starts in greenhouses and fields, and then moves to real-world trials at nurseries and farms—a process that can take up to 15 years.

The meticulous science and diligent work of CALS breeders are part of what makes the research so respected. Cornell's plant breeding program is one of the oldest in the country, and the berry program is the only one still remaining in the Northeast. "Cornell's varieties are grown all over the world," Pritts said. "I was in Kyrgyzstan, and people knew about our website. The work we're able to do for New York is significant, but it's only part of the picture. People from all over come to us for information. The impact we're able to have is really broad and wide and deep."

—KRISY GASHLER



More online at
cals.cornell.edu/sled-dogs

A GENETIC MYSTERY

Sled dogs lead the way in a quest to slow aging

Dashing through the snow at 25 miles an hour, Heather Huson '97 got her first thrill as a musher at age 7. From then on, she was hooked on dog sledding and raced competitively for almost 30 years. Now, as an assistant professor of animal science, Huson is co-leading a \$4.2 million project to study roughly 100 Alaskan sled dogs between the ages of 8 and 13—all retired from their glory days as racers.

The research involves a quest for one of the holy grails of medicine: how to slow aging.

Huson and co-leader John Loftus, assistant professor of small animal medicine in the College of Veterinary Medicine, are trying to determine whether a certain drug can mitigate the effects of aging and extend life in older dogs—and potentially in humans.

The drug in question inhibits an enzyme called reverse transcriptase that can help certain retroviruses replicate their genomes. If the replicated DNA is inserted into healthy cells, it can trigger unhealthy mutations, inflammation or cancer. Loftus said, "Our approach is to give the dogs a reverse transcriptase inhibitor to turn the transcriptase off and hopefully reduce inflammation, reduce the incidence of cancer and other diseases related to mutations and DNA damage, and ideally increase life span."

Project collaborators from Roswell Park Comprehensive Cancer Center, along with other researchers, have found evidence that reverse transcriptase inhibitors can suppress tumors and extend life span in mice. But for Huson and Loftus, dogs offer many advantages as research subjects since canines and humans share similar aging-related diseases.

Sled dogs are a genetically distinct breed but are also subject to an open breeding scheme. That diverse gene pool makes for fewer genetic issues and diseases than pure breeds. "They create a unique population that is still homogenous. We can say 'this response is potentially related to the drug and not because it's a poodle versus a beagle,'" Huson said.

In May 2018, Huson and Loftus began acquiring dozens of dogs from across the U.S. and Canada and kenneling them at the Baker Institute for Animal Research at Cornell. They collected the first baseline data in March 2019.

To test the drug's effectiveness, the team has been quantifying the animals' aging through tests related to cognitive behavior, immune function and physical



"They create a unique population that is still homogenous. We can say 'this response is potentially related to the drug and not because it's a poodle versus a beagle.'"

—Heather Huson, assistant professor of animal science

condition. "Any procedure that we're doing on these dogs for research is nothing that wouldn't be done on an awake human athlete," Loftus said.

It will take years to gather enough data to make a definitive statement about the drug's effects. But funds have already been allotted to provide the dogs with a high quality of life until they die of natural causes.

It reminds Huson of her childhood, when her family owned as many as 50 sled dogs. "I used to train dogs to run all the time," she said. "Now we're training them in a slightly different scenario. It's fun and rewarding. And, it's therapy for us."

—KRISHNA RAMANUJAN



Paul DuBoway '75 leads an excursion through a wetlands ecosystem near Ithaca, New York in July 2019.



More online at
cals.cornell.edu/bog-conservation

SUPPORTING AQUATIC ECOSYSTEMS

Alumni gift creates bog and wetlands conservation internship

With insect-eating plants and acidic conditions that can pickle dead bodies and preserve them for thousands of years, bogs are fascinating and mysterious ecosystems. But scientists are becoming increasingly aware that bogs can be crucial for combating climate change: in some cases, they sequester more carbon than rain forests.

For Paul DuBoway '75, who majored in natural resources and then had a distinguished career as a wetland ecologist, CALS fostered a fundamental appreciation and understanding of these ecosystems.

To continue the legacy of their work, DuBoway and his wife, Virginia Steinhaus DuBoway, have established an endowment to fund a student internship at Cornell Botanic Gardens. The Paul DuBoway Internship in Bog and Wetland Conservation will continue the university's tradition of leadership in bog and

wetland science and management.

The Cornell Botanic Gardens Internship Program was established more than 20 years ago to provide students with full-time, hands-on learning opportunities in natural resources management, public education and more. Lynn Swain, director of development for Cornell Botanic Gardens, said all of their student internships are funded by donors like the DuBoways. "The internship program provides life-altering experiences to Cornell students year after year," she said. "This is a direct, visible way for a donor to make a tangible difference."

"We were looking for opportunities to provide training and learning to undergraduates," Paul DuBoway said. "The foundation in sciences I got at Cornell is something that has stuck with me for over 40 years now."

—KRISY GASHLER

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THEN AND NOW

Cornell CALS empowers us to explore the boundaries of knowledge, supported by the leading minds of today and surrounded by the leading minds of tomorrow.

We sat down with past and present biology students Martha Furie '74 and Chenab Khakh '20 to discuss their CALS experiences, the evolution of biology, and women in science, technology, engineering and mathematics (STEM) fields.

Martha Furie '74 received a B.S. in genetics from Cornell and a Ph.D. in protein chemistry from Rockefeller University in 1980. She is currently a professor of pathology, microbiology and immunology at Stony Brook University. Her research has focused on mechanisms of inflammation, particularly in the context of bacterial infections.

Chenab Khakh '20 received a B.S. in biology and society, with a concentration in public health. She feels passionately about addressing health care disparities through sustainable solutions that span biology, public health and community engagement. She is a student member of the CALS Alumni Association and plans to apply for medical school.

RESEARCH AT CORNELL

MARTHA: When I was here for undergrad, we science majors were busy! Can you believe that I had a three-hour chemistry lab at 8 a.m. on Saturdays? My career trajectory was shaped by my work in Dr. Adrian Srb's lab, studying the genetics of a fungus, *Neurospora crassa*. I began as a lab assistant to earn money but was soon assigned my own project. This experience cemented my desire to go into biological research.

CHENAB: The biology and society major has been a perfect fit for me. I have always been fascinated by how DNA and evolution connects all life, from the smallest microorganism to ancient mammoths. I also think a lot about how our historical and current societal structures have shaped science applications. I have been exploring this relationship between science and society and learning ways to apply what I learned in my STEM classes to make the world a better place.

MARTHA: Experiential learning was possible in my time, obviously, because I worked in a lab, but there weren't any programs like there are now. We had to be proactive about seeking out the experiences.

CHENAB: The most notable part of my academic experience has been not only the vast breadth and depth of my courses, but also how applicable my education has been to the real world. With Engaged Cornell, I was able to explore biology at a community level in hospitals. And with Cornell Cooperative Extension, I taught nutrition to youth in New York City summer camps. The impact I made with the children, in just a few weeks, was inspiring and a huge reason why I want to continue working with community-based research opportunities. The way I have been able to lead real-world community engagement based off what I have learned in my academic classrooms has been a true highlight of my CALS experience.

BRINGING BIOLOGY INTO SOCIETY

MARTHA: The opportunity you've had at CALS to connect the biology you are learning to society is wonderful. It's not really a mindset we had back in my day, but it's so important. The growing combination of technology and biology renders it important to have informed people making the decisions about what is an ethical way to implement technology. We also need effective science communicators to spread the word that these new developments are safe and being handled in a responsible way.

CHENAB: One of our course distribution requirements in CALS is communication. Last semester, I took Science, Technology, Health and Communication, and it was fascinating how most students in the class were not STEM majors. Instead, there were more communication or business students because the ability to accurately communicate about scientific research is so marketable.

MARTHA: It sounds like CALS is doing a terrific job of broadening the spectrum of careers that are available to biology majors. By integrating biology with other disciplines, students can learn how their science training can be used, not just in academic research but also in industry, medicine, law, public policy and more.

Back in my day, biology was a very defined discipline, and the problems we looked at were very fundamental. Today, people still do fundamental research, but there is also a lot of team-based translational research. It used to be that published scientific papers had two or three authors. Now they have 20 or even 30, because that's the way to truly advance science.

CHENAB: I only see the biological sciences becoming more integrated into a variety of industries as a foundation for further advancement. For example, pharmaceuticals or

“The growing combination of technology and biology renders it important to have informed people making the decisions about what is an ethical way to implement technology.”

—Martha Furie '74



“I have always been fascinated by how DNA and evolution connects all life, from the smallest microorganism to ancient mammoths.”

—Chenab Khakh '20

biotechnology—the people working at the forefront of those industries must understand not only business and economics but also biology and how their product is produced. Now there is biotechnology, bio-consumerism, bio-communication—I see this prefix popping up in many different industries.

MARTHA: The move of research and innovation in biology to biotechnology and to industry is something that has been a huge change since I was in school. When I was a graduate student, almost no one went into industry. Everyone was on the academic pathway. But today, the basic sciences and industry are working hand in hand.

WOMEN IN STEM

CHENAB: To be a female in STEM certainly means forging your own path, working harder to establish your name and going the extra mile to build your community. I am extremely grateful for all of my mentors and for the access I have had to passionate, successful women in STEM, like you, Dr. Furie.

Having benefitted from strong female role models, I feel it is my responsibility to mentor younger girls and encourage them to pursue what they are most passionate about. On campus, I serve as a buddy in the Expanding Your Horizons program,

where girls in middle school come to Cornell for a day of science workshops.

MARTHA: I feel blessed that I never felt discriminated against as a woman in biology. I was lucky to land my first faculty position in a department that had several senior female faculty members, which was fairly unusual at the time. They served as excellent role models, especially when it came to balancing career and family. The only glass ceiling I've broken happened recently. I am the first female editor in chief of the American Journal of Pathology since its founding in 1896.

It's also great to see that there is now such a focus on diversity in STEM. It was thought about in my day but not at every level.

CHENAB: I think CALS goes above and beyond in ensuring that there is diversity across the entire community. CALS started the Intergroup Dialogue Program in 2012, and now it's required for all Cornell undergrads during freshmen orientation. I was one of the peer-facilitators for the project, and I think it shows CALS' commitment to diversity and the integration and inclusivity of people with different backgrounds—both in lived experiences and schools of thought.

POSITIONING GRADUATE STUDENTS FOR SUCCESS

New specializations accelerate growth of MPS programs



Charles Gagne, MPS '19, examines lettuce growing in a controlled environment agriculture space on campus.

After working as a civil engineering analyst in Los Angeles, Charles Gagne, MPS '19, decided to switch career paths, and he found the CALS Master of Professional Studies (MPS) program to be the perfect catalyst. Gagne graduated with a degree in horticulture and a specialization in controlled environment agriculture and recently landed an apprentice grower position at BrightFarms, a company based in the Hudson Valley.

Controlled environment agriculture is just one of the many newly developed specializations that the Office of Professional Programs and Extended Learning (OPPEL) has launched to further support professional master's programs offered by CALS. Others include environmental management and sustainable systems in the Department of Natural Resources, plant biotechnology and geospatial applications in the School of Integrative Plant Science (SIPS) and dairy business management in the Department of Animal Science.

"This has been a real team effort," said OPPEL Director Janet Anderson. "We are grateful for the support of CALS' senior leadership and collaboration with faculty experts."

There's a strong demand for OPPEL graduates. Anderson said that MPS

food science graduates, for example, have found positions at a variety of companies, ranging from small, entrepreneurial startups to large, multinational companies and anywhere in between. "It's important for us to deliver a solid return on investment for our students, both in higher-paying jobs and opportunities for career-changers," Anderson said. "With one year of coursework and a tailored capstone project, students have the opportunity to explore new disciplines and focus their graduate education over an accelerated time frame."

Gagne said he grew immensely, thanks to the support of what he called "an incredibly diverse and intelligent community." He said, "The realization that I can now have an engaging conversation with a professional about a subject I knew nothing about just months ago brings me a lot of joy."

OPPEL has also seen considerable interest in a new MPS specialization in hemp science in SIPS, with the first cohort starting in fall 2020. "The hemp industry is poised for significant growth in the next several years, and it is important to deliver an educated workforce to address all aspects, from science to business to law and policy," Anderson said.

Additional new specializations planned include animal health, plant protection (from pests and pathogens) and biological data science. CALS also offers an early admit program for qualified Cornell undergraduates to begin their master's education in the final semester of their senior year.

"We are also actively moving forward with online courses and certificates to meet the needs of students who cannot join us on campus," Anderson said.

—JIM CATALANO

TRACKING GROWTH

OPPEL has made several advances since opening in January 2017:

- Increased enrollment by 26% across 11 graduate fields of study
- Created collaborative spaces for the MPS community
- Launched an engaged learning career skills course

Find out more at:
cals.cornell.edu/masters

With gratitude, the CALS community remembers faculty members who recently passed away.

JOHN R. BRAKE

(b. 1932)

W. I. Myers Professor Emeritus of Agricultural Finance in the former Department of Agricultural, Resource and Managerial Economics

Throughout his career, Brake remained dedicated to supporting local farms, serving as an advisor to the Farm Credit Administration and offering workshops for family farmers.

THOMAS J. CADE

(b. 1928)

Professor emeritus of the former Section of Ecology and Systematics, and research director at the Lab of Ornithology

Cade was perhaps best known for his pioneering work in the captive breeding, wild releasing and eventual recovery of the peregrine falcon in North America.

JOHN MURRAY ELLIOT

(b. 1927)

Professor emeritus and chair of the Department of Animal Science

Elliot was known for his nutritional science research in ruminants. The American Dairy Science Association honored him with an award for outstanding teaching and later named him a fellow.

RAYMOND T. FOX

(b. 1922)

Professor emeritus of the former Department of Floriculture and Ornamental Horticulture

Fox was renowned for his elaborate campus floral displays and floriculture expertise. His academic pursuits focused on teaching and outreach, and he taught popular courses in floral design and retail flower store management.

DONALD J. LISK

(b. 1930)

Professor emeritus of the former Department of Fruit and Vegetable Science

A former director of Cornell's Toxic Chemicals Laboratory, Lisk was recognized for his work in analyzing pesticides. He studied the fate of heavy metals and industrial toxins in animals, plants and soils, and measured the effects on occupationally exposed populations.

DAVID PIMENTEL

(b. 1925)

Professor emeritus and chair of the Department of Entomology

Pimentel was known as a prolific researcher, writer and advocate for the environment. His sustainability research on climate change and the effects of the growing human population remain relevant today.

JAMES PRESTON

(b. 1926)

Professor emeritus of the former Department of Rural Sociology

Preston developed the Empire State Food and Agriculture Leadership Institute (LEAD New York), and exhibited a lifelong commitment to rural community development.

ROSARIO PROVVIDENTI

(b. 1921)

Liberty Hyde Bailey Professor Emeritus of Plant Pathology

Recognized as one of the world's foremost authorities on viral diseases affecting vegetables, Provvidenti also pioneered the use of genetic approaches for managing these diseases.

THOMAS WALTER SCOTT

(b. 1929)

Professor emeritus of the former Department of Agronomy

Scott was a specialist in soil fertility and focused on the effects of crop management on long-term soil productivity. He recognized the need to get students out of the classroom and into the field, so he helped develop a course that included visits to farms and experiment stations in the United States and Central America.

LEONARD D. TOPOLESKI

(b. 1935)

Professor emeritus of the former Department of Vegetable Crops

Outside of his research accomplishments, Topoleski's popular horticulture course introduced hundreds of undergraduates to the world of fruits, vegetables and landscape plants for the first time.

ROGER DARLINGTON WAY

(b. 1918)

Professor emeritus and chair of the former Department of Pomology and Viticulture

A world-renowned pomologist and fruit breeder, Way was a co-inventor of 16 new apple varieties, including Empire and Jonagold.

MADISON J. WRIGHT

(b. 1924)

Professor emeritus and chair of the former Department of Agronomy

Wright was credited with the reintroduction of soybeans to New York agriculture.

MY CORNELL STORY: DEBORAH ARRINDELL '79

My dad said that ever since I was 4 or 5 years old, I knew I wanted to be a doctor. I was always science-minded, and my parents encouraged academic achievement, so it's no surprise that I had a wonderful time studying biology at Cornell. I went on to earn a dual M.D. and master's in public health at Yale University. Then I trained as an anesthesiologist at Johns Hopkins University and practiced medicine for a couple of years, but realized I didn't want to stay in medicine forever.

What really interested me was the intersection of medicine and law, especially how legal issues can influence the care that patients receive, for better or worse. So while working as an anesthesiologist by day, I began law school at night and completed my juris doctorate at the University of Maryland School of Law.

I wanted to use my new law degree to keep helping medical patients, so I transitioned into the pharmaceutical industry. In 2008, I was hired as an executive director at Amgen Inc., one of the world's largest independent biotechnology companies, and it's been a very fulfilling role.

My work focuses on drug safety, with an emphasis in cancer research. I oversee a team of doctors, nurses and pharmacists who monitor the safety of patients during oncology clinical trials and the safety of our drugs after they reach the market.

I've worked on two first-in-class drugs for cancer treatment: Blincyto, which is used to treat acute lymphoblastic leukemia, and Imlygic, which treats melanoma. They're both very exciting breakthrough drugs that are used to boost the body's natural immune defenses to fight cancer.

Blincyto works by engaging immune T-cells and pulling them into a position where they can kill the cancerous cells. It's a game-changer compared to



Deborah Arrindell '79 walks through the Amgen Inc. campus in Thousand Oaks, California, which is the corporate headquarters for the global biotechnology company.

previous treatments because the drug directly targets leukemic cells—unlike chemotherapy, which takes a more generalized approach and kills cancerous and healthy cells.

Imlygic is actually a modified version of the herpes simplex virus—the virus that causes cold sores. Doctors inject it directly into a melanoma tumor, and this triggers the patient's immune system to fight the cancer.

One of the biggest things Cornell taught me was how to teach myself. Of course, you have excellent professors and resources, but at the end of the day, you are responsible for your own learning. That's been a big life lesson. Cornell also taught me about strategic thinking and problem solving—skills that I've used throughout my career.

I'm a member of the Cornell University Council, the CALS Advisory Council, the President's Council of Cornell Women, Cornell Black Alumni Association, the Cornell Club of Los Angeles, and I recently took on a role with the Cornell Mosaic Council. I also host a Cornell on Martha's Vineyard event every year at

my house. Next summer will be our third year, and it's open to anyone—faculty, alumni, parents and friends.

One of my favorite ways to give back is through the Cornell Alumni Admissions Ambassador Network, which connects alumni with students applying to Cornell. Our students come from such fascinating and varied backgrounds—it's a real pleasure to learn their stories and interests, and then talk with them about all that Cornell offers.

Deborah Arrindell '79 has 19 years of experience in the pharmacology and biotechnology industries. She currently works as an executive medical director in global patient safety and labeling at Amgen Inc. located in Thousand Oaks, California.

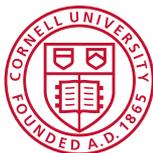


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