2020 ANNUAL REPORT

Prepared for the Wisconsin Alumni Research Foundation Board of Trustees

MORGRIDGE
INSTITUTE FOR RESEARCH

A partnership built on trust, nimbleness and flexibility

Some of you may recall a long-running 1990s television commercial series by the chemical company BASF, running under the theme: "We don't make a lot of the products you buy. We make a lot of products you buy better."

It was a fairly brilliant approach for a decidedly behind-the-scenes company that focuses on materials science to enhance thousands of everyday products. They don't make jeans, they make them bluer. They don't make jets, they make them lighter. They don't make speedboats, they make them faster.

I'm reminded of this series when I think about the Morgridge Institute's inspired relationship with the University of Wisconsin-Madison. Morgridge was founded roughly 15 years ago to, in part, bring the benefits of a private research model to a great public research university, helping it move more quickly into uncharted research territory. Our question has become: Like the chemical company, can we serve as a catalyst to make a great biomedical research initiative even better?

Even though we're a small entity by comparison — 16 lead investigators, about 150 employees — when we do our job right, we punch well above our weight in terms of campus impacts. And also like BASF, we're comfortable taking a back seat to the university in terms of public recognition.

The Wisconsin cryo-electron microscopy initiative may be our best example yet of how the partnership works. This decade-long effort reached its zenith in 2020 when new UW–Madison biochemistry professor and Morgridge affiliate Elizabeth Wright led the charge to make UW–Madison a national research and training hub for cryo-EM. The National Institutes of Health will provide UW–Madison $22.7 million over five years to bring more scientists into the cryo-EM field, which has the potential to impact every corner of medicine.

But the behind-the-scenes story is quite remarkable. About eight years ago, biochemistry faculty recognized that the university had fallen behind in this important new field, and dramatic steps would be needed to stay competitive. Biochemistry took the clear lead in this effort. Despite the department's strong financial capabilities, this was going to be too expensive to do entirely on its own. Because of our very early collaboration at the inception of this project, Morgridge became biochemistry's lead partner and helped secure other campus investors. By 2018, more than $16 million had been committed to core infrastructure around cryo-EM.

That partnership helped attract a superstar like Wright, who came to campus after having built a cryo-EM initiative from scratch at Emory University. She could see the commitment here to being leaders in this field. When NIH saw Wright's proposal, they actually convinced her to not just to apply for a regional center, but to be the national hub. We had the talent and infrastructure in place to make it happen.

“As the institute was conceptualized by WARF trustees, John and Tashia Morgridge and campus leaders, they recognized the importance of pairing UW–Madison with a private research partner, giving us competitive attributes that many other major research universities — mostly along the coasts — have been enjoying for decades.”

Since Wright’s hire, biochemistry has hired two new cryo-EM faculty and Morgridge added its newest PI — cryo-EM imaging software expert Tim Grant — to the talent pool. We also plugged in expertise from Morgridge’s research computing theme — including Miron Livny and Brian Bockelman — to build a tailored computing infrastructure to support this massive endeavor.

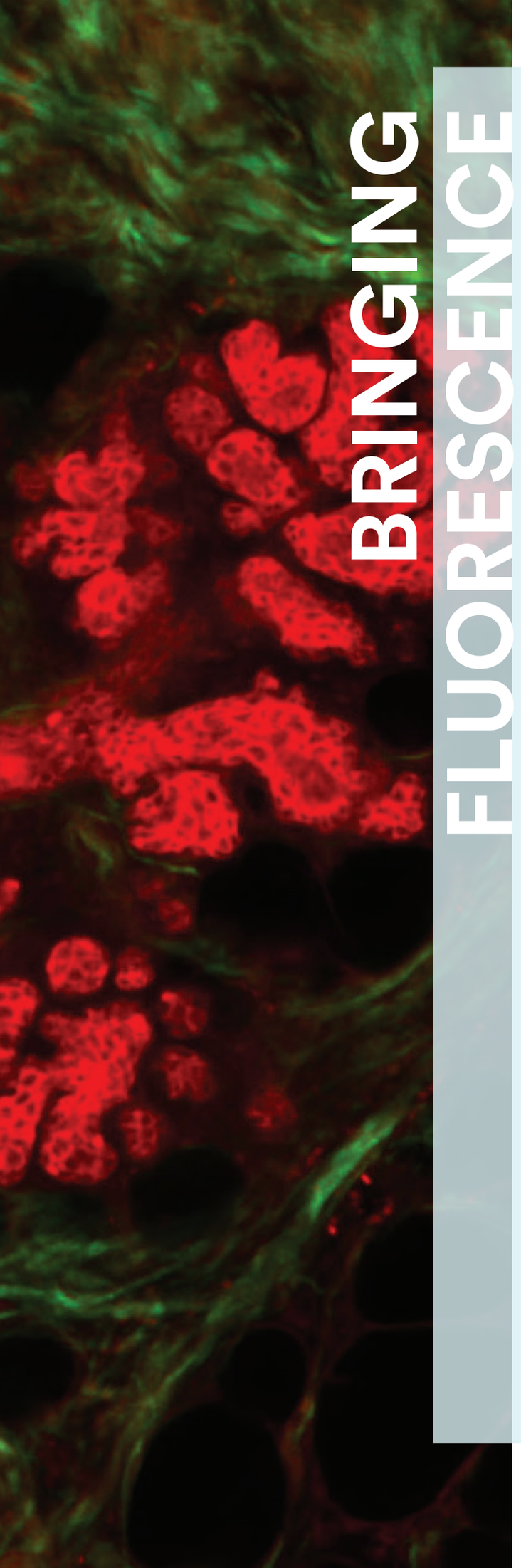
Our flexibility and ability to take reasoned risks came in handy throughout the process. For example, one key component of the microscope was slated to take up to ten months for delivery under university procurement rules. We were able to switch that to a Morgridge expense and get the key component delivered within a month.

None of this would have been possible without the leadership and vision of the Wisconsin Alumni Research Foundation Board of Trustees, along with John and Tashia Morgridge. As the institute was conceptualized, they both recognized the importance of pairing UW–Madison with a private research partner, giving us competitive attributes that many other major research universities — mostly along the coasts — have been enjoying for decades.

As WARF trustees, I hope you take great pride in having the foresight to back this bold initiative for Wisconsin science, and for continuing to help us pursue basic research that will drive the next advances in human health. This report highlights some recent successes — as well as some directional pivots — during our pandemic-altered year.

My best,

Brad Schwartz,
CEO, Morgridge Institute for Research



BRINGING FLUORESCENCE

IMAGING OUT OF THE DARK

It's not often that a new surgical imaging technology is inspired by pure darkness.

That is one way of looking at the origins of OnLume, a Morgridge Institute spinoff company that is working to bring a new generation of fluorescence image-guided surgery to hospitals everywhere.

Because fluorescence imaging is extremely sensitive to ambient light, physicians currently cannot use it on patients in real time during surgery without hurting the quality of the image. They have to interrupt the procedure and turn out the lights to see the fluorescent agents — which are critical tools for illuminating nerves and veins, and defining the precise location of diseased tissues.

OnLume has developed a novel system that removes the ambient light from the fluorescence guided procedure, all while the operating room environment remains bathed in light. The company had a banner year in 2020, when it received Food and Drug Administration (FDA) approval, met its venture funding goals and launched its first clinical trial with a California company. And they are working closely with UW Health physicians to get expert feedback and data on the device.

"The surgeon response has been very positive," says Adam Uselmann, co-founder and Chief Technology Officer of OnLume. "Especially with folks who are using competing technology that requires a darkened operating room, there's definitely been a kind of 'ah-ha' moment, where the light bulb goes on. It's been great to see."

After Uselmann completed his medical physics PhD in early 2015, he co-founded OnLume with colleagues at Morgridge's medical engineering lab, at the time directed by his adviser Thomas "Rock" Mackie. Uselmann landed

"We coordinated with the Fab Lab on some of the first embodiments to demonstrate proof-of-concept for a WARF IP filing."

— ADAM USELMANN

a postdoctoral position at Morgridge in 2015 and began developing non-surgical applications of the technology in earnest. On nights and weekends, he worked on the OnLume business plan and other company details.

The technology had a broad range of Morgridge involvement, including co-inventors Mackie, Fab Lab Director Kevin Eliceiri, and scientist Andreas Velten. Morgridge also was a key collaborator on the company's first Small Business Innovation Research (SBIR) grant in 2016.

"Working at Morgridge was very instrumental, not only in having the intersection of expertise and ideas, but the resources to prototype it and make it happen, and then also be able to file our IP with WARF," Uselmann says.

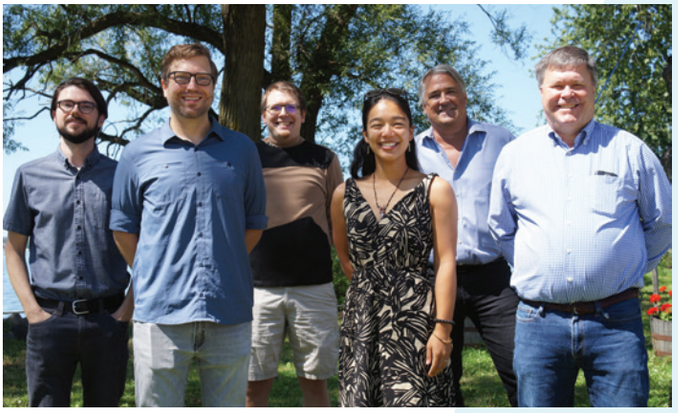
"We coordinated with the Fab Lab on some of the first embodiments to demonstrate proof-of-concept for a WARF IP filing," Uselmann says. We actually modified a vintage desk lamp with a 3D-printed assembly of LEDs that incorporated our transient lighting IP."

Adds Fab Lab Director Kevin Eliceiri: "Seeing the evolution of OnLume has been very gratifying, not only in terms of its significant potential for surgical impact but also seeing the great talent that has driven this company. One of the great deliverables of the Morgridge mission is our talented trainees and seeing what they do is inspiring to all of us."

The company's first clinical trial is with Alume Biosciences in San Diego, which develops technology to help protect nerves during head and neck surgeries. The company is also exploring applications in reconstructive surgery and will be pursuing the rapidly emerging field of fluorescence guided surgery for cancer.

In cancer surgery, for example, physicians would be able to see the boundaries of residual cancer in real time, as they are resecting the cancer tissue. And with head and neck surgeries, "the goal is to literally light up those nerves so surgeons can avoid damaging sensitive tissues."

"There are dozens of fluorescent agents currently in different stages of clinical trials," Uselmann says. "The opportunities in this space will be really huge moving forward. It's only the tip of the iceberg in terms of what will come as more cancer agents get approved by the FDA."



OnLume leadership (l to r): David Bunger, lead mechanical engineer; Adam Uselmann, CTO and co-founder; Daniel Seemuth, director of systems engineering; Christie Lin, director of research; James Bowman, CEO; and Greg Bange, senior director of regulatory affairs and quality assurance.

The company has eight employees and are actively expanding in 2021. OnLume has two manufacturing partners with home bases in Wisconsin. "Our goal this year is getting the technology into the hands of as many surgeons as possible," Uselmann says.

As a medical physics student, Uselmann was far removed from the fundamentals of starting and running a company. So in 2014 he enrolled in the UW–Madison business school's Morgridge Entrepreneurial Bootcamp, launched by John Morgridge. The course set him on a path to where he is today.

"I recommend it to every graduate student I can because it was just a really transformative experience. It's probably unlikely OnLume would have started the way it did without having gone through that experience."

THOMSON LAB LOOKS TO MAKE MAJOR HEALTH IMPACT WITH ARTERY ENGINEERING PROJECT

People suffering from a wide range of health problems need vascular transplants — replacing damaged arteries and veins. Cardiovascular disease accounts for one in every three deaths each year in the United States, more than all forms of cancer combined.

At the Morgridge Institute, stem cell pioneer James Thomson is leading a potentially transformational project to develop a safe and functional cell-based artificial artery that could be pulled from medical inventories and used by vascular surgeons.

"People with diabetes and sclerosis frequently suffer from blockage in the main arteries in their legs, a debilitating condition that often leads to amputation and even death," says Thomson. "So far, we have used artificial grafts made of synthetic materials. But as the grafts get smaller and smaller, they fail at a higher and higher rate. And for smaller arteries like in the heart, they aren't used at all."

Producing arteries in the lab requires two essential cell types: endothelial cells, which line the interior of blood vessels, and smooth muscle cells from pluripotent stem cells, Thomson says. In 2017, the Thomson Lab was able to generate and characterize endothelial cells. Now, its latest research focuses on the smooth muscle cells. Healthy smooth muscle cells need the ability to contract so they can distribute blood throughout the body and regulate blood pressure.

The lab is developing scaffolds from natural and synthetic materials to provide structure and shape for the artery. UW–Madison biomedical engineer Naomi Chesler is working on a bioreactor that provides an environment in which the arterial cells can grow around the scaffolding.

"There are still challenges, such as the body rejecting artificial arteries, and there is also a risk of cancer, so we have a lot of work to do," Thomson adds.

The lab has discovered a small molecule, known as RepSox, that has the best potential to produce cells with the properties that allow arteries to bend and stretch. The characteristics that make RepSox good for differentiating smooth muscle cells also make it a desirable drug candidate to reduce risk of post-surgery complications. "We are now seeing some hopeful results with peripheral artery disease," Thomson says.

Thomson adds that there is similar work taking place in Europe where they remove a vein, culture the endothelial cells for about a month, and then line the artificial vessels and put them back in, and they work about as well as veins.

The lab is hoping to create tissue with cells banked from a unique population of people who have genetic characteristics that help circumvent rejection. It has been estimated that about 100 different cell lines from this rare population would be enough to cover a majority of the U.S. population.

"If we can replace those cells in a way that is tolerated, it's probably going to work," Thomson says. "My confidence level is very high."

— JAMES THOMSON

Members of the artery engineering team (Left, top to bottom:) **Jue Zhang**, assistant scientist; **Matthew Brown**, affiliate; **Diana Tabima**, assistant scientist (Chesler Lab); **John Maufort**, assistant scientist; and **Mitch Probasco**, project manager/automation. Right: A bioreactor prototype.

BEYOND FUN

DISCOVERY OUTREACH STRENGTHENING BOND BETWEEN SCIENCE, SOCIETY

Laura Heisler and her Discovery Outreach team are growing an iceberg.

The visible part of that iceberg can be seen on a regular basis in the Discovery Building, through programs like Saturday Science, the Wisconsin Science Festival, summer camps and after-school programs. Tens of thousands of people of all ages participate in these programs every year, pursuing a seemingly unquenchable curiosity about the mysteries of life and the world.

But that mass of ice below the surface is equally important. It represents the hundreds of Wisconsin scientists, researchers and experts who are adding their voice to science engagement each year, searching for new ways to make their science relevant and exciting to the community.

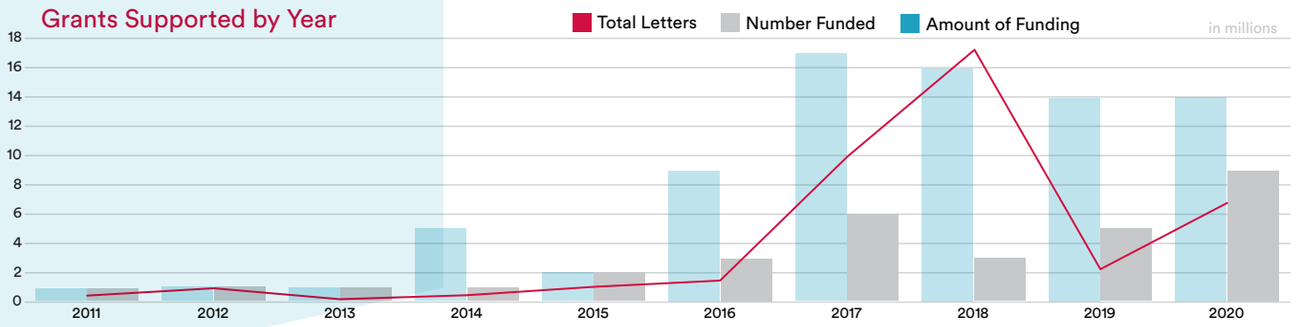
"The part that's below the water is the effort to work with researchers to expand their role in feeding this beneficial endeavor and this cycle of bringing more people into science," says Heisler, director of Discovery Outreach that is jointly supported by the Wisconsin Alumni Research Foundation and the Morgridge Institute.

"We want to create this sort of virtuous cycle that starts with great programs that are a magnet for the public," she adds. "And the greater the programs are, the more researchers want to get connected to them as a way of growing their skillsets."

Known formally by federal funding agencies as "broader impacts," connecting scientists with the public is increasingly seen not as an "extra," but as an essential outcome of quality research. But it doesn't simply

"We are facing catastrophic challenges of climate change, declining water resources, and current and future pandemics. I would like to see efforts like ours contribute to breaking down the mistrust of expertise and othering of society and science."

— LAURA HEISLER



happen; Wisconsin scientists need support and expertise to create programming that resonates with the public, and especially programs that enhance K-12 science literacy.

Discovery Outreach has helped UW–Madison and Morgridge scientists generate 102 letters of support in their federal grants, including 22 still in process.

But what's most exciting is that Discovery Outreach is averaging a 40 percent success rate for supporting federal grant funding. The national average is between 30 and 35 percent. And in total, the outreach team has helped net $41.5 million in federal funding for UW–Madison investigators.

Travis Tangen, education and outreach manager for Discovery Outreach, says a lot of their success stems from taking full advantage of the Discovery Building, with its massive open spaces for public events and high-tech teaching labs for both students and educators. It's a major competitive advantage for taking programs to the public.

"Sometimes it's sharing proven strategies that jumpstart conversations with the public, just a 10-second change," Tangen says. "But that 10 seconds can make a huge difference in a scientist connecting as a person first and allow for the shield of expertise to not be a barrier for the public to relate to science."

These programs put a smile on peoples' faces and make science fun and approachable. But that unseen chunk of the iceberg — fostering societal trust in science — is always there.

"We are facing catastrophic challenges of climate change, declining water resources, and current and future pandemics," says Heisler. "I would like to see efforts like ours contribute to breaking down the mistrust of expertise and othering of society and science."

Highlights of the first 10 years:

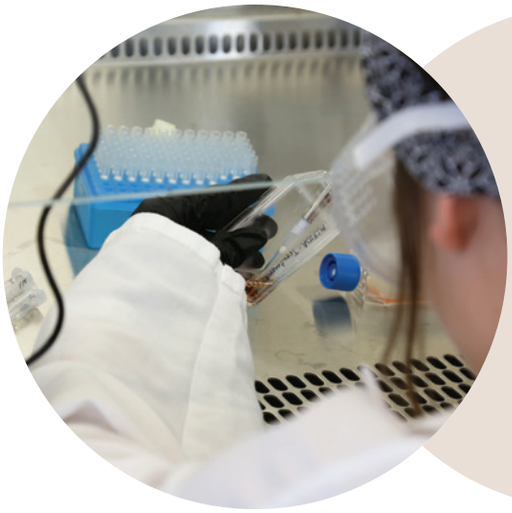
- **Wisconsin Science Festival grows:** What began as a Madison-centric event engaging a few thousand people now has a statewide footprint, with more than half of all programming taking place outside of Dane County with 30,000-plus annual participants.
- **Bringing science to students:** Since 2007, the Rural Summer Science Camps have brought cutting-edge Morgridge science to 400-plus rural high school students from more than 70 Wisconsin schools districts.
- **Meet the Lab:** A new partnership with PBS Wisconsin and Discovery Outreach is creating in-depth research education modules for middle schoolers. The first two modules featured the Melissa Skala Lab and the Tiny Earth Lab at the Wisconsin Institute for Discovery.
- **The story of 2020: digital engagement.** While the COVID-19 pandemic all but eliminated in- person programming for the year, it triggered a successful pivot to webinar-based programs that in many cases attracted more people from a broader range of communities.
- **Saturday Science.** Discovery throws open its doors once a month for a hands-on science free-for-all, typically bringing in 500-plus children and families on themes ranging from bioblitzes to space exploration.

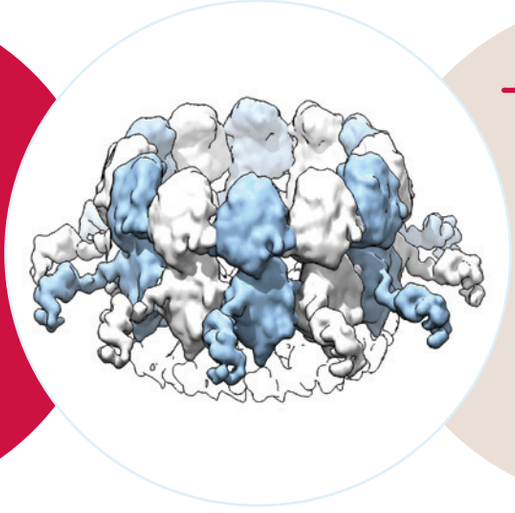
2020 MILESTONES

The COVID-19 pandemic took everyone by surprise, but teams at the Morgridge Institute continued pushing science and engagement forward through collaboration and innovation.

Students discover their science identity

The Summer Science Workshop Series sparked enthusiastic engagement between high school students and Morgridge scientists through storytelling and the diverse paths leading to scientific careers.





Zooming in on a viral crown

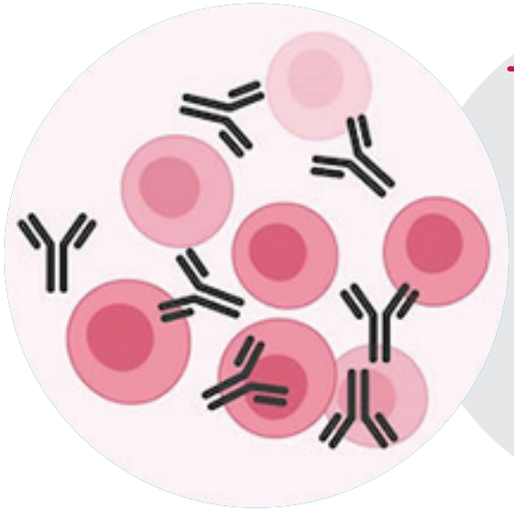
The Paul Ahlquist Lab generated near-atomic resolution images of a major viral protein complex responsible for replicating the RNA genome of a member of the positive-strand RNA viruses — the large class of viruses that includes coronavirus and other pathogens.

Evasive parasites

Postdoctoral Fellow Jayhun Lee in the Phil Newmark Lab discovered how schistosomes, parasitic worms that infect more than 200 million people in tropical climates, use their esophageal gland to help survive the host's immune defenses.

Fearless Science Seminar debuts

The new Morgridge speaker series, which features scientists and collaborators discussing innovative biomedical research, has attracted hundreds of viewers across the state and nation during its 2020 debut. Topics for 2020 focused on the coronavirus and COVID-19 and in future years will target other areas of Morgridge research leadership.



Illuminating T cells

The Melissa Skala Lab developed an imaging method to measure T cell activity by observing the natural autofluorescence. The method could help assess T cell involvement in cancer treatments or other immunotherapies.

Computing collaboration

High-throughput computing got a boost through a $22.5 million NSF grant to fund The Partnership to Advance Throughput Computing (PATh) collaboration, led by Miron Livny.

MORGRIDGE SCIENTISTS SEIZE THE MOMENT

RESEARCHERS WORK TO END COVID-19 PANDEMIC

Even as the COVID-19 pandemic forced biomedical labs around the nation to scale down, many scientists at the Morgridge Institute are taking on new research challenges to help understand the novel coronavirus and defeat the viral outbreak.

The John W. and Jeanne M. Rowe Center for Research in Virology has contributed to a fundamental understanding of how viruses work for decades, and its expertise and technologies are uniquely suited today to accelerate discovery related to coronaviruses.

Other Morgridge research teams in metabolism, regenerative biology and medical engineering are also making important contributions.

Here is a look at Morgridge efforts to lend expertise to the crisis.

A wake-up call for the need for new antiviral weapons

Given the death toll and multi-trillion dollar costs of COVID-19, it's not hyperbole to suggest that an effort on the scale of the Space Race is needed to break the cycle of viral pandemics.

Those threats underscore the need for dramatic new approaches to fighting viruses, says Paul Ahlquist, lead investigator in the John W. and Jeanne M. Rowe Center for Research in Virology.

The Ahlquist Lab is looking for longer-term answers by deciphering the molecular mechanisms by which viruses replicate and spread, to identify their vulnerabilities.

The lab has been working to gain a fundamental understanding of how viruses work, to produce new ways to arrest their spread, and potentially to prevent or more quickly quell future pandemics.

"We've got to get to know the enemy. Our recent work on one crucial class of viral processes is akin to, for the first time, taking the cover off a machine and seeing the inner workings."

— PAUL AHLQUIST, JOHN W. AND JEANNE M. ROWE CHAIR IN VIROLOGY

Albany, Wisconsin teams search for molecular clues to defeat COVID-19

In the COVID-19 pandemic, many hospitals are racing to maintain quality care for patients with severe disease while facing a shortage of resources and limited understanding of the novel coronavirus.

In April 2020, the Josh Coon Lab launched a project with Dr. Ariel Jaitovich, a pulmonary and critical care physician at Albany Medical Center in New York, to analyze blood samples from 128 sick patients from the Albany Medical ICU — 102 samples were from patients with COVID-19, and 26 samples were identified as non-COVID-19 controls.

The researchers created a database of more than 17,000 different proteins, metabolites, lipids, and RNA transcripts that have an association with clinical outcomes. They identified 219 molecular features that correlated strongly with COVID-19 severity.

Many of these molecules and genes are involved in blood vessel damage and blood coagulation, as well as dysregulation of several processes involved in the immune response — results that have also been independently published in other research studies.

The data were also then analyzed by Morgridge bioinformaticists including computational biologists Ron Stewart and Scott Swanson, and postdoctoral fellow Matt Bernstein. They provided RNA-sequencing to help identify unique gene expression profiles.

Together, the team made their findings available on the pre-print server medRxiv and published the results of this collaborative study in October in a collaborative study in *Cell Systems*. You can learn more by visiting the interactive web tool covid-omics.app, a free public resource for the scientific community.

“We want to help people. We want to spend some energy in this terrible time to see if we can help the suffering people…that was the primary driver.”

— DR. ARIEL JAITOVICH, PHYSICIAN AT ALBANY MEDICAL CENTER

Chronicling pandemic science in real time

In the span of six months, thousands of the world's trained scientists have pivoted their focus to the COVID-19 pandemic, making it one of the largest and fastest-moving research efforts ever assembled.

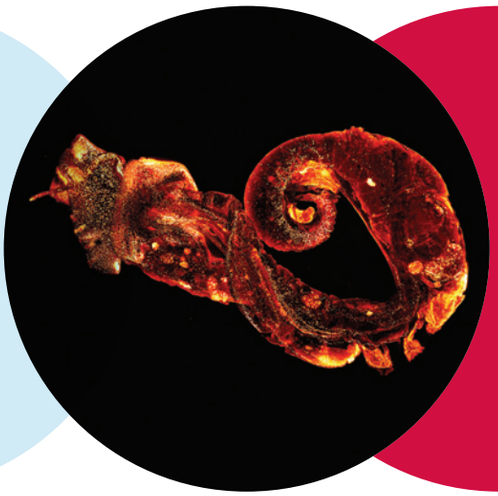
Virology investigator Anthony Gitter co-developed a software tool called Manubot to help orchestrate a rapid expert assessment of COVID-19 diagnostics and therapeutics. The tool is contributing to an international collaborative effort to organize and consolidate the rapidly emerging scientific literature related to SARS-CoV-2 and COVID-19.

"How can we crowdsource expert knowledge about a topic that's too big and growing too rapidly for any one lab, or any one small team of collaborators, to really know everything? We bring in people who have the expertise to be peer reviewers of these manuscripts, form a collective opinion about them, and try to summarize the different approaches that might advance treatment."

— ANTHONY GITTER, MORGRIDGE VIROLOGY INVESTIGATOR

“On one hand, it is possible that interactions will happen between the repurposed drug and the comorbid diseases that cause side effects and drug intolerance. On the other hand, we can find and repurpose drugs with comorbidity in mind, limiting the number of drugs needed.”

— KALPANA RAJA, POSTDOCTORAL RESEARCH ASSOCIATE



Could pre-existing conditions hold the clue to new COVID-19 drugs?

The deadliest cases of COVID-19 often arise in patients with a variety of pre-existing conditions, known to medicine as "comorbidities."

Morgridge investigator Ron Stewart, associate director of bioinformatics; and Kalpana Raja, postdoctoral research associate; have devised a literature-based discovery system called TripleMiner that could speed up the race to repurpose drugs to help in the battle against COVID-19.

TripleMiner's data frontier is the enormous PubMed database, which contains more than 30 million abstracts of published medical research articles dating back decades. By pairing searches for COVID-19 treatments, of which more than 40,000 articles have already been produced, with known related diseases, they hope to find a bounty of drug candidates worthy of deeper investigation and clinical trials.

Using nanobodies to fish for coronavirus clues

A new project intended to shed light on planarians — remarkable flatworms capable of almost limitless regeneration — is being repurposed to focus on the novel coronavirus causing COVID-19.

Phil Newmark's lab originally planned to use nanobodies to learn more about key proteins in planarians and schistosomes. Nanobodies are antibodies that happen to be extremely small, roughly one-tenth the size of antibodies produced by humans.

Newmark recognized that nanobodies would also be valuable tools for the study of SARS-CoV-2 with the potential to advance our fundamental understanding of the virus, and identify targets of diagnostic and therapeutic value. The project is led by visiting assistant scientist John Brubacher.

"Essentially what I'm doing is using the coronavirus spike protein as bait to try to fish yeast cells out of that library that bind to that particular protein."

— JOHN BRUBACHER, VISITING ASSISTANT SCIENTIST

INVESTING WITH THE UNIVERSITY

New national imaging center has potential to transform medicine

A national research initiative announced in September will place the University of Wisconsin–Madison at the forefront of a revolution in imaging fostered by cryo-electron microscopy and cryo-electron tomography — technologies that can illuminate life at the atomic scale.

The National Institutes of Health (NIH) will provide $22.7 million over six years to create a national research and training hub at UW–Madison that will enable scientists across the country to gain access to this game-changing technology.

Cryo-EM has the potential to impact every corner of medicine, from Alzheimer's disease to vaccine development, protein and cellular engineering and many other areas across all aspects of life sciences research.

"One of the most exciting parts of the project will be bringing new investigators into the cryo-ET field," says lead investigator Elizabeth Wright, a UW–Madison professor of biochemistry and affiliate with the Morgridge Institute for Research. "This will help everyone in biological science research because discoveries made here will have the potential to be translated into new therapeutics and drug targets that benefit humanity."

One major aim of the NIH initiative is to bring more scientists into the game. Cryo-EM and cryo-ET are still young technologies with a limited workforce and very low access to the necessary equipment and expertise. The creation of four new centers — others will be at Stanford University, the University of Colorado-Boulder, and the New York Structural Biology Center — are meant to provide access to advanced instrumentation for cryo-ET, train a new workforce, and continually improve the technology while also providing new research discoveries.

UW–Madison became a cryo-EM leader thanks to a decade-long investment beginning around 2010. The Department of Biochemistry in the College of Agricultural and Life Sciences (CALS) took the lead and the Morgridge Institute joined with significant financial and organizational support. The investment attracted partnerships with the Office of the Vice Chancellor for Research and Graduate Education (OVCRGE), the School of Medicine and Public Health (SMPH) and several other campus units.

The Morgridge Institute served as an important early catalyst in bringing cryo-EM tools and talent to Madison. Morgridge virology investigator Paul Ahlquist was key in the campus-wide team effort that put UW–Madison on the map as a cryo-EM leader.

Welcoming Tim Grant

New investigator unravels cellular machinery

A new piece in the campus-wide puzzle of cryo-electron microscopy (or cryo-EM) is in place, as Tim Grant joined the investigator team of the Morgridge Institute for Research in March of 2020.

Grant is an expert on new methodologies to enhance images being generated from this game-changing technology. As an investigator at the institute's John W. and Jeanne M. Rowe Center for Research on Virology, Grant will have the opportunity to partner with UW–Madison biologists to help perfect new tools that see deeper into cellular machinery.

Cryo-EM is a revolutionary imaging technology that allows biologists to see the structure of molecules within cells. Scientists can explore the very cellular surfaces where drugs and proteins interact, or where viruses orchestrate their cellular attacks. Simply, Cryo-EM could transform the development and delivery of precision medicine.

Grants says cryo-EM can contribute to an exciting future in cellular biology. It may help produce a complete molecular map of a cell, with all the topographic peaks and valleys where interactions take place.

Grant is the author of an open-source software platform called CISTM, one of the top programs on the market to help derive detailed and precise 3D structures from cryo-EM data. More than 350 scientists and industry leaders are using the platform.

"As a basic research nonprofit, we have the ability to act quickly and make these kinds of strategic partnerships and investments in new frontiers of science."

— BRAD SCHWARTZ, CHIEF EXECUTIVE OFFICER

Bioethics Program at the Morgridge Institute

The Morgridge Institute's strategic focus on bioethics continues to pay dividends across UW–Madison, reinforcing how strong bioethics principles are the backbone of sound biomedical science.

Over the past year, the program continued to provide expert research consultation services during the pandemic, in addition to continuing scholarship and research with collaborators at Harvard University and the Broad Institute. And the third annual Morgridge Ethics Cartooning Competition drew more than 70 contestants to highlight the social and ethical impacts of their research.

New NIH research and scholarship

The Promoting Resilience project, part of the NIH-funded HEALthy Brian and Child Development (HBCD) project, has assessed legal risks of research involving women who use opioids during pregnancy by coding the relevant laws of 28 states so far. The Bioethics team created a chart that allows people to quickly assess legal risks to research participants of various research activities, such as testing pregnant women for illegal substance use or testing their newborns for illegal substances present at birth. The team next plans to create a website to display this information and move the chart online.

New collaboration with Harvard University, Broad Institute

The Bioethics Program submitted a new NIH grant proposal in collaboration with Harvard University and the Broad Institute. The proposal seeks to undertake scholarship on race and genetics that can help researchers think through the issues carefully.

Pilar Ossorio, in collaboration with Alexandra Shields (Harvard), aims to develop technical methods to ensure that polygenic risk scores (PRS) are generalizable to people from a broad range of genetic ancestries. Polygenic risk scores sum the risk created by many small genetic polymorphisms across a person's entire genome. For instance, a PRS for heart disease would sum many small but significant genetic risks to create a single heart disease risk score for a person. This can easily slip into "race-based" science and into science that reinforces stereotypes of human races as genetically separable and separate groups.

Ethics consultations continue during COVID-19

The Research Ethics Consultation Services continues despite the slowdown in research during COVID-19. The program helped researchers modify protocols to make research with humans safer during the outbreak.

One consultation this past year explicitly addressed questions related to COVID-19. The researchers were concerned about how best to modify the approved protocol in light of higher background risks to participants if they come to the UW Hospitals and Clinics for research visits, and how to conduct remote research activities while complying with ethics regulations and guidelines.

Celebrating the third annual Cartooning Contest

Four prizes were awarded in the third annual Ethics Cartooning Contest, which invites participants to make a cartoon on any ethical issue related to biomedical research.

The competition drew 72 entrants from more than 39 different departments and programs at the University of Wisconsin–Madison and affiliated research institutions.

A panel of three judges applied the following criteria to the competition: depiction and analysis of a research ethics issue, humor, and artistry. Charlotte Kanzler, a first-year graduate student in the UW–Madison Cellular and Molecular Biology program and a member of the Phil Newmark Lab, took the top prize.

Kanzler's winning cartoon explores the complexity of environmental advocacy when scientific laboratories are dependent on single-use plastics.

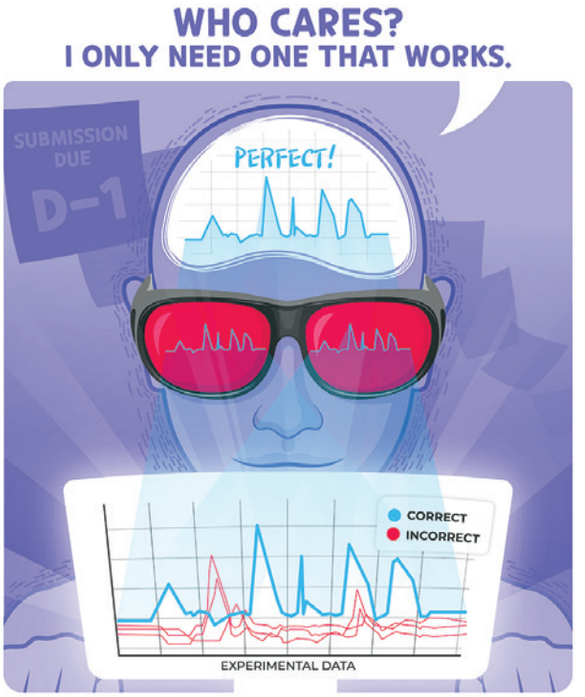
"I wanted to do a piece based around plastic use because it's often something I've heard joked about, by myself as well, in the lab: 'Ha, I'm killing the environment, I used 10 boxes of pipette tips today,'" says Kanzler. "Researchers who are often conscientious in their home life with recycling, purchasing green energy, or driving efficient cars, then turn a blind eye to their plastic use once they cross the threshold of the lab."

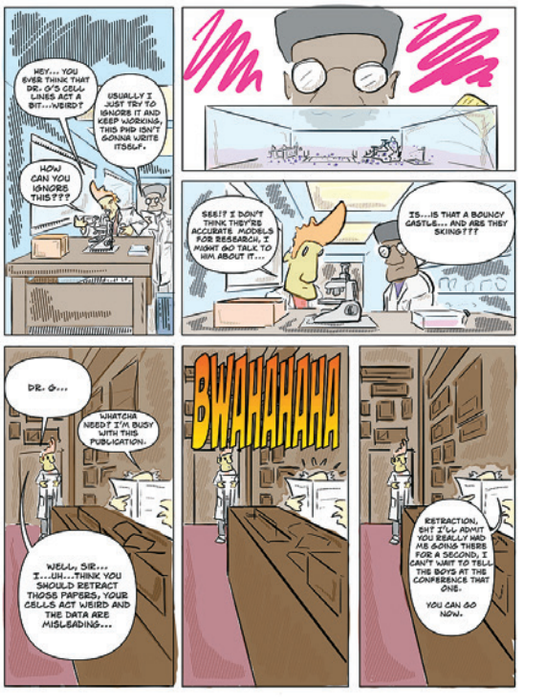
Single-use plastics are often indispensable to many laboratory workflows, and the cost is necessary to ensure sterile handling to avoid cross contamination of samples. However, Kanzler believes there is a way to adopt "green" practices and produce less waste.

"It would require a large paradigm shift on the part of research institutions and biotech companies, but there are stories of individual labs adopting practices that drastically reduce their plastic use with thought, effort, and trial and error," she says.

First Prize: **Charlotte Kanzler**, Cellular and Molecular Biology

"No pressure..."





Clockwise – Second Prize: **Lena Vincent**, Wisconsin Institute for Discovery
Third Prize: **Noah Trapp**, School of Medicine and Public Health
Honorable Mention: **Dasom (Somi) Hwang**, Biotechnology Center

NEWS & HIGHLIGHTS FROM 2020

Morgridge community earns honors, awards

Stem cell pioneer and Morgridge investigator **James Thomson** was named to the Power List 2020 for his contributions to advancing the field of medicine to save lives and improve the world.

Jan Huisken, medical engineering investigator at the Morgridge Institute for Research, was awarded the 2020 Lennart Nilsson Award for outstanding achievements in biological imaging.

OnLume Surgical, a spinoff company originating from Morgridge Institute for Research, received a 2020 Wisconsin Innovation Award. The company, which develops precise fluorescence for image-guided surgery, was chosen for the award from more than 400 nominees.

Morgridge Institute investigator and UW–Madison biomedical engineering professor **Kevin Eliceiri** was elected a fellow by The Optical Society, an honor given to only one in 10 members.

Computer Sciences Professor **Miron Livny** received the 2020 IEEE Technical Committee on Distributed Processing (TCDP) Award for Outstanding Technical Achievement and the 2020 IEEE TCDP ICDCS High Impact Paper Award. IEEE is the world's leading professional organization for the advancement of technology. The awards recognize his contribution to high-throughput computing and the field of distributed systems over the last 40 years.

Morgridge Affiliate **Dominique Brossard** and Morgridge Investigator **Joshua Coon** are 2020 recipients of Kellett Mid-Career Awards, given by the Wisconsin Alumni Research Foundation every year to recognize mid-career excellence.

Principal Investigators

Paul Ahlquist, John W. and Jeanne M. Rowe Center for Research in Virology

Brian Bockelman, Research Computing

Jason Cantor, Metabolism Research

Joshua Coon, Metabolism Research

Kevin Eliceiri, Medical Engineering

Jing Fan, Metabolism Research

Anthony Gitter, John W. and Jeanne M. Rowe Center for Research in Virology

Tim Grant, John W. and Jeanne M. Rowe Center for Research in Virology

Laura Heisler, Discovery Outreach

Jan Huisken, Medical Engineering

Miron Livny, Research Computing

Pilar Ossorio, Bioethics Scholar in Residence

Phil Newmark, Regenerative Biology

Melissa Skala, Medical Engineering

Ron Stewart, Regenerative Biology

James Thomson, Regenerative Biology

Faculty Affiliates

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Matthew Brown, Regenerative Biology

Rick Eisenstein, Metabolism Research

Elizabeth Meyerand, Medical Engineering

Deane Mosher, Metabolism

Dave Pagliarini, Metabolism

Dietram Scheufele, Discovery Outreach

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Justin Williams, Medical Engineering

Elizabeth Wright, John W. and Jeanne M. Rowe Center for Research in Virology

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“The general public really needs to understand the importance of trial and error in the scientific process. It’s one of the reasons we value public engagement so much at the Morgridge Institute, because it gives people a real window into how science is done. When people understand that scientists are constantly building on our often incomplete understanding of how biology works — and that new information tomorrow could change the way we think about something important — we stand a much better chance that they will continue to have confidence in the scientific enterprise.”

— BRAD SCHWARTZ, CHIEF EXECUTIVE OFFICER


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