A Community Responds in a Pandemic Year

2020 ANNUAL REPORT
A Legacy Lives On

Dr. Danforth loved people. He touched the lives of so many and united people to accomplish great things. As our founder, he worked to ensure the health and happiness of people around the world and to create opportunities for the people of St. Louis. He has left behind an enduring legacy—and a challenge to each of us to continue the work. As the Center moves forward, his remarkable humanitarian vision will continue to guide us.

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Letter from the President

To say that 2020 was a notable year would be a monumental understatement. Yes, we confronted a global pandemic that caused countless challenges, but that was only part of the story. Despite the disruptions and unprecedented circumstances, the Danforth Center had one of its most productive years ever! Though we shifted much work to home offices and kitchen tables, we maintained more grant-funded research activity, and published more scientific discoveries, than in any prior year. We established new ways to reach the public through creative outreach and built new greenhouse facilities on our campus. We celebrated the opening of the EDGE@BRDG building, now headquarters for Benson Hill, on our campus. And we implemented better ways to grow as a more diverse and inclusive community.

None of this happened by chance, but rather by the Center community working collaboratively, inventively, and with purpose to deliver on our mission to improve the human condition through plant science. These achievements were made possible through remarkable financial support from the Center’s committed friends, who despite the turbulence of the past year, understood that our work is more relevant now than ever before.

Our Danforth Center community of scientists, staff, and supporters gets better every year. Thank you for joining us!

Letter from the Chair

The year 2020 provided many of us with time for reflection. The pandemic, which continues even now, shined a light on the impact our actions have on others. It also called many to consider what we can do to improve the lives of those around us. It is something our Founding Chair, Dr. William H. Danforth, dedicated his life to doing.

We were deeply saddened in 2020 by the loss of Dr. Danforth. Bill was a shining example of selflessness, humility, and dedication to the greater good. He believed passionately in people, especially the people of St. Louis. He once said, “Our people are willing to work together for a common good. That’s a rare plus not present in every community.” With the support of our donors, partners, scientific community, and the public, the Danforth Center has been able to continue progress, even during a tumultuous year.

As you will read in these pages, important scientific discovery continued, and a new research field site opened. The new EDGE@BRDG building was completed, and Benson Hill moved in. The greenhouse range expansion got underway and is soon to be opened as the new Michael W. and Quiris V. Riney Family Greenhouse. The Danforth Center continues to help renew and strengthen our local economy.

We are grateful for your support and interest, and we invite you to learn more about the work of the Danforth Center.
Science in a Pandemic

Despite facing a whirlwind of challenges unlike any faced before, Danforth Center principal investigators accomplished remarkable things this pandemic year. Together with the talented scientists in their labs, they made breakthrough discoveries and publications, landed significant grants, and achieved national recognition for their work. They are the solution-creators of our Center, our region, and our world.
Making History

The Danforth Center is a scientific institute with a mission to improve the human condition through plant science. Our mission demands constant innovation and nimble responsiveness to emerging threats within the plant and agtech world. When lab access was limited by the threat of COVID-19, scientists pivoted to publish the greatest one-year total of articles in Danforth Center history. (See publication highlights on page 5.)

Onsite work continued, with Minimum Basic Operations (MBO) teams in place to maintain essential experiments. Learning opportunities, like the Center’s weekly Scientific Seminar, transitioned rapidly from in-person to online, and the new virtual format allowed expanded participation from institutions across the country.

With great, but virtual, celebration, Dr. Elizabeth “Toby” Kellogg, the Danforth Center’s Robert E. King Distinguished Investigator, was elected to the National Academy of Sciences (NAS). She joins Danforth Center President Jim Carrington in this highest honor for scientists in the US. Kellogg is one of the foremost experts on grasses, and her election to the NAS signifies the importance of her contributions to our world.

**Total Publications: 1,491**

**2020 Publications: 137**
Principal Investigators

Doug Allen, PhD  
Member and USDA Research Scientist  
The Allen lab uses isotopes combined with computational methods to assess plant growth and productivity at the molecular level that contribute to enhanced biomass production and value-added seed compositions.

Rebecca Bart, PhD  
Associate Member  
The Bart lab combines genetics with molecular and computational biology to study host-microbe interactions in important crops including cassava, sorghum, and cotton.

Ivan Baxter, PhD  
Member  
The Baxter lab uses advanced technologies to understand the diverse ways plant genetics interacts with the environment to enable growth.

Kristine Callis-Duehl, PhD  
Solly and Derrick Driemeyer Director of Education Research and Outreach  
The Education Research & Outreach lab studies how to effectively engage students in authentic STEM research at all grade levels, K-16, in formal, informal, and virtual learning environments in an effort to recruit, train, and retain the next generation of diverse STEM and agtech scientists and leaders in St. Louis and around the world.

James Carrington, PhD  
President and CEO  
The Carrington lab focuses on how plants respond to viruses, mechanisms of epigenetics, and how crops can be improved to increase productivity.

Kirk Czymmek, PhD  
Director, Advanced Bioimaging Laboratory  
The Czymmek lab uses advanced imaging approaches to understand the inner workings of plants, microbes, and their interactions with each other and the environment.

Bradley Evans, PhD  
Director, Proteomics and Mass Spectrometry  
The Evans lab uses high-performance mass spectrometry, proteomics, and metabolomics for connecting molecular phenotypes with the macroscopic form and function of organisms.

Andrea Eveland, PhD  
Associate Member  
The Eveland lab uses experimental and computational approaches to investigate the regulation of architecture traits and yield potential in cereal crops.

Noah Fahlgren, PhD  
Director, Data Science Facility  
The Data Science team is a computing and data analytics hub that develops and deploys technologies in computational biology, computer science, mathematics, and statistics to accelerate discoveries from data and models in plant science.

Malia Gehan, PhD  
Assistant Member  
The Gehan lab develops high-throughput phenotyping approaches to study mechanisms of crop resilience under temperature stress.

Elizabeth Kellogg, PhD  
Member, Robert E. King Distinguished Investigator  
The Kellogg lab studies genomes, growth, and development of sorghum, maize, and their wild relatives, using biodiversity research to make ecosystems and agriculture more sustainable.

Toni Kutchan, PhD  
Member, Oliver M. Longenberg Distinguished Investigator, VP for Research  
The Kutchan lab studies the production of the anticancer compound cyclopamine in corn lily, the modification of plant medicinals by the soil microbiome, and the oilseed crop camelina as a source of renewable fuel.

Mao Li, PhD  
Senior Research Scientist and Principal Investigator  
The Li lab develops mathematical methods, models, and computational tools to extract and analyze comprehensive plant morphological features from 2D and 3D imaging data to fully utilize new technologies and accelerate biological discoveries.

Donald MacKenzie, PhD  
Executive Director, Institute for International Crop Improvement  
Dr. MacKenzie leads the Institute for International Crop Improvement (IICI). The IICI is committed to delivering precision genetics technologies to meet the most significant food and nutritional security challenges faced by smallholder farmers everywhere.

Blake Meyers, PhD  
Member and Professor, Division of Plant Sciences, University of Missouri – Columbia  
The Meyers lab uses experimental and computational approaches to study plant reproduction and fertility to enhance yield gains in crop plants.

Allison Miller, PhD  
Member and Professor of Biology, Saint Louis University  
The Miller lab explores how long-lived plants respond to dynamic environments, with the goal of developing perennial crops that support ecologically sustainable agricultural systems.

Todd Mockler, PhD  
Member, Geraldine and Robert Virgil Distinguished Investigator  
The Mockler lab uses genomics, high-resolution phenotyping, and computational biology to understand plant responses to environmental stresses to improve productivity in food and energy crops.
Dmitri Nusinow, PhD
Associate Member
The Nusinow lab focuses on finding new genes that have the potential to increase productivity in response to daily and seasonal changes in light and temperature.

Sona Pandey, PhD
Member
The Pandey lab uses molecular, biochemical, and functional studies to understand the mechanisms of stress tolerance and yield improvement in plants by heterotrimeric G-proteins.

Dilip Shah, PhD
Associate Member
The Shah lab investigates modes of action of antifungal plant defensins and defensin-like peptides to enable development of fungal disease resistant crops for yield protection.

R. Keith Slotkin, PhD
Member and Associate Professor, Division of Biological Sciences, University of Missouri – Columbia
The Slotkin lab seeks to uncover how plants determine which regions of their genomes should be expressed, which regions should not be expressed, and to create new technologies in plant biology.

Nigel Taylor, PhD
Associate Member, Dorothy J. King Distinguished Investigator
The Taylor lab has advanced virus-resistant cassava into regulatory field trials in East Africa as a critical step toward delivering enhanced planting materials to farmers.

Christopher Topp, PhD
Associate Member
The Topp lab deploys X-ray-based imaging and analysis of corn and other root systems to develop more robust and sustainable crops.

James Umen, PhD
Member, Enterprise Rent-a-Car Institute for Renewable Fuels and Joseph Varner Distinguished Investigator
The Umen lab investigates the genetics and cell biology of green algae to enable development of sustainable sources of biofuel and other high-value compounds.

Veena Veena, PhD
Director, Plant Transformation Facility
The Veena lab explores novel approaches for plant genetic engineering and genome modification technologies to enable plant biology research for crop improvement.

Sam Wang, PhD
Member and E. Desmond Lee Professor, University of Missouri – St. Louis
The Wang lab focuses on lipid metabolism and signaling in plant response to nitrogen/phosphorus/water deficiency and seed oil production.

Bing Yang, PhD
Member and Professor, Division of Plant Sciences, University of Missouri – Columbia
The Yang lab uses enhanced genetic and molecular tools to increase the understanding of plant responses to biotic and abiotic stresses that can be coupled with enabling technologies to develop improved crops.

Ru Zhang, PhD
Assistant Member
The Zhang lab studies how photosynthetic cells, especially photosynthesis, responds to high temperatures in order to engineer more heat-resistant crops and algae for improved food and biofuel production.

2020 PUBLICATION HIGHLIGHTS
The year 2020 saw more Danforth Center scientific publications than ever before: 137 in total. Here are just a few highlights.


Stepping Up to the Plate

Food is a basic human right that millions of people around the world are denied each day. As the world’s population grows, and the climate continues to change, even more will face hunger and malnutrition. Danforth Center scientists are harnessing the power of plant science to find sustainable solutions to this critical problem.
Improved Cassava: First in the World

**VIRCA Plus Cassava Combines Disease Resistance and Enhanced Nutrition for Food Security**

This year, the Danforth Center’s VIRCA Plus improved cassava became the first ever non-cereal crop to stack the traits of disease resistance and biofortification. The improved cassava is enhanced with higher levels of the micronutrients iron and zinc to combat malnutrition. It also includes the traits of resistance to two major cassava diseases—cassava mosaic disease and cassava brown streak disease—to increase harvests.

Danforth Center scientists Nigel Taylor, PhD, Dorothy J. King Distinguished Investigator, and Andrew Kiggundu, PhD, Danforth Center project manager, have completed field trials in Puerto Rico. Trials are now underway in Nigeria under the oversight of Ihuoma Okwuonu, PhD, of the National Root Crops Research Institute in Nigeria, who trained previously in the Taylor lab at the Danforth Center. The VIRCA Plus project is showing that by applying cutting-edge technology to orphan crops like cassava, we can create a better, healthier world.

“Farmers should not have to make difficult choices between crops that either improve nutrition or allow productive harvests. With improved cassava, they will have both.”

-Donald MacKenzie, PhD, Executive Director, Danforth Center IICI

The Institute for International Crop Improvement translates plant science discoveries and technology into food security solutions for the people who need them most.

Cassava brown streak disease can cause losses of up to 100%. The Danforth Center’s VIRCA Plus project is developing a variety that is not only disease resistant, but also enhanced with micronutrients to combat malnutrition.

Danforth Center partner Dr. Ihuoma Okwuonu, who trained at the Danforth Center in the Taylor lab, oversees the improved cassava field trials in Nigeria.
Rice is grown in more than 100 countries around the world. Danforth Center scientists are working to defeat bacterial blight for the good of smallholder farmers everywhere.

“\textit{It’s exciting to use science and technology to help farmers protect and improve their rice production, both in Missouri and around the world.}”

\begin{quote}
\textbf{- Bing Yang, PhD, Danforth Center Principal Investigator and Professor, University of Missouri–Columbia}
\end{quote}

\section*{Fight the Blight}

\textit{New Resistant Rice Varieties Clear Hurdle}

The world depends on rice. It is a staple food for more than half the Earth’s population, but a disease called bacterial blight can reduce yields of this important crop by up to 70 percent, with the heaviest losses typically experienced by smallholder farmers in low and middle-income countries. The Healthy Crops program, a consortium made up of scientists from around the world, are working to find solutions to this problem.

Danforth Center Principal Investigator Bing Yang, PhD, is a member of the project. Using CRISP-R technology, his team has developed rice varieties resistant to bacterial blight. In 2020, regulators in the United States and Colombia determined the varieties were equivalent to what could be accomplished with conventional breeding, clearing the way for field tests. The varieties can also now be used to introduce the resistance trait into many different types of rice via standard breeding strategies.

\begin{quote}
\textit{Rice harvest in the Missouri Bootheel. The state is the fourth largest rice producer in the country.}
\end{quote}
Foundational Science for Food

Danforth Center Scientists Unlock Genetic Secrets of Crop Plants

Danforth Center scientists undertake broad research aimed at providing crucial knowledge for crop breeding in a changing climate. In 2020, researchers made some startling discoveries.

A research team led by Danforth Center Principal Investigator Blake Meyers, PhD, discovered a way to turn pollen production off and back on again in corn using temperature, as published in Nature Communications.

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. Published in Genome Biology, these findings map gene regulation during the development of male and female reproductive structures.

In 2020, the lab of Elizabeth Kellogg, PhD, Robert E. King Distinguished Investigator, published two significant findings. The first, published in Nature Biotechnology, revealed her team’s discovery of a gene that prevents seed shattering. The second, published in Plant Cell, was a collaboration with the lab of Principal Investigator Doug Allen, PhD. They found that infertile spikelets, once thought unimportant parts of a major group of grasses, actually collect and transfer carbon to be stored as energy in the seed.

“To create higher-yielding corn, we must learn how to adjust gene expression precisely in space and time. My lab is investigating ways to do this.”

-Andrea Eveland, PhD, Danforth Center Principal Investigator

More corn seeds are planted in the United States each year than stars in the Milky Way. By studying maize genetics, we can help create more efficient, productive crops for a changing climate.
The Earth is our home, and we believe plant science holds the key to its sustainable future. Danforth Center scientists seek new solutions to feed and power the world, solutions that can preserve and protect our natural environment. We are discovering the technologies today that will bring about a cleaner, healthier planet for future generations.
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 field site close to home… until now.

The year 2020 marked the first season at the new Danforth Center Field Research Site at Planthaven Farms. Pauline and John Cella, owners of grower-retailer Planthaven Farms, and supporters of the Danforth Center, made the land available. Located in O’Fallon, MO, only 35 minutes from the Center, the site is enabling new experiments in field conditions.

A nearby site is convenient and saves significantly on travel costs. It is also crucial to the control needed for long-term projects, such as an experimental vineyard where the effects of grafting are being studied, a project led by Principal Investigator Allison Miller, PhD. And because the Field Research Site is so convenient, it allows for more exploratory projects as well. Already six Danforth Center labs have utilized the site in its first season.

“Our Work: Heal the Planet

Heal the Planet

“These field experiments are helping to unlock the power of plants to feed people while healing the planet at the same time.”

—Allison Miller, PhD, Danforth Center Principal Investigator and Professor, Saint Louis University
Fungal diseases cause substantial losses of agricultural harvests each year. To combat the problem, farmers must resort to dangerous and expensive chemical fungicides, which can have diminishing effectiveness. But 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 alternative.

They have identified a natural substance occurring in a legume that proved effective in inhibiting growth of the fungus causing gray mold when sprayed on tomato plants. The results of their research were published in *Proceedings of the National Academy of Science*. The substance is a subclass of peptides found in the nodules of an alfalfa relative. Using these natural substances would be safer and potentially less expensive than the current chemicals used. In addition, the peptides would be positive for the environment, as they eventually break down and are used by beneficial microbes in the soil as an energy source.

“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
Farms of the Future

Danforth Center Scientists Break New Ground in Sustainable Ag

Danforth Center researchers are constantly breaking new ground in their efforts to fight climate change and increase sustainability. In 2020, several new Danforth Center projects aimed at preserving and enhancing the environment received recognition and funding.

SMART TECH FOR ENERGY EFFICIENCY
Senior Research Scientist Nadia Shakoor, PhD, received a three-year grant from the National Institute for Food and Agriculture and the National Science Foundation to develop FieldDock, an integrated smart farm system. The information collected will guide researchers and breeders who are developing high-yielding, energy-efficient crops that are resilient to variable climates, and help farmers reduce water and energy use without compromising yield.

BIOENERGY OF THE FUTURE
Pennycress produces high-quality oilseed. Grown as a cover crop, it reduces soil erosion and fertilizer pollution. This year, the US Department of Energy awarded a five-year grant for a nationwide research project to genetically strengthen pennycress for use in sustainable energy efforts. Danforth Center Principal Investigators Dmitri A. Nusinow, PhD, and Chris Topp, PhD, are a part of the project, and together they are working to increase the crop’s tolerance to heat and drought.

AI ON THE FARM
The National Artificial Intelligence Research Institutes program awarded a five-year grant to develop an autonomous “farm of the future.” Todd Mockler, PhD, who is the Geraldine and Robert Virgil Distinguished Investigator at the Danforth Center and the co-founder of Benson Hill, will co-lead a research team. Their goal is to use AI to accelerate crop improvement with a focus on enhancing the efficiency of nitrogen and water use in crops such as corn and soy.

The Enterprise Rent-A-Car Institute for Renewable Fuels explores the potential of oilseed crops, algae, and bioenergy grasses to sustainably replace fossil fuels.

Pennycress has potential as a sustainable energy crop—it is also a cover crop. Danforth Center Principal Investigators Dmitri A. Nusinow, PhD, and Chris Topp, PhD, are part of a team working to unlock its potential.

The farm of the future is coming. Danforth Center principal investigator Todd Mockler, PhD, the co-founder of Benson Hill, is part of a nationwide team using artificial intelligence (AI) to accelerate crop improvement.
From the Lab to the World

The Danforth Center was founded to feed the world and heal the planet. Our principal investigators make discoveries that generate new technology and startups. Top-tier talent, combined with leading-edge infrastructure attracts new companies and investors to St. Louis. The 39 North innovation community is speeding agtech innovation out into the world.
At left: The Plastomics team in their lab at the Danforth Center prepandemic. Plastomics was one of six agtech startups selected for the 2020 IN² cohort. The program pairs startups with Danforth Center scientists to validate promising agtech solutions.

A BRDG to the Cutting EDGE

BRDG Park Expands with EDGE@BRDG Building

EDGE@BRDG building opened in BRDG Park, home to anchor tenant Benson Hill. Benson Hill is a “food tech” company co-founded in 2012 by Todd Mockler, PhD, Danforth Center principal investigator. After growing in multiple locations, last year Benson Hill chose St. Louis as their world headquarters. The Danforth Center campus anchors the 39 North innovation community. Together, the Danforth Center, BRDG Park, and Helix incubator provide a path for new companies from idea to IPO, bringing jobs and investment to St. Louis.

BENSON HILL™

Despite necessary health and safety restrictions, improvements to the Danforth Center campus continued this year. The new state-of-the-art EDGE@BRDG building opened in BRDG Park, home to anchor tenant Benson Hill. Benson Hill is a “food tech” company co-founded in 2012 by Todd Mockler, PhD, Danforth Center principal investigator. After growing in multiple locations, last year Benson Hill chose St. Louis as their world headquarters. The Danforth Center campus anchors the 39 North innovation community. Together, the Danforth Center, BRDG Park, and Helix incubator provide a path for new companies from idea to IPO, bringing jobs and investment to St. Louis.

Innovators for Sustainable Ag

Danforth Center Partnership with IN2 Enters Second Year

This year, the Danforth Center and the Wells Fargo Innovation Incubator (IN²) collaborated again to speed the science of six agtech startups. The collaboration paired the companies in the 2020 cohort with Danforth Center principal investigators to provide expert guidance and help validate their innovative, sustainable agriculture technologies. The six companies from around the nation were: AgroSpheres, EarthSense, mobius, Plastomics, Pluton Biosciences, and TerViva.
Meet the Innovation Team

In 2020, the Danforth Center announced the creation of a new innovation team to help speed the progress of cutting-edge agtech ideas into the hands of farmers who need them most. Joining Claire Kinlaw, PhD, MBA, director of innovation commercialization, were Stephanie Regagnon, executive director of innovation partnerships, and Tom Laurita, PhD, director of entrepreneurship. Together, the Danforth Center innovation team works to create an environment where it is natural for scientists to think about commercial applicability of their research—and to create a thriving community across the broader campus where those enterprises can develop and thrive.

Introducing AgTech NEXT

This year, the Danforth Center launched AgTech NEXT, a new annual agtech innovation summit. In 2020, the virtual event consisted of seven weeks of midday programming with thought leaders and subject matter experts from around the world. The inaugural AgTech NEXT attracted more than 300 attendees representing 22 countries.
Next-Generation Science

For students, parents, and teachers around the world, the pandemic brought about new barriers to quality education and revealed other, long-standing ones. The Danforth Center’s Education Research and Outreach lab is working to overcome such barriers by providing high-quality science education for students across the St. Louis region—inspiring all students to see themselves as scientists.
I’m a Jackie Joyner-Kersee FAN!

New Danforth Center Partnership Aims to Inspire Students

Track star Jackie Joyner-Kersee holds six Olympic medals and is one of ESPN’s “50 Great Athletes of All Time,” but she never forgot where she came from. Growing up poor in East St. Louis, Illinois, she vowed to make a difference in the lives of children like herself. In 1988, she founded the Jackie Joyner-Kersee Foundation to inspire youth to thrive in academics and athletics, and to enhance their communities through the Jackie Joyner-Kersee (JJK) Community Center in her hometown.

The Danforth Center recently announced a partnership with the JJK Center and the University of Illinois. The new Jackie Joyner-Kersee Food, Agriculture, and Nutrition Innovation Center (JJK FAN – I Center) will be adjacent to the JJK Community Center. Its aim? To teach children vital information about nutrition and food production, while providing a pathway from kindergarten to adulthood of opportunities in urban agriculture, scientific research, and innovation/entrepreneurship. Through training, mentoring, and unique learning programs, the partnership will engage students in STEAM and agriculture, prepare them for college and careers, and help them transform their community.

“When students learn to see themselves as scientists, a new future becomes possible. Through this partnership, we seek to inspire students to transform their lives, while simultaneously transforming their community from a food desert to a food oasis.”

– Kristine Callis-Duehl, PhD
Sally and Derick Driemeyer
Director of Education Research and Outreach

Students pre-pandemic at the Jackie Joyner-Kersee Center in East St. Louis participate in hands-on science. The Danforth Center recently announced a partnership with the JJK Center to empower young scientists in the region.
Studying How Students Study

While the COVID-19 pandemic interrupted normal K-12 programming, the Danforth Center’s Education Research and Outreach Lab pivoted quickly to study those very impacts. The team conducted several studies to examine the effects COVID-19 has had on education and learning. Surveying both students and teachers across different institutions, the lab found, among other things, that students were less emotionally engaged with their science courses after switching to online learning. Even more concerning, less than 40 percent of teachers reported that they had any formal training in online instruction before virtual learning began. The lab hopes to use the information they have gathered to better prepare schools for any future disruptions.

2020 WHD FELLOW

Third-year PhD student at Saint Louis University Zachary N. Harris was named the 2020 William H. Danforth Plant Science Fellow. The fellowship was endowed in honor of Dr. Danforth by Dr. P. Roy and Diana Vagelos and supports outstanding PhD students whose research demonstrates great promise for advancing plant science. Harris is a member of the Miller lab and is studying how long-lived crop species function and adapt.

A RESET FOR REU

Each year, hundreds of students compete for spots in a rigorous training program known as the Research Experience for Undergraduates (REU). Funded by the National Science Foundation, REU interns have been welcomed to the Danforth Center for 17 years. In 2020, due to the pandemic, REU was cancelled. It is returning in 2021 as a virtual experience and all eligible 2020 interns were invited to participate.

GRADS GO VIRTUAL

At the Danforth Center, graduate students have the opportunity to participate in cutting-edge thesis research, gain interdisciplinary skills, and learn how we turn plant science discoveries into real-world solutions. In 2020, much of the mentoring went virtual, including the weekly mentoring seminar. The first Zoom presentation was by Postdoctoral Associate Nikita Bhatnagar, PhD, of the Pandey Lab on March 26.
2020 By the Numbers

350 Danforth Center community members

28 principal investigators

4 licensed technologies

20 active patent families

4 options for licensing

74,251 unique website visitors

2 National Academy of Sciences members

8,804 citations of scientific papers authored by Center scientists

137 publications (a record!)

$377M annual economic impact of Danforth Center campus and Helix

35 graduate students

310 unique log-ins at virtual Conversations

16 scientific seminars + 83 average seminar attendance
Our (Virtual) Community of Support

We cannot do it alone. The Danforth Center relies on the tremendous efforts of our donors, volunteers, and partners. When events turned virtual in 2020, we worried whether our community would still feel connected. We did. Together in spirit, if not in person, we continued to work toward scientific discovery and a brighter future for all.
“The year 2020 was tumultuous, but the Friends Committee used that time to reassess our methods, strengthen our resolve, and continue to engage the public through new forms of virtual events and volunteer efforts. Thank you for helping all of us at the Danforth Center emerge from a difficult year stronger than ever.”

Friends Committee
The Friends Committee promotes the work of the Center and grows membership and financial support through annual giving.

2020 FRIENDS COMMITTEE
Tim Rodgers, Chair
James R. von der Heydt, Chair Emeritus
A. Van Brokaw, III
Bruce Buckland
Harold R. Burroughs
Ann L. Case
Molly Cline, PhD
Joan Culver
Maebelle Danforth
Ann Desloge
Adie Dietz
George Fonyo

Danforth Society Membership Committee
Tim Halls, Chair
Molly Cline, PhD, Chair Emeritus
Cicardi Bruce
Ann Case
Michael Davies
Ann Desloge
Steve Epner
Courtney Evans
Glenn Fischer
George Fonyo
Gary Halls
Phil Hellwege
Jim Klingler
Paul Kravitz
David Rath
Tim Rodgers
John Rowe
Rich Schumacher

Roberta (Robbye) Frank
Gary Halls
Tim Halls
Ruth E. Kim
M. Paul Kravitz
Ann Liberman
Jay Nouss, Jr.
John W. Rowe
Jared Spader
Matt S. Wolfe
2020 Conversations Series

Organized by the Friends Committee since 2003, Conversations is a series of free public events that provide the opportunity to learn about the world of the Center and the partners who help to sustain it. In 2020, Conversations pivoted to virtual for the first time to offer two events. Both livestreams were recorded and may be viewed on our blog at danforthcenter.org.

INSPIRING TOMORROW’S SCIENTISTS | AUGUST 20

Nearly 140 households, including participants from other countries, joined the Danforth Center’s first-ever virtual Conversations event. The focus was 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 livestreamed from the McDonnell Atrium with the speakers seated more than six feet apart.

THE INNOVATION STACK WITH JIM MCKELVEY | OCTOBER 15

This Virtual Conversations sent a new high mark with more than 195 unique households tuning in for Jim McKelvey, cofounder of Square and serial entrepreneur, philanthropist, and artist. Jim discussed his new book, The Innovation Stack, 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 event began with a somber acknowledgment by Danforth Center President Jim Carrington of the recent passing of Danforth Center Founding Chair Dr. William H. Danforth.

Media sponsorship by:

HEC stlpr
Young Friends
The Young Friends is a group of professionals, 40 and under, who raise friends and funds to advance the mission of the Danforth Center.

2020 YOUNG FRIENDS STEERING COMMITTEE
Logan O’Connor, Chair
Davey Oetting, Vice Chair
Matt Plummer, Vice Chair
Erica Agnew
Tony Aiazzi
Melanie Bernds Smith
Stephen Brauer, Jr.
Will Brown
David Culver, Jr.
Brandon Day
Bartow Hawes, Jr.
Nick Hawes
Ben Hjelle
D. Michael Hollo, Jr.
Tom Hough
Erin M. Jones
Connor L. Kolb
Anna D. Krane
Kevin Maher, Jr.
Ted Maritz
Connor J. McCarthy
Will McHargue
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Tim Rodgers, Jr.
Drew Roznowski
Andrew Rzonca
Kelcee A. Sachtleben
Peter M. Schankman
Dan Schindler
Justin Scholz
Scott Smithson, Jr.
Parker M. Spann
Joy Straney
John Wahl
Michael Williams
Monica Zawicki

“Our annual Party with the Plants event had to be cancelled for safety, but the Young Friends still wanted to make a difference. We pivoted to the online Grow Challenge, and thanks to all who donated and asked their friends, it became a resounding success.”

-Logan O’Connor
Chair, Young Friends
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 could not wait. Despite tough conditions during the pandemic, they launched the Danforth Center’s first-ever peer-to-peer fundraising effort, the Grow Challenge. This online week of giving took place September 28 through October 2 and raised more than $45,000 for STEM education and early-stage research. Thank you to everyone who contributed to grow our Center, help our region, and feed our world.

2020 CONTRIBUTORS
Anonymous
Isabel Acevedo
Sally Bailey
Frank & Mariann Baker
Tom & Cindy Bander
Ivan Baxter & Joanna Dinsmore
Teresa Bongiorno
Patrick Bowey
Mr. & Mrs. Blackford F. Brauer
Stephen F. Brauer, Jr.
Mr. & Mrs. A. Van Brokaw
David E. Brown
James Canning
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“With Seeds of Change postponed, the Danforth Leadership Council focused on helping the new AgTech NEXT conference succeed. These virtual seminars drew attendees from 22 countries, positioning St. Louis and the Danforth Center as a global hub of agtech innovation.”

- Chip Lerwick
Chair, Danforth Leadership Council
Toast to Innovation

On November 14, the Danforth Center community acknowledged a very different year with a very different celebration. The virtual “Toast to Innovation” provided an opportunity to celebrate our innovation community—and our outstanding Danforth Society supporters, who make this work possible. With your support, the Danforth Center is spinning out new technologies and startups, attracting in new talent and companies, and helping our region grow.

The virtual event was attended by 132 unique households and emceed by Stephanie Regagnon. It featured presentations by Aker Technologies CEO Orlando Saez, Benson Hill Chief of Staff Natalie DiNicola, and VP of St. Louis Economic Development Partnership, Janet Wilding. There was a conversation between Danforth Center President Jim Carrington and former Danforth Center COO Sam Fiorello, who was named President and CEO of Cortex earlier in the year. The event concluded with a tribute to Danforth Center Founding Chair Dr. William H. Danforth by FleishmanHillard General Counsel and SVP Ruth Kim.

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“This Center, the brilliant and dedicated scientists and administration, are making real, every day, Dr. Danforth’s vision.”

- Ruth Kim,
  Board Secretary,
  Speaker at Toast to Innovation
Legacy Society

The Danforth Center is grateful for members of the Legacy Society. These generous donors have provided for the future of the Center through planned gifts. Founding members include Dr. William H. Danforth†, Mary† and Oliver† M. Langenberg, and Mrs. Jefferson L. Miller†.

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“I am happy to donate to help St. Louis and the world. I know the Danforth Center is putting my investment to good use wherever it is needed most.”

– Beth Early, Legacy Society Member
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The Danforth Center is grateful for donors who honor or memorialize their friends, loved ones, and colleagues with a gift to the Center. Gifts listed here were received by December 31, 2020. To make a tribute, visit danforthcenter.org/donate.

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Financials in a Pandemic

The Danforth Center was not immune to the financial impacts of the pandemic. Closed and curtailed operations meant fewer clients for Core Facilities. Canceled events resulted in lost sponsorship and ticket revenue, as well as fewer opportunities to meet potential new donors. Many individuals and corporations were forced to make difficult decisions about their giving, while others, recognizing the need, were able to give more. The passing of our founder, Dr. William H. Danforth, was met with an outpouring of more than 100 gifts in his memory. We are grateful to our community who pulled together to keep the science going during this difficult year.

Selected Financial Data
Fiscal Year Ended December 31, 2020
(Unaudited)

<table>
<thead>
<tr>
<th>UNRESTRICTED OPERATING REVENUES¹</th>
<th>Revenue</th>
<th>Source %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Grants and Contracts</td>
<td>$17,212</td>
<td>46.2%</td>
</tr>
<tr>
<td>Donor Support</td>
<td>$15,438</td>
<td>41.5%</td>
</tr>
<tr>
<td>Annual Gifts</td>
<td>$2,122</td>
<td>5.7%</td>
</tr>
<tr>
<td>Endowment Draw</td>
<td>$13,316</td>
<td>35.8%</td>
</tr>
<tr>
<td>Core Facility Fees</td>
<td>$1,888</td>
<td>5.1%</td>
</tr>
<tr>
<td>Other Income</td>
<td>$2,686</td>
<td>7.2%</td>
</tr>
<tr>
<td><strong>Total Operating Revenues</strong></td>
<td><strong>$37,223</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPERATING EXPENSES²</th>
<th>Expenditures</th>
<th>Expenditure %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Research/Science</td>
<td>$25,155</td>
<td>80.6%</td>
</tr>
<tr>
<td>Administration</td>
<td>$4,088</td>
<td>13.1%</td>
</tr>
<tr>
<td>Development and Public Relations</td>
<td>$1,983</td>
<td>6.3%</td>
</tr>
<tr>
<td><strong>Total Expenses from Continuing Operations</strong></td>
<td><strong>$31,226</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAPITAL EXPENDITURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse Expansion</td>
</tr>
<tr>
<td>Lab and Core Facility Equipment</td>
</tr>
<tr>
<td>All Other</td>
</tr>
<tr>
<td><strong>Total Capital Expenditures</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REPLACEMENT AND RENEWAL EXPENDITURES</th>
<th>$435</th>
</tr>
</thead>
<tbody>
<tr>
<td>NON-OPERATING EXPENDITURES</td>
<td></td>
</tr>
<tr>
<td>Debt Service Payments</td>
<td>$797</td>
</tr>
<tr>
<td>DEPRECIATION EXPENSE</td>
<td></td>
</tr>
<tr>
<td>Depreciation of Fixed Assets</td>
<td>$7,194</td>
</tr>
</tbody>
</table>

2020 Unrestricted Operating Revenues\(^1\)

- Research Grants and Contracts: 46.2%
- Donor Support: 41.5%
- Other Income: 7.2%
- Core Facility Fees: 5.1%

2020 Operating Expenses\(^2\)

- Total Research/Science: 80.6%
- Administration: 13.1%
- Development and Public Relations: 6.3%

---

\(^1\) Cash basis and excludes income(los) on Endowment investments and reimbursement for subcontracted research.

\(^2\) Excludes subcontracted research on Grants and Contracts and Depreciation Expense.
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The Donald Danforth Plant Science Center stands unambiguously and proudly with individuals, families, and communities of color. We condemn all acts and forms of racism, and we grieve with those who are affected. The Danforth Center community commits to continuously learn about impediments to racial equality, to implement positive changes that address racial inequality, and to support our diverse communities.
### OUR MISSION

**Improve the human condition through plant science**

As a world center for plant science research, our discoveries will help:

- Feed the hungry and improve human health
- Preserve and renew our environment
- Enhance the St. Louis region