



**STORIES REVEALED:
REDISCOVERING US**

Carl R. Woese Institute for Genomic Biology
2020 Annual Report

TABLE OF CONTENTS

Director's Message | 2

About the IGB | 6

Stories, Reflections and Awards from 2020 | 10

2020 Numbers, Publications, and Thanks | 102

About the Icons

The success of the IGB depends on collaborations that transcend traditional disciplines and close partnerships between researchers and support staff. Throughout this annual report, we use the icons below to indicate connections to the following research and impact areas.



Health

Research that seeks to understand the origins and mechanisms of disease and discovers new ways to promote wellness.



Technology

Research that imagines, develops, and refines new tools that enable discovery and create solutions.



Environment

Research that explores and protects ecosystems, especially those we rely on for food and fuel.



Fundamental Research

"Blue Sky" research that creates the knowledge base needed for future progress.



Community Engagement

Programs that promote open dialogue between genomic research and society.



COVID-19

Efforts that specifically dealt with research and discovery related to COVID-19.

Abbreviations and Acronyms

Research Themes and centers

ACPP

Anticancer Discovery from Pets to People

BCXT

Biocomplexity

BSD

Biosystems Design

CABBI

Center for Advanced Bioenergy and Bioproducts Innovation

CGD

Center for Genomic Diagnostics

EIRH

Environmental Impact on Reproductive Health

GSE

Genome Scale Engineering Center

GEGC

Genomic Ecology of Global Change

GNDP

Gene Networks in Neural and Developmental Plasticity

GSP

Genomic Security and Privacy

IGOH

Infection Genomics for One Health

MME

Microbiome Metabolic Engineering

MMG

Mining Microbial Genomes

M-CELS

Multi-Cellular Engineered Living Systems

RBTE

Regenerative Biology and Tissue Engineering

Other abbreviations and acronyms

DOE

Department of Energy

IGB

Carl R. Woese Institute for Genomic Biology

NIH

National Institutes of Health

NSF

National Science Foundation

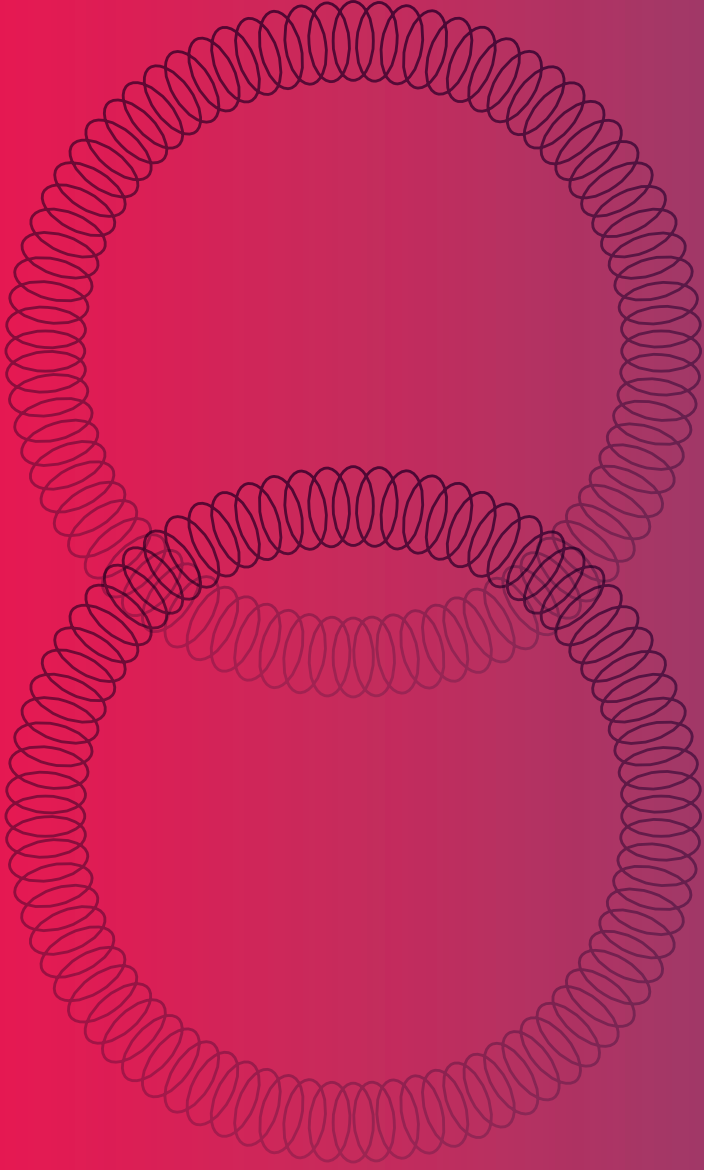
USDA

United States Department of Agriculture



TAKE A DEEP BREATH.
LET'S REFLECT ON OUR 2020.

22





AT THE BEGINNING OF 2020,
NONE OF US HAD IMAGINED THAT THE
WORLD WOULD BE OVERWHELMED BY
A PANDEMIC. THINGS THAT WE TOOK
FOR GRANTED: COMING INTO WORK,
MEETING OUR FRIENDS AND FAMILY,
ATTENDING CLASSES OR SOCIAL
EVENTS, EVERYTHING CAME TO
A GRINDING HALT.

AND YET, AS MANY OTHERS HAVE, the community at the Carl R. Woese Institute for Genomic Biology remained resilient as we worked together to face this unique challenge. In this annual report you will read stories from different members of the IGB family.

THEIR **VOICES** REMIND US THAT OUR FUNDAMENTAL QUALITIES OF PERSEVERANCE, TEAMWORK, SACRIFICE, AND EMPATHY REMAIN STRONG EVEN WHEN THE WORLD AROUND US LOOKS COMPLETELY DIFFERENT.



OUR VOICES

- 20
Diana Ranoa
 - 35
Jack Humphrey
 - 53
Jing Dong
 - 74
Shravan Dommaraju
 - 94
Ursula Ruiz Vera
-

AND 9 MORE

In early March, it became undeniably obvious that we needed to take several measures to curb the pandemic. Perhaps unsurprisingly, members of the IGB approached the problem in different ways including volunteering their time, laboratory supplies, and equipment to help increase the COVID-19 testing; making 3D-printed cartridges that can carry out 30-minute COVID tests; building prototypes for emergency ventilators; and creating a web tool that can model the COVID-19 spike protein as it mutates, aiding the development of new drugs and vaccines.

In addition to these important activities to help fight the pandemic, there were also other notable achievements. Two new IGB research themes—Environmental Impact on Reproductive Health and Multi-Cellular Engineered Living Systems—were established in the past year. We received new funding awards to develop faster COVID-19

tests, study the prevention and treatment of breast cancer, and develop novel therapeutics for cancer and autoimmune disorders. Several faculty members were honored, including Lisa Ainsworth who was elected to the National Academy of Sciences and Alison Bell and Carl Bernacchi, who were elected to the American Association for the Advancement of Science, further emphasizing that we continued to maintain our pre-pandemic levels of success even in the dramatic environment of 2020.

Personally, the pandemic forced me to adopt new routines to match my hybrid home/IGB office routine. Like many of the IGB faculty, I had to devise new ways to interact with my research group, a feat that was made possible because of their cooperation. Even establishing a new exercise routine was a challenge, as was convincing my Golden Retriever that I wasn't at home exclusively to play with him...I'm not sure he ever got that message.

Even though 2020 presented us with many new obstacles, we remained united and worked together to find solutions.



IN ADDITION TO CHALLENGING OUR SCIENTIFIC PRACTICES, THE PAST YEAR HAS REQUIRED US TO CHANNEL OUR **HUMANITY** AND REACH OUT TO ONE ANOTHER.

With the vaccine rollout, it is likely that our struggles with the pandemic will abate over the next year. However, I hope that when we look back on our efforts and recall what was done well and what could have been done better, we will use the lessons we learned from each other to make our community stronger.

A handwritten signature in black ink, appearing to read 'Don Ort'. The signature is stylized with loops and a long horizontal stroke at the end.

Don Ort
ACTING DIRECTOR
CARL R. WOSEE INSTITUTE FOR GENOMIC BIOLOGY

**WE ARE PERSISTENT /
DRIVEN / DELIBERATE /
COMMITTED / SUPPORTIVE /
EMPATHETIC / RESILIENT /
INTENTIONAL / CREATIVE /
STRONG / RESOURCEFUL.
WE ARE THE IGB
COMMUNITY.**

ABOUT IGB

The Carl R. Woese Institute for Genomic Biology (IGB) was founded in 2007 with the intention of facilitating genomic research across the campus. IGB members are drawn from many schools and departments, including biology, chemistry, physics, engineering, sociology, and business. What unites them is a shared vision of what a genomics-based approach can achieve: a healthier global population, increased food and fuel security, a toolbox of genomic technologies to meet future societal challenges, and a deep knowledge of the diversity of life on our planet.

OUR MISSION

To advance life science research at the University of Illinois Urbana-Champaign and to stimulate bio-economic development in the state of Illinois.

IGB STRATEGIC PARTNERSHIPS, RESEARCH THEMES, AND CENTERS

IGB's research is organized into research themes, each of which comprises multiple laboratory groups brought together by shared scientific approaches and goals. Our research themes are connected through their overlap within three broad areas of fundamental and applied research: health challenges and solutions, genomic technologies, and environmental resources and conservation. Our scientists participate in a variety of strategic partnerships with academic, governmental and industry partners.

STRATEGIC PARTNERSHIPS



HPCBio

High Performance Biological Computing (HPCBio) was created to address the need for a structure that could supply infrastructure, user support and training, and R&D capability in computational genomics to the Illinois research community. HPCBio provides a single, straightforward point of access, open to researchers from all campus units, helping them to find solutions to their biomedical data management and analysis problems.



KnowEnG: NIH Center of Excellence in Big Data Computing

KnowEnG is a National Institutes of Health-funded initiative that brings together researchers from the University of Illinois and Mayo Clinic to create a Center of Excellence in Big Data Computing. It is part of the Big Data to Knowledge (BD2K) Initiative that NIH launched in 2012 to tap the wealth of information contained in biomedical Big Data. KnowEnG is one of 11 Centers of Excellence in Big Data Computing funded by NIH in 2014.



Microbial Systems Initiative

The goal of the Microbial Systems Initiative (MSI) is to sustain a vibrant microbial sciences research and training enterprise at the University of Illinois Urbana-Champaign. Illinois microbial systems research addresses critical problems in health, agriculture, energy, and many other sectors. The MSI carries out ongoing activities to build collaboration across disciplines, provide world class training opportunities, and build environments of inclusive excellence.



Personalized Nutrition Initiative

The Personalized Nutrition Initiative is a campus-wide initiative under the leadership of the Office of the Vice Chancellor for Research and Innovation, in partnership with the IGB and the College of Agricultural, Consumer and Environmental Sciences, to facilitate transdisciplinary collaborative efforts across campus to answer fundamental questions regarding how nutrition modulates health and disease across the lifespan and to translate that information to clinical care and the public.

RESEARCH THEMES AND CENTERS



Anticancer Discovery from Pets to People (ACPP)

Develops cancer treatments in pet animals that translate to human disease



Biocomplexity (BCXT)

Explores the origin of life and the behavior of biological systems



Biosystems Design (BSD)

Applies engineering principles to real and artificial biological systems



Center for Advanced Bioenergy and Bioproducts Innovation (CABBI)

Develops ways to grow bioenergy crops, transform biomass into valuable chemicals, biofuels, and bioproducts



Center for Genomic Diagnostics (CGD)

Identifies reliable biomarkers of disease and develops technologies to detect those biomarkers



Environmental Impact on Reproductive Health (EIRH)

Studies reproductive function and fertility disorders and develops therapeutic tools



Genome Scale Engineering Center (GSE)

Develops tools to allow rapid engineering of new organisms for the production of industrial compounds



Genomic Ecology of Global Change (GEGC)

Studies the intersection of plant genomics and global climate change



Gene Networks in Neural and Developmental Plasticity (GNDP)

Examines the effects of coordinated gene activity on biological diversity



Genomic Security and Privacy (GSP)

Considers the implications of genomic applications on an individual's security and privacy



Infection Genomics for One Health (IGOH)

Examines how microbes in human-inhabited environments influence health and disease



Microbiome Metabolic Engineering (MME)

Explores the relationships between human microbiota, environment, and health



Mining Microbial Genomes (MMG)

Discovers small molecules that might provide new medical solutions



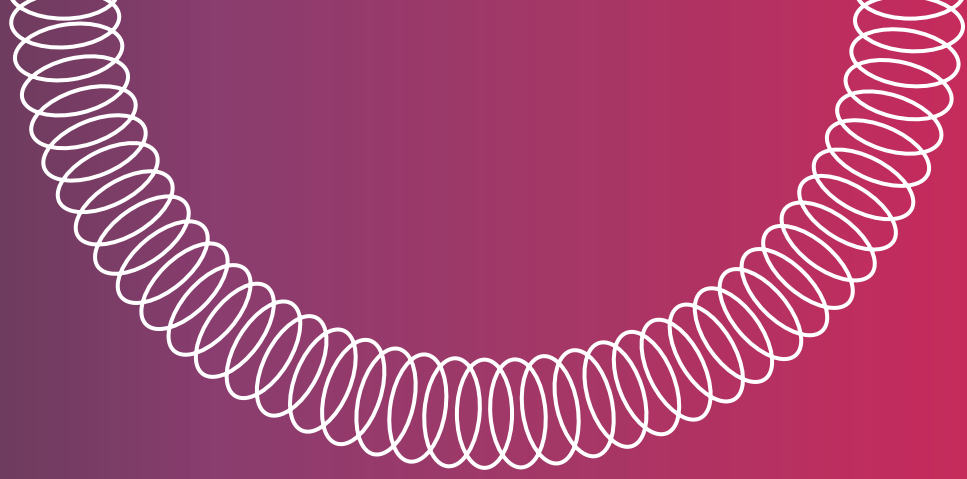
Multi-Cellular Engineered Living Systems (M-CELS)

Develops *in silico*, cellular, and artificial components for precision assembly of biomachinery and computing processors



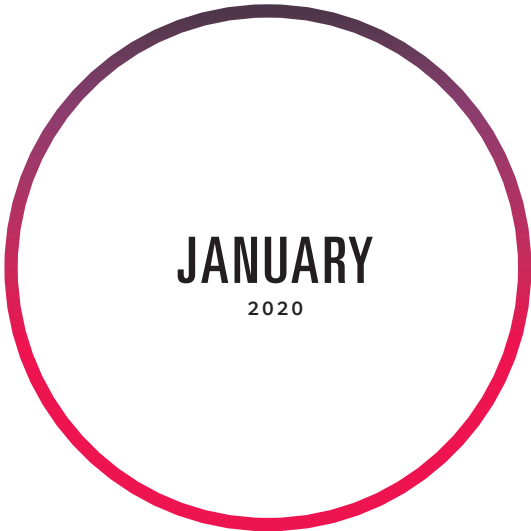
Regenerative Biology and Tissue Engineering (RBTE)

Studies the replacement or regeneration of tissues and organs



Scientific endeavors may sometimes be considered impersonal or dispassionate. But we often forget the human stories that make such efforts possible. This year, we are illuminating individuals who have persevered through challenges posed by the pandemic. Their experiences emphasize the resilience, compassion, and resourcefulness within us. Although each story is unique, they collectively highlight the universality of what makes each and every one of us human.

	20
Diana Ranoa	
	27
Samantha Zambuto	
	35
Jack Humphrey	
	42
Lori McClain	
	47
Gabriela Andrea Hernandez Gonzales	
	53
Jing Dong	
	62
Austin Cyphersmith	
	68
Hyang-Yeon Lee	
	74
Shravan Dommaraju	
	78
Kristen Farley	
	86
Beth Penner	
	89
Sara Haba Pedron	
	94
Ursula Ruiz Vera	
	98
Nilmani Singh	



JANUARY

2020

Jan 3

**NEW COMPOUNDS
BLOCK MASTER
REGULATOR OF
CANCER GROWTH,
METASTASIS**



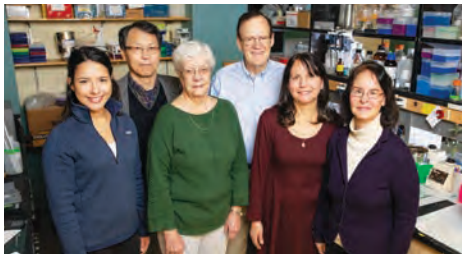
go.igb.illinois.edu/block

Scientists have developed new drug compounds that thwart the pro-cancer activity of FOXM1, a transcription factor that regulates the activity of dozens of genes. The new compounds suppress tumor growth in human cells and in mouse models of several types of human breast cancer.

The researchers report their findings in the journal *NPJ Breast Cancer*.

FOXM1 is a naturally occurring protein that ramps up the expression of genes that are important to cell proliferation and development. The researchers focused on FOXM1 because it is found in higher abundance in cancer cells than in healthy human cells, said Benita Katzenellenbogen (CGD), a professor of molecular and integrative physiology who led the study with chemistry professor John Katzenellenbogen and life sciences research specialist Yvonne Ziegler.

Left to right: Graduate student Valeria Sanabria Guillen, research scientist Sung Hoon Kim, researcher Kathy Carlson, chemistry professor John Katzenellenbogen, research specialist Yvonne Ziegler, and molecular and integrative physiology professor Benita Katzenellenbogen developed new drug agents that can kill cancer cells and reduce the growth of breast cancer tumors in mice.



The researchers developed the new drugs by analyzing the properties of various compounds in a chemical library of potentially therapeutic agents. They selected those that reduced

breast cancer cell proliferation and inhibited the expression of genes known to be regulated by FOXM1. The team then modified the compounds to enhance their inhibition of FOXM1 and increase their cellular potency. Three of the tested compounds performed best. "Because cancers are often treated with a combination of drugs, we are exploring how our FOXM1 inhibitors might be combined with other standard-of-care agents to improve cancer treatment," Benita Katzenellenbogen said.

The Breast Cancer Research Foundation, the Julius and Mary Landfield Cancer Research Fund, the NIH and the National Institute of Food and Agriculture at the USDA supported this research.

Jan
6

BRIDGE-ING THE GAP BETWEEN DIAGNOSTICS AND GESTATIONAL DIABETES

go.igb.illinois.edu/gap

Justina Zurauskiene, top, is a Birmingham-Illinois Partnership for Discovery, Engagement and Education (BRIDGE) fellow collaborating with Assistant Professor in Food Science and Human Nutrition Zeynep Madak-Erdogan. Zurauskiene is also a fellow at the Institute of Cancer and Genomic Sciences in Birmingham, England.

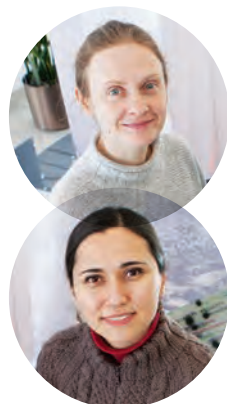


As a result of intersecting research interests in women's health, a new collaboration was forged between Zeynep Madak-Erdogan (CGD/EIRH/GSP), Assistant Professor in Food Science and Human Nutrition, and Justina Zurauskiene, Birmingham-Illinois Partnership for Discovery, Engagement and Education (BRIDGE) fellow and fellow at the Institute of Cancer and Genomic Sciences in Birmingham, England.

Zurauskiene is working with Madak-Erdogan for one year, where she is harnessing her computational biology expertise for generating and analyzing diverse datasets. Emphasis is placed on health disparities in pregnant women and environmental factors that impact birth including gestational diabetes, a type of diabetes that appears in pregnant women who didn't have the condition before. The researchers pointed out that the baseline for levels of the detected predictors of the disease might be variable across different races.

"The impact will be great given that obesity is rising, and we are now learning that exposures in the uterus are actually changing the outcomes for the baby," said Madak-Erdogan.

"We are trying to catch these things as early as possible so that the future generations are healthier and they are born with a biology that is less prone to these problems later in life."



This research is supported by Agricultural, Consumer and Environmental Sciences-Division of Nutritional Sciences Vision 20/20, USDA-National Institute of Food and Agriculture, and the BRIDGE Fellowship.



Matthew Hudson, Professor of Crop Sciences (CABBI/GNDP) received the Runge Faculty Distinguished Achievement Award from the College of Agricultural, Consumer and Environmental Sciences.

Jan
21

CDC confirmed the first coronavirus case in the U.S.

Jan
29

NEW CENTER FOR GENOMIC DIAGNOSTICS WILL REIMAGINE DISEASE DETECTION TECHNOLOGIES

go.igb.illinois.edu/CGD



A new research center at Illinois directed by Donald Biggar Willett Professor in Engineering Brian Cunningham (MMG) aims to revolutionize diagnostics and personalized medicine, developing technologies that are simultaneously more accurate, affordable, and practical for routine care. The IGB and the Grainger College of Engineering supported the launch of the new Center for Genomic Diagnostics (CGD), which is housed within the IGB.

The vision for the new center begins with molecules called biomarkers that are naturally produced as part of a healthy biological state or disease process. If such a molecule is produced in detectably larger or smaller quantities in certain conditions, it can serve as the basis for a reliable test for that condition. The center already works closely with the Cancer Center at Illinois and will grow its relationships with Illinois' Health Care Engineering Systems Center, as well as the Mayo Clinic and Illinois Alliance.

“Our diagnostic [capability] is one of the things that allows medicine to be personalized,” Cunningham said. “So if you can have a test for a biomarker that tells the clinician something about a particular patient: they have a specific gene is being expressed, or they have a protein molecule that is present in high levels, the information can indicate that the patient is more likely to have successful treatment with a particular drug.”

The center also involves clinicians from Mayo Clinic, Carle, OSF Hospital, Stanford, and Huntsman Cancer Institute.

Jan
31

STEPHEN LONG INVESTED AS IKENBERRY CHAIR PROFESSOR, PLANT BIOLOGY & CROP SCIENCES

go.igb.illinois.edu/ikenberry

Provost Andreas Cangelaris places a medallion around the neck of Ikenberry Endowed Chair Stephen Long in recognition of his investiture.



Illinois Provost Andreas C. Cangelaris held the investiture of Stephen P. Long as the Stanley O. Ikenberry Chair Professor of Plant Biology and Crop Sciences.

“Steve has led the world in advancing our knowledge of the mechanisms of photosynthesis, a process that starts with a photon of light and ends up with a bite of food, especially towards the goal of increasing the efficiency of photosynthesis to help feed the world’s burgeoning population,” said IGB Director Gene Robinson (GNDP) in his remarks.

Long (BSD/CABBI/GEGC) joined Illinois in 1999, where he established an internationally acclaimed laboratory dedicated to using computational and experimental approaches to understand all 170 steps of photosynthesis. Since then, Long has worked tirelessly to build connections worldwide and across generations of graduate students, postdoctoral researchers, and faculty to transform our knowledge of photosynthesis into higher-yielding crops and address the effects of climate change on crop productivity.

Today Long leads the international research project Realizing Increased Photosynthetic Efficiency (RIPE) that has demonstrated technologies that promise to substantially increase the productivity of staple food crops under his leadership. RIPE aims to improve photosynthesis to equip farmers with higher-yielding crops to ensure everyone has enough food to lead a healthy, productive life.

The international research project is sponsored by the Bill & Melinda Gates Foundation, the U.S. Foundation for Food and Agriculture Research, and the U.K. Government’s Department for International Development.



Stephen Long, Professor of Crop Sciences and Plant Biology (BSD/CABBI/GEGC) named Stanley O. Ikenberry Chair.



U.S. declared a Public Health Emergency.



**HONORING
THEIR WALK OF
LIFE THROUGH
FELLOWSHIPS IN
GENOMIC BIOLOGY**

go.igb.illinois.edu/mlfellow

Drs. Martha Oehmke
Loustaunau and
Joaquin O. Loustaunau.



Established earlier this year, the Drs. Martha Oehmke Loustaunau and Joaquin O. Loustaunau Graduate Travel Fellowship for Computational Genomics will provide professional development support to graduate students in the areas of computational genomics, systems biology, genome technology, and metabolic engineering.

Growing up in the small rural town of Monticello, Illinois, Loustaunau began her studies at Illinois, receiving her BA in Latin American Studies and later a MS in Journalism. Loustaunau had attended summer school in Guadalajara, Mexico the previous summer and was therefore interested in connecting with Latin American students at Illinois. It was there that she met Joaquin, who was pursuing a PhD in mathematics.

Later on, the Loustaunau's interests in genomic biology stemmed from a passion for horses.

After Joaquin's passing in 2002, Loustaunau started an academic graduate scholarship in Joaquin's name at NMSU geared towards underrepresented minority students from the departments of mathematics, biology, and sociology, with a focus on genetics. Thereafter, Loustaunau established a similar scholarship at Illinois.

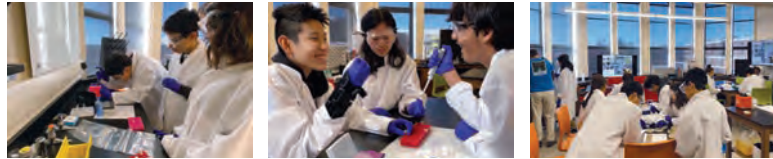
Alongside other pavers that comprise the IGB Walk of Life, one can find the words "In gratitude that our walk of life brought us together, Drs. Joaquin and Martha Loustaunau" inscribed on her paver. This paver represented the Loustaunau's lasting connection to Illinois, both sharing a strong desire to contribute what they could for the benefit of others and ultimately, to making the world a better place.

Feb
11

WHO announced that the disease caused by the novel coronavirus will be named COVID-19.

Feb
18

This week, IGB staff visited **Uni (University Laboratory) High School for their Agora Days**. Instead of their regular classes, the students learnt about bacteria. They swabbed their surroundings to get bacterial samples, grew the bacteria, and identified them using common lab techniques.



Feb
24

COLLABORATION PROVIDES RESEARCH-BASED TRAINING OF UNDERREPRESENTED MINORITIES



A collaboration with Fisk University was approved for an additional five years of continued financial support from the Office of Executive Associate Chancellor for Administration

and University Relations and the Office of the Vice Chancellor for Research and Innovation. Founder Professor of Physics Jun Song (ACPP) will oversee hands-on bioinformatics, data analysis, and biophysics training for under-represented minority undergraduate students from Fisk University, a minority-serving institution (MSI) in Nashville, Tennessee. Song views the collaboration with Fisk University as a springboard for future partnerships with other MSI, with the goal of increasing overall diversity on campus.

The IGB and the Department of Physics will provide administrative and technological support to hosting students and also manage faculty-faculty collaborations between Fisk University and Illinois. The Grainger College of Engineering will also contribute funds,

go.igb.illinois.edu/fisk5

and its new “Institute for Inclusion, Diversity, Equity, and Access” (IDEA Institute) will help establish research collaborations between Illinois and Fisk faculty members. The Carver Biotechnology Center’s High-Performance Biological Computing group will also provide personalized training resources and consulting.

Fisk University students Skye Faucher (top) and Jaia Holleman returned to campus as part of the KnowEnG collaboration with Mayo Clinic.



Previously, two Fisk University students, Jaia Holleman and Skye Faucher, spent five weeks learning programming languages, executing a bioinformatics pipeline, gaining professional development skills, and touring facilities and labs within the IGB.



“I enjoyed being surrounded by a group of aspiring young scientists, much like myself, and experiencing the true interdisciplinary nature of science through discussions about our educational and career goals,” said Faucher.



Fan Lam, Assistant Professor of Bioengineering (GNBP) received an NSF CAREER award for his project “Ultrahigh-Resolution Magnetic Resonance Spectroscopic Imaging for Label-Free Molecular Imaging of the Brain.” CAREER awards are given to early-career faculty who exemplify leadership through research and education.

ADAPTING PHOTOSYNTHESIS TO FLEETING SHADOWS BOOSTS SOYBEAN YIELDS

go.igb.illinois.edu/shadows

University of Illinois Postdoctoral Researcher Yu Wang, left, and Professor Stephen Long created a model to find out how soybeans cope with minute-by-minute changes in light intensity—and found that grappling with these fluctuations can cost 13% of the soybean crop’s yield potential.



In a special issue of *Plant Journal*, a team from Illinois reports a new mathematical computer model that is used to understand how much yield is lost as soybean crops grapple with minute-by-minute light fluctuations on cloudy and sunny days.

“Soybean is the fourth most important crop in terms of overall production, but it is the top source of vegetable protein globally,” said Yu Wang, a postdoctoral researcher at Illinois, who led this work for the Realizing Increased Photosynthetic Efficiency (RIPE) project.

“We found that soybean plants may lose as much as 13 percent of their productivity because they cannot

adjust quickly enough to the changes in light intensity that are standard in any crop field. It may not sound like much, but in terms of the global yield—this is massive.”

Past models have only examined hour-by-hour changes in light intensity. For this study, the team created a dynamic computational ray-tracing model that was able to predict light levels to the millimeter across every leaf for every minute of the day in a flowering soybean crop. The model also takes into account two critical factors: photoprotection and Rubisco activase.

RIPE is an international research project that aims to improve photosynthesis to equip farmers worldwide with higher-yielding crops needed to ensure everyone has enough food to lead a healthy, productive life. RIPE is sponsored by the Bill & Melinda Gates Foundation, the U.S. Foundation for Food and Agriculture Research, and the U.K. Government’s Department for International Development.



Robin Fretwell Wilson, Professor and Associate Dean, College of Law (GSP) was appointed Director of the Institute of Government and Public Affairs.

NEW CRISPR BASE-EDITING TECHNOLOGY SLOWS ALS PROGRESSION IN MICE

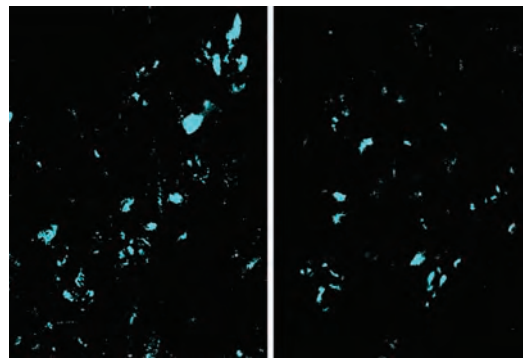
go.igb.illinois.edu/alsmice



With a new CRISPR gene-editing methodology, Illinois scientists inactivated one of the genes responsible for an inherited form of amyotrophic lateral sclerosis—a debilitating and fatal neurological disease for which there is no cure. The novel treatment slowed disease progression, improved muscle function and extended lifespan in mice with an aggressive form of ALS.

CRISPR base editing decreased the amount of a mutant protein (blue) that contributes to ALS in the spinal cord. Left, a spinal cord section from an untreated mouse.

Right, a spinal cord section from an animal treated by base editing.



“Unfortunately, ALS has few treatment options. This is an important first step in showing that this new form of gene editing could be used to potentially treat the disease,” said bioengineering professor Thomas Gaj (BSD), who co-

led the study with bioengineering professor Pablo Perez-Pinera (ACPP). Graduate student Colin Lim is the co-first author of the study along with graduate students Michael Gapinske and Alexandra Brooks.

Traditional CRISPR gene-editing technologies cut both strands of a DNA molecule, which can introduce a variety of errors in the DNA sequence, limiting its efficiency and potentially leading to a number of unintended mutations in the genome. The Illinois group instead used base editing to change one letter of the DNA sequence to another without cutting through both DNA strands. Gaj and Perez-Pinera

targeted and permanently disabled a mutant SOD1 gene, which is responsible for roughly 20% of inherited forms of ALS. They published their results in the journal *Molecular Therapy*.

The Muscular Dystrophy Association, the Judith and Jean Pape Adams Foundation, the American Heart Association and the NIH supported this work. Perez-Pinera is affiliated with the Carle Illinois College of Medicine and the Cancer Center at Illinois.

Feb
28

TEAM DECIPHERS HOW MYOTONIC DYSTROPHY GENERATES LETHAL HEART DYSFUNCTIONS

go.igb.illinois.edu/myotonic



Heart rhythm defects are the second-leading cause of death for those with myotonic dystrophy, a condition marked by progressive muscle degeneration. In a new study, researchers traced the molecular events that lead to heart abnormalities in myotonic dystrophy and recreated the disease in a mouse model. They report their findings in the journal *Developmental Cell*.

“In this study, we discovered that the genetic abnormalities associated with myotonic dystrophy lead to the overproduction of an alternative-splicing factor that regulates how cells process other proteins,” said Auinash Kalsotra (CGD/GNDP), a professor of biochemistry at Illinois who led the work. He is also a faculty member in the Cancer Center at Illinois.

The nonmuscle form of the protein is elevated in the heart muscles of people with myotonic dystrophy, the researchers found. They now hope to explore new approaches for treating cardiac arrhythmias and bringing us closer to finding a cure for this disease.

The research team included Illinois graduate student Sushant Bangru; undergraduate students Feikai Lin and Darren J. Parker; Thomas A. Cooper, of Baylor College of Medicine; Sara N. Koenig, Ellen R. Lubbers and Peter J. Mohler, of Ohio State University; and Illinois postdoctoral fellow Jamila Hedhli, graduate student Kin Lam, bioengineering professor Lawrence W. Dobrucki and biochemistry professor Emad Tajkhorshid, all of whom are affiliated with the Beckman Institute for Advanced Science and Technology at Illinois. The NIH, Muscular Dystrophy Association and American Heart Association funded this research.

Researchers determined key molecular events that lead to heart abnormalities in myotonic dystrophy. The team included, from left, bioengineering professor Lawrence Dobrucki, postdoctoral fellow Jamila Hedhli, biochemistry professor Auinash Kalsotra, graduate student Sushant Bangru, research scientist Chaitali Misra and graduate student Kin Lam.





**DIANA
RANOA**

RANOA, DR

BACKGROUND
POSTDOCTORAL FELLOW, ACPH THEME

WHAT I ACCOMPLISHED IN 2020
DEVELOPED THE SALIVA-BASED COVID-19 TEST

WHAT BROUGHT ME JOY
PLANTS

Diana Ranoa is a postdoctoral fellow in the ACPD theme who joined the IGB in November 2019. Five months after joining, she volunteered to help with the viral transport medium (VTM) project, led by microbiology professor Chris Brooke, and answered the call to help develop a COVID-19 testing protocol that would allow re-opening of campus in the Fall 2020 semester. She led a small team of four that was tasked with developing the COVID-19 saliva-based testing in six weeks. Working 12-hour shifts every

day, Ranoa helped to collect and process the patient samples, at one point having to process 18,000 samples per day. Thanks in part to her dedication and hard work, the University of Illinois was successful in implementing an ambitious testing program officially known as covidSHIELD. She also contributed to the process of obtaining an FDA EUA for UIUC covidSHIELD, allowing other laboratories in Illinois and across the nation to be able to implement the campus COVID-19 testing protocol.

She is currently juggling three projects, including investigating the ability of chemical compounds to enhance anti-tumor responses, developing CART (chimeric antigen receptor T-cells) therapy, and detecting cancer markers in saliva. Although Ranoa spends most of her days at the IGB, she devotes her free time to taking care of her house plants. Ranoa is thankful for the opportunity to be a part of the SHIELD team and is looking forward to the next step in her career path.



"I've had the 'Never Ever Give Up' laminated photo since I was in undergrad. It was given to me by my mom to encourage me to keep going despite meeting challenges along the way."

"WHEN GOVERNOR J.B. PRITZKER CALLED THE STAY-AT-HOME ORDER, I had some mice experiments running and knew it would be a huge loss if I stayed at home and didn't continue the experiments. Fortunately, the IGB was very accommodating for researchers that had ongoing experiments that would be too expensive to drop. I was able to continue my mice work and came into the lab daily because the mice were already in the middle of the treatment plan. When Chris Brooke called for volunteers for the VTM project, I said why not, I'm already at the IGB. My advisor Paul Hergenrother, who was part of the COVID steering committee that the Chancellor set up for planning the campus reopening, knew that I was volunteering for the VTM project and so he asked me and several other people from my lab for our thoughts. During that time, I found a paper from Yale demonstrating that the virus in saliva is detectable and in fact, the viral load was observed to be higher in saliva compared to nasopharyngeal swabs. The timing was perfect and I forwarded the paper to my advisor and suggested to him that hey, if we can use saliva, it's going to be easier for everyone. He passed that on to the other members of the committee and they were receptive to the idea. Three days later, a team was assembled and I was asked by Paul to lead it.

"As we were setting up the diagnostic lab at Vet Med in June, I was tasked to pick up and handle most of the clinical samples and Robin Holland was the lead supervisor for the diagnostics lab. Part of me was scared. I was handling known positives but I told myself, you are already too deep into this project, it's too late to step back. Just suck it up! At the beginning of the Fall 2020 semester, when we were testing everyone on campus twice a week, and we were receiving up to 18,000 samples per day, there was a point when we could no longer catch up with the demand, our turn-around time suffered, and it was too much for us so

we complained to the higher-ups. Fortunately they listened and made a few changes. Back then, we were still understaffed and we needed more time to train new people since there's a learning curve for the process. The newly-hired individuals were thrown into the frying pan right away. I am an introverted person so having to deal with more people in the diagnostics lab took a lot of energy for me. You have to train them and deal with their personalities.

THEY WERE ASKED TO COME IN EVERY DAY WITH NO TIME OFF FOR THE FIRST 2-3 WEEKS. THAT'S HOW BUSY IT WAS. I WOULD COME IN BEFORE SUNRISE AND GO HOME WHEN THERE'S NO MORE SUN. I LOST SENSE OF TIME BECAUSE ALL YOU DO IS TRAIN PEOPLE AND PROCESS SAMPLES AT THE SAME TIME.

"The frustrating part was going home and seeing students con-



gregating in groups. We were breaking our backs, working non-stop, and supervisors (a.k.a me and Robin) didn't get days off. It was too stressful. So it was heartbreaking to come out of the lab, drive home, and see irresponsible students not taking it seriously. They get the perk of free testing and then they act like there's not a pandemic going on. That was frustrating. I was glad that the university put their foot down and reprimanded those students. It was demoralizing for the test team to continue working while the pandemic was not being taken seriously.

"These days I haven't had that much free time. When I do, I just wanna sit down or lie down. But before, when I had free time, I used to go hiking and travel, mostly hiking or being at the beach. I'm from the Philippines

so I like the beach and tropics. I like reading, but haven't been able to read leisure books. I have this habit of ordering books that I thought I would read, but haven't found the time yet to read them. I am looking forward to that time where I could get days off. I would use those days off to travel or go back to the Philippines when it's safe to do so.

"I do have plants which I consider my pets. I am one of those plant enthusiasts that started during the pandemic. That's what's keeping me busy when I'm not doing lab work or thinking about my experimental plans. I dip my finger in the soil to see if the plants need water or check plants for bugs or try to relocate them to find the spot where they thrive better. I've managed to fill up my apartment space with different plants.

I HAVE PHILIPPINE CITRUS PLANTS THAT I GERMINATED FROM THE SEED OF FRUITS THAT MY AUNT FROM CALIFORNIA SENT ME AND THEY HAVE ALREADY STARTED GROWING. I DIDN'T REALIZE HOW SATISFYING IT WOULD BE TO SEE AN ACTUAL SEED GERMINATE AND GROW. SOMETIMES SITTING THERE AND LOOKING AT THEM RELAXES MY BRAIN, ESPECIALLY ON STRESSFUL DAYS.

I didn't know that before the pandemic because I thought I didn't have time to take care of plants. I realized how happy I was just looking at them and seeing them thrive in an indoor space."

MARCH

2020

Mar
3

SEED FUNDS FROM ALUMNUS FURTHERS CELL CULTURE MODELS OF NEUROLOGICAL DISEASES

go.igb.illinois.edu/fisherms



As a result of seed funds from alumnus Scott Fisher, Professor of Cell and Developmental Biology Lisa Stubbs and Robert W. Schaefer Professor of Chemical and Biomolecular Engineering Brendan Harley (RBTE leader/



EIRH) were further funded by the National Cancer Institute within the NIH to use three-dimensional hydrogel systems to study neurodegenerative disease models, particularly Alzheimer's disease. The funding allowed researchers to show that biomaterials can be adapted for brain cancer studies in order to investigate processes related to neurodegeneration.

Top: Professor of Cell and Developmental Biology Lisa Stubbs, left, with Robert W. Schaefer Professor of Chemical and Biomolecular Engineering Brendan Harley and Research Assistant Professor Sara Pedron Haba.

Bottom: PhD student Samantha Zambuto, left, Illinois alumnus and former manager of Ecolab Scott Fisher, and Research Assistant Professor Sara Pedron Haba.



In a proof-of-principle study led by Research Assistant Professor Sara Pedron Haba, PhD student Samantha Zambuto, and postdoc Julio Serrano, hydrogels, which are polymers used for soft tissue regeneration, were demonstrated as viable cell culture platforms for

investigating neurodegenerative processes. More importantly, the hydrogel system could be used to investigate the effects of hypoxia-mediated stress on neural cell populations. Their findings were reported in the journal *MRS Communications*.

"This supplement is letting us expand the work Scott helped initiate," said Harley.

"Each is a stepping stone to larger scientific questions, but honestly without the initial seed from Scott this never would have gotten off the ground."



Paul J. Hergenrother, Professor of Chemistry (ACPP leader/MMG) was appointed Deputy Director of the Cancer Center at Illinois.

Mar 10



SYNFONI: STRENGTHENING SYNTHETIC BIOLOGY IN FOOD, NUTRACEUTICAL PRODUCTION

go.igb.illinois.edu/synthfood

Yong-Su Jin,
professor of food science
and human nutrition.

Over the years, the democratization of synthetic biology for the production of food has led to products like the Impossible burger, a burger impostor that uses plant tissues instead of meat. Regardless, food companies remain hesitant to utilize synthetic biology due to concerns with genetically modified foods.

With the emergence of genome editing techniques, such as CRISPR-Cas, Professor of Food Science and Human Nutrition (FSHN) Yong-



Su Jin (BSD/CABBI/MME) believes both the consumer and manufacturer can benefit from synthetic biology with minimal risks. This idea was used to propose the Synthetic Biology for Food and Nutrition Innovation (SynFoNI) program for which Jin currently serves as Director along with Deputy Director and Professor of FSHN Mike Miller (IGOH/MME).

“The clear goal of SynFoNI is to make ACES and Illinois a world leader in applying synthetic biology to food and nutritional problems,” said Jin.

“Instead of changing many things which are mostly undesirable in the cell, we can use molecular surgery to change desirable base pairs with CRISPR-Cas. If we can do that, we can reduce the risks and create consumer products in a highly safe manner.”

SynFoNI plans to build a network that integrates the IGB, the Integrated Bioprocessing Research Laboratory, the FSHN program, Agricultural, Consumer and Environmental Sciences (ACES) farms, and numerous food companies in the Chicago area, with plans to create a Food Innovation Center at the Discovery Partners Institute in Chicago.



Ting Lu, Associate Professor of Bioengineering (BSD/BCXT/CABBI/MME) was appointed Donald Biggar Willett Faculty Scholar.

Mar 11



ADVANCING THE FRONTIER OF AQUATIC SYMBIOSIS RESEARCH

go.igb.illinois.edu/sasi

The Gordon and Betty Moore Foundation has awarded grants to support the work of 15 scientists as part of the Symbiosis in Aquatic Systems Initiative investigator program.

This vibrant international cohort will receive five years of unrestricted support to pursue innovative, risky research that has high potential for significant conceptual and methodological advances in aquatic symbiosis.

The collective research is expected to move the community towards a more comprehensive understanding of the origins, evolution, physiology, ecology and natural history of aquatic symbioses.

The cohort's research is expected to create a scientific impact greater than the sum of the individual awards because the awardees represent a spectrum of complementary research questions, methods, technologies and emphasis on either or both marine and freshwater symbiotic associations.

"We are all connected by a hidden sea of microbes and viruses," said Professor of Microbiology Rachel Whitaker (IGOH leader/BCXT). "I am grateful for the unique opportunity to deepen our understanding of symbiosis within a model microbial ecosystem in geothermal hot springs with a multidisciplinary team of collaborators, and I look forward to sharing what we learn in a comparative context to advance forward-thinking goals of the Moore Foundation Initiative."

The Gordon and Betty Moore Foundation's Symbiosis in Aquatic Systems Initiative, launched in 2019, seeks to advance the understanding of aquatic symbioses that include microbial partners. The Gordon and Betty Moore Foundation fosters path-breaking scientific discovery, environmental conservation, patient care improvements and preservation of the special character of the Bay Area.

Mar
11

WHO declared COVID-19 a pandemic. In-person classes at University of Illinois were suspended.

Mar
16

IGB continued work and research remotely.

Mar
16

TECHNOLOGY TO SCREEN FOR HIGHER-YIELDING CROP TRAITS NOW MORE ACCESSIBLE

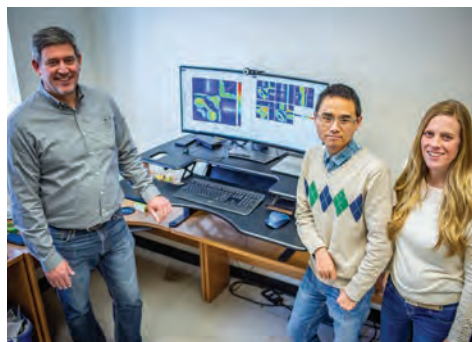


Scientists are seeking to analyze thousands of plants to pinpoint genetic tweaks that can boost crop production—historically a Herculean task. To drive progress toward higher-yielding crops, a team from Illinois is revolutionizing the ability to screen plants for key traits across an entire field. In two recent studies—published in the *Journal of Experimental Botany* and *Plant, Cell & Environment*—they are making this technology more accessible.

go.igb.illinois.edu/traittech

The team analyzed data collected with specialized hyperspectral cameras that capture part of the light spectrum that is reflected off the surface of plants. Using hyperspectral analysis, scientists can tease out meaningful information from these bands of reflected light to estimate traits related to photosynthesis.

From left to right:
USDA-ARS Research
Plant Physiologist
Carl Bernacchi, and
postdoctoral researchers
Peng Fu and Katherine
Meacham-Hensold
worked on revolutionizing
how scientists screen
plants for key traits.



"Hyperspectral cameras are expensive and their data is not accessible to scientists who lack a deep understanding of computational analysis," said Carl Bernacchi (CABBI/GEGC), a research plant physiologist with the USDA-ARS at the IGB.

“Through these studies, our team has taken a technology that was out of reach and made it more available to our research community so that we can unearth traits needed to provide farmers all over the world with higher-yielding crops.”

Realizing Increased Photosynthetic Efficiency (RIPE) is an international research project that aims to improve photosynthesis to equip farmers worldwide with higher-yielding crops needed to ensure everyone has enough food to lead a healthy, productive life. RIPE is sponsored by the Bill & Melinda Gates Foundation, the U.S. Foundation for Food and Agriculture Research, and the U.K. Government’s Department for International Development.

Mar 19

IGB launched our “**couchreach**” activities to continue to connect with communities, both locally in Urbana-Champaign and across the globe.



Mar 21

Governor J.B. Pritzker issued a stay-at-home order for Illinois.

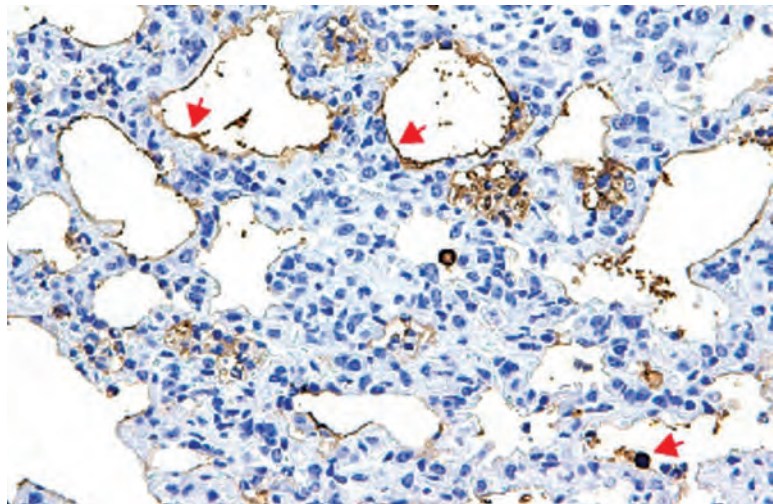
Mar 24

BACTERIAL PROTEIN FRAGMENT KILLS LUNG CELLS IN PULMONARY FIBROSIS



go.igb.illinois.edu/ipfprotein

Lung tissue from mice with pulmonary fibrosis that were infected with corisin-secreting bacteria showed signs of acute exacerbation and lung tissue death.



A bacterial protein fragment instigates lung tissue death in pulmonary fibrosis, a mysterious disease affecting millions of people worldwide, according to a new study from researchers at Illinois and Mie University in Japan. Led by Illinois microbiology and animal sciences professor Isaac Cann (MME leader/BCXT) and Mie University immunology professor Esteban Gabazza (MME), the researchers published their findings in the journal *Nature Communications*.



**SAMANTHA
ZAMBUTO**
PHD CANDIDATE,
RBTE THEME

MY PHD RESEARCH FOCUSES ON DEVELOPING MODELS OF EARLY PREGNANCY. I never thought I would spend 2020 mostly away from the lab and focusing on my own pregnancy “experiment.”

I found out I was pregnant in January right before COVID-19 struck our city. Moving through the unknowns and anxieties of the pandemic and lockdown at the beginning of March, I continued my thesis research while my son grew inside of me. I experienced pregnancy as a scientist and a future mom. I experienced the ups and downs of pregnancy from the safety of my apartment, nervously watching my husband continue to work in the hospital while the case numbers rose and my belly grew larger and larger. I missed out on experiences that first time moms celebrate, like an in-person baby shower and holding my husband’s hand during each appointment.

My son was born in August 2020 and has taught me so much about myself as a woman, mother, and scientist. If anything, this pandemic as well as the birth of my son have taught me to expect the unexpected. Each day, I’m amazed to watch him grow and learn new things and although 2020 was an extremely challenging year, it also marks the best year of my life—**the year I met my son.**

Researchers found a small peptide, secreted by *Staphylococcus nepalensis*, that rapidly kills lung cells. They named the peptide corisin.

“It’s like a Trojan horse,” Cann said. “Anybody trying to characterize the large protein to find what it does would never know it has this destructive element hidden inside it. The microbe makes the polypeptide and then it cuts out that small piece of it, the corisin, and that is very deadly.”

Next, the researchers hope to identify the enzyme that cuts corisin out of its larger protein. They aim to create agents to block it—effectively bolting shut the door of the Trojan horse. They also plan to identify which other strains of bacteria produce corisin or similar peptides, and to study other types of fibrosis, such as in the kidneys and liver, to see if corisin or other bacterial agents play a role in those diseases.

The Ministry of Education, Culture, Sports, Science, and Technology of Japan, the IGB and the College of Agricultural, Consumer and Environmental Sciences Office of International Programs at Illinois supported this work.



Andrew Smith, Associate Professor of Bioengineering (CGD) was appointed Donald Biggar Willett Faculty Scholar.

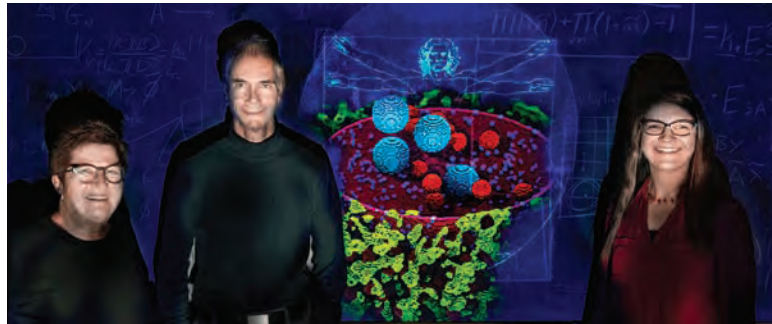


COMPUTATIONAL HUMAN CELL REVEALS NEW INSIGHTS



go.igb.illinois.edu/compcell

From left to right: Chemistry professors Zaida Luthey-Schulten and Martin Gruebele, and research scientist Zhaleh Ghaemi developed the most complete computational model of a human cell to date.



Researchers have developed the first computational model of a human cell and simulated its behavior for 15 minutes—the longest time achieved for a biological system of this complexity. In a new study, simulations reveal the effects of spatial organization within cells on some of the genetic processes that control the regulation and development of human traits and some human diseases. The study, which produced a new computational platform that is available to any researcher, is published in the journal *PLoS Computational Biology*.

“This is the first program that allows researchers to set up a virtual human cell and change chemical reactions and geometries to observe cellular processes in real time,” said Zhaleh Ghaemi, a research scientist at Illinois and lead author of the study.

Working off the notion that the insides of cells are packed with various organelles and molecules, the group, led by chemistry professor Zaida Luthey-Schulten (BCXT), focuses on how the movement of individual molecules around the many obstacles affects the chemical reactions inside cells. To test the new model, the team performed simulations of a process called RNA splicing, which is one of the most complex cellular processes and a hallmark of human cellular biology.

The researchers designed the computational platform to model a variety of cellular processes while being fully customizable by the researcher using it. Although the most comprehensive human cell model to date, the computational model still has ample room for advancement and customization to study other cellular processes.

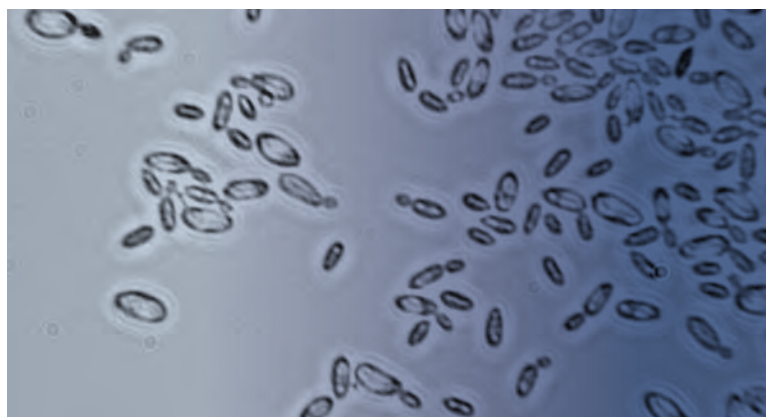
Mar
27

TRIPLE-THREAT GENETIC TOOLKIT FOR PRODUCING ECO-FRIENDLY CHEMICALS



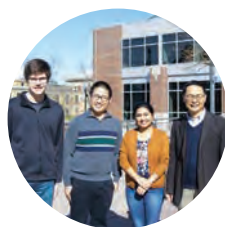
go.igb.illinois.edu/3threat

Issatchenkia orientalis may have the acid tolerance to be a viable producer of bioproducts.



Researchers have developed a triad of innovative tools to engineer low-pH-tolerant yeast *Issatchenkia orientalis* for production of valuable bioproducts from renewable biomass. A paper published in *Metabolic Engineering* outlines the study's three-pronged approach and its importance to the field of sustainable chemical production.

University of Illinois
Department of Chemical
and Biomolecular
Engineering scientists
(from left) William L. Lyon,
Mingfeng Cao, Zia Fatma,
and Huimin Zhao.



The team was led by Mingfeng Cao, an Illinois Research Scientist in the Department of Chemical and Biomolecular Engineering (ChBE). Cao works in ChBE Professor Huimin Zhao's (BSD leader/CABBI/GSE/MMG) lab at CABBI. CABBI Postdoctoral Researcher Zia Fatma, also in Zhao's lab, is a coauthor of the study.

In an effort to decrease dependence on nonrenewable fossil fuels, scientists are exploring methods of producing valuable products from renewable biomass using organisms such as yeast.

Generating economically competitive quantities of these products involves metabolic engineering—editing cells' genetic blueprint to produce greater quantities of desired substances.

"In addition to conventional yeasts, we're discovering that nonconventional yeasts can prove to be just as high-performing," Cao said. "The more organisms we can engineer for valuable compound

production, the more opportunities we will have in order to make chemical production economically and environmentally sustainable.”

In addition to Cao, Zhao, and Fatma, the research team includes CABBI's Yasuo Yoshikuni and Ping-Hung Hsieh, Lawrence Berkeley National Laboratory; CABBI's Vinh G. Tran, ChBE at Illinois; William L. Lyon, ChBE; Xiaofei Song, Department of Microbiology, Nankai University, Tianjin, China; Maryam Sayadi, Genome Informatics Facility, Office of Biotechnology, Iowa State University; and Zengyi Shao, Department of Chemical and Biological Engineering, Iowa State University.



Amy Wagoner Johnson, Professor of Mechanical Science and Engineering (EIRH/RBTE) was appointed an Anderson Faculty Scholar. She received the Outstanding Advisor Award by the Engineering Council from Grainger College of Engineering.



Roy Dar, Assistant Professor of Bioengineering (BCXT/GNDP/M-CELS) received an NSF CAREER award.



AT-HOME ACTIVITIES FOR FAMILIES AND FRIENDS



[go.igb.illinois.edu/
AtHomeReach](http://go.igb.illinois.edu/AtHomeReach)



In accordance with current health guidelines and wellness practices, the suspension of in-person activities this past year found many at home much more than before. During the summer, the IGB provided a suite of fun and educational activities that could be done from the comfort of one's home, with the goal of connecting with communities both locally and globally. These activities provided opportunities to engage with others while learning about something new and exciting, experiment with a fresh idea, or just be curious.

Some notable activities included a flower dissection activity, an ongoing comic featuring our favorite Pocket Monsters, an at-home scavenger hunt, and a COVID-19-themed escape room series. These activities allowed families and friends to stay engaged and connected while stuck at home.

All of the activities are archived and available on our website, with some activities currently ongoing: go.igb.illinois.edu/couchreach.



Tandy Warnow, Professor of Computer Science (BCXT/IGOH) was appointed Chief Scientist and Executive Committee member of the C3.ai Digital Transformation Institute.

APRIL

2020



Donald Ort, Professor of Plant Biology & Crop Sciences (GEGC Leader/BSD/CABBI) received the Charles Reid Barnes Life Membership Award from the American Society of Plant Biologists.



Gov. J.B. Pritzker announced that Illinois was “bending the curve” on the coronavirus pandemic, citing a slowdown in the growth rate of new cases and stability in the number of patients using intensive care unit beds.



U OF I PARTNERS WITH CARLE HEALTH AND STATE TO INCREASE COVID-19 TESTING

go.igb.illinois.edu/carletesting

The machines identify and amplify specific RNA segments within a sample and are used to assist with COVID-19 testing.



Launched in April 2020, a collaborative effort spearheaded by Assistant Professor of Microbiology Chris Brooke (IGOH) produced enough buffered saline and viral transport media (VTM)—an essential mix of buffers, nutrients, and antimicrobials used to preserve test samples from patients—to support some 200,000 coronavirus tests across the state. Responding to a request for help from Carle Health, Brooke approached research partners around campus for assistance providing Carle with the means to conduct tests, and the response was immediate. Brooke, May and Ving Lee Professor for Chemical Innovation and Professor of Chemistry Martin Burke (MMG), and Alumni Research Scholar Professor of Chemistry Douglas Mitchell (MMG) collaborated to mass produce liquids necessary for COVID-19 testing.

Not only did the effort allow healthcare workers at Carle to begin testing for COVID-19, thus reducing the wait period for local tests to within 24 hours in many cases, but the University of Illinois expanded the partnership to the Illinois Department of Public Health and Illinois Emergency Management Agency to ramp up testing operations.

“This was a clear example where Illinois students, postdocs, faculty, and staff stepped up and volunteered a ton of time and hard work to help save lives in the community,” said Brooke. “What we’re doing is small compared to the health workers who are actually serving patients on the front lines.”

We recognize the entire VTM team (pg.108) for their tireless work to keep these efforts safely and efficiently coordinated.

Apr
23

Nigel Goldenfeld (BCXT leader/GNDP) and **Sergei Maslov** (BCXT/CABBI) presented their COVID-19 modeling efforts at a live press briefing with Illinois Governor J.B. Pritzker, kicking off months of data analysis and epidemiological modeling efforts to form effective mitigation strategies.



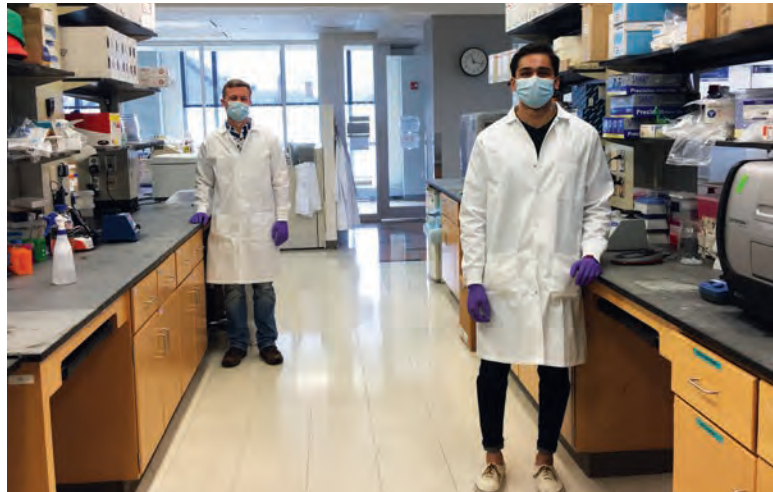
Brian Cunningham, Professor of Engineering and Professor of Electrical and Computer Engineering (CGD Director/MMG) was elected Fellow of the Royal Society of Chemistry.

Apr
23

DONATION OF NASOPHARYNGEAL SWABS FOR LOCAL AND STATE TESTING

go.igb.illinois.edu/carletesting

Laboratory technicians Justin Lange, left, and Akanksh Shetty observe social distancing while creating Viral Transport Media in the IGB. The fluid is used to preserve patient test samples for COVID-19.



A campus-wide collaboration at Illinois spearheaded the mass production of nasopharyngeal swabs, which are used to collect test samples from patients’ noses. In collaboration with Carle diagnostic labs, the team reverse-engineered a commercial swab to design and test their own. The team, which includes Douglas Mitchell (MMG), Alumni Research Scholar Professor of Chemistry, Jeffery Moore (BSD), Stanley O. Ikenberry Chair and Professor of Chemistry and Materials Science and Engineering and Director of the Beckman Institute for Advanced Science & Technology, and Nancy Sottos, Swanlund Chair and head of the Department of Materials Science and Engineering, developed a method to create enough swabs that, if validated,

could meet a portion of the need in the state of Illinois. The team also includes Martin Gruebele, James R. Eiszner Endowed Chair in Chemistry and head of the Department of Chemistry.

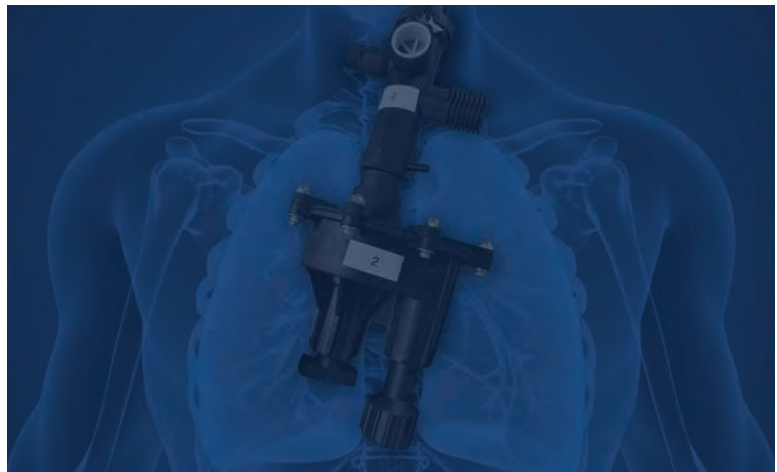
Mitchell described the process as converting a precursor rod into a viable swab using a hot draw. The key, he said, is to stretch the material in a way that retains rigidity in the handle while allowing for flexibility in the portion that enters the patient's nose.

“We came to the lab to reverse engineer the nasopharyngeal swab with a safe, inexpensive, rapid, scalable method from common laboratory supplies and equipment,” Moore said. “When our initial idea hit a snag, the graduate students put their ingenuity to work and improvised a brilliant solution that checked all the boxes.”

**PIGS PUSH FORWARD
QUICK SOLUTION
FOR EMERGENCY
VENTILATORS**



go.igb.illinois.edu/pigvent



When Matt Wheeler (RBTE) got the call on a Sunday morning in March—just two days after Gov. J.B. Pritzker issued his first stay-at-home order—he wasn't expecting to launch an experiment that could save countless lives.

Leaders from the Illinois RapidVent team explained they had built a prototype of an emergency ventilator to address a nationwide shortage amid the COVID-19 pandemic.

Within a week, Wheeler wrote a protocol; obtained approval from the Illinois Institutional Animal Care and Use Committee; assembled his team, supplies, and animals; and had completed the first 24-hour tests of the ventilator. A few tweaks and a few days later, final testing was complete. The RapidVent worked.

Wheeler's team tested the device in pigs, widely recognized as the non-primate mammals most physiologically similar to humans. The device is designed for short-term, emergency respiratory support in hospitals when regular ventilators are not available.

INEXPENSIVE, PORTABLE DETECTOR IDENTIFIES PATHOGENS IN MINUTES

go.igb.illinois.edu/phonekit

Bioengineering professor and Grainger College of Engineering Dean Rashid Bashir and electrical and computer engineering professor Brian Cunningham co-led a multi-institutional team to demonstrate an inexpensive and rapid smartphone-based pathogen testing device designed to ease pressure on testing laboratories during pandemics.

A photo of the first PathTracker clip-on box.



Brian Cunningham (CGD Director/MMG) and bioengineering professor and Grainger College of Engineering Dean Rashid Bashir (CGD/M-CELS), are reported in the journal *Lab on a Chip*.

“This test can be performed rapidly on passengers before getting on a flight, on people going to a theme park or before events like a conference or concert,” Cunningham said.

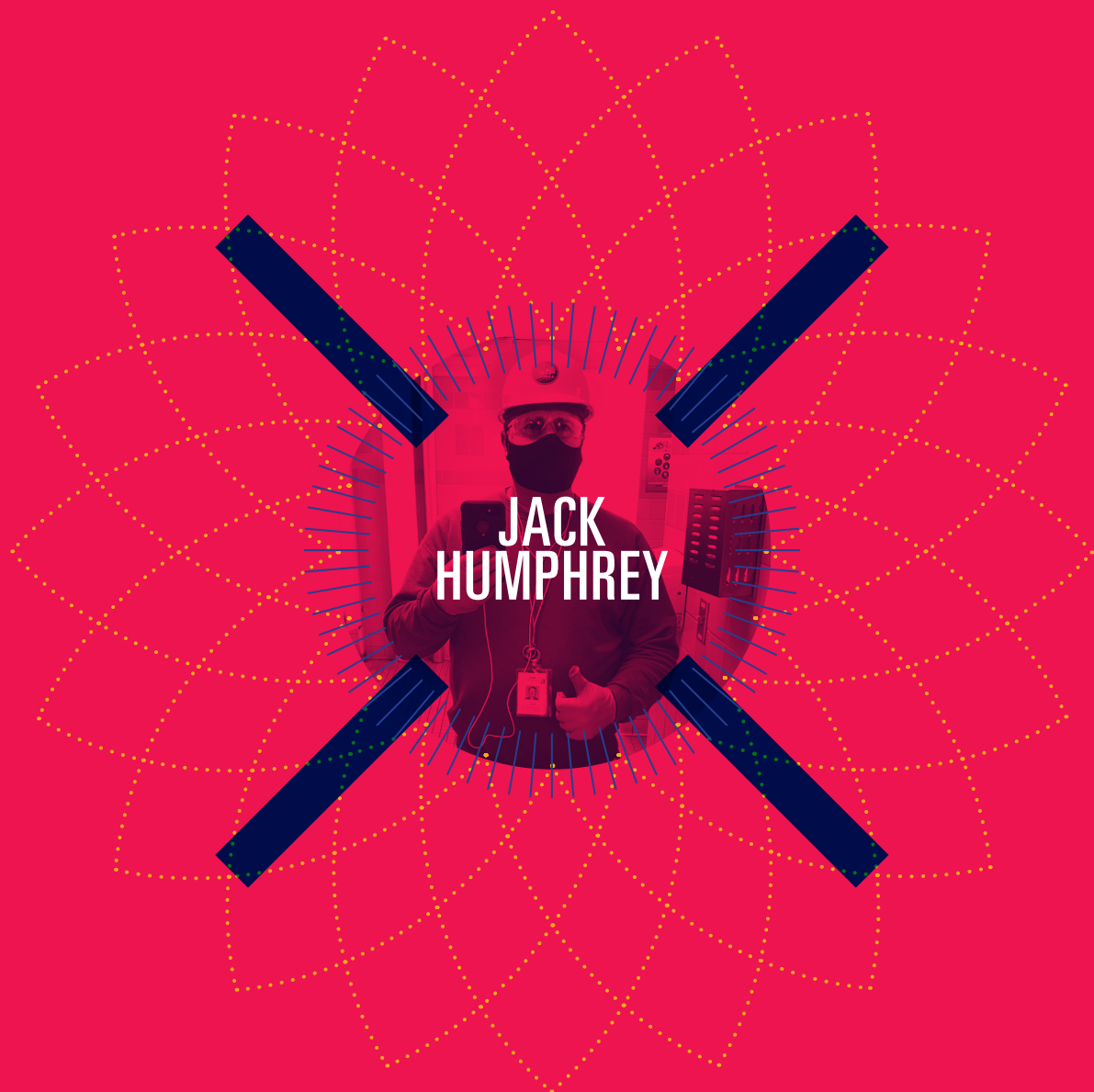
“Cloud computing via a smartphone application could allow a negative test result to be registered with event organizers or as part of a boarding pass for a flight. Or, a person in quarantine could give themselves daily tests, register the results with a doctor, and then know when it’s safe to come out and rejoin society.”



Study co-authors with Cunningham and Bashir were Fu Sun, Anurup Ganguli and Matthew B. Wheeler, of Illinois; Ryan Brisbin and David L. Hirschberg, of RAIN Incubator; Krithika Shanmugam, of the University of Washington; and veterinarian David M. Nash. The NSF and the Center for Genomic Diagnostics at the IGB supported this research.



Jian Peng, Assistant Professor of Computer Science (CABBI) received the Overton Prize from the International Society for Computational Biology.



JACK HUMPHREY

BACKGROUND

BUILDING SERVICE WORKER

WHAT I ACCOMPLISHED IN 2020

BUILT AN AVIARY FOR MY 23 CHICKENS

WHAT BROUGHT ME JOY

PEOPLE SMILING AT MY MASK



Jack Humphrey is a building service worker at IGB. During the pandemic, he has been working from 6:00 am to 2:30 pm, and his responsibilities include emergency services; deep cleaning of vacated offices; wiping down the most commonly trafficked areas including bathrooms, lobbies, and

break rooms; and cleaning the glass windows. Additionally, Humphrey undertook several home improvement projects during the lockdown, some of which he had been putting off for the last few decades. His only complaint about the pandemic: He hates masks since he can't see people smile.



“NOTHING IS NORMAL ANY-MORE. The pandemic is a historic event and it’s going to be a page in the history books where we read about how people dealt with it. After working on campus for 25 years, you would think that cleaning would be routine for me. However, it was a learning process because you had to think about where people’s hands make contact and clean those areas. We worked once a week during the first few weeks of the lockdown and that changed to three days a week. We started coming back full-time in June.

“I enjoy working at IGB. I treat the building like it’s mine. I also work with great people; everyone pays attention to the details and is very accommodating. I know that the pandemic has made people unhappy, but your personal attitude affects a lot of things. It doesn’t bother me because I get tested twice a week, I follow social distancing measures, every-

thing gets wiped down before I arrive at work, and I wipe everything down before I leave.

“I DO TRY TO GET PEOPLE TO CRACK A SMILE EVERY NOW AND THEN, EVEN IF I DON’T SEE IT.

I bought a mask that has the same complexion as my face. It has a moustache and a blue mask on the chin, where masks are not supposed to be. The only thing that can throw you is that the lips don’t move when you talk. It got so much attention that I couldn’t have a conversation without people asking me where I got it from.

“My children had a hard time with remote learning because they didn’t like it. It’s interesting how much technology has helped. It’s like ‘The Jetsons’ where they talk to each other live on video. I worked on a lot of projects at home during the lockdown. I had

a shed that needed electrical connections put in. I did that with the help of my father-in-law and my son. It wasn’t hard, and electricity will tell you when you get it wrong because it will shock you. I was fine because my father-in-law knew how to do it. I also built a circular driveway for my house, which I moved into 17 years ago. I cut out a path with my tractor, bought gravel, and put it in. I should’ve built it sooner but I kept putting it off because I didn’t have the time. Since we have 23 chickens, we’re always worried about hawks and coyotes, and so I built them an aviary.

I DID LOSE TRACK OF TIME DURING THE LOCKDOWN. I DIDN’T KNOW WHAT DAY IT WAS UNLESS IT WAS SUNDAY, WHEN WE GO TO CHURCH, OR THE DAY I HAD TO WORK. I LEARNT WHAT RETIREMENT WOULD BE LIKE.”



Lisa Ainsworth, USDA Agricultural Research Service Scientist and Adjunct Professor of Plant Biology and Crop Sciences (CABBI/GEGC) was elected to the National Academy of Sciences.

Apr
28

LISA AINSWORTH OF USDA-ARS ELECTED TO NAS

[go.igb.illinois.edu/
ainsworthnas](http://go.igb.illinois.edu/ainsworthnas)

USDA Agricultural
Research Service Scientist
Lisa Ainsworth.



Lisa Ainsworth (CABBI/GEGC), a research plant physiologist with the USDA-ARS and adjunct professor of plant biology and crop sciences at Illinois, was elected to the National Academy of Sciences—largely considered one of the highest honors that a scientist can receive.

Ainsworth, known for her research on how crops are impacted by pollutants such as ozone and carbon dioxide, was among 120 new members announced. This honor recognized her “distinguished and continuing achievements in original research,” according to the NAS.

“I am humbled to receive this tremendous honor,” Ainsworth said. “My election to the NAS is a reflection of considerable good fortune in a career filled with generous mentors and collaborators, creative postdocs and students, and incredible research opportunities made possible by the USDA-ARS and the University of Illinois.”

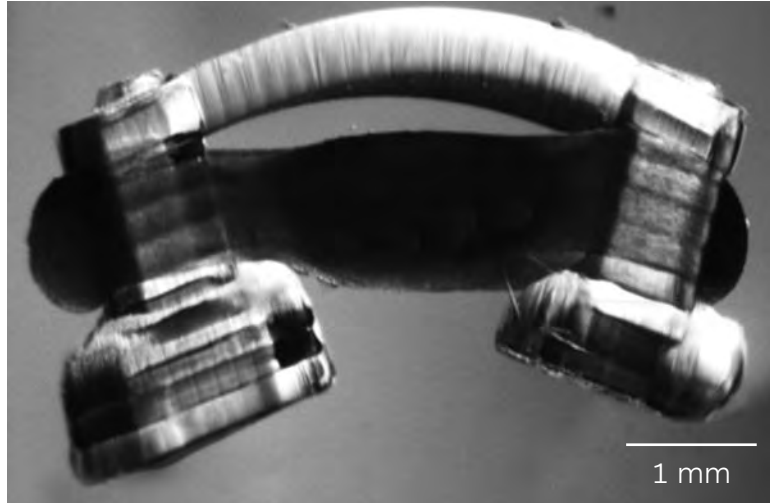
Currently, she leads the USDA-ARS Global Change and Photosynthesis Research Unit and the Soybean Free Air Concentration Enrichment (SoyFACE), a cutting-edge research facility where scientists can explore the current and future impact of the climate crisis on crops that are grown outdoors in real-world field conditions.

Ainsworth is also a research leader of Realizing Increased Photosynthetic Efficiency (RIPE), an international research effort to ensure food security by improving photosynthesis, the natural process all plants use to convert sunlight into yield. RIPE is supported by the Bill & Melinda Gates Foundation, the U.S. Foundation for Food and Agriculture Research, and the U.K. Government’s Department for International Development.

SPINAL CORD GIVES BIO-BOTS WALKING RHYTHM

go.igb.illinois.edu/
biobotrhythm

Bio-bots are propelled by a ring of muscle on a hydrogel skeleton. Illinois researchers have been the first to innervate them with rat spinal cord segments, giving the “spinobots” a natural walking rhythm.



Miniature biological robots are making greater strides than ever, thanks to the spinal cord directing their steps. Illinois researchers developed the tiny walking “spinobots,” powered by rat muscle and spinal cord tissue on a soft, 3D-printed hydrogel skeleton.

While previous generations of biological robots, or bio-bots, could move forward by simple muscle contraction, the integration of the spinal cord gives them a more natural walking rhythm, said study leader Martha Gillette (GNBP/M-CELS), a professor of cell and developmental biology. The researchers published their findings in the journal *APL Bioengineering*.

“These are the beginnings of a direction toward interactive biological devices that could have applications for neurocomputing and for restorative medicine,” Gillette said.

To make the spinobots, the researchers first printed the tiny skeleton: two posts for legs and a flexible “backbone,” only a few millimeters across. Then, they seeded it with muscle cells, which grew into muscle tissue. Finally, they integrated a segment of lumbar spinal cord from a rat.

Next, the researchers plan to further refine the spinobots’ movement, making their gaits more natural. The researchers hope this small-scale spinal cord integration is a first step toward creating *in vitro* models of the peripheral nervous system, which is difficult to study in live patients or animal models.

NSF supported this work through the Emergent Behaviors of Integrated Cellular Systems science and technology center.



Andrew Suarez, Professor of Entomology (GNBP) was named Jeffrey S. Elowe Professor in Integrative Biology (April 2020).



An effort led by **Chris Brooke** (IGOH) produced 280,000 vials of Viral Transport Media for the state of Illinois.



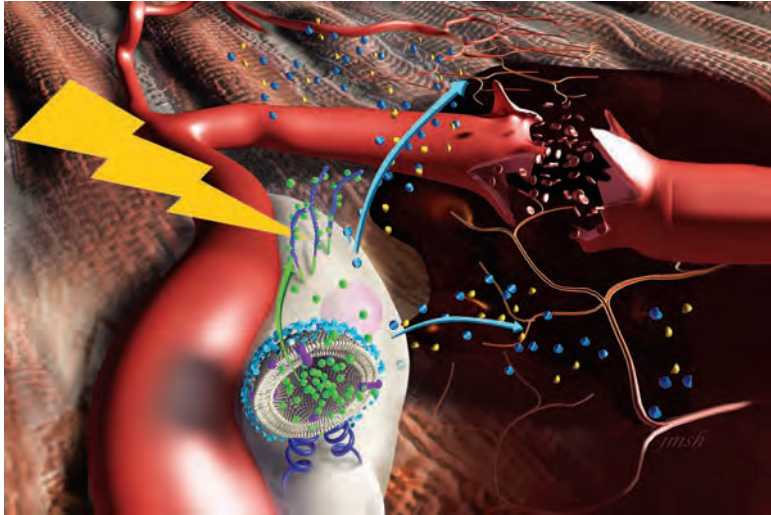
Remdesivir was granted the Emergency Use Authorization.



NANOSTIMULATORS BOOST STEM CELLS FOR MUSCLE REPAIR

[go.igb.illinois.edu/
stemboost](http://go.igb.illinois.edu/stemboost)

Nanostimulators bind to the surface of stem cells, delivering agents that spur the cells to release factors that promote blood vessel growth and modulate inflammation in damaged muscle.



In regenerative medicine, an ideal treatment for patients whose muscles are damaged from lack of oxygen would be to invigorate them with an injection of their own stem cells.

In a new study published in the journal *ACS Nano*, researchers at Illinois demonstrated that “nanostimulators”—nanoparticles seeded with a molecule the body naturally produces to prompt stem cells to heal wounds—can amp up stem cells’ regenerative powers in a targeted limb in mice.

“We wanted to utilize the natural functions of the stem cells and the stimulating factors to address muscle ischemia locally,” said study leader Hyunjoon Kong (M-CELS leader/EIRH/RBTE) Robert W. Schafer Professor of Chemical and Biomolecular Engineering.

Muscle ischemia, or damage to muscle from limited oxygen or blood supply, can result from multiple causes, such as injury to a limb or peripheral artery disease. Stem cells derived from a patient’s own fat tissue are known to produce factors that prompt new blood vessels to grow into the damaged muscle, restoring oxygen and nutrients, and to modulate inflammation in the damaged tissues. The researchers saw increased blood flow and oxygen levels in the ischemic legs of mice. They also witnessed improvements in mobility—the treated mice could walk longer distances and their legs were stronger.

The NIH, the Korea Institute of Science and Technology and A*STAR in Singapore supported this work.



May
7

FACULTY RECEIVE THREE NSF RAPID GRANTS FOR COVID-19 TESTING

go.igb.illinois.edu/rapidNSF



Three Holonyak Micro and Nanotechnology Lab (HMNTL) and IGB faculty members have received NSF Rapid Response Research (RAPID) program grants, all of which aim to shorten the amount of time it takes to process a COVID-19 test. Many tests can take as long as five days for results to be returned to the patient.

A team led by Rashid Bashir (CGD/M-CELS), Dean of the Grainger College of Engineering, has proposed the development of a point-of-care device that uses nasal fluid samples to detect the presence of COVID-19 within 10 minutes. The test being developed by Bashir’s group will simplify the process by eliminating the need to extract RNA from samples and simplify the test as a whole.

The next COVID-19 detection project combines capturing intact COVID-19 viruses with custom-designed DNA nanostructures so they can be immediately counted with a newly-invented type of biosensor imaging. This process can be completed in less than 15 minutes. The team for this research is led by Brian Cunningham (CGD Director/MMG), Donald Biggar Willett Professor in Engineering and of Electrical and Computer Engineering and also includes Xing Wang (CGD), Associate Professor of Chemistry, Taylor Canady, former IGB Fellow, and Nantao Li, Cunningham’s graduate student.

Jay and Ann Schenck Professor of Chemistry Yi Lu (BSD/CABBI/CGD) is working with Lijun Rong from the University of Illinois at Chicago to develop a biosensor that could detect and differentiate infectious SARS-CoV-2 from the SARS-CoV-2 that have been rendered noninfectious by patient’s antibodies or disinfectants.

May
8

State of Illinois conducted more than 20,000 tests for coronavirus in one day.

May
9

The Food and Drug Administration approved the antigen test, which rapidly detects fragments of virus proteins in samples collected from swabs swiped inside the nasal cavity. It's the third type of test for coronavirus authorized by the FDA.

May
11



NEW IGB THEME DEVELOPS ENGINEERED LIVING SYSTEMS WITH NOVEL FUNCTIONALITIES

go.igb.illinois.edu/newmcels

Robert W. Schafer
Professor of Chemical and
Biomolecular Engineering
Hyunjoon Kong.



For years, artificial systems—such as robots and machines—have been used for industrial applications, making a tremendous impact on society. However, steady progress made by scientists could see the replacement of artificial systems with “Multi-Cellular Engineered Living Systems” (M-CELS) composed of living cells and extracellular matrices organized to perform novel functions absent in natural systems.

Two research programs—bio-hybrid robots and biological processors—form the foundation of the newly formed IGB research theme M-CELS, which is led by Robert W. Schafer Professor of Chemical and Biomolecular Engineering Hyunjoon Kong (EIRH/RBTE).

“We can utilize M-CELS to assemble various transformative engineering systems, such as a bio-hybrid robot, an organic computer, an energy generation device, as well as other new and unforeseen possibilities,” said Kong. “These systems may also encompass implantable “hyperorgans” that sense a biological signal, and in response, synthesize, secrete and deliver a biologic product, via diffusion or pumping.”

The M-CELS theme will focus on developing *in silico*, cellular, and artificial components for precision assembly of biomachinery and computing processors along with genomics and proteomics of M-CELS. Multi-Cellular Engineered Living Systems research theme members also include Rashid Bashir (CGD), Bioengineering; Martha Gillette (GNBP), Neuroscience Program, Molecular & Cell Biology; Mattia Gazzola, Mechanical Science and Engineering; Taher Saif (RBTE), Mechanical Science and Engineering; and Gabriel Popescu, Electrical and Computer Engineering.



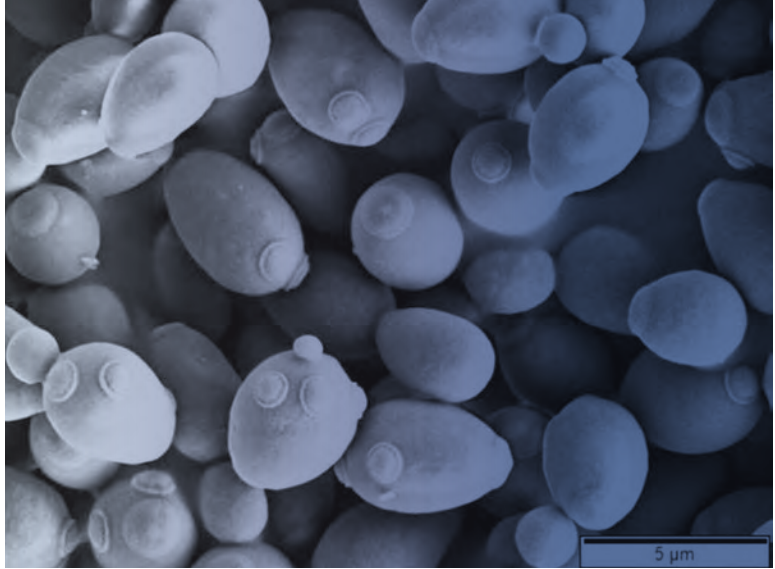
MY NEIGHBORHOOD CONSISTS OF WOMEN WHO ARE WIDOWS, AND WE ALL WATCH OUT FOR EACH OTHER. At the beginning of COVID-19 I would do all of our grocery shopping every week, sometimes every week and a half. My daughter specializes in cardiac catheterization at the hospital but with COVID-19, cardiac catheterization became an elective surgery, and she was moved to the COVID-19 ward. As a result, my 17-year-old granddaughter moved in with me. My parents both contracted COVID-19, and my father ended up with double pneumonia. Since my daughter never got sick, she and I became their caregivers to keep them alive (my daughter already had all the PPE to be in the house with them). They both lived through COVID-19. We have had family members die due to COVID-19, but were blessed that my daughter was able to be with them as they took their last breath.

On the work front, COVID testing supplies and machinery became emergency orders, but I was able to complete them all while working from home and watching the devastation play out in the news and on the home front. I myself am medically immunocompromised and have tried to keep myself as safe and healthy as possible.

It's been an "interesting" and challenging year, but **we really have all been blessed through it.**

RAPID SCREENING METHOD TARGETS FATTY ACIDS IN YEAST

go.igb.illinois.edu/fatyeast



Saccharomyces cerevisiae,
SEM image.

Researchers at Illinois developed a novel mass spectrometry-based screening technique to rapidly profile medium-chain fatty acids produced in yeast—part of a larger group of free fatty acids that are key components in essential nutrients, soaps, industrial chemicals, and fuels. They also identified seven new genetically engineered mutants of the yeast *Saccharomyces cerevisiae* that produce higher levels of those fatty acids.

The study is detailed in a paper published in the journal *Biotechnology and Bioengineering*. The research was performed at CABB I by two Illinois professors: Huimin Zhao (BSD leader/CABB I/GSE/MMG), Professor of Chemical and Biomolecular Engineering, and Jonathan Sweedler (BSD/CABB I/MMG), Professor of Chemistry and Director of the School of Chemical Sciences. The lead author is Pu Xue, a doctoral student with Zhao's lab at CABB I.

Zhao's group genetically engineers tiny yeast cells to increase production of fatty acids, crucial components of biodiesel, fatty alcohols, waxes and olefins—the building blocks for detergents, adhesives, and plastics. Xue and other researchers worked with Sweedler's group to develop a high-throughput screening tool, a

chemical characterization approach based on MALDI-TOF MS (matrix-assisted laser desorption/ionization time-of-flight mass spectrometry).



Lead author Pu Xue is a Chemical and Biomolecular Engineering doctoral student with the Zhao lab at CABB I.

“In the future if we can directly generate biofuels and bioproducts, such as fatty acids, from microbial

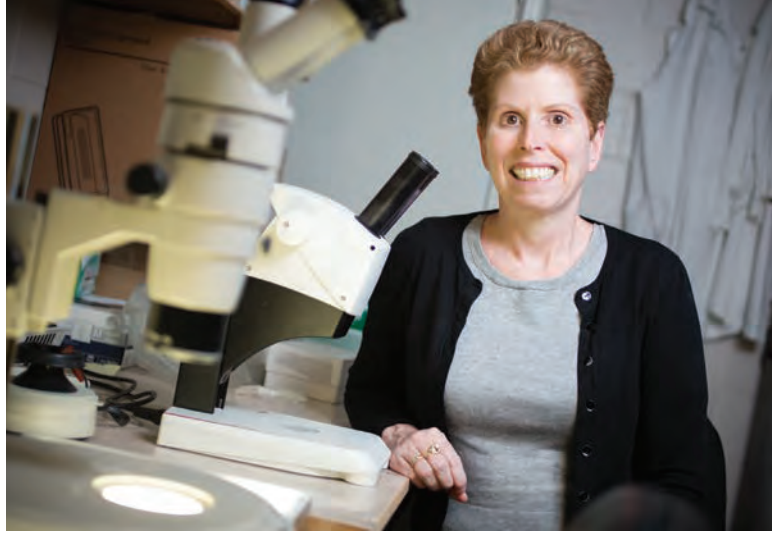
cells like yeast on a large scale, meaning we don't need to use petrol,” Xue said. “We can save the environment and save a lot of money.”

May
22

ENVIRONMENTAL CONTAMINANTS ALTER GUT MICROBIOME, HEALTH

[go.igb.illinois.edu/
envirochem](http://go.igb.illinois.edu/envirochem)

Professor of Comparative Biosciences Jodi Flaws and her colleagues reviewed dozens of studies exploring the relationship between exposure to environmental contaminants, the gut microbiome, and human and animal health.



The microbes that inhabit our bodies are influenced by what we eat, drink, breathe and absorb through our skin, and most of us are chronically exposed to natural and human-made environmental contaminants. In a new paper, scientists from Illinois review the research linking dozens of environmental chemicals to changes in the gut microbiome and associated health challenges. The review is published in the journal *Toxicological Sciences*.

The study includes sections on compounds used in manufacturing consumer goods, including the bisphenols found in plastic food packaging, and phthalates, which are used in everything from vinyl flooring to plastic films. It also describes the science associated with exposure to persistent organic pollutants and heavy metals.

“More than 300 environmental contaminants or the metabolic byproducts of those contaminants have been measured in human urine, blood or other biological samples,” said Jodi Flaws (EIRH co-leader/MME), a professor of comparative biosciences who led the analysis with PhD student Karen Chiu.

“Chemicals such as bisphenols, phthalates and some pesticides, persistent organic pollutants and heavy metals can alter hormone metabolism and are associated with adverse health outcomes.”

The negative health effects linked to these chemicals include reproductive and developmental defects, Type 2 diabetes, cardiovascular dysfunction, liver disease, obesity, thyroid disorders and poor immune function, the researchers report. High phthalate exposure in human newborns is associated with changes in the gut microbiome and altered immune responses to vaccination.

The NIH, U of I Division of Nutritional Sciences and College of Veterinary Medicine supported this work.

May
29

Illinois began Phase 3 of reopening, allowing outdoor dining.

JUNE

2020

Jun 10

U.S. COVID-19 cases reached 2 million.

Jun 16

GENE ROBINSON NAMED INTERIM DEAN OF THE COLLEGE OF LAS

[go.igb.illinois.edu/
DeanGene](http://go.igb.illinois.edu/DeanGene)

IGB Director
Gene Robinson.



Gene Robinson, IGB Director and Professor of Entomology, was named interim dean of the College of Liberal Arts & Sciences. Robinson filled the role while a national search was conducted for the dean's position.

Robinson took the place of Feng Sheng Hu, the Harry E. Preble Dean of the College of Liberal Arts & Sciences, who left to become Dean of Arts & Sciences at Washington University.



Harry E. Preble
Dean of the College of
Liberal Arts & Sciences
Feng Sheng Hu.

Robinson is a world-renowned scholar and teacher who brings more than three decades of experience as a faculty member, academic leader, and university administrator at Illinois.

He is a Swanlund Chair and a member of the National Academy of Sciences, the National Academy of Medicine, the American Academy of Arts and Sciences, and the recipient of the prestigious Wolf Prize in Agriculture.

Donald Ort, the Robert Emerson Professor of Plant Biology and Crop Sciences, served as Acting Director of IGB.

Jun 19

RESEARCH FINDS MULTIPLE COVID-19 STRAINS CAN CO-EXIST IN PATIENTS

go.igb.illinois.edu/costrains

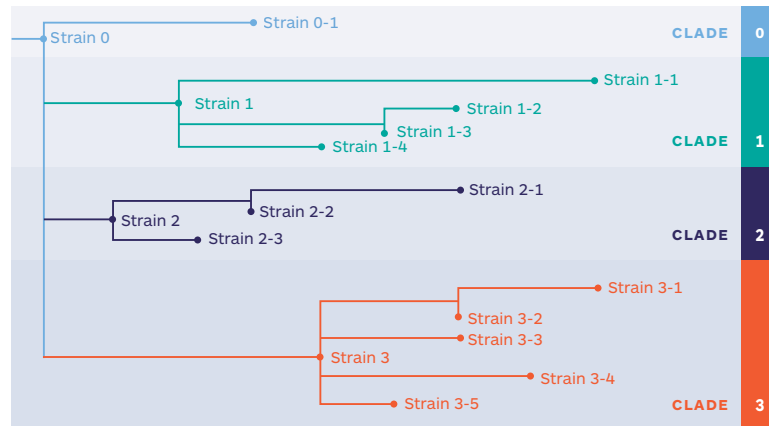


A workgroup, including Illinois computer science professors Mohammed El-Kebir (IGOH) and Jian Peng (CABBI), published a preprint research paper to identify genomic signatures of SARS-CoV-2 strains that occur within and across individual hosts. They collaborated with PhD student Yunan Luo and incoming MS student Palash Sashittal.

Using genomic signature deconvolution, the group identified multiple strains present in the global population and found evidence of the coexistence of distinct strains within infected patients.

“If you have multiple strains within one host you can start thinking about whether or not there is a competition happening there,” El-Kebir said.

The phylogenetic tree on the 17 strains was inferred using the discovery set and validated against the GISAID sequences in the validation set. The researchers identified four distinct clades in the tree with distinct characteristics in terms of geographical and temporal spread, transmissibility, and mutability.



The workgroup reviewed 621 bulk RNA sequencing samples and 7,540 consensus sequences from COVID-19 patients. In time, their work will assess whether coexisting strains are the result of multiple infection points. El-Kebir said they would like to access the Sequence Read Archive (SRA) for about 5,000 more samples from COVID-19 patients. Their ultimate, although difficult, priority would be to cross-check their findings with disease outcomes.

The workgroup produced the preprint based on a \$100,000 RAPID grant received from the NSF.



Carla Cáceres, Professor of Evolution, Ecology, and Behavior (IGOH) was named President’s Executive Leadership Program (PELP) Fellow by University of Illinois.



**GABRIELA
ANDREA
HERNANDEZ
GONZALEZ**
PHD STUDENT,
BELMONT
(BSD) LAB

AS A NIGHT OWL, I HAVE EMBRACED AN “ALTERNATIVE”

SCHEDULE. It works well for the most part, and I can usually get all my work done through the week, albeit at odd hours. It was because of this schedule that quarantine hit me hard. With no one to talk to, night-time can be lonely, and it became even more so with nothing to do and nowhere to go. It might seem strange to most people that my escape from a dark closed room was to go to a different dark closed room. But I have always loved looking through the lens of a microscope or telescope and being able to come back to work to do just that was a relief for me and a welcome escape.

Nevertheless, working from home had its bright side. I was finally able to converge with my husband’s “normal” working schedule where he could teach me some programming during his breaks, and I could make some German bread rolls to thank him with. During my own breaks, I had time in the middle of the day to call my sister, who is living in Europe, and join her to play online games like Age of Empires and Animal Crossing.

In the end I guess we are all just trying to make the best out of a bad situation and, just as many others did during quarantine,
I learned how to bake bread.

Jun
25

COWBIRDS CHANGE THEIR EGGS' SEX RATIO BASED ON BREEDING TIME

go.igb.illinois.edu/sexratio



A female, left, and male cowbird perch on a wire fence. Both birds are adults.

Brown-headed cowbirds are brood parasites: They lay their eggs in the nests of other birds and let those birds raise their young. Prothonotary warblers are a common host of cowbirds. Since they can't tell the difference between their own offspring and cowbirds, they do a really good job of raising cowbirds, even though cowbird chicks are larger and need more food, according to Wendy Schelsky, a principal scientist at the Illinois Natural History Survey.

The researchers studied the interactions between cowbirds and warblers for seven years to determine whether there was a difference in the relative number of males and females among cowbird offspring. They collected DNA samples from cowbird eggs or newly hatched chicks and found that more female offspring hatch early in the breeding season in May, and more male hatchlings emerge in July. "This is the first time anyone has detected a seasonal bias and we believe that it is due to our large sample sizes," said study co-author Mark Hauber (GNBP), a professor of evolution, ecology, and behavior at Illinois.

The findings were published in the *Journal of Avian Biology*. Funding for field work was provided by the United States Fish and Wildlife Service, Illinois Department of Natural Resources and the Nature Conservancy in Illinois. Funding for lab work was provided by the Harley Jones Van Cleave Professorship. Additional financial support was provided by the NSF.



Madhu Khanna, ACES Distinguished Professor (CABBI) was named president-elect of the Agricultural and Applied Economics Association.

Jun
26

Illinois began Phase 4 of reopening, allowing gatherings of up to 50 people.

Jun
26

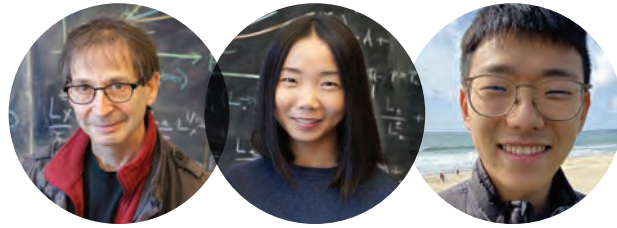
PATTERN ANALYSIS OF PHYLOGENETIC TREES COULD REVEAL CONNECTIONS BETWEEN EVOLUTION, ECOLOGY

go.igb.illinois.edu/phylotree

From left, Swanlund
Professor of Physics Nigel
Goldenfeld, graduate
student Chi Xue, and former
undergraduate student
Zhiru Liu.



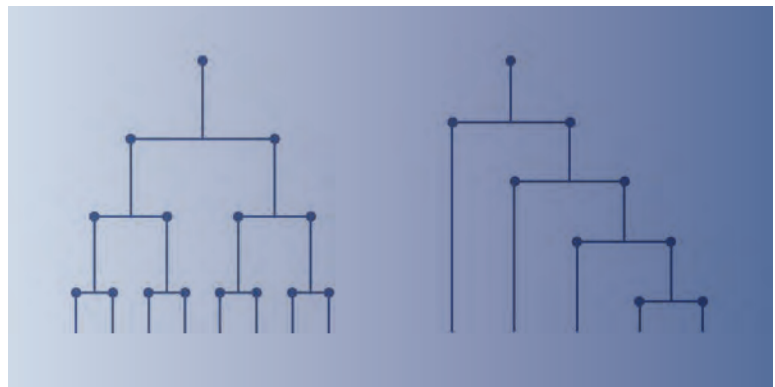
Phylogenetic trees not only describe the evolution of a group of organisms but can also be constructed from the organisms within a particular environment or ecosystem, such as the human microbiome. Now, researchers at Illinois have presented a new analysis of the patterns generated by phylogenetic trees, suggesting that they reflect previously hypothesized connections between evolution and ecology. The study was led by Swanlund Professor of Physics Nigel Goldenfeld (BCXT leader/GNDP), with team members graduate student Chi Xue and former undergraduate student Zhiru Liu.



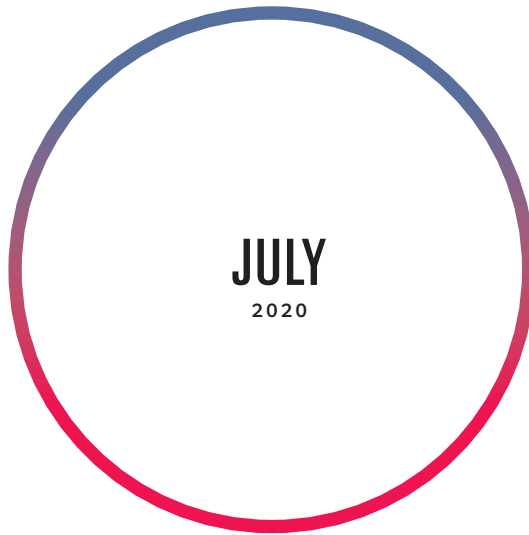
The study revolved around a concept in evolutionary ecology known as niche construction where organisms modify their environment, thereby creating new ecological niches in the ecosystem and changing the environment. In turn, these new niches affect the overall evolutionary trajectory of the organisms that share the environment.

The end result is that evolution and the environment are coupled closely together. The researchers simulated organisms and associated a niche value to them that described their interaction with their environment. Organisms with a large niche value contained a large number of ways to adapt to their environment and ultimately led to their survival while those with small niche values were less resilient.

Left: A balanced
phylogenetic tree. Right:
A maximally unbalanced
phylogenetic tree. In both
panels time runs from top
to bottom and the nodes
represent species. The lines
connecting them represent
the number of mutations
in DNA associated with the
gene that is being studied.



Their findings were published in *Proceedings of the National Academy of Science*. The work was supported by the NASA Astrobiology Institute under the Cooperative Agreement issued through the Science Mission Directorate.



Jeffrey Moore, Professor of Chemistry and Materials Science & Engineering (BSD) was appointed Center for Advanced Study Professor.



ENGINEERED IMMUNE CELLS RECOGNIZE, ATTACK SOLID-TUMOR CANCER CELLS



go.igb.illinois.edu/cartcells

Illinois postdoctoral researcher Preeti Sharma and her colleagues engineered a molecule that targets both human and mouse solid-tumor cancer cells.



A method known as CAR-T therapy has been used successfully in patients with blood cancers such as lymphoma and leukemia. It modifies a patient's own T-cells by adding a piece of an antibody that recognizes unique features on the surface of cancer cells. In a new study, researchers report that they have dramatically broadened the potential targets of this approach—their engineered T-cells attack a variety of solid-tumor cancer cells from humans and mice.

“Cancer cells express on their surface certain proteins that arise because of different kinds of mutations,” said Preeti Sharma, a postdoctoral researcher at Illinois who led the research with

biochemistry professor David Kranz (ACPP), a member of the Cancer Center at Illinois.

Some mutations disrupt the molecular pathway that attaches sugars to proteins, creating abnormally short sugar chains on some types of cancer cells. The team started with a piece of an antibody that was known to interact with one such abnormally formed sugar attached to a protein on solid-tumor cancer cells in mice. Once they found the antibodies with the desirable traits, the researchers engineered them into T-cells and tested them with mouse and human cancer cell lines. The resulting T-cells can now recognize several different proteins that have short sugars attached to them, which is important because having multiple targets makes it more difficult for the cancer to evade the treatment.

The researchers reported their findings in the *Proceedings of the National Academy of Sciences*. The work was supported by the NIH.



Donald Ort, Professor of Plant Biology & Crop Sciences (GEGC Leader/BSDB/CABBI) was appointed Center for Advanced Study Professor.



VOLUNTEERS AT ILLINOIS PRODUCE SUPPLIES FOR 200,000 COVID-19 TESTS

go.igb.illinois.edu/vtmeffort



From left: Max Simon, Kyle Shelton, Laura Daigh, Auroni Gupta, Jana Radin, Katie Frye, and Xiaorui Guo stand next to a shipment of viral transport media (VTM) prior to shipment. The group was among the nearly 50 volunteers at Illinois who helped produce enough VTM for 200,000 COVID-19 tests.

Chris Brooke (IGOH), an assistant professor of microbiology, spearheaded the effort to produce enough viral transport media (VTM) to support about a quarter of all COVID-19 tests in Illinois. VTM is a mix of buffers, nutrients, and antimicrobials used to preserve test samples from patients until testing occurs.

The effort launched in April when Brooke, Martin Burke (MMG), the May and Ving Lee Professor for Chemical Innovation in the Department of

Chemistry and Associate Dean for Research at the Carle Illinois College of Medicine, and Douglas Mitchell (MMG),

Microbiology assistant professor Chris Brooke, chemistry professor Martin Burke, and chemistry professor Douglas Mitchell.



Alumni Research Scholar Professor of Chemistry, realized that they had the basic ingredients in their own research laboratories to create VTM. Together with a pair of laboratory technicians from Burke's laboratory, Justin Lange and Akanksh Shetty, they began creating the fluid for local testing. Tyler Stack, a postdoctoral researcher who coordinated the production, said that they worked out of four laboratories in the IGB.

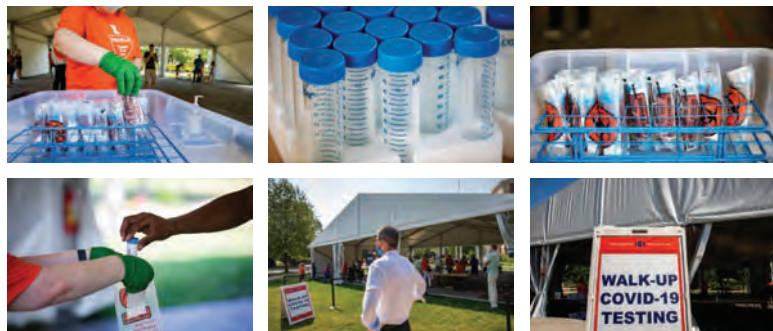


The workers temporarily set aside their own research to create 6,000 to 8,000 vials of VTM per day. The teams often worked at sterile work stations for up to eight hours a day, filling each vial with 3 milliliters of VTM. The vials were then shipped to Springfield, Illinois.

“This was a clear example where U of I students, postdocs, faculty, and staff stepped up and volunteered a ton of time and hard work to help save lives in the community,” said Brooke.

Jul
6

The SHIELD project launched, enabling saliva-based, rapid-result PCR testing.



Thanh (Helen) Nguyen, Professor in Civil and Environmental Engineering (IGOH) was named Ivan Racheff Endowed Professor.

Wilfred Van der Donk, Professor of Chemistry (MMG) received the Royal Society of Chemistry's Pedler Award.



**JING
DONG**

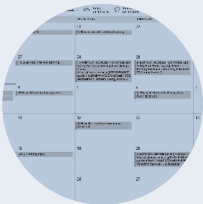
BACKGROUND
LAB MANAGER, GEGC THEME

WHAT I ACCOMPLISHED IN 2020
KEPT MY LAB STOCKED AND RUNNING

WHAT BROUGHT ME JOY
**SPENDING QUALITY TIME WITH MY BOYS DOING
HOUSE CHORES TOGETHER**



Jing Dong is a laboratory research manager for the GEGC theme. Researchers within the theme are currently working on transgenic plants with high photosynthetic efficiency to increase crop yield and studying the impact of climate change on our ecosystems. As a lab manager, Dong is in charge of maintaining instruments and lab space; managing inventory; ordering laboratory supplies; training researchers on using instruments and troubleshooting. On a normal day, Dong oversees 30-50 researchers working in the GEGC lab spaces. However, during the pandemic, the labs were allowed to run at 50% capacity.



To ensure everyone's safety, Dong monitors the Google calendar schedule to make sure researchers are signing up and showing up for the allotted time. Her current schedule is 8:00 am to 3:00 pm, but she remains on standby in case of emergencies.

“ALL OF A SUDDEN, OUR RESEARCH STOPPED. At that time, I realized we have so many challenges ahead of us. The first is due to the pandemic, there is a national shortage of almost everything. The normal things that we use, such as goggles, gloves, hand sanitizer, and even hand soaps, were all out of stock, not to mention masks. The first thing I did when I was planning for the reopening was to secure those lab supplies. I reached out to our vendors and explained how im-

portant our research is to make sure they prioritize our supplies. Facilities had masks ready for us so when we came back, we didn't have to worry about wearing the same masks for the whole week. At the end of June, we changed our lab coat cleaning service company. Due to the pandemic, the new company couldn't deliver our lab coats in time. Since we already turned out our old lab coats, we had to negotiate with the new company to temporarily lend us lab coats.

Instruments are another thing that gave us a hard time because almost all companies suspended their on-site services. If we had a broken instrument, we either had to do virtual troubleshooting or had to figure it out ourselves. We shared those lab coats and other resources such as lab supplies and instruments among our lab managers. We have six to eight lab managers at the IGB so we kind of created a small support group among us. It's really important that our



lab managers come together and support each other at this time during the pandemic.

WE NOT ONLY SUPPORT EACH OTHER IN TERMS OF WORK BUT WE SUPPORT EACH OTHER EMOTIONALLY. SOMETIMES RUNNING A HOUSEHOLD CAN BE STRESSFUL SO WE TALK TO EACH OTHER WHILE SOCIALLY DISTANCED.

“Most of the lab managers have kids, including me. The public schools are doing online studies and luckily my kids’ schools have in-person options but it’s still hard to find after school care so I have to leave early. My husband is currently working from home and his schedule is a bit more flexible than mine so he helps a lot with housework and playtime with the kids. My parents live close to us so they babysit the kids sometimes.

“I’m from China and my hometown, Wuhan, was at the

epicenter when COVID started. Even in January, we heard all kinds of scary stories and so I’m scared because I have friends and relatives who got COVID back in China. At the same time, I’m a scientist so I believe in science. You have to decide what the best and necessary thing is to keep you from getting the virus. Things like wearing masks, washing hands, social distancing and avoiding crowded spaces, that’s science. My 6-year-old can wear a mask for a whole day, why can’t we do that? I’m really thankful that our university provides the rapid COVID test. It makes me feel so much safer. I have friends working at other universities who don’t have it so they are all virtual.

“You never think something like this would happen to you and all of a sudden, your life has changed. I miss having lunch with other researchers. We used to have lunch conversations in the break room about life, research, job interviews, all kinds of things. That chit-chat is important for me to get to know

the researchers. I want to see each other’s faces again without having to wear a mask. I miss that part a lot.

WHAT KEEPS ME GOING IS THE EXCITING RESEARCH WE ARE DOING. ALTHOUGH I DON’T HAVE MY OWN PROJECT, I STILL FEEL I PLAY A ROLE IN KEEPING THE RESEARCH GOING.”

Jul
8



DIVERSITY, EQUITY AND INCLUSION

go.igb.illinois.edu/IGBDEI20



The IGB values equality and respect for every member of our community. Investigators, students and staff from diverse backgrounds bring their lived experiences and unique perspectives together. This diversity improves our ability to solve problems and be responsive to societal needs.

We are proud of our ongoing efforts to create programs to diversify science and increase participation from members of minority groups in genomics, including Pollen Power, SING and our partnership with Fisk University.

We established a Committee on Diversity (COD) Task Force to gather more individuals to take action on the COD's ideas and bring new initiatives to light. The COD Task Force helped to organize talks aimed at increasing awareness, including "More Than Just a Good IDEA: Why Inclusion, Diversity, Equity and Accessibility Make Your Science Stronger" and "Solidarity Works: Lessons from Mauna Kea." However, we realize we can and should do more to diminish racism, other inequities and where they intersect.

We are bolstering our efforts in this crucial area and are dedicated to creating a more welcoming and inclusive environment for all members and visitors of the IGB. To do so, we will be intensifying efforts to: develop additional programs to diversify the practice of science; create change by increasing dialogues through workshops, panels and hiring practices; fund new initiatives to help eliminate institutional racism and other inequities; and working with campus units to strengthen intercultural relationships focused on diversity, equity and inclusion.

Jul
9

WHO announced that COVID-19 can be airborne.

Jul
14

IGB took the Illinois community pledge to be conscientious about following the safety guidelines issued by the CDC, continue regular testing, and participate in the contact tracing programs.

Jul
16

DONOVAN TO DIRECT NEW PERSONALIZED NUTRITION INITIATIVE

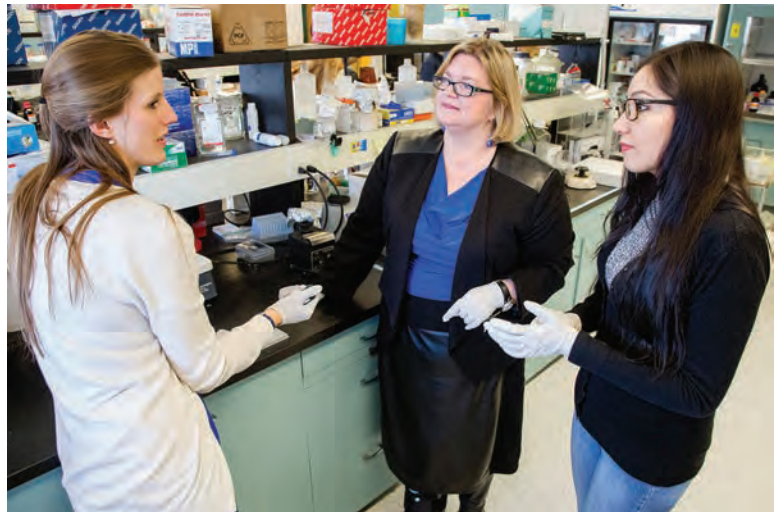
go.igb.illinois.edu/PNIlaunch



Sharon Donovan (MME), Professor and Melissa M. Noel Endowed Chair in Diet and Health at University of Illinois, assumed the role of director of the newly established Personalized Nutrition Initiative (PNI). The PNI is a partnership between the IGB and the College of Agricultural, Consumer and Environmental Sciences (ACES) at Illinois. Precision or personalized nutrition is also a keystone of the new NIH 10-year Strategic Plan for Nutrition.

“Personalized nutrition offers a way to optimize human health and the quality of life by tailoring recommendations based not only on diet history and phenotype, but also on an individual’s genetics, microbiome, and metabolome,” Donovan explains.

To meet this challenge, Donovan envisions the PNI building transdisciplinary collaborative efforts across campus to answer fundamental questions regarding how nutrition modulates health and disease across the lifespan. Donovan’s research, administration, internal and external interdisciplinary collaborations, and industry relations experiences bring significant value to the PNI in achieving its goal of coordinating transdisciplinary research, education, outreach, and entrepreneurship in the area of personalized nutrition. She holds appointments in the Department of Food Science and Human Nutrition and the Division of Nutritional Sciences in the College of ACES, as well as the Carle Illinois College of Medicine.



University of Illinois food science and human nutrition professor Sharon Donovan (center).



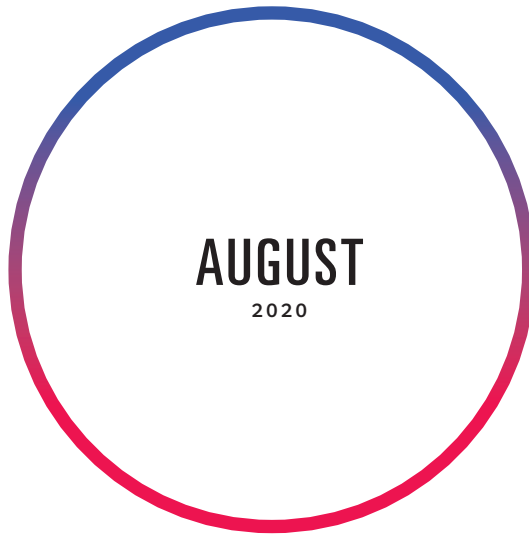
Sharon Donovan, Professor of Food Science & Human Nutrition (MME) was appointed Center for Advanced Study (CAS) Professor.



Vijay Singh, Professor in Agricultural and Biological Engineering (CABBI/GEGC) received the International Food Engineering Award from the American Society of Agricultural and Biological Engineers.

Jul
27

Approximately 30,000 Americans participated in the first vaccine trial.



Aug
9

Confirmed coronavirus cases in the U.S. hit 5 million.

Aug
10

Martin Burke (MMG) was invited to the morning edition of NPR to speak about the saliva-based COVID-19 test.

Aug
13

TRACKING THE EVOLUTION OF SARS-COV-2 VIRUS MUTATIONS

[go.igb.illinois.edu/
IGEMspike20](http://go.igb.illinois.edu/IGEMspike20)



A new study published in *Evolutionary Bioinformatics* looks at how SARS-CoV-2 is honing the tactics that may make it more successful and stable. A group of graduate students in a spring semester Bioinformatics and Systems Biology class tracked the mutation rate in the virus's proteome—the collection of proteins encoded by genetic material—through time, starting with the first SARS-CoV-2 genome published in January and ending more than 15,300 genomes later in May. The study was led by Gustavo Caetano-Anolles (GEGC), professor of bioinformatics in the Department of Crop Sciences at Illinois and senior author on the study.



The iGEM 2020 Team.

The stabilization of certain proteins could be good news for COVID-19 treatment and vaccine development. The

team documented a slowdown in the virus's mutation rate starting in April, after an initial period of rapid change. They observed stabilizations within the spike protein, the NSP12 polymerase protein, and the NSP13 helicase protein.

Tracking the mutations was also a central theme for this year's International Genetically Engineered Machine (iGEM) contest. The six undergraduates pooled their talents remotely to create a web tool to build visual models of a key part of the virus as it mutates. The hope is to give researchers crucial information about the virus as they design new drugs and vaccines.

To build their web tool, the students used NextStrain, an open-source project that pulls together data and visualization tools to track the spread of outbreaks and improve the public health response. Users can upload their own protein sequences, models, and geographic data to make a phylogenetic tree showing different spike protein strains in each location. The Illinois iGEM team is sponsored by the IGB and the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI).

Aug
17

COWPEA RESEARCH BOOSTS CANOPY CO₂ ASSIMILATION, WATER-USE EFFICIENCY



[go.igb.illinois.edu/
cowpeacanopy](http://go.igb.illinois.edu/cowpeacanopy)

The team, led by postdoctoral researcher Anthony Digrado, collecting data from the cowpea population.



Crops grow dense canopies that consist of several layers of leaves—the upper layers with younger sun leaves and the lower layers with older shaded leaves that may have difficulty intercepting sunlight trickling down from the top layers. In a recent study published in *Food and Energy Security*, scientists from Realizing Increased Photosynthetic Efficiency (RIPE) aimed to understand how much variation exists within diverse cowpea lines in light absorption and carbon dioxide assimilation throughout the canopy. This information can ultimately be used to design more efficient canopies to increase yields.

Cowpeas, commonly known as black-eyed peas in the U.S., are one of the oldest domesticated crops in the world, responsible for feeding more than 200 million people per day. The RIPE team screened 50 cowpea genotypes from a multi-parent advanced generation inter-cross (MAGIC) population for canopy architecture traits, canopy photosynthesis, and water-use efficiency.

Results showed that in canopies with lower biomass, the major limitation to canopy photosynthesis was leaf area; however, in higher biomass canopies, the major limiting factor was, instead, the light environment.

Overall, canopy architecture significantly affected canopy photosynthetic efficiency and water-use efficiency, suggesting that optimizing canopy structures can contribute to yield enhancement in crops.

RIPE is supported by the Bill & Melinda Gates Foundation, the U.S. Foundation for Food and Agriculture Research, and the U.K. Government's Department for International Development.

Aug
19

The Washington Post covered the saliva-based COVID-19 tests at the University of Illinois.

Aug
24

University of Illinois began modified in-person instruction, mandating twice-a-week saliva-based COVID-19 testing, mask wearing and social distancing.

Aug
26



Since each type of cancer is unique, there is a push towards 'personalized medicine' in which a highly effective treatment can be selected based on measured characteristics from the patient. To this



end, the Holonyak Micro & Nanotechnology Lab is working to develop a device that can detect cancer biomarkers with just a few drops of blood.



The blood will be filtered through a device that separates small objects called exosomes, which are carriers of molecules called micro RNA, from the cells. These

exosomes will be broken open and examined with a highly sensitive biosensor that can count each cancer-specific micro RNA. The method would provide rapid results, enabling the clinician to quantitatively observe the effects of treatment on the tumor by measuring increases or decreases in strategically selected molecules.

"The future of cancer diagnosis is moving towards the idea of "liquid biopsy" in which cancer-specific molecules can be found and measured from easily obtained bodily fluids," says Brian Cunningham (CGD Director/MMG), the Intel Alumni Endowed Chair with appointments in Electrical and Computer Engineering and Bioengineering.

PERSONALIZING CANCER DIAGNOSTICS

[go.igb.illinois.edu/
biomarkerdetect](http://go.igb.illinois.edu/biomarkerdetect)

Donald Biggar Willett
Professor in Engineering
and of Electrical and
Computer Engineering
Brian Cunningham, Jay and
Ann Schenck Professor
of Chemistry Yi Lu, and
Associate Professor of
Pathobiology Rebecca Smith.



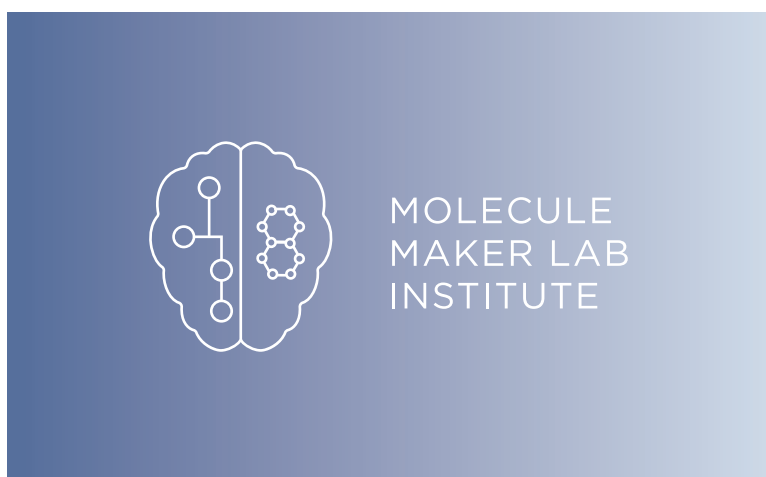
The Illinois research team also includes Manish Kohli at the Huntsman Cancer Institute and Utkan Demirci at Stanford University, as well as chemistry professor Yi Lu (BSD/CABBI/CGD) and Associate Professor of Pathobiology Rebecca Smith (IGOH). The work is funded by the NIH.

Aug
28

\$20M NSF GRANT, NEW ARTIFICIAL INTELLIGENCE INSTITUTE FOR MOLECULE SYNTHESIS



[go.igb.illinois.edu/
MMLINSFgrant](http://go.igb.illinois.edu/MMLINSFgrant)



A team led by Steven L. Miller Chair Professor of Chemical and Biomolecular Engineering Huimin Zhao (BSD leader/CABBI/GSE/MMG) was awarded a five-year \$20 million grant from the NSF for the NSF Artificial Intelligence (AI) Institute for Molecular Discovery, Synthetic Strategy and Manufacturing (Molecule Maker Lab Institute or MMLI).

The MMLI focuses on development of new AI-enabled tools, such as AlphaSynthesis, to accelerate automated chemical synthesis and advance the discovery and manufacture of novel materials and bioactive compounds. Researchers use the data generated from the analysis of these molecules to guide further development of synthesis planning and catalyst design tools using AI and machine learning. The institute also serves as a training ground for the next generation of scientists with combined expertise in AI, chemistry, and bioengineering.

“Synergistically integrating these powerful disciplines now has the potential to dramatically accelerate and advance the manufacturing and discovery of molecules with important functions that address major unsolved problems in society. Not doing so would result in a major missed opportunity for the U.S. research community,” said Zhao.



**AUSTIN
CYPHERSMITH**
SENIOR RESEARCH
SPECIALIST,
CORE
FACILITIES

MOST OF MY WORK INVOLVES TRAINING PEOPLE ON MICROSCOPES. When the Core Facilities closed, I was able to do some work from home, but there were not as many trainings to do. In some ways, the lockdown was easy for me. I was grateful to have a stable income and to be safe. However, I was living alone and except for going to the grocery store each week, I really did not interact with anyone for about two months. I can appreciate solitude, but I am a very social person and the lockdown made me depressed in a profound way. I had ambitions of using the lockdown to read more books and to put time into new hobbies. It was not that productive; I feel like the lockdown was kind of a blur and a fog. It was difficult to focus on anything and my sense of time was really warped. Worst of all, the lockdown seriously delayed my wife’s visa application.

I married my wife in Morocco in March of 2019, and I submitted the petition for alien relative (I-130) in May of 2019. This process typically takes a little over a year. My wife was on track for getting her visa issued in May 2020 and coming to the U.S. in June. The lockdown in Morocco also meant that the U.S. consulate was closed and not issuing visas.

Throughout the pandemic, I have developed some good habits, like enjoying walks in the park, where I would try to sneak in a fresh breath of air when nobody was around. I also spent a lot of time cooking in the kitchen rather than eating out frequently. Once I started going back into the lab in June, I started feeling better. My wife finally got her visa appointment in October of 2020 and **she arrived in the U.S. in November.**

Aug
31

PORTABLE, POINT-OF-CARE COVID-19 TEST COULD BYPASS THE LAB

go.igb.illinois.edu/30minPOC

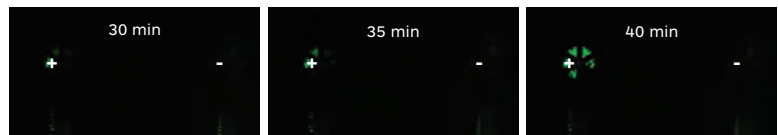
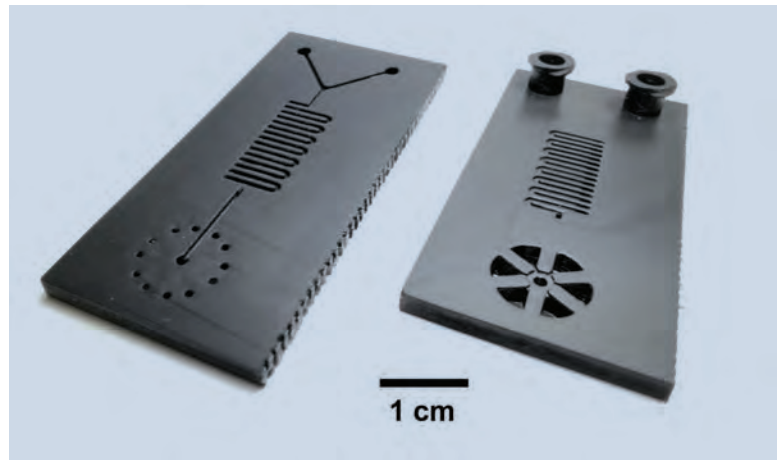


Typical tests for SARS-CoV-2 take a sample from a patient with a nasal swab, put that swab into viral transport media, and send it to a lab for the multistep process of extracting viral RNA. A study led by Rashid Bashir (CGD/M-CELS), a professor of bioengineering and Dean of the Grainger College of Engineering, Brian Cunningham (CGD Director/MMG), an electrical and computer engineering professor, and Bill King, a mechanical science and engineering professor, used a simpler process to analyze the viral transport media, called LAMP, which bypasses the RNA extraction and purification steps.

The researchers have also incorporated the LAMP assay onto a small 3D-printed microfluidic cartridge that has two input slots for syringes: one for the sample-containing viral transport media and one for the LAMP chemicals. Once the two are injected, they react within the cartridge. The team is working with Fast Radius Inc., a Chicago-based technology company King co-founded, to manufacture the microfluidic cartridges.

The cartridge can be inserted into a hand-held portable instrument that can carry out the reaction and a smartphone cradle for reading the results. In approximately 30 minutes, a positive result will emit a fluorescent light.

Researchers developed microfluidic, 3D-printed cartridges capable of performing a COVID-19 test within 30 minutes.



The study was published in the *Proceedings of the National Academy of Sciences* and was supported by funds from the NSF, NIH, and the Defense Advanced Research Projects Agency.



SEPTEMBER

2020

Sept 1

**COLLABORATIVE
TEAM AWARDED
\$12.5 MILLION FOR
NEW NSF BIOLOGY
INTEGRATION
INSTITUTE**



The NSF announced a five-year, \$12.5 million grant to integrate biology to a collaborative team based in the IGB. The new institute, Genomics and Eco-evolution of Multi-scale Symbioses (GEMS), will include molecular, organismal, computational and theoretical approaches.

An interdisciplinary team of 27 professors from microbiology, plant biology, entomology, ecology, evolution, computational biology, and education, led by microbiology professor Rachel Whitaker (IGOH leader/BCXT), evolution, ecology and behavior professor Carla Cáceres (IGOH), and plant biology professor Katy Heath (IGOH), will integrate recent discoveries about the impact of microbial symbiosis on evolution and ecology. The work will also include the National Center for Supercomputing Applications at Illinois. Partners in outreach endeavors include local Illinois school districts, Project Microbe, Cena y Ciencias, and the Illinois chapter of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science.

[go.igb.illinois.edu/
GEMSNSFgrant](http://go.igb.illinois.edu/GEMSNSFgrant)

Microbiology professor Rachel Whitaker, evolution, ecology and behavior professor Carla Cáceres, and plant biology professor Katy Heath.



“The inspiration behind GEMS is to integrate biology since all too often, fields of biology are

siloed by funding, approach, language and culture,” said Whitaker. “NSF support will allow this team to work toward a bold vision that not only uses the study of symbiosis to integrate across science, but to port the best approaches across these institutions, to thoughtfully and effectively engage K-12 students and the broader public, and to break down historical barriers to creative and groundbreaking idea generation.”



Carla Cáceres, Professor of Evolution, Ecology, and Behavior (IGOH) received the Executive Officer Distinguished Leadership Award from the Office of the Provost.



Rachel Whitaker, Professor of Microbiology (IGOH leader/BCXT) was named University Scholar.



NEW IGB RESEARCH THEME AIMS TO IMPROVE REPRODUCTIVE HEALTH

go.igb.illinois.edu/newEIRH



Environmental exposures, particularly during pregnancy, can have long-lasting and devastating health impacts and exert long-ranging effects on maternal and child health. Particularly, exposures to endocrine disrupting chemicals (EDCs)—widely used in plastics and personal care products—have the potential to increase the prevalence of infertility and/or premature reproductive senescence in men and women, and reproductive disorders such as recurrent miscarriage, preeclampsia, and endometriosis in women. As a growing health concern, it is critically important to understand how exposure to EDCs affects fertility and establishment of pregnancy.

The newly formed Environmental Impact on Reproductive Health (EIRH) theme will focus on improving reproductive health by gaining fundamental knowledge in both normal variation in reproductive function and fertility disorders/diseases and developing therapeutic tools through multidisciplinary research collaborations across campus.

The EIRH theme represents the first co-led theme, with Professors of Comparative Biosciences Jodi Flaws and Indrani Bagchi serving as theme co-leaders.

Researchers will use genomics, epigenomics, mechanics and bioengineering tools to develop platforms to study the physiology and pathology of the reproductive system to investigate the effects of exposure to EDCs on fertility, placental function, and endometriosis. Additionally, researchers will investigate the impact of stress and high fat diets on fertility and pregnancy outcomes since recent evidence suggests that maternal obesity and stress may be linked to impaired reproductive function.



COV-COURSE: A MULTIDISCIPLINARY APPROACH TO UNDERSTANDING THE PANDEMIC

[go.igb.illinois.edu/
COVcourseUIUC](http://go.igb.illinois.edu/COVcourseUIUC)



This is the new normal, but
what does it all mean?
COVID has turned your life upside down, but how much do you really know about this unprecedented public health crisis?

Broaden and deepen your understanding of the pandemic in a free, multidisciplinary course taught by experts at the UIUC. No matter what your area of interest is—education or history, economics or theater—the pandemic is impacting your field and every facet of life on this planet. This is your opportunity to grasp the big picture.

Course Description
COV-Course: A Multidisciplinary Approach to Understanding the Pandemic
The COVID-19 pandemic has created an unprecedented public health crisis. In this course, created by provost Andreas Cangelaris and other campus leaders, you will gain a comprehensive, multidisciplinary understanding of the pandemic. The course will guide you through past, present and future perspectives on the pandemic, with weekly topics that range from history, biology and business to data security, racial disparities, mental health and more.

The COVID-19 pandemic created an unprecedented public health crisis. The COV-course, created by provost Andreas Cangellaris and other campus leaders, provided a comprehensive, multidisciplinary understanding of the pandemic. The course offered past, present and future perspectives on the pandemic, with weekly topics that ranged from history, biology and business to data security, racial disparities, mental health and more.

The speakers included Rashid Bashir (CGD, M-CELS), May Berenbaum (GEGC/IGOH), Jessica Brinkworth (IGOH), Paul Hergenrother (ACPP leader/MMG), Ruby Mendenhall (GNDP), Brent Roberts (GNDP), Gene Robinson (GNDP), Rebecca Smith (IGOH), and Robin Fretwell Wilson (GSP). Some of the topics included pandemics in history; infection: biology and anthropology; diagnostic technologies; COVID-19 and the election; health inequities; food insecurity; and financial consequences.



Rashid Bashir, Dean of the Grainger College of Engineering (CGD/M-CELS) was named President's Executive Leadership Program (PELP) Fellow by University of Illinois.



CELL-AUTONOMOUS IMMUNITY SHAPED HUMAN EVOLUTION

go.igb.illinois.edu/cellauto



Every cell has a deep evolutionary history. For example, the methods that human cells use to detect, pierce or hack up invading microbes are inherited from—and shared by—bacteria and viruses, according to Jessica Brinkworth (IGOH/GNDP), a professor of anthropology at Illinois who wrote a new report with former undergraduate student Alexander Alvarado.

Assistant Professor
of Anthropology
Jessica Brinkworth.



For that reason, she suggests that medical approaches to fighting infection that try to tamper evolutionarily conserved immune responses such as pro-inflammatory pathways are misguided. While it can be useful or necessary to use immune-suppressing drugs against autoimmune conditions or in the case of organ transplants, such drugs do not appear to work against severe microbial infections.

In the context of such infections, there have been many attempts to come up with ways of reducing the immune response by using steroids or blocking the body's ability to detect the pathogen. However, targeting these immune mechanisms that have been around for millions of years is potentially counterproductive, Brinkworth said.

"If you're talking about human evolution, if you're in any physiological system, you're going to have to address at some point how pathogens have shaped it," she said.

The study was published in *The Quarterly Review of Biology*. The study was funded by the NSF and the UIUC Student Sustainability Committee.

Sept
10

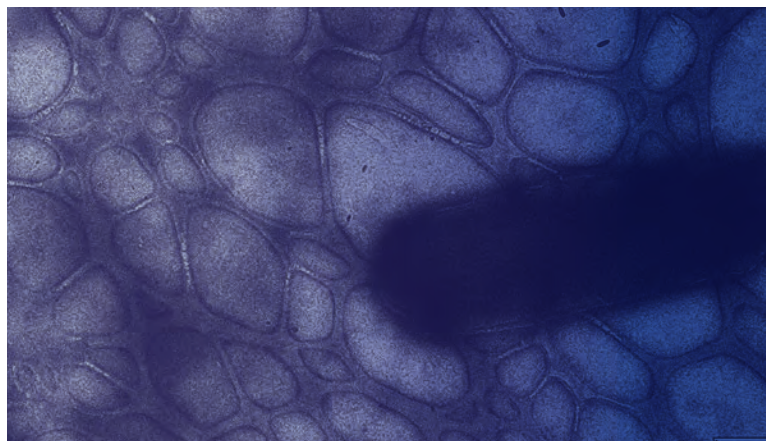
ABC News covered the COVID-19 testing operation, reporting that **20% of all the testing in Illinois is conducted by the university.**

Sept
16

NOVEL PHAGE ALTERS TRANSCRIPTOME OF A COMMON HUMAN GUT MICROBE

go.igb.illinois.edu/
campbellphage

Zoomed out view of
B. vulgatus.



The human gut is home to a dense and diverse microbial community that represents a vital component of human health, development, and disease states. Within those communities, phage-bacterial host interactions, which have been largely underexplored, shape the community and contribute to the constantly fluctuating landscape.

A new study led by PhD student Danielle Campbell and supervised by Professor of Microbiology Rachel Whitaker (IGOH leader/BCXT) reveals how a temperate phage—named BV01—of the prominent human gut symbiont *Bacteroides vulgatus* (*B. vulgatus*) broadly alters its host's transcriptome. Additionally, BV01 and its relatives were shown to represent a novel family of phages that are ubiquitous in human gut metagenomes, infecting a broad range of *Bacteroides* hosts.



PhD student
Danielle Campbell of the
Whitaker lab.

Researchers were able to predict and annotate *Bacteroides* phage BV01 using computational tools and comparative genomics against the host genome.

“We’ve done a pretty good job in the last couple of decades of dissecting the microbiome but sampling the phages and other viruses from the gut is a little more difficult and includes a lot more biological dark matter,” said Campbell.

The study also included Professor of Animal Sciences Jason Ridlon (MME), PhD student Lindsey Ly, Professor of Microbiology and Plant Pathology Ansel Hsiao (UC Riverside), and Professor of Microbiology and Plant Pathology Patrick Degnan (UC Riverside). The findings were reported in *Cell Reports*. The research was supported by the University of Illinois, the University of California, Riverside, the NSF, the National Institute of General Medical Sciences, and the Allen Foundation with an Allen Distinguished Investigator Award.



**HYANG YEON
LEE**
RESEARCH
SCIENTIST,
ACPP THEME

MY HUSBAND AND I ARE RESEARCH SCIENTISTS in the Hergenrother lab. When the laboratory reopened last June, everything changed. We needed to social distance, wear masks at the laboratory, and take COVID testing once/twice every week. The most difficult part was the limited childcare. Due to the nature of our work, most of our research is conducted at the laboratory. Thankfully, my son's day care reopened. But my daughter's school was not open for in-person learning, and this meant that one of us needed to work from home while my daughter learned remotely. My husband and I became busier than before the pandemic, but we tried to do our best to keep the balance between working and childcare. Since we work at the same laboratory, my husband and I have been working together by helping each other to continue our research and make progress. We are still in a dark tunnel with no end in sight. But my daughter's school has started hybrid learning that includes both in-person and remote learning, and vaccines are becoming more available now. We hope that these small changes will help us overcome COVID-19 and **bring us back to our "normal life" in the near future.**

Pictured with Hyang Yeon Lee is Myung Ryul Lee, Research Scientist, ACPP

Sept
16

NBC News took an in-depth look at how the University of Illinois handled a coronavirus outbreak on its campus.

Sept
18

MOST HOMEMADE MASKS DOING A GREAT JOB, STUDY FINDS



go.igb.illinois.edu/
homemademask

Researchers tested 11 household fabrics that are commonly used for homemade masks and found that all are effective at curbing the small and large respiratory droplets that are released when we speak, cough or sneeze.



Taher Saif (M-CELS/RBTE), a mechanical science and engineering professor at Illinois led a study that examined the effectiveness of common household fabrics in blocking droplets. The findings have been published in the journal *Extreme Mechanics Letters*.

Droplets are expelled when an individual speaks, coughs or sneezes. They pose a problem because, with sufficient momentum, they can squeeze through the pores of some fabrics, break into smaller droplets and become airborne. Therefore, the masks used

should be able to block these droplets and be comfortable and breathable, the researchers said.



The team tested the breathability and droplet-blocking ability of 11 common household fabrics, using a medical mask as a benchmark.

The fabrics selected ranged from new and used garments, quilted cloths, bedsheets and dishcloth material. The researchers then characterized the fabrics in terms of their construction, fiber content, weight, thread count, porosity and water-absorption rate.

The researchers found that all of the fabrics tested are considerably effective at blocking the high-velocity droplets similar to those that may be released by speaking, coughing and sneezing, even as a single layer.

“With two or three layers, even the more permeable fabrics, such as T-shirt cloth, achieve droplet-blocking efficiency that is similar to that of a medical mask, while still maintaining comparable or better breathability,” Saif said.

From left to right: Students Onur Aydin, Bashar Emon, and Mechanical Science and Engineering Professor Taher Saif test common household fabrics used to make masks to help stop the spread of the coronavirus.



Martin Burke, Professor of Chemistry (MMG) was named A Researcher to Know by the Illinois Science and Technology Coalition.

DO-IT-YOURSELF COVID-19 VACCINES FRAUGHT WITH PUBLIC HEALTH PROBLEMS

go.igb.illinois.edu/DIYCOVID

Professor of law
Jacob Sherkow.



Ryan Dilger, Associate Professor of Animal Sciences (GNPD) was named University Scholar.



As the novel coronavirus pandemic continues to spread across the globe, several citizen science groups outside the auspices of the pharmaceutical industry were working to develop and self-test unproven medical interventions to combat COVID-19. Although some of the interest in a DIY approach stems from the idea that self-experimentation can't be regulated by the U.S. Food and Drug Administration (FDA) and other public health authorities, that belief is legally and factually incorrect, said Jacob S. Sherkow (GSP), a professor of law at Illinois.

The interest in a do-it-yourself approach stems from a mistaken belief that self-experimentation wouldn't be subject to laborious ethics board review or federal regulation. But that misunderstanding has



potentially dire public health implications, said Sherkow. Similarly, simply publishing medical information on the internet is, generally speaking, not regulated by the FDA. But developing a possible therapeutic product using typical equipment, chemicals and reagents would likely be regulable by the FDA, Sherkow said.

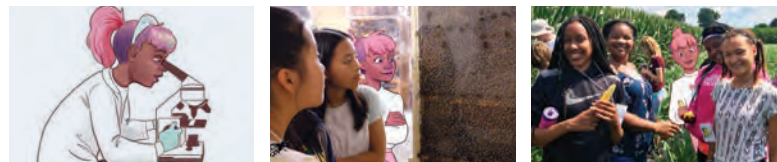
Homemade interventions exist in stark contrast to traditional paths to vaccine development, which require randomized controlled trials with well-defined endpoints, such as demonstrated immune responses, and protocols concerning the retention and use of data.

Biohackers creating and self-administering unapproved and unproven medical interventions run the risk of not only endangering public health, but also undermining public trust in all vaccines, Sherkow said.

The research was funded by a grant from the National Human Genome Research Institute.



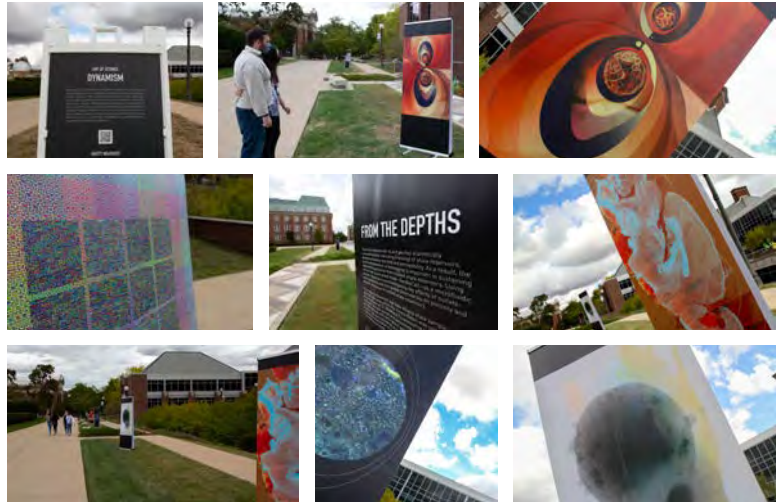
Pollen Power offered online adventures with virtual camper Persephone.



Amy Wagoner Johnson, Professor of Mechanical Science and Engineering (EIRH/RBTE) was awarded the Distinguished Engineering Educator Award from the Society of Women Engineers.

Sept
30

The Art of Science 10.0 Installation, “Dynamism,” provided a hybrid experience featuring in-person, socially-distant viewing for four days along with an online gallery containing brief discussions with scientists about their featured work.



OCTOBER

2020

Oct
6

CANCER COMPOUND LEADS TO MAJOR LICENSING DEAL

go.igb.illinois.edu/CCILBayer



Researchers have discovered a novel small molecule compound that is now the subject of a new global licensing agreement between the pharmaceutical company Bayer AG and the cancer drug development company Systems Oncology LLC. This compound, called ERSO, was originally discovered by the laboratories of chemistry professor Paul Hergenrother (ACPP leader/MMG) and biochemistry professor David Shapiro. Their research was the first to show that the

compound can effectively target and kill certain cancer cells, especially breast cancer cells that express the estrogen receptor.

Professor of Biochemistry David Shapiro, Professor of Veterinary Clinical Medicine Timothy Fan, Professor of Chemistry Paul Hergenrother, and Associate Professor of Molecular and Integrative Physiology Erik Nelson.



An estimated 70% of women diagnosed with breast cancer have ER-positive breast cancer. According to Hergenrother, these types of breast cancer cells are very sensitive to ERSO, which rapidly and selectively kills these cancer cells.

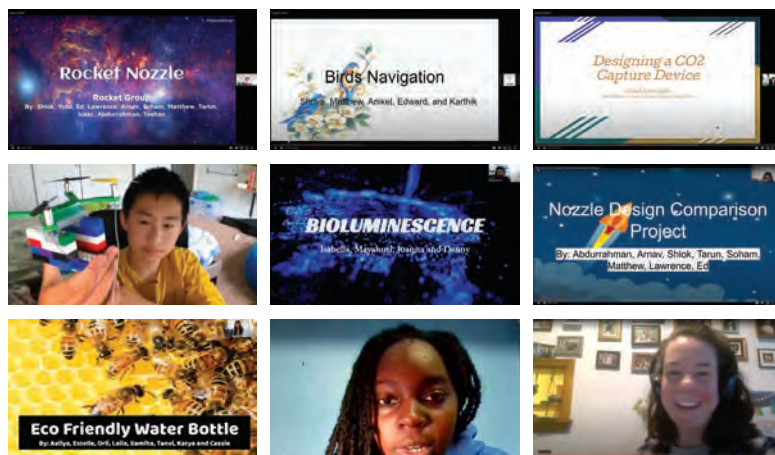
The research was further empowered through collaborations with other Illinois cancer researchers, the imaging resources

available at the U of I, and strategic collaborations with Systems Oncology, all of which contributed to the success of the new compound. Erik Nelson (ACPP), a member of the Cancer Center at Illinois and a professor of molecular and integrative physiology, provided essential guidance to the scientists through their tumor studies. Timothy Fan (ACPP/CGD), a professor of veterinary clinical medicine and CCIL Research Program Leader, was their expert in toxicology and pharmacology.

“We have amazing people at the university who have contributed beyond this partnership, and it’s enabled creation of this very robust and powerful set of data,” Shapiro said.

Oct 6

The **STEAM TRAIN project** started and it involved groups of Franklin STEAM Academy students, Uni High students, and IGB mentors who explored student-led research topics.



Christopher Brooke, Assistant Professor of Microbiology (IGOH) was named the 2020 Forty Under 40 Man of the Year by Central Illinois Business Magazine.

GENOMIC STUDY REVEALS EVOLUTIONARY SECRETS OF BANYAN TREE

go.igb.illinois.edu/banyanfig

The banyan tree *Ficus macrocarpa* produces aerial roots that give it its distinctive look. A new study reveals the genomic changes that allow the tree to produce roots that spring from its branches.



In a new study, researchers identify regions in the banyan fig tree's genome that promote the development of its unusual aerial roots and enhance its ability to signal its wasp pollinator. The study was led by Ray Ming (GEGC), a plant biology professor at Illinois who led the study with Jin Chen of the Chinese Academy of Sciences.

Top: Professor of Plant Biology Ray Ming. Bottom: Each type of banyan tree has a distinctive fig and is pollinated by a single species of wasp that has coevolved with it. Pictured is the fig of *Ficus hispida* and its pollinator, the wasp *Ceratosolen solmsi marchali*.



The relationship between figs and wasps presents an intriguing scientific challenge. The body shapes and sizes of the wasps correspond exactly to those of the fig fruits, and each species of fig produces a unique perfume to attract its specific wasp pollinator. To better understand these evolutionary developments, Ming and his colleagues analyzed the genomes of the fig tree and the wasp that pollinates it. They found that there were more duplications in the genome of the banyan tree which increased the number of genes involved in the synthesis and transport of hormones that promote plant growth. The

duplicated regions also contained genes involved in the production of volatile organic compounds that signal pollinators.

When they studied the genome of the fig wasp and compared it with those of other related wasps, the researchers observed that the wasps were retaining and preserving genes for odorant receptors that detect the same smelly compounds the fig trees produce. These genomic signatures are a signal of coevolution between the fig trees and the wasps, the researchers report.

The study was published in *Cell*. The Fujian Agriculture and Forestry University, NSF and the National Natural Science Foundation of China supported this research.

A portrait of a man wearing a black face mask and headphones, looking directly at the camera. The portrait is centered within a white, multi-layered geometric pattern resembling a stylized flower or a complex lattice. The background of the entire page is a solid red color with several dark red triangles scattered around the central portrait.

SHRAVAN DOMMARAJU

BACKGROUND
GRADUATE STUDENT, MMG THEME

WHAT I ACCOMPLISHED IN 2020
**LEARNING IMPORTANT TECHNIQUES FOR MY RESEARCH
DESPITE INITIAL SETBACKS**

WHAT BROUGHT ME JOY
SPENDING QUALITY TIME WITH MY WIFE AND SON

Shravan Dommaraju is a 2nd-year graduate student in the MMG theme who joined the IGB in 2019. In the laboratory of professor of chemistry Doug Mitchell, Dommaraju's research centers on harnessing bioinformatics and big data to discover new natural products. Dommaraju starts his days at the IGB between 7:30

am to 8:00 am and leaves between 5:30 pm to 7:00 pm. In addition to his research obligations, Dommaraju creates and grades problem sets and quizzes and holds office hours as a teaching assistant. Dommaraju is looking to maximize his time at the IGB while spending quality time with his wife Laura and son David.

“WE ADOPTED DAVID IN JUNE OF 2019 AND HE IS ABOUT TO TURN 16.

We have a very unconventional family since I am 23 and my wife is 25. I wanted to go to graduate school so we immediately left Columbia, Missouri and moved to Champaign so I could start my PhD. When Champaign officially started closing up, David was on spring break as well so it all of a sudden hit that David was not going back to school. Luckily my wife worked from home already as a social worker so I think we got lucky that she could stay home.

“For my research, we do a lot of microbiology-type work and there's a lot of those techniques that got put on hold for a few months. With the restrictions, I lost a lot of the important social interactions with older graduate students. My research has gotten off to a slower start, but luckily I do a lot of computer work. I write code, which was only impacted by the fact that I had to work on my personal laptop instead of the computers in the lab space. I lost three months of wet lab practice and a couple more months of expertise. I had experiments that failed over and over and I couldn't figure out why.

“But I finally think I am getting the hang of a lot of the cloning techniques.

I THINK PART OF THAT TOO IS THAT I'M MORE DELIBERATE ABOUT ASKING SOMEONE FOR HELP. WHEN SOMETHING FAILS, I CONSULT WITH SOMEONE INSTEAD OF LETTING MYSELF CONTINUE TO TRY.

“Right now we are making sure David is not going to suffer from his schooling or social interactions. Unfortunately, it's that sacrifice that he's having to make where he is not seeing his friends, and it's much tougher to pay attention over Zoom. It's been really hard. He's definitely in that age range where he doesn't want to try new things. We've been playing video games together. Getting him to read more has been big. Last summer, he did the reading challenge at the Champaign Public Library and won a backpack full of books and coupons. We got him a sewing machine for Christmas since he's interested in making his own clothes. For the three of us, it's been stressful especially for David and Laura because they're stuck in the house together and he's a teenage boy. There have been a lot of frustrations and door slamming, but hopefully we're kinda getting to the end of this and he can get back to school for the Fall.

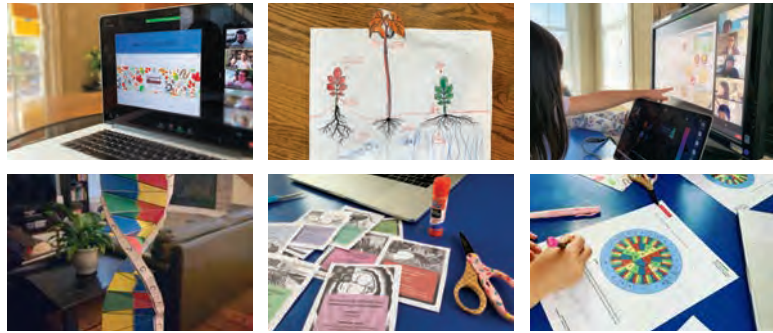


“I'm trying to make time for both my wife and my son. They are both pretty understanding but now it's about trying to make sure I get deliberate time in those scenarios when possible. Before the pandemic, I didn't think about this nearly as much. We live by the airport in Savoy and our neighbor has a barn with goats, a pig, chickens, and peacocks.

Laura loves the peacocks and she's been training some of the baby peacocks to fly to her arm. It's little stuff like that where we've been working harder to make sure we get that quality time. The easier options, like going to the theater or bowling, just aren't viable so we just have to be intentional about the time we spend together.”

Oct
17

Genomes at Home started, a virtual 6-week program with different themes and hands-on activities for elementary school age kids.



Oct
19

CRISPR-INDUCED IMMUNE DIVERSIFICATION IN HOST-VIRUS POPULATIONS

[go.igb.illinois.edu/
CRISPRhostvirus](http://go.igb.illinois.edu/CRISPRhostvirus)



A new study led by Professor of Life Sciences Shai Pilosof (Ben-Gurion University of the Negev, Beer-Sheva, Israel), Professor of Microbiology Rachel Whitaker (IGOH leader/BCXT, University of Illinois), and Professor of Ecology and Evolution Mercedes Pascual (University of Chicago) highlights the role of diversified immunity in mediating host-pathogen interactions and its eco-evolutionary dynamics. The study also included Professor of Bioengineering and Bliss Faculty Scholar Sergei Maslov (BCXT/CABBI, University of Illinois), Sergio A. Alcalá-Corona (University of Chicago), and PhD graduate students Ted Kim (University of Illinois) and Tong Wang (University of Illinois).

Researchers used computational models to explore the influence of microbial immune diversity on population dynamics of host-virus interactions. Their simulations revealed two alternating major regimes: the virus diversification regime (VDR) where viruses proliferate and diversify, and the host-controlled regime (HCR) where hosts constrain virus diversification, leading to their extinction.



Professor of Microbiology
Rachel Whitaker and
Professor of Bioengineering
Sergei Maslov.



By understanding the dynamics of host-virus populations in natural systems, researchers can better control microbes in industrial applications like wastewater treatment, yogurt, and solvent production, which depend on stable microbial populations. Often, these applications fail because of viral epidemics that kill these microbes.

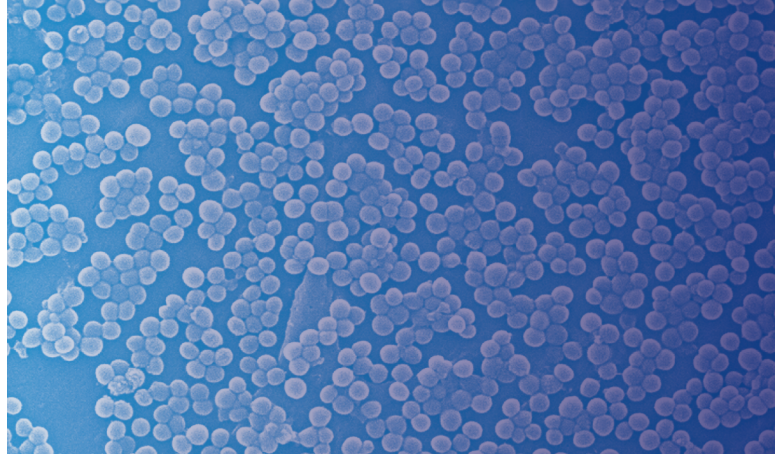
“We believe that our studies can support the design of stable microbial populations that are immune to virus infection,” said Whitaker.

The findings were reported in the journal *Nature Ecology & Evolution*. This work was funded by the Paul G. Allen Family Foundation through an Allen Distinguished Investigator award.

STUDY ON HOW BACTERIA OBTAIN ESSENTIAL NUTRIENTS IN SOIL, DURING INFECTION

go.igb.illinois.edu/
soilinfection

This scanning electron micrograph (SEM) depicts numerous clumps of methicillin-resistant *S. aureus* (MRSA).



Much like humans eat food in order to obtain essential nutrients, bacteria acquire nutrients by importing them. An essential nutrient for life is zinc, which cannot be manufactured and therefore must be obtained from the environment. However, the availability of zinc is frequently limited. This is exemplified by a defense mechanism, nutritional immunity, used by the immune system to prevent infections in which the body withholds metals to combat invading bacteria.

One recently discovered strategy that bacteria use to overcome nutritional immunity is the production of small zinc-binding molecules known as zincophores, which help import zinc. Previous research revealed that a handful of other bacteria use zincophores to obtain zinc, yet the full range of microbes that utilize these metal-binding molecules remained unknown.



Postdoctoral researcher
Jacqueline Morey and
Associate Professor of
Microbiology Thomas Kehl-Fie.



A new study by postdoctoral researcher Jacqueline Morey and Thomas Kehl-Fie (MMG), a professor of microbiology, reveals the astounding prevalence and biodiversity of zincophores.

Using bioinformatics and computational approaches, they leveraged information about the machinery that produces zincophores in *Staphylococcus aureus* and three other species of zincophore-producing bacteria to identify 250 additional species capable of producing these zinc acquisition molecules. Their work also revealed a previously unappreciated potential chemical diversity.

This study not only sheds light on the biodiversity of zincophores among bacteria, but it also opens doors for researchers interested in investigating these molecules for their potential role in therapeutics to treat infection or tools for manipulating the soil microbiome to increase crop yield. Their article was published in *mSystems*. The study was funded by the NIH and a Vallee Scholar Award.



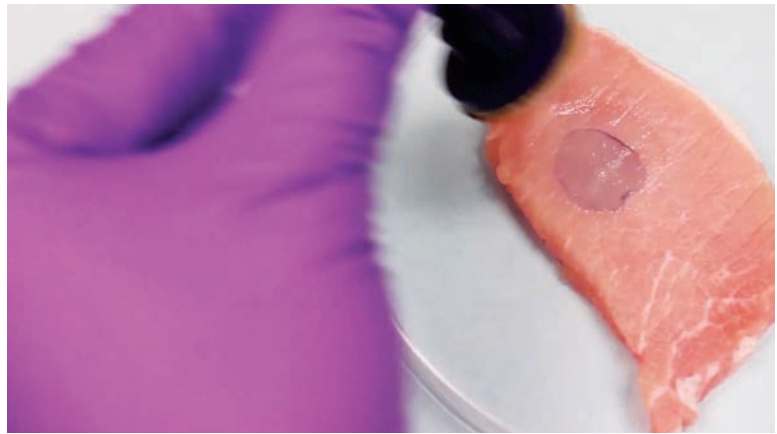
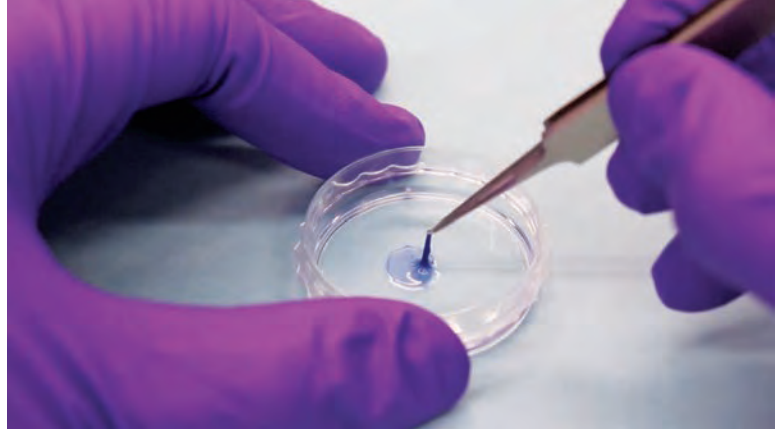
**KRISTEN
FARLEY**
POSTDOCTORAL
RESEARCH
ASSOCIATE,
IGOH, MME
THEMES

I REMEMBER FEELING SO LUCKY TO SHARE A HOME WITH MY BOYFRIEND WHEN WE LEARNED ABOUT THE COVID-19 LOCKDOWN LAST YEAR. We made the best of our time in quarantine and stayed sane by sitting on our front porch frequently and going on multiple walks outside almost every day. Looking back, it wasn't so bad, and I remember how excited and relieved we felt when we could finally go back to work in our labs last June. We have been happy working on our benchwork since then while adjusting to this **new normal after the pandemic.**

Oct
9

**OCTOPUS-INSPIRED
SUCKER TRANSFERS
THIN, DELICATE
TISSUE GRAFTS,
BIOSENSORS**

[go.igb.illinois.edu/
octopusgrafts](http://go.igb.illinois.edu/octopusgrafts)



A crucial aspect of tissue transplantation surgery is surgical gripping and safe transplantation of soft tissues. However, handling these living substances remains a grand challenge because they are fragile and easily crumple. The current methods also require skilled technicians and take up to an hour to transfer the tissues.

To deal with this problem, the researchers turned to the animal kingdom for inspiration. Octopi can pick up both wet and dry objects of all shapes with small pressure changes in their muscle-powered suction cups.

The researchers designed a manipulator made of a temperature-responsive layer of soft hydrogel attached to an electric heater. To pick up a thin sheet, the researchers heat the hydrogel to shrink it, press it to the sheet and turn off the heat. The hydrogel expands slightly, creating suction with the soft tissue so it can be lifted and transferred. They then place the thin film on the target and turn the heater back on, shrinking the hydrogel and releasing the sheet. The entire process takes about 10 seconds.

The study was carried out by Hyunjoon Kong (M-CELS leader/EIRH/RBTE), a professor of chemical and biomolecular engineering at Illinois along with collaborators at Purdue University, the University of Illinois at Chicago, Chung-Ang University in South Korea, and the Korea Advanced Institute for Science and Technology. The research

Postdoctoral researcher Byoungsoo Kim, left, and professor Hyunjoon Kong led a team that developed an octopus-inspired device for transferring fragile, thin sheets of tissue or flexible electronics.



was published in the journal *Science Advances*. The NSF, the NIH, the Department of Defense Vision Research Program and the Jump Applied Research in Community Health through Engineering and Simulation endowment supported this work.

Oct
22

CONGRESS MUST CLARIFY LIMITS OF GENE-EDITING TECHNOLOGIES

[go.igb.illinois.edu/
congressgene](http://go.igb.illinois.edu/congressgene)



Genome editing of human embryos represents one of the most contentious potential scientific applications today. But what if geneticists could sidestep the controversy by editing sperm and eggs instead? According to a new paper, how the next Congress decides to handle the issue will affect the science, ethics and financing of genome editing for decades to come. The paper was published in *The Journal of Law, Medicine and Ethics*.

The current federal funding ban is predicated on a concept of bioethics that focuses on the embryo, and that's because there's widespread recognition in U.S. society that embryos have a certain moral salience that other biological components don't. However, with advances in biotechnology, one can sidestep editing embryos by editing sperm and eggs instead said Jacob S. Sherkow (GSP), a professor of law at Illinois.

Some of the ethical concerns raised about editing embryos are applicable to editing sperm and eggs while others are not. Objections to embryonic gene editing due to the need to destroy human embryos in research and clinical applications are quite different for sperm and eggs.

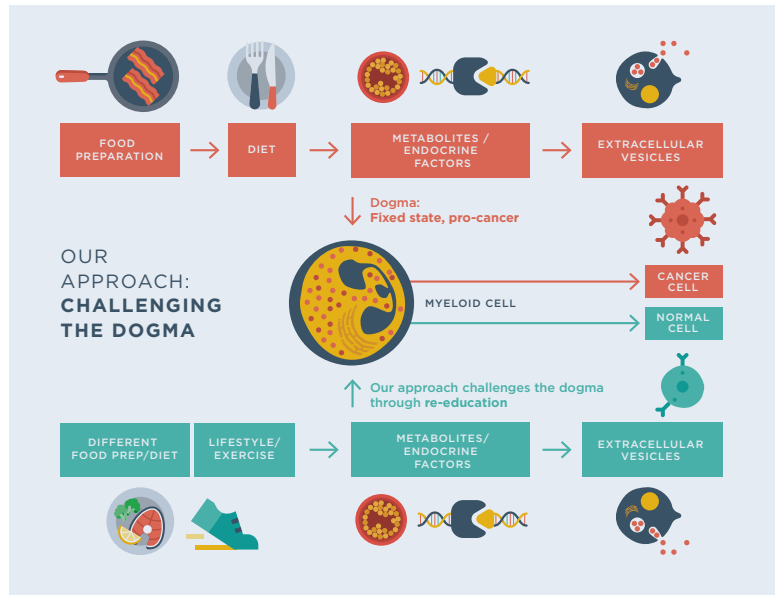
Those who have opposed the destruction of embryos, including members of some religious communities, haven't raised similar objections to sperm and egg editing, Sherkow said. At the same time, policymakers should be heartened by the notion that "we don't necessarily have to stop research on these technologies because now we have the ability to do it in gametes as opposed to embryos," Sherkow said.

Oct 30



NELSON AWARDED \$4.5M TO STUDY PREVENTION, TREATMENT OF BREAST CANCER

go.igb.illinois.edu/nelsonera



Professor of Molecular and Integrative Physiology Erik Nelson (ACPP) has won a \$4.5M Era of Hope Scholar Award from the United States Department of Defense (DoD) Breast Cancer Research Program. Approximately 1 in 8 women will be diagnosed with invasive breast cancer in their lifetime as it continues to be the second leading cause of cancer-related deaths in women in the United States.

The DoD, in collaboration with several experts, has identified several areas of current shortcomings in the areas of breast cancer management, diagnosis, and therapy. Nelson will spearhead a collaborative and interdisciplinary research team to address several of these key areas.

Professor of Molecular and Integrative Physiology Erik Nelson.



One aspect of the project includes a collaboration with Professor of Chemistry Paul Hergenrother (ACPP leader/MMG) to develop strategies in inhibiting the synthesis of 27-HC as well as developing drugs that target key biological regulators of cholesterol metabolism. Other collaborators include Professor of Biochemistry David Kranz (ACPP),

Professor of Electrical and Computer Engineering Stephen Boppart, Professor of Computer Science Saurabh Sinha (BSD/CABBI/GNDP/GSP), Professor of Bioengineering Wawrzyniec Dobrucki (RBTE), Professor of Food Science & Human Nutrition William Helferich, and Professor and Chief of Clinical Breast Radiotherapy Service Wendy Woodward at the University of Texas MD Anderson Cancer Center.

Nelson's project also involves cancer research advocates, who are typically cancer survivors or caregivers of someone with cancer. Nelson co-leads a Cancer Research Advocacy Group along with Professor of Food Science & Human Nutrition Zeynep Madak-Erdogan (CGD/EIRH/GSP), working with advocates Sarah Adams, Lea Ann Carson, and Renaé Strawbridge.

Oct
31

30 YEARS OF EXPERIMENTS SIMULATE FUTURE CROP CLIMATE RESPONSE



go.igb.illinois.edu/climate30

Soybeans from the 2020 field trials that have been modified to improve their ability to react to fluctuations in light levels.



A review published in *Global Change Biology* synthesizes 30 years of data to grasp how global crop production may be impacted by rising CO₂ levels and other factors. The study portends a less optimistic future than the authors' previous review published 15 years ago in *New Phytologist*. The study was led by co-author and Professor of Crop Sciences and Plant Biology Stephen Long (BSD/CABBI/GEGC).

USDA-ARS Research Plant Physiologist Lisa Ainsworth and Professor of Crop Sciences and Plant Biology Stephen Long.



“It’s quite shocking to go back and look at just how much CO₂ concentrations have increased over the lifetime of these experiments,” said co-author Lisa Ainsworth (CABBI/GEGC), a research plant physiologist with the U.S. Department of Agriculture, Agricultural Research Service (USDA-ARS).

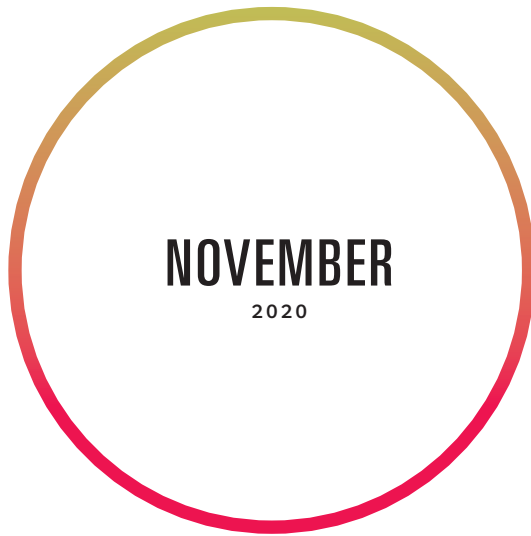


As in their previous review, but this time with ten times more studies, the authors show that elevation of CO₂ to levels expected for the second half of this century could increase crops' yields by 18% with adequate nutrients and water. While CO₂ increased yields, it also caused important quality losses; many crops showed lower mineral nutrient and protein contents.

Alarming, what has become apparent since the first review is that our major food crops become considerably more vulnerable to pests and diseases at higher CO₂. On a positive note, the authors show that there is sufficient genetic variation within our major crops to overcome some of these negative effects and capitalize on the yield benefit of higher CO₂.



Naveen Narisetty, Assistant Professor of Statistics (MME) received an NSF CAREER award.



NOVEMBER

2020



Alison Bell, Professor of Evolution, Ecology, and Behavior (GNBP leader) was elected Fellow of the American Association for the Advancement of Science.



**LASSOGEN RAISES
\$4.5M IN SEED
ROUND TO DEVELOP
NOVEL THERAPEUTICS**



go.igb.illinois.edu/lassoseed

Professor of Chemistry
Douglas Mitchell is
one of the academic
co-founders of Lassogen.



A new class of therapeutics—lasso peptides—may prove effective for targeting diseases that thwart traditional approaches. Combining the power of antibodies and small molecule drugs, the San Diego-based startup Lassogen is developing lasso peptides as a new therapeutic modality.

Lassogen was founded by CEO Mark Burk, PhD, along with co-founder Kent Boles, PhD, and academic co-founders and advisors Professor of Chemistry Douglas Mitchell (MMG) and Professor of Pharmaceutical Science Tracy Handel from the University of California, San Diego. Now, with \$4.5 million raised in a seed round, the company moves one step closer to demonstrating the power of lasso peptides for treating human diseases such as cancer and autoimmune disorders.

The shape and volume of lasso peptides allow them to easily engage the binding pockets of important receptors, overcoming many of the limitations presented by antibodies and small molecule drugs. “Lasso peptides are sort of in this Goldilocks zone where they’re not too big or too small,” said Mitchell.

In order to find lasso peptides in nature, Mitchell recruited University of Illinois undergraduates to write a discovery algorithm that allowed them to define and catalog lasso peptides found in microbial genomes. What was once a bottleneck is no longer the case, as close to 5,000 lasso peptides have been discovered.

Lassogen has a federally funded collaborative project with Mitchell to allow programming of a substrate to become compatible with an enzyme that would normally not process it, thus enabling discovery and optimization for anticancer research or other therapeutic areas.

Nov
9

FDA issued the Emergency Use Authorization for Eli Lilly’s bamlanivimab.



Carl Bernacchi, Professor of Plant Biology (CABBI/GEGC) was elected Fellow of the American Association for the Advancement of Science.

Nov
10



\$87M GRANT WILL HELP ADVANCE BIOINDUSTRIAL MANUFACTURING

go.igb.illinois.edu/bioin87

An \$87 million grant from the U.S. Department of Defense (DoD) matched by more than \$187 million in non-federal cost-share will fund collaborative efforts by a team of private and public entities to advance sustainable and reliable bioindustrial manufacturing technologies.

The DoD awarded the money over seven years to the BioIndustrial Manufacturing and Design Ecosystem (BioMADE), a nonprofit headquartered at the University of Minnesota in St. Paul, for a new Manufacturing Innovation Institute. The University of Illinois is a governing member of BioMADE.

Illinois is a preferred research site for the organization because of the campus’ breadth and depth in biomanufacturing, said Huimin Zhao (BSD leader/CABBI/GSE/MMG), the Steven L. Miller Chair in

Chemical and Biomolecular Engineering.

The biomanufacturing strengths include the Illinois Biological Foundry for Advanced Biomanufacturing, the Integrated Bioprocessing Research Lab, the Center for Advanced Bioenergy and Bioproducts Innovation, and the Molecule Maker Lab Institute, a five-year \$20 million NSF-funded research institute led by Zhao.



Steven L. Miller Chair in Chemical and Biomolecular Engineering Huimin Zhao.

Vijay Singh (CABBI/GEGC), a professor of agricultural and biological engineering, and Christopher Rao (BSD/CABBI/GSE/MME), a professor of chemical and biomolecular engineering, are also part of the BioMADE collaboration, with the potential for more faculty to join in the

future. The collaboration aims to establish long-term and dependable bioindustrial manufacturing capabilities for a wide array of products that are used in the chemical, agriculture, food, and textile industries.

Nov
13

CASSAVA MAY BENEFIT FROM ATMOSPHERIC CHANGE MORE THAN OTHER CROPS

go.igb.illinois.edu/cassavaco2

Amanda De Souza studies cassava photosynthesis in an effort to improve the productivity of this tropical root crop that feeds millions across the world.



A team from the University of Illinois and Monash University studied how the root crop cassava, which feeds over 1 billion people, will adapt to the amount of carbon dioxide expected by the second half of this century. They grew the crop in an outdoor research facility called SoyFACE that artificially boosts carbon dioxide to understand how increasing levels will impact crops in the coming decades.

In the *Journal of Experimental Botany*, the team reported yield increases ranging from 22 to 39 percent in seven out of eight varieties of cassava. Additionally, they found that when carbon dioxide levels increase from 400 to 600 ppm, cassava leaves could conserve 58 percent more water on average by optimizing stomatal conductance, which is the rate that carbon enters compared to water exiting the leaf.

“Cassava’s natural ability to produce high yields with little water is part of what makes this crop a staple in drought-prone regions across sub-Saharan Africa,” said co-author Amanda De Souza, a postdoctoral researcher for the RIPE project at Illinois.

This study is the result of a partnership between two international research projects that are supported by the Bill & Melinda Gates Foundation. Cassava Source-Sink is focused on improving the yield of cassava. Realizing Increased Photosynthetic Efficiency (RIPE) is improving photosynthesis to boost crop yields with support from the Gates Foundation, Foundation for Food and Agriculture Research, and U.K. Foreign, Commonwealth & Development Office.



Carl Gunter, Professor of Computer Science (GSP leader) was named George and Ann Fisher Distinguished Professor in Engineering.



Fan Lam, Assistant Professor of Bioengineering (GNDP) received a National Institute of Biomedical Imaging and Bioengineering Trailblazer R21 Award.



**BETH
PENNER**
LABORATORY
SUPERVISOR,
ACPP, RBTE,
M-CELS, BCXT
THEMES

AS A WORKING MOM, I NOW FOUND MYSELF HOME with my 3 young children (twin 6 month olds and a 3.5 year old) at the start of the pandemic. My husband's hours were drastically cut and we made the decision to pull the kids out of daycare. This was a huge adjustment for everyone, but we made many great memories going on family walks, playing outside, and witnessing the twin's big milestones—learning to sit, crawl, walk, and talk. During this time, I was successfully managing my job responsibilities by working both in person and remotely. However, in August my husband started back to work full time as an essential worker and all of a sudden I was forced to work completely remote due to a lack of childcare.

The fall was a very stressful time trying to balance taking care of my children but also getting work done during naps, evenings, and weekends. I was overwhelmed and just trying to survive. I felt guilty for not being able to give 100% in any part of my life, but finally I found part-time childcare and eventually full-time by the end of 2020. **Everyone at IGB was very supportive and understanding throughout all of this and for that I'm very appreciative!**



Nov 19

THREE ILLINOIS SCIENTISTS RANK AMONG WORLD'S MOST INFLUENTIAL

go.igb.illinois.edu/clarivate20

Robert Emerson Professor of Plant Biology and Crop Sciences Donald Ort, left, with Stanley O. Ikenberry Chair of Crop Sciences and Plant Biology Stephen Long.



Three faculty members at the University of Illinois have been named to the 2020 Clarivate Analytics Highly Cited Researchers list, including two from IGB. The list recognizes leading researchers in the sciences and social sciences from around the world.

It is based on an analysis of journal article publication and citation data, an objective measure of a researcher's influence, from 2009-2019.

The highly cited Illinois researchers this year are: Materials Science and Engineering Professor Axel Hoffmann, Crop Sciences and Plant Biology Professor Stephen Long (BSD/CABBI/GEGC), and Professor of Plant Biology and Crop Sciences and IGB Acting Director Donald Ort (GEGC leader/BSD/CABBI).

Hoffmann is a Founder Professor in materials science and engineering and a member of the Materials Research Laboratory. His research focuses on topics related to magnetism, such as spin transport, magnetization dynamics, and biomedical applications.

Long is the Stanley O. Ikenberry Chair of Crop Sciences and Plant Biology. He uses computational and bioengineering approaches to improve photosynthetic efficiency and works to address the effects of climate change on crop yields. He was elected a Fellow of the Royal Society of London in 2013 and has been recognized as a highly cited researcher every year since 2005.

Ort is the Robert Emerson Professor of Plant Biology and Crop Sciences at Illinois. His research focuses on improving photosynthesis and addresses crop responses to global change factors including increases in atmospheric carbon dioxide and temperature. He was elected to the National Academy of Sciences in 2017.

Nov 21

Genomes at Home concluded after 136 attendees virtually participated in 6 weeks of hands-on activities centered around DNA and DNA sequencing, plants, extremophiles, translation, and animal behavior.



Nov
29

TWO IGB FACULTY MEMBERS ELECTED AAAS FELLOWS

go.igb.illinois.edu/AAAS20



Two faculty members from IGB were elected 2020 Fellows of the American Association for the Advancement of Science. Evolution, Ecology and Behavior Professor Alison Bell (GNNDP leader) and Plant Biology Professor Carl Bernacchi (CABBI/GEGC) were elected. They are among the 489 scientists to be awarded the distinction of AAAS Fellow in that year.



Bell studies the evolution of behavior in the three-spined stickleback, a fish species adapted to diverse habitats. She is a pioneer in the study of animal personality, using genomics and other tools to understand the causes and consequences of individual behavior differences. She is a member of the Animal Behavior Society, the International

Society for Behavioral Ecology and the American Society of Naturalists. She was a recipient of the 2012 Young Investigator Award from the Animal Behavior Society. She is the leader of the GNNDP theme; the Lowell Getz Scholar in Evolution, Ecology and Behavior; a Romano Scholar; and a professor in the Beckman Institute; the Program in Ecology, Evolution and Conservation; and the Neuroscience Program.



Bernacchi is a professor and a U.S. Department of Agriculture Agricultural Research Service scientist. He investigates the impacts of climate change on crop physiology, energy fluxes between the atmosphere and plant canopies, carbon sequestration and crop canopy responses to stress. He is a member of the Center for

Advanced Bioenergy and Bioproducts Innovation and the GEGC theme. Bernacchi also serves on the editorial board for three journals and led the development of the American Society of Plant Biologists' Ecological and Environmental Plant Physiology section.



Sergei Maslov, Professor of Bioengineering (BCXT/CABBI) was elected as a Fellow of the American Physical Society.



**SARA
PEDRON HABA**
RESEARCH
ASSISTANT
PROFESSOR,
RBTE THEME

WE HAVE ALWAYS HAD A VERY BUSY SOCIAL AND CULTURAL LIFE: friends' reunions, playdates, sport activities, frequent travel and assiduous attendance of the Krannert Center for Performing Arts' high-quality performances. The pandemic has grounded us for more than a year now, and when I look back, I see how slowly time passed in 2020. We froze into a routine of remote schooling, zoom meetings, bleaching doorknobs and feeling startled every time someone coughed around us. But Coco Chanel said "Don't spend time beating on a wall, hoping to transform it into a door." This was the perfect opportunity to let go of things that would not happen and adapt to a new routine that has led to many positive things. I got to spend more time with my children and realized how much they know already. I would think to myself 'Can you already read a whole book? When did that happen?' We cooked dishes we had not prepared since becoming parents, and got to catch up with our international friends. But most importantly for me is that even though work got a little slower, I got faster. I started running again, and **I hope I can carry that boost of neurotransmitters over to the post-pandemic era.**

DECEMBER

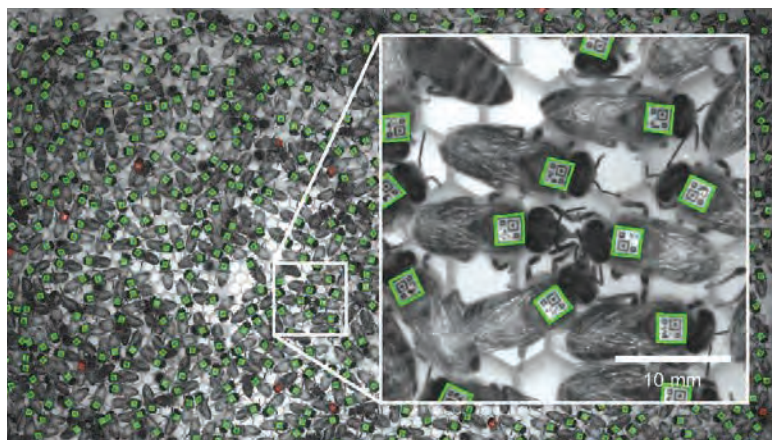
2020

Dec 1

UNEXPECTED SIMILARITY BETWEEN HONEY BEE AND HUMAN SOCIAL LIFE



go.igb.illinois.edu/unexpectedbee



An image obtained from the system showing barcoded bees inside the observation hive. Outlines reflect whether a barcode could be decoded successfully (green), could not be decoded (red), or was not detected (no outline). The hive entrance is in the lower-right corner, and the inset reveals two bees that were automatically detected performing trophallaxis.

Bees and humans exhibit surprising similarities in the ways that they interact socially. A team of researchers have experimentally measured the social networks of honey bees and how they develop over time. They discovered that there are detailed similarities with the social networks of humans. The theory, confirmed in experiments, implies that there are individual differences between honey bees, just as there are between humans.

The study, which measures the extent of individual differences in honey bee networking for the first time, was carried out by physics PhD student Sang Hyun Choi, postdocs Vikyath D. Rao, Adam R. Hamilton and Tim Gernat, Swanlund Chair of Physics Nigel Goldenfeld (BCXT leader/GNDP) and Swanlund Chair of Entomology and IGB Director Gene E. Robinson (GNDP).

Previous studies that looked at the individual interactions between bees showed that the time spent varied from short interactions to long interactions. Based on these observations, Choi developed a

theory where bees exhibited an individual trait of attractiveness that could be likened to human interaction.

For example, humans might prefer to interact with friends or family members rather than strangers. Using mathematical modeling, the researchers applied the same theory to human datasets, revealing similar patterns as with the honey bee dataset. These results indicate a surprising universality of the patterns of social interactions in both honey bees and humans.

Their findings were published in a recent article in the journal *Proceedings of the National Academy of Science*. The work was partially supported by the NIH.

Dec
2

SUPPORTING NEW RESEARCH AREAS THROUGH SEED FUNDS



[go.igb.illinois.edu/
benziger20](http://go.igb.illinois.edu/benziger20)

Robert and Kim Benziger at SoyFACE (Soybean Free Air Concentration Enrichment) during their 2019 tour of IGB research projects.



From the beginning, Kim and Robert Benziger shared a desire to spread positivity and to give back to the community so that others would have the same opportunities. In line with their philanthropy, the Benzigers have given a generous contribution to the Director's Innovation Fund, which provides seed funds for budding IGB research themes.

The Benzigers developed an adoration and appreciation for nature from their passion for gardening and National Geographic tours, which took them to places like Antarctica and the Galapagos Islands. These trips reinforced their embedded desire to learn new things about nature and the world around them.

When they were invited to do a tour of the IGB, the Benzigers expressed that they were interested in nature, specifically work at IGB that focused on adapting crops for climate change and the future of pollinators because they had read about their decline. They visited the corn and soybean fields where atmospheric controls simulated changing climate conditions. One of the topics addressed during their IGB visit was the future of crop growth in light of climate change, reflecting the Benzigers' interests in all aspects of nature. Their wide-

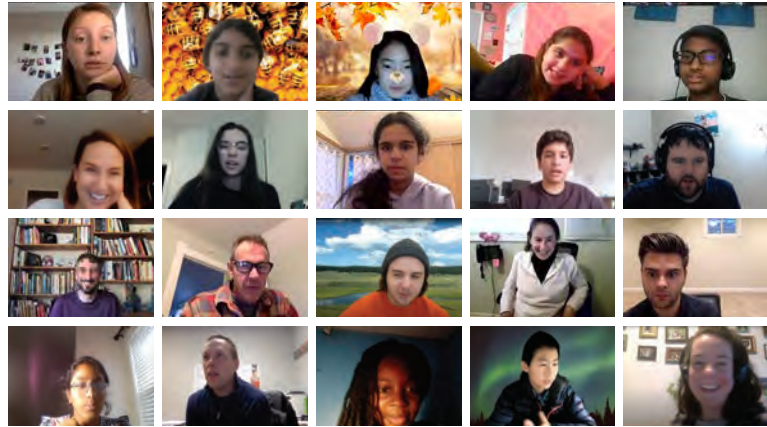
ranging interests spurred them to support the development and in-depth studies of new research areas.

The Benzigers wanted to do something positive that has the potential to outlive them and that inspired them to provide seed money for the initial work within potential new themes. “Our investment opens doors to things we couldn’t even imagine or think possible,” they said.

Dec
4

STEAM TRAIN: MIDDLE SCHOOLERS PERFORM STUDENT- DRIVEN RESEARCH

go.igb.illinois.edu/
COREtrain



In 2020, the STEAM TRAIN (Transdisciplinary Research Across Institutional Near-Peers) project conceived by the IGB outreach staff was one of five projects awarded seed funding and up to two years of subsequent support from the Community + Research Partnership Program (CO+RE). The CO+RE grant represents the first awarded grant for outreach endeavors at the IGB. Supported by the Office of the Vice Chancellor for Research and Innovation, the grant is dedicated to fostering relationships between the community and researchers.

The STEAM TRAIN project will be a student-led effort consisting of a partnership between Franklin STEAM Academy (Franklin) students, University of Illinois Laboratory High School (Uni) students, Illinois graduate and undergraduate students, and the IGB outreach staff. Every Tuesday afternoon after school, six groups of around 24 excited Franklin STEAM Academy students hung around online a bit longer to conduct independent research on topics of importance to them. The hope is that experiencing research by exploring issues they’re passionate about might foster the middle schoolers’ love of science—and possibly even solve some of today’s intractable problems.

The primary goal of STEAM TRAIN is creating a mentorship chain between Illinois students, Uni students, and Franklin students where each group works with and provides guidance to their near-peers, said IGB Senior Outreach Activities Coordinator Daniel Urban, who

submitted the CO+RE grant. “Ultimately, STEAM TRAIN seeks to promote increased science literacy and prolonged involvement, especially geared toward groups underrepresented in STEM fields,” he said.



Paul J. Hergenrother, Professor of Chemistry (ACPP leader/MMG) was named a National Academy of Inventors (NAI) Fellow.



INITIATIVE OFFERS COVID-19 TESTING, EXPLORES VIRUS TRANSMISSION'S SOCIAL FACTORS



go.igb.illinois.edu/LHEAP20

Workers gather at the Rantoul Parks and Recreation Department before hosting a pop-up test clinic.



An interdisciplinary team of Illinois scientists, including microbiology professor Rachel Whitaker (IGOH leader/BCXT) and anthropology professors Jessica F. Brinkworth (GNBP/IGOH), Korinta Maldonado, Ellen Moodie and Gilberto Rosas, is investigating the structural, economic and sociocultural factors that impact transmission and response to the disease among essential agricultural laborers in rural communities like Rantoul.

Workers at the Rantoul Foods pork-processing plant were among the first outbreak clusters when COVID-19 emerged in central Illinois early last spring. James F. Lowe (IGOH), a professor of veterinary clinical medicine, and Civil and Environmental Engineering Professor Helen Nguyen (IGOH) collected samples in the plant over a seven-week period. But when they found no traces of the virus, it raised questions about how the disease was being spread person-to-person at work and among other people in the community.

According to data from the Centers for Disease Control and Prevention, many front-line and essential workers are racial and ethnic minorities, who are more likely to progress to severe cases.

“By producing the research knowledge collaboratively and reporting the findings back to these communities, we can find better, smarter mitigation strategies,” said Maldonado, who also is a Professor of American Indian studies.

Funding for the project was provided by the College of Agricultural, Consumer and Environmental Sciences; the Office of the Vice Chancellor for Research and Innovation; the IGB; the Illinois Pork Producers Association; and private donors.



**URSULA
RUIZ
VERA**

BACKGROUND
POSTDOCTORAL RESEARCHER, GEGC THEME

WHAT I ACCOMPLISHED IN 2020
**COMPLETED A COURSE ON PERSONAL GROWTH
AND DEVELOPMENT**

WHAT BROUGHT ME JOY
ADOPTING A DOG

Ursula Ruiz Vera is a postdoctoral researcher who studies photosynthesis and how plants respond to different environmental conditions. As part of the RIPE team, she has worked on soybean, tobacco, and cassava. Although she was able to work from home, Ruiz Vera took time to adjust

to her new circumstances. She found solace in adopting a dog and building an online community of friends, who she met during a course on personal growth and development. She is excited to continue this journey and accomplish other personal goals.



"I never imagined that you can make so many friends online during a time when personal interactions with people are limited."

"IN THE BEGINNING I WAS SCARED BECAUSE COVID-19 WAS SO NEW AND THE NUMBERS JUST KEPT INCREASING.

I was glad that the university and IGB did such a wonderful job ensuring that everyone felt comfortable with their work situation. Working from home, I focused my efforts on data analysis and writing. There were a few essential tasks, including keeping the plants alive, that were handled by two technicians. In addition to the COVID difficulties, during the summer of 2020 we also had a hailstorm, which destroyed all the cassava plants I had in the field. Fortunately, they recovered and we could carry out measurements, but all our plans needed to change. As the COVID data became clear, I felt more confident that I was going to have successful experiments by adapting all the precautions needed to work in the field.

I live with two roommates, they are very nice people and I am happy to share the house with them. However, since we are

all very busy with our work and are immersed in our own lives, I thought that having a dog would make everything even better. Although I had always wanted a dog, I never had the time and I was never at home since I kept traveling. The year 2020 was the perfect time to adopt one. It helped me mentally and emotionally. Before I adopted Dalia, my schedule was not very structured; some days I would wake up late and have no time to finish my work. After I got Dalia, I needed a better schedule so I could fit the time I needed to walk her and play with her while fulfilling my other obligations and also having some time for myself. Now we have a routine and she knows when I'm working and waits for me to finish; she's a smart dog. I don't know how I would've handled the pandemic without her. I am now training her so she is well-behaved whenever I have the chance to bring her with me to Peru.

Especially with COVID, it's hard to meet people. So, I decided

to take a course on personal growth and development where I can find people with similar interests. The online community and support I found has been amazing. For example, one of the activities that I have joined is one called the 100 days challenge, and it has forced me to work very hard on my goals while we support each other so that everybody can achieve their goals. I never imagined that you can make so many friends online during a time when personal interactions with people are limited.

I ACHIEVED ALMOST EVERYTHING I WANTED TO IN 2020. I REALIZED I NEEDED TO FOCUS ON SELF-CARE AND CONNECT WITH MORE PEOPLE. NOW I WANT TO GET INTO FITNESS, FINISH THE PAPERS THAT I WAS WORKING ON, AND LEARN SOME NEW SKILLS."

Dec
11

FDA issued the Emergency Use Authorization for COVID-19 vaccine from Pfizer, BioNTech.

Dec
15

UIUC administered one million tests on campus.

Dec
15

CHANCELLOR, PROVOST
OFFER REFLECTIONS
ON 1 MILLION
COVID-19 TESTS



go.igb.illinois.edu/1Mtests



It sometimes seems a million doesn't command quite the same attention that it used to. We live in a world where the population is measured in billions, economies are scaled in trillions and computer calculations are counted by the quadrillion. But it takes on a very special significance when you're talking about looking after the well-being of your community in the middle of a globally devastating pandemic.

In December 2020, the University of Illinois administered its one millionth saliva-based, rapid-result PCR COVID-19 test. The pioneering SHIELD program made a lot of headlines during the summer and early fall with the massive deployment of faster, cheaper and more accurate PCR tests that use saliva rather than the more-common nasal swabs.

Professor of Chemistry and Associate Dean for Research of the Carle Illinois College of Medicine Martin Burke (MMG), who leads the SHIELD team, explained how a unique spirit of innovation and collaboration across our campus made SHIELD possible. "Failure was not an option—and our entire campus rallied together to succeed."

"We considered this challenge to be the 2020 version of President John F. Kennedy's moonshot. When he gave his famous moonshot speech, many called his pledge to send someone to the moon within just a few years after the first U.S. manned spaceflight to be audacious and impossible. Over the past six months, we have proved that problems that seem insurmountable are exactly what world-class research universities like Illinois exist to solve," said University of Illinois Chancellor Robert Jones and Provost Andreas Cangelaris.

Dec
17

STUDY TRACKS ELEPHANT TUSKS FROM 16TH CENTURY SHIPWRECK



[go.igb.illinois.edu/
elephantwreck](http://go.igb.illinois.edu/elephantwreck)

Forest elephants (*Loxodonta cyclotis*) in the swamp Mbeli Bai, Nouabalé-Ndoki National Park, Congo.



In 1533, the Bom Jesus—a Portuguese trading vessel carrying 40 tons of cargo and more than 100 elephant tusks—sank off the coast of Africa near present-day Namibia. The wreck was found in 2008, and scientists say they now have determined the source of much of the ivory recovered from the ship.

The ivory had been stowed in a lower level under a weighty cargo of copper and lead ingots, said Alida de Flamingh, a postdoctoral researcher at the Illinois who led the study with animal sciences professor Alfred Roca (EIRH/GNDP) and anthropology professor Ripan Malhi (GNDP/GSP/IGOH).

From left, animal sciences professor Alfred Roca, postdoctoral researcher Alida de Flamingh and anthropology professor Ripan Malhi led a team that analyzed DNA extracted from elephant tusks recovered from a 16th century shipwreck.



Their study, reported in the journal *Current Biology*, used various techniques, including a genomic

analysis of DNA extracted from the well-preserved tusks, to determine the species of elephants, their geographic origins and the types of landscapes they lived in before they were killed for their tusks. The team extracted DNA from 44 tusks and determined that all of the tusks they analyzed belonged to forest elephants. Furthermore, they were all from elephants residing in West Africa. Further analysis also revealed that the elephants lived in mixed habitats, switching from forested areas to savannas in different seasons, most likely in response to water availability.

The U.S. Fish and Wildlife Service African Elephant Conservation Fund, USDA, National Research Foundation of South Africa, Department of Science and Technology of South Africa, and Claude Leon Foundation supported this research.

Dec
18

FDA issued the Emergency Use Authorization for COVID-19 vaccine from Moderna.



**NILMANI
SINGH**
POSTDOCTORAL
RESEARCHER,
CABBI

MY WIFE AND I WERE BOTH GOING TO GRADUATE IN 2020. I had to submit my manuscript for publication, write my PhD thesis, prepare for my defense, and look for future opportunities. We submitted our manuscript in early spring, and when the reviews came back, the lab was shut down. Since we couldn't perform any experiments for 4-5 months, our revisions for the manuscript were delayed. On the bright side, it afforded me more time to write my thesis.

I missed working with my colleagues, those random hellos in corridors, discussing, and designing experiments. We had to learn to make our

lives digital. We shared recipes, jokes, and movie recommendation over email and Zoom. We had to be content with pictures rather than in-person celebrations. I was fortunate to have an amazing PhD mentor and she made this period significantly less stressful. We learnt lots of new recipes sometimes to our pleasure and sometimes not so much. After the quarantine was over, our lab designed a quarantine cookbook from recipes shared by lab members over emails.

My wife had graduated in spring, and she started applying for jobs at the peak of the pandemic. For her, it was demoralizing to apply and not hear back anything promising. Even if the recruiters seemed interested, they wanted to wait for the pandemic to be over. It was the year both of us had planned to take a break from work and explore the United States. We did get a break, but we were forced to in-house explorations. Looking back, I think we did good in such unprecedented times, and both of us have gotten new opportunities to advance our careers. We are grateful to the generous people whose support we relied upon. I am happy that we have now been able to go back to partial in-person work. **I have learnt to appreciate the masked smiles just a bit more than I may have ever realized in normal times.**

Dec
18

GENE BIOMARKERS INDICATE LIVER TOXICITY QUICKLY AND ACCURATELY

go.igb.illinois.edu/livergene



When agrochemical and pharmaceutical companies develop new products, they must test extensively for potential toxicity before obtaining regulatory approval. This testing usually involves lengthy and expensive animal studies. A research team at University of Illinois has developed a gene biomarker identification technique that cuts the testing process down to a few days while maintaining a high level of accuracy.

The study, published in *Scientific Reports*, identifies a biomarker gene signature that indicates potential liver toxicity just 24 hours after exposure. “The aim of this research was to identify the smallest set of indicators from the liver to predict toxicity and potential liver cancer,” said Zeynep Madak-Erdogan (CGD/EIRH/GSP), Associate Professor in the Department of Food Science and Human Nutrition and a lead author on the study.

Normally, companies track animals for up to a year to see if they develop liver cancer after exposure to these compounds. The studies require thousands of mice or rats, and a lot of human time taking care of the animals, collecting samples, and analyzing the data. On the other hand, the study involves treating a few mice for 24 hours, collecting livers, looking at the biomarkers, and predicting whether the animal will potentially develop liver cancer or not.

Funding for this research was provided by Corteva Agriscience; University of Illinois, Office of the Vice Chancellor for Research; College of ACES FIRE grant; National Center for Supercomputing Applications Faculty Fellowship; and National Institute of Food and Agriculture.

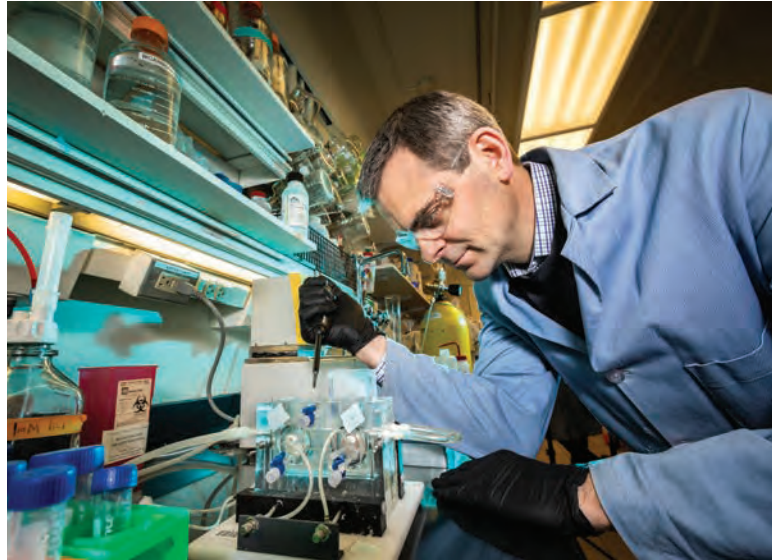
Dec
19

ANTIFUNGAL DRUG IMPROVES KEY CYSTIC FIBROSIS BIOMARKERS IN CLINICAL STUDY



go.igb.illinois.edu/cfdrug

Chemistry professor Martin Burke continues his research on mechanisms that control the processes that affect cystic fibrosis, in his lab at Roger Adams Laboratory.



A drug widely used to treat fungal infections improved key biomarkers in lung tissue cultures as well as in the noses of patients with cystic fibrosis. The disease is caused by a missing or defective ion channel in the lining of the lungs, called CFTR. The study was published in the *Journal of Cystic Fibrosis*.

The patients who participated in the clinical study were among the 10% of patients who cannot respond to modulator treatments, suggesting the antifungal drug, amphotericin B, could benefit all patients regardless of their mutation, said study leader Martin D. Burke (MMG). Burke is a professor of chemistry at Illinois and the Associate Dean for Research for the Carle Illinois College of Medicine, as well as a medical doctor.

In the new study, Burke's group, in collaboration with Dr. Michael J. Welsh at Iowa, tested the drug in cultures of lung tissue from patients with cystic fibrosis. They confirmed that the drug increased ion secretion in the cultures. Then, in experiments designed to replicate the first clinical studies of the modulator drugs, they tested it in patients' noses. The researchers assessed whether the drug increased ion flow in the nose cells by measuring a biomarker known as nasal potential difference. In the study, the nasal form of amphotericin B changed the nasal potential difference in a way that suggested that amphotericin was performing the job of the missing CFTR channels.

The nonprofit cystic fibrosis research foundation Emily's Entourage and the NIH supported this work.

Dec
21

LIGHT SIGNAL EMITTED DURING PHOTOSYNTHESIS USED TO QUICKLY SCREEN CROPS

go.igb.illinois.edu/SIFsignal



Researchers have revealed a new approach to estimate the photosynthetic capacity of crops to pinpoint the top-performing traits, according to a new study in the *Journal of Experimental Botany*. The study was led by Carl Bernacchi (CABBI/GEGC), a Research Plant Physiologist for the U.S. Department of Agriculture, Agricultural Research Service.

Bernacchi's team used two spectral instruments simultaneously—a hyperspectral camera for scanning crops and a spectrometer used to record very detailed information about sunlight—to quickly measure a signal called Solar Induced Fluorescence (SIF) that is emitted by plants when they become 'energy-excited' during photosynthesis. With this SIF signal, the team gained critical insights about photosynthesis that could ultimately lead to improving crop yields.

USDA-ARS Research
Plant Physiologist Carl
Bernacchi and postdoctoral
researcher Katherine
Meachem-Hensold.



These tools could speed up progress by orders of magnitude, said Katherine Meachem-Hensold, a postdoctoral researcher at Illinois.

“This technology is game-changing for researchers who are refining photosynthesis as a means to help realize the yields that we will need to feed humanity this century,” she said.

The study was supported by the Bill & Melinda Gates Foundation, the U.S. Foundation for Food and Agriculture Research, and the U.K. Foreign, Commonwealth & Development Office.



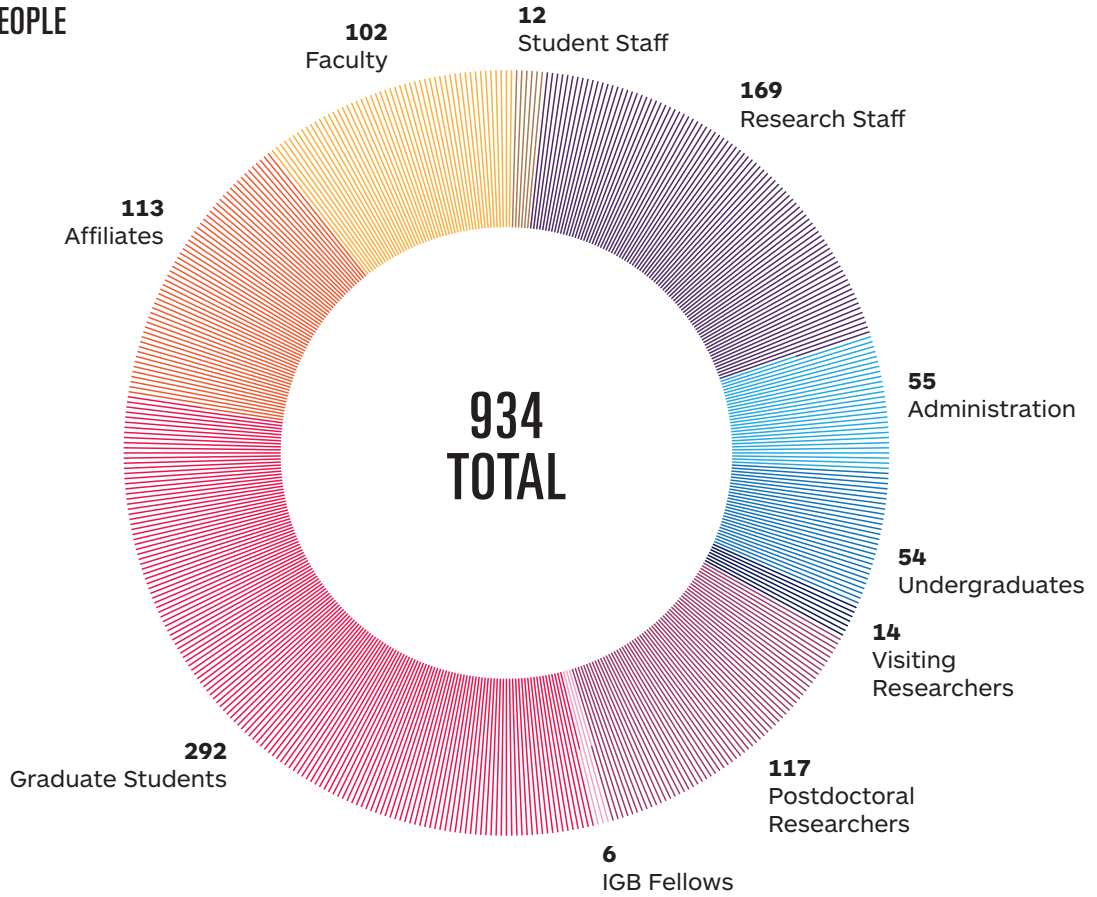
Dec
30

14 million COVID-19 vaccine doses were distributed in the U.S.

**2020
NUMBERS, PUBLICATIONS, AND THANKS
FROM THE**



PEOPLE



ECONOMIC DEVELOPMENT

21

Disclosures

16

Patent Applications

3

Licenses & Options

4

Patents Issued in FY20

Methods and Compositions for Producing Solvents, **Hans Blaschek**

Recombinant Microorganisms for Conversion of Oligosaccharides into Functional Sweeteners, **Yong-Su Jin**

Procaspase-Activating Compounds and Methods, **Paul Hergenrother**

Plants Having Increased Biomass and Methods for Making The Same, **Stephen Long**

PUBLICATIONS

1106 PAPERS PUBLISHED

Science

Sept
4

Engineering human ACE2 to optimize binding to the spike protein of SARS coronavirus 2. Chan, K. K., Dorosky, D., Sharma, P., Abbasi, S. A., Dye, J. M., **Kranz, D. M.**, Herbert, A. S. & Procko, E., Sep 4 2020, *Science*. 369, 6508, p. 1261-1265 5 p.

Dec
18

Transparency is key to ethical vaccine research-Response. Guerrini, C. J., **Sherkow, J. S.**, Meyer, M. N. & Zettler, P. J., Dec 18 2020, *Science*. 370, 6523, p. 1423 1 p.

Nature

Jan
23

An anti-CRISPR viral ring nuclease subverts type III CRISPR immunity. Athukoralage, J. S., McMahon, S. A., Zhang, C., Gruschow, S., Graham, S., Krupovic, M., **Whitaker, R. J.**, Gloster, T. M. & White, M. F., Jan 23 2020, *Nature*. 577, 7791, p. 572-575 4 p.

Feb
20

GDF15 mediates the effects of metformin on body weight and energy balance. Coll, A. P., Chen, M., Taskar, P., Rimmington, D., Patel, S., Tadross, J. A., Cimino, I., Yang, M., Welsh, P., Virtue, S., Goldspink, D. A., Miedzybrodzka, E. L., **Konopka, A. R.**, Esponda, R. R., Huang, J. T. J., Tung, Y. C. L., Rodriguez-Cuenca, S., Tomaz, R. A., Harding, H. P., Melvin, A., Yeo, G. S. H., Preiss, D., Vidal-Puig, A., Vallier, L., Nair, K. S., Wareham, N. J., Ron, D., Gribble, F. M., Reimann, F., Sattar, N., Savage, D. B., Allan, B. B. & O'Rahilly, S., Feb 20 2020, *Nature*. 578, 7795, p. 444-448 5 p.

Jul
9

Potential for large-scale CO₂ removal via enhanced rock weathering with croplands. Beerling, D. J., Kantzas, E. P., Lomas, M. R., Wade, P., Eufrazio, R. M., Renforth, P., Sarkar, B., Andrews, M. G., James, R. H., Pearce, C. R., Mercure, J. F., Pollitt, H., Holden, P. B., Edwards, N. R., **Khanna, M.**, Koh, L., Quegan, S., Pidgeon, N. F., Janssens, I. A., Hansen, J., Banwart, S. A., Jul 9 2020, *Nature*. 583, 7815, p. 242-248 7 p.

Aug
6

Photoenzymatic enantioselective intermolecular radical hydroalkylation. Huang, X., Wang, B., Wang, Y., **Jiang, G.**, Feng, J. & **Zhao, H.**, Aug 6 2020, *Nature*. 584, 7819, p. 69-74 6 p.

Oct
1

Modular synthesis enables molecular ju-jitsu in the fight against antibiotic resistance. Blair, D. J. & **Burke, M. D.**, Oct 1 2020, *Nature*. 586, 7827, p. 32-33 2 p.

Nov
12

Dense sampling of bird diversity increases power of comparative genomics. Feng, S., Stiller, J., Deng, Y., Armstrong, J., Fang, Q., Reeve, A. H., Xie, D., Chen, G., Guo, C., Faircloth, B. C., Petersen, B., Wang, Z., Zhou, Q., Diekhans, M., Chen, W., Andreu-Sánchez, S., Margaryan, A., Howard, J. T., Parent, C., Pacheco, G., Sinding, M-H. S., Puetz, L., Cavill, E., Ribeiro, . M., Eckhart, L., Fjeldså, J., Hosner, P. A., Brumfield, R. T., Christidis, L., Bertelsen, M. F., Sicheritz-Ponten, T., Tietze, D. T., Robertson, B. C., Song, G., Borgia, G., Claramunt, S., Lovette, I. J., Cowen, S. J., Njoroge, P., Dumbacher, J. P., Ryder, O. A., Fuchs, J., Bunce, M., Burt, D. W., Cracraft, J., Meng, G., Hackett, S. J., Ryan, P. G., Jönsson, K. A., Jamieson, I. G., da Fonseca, R. R., Braun, E. L., Houde, P.,

Mirarab, S., Suh, A., Hansson, B., Ponnikas, S., Sigeman, H., Stervander, M., Frandsen, P. B., van der Zwan, H., van der Sluis, R., Visser, C., Balakrishnan, C. N., Clark, A. G., Fitzpatrick, J. W., Bowman, R., Chen, N., Cloutier, A., Sackton, T. B., Edwards, S. V., Foote, D. J., Shakya, S. B., Sheldon, F. H., Vignal, A., Soares, A. E. R., Shapiro, B., González-Solis, J., Ferrer-Obiol, J., Rozas, J., Riutort, M., Tigano, A., Friesen, V., Dalén, L., Urrutia, A. O., Székely, T., **Liu, Y.**, Campana, M. G., Corvelo, A., Fleischer, R. C., Rutherford, K. M., Gemmell, N. J., Dussex, N., Mouritsen, H., Thiele, N., Delmore, K., Liedvogel, M., Franke, A., Hoepfner, M. P., Krone, O., Fudickar, A. M., Milá, B., Ketterson, E. D., Fidler, A. E., Friis, G., Parody-Merino, Á. M., Battley, P. F., Cox, M. P., Lima, N. C. B., Prosdocimi, F., Parchman, T. L., Schlinger, B. A., Loiselle, B. A., Blake, J. G., Lim, H. C., Day, L. B., Fuxjager, M. J., Baldwin, M. W., Braun, M. J., Wirthlin, M., Dikow, R. B., Ryder, T. B., Camenisch, G., Keller, L. F., DaCosta, J. M., **Hauber, M. E.**, Louder, M. I. M., Witt, C. C., McGuire, J. A., Mudge, J., Megna, L. C., Carling, M. D., Wang, B., Taylor, S. A., Del-Rio, G., Aleixo, A., Vasconcelos, A. T. R., Mello, C. V., Weir, J. T., Haussler, D., Li, Q., Yang, H., Wang, J., Lei, F., Rahbek, C., Gilbert, M. T. P., Graves, G. R., Jarvis, E. D., Paten, B. & Zhang, G., Nov 12 2020, *Nature*. 587, 7833, p. 252-257 6 p.

CORE FACILITIES

FY 20

97

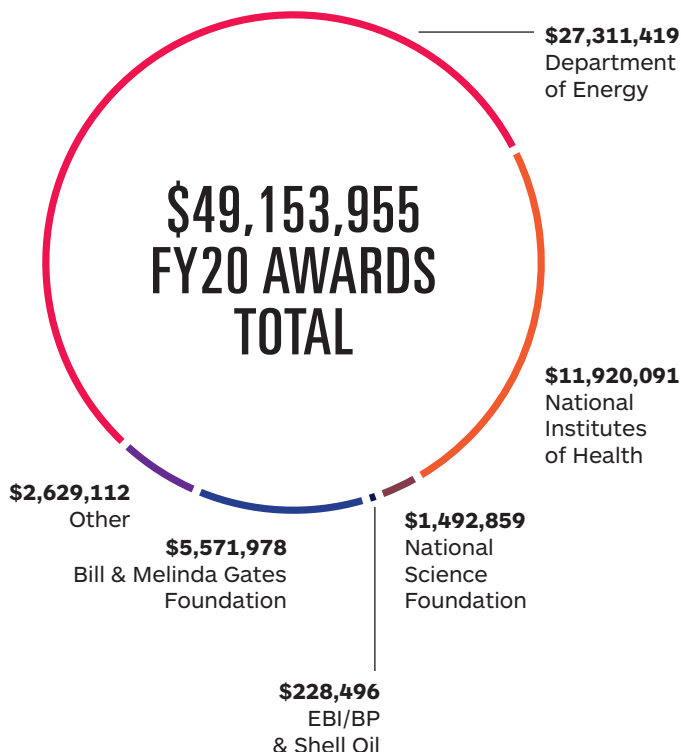
Research Groups

250

Active Users

GRANT AWARDS

FY 20



OUTREACH



297

People reached in-person

5,175

People reached via video

1,755

People reached via online content

Jan
20

Led by IGB instructors, the 15-week Team Training in Science (**IB 299**) course began for undergraduates to build a foundation in genomics, scientific collaboration, research etiquette, and scientific communication, and to enhance their team science skill set.

Number of participants: 7 Hours: 14

Jan
28

Supported by Peter and Kim Fox, the first **Fox Family Lecture Series** took place, bringing speakers such as CEOs Eva Garland and Rosemarie Truman to discuss all aspects of innovation and entrepreneurship.

Number of participants: 60 Hours: 2

Feb
6

First visit of the year with the **Mahomet-Seymour Junior High School Science Club** to run after-school science activities.

Number of participants: 50 Hours: 4

Kickoff of **Professional Skills for Careers in Biosciences (PSCB)**, 13 weeks of workshops intended for graduate students and postdocs to develop and enhance their universal job skills, including communication, professionalism, marketing, budgeting, and leadership.

Number of participants: 42 Hours: 18

Feb
18

IGB outreach staff visited Uni (University Laboratory) High School for their **Agora Days**. Students sampled, cultured, and identified microbes from around the school and learned about microbial ecology. (P16)

Number of participants: 18 Hours: 4

Mar
4

First evening of the IGB- and Beckman-sponsored **Chambana Science Café**, a monthly informal meeting with presenters including postdocs Amanda de Souza and Benjamin Zimmerman, the Illinois iGEM team, and faculty Jacob Sherkow and Jonathan Sweedler.

Number of participants: 131 Hours: 5

Genomics for™ CG Life takes place for healthcare and marketing professionals with topics including genomic applications and diagnostics, impact of the microbiome, and natural product discovery.

Number of participants: 44 Hours: 4

- Mar 19** Daily online posts of outreach activities you can do from your couch—or **Couchreach**—began, running through May 29, 2020. (P30)
Number of participants: 1,755
- Apr 14** New series of remote presentations **IGB Science Chats** began, featuring diverse topics from IGB faculty on COVID-19, cancer, personalized nutrition, tissue modeling, and more.
Number of participants: 928
- May 11** The Illinois **International Genetically Engineered Machine (iGEM)** team began work on their web tool for visualization. (P58)
Number of participants: 5
- Jun 1** Start of the **Fisk University** summer program with student and faculty collaborations. (P16)
Number of participants: 6 Hours: 200
- Jun 25** Lectures in partnership with the **Chicago Council on Science & Technology (C2ST)** began, featuring IGB faculty Cris Hughes, Rashid Bashir, Ripan Malhi, Thomas Kehl-Fie, Brian Allan, Lisa Ainsworth, and Bruce Fouke. Sponsored by the Don and Catherine Kleinmuntz Center for Genomics in Business and Society.
Number of participants: 3,724 Hours: 7
- Sept 22** The **STEAM TRAIN** project launches with Franklin STEAM Academy students, Uni High students, and IGB mentors, running through December 14, 2020. (P92)
Number of participants: 54 Hours: 12
- Sept 30** **The Art of Science 10.0 Installation, “Dynamism,”** provided a weeklong hybrid experience featuring in-person, socially-distant viewing along with an online video gallery of discussions with scientists on their featured work.
Number of participants: 50 Hours: 24
- Oct 17** **Genomes at Home** launched, a 6-week virtual program of interactive activities intended for children of elementary school age spanning diverse themes including DNA, animal behavior, and inventorship, lasting through November 21, 2020.
Number of participants: 180 Hours: 6
- Dec 16** IGB staff participated in a **Skype a Scientist** event with the Massachusetts Greater Lowell Tech High school, giving community members the opportunity to ask questions about science, genomics, and research.
Number of participants: 12 Hours: 1
- Dec 17** The **IGB Postdoctoral Association** speaker series ends with IGB Fellow Diana Ranoa speaking on her role in developing the saliva-based COVID-19 test.
Number of participants: 183 Hours: 2

THANK YOU TO THE VIRAL TRANSPORT MEDIUM (VTM) TEAM

The IGB has been proud to help support the efforts to make COVID-19 testing more broadly available to those in need. Our efforts to create Viral Transport Medium (VTM) in mass quantities to facilitate testing in the state of Illinois were very successful, with upwards of 35,000 vials produced each week in the IGB labs. Such a massive effort required the perseverance of many dedicated individuals working closely with a team of faculty, and we recognize them for their tireless work to keep those efforts safely and efficiently coordinated. Without the following individuals, this would not have been able to take place. Thank you for all that you do, and continue to do.

Matthew Boudreau

Graduate Student

Emily Gaither

Laboratory Technical
Specialist

Ashley Kretsch

Postdoctoral
Researcher

Kenneth Ringwald

Postdoctoral
Researcher

Luke Bown

Postdoctoral
Researcher

Emily Geddes

Graduate Student

Justin Lange

Research Assistant

Carl Schultz

Graduate Student

Lauren Carnevale

Graduate Student

Kelsie Green

Lab Assistant

Teresa Anne Martin

Coordinator of
Research Programs

Kyle Shelton

Graduate Student

Lindsay Chatkewitz

Graduate Student

Xiao Rui Guo

Graduate Student

Shekhar Mishra

Graduate Student

Shaun Shetty

Research Technician

Laura Daigh

Graduate Student

Auroni Gupta

Graduate Student

Jana Radin

Research Scientist

Max Simon

Graduate Student

Stella Ekaputri

Graduate Student

Lonnie Harris

Graduate Student

Imran Rahman

Graduate Student

Che Yang

Graduate Student

Sara Eslami

Graduate Student

Ahmed Hetta

Visiting Scholar

Diana Ranoa

IGB Fellow

Katie Frye

Graduate Student

Aya Kelly

Graduate Student

Credits

Managing Editor

Nicholas Vasi

Design

Mirhee Lee

Writing

Alisa King-Klemperer & Ananya Sen

Printing

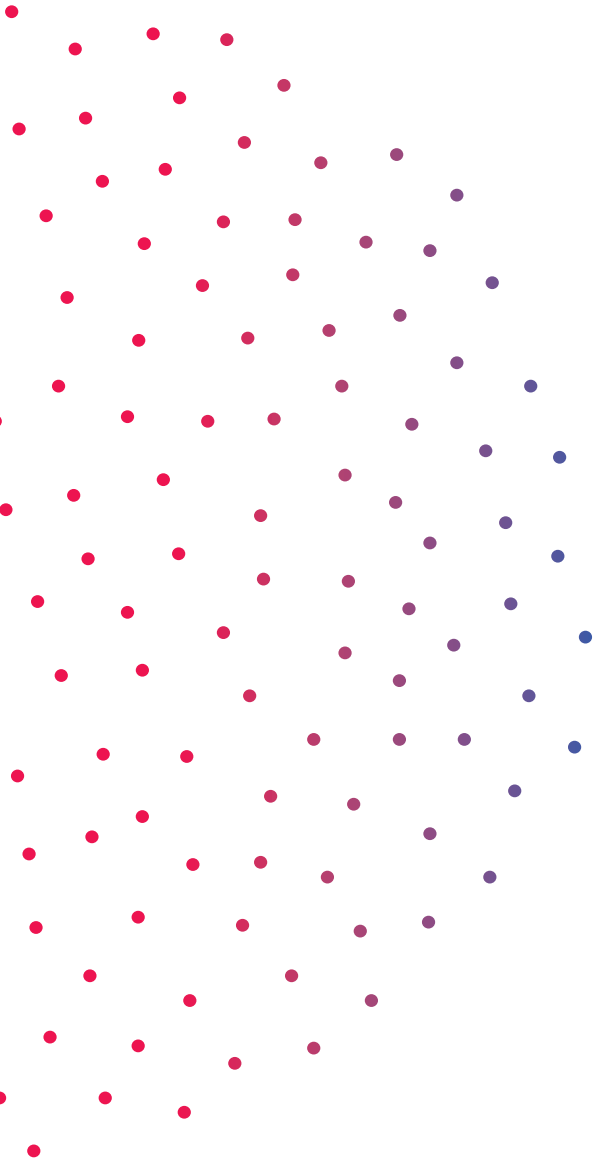
Curtis 1000

Contributing authors: Aaron Seidlitz, Alisa King-Klemperer, Allie Arp, Amanda Nguyen, Ananya Sen, Chancellor Robert Jones, Claire Benjamin, Claudia Lutz, Dave Evensen, Diana Yates, Elizabeth Innes, GEMS, Jenna Kurtzweil, Jordan Goebig, Julie Wurth, Kimberly Belser, Lauren Quinn, Liz Ahlberg Touchstone, Lizzie Roehrs Lois Yoksoulian, Maddie Blaauw, Marianne Stein, MCB Communications Office, Moore Foundation, Phil Ciciora, Provost Andreas Cangellaris, Sharita Forrest, Sharon Donovan, Stephanie Henry, Therese Pokorney.



Images contributors: Alaina Kanfer, Anna Fedders, Ann Hyoung Sook, Austin Cyphersmith, Beth Penner, Bill King, Brian Cunningham, Chi Zue, Christopher Brooke, Claire Benjamin, Collin Kaufman, Danielle Campbell, Diana Ranoa, Erin Louer, Esteban Gabazza/Nature Communications, Fred Zwicky, Gabriela Andrea Hernandez Gonzalez, Gang Wang, Grainger College of Engineering, Hailey Ahlers, Hyang Yeon Lee, Jack Humphrey, Jacqueline Morey, Jaia Holleman, Janet Sinn-Hanlon, Jenna Kurtzweil, Jian Peng, Jillian Nickell, Jing Dong, Jordan Goebig, Julia Pollack, Kathryn Faith, Kong Lab, Kristen Farley, L. Brian Stauffer, Lori McClain, Martha Oehmke Loustanaunau, Michael Jeffords, Michael Vincent, Mirhee Lee, Mogana Das Murtey, Mohammed El-Kebir, Nicholas Georgiadis, Nicholas Vasi, Nigel Goldenfeld, Nilmani Singh, Palash Sashittal, Patchamuthu Ramasamy, RIPE project, Samantha Zambuto, Sara Pedron Haba, Skye Faucher, Steph Adams, Sue Post, Taher Saif, Thomas Gaj, Tim Gernat, UI Public Affairs, University of California, Davis, Ursula Ruiz Vera, U.S. Civil Rights Trail campaign, Wikimedia Commons, Yunan Luo, Zhiru Liu.



LET US REMEMBER OUR
ACCOMPLISHMENTS IN 2020
AS WE MOVE ON TO NEW CHALLENGES
AND ACHIEVEMENTS IN 2021!



Carl R. Woese
Institute for Genomic Biology
Where Science Meets Society
igb.illinois.edu

@IGBillinois  

 @IGB.Illinois