



DONALD DANFORTH  
PLANT SCIENCE CENTER

the  
**Leaflet**

VOLUME 22 • ISSUE 2 • FALL 2020

**REMEMBERING  
OUR FOUNDER,  
BILL DANFORTH**

*The Leaflet is a publication for partners,  
friends, and supporters of the Donald  
Danforth Plant Science Center.*



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Postdoctoral Associate Kevin Cox, Jr, PhD, is investigating where microbes and plants meet at the single-cellular level. Read more on p. 7.

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William H. Danforth, MD

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**Mission:** To improve the human condition through plant science

**Vision:** The Danforth Center seeks to feed the hungry and improve human health while preserving and renewing our environment. Through our work, we enhance the St. Louis region as a world center for plant science and innovation.

**Values:** Collaboration • Diversity and Inclusion • Innovation • Integrity and Respect • Environmental Sustainability • Stewardship



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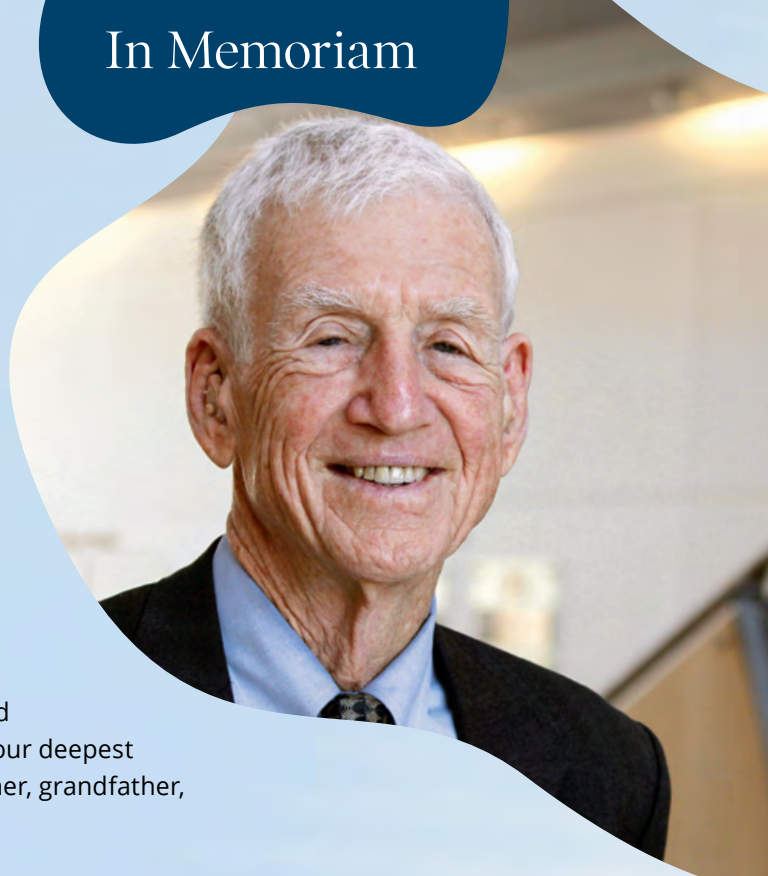
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## IN MEMORIAM

### William H. Danforth, MD

1926 – 2020



Dear Danforth Center Community,

It is with a deep sense of loss that we acknowledge the passing of our founder William Henry Danforth, MD, in St. Louis on September 16 at the age of 94.

In the weeks ahead, we will share information about how the Center will honor Dr. Danforth's extraordinary life and achievements. For now, we mourn his passing and send our deepest condolences to the Danforth family for their loss of a father, grandfather, great-grandfather, uncle, and brother.

Bill — as he always asked others to call him — was a shining example of selflessness, humility, and dedication to the greater good. He brought a passion for excellence and an unwavering commitment to serving others. In his more than two decades as chancellor at Washington University, he transformed it into one of the nation's leading universities and a cornerstone institution of St. Louis.

Then, in 1995, he "retired." It was Bill's vision to build a "Silicon Valley for plant science" that would unite and uplift his beloved hometown, St. Louis, and improve agriculture for a healthy planet "for our grandchildren and great-grandchildren." He founded the Donald Danforth Plant Science Center in 1998, served as chairman through 2013, and remained active until most recently.

Even as we remember Bill for his remarkable public achievements, we recall with great admiration his exceptional personal character, his passion for knowledge, his courtesy and humor. **He truly believed that all of us have a common purpose in life to help others and improve the world.**

This is the spirit in which Bill founded the Danforth Center, and we believe that we best honor his memory by continuing the vital work that he envisioned and so generously supported. **Let us all go forward with profound gratitude for the privilege of knowing this great man and with determination to preserve and build on his legacy.**

A handwritten signature in black ink, appearing to read "Todd R. Schnuck".

Todd R. Schnuck, Chair

A handwritten signature in black ink, appearing to read "James C. Carrington".

James C. Carrington, President

See a photo timeline of Bill Danforth's life on **page 12**. View a video tribute at [danforthcenter.org](http://danforthcenter.org).



# News & Events

## COVID-19 RESPONSE & UPDATES

The Danforth Center’s primary concern is the health and well-being of our community. We continue to operate under minimum basic operations (MBO)—and are grateful to the team members who continue to perform their necessary activities on location with all safety precautions. Staff who can are working from home, and all in-person events have been cancelled. Early in the pandemic, Danforth Center community members were involved in mask sewing efforts and face shield 3D printing. President **Jim Carrington, PhD**, who is a virologist, has recorded his thoughts on “Coronavirus, Science, and the Public Health” (April 11). “For a couple of reasons, I am sensitive to how the public perceives and values science,” he writes. Read more on our blog.

## FIGRELLO NAMED CORTEX CEO

Sam Fiorello, Danforth Center COO and SVP, and president of BRDG Park, accepted the role of president and CEO of Cortex Innovation Community in March. Fiorello has been part of the executive leadership of the Danforth Center since its founding in 1998. He writes “More than twenty years ago I first heard Dr. Danforth articulate a dream of establishing the world’s pre-eminent plant research institute in St. Louis. Little did I know then that I was about to embark on a career opportunity of a lifetime.” Read Fiorello’s complete farewell letter and thank you on our blog.

## STATEMENT OF ANTI-RACISM AND SOLIDARITY



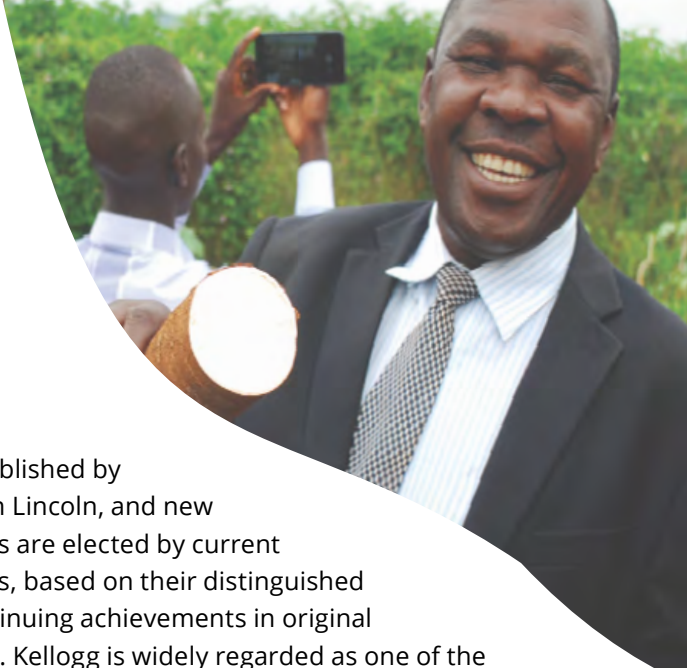
On June 9, the Danforth Center released a statement of anti-racism and solidarity with the Black community that begins “The Danforth Plant Science Center stands unambiguously and proudly with Black individuals, families and communities. We condemn all acts and forms of racism.... The Danforth Center community

• Sam Fiorello



• Black Botanists Week





commits to continuously learn about impediments to racial equality, to implement positive changes that address racial inequality, and to support our Black colleagues and Black communities." Read the full statement on our blog.

#### IMPROVED CASSAVA CLEARS HURDLE IN KENYA

Cassava is an essential food of 500 million people in Africa, but it is susceptible to brown streak disease (pictured below). This devastating plant virus can cause losses of up to 100 percent. That's why Danforth Center scientists have worked to develop Virus Resistant Cassava for Africa (VIRCA). The crop is now one step closer to farmers' hands in Kenya, thanks to completion of the public review phase this spring. Read more on our blog or visit [cassavaplus.org](http://cassavaplus.org), the website of the VIRCA Plus project, where you can watch a brief video with Senior Advisor Dr. Simon Gichuki about why Kenyans need virus-resistant cassava.

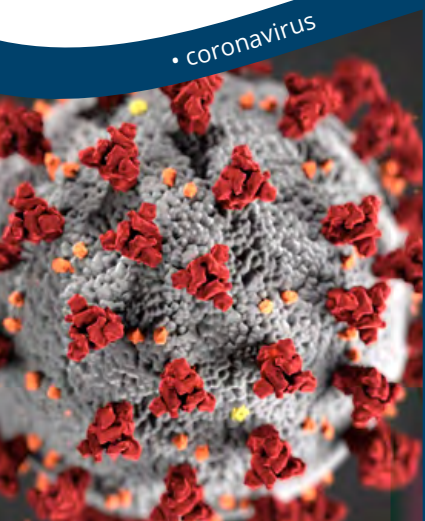
#### KELLOGG ELECTED TO NATIONAL ACADEMY OF SCIENCES

Principal Investigator **Elizabeth Kellogg, PhD**, the Robert E. King distinguished investigator at the Danforth Center, was elected into the National Academy of Sciences (NAS) in April. Election to the National Academy is one of the highest honors for scientists in the U.S. The independent organization

was established by Abraham Lincoln, and new members are elected by current members, based on their distinguished and continuing achievements in original research. Kellogg is widely regarded as one of the world's foremost experts on wild grasses. She joins Danforth Center President **Jim Carrington, PhD**, in membership. Read more about Dr. Kellogg on p. 16 in this issue.

#### CELEBRATION OF BLACK BOTANISTS

The Danforth Center took part in the celebration of Black Botanists Week in July on social media, highlighting and amplifying the voices of Black scientists who work at the Center. The St. Louis Post Dispatch interviewed **Kevin Cox, PhD**, postdoctoral associate in the Meyers lab and graduate students Kiona Elliott (pictured) and Taylor Harris in the Bart lab. According to Elliott "Black Botanists Week is a really great way to say: 'Hey, we are here, we exist!' and to show younger people that this is a viable career option for them." Read more about Cox on p. 7 in this issue.



• coronavirus



• cassava brown streak



• Elizabeth Kellogg, PhD





Left: Sarah Fenske, Dr. Bradford, and Dr. Callis-Duehl discussed the future of education and virtual learning with President Jim Carrington, PhD. At right: Jim McKelvey, serial entrepreneur and co-founder of Square.

Media sponsorship by:



## Virtual Conversations: “Inspiring Tomorrow’s Scientists”

On August 20, people from all over the world came together for the Danforth Center’s first-ever virtual Conversations event. Called “Inspiring Tomorrow’s Scientists,” the event focused on the future of education and the impact of online learning in a pandemic. Speakers included **Dr. Corey S. Bradford**, president of Harris-Stowe State University, and **Kristine Callis-Duehl, PhD**, the Sally and Derick Driemeyer director of education research and outreach at the Danforth Center. St. Louis Public Radio’s **Sarah Fenske** served as moderator. The conversation was live-streamed from the McDonnell Atrium with the speakers seated more than six feet apart. Watch the recorded event at [danforthcenter.org](http://danforthcenter.org).

## Virtual Conversations: “The Innovation Stack with Jim McKelvey”

Innovation has the power to change the world forever. But what exactly is it anyway? And how do we get that new idea into the hands of people who need it? On October 15, the public enjoyed a virtual conversation with **Jim McKelvey**, cofounder of Square and serial entrepreneur, philanthropist, and artist. His new book, *The Innovation Stack*, is an inspiring account of what it means to be an innovator and what it takes to build a resilient, world-changing company. Natalie DiNicola, Benson Hill chief of staff, served as moderator. The recorded event is available on the blog at [danforthcenter.org](http://danforthcenter.org).

For information about sponsorship: Contact **Isabel Acevedo**, corporate and foundation relations coordinator, at 314.324.5401 or [iacevedo@danforthcenter.org](mailto:iacevedo@danforthcenter.org).

## The Bioguy

GETTING TO KNOW HANNA GRAY FELLOW KEVIN COX

Danforth Center Postdoctoral Associate **Kevin Cox, Jr, PhD**, remembers where he was when he first learned he had been selected as a Hanna H. Gray Fellow: “I had just completed something at the lab bench, then walked back to my desk to check my email. When I opened it, I shouted out loud and ran a victory lap around the lab.”

The Howard Hughes Medical Institute grants the Hanna H. Gray Fellowship to only 15 scientists nationally. The prestigious award includes a \$1.4 million investment in a postdoctoral researcher’s career as they transition to principal investigator and begin to set up their own laboratory.

“Being a Hanna Gray Fellow is an extraordinary opportunity,” said Cox. “Meeting the other fellows was so inspiring. We all want to make a change, make better science, make science more diverse, and help the community.”

Growing up in Florissant, MO, in the Hazelwood School District, Cox loved science and wanted to be a doctor. “I wanted to be a pediatrician, but then I met microbes,” said Cox. “These tiny little objects have so much power—to hurt us, to heal us.”

During his junior year at the University of Missouri—St. Louis, he landed a lab assistant job at the Danforth Center. “I was fascinated to learn that plants can get sick just like humans get sick. And sick plants lead to so many problems... less food, higher prices, even illness. Pathology allowed me to merge my love for microbes and plants.”

*continued on page 8*

### About Kevin

**FAVORITE MICROBE?**

“*Xanthomonas*. It’s really bright yellow and it produces the food additive xanthan gum.”

**FAVORITE PLANT?** “I grow sunflowers with my 8-year-old daughter. We recently harvested the seeds.”

**SUPER POWER?** “Making people laugh while I teach them some science as Bioguy.”



*Danforth Center Postdoctoral Associate Kevin Cox, PhD, at STEM Splash Day 2019. As a Black PhD scientist, Dr. Cox feels an extra responsibility. “Hopefully today’s kids can have what I didn’t have: a Black scientist role model.”*



*continued*

Cox completed his PhD in plant pathology at Texas A&M University, then landed a postdoctoral position back at the Danforth Center with Principal Investigator **Blake Meyers, PhD**. “I always knew I wanted to come back to St. Louis—it’s my home. And the Danforth Center made that possible.”

Kevin’s work today involves genetics, bioimaging, and plant pathology. “I’m figuring out which genes are key for plants to defend themselves against microbes,” said Cox. “When we get sick, our white blood cells ramp up. Plants have a different way of defending themselves. Mainly they use some proteins to notify the plant that it’s under attack, but right now we don’t know which genes are critical to the process. I hope to change that.”

Cox is an educator in his spare time, serving as a science ambassador at Danforth Center STEM Splash Days: “I feel an extra responsibility as a Black PhD in science. I have a responsibility to help inspire the next generation. I want kids today to have what I didn’t have: a Black scientist role model.”

And “Bioguy”? That started as a gamer tag and is now a full-fledged persona: “I started making funny skit videos and Bioguy came to life. Now it’s the name I use for gaming and science communication videos. I like to make people laugh while I teach them something.”



*Above: Anna Casto, PhD, and Jose Tovar, PhD*

## Lightning Strikes Twice

POSTDOCS IN SAME LAB WIN NIFA FELLOWSHIPS

It’s always special when a postdoctoral associate lands a prestigious national fellowship, but when *two postdocs both win awards at the same time? In the same lab?* “I don’t know if it’s happened before, but Jose and Anna are both extremely talented and hard-working researchers. It is a privilege to work with scientists like them,” said Danforth Center Principal Investigator **Malia Gehan, PhD**.

Both Postdoctoral Associates **Anna Casto, PhD**, and **Jose Tovar, PhD**, in the Gehan lab were awarded this spring the prestigious USDA-NIFA Postdoctoral Fellowship. Casto is interested in enhancing cold tolerance in sorghum, an important bioenergy stock with a limited growth range. Tovar is interested in enhancing heat tolerance in quinoa, the highly nutritious and increasingly popular grain that originated in his home country Peru. Read more about Anna and Jose’s projects on the Danforth Center blog.





## Speed the Plow

MEET THE 2021 WILLIAM H. DANFORTH FELLOW

Just 140 miles south of Laredo, Texas, in the north of Mexico, lies the city of Monterrey. On the plain beside the eastern Sierra Madre mountains, it has a hot semi-arid climate with only about 23 inches of rain per year. But thanks to modern irrigation, it is an agricultural region, growing crops like cotton, citrus, sugarcane, corn, and vegetables.

Diego Cuerda-Gil, the 2021 recipient of the William H. Danforth Fellowship, grew up here, working in his family's irrigation water pump business. "My grandfather started the business. I was going to client's farms and every year, the water was deeper and deeper down. If something doesn't change, eventually this region will be completely dry."

While studying biology at the Universidad Autónoma de Nuevo León, Cuerda-Gil helped organize an international conference and through it, met several U.S. professors. "I realized that plant science is amazing and can help these farmers in my region."

Cuerda-Gil was accepted into the PhD program at The Ohio State University and there met **R. Keith Slotkin, PhD**. He came to St. Louis when Slotkin accepted a position as principal investigator at the Danforth Center. "The quality of my research has gone up significantly since joining the Danforth Center," said Cuerda-Gil. "I don't have to worry about access to machines, infrastructure, experts. There is so much support and mentorship." He expects to obtain his PhD from OSU in summer 2021.

For his project, Cuerda-Gil is working to help decipher the mechanism of gene silencing. "Agtech businesses and universities are investing millions of dollars in plant genetics to improve food crops around the world, but gene silencing remains a major bottleneck," said Cuerda-Gil. "I hope to change that, so that plant breeding for traits like drought-resistance becomes more economical and efficient." Read more on the Danforth Center blog.

●  
*Monterrey in northern Mexico is home to PhD candidate Diego Cuerda-Gil, who has been named the 2021 William H. Danforth Fellow.*



*"I realized that plant science is amazing and can help these farmers in my region."  
– Diego Cuerda-Gil,  
2021 WHD Fellow*





The new EDGE@BRDG building on the Danforth Center campus opened in June. Benson Hill, a Danforth Center spinoff, is the main tenant. Inset: the virtual grand opening.



## A Celebration of Innovation

DANFORTH CENTER, 39 NORTH A BRIGHT SPOT IN PANDEMIC

The Danforth Center campus anchors the 39 North innovation community. It is home to BRDG Park, the BioResearch and Development Growth Park just beyond the Danforth Center greenhouses. Together, the Danforth Center, BRDG Park, and Helix have a goal to attract, retain, and grow new companies, bringing jobs and investment to the St. Louis region.

### NEW BUILDING

Despite challenging working conditions, and necessary health and safety restrictions, improvements to the Danforth Center campus continued this year. EDGE@BRDG, the new 160,000 square foot building by Seneca CRE and Clayco, opened on time in June, and anchor tenant Benson Hill moved right in. Benson Hill is a “food tech” company, combining ag and data science to empower crop breeders. It was founded in 2012 and is a Danforth Center spinout. After growing in multiple locations, last year Benson Hill chose St. Louis as their world headquarters. The company employs more than 300 people here.

“Part of the Danforth Center’s mission is to enhance the St. Louis region as a world center for plant science. Innovation and partnerships are how we move discoveries around food and the environment quickly into the marketplace, so they can reach real people.” –*Stephanie Regagnon, Executive Director of Innovation Partnerships*



## NEW FACES

Scientists at the Danforth Center tackle some of humanity's greatest challenges, such as hunger, malnutrition, and climate change. Through startups, spinouts, and partnerships, we speed the progress of cutting-edge agtech ideas into the hands of farmers who need them most. Assisting in this journey are members of the new innovation team, each with a unique role.



The former CEO of FieldWatch, **Stephanie Regagnon**, is the Danforth Center's new executive director of innovation partnerships. She brings nearly 20 years of experience in agriculture and renewable energy to her role, which is to build partnerships to grow and strengthen the Danforth Center's innovation ecosystem, particularly BRDG Park and 39 North.



Serial entrepreneur and former CEO of NewLeaf Symbiotics, **Tom Laurita, PhD**, is the Danforth Center's new director of entrepreneurship. Tom has successfully founded and run five companies in the ag and finance areas, including NewLeaf. He is leading efforts to create more start-up companies based on Danforth Center science and technologies.



**Claire Kinlaw, PhD, MBA**, is director of innovation commercialization. A scientist with a business degree, Claire is facilitating the development of intellectual property emerging from Center labs. She has extensive experience in early-stage commercialization through her previous work for Larta and TerViva.

The team wants to create an environment where it is natural for scientists to think about commercial applicability of their research—and to create a thriving, vibrant community across the broader campus where those enterprises can start and grow.

## Six Agtech Startups to Watch



The Danforth Center in collaboration with the Wells Fargo Innovation Incubator (IN2) has announced a new cohort of agtech startups. This partnership pairs promising sustainable ag innovations with expert Danforth Center principal investigators for testing and development in order to speed solutions to market. These six early-stage companies include:

- **AGROSPHERES** - Charlottesville, VA - Develops AgriCell that can mitigate the direct and indirect detriments of using chemical pesticides, with the goal to cut chemical pesticide use by at least 50 percent. *Danforth Center PIs: Dilip Shah and Kirk Czymmek*
- **EARTHSENSE** - Champaign, IL - Employs machine learning and robotics in the field to increase yield, eliminate resistant superweeds, and accelerate crop improvement. *Danforth Center PIs: Todd Mockler and Andrea Eveland*

- **MOBIUS** - Lenoir City, TN - Creates naturally biodegradable and compostable materials that can replace controlled-release fertilizers for improved plant and soil health. *Danforth Center PI: Chris Topp*
- **PLASTOMICS** - St. Louis, MO - Next-generation trait delivery technology that harnesses the chloroplast to efficiently build higher yielding crops. *Danforth Center PIs: Keith Slotkin and Blake Meyers*
- **PLUTON BIOSCIENCES** - St. Louis, MO - Deploys a "micromining" process to offset resistance to microbes that are specifically targeted against various pests. *Danforth Center PIs: Toni Kutchan and Brad Evans*
- **TERVIVA** - Oakland, CA - Commercializing climate-resilient pongamia, a hardy legume tree that produces an annual crop of beans up to 10 times greater than soy for over 25 years. *Danforth Center PI: Allison Miller*

"The Danforth Center is proud to collaborate for the second year with a cohort of exciting early-stage companies that are commercializing promising sustainable ag innovations," said Claire Kinlaw, director of innovation commercialization at the Danforth Center.

# Our Founder William H. Danforth, MD

## A TIMELINE OF HIS LIFE

1926

William Henry Danforth II born April 10 in St. Louis, MO, to Dorothy and Donald Danforth.



As a young child his grandfather William H. Danforth I, founder of the Ralston-Purina company and author of the self-help book *I Dare You!*, instructs him to cut the word "impossible" out of his dictionary, providing lifelong inspiration to achieve the extraordinary.



1944-1945

Served in the U.S. Navy during World War II; assigned to Westminster College in Fulton, MO.



1947

Received B.A. degree from Princeton University.



1950

Married to Elizabeth "Ibby" Gray, his partner for 55 years until her passing in 2005. They raised four children.



1951

Returned to St. Louis to intern at Barnes Hospital after receiving MD degree at Harvard Medical School.

1952-1954

Served as a physician in the U.S. Navy during the Korean War.



1957

Joined the faculty of the Washington University School of Medicine as a cardiologist.



1965-1971

Served as vice chancellor of medical affairs and president of the Washington University Medical Center, appointed professor of internal medicine in 1967.



1971

Named the 13th chancellor of Washington University with universal support at age 44.

1977

Named "Man of the Year" by the *St. Louis Globe-Democrat*.





1995

Retired as chancellor of Washington University after leading the effort to transform it into one of the world's leading teaching and research institutions.

1995

Appointed to negotiate a settlement to the St. Louis Public School desegregation case that had been stuck in the courts for 24 years.

1998

Founded the Donald Danforth Plant Science Center with the mission to improve human condition through plant science. Served as chairman.



1999

Named Washington University chancellor emeritus, vice chairman of the Board of Trustees, and life trustee. Groundbreaking on the Danforth Center building.



2001

Construction of the Donald Danforth Plant Science Center building, an early example of sustainable design.



2001

Founded the Coalition for Plant and Life Sciences (which became BioSTL in 2011) to promote bioscience company creation and drive economic growth in St. Louis.



2006

Main campus of Washington University named the Danforth Campus in recognition of the family's contributions.



2009

Bio-Research Development and Growth (BRDG) Park opened on the Danforth Center campus.



2009

Chaired the U.S. Department of Agriculture (USDA) Research, Education and Economics Task Force, recommended the creation of the National Institute of Food and Agriculture.



2013

Retired as chairman; named founding chairman and emeritus director of Danforth Center.



2016

Dedication of the William H. Danforth Wing at the Danforth Center.



2020

Passed away at age 94.



**In Memoriam  
William H. Danforth, MD  
1926 - 2020**

View a video tribute to Bill Danforth at:  
[danforthcenter.org](http://danforthcenter.org)



Visit our blog at [danforthcenter.org](https://danforthcenter.org) to see time-lapse video of the peptide at work.

From left: Siva Velivelli, PhD; Principal Investigator Dilip Shah, PhD; and Hui Li from the Shah lab. Velivelli and Shah coauthored a paper with Principal Investigator Kirk Czymmek, PhD, that reveals a new method for fighting agricultural fungus infections.

## Breaking News in the Fight Against Fungus

Fungal diseases cause substantial losses of agricultural harvests each year, and the fungus causing gray mold disease is a major problem for fresh produce like strawberries, grapes, raspberries, tomatoes, and lettuce. To combat the problem, farmers must resort to dangerous and expensive chemical fungicides, which can have diminishing effectiveness.

Danforth Center Principal Investigators **Dilip Shah, PhD**, and **Kirk Czymmek, PhD**, with Postdoctoral Associate **Siva Velivelli, PhD**, and collaborators at Pacific Northwest National Laboratory, have discovered a natural and potentially less expensive alternative.

They have identified a natural substance occurring in a legume (the bean family) that proved effective in inhibiting growth of the fungus causing gray mold when sprayed on tomato plants. The results of their research were recently published in the journal *Proceedings of the National Academy of Science*. The substance is a subclass of peptides found in the nodules of an alfalfa relative.

A spray of these natural substances would be safer and potentially less expensive than the current chemicals used. In addition, the peptides eventually break down and are used by beneficial microbes in the soil as an energy source.



Image from the Advanced Bioimaging Lab at the Danforth Center revealing the peptide's advance against the fungus.

“Discoveries like this can provide farmers with sustainable alternatives. It’s better for farmers, for consumers, and for the environment.” -**Dilip Shah, PhD, Danforth Center Principal Investigator**

A portion of the project was funded by TechAccel. Remaining support was provided by generous individuals and donors to the Danforth Center Innovation Fund. To learn more about supporting work like this, [visit danforthcenter.org/get-involved](https://danforthcenter.org/get-involved).

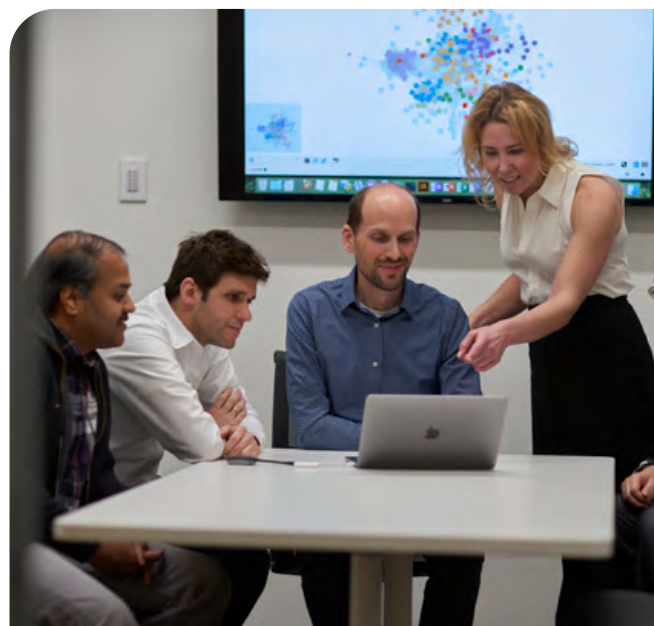


## Genetic Research toward Higher Yielding Corn

New research conducted by a team led by Danforth Center Principal Investigator **Andrea Eveland, PhD**, has revealed regulatory features of the corn/maize genome during early reproductive development. These maps of regulatory DNA separate out genetic differences in development of male and female reproductive structures, tassel and ear, respectively, and have significant impacts on breeding efforts in maize. "To enhance crop productivity, the ability to adjust gene expression precisely in space and time is very important," said Eveland. "This study serves as a foundation for doing this in corn." Integrating computational and experimental approaches, Dr. Eveland's research focuses on plant architecture in cereal crops with the goal of improving yield. The findings were published in the journal *Genome Biology*. Funding provided by National Science Foundation Plant Genome Research Program.

## Better Understanding Male Fertility in Corn

A research team led by Danforth Center Principal Investigator **Blake Meyers, PhD**, has discovered a way to turn pollen production off and back on again in corn using temperature. The findings were published in the journal *Nature Communications*. The article is a companion piece to a previously published genetics study, which demonstrated that a small RNA pathway thought unique to grasses is actually widely present in flowering plants. "Putting these two discoveries together, we can understand the role these molecules play is important for full male fertility in maize," said Meyers. "These molecules are widely present across species of flowering plants. Understanding the genetic mechanisms by which flowers develop is important for improving crop yields and breeding better varieties." The work is funded by the National Science Foundation.



*Principal Investigator Andrea Eveland, PhD, and members of her lab consult with Noah Fahlgren, PhD (center), director of Data Science. A group of researchers led by Eveland has published genetic mapping of regulatory features in corn.*



*In a development that could be useful in seed production, a team led by Principal Investigator Blake Meyers, PhD, has discovered a way to turn pollen production off and on in corn using temperature. Pictured: fertile corn tassel with pollen.*



●  
*Dr. Elizabeth Kellogg reviewing plants in the Danforth Center greenhouse with Postdoctoral Associate Yunqing Yu and Senior Lab Technician Taylor AuBuchon.*



## NATIONAL ACADEMY OF SCIENCES

**Founded:** 1863 by Abraham Lincoln

**Purpose:** providing independent, objective advice to the nation on matters related to science and technology

**Membership:** elected by their peers for outstanding contributions to research

**Current members:** 2,400

**Nobel Prizes:** 500 past and present

## What Is It?

### A LIFETIME OF QUESTIONS LEADS TO DR. ELIZABETH KELLOGG'S ELECTION TO THE NATIONAL ACADEMY

From the time she was a small child collecting tadpoles in the pond in her hometown of Nashua, New Hampshire, **Elizabeth A. "Toby" Kellogg, PhD**, has been asking questions – lots and lots of wide-ranging, highly impactful questions that, she learned, can ultimately be tested in a lab.

Kellogg's questions took her to Harvard for a biochemistry undergraduate degree; to a stint in the Forest Service and a masters in ecology at the University of Idaho; and back to Harvard for a biology PhD and postdoc. She taught at Harvard before relocating to St. Louis with her spouse, botanist Peter F. Stevens, to hold joint appointments at the Missouri Botanical Garden and the University of Missouri – St. Louis. It was here she determined the question that would define her research career: "Is it the same or is it different?" It is a question that she has gone from the field to the herbarium to the DNA-sequencing lab to attempt to answer.

#### THE ACADEMY

Kellogg is today the Robert E. King Distinguished Investigator at the Danforth Center and an adjunct professor at Washington University in St. Louis. She is also the Danforth Center's newest member of the National Academy of Sciences, elected by her peers to the highest honor for scientists in the U.S.

She was in the middle of a Zoom meeting with her lab when she got the phone call notifying her of the election. "It was a total surprise—and immensely gratifying," said Kellogg. "To be elected, multiple people have to come together to nominate you. It's an incredible vote of confidence from my colleagues—and an amazing honor."



Read more about Dr. Kellogg's recent publications in the News section of:  
danforthcenter.org

#### A BRIDGE BETWEEN DISCIPLINES

Kellogg is widely regarded as one of the world's foremost experts on wild grasses, but her expertise is diverse. She also works in comparative genomics and developmental genetics, a fact that can come as a surprise even to her collaborators since most scientists specialize in just one area.

One constant is her work as a wild grass *taxonomist* (a scientist who describes and classifies species). But she's a taxonomist who has evolved to embrace all the latest technologies of genetics research.

"She has a very special position in the community," said **Yunqing Yu, PhD**, a postdoctoral associate in the Kellogg lab. "Normally geneticists and taxonomists don't talk to each other, but she's in the middle. She's an expert on *both*."

#### WHY IT MATTERS

Dr. Kellogg has applied her prodigious curiosity to a lifetime of study of one of the world's largest and most useful families of flowering plants: the grasses. Grasses dominate more than 25 percent of the land area of Earth. Cereals have fed civilizations for millennia— rice, maize (corn), wheat, sorghum, barley, oats, and many more. These crops were selected by humans from an entire ecosystem of wild grasses. How this happened—and what we can learn from wild crop relatives—is the center of Dr. Kellogg's research.

It's especially important in a changing world: "By studying cereal crops and their relatives in the grass family, we can then predict how plants may adapt to a warmer, drier climate," said Kellogg. "We are writing the papers now that crop breeders need for the future."

## From Wild Collection to Conservation

The Kellogg lab is home to a variety of projects, including studies of salt tolerance and seed shattering, but the largest in sheer scale is a study of the 1,200+ wild grass species related to corn/maize and sorghum. By sampling as many different environments as possible, Kellogg and team plan to identify stress adaptations that may help enable future crops to better adapt to warming climates.

Now 2 years into the 4-year grant, the lab was about to embark on more field work when the pandemic cancelled all travel. How to proceed? The team pivoted to turn their abundant data into a tool for conservation assessment, and the results are expected to be published next year.

#### A COMMUNITY-WIDE EFFORT

"We are able to pursue our scientific goals because of immense support from the society in which we live, in the form of institutions, grant dollars, and public donations," said **Kellogg**. "Advancing science is a community-wide effort."

*If you would like to support the work of researchers like Dr. Kellogg, visit [danforthcenter.org/donate](https://danforthcenter.org/donate) to make a gift to the Innovation Fund today.*

*Field work site in Northern Territory, Australia.*







*Dr. Chris Topp and team keep social distance while working at the new field site this spring.*

"The Cellas have enabled us to accelerate our long-term plans to develop a nearby field research station," said **Danforth Center President Jim Carrington, PhD.** "So much of our research is done in the field, so this resource being made available by generous supporters is a tremendous boost to our ability to deliver on our mission."

## Outstanding in Their Field

Pauline and John Cella remember the exact moment the idea occurred to them. They were hosting a dinner on behalf of the Danforth Center. As three Center scientists presented on their food-related research and the cutting-edge infrastructure of their laboratories at the Danforth Center, Pauline had a thought: "As a horticulturist, I wondered if they ever conducted research in the field."

"Afterward, one of the scientists talked to us about how challenging it was to do field work," said Pauline. "They had to drive long distances, stay overnight, be away from their families. That's when the lightbulb went off."

Pauline and John are the owners of Planthaven Farms, a grower-retailer headquartered in O'Fallon, MO. Planthaven is a home gardener's dream with 20 greenhouses and 100,000 square feet of plant displays open to the public. The property is also surrounded by 50 acres of rich Meramec River bottomland, good for farming.

"We went in and met with [Danforth Center President] Jim Carrington," said John. "We said, 'What if we let you use some acres at our farm?' We thought we could help get those scientists out of the labs, away from their test tubes, and into the field."



### CLOSE TO HOME

The plan for the 5-acre Danforth Center Field Site at Planthaven Farms was finalized in 2019, but a levee break along the Meramec prevented implementation until early 2020, just before the COVID-19 pandemic led to lockdowns across the country. However, outdoor work with appropriate safety precautions was able to begin.

Danforth Center teams have always undertaken field research in partnership with universities and nonprofits across North America and around the world, but they have never enjoyed a dedicated site so close to home, only 35 minutes from the Center—and the partners to make it a success.

“As any farmer knows, it’s a lot of work to grow plants outside, and we have responsibilities in the lab,” said **Chris Topp, PhD**, Danforth Center principal investigator, and one of six early adopters of the new field site. “My group has tried to do field work nearby before, but it didn’t work out, largely because we didn’t have a partner to help. John and Pauline have been incredibly enthusiastic about the work. And Farmer John was instrumental.”

“Farmer John” is John Williams, an organic vegetable grower and friend of the Cella family, who previously grew produce for their restaurant, Truffles in Ladue. On the recommendation of John and Pauline, the Danforth Center hired “Farmer John” to manage the research field, and his help has proved important to its success.

Danforth Center Principal Investigator **Allison Miller, PhD**, agreed: “John Williams serves as an on-farm technician, working tirelessly to prepare fields, set up irrigation systems, help with plantings, and control weeds. He has helped us succeed at the new site.”

### WHY IT MATTERS

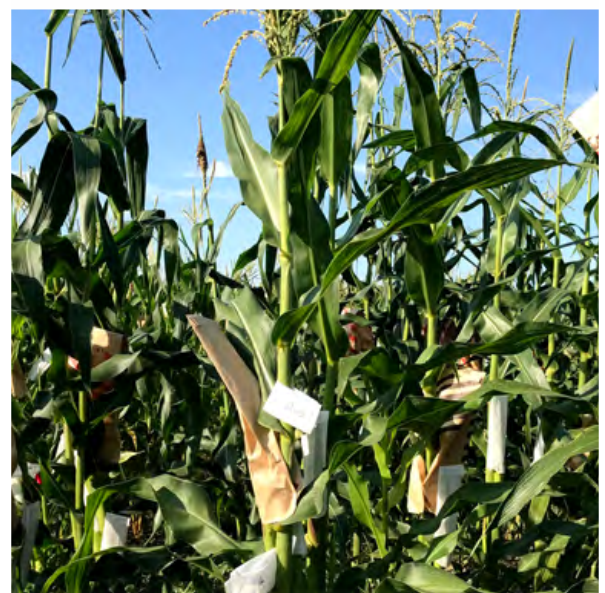
There are many reasons why having a dedicated field site is a boon to research. Beyond the convenience and significant cost savings of proximity, Center scientists are also able to control the site as never before. When field access depends on collaboration, it can be difficult to establish priority—and setbacks can occur if collaborators switch institutions. Having convenient field access managed by the Danforth Center is crucial to long-term projects, and it is cost effective, so it allows more exploratory projects as well.



*“Farmer John” Williams, field manager and organic farmer, demonstrates the use of the wheel hoe.*



*The Miller lab planted one hundred experimental grape vines in 2020 and hope to triple that number in 2021.*



*The Topp lab’s experimental corn plot, which allowed validation of three major genes that affect plant roots.*





*Pauline and John Cella at their home in Wyoming.*

## DONOR PROFILE :

### Pauline & John Cella

The owners of Planthaven Farms didn't intend to become professional horticulturists. Says John: "I called Pauline one day and said 'You have a very successful banking career in St. Louis, do you want to give it all up and become a farmer?'"

Fast forward 20 years and today Planthaven Farms is a beloved locally grown garden-center operation with three retail locations, one of which is a summertime pop-up in Olivette, MO, just down the street from the Danforth Center.

"We were fascinated by what was happening at the Danforth Center," says Pauline. The family quickly became engaged. John became an ambassador [an early version of the Danforth Leadership Council], they took a tour, and their son even became a member of the Young Friends.

Through the intervening years, the Cellas continued to support the Center with annual gifts and by hosting dinners and events at Planthaven, always with a goal to introduce the Danforth Center to more people.

**"The Danforth Center is a shooting star in St. Louis," says John. "It brings so much to our town, think of the scientists that have been brought here with their families—their genius, their experiments! We wanted more people to know about it."**

When the Cellas decided to grant use of their property for a field site, they were clear in their motivation: "Plant science can change everything," says Pauline. "The Danforth Center is bringing cutting-edge science universally to the world, to places that wouldn't normally have access. That is inspiring."

Now with a first season of scientific experiments underway, John adds: "To see your gift make a difference is a really rewarding thing."

●  
*Corn growing at the new Danforth Center Field Site at Planthaven Farms.*







## Introducing... the Grow Challenge

When the Young Friends' signature event, Party with the Plants, had to be cancelled, they decided the work of the Danforth Center couldn't wait. They launched the **Danforth Center Grow Challenge Week of Giving** (Sept. 28 – Oct. 2) and raised more than \$45,000 for STEM education and early-stage projects. Thank you to everyone who contributed to grow our Center, help our region, and feed our world.

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