



MORGRIDGE
INSTITUTE FOR RESEARCH

FALL 2020

YOU make a difference

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A SPECIAL REPORT
FOR SUPPORTERS OF THE
MORGRIDGE INSTITUTE
FOR RESEARCH



BRAD'S UPDATE

Why science matters

Since I last wrote to you, science has been at the top of everyone's mind — the unknown novel coronavirus, the mystery of the disease's severity, and the need for a safe, effective vaccine to end the pandemic caused by the SARS-CoV-2.

In spring, Morgridge teams quickly pivoted to respond to COVID-19. Scientists in virology, metabolism, regenerative biology and medical engineering took on new research challenges to help understand the virus and defeat the outbreak.

As a private, biomedical research institute we are uniquely positioned to rise to the pandemic's challenge.

And thanks to donors like you, the institute quickly deployed resources to help scientists tackle coronavirus research.

In this report, you will see how your support is making a difference.

Right now, the John W. and Jeanne M. Rowe Center for Research in Virology is contributing fundamental information about how viruses replicate to accelerate discovery on coronaviruses.

And this spring, the Coon Research Group partnered with Albany Medical Center in New York to unveil the molecular signature in plasma of people with COVID-19 and highlight the disease's range of severity.

You can also read about the effort to move the annual in-lab, on-campus Rural Summer Science Camp into an online experience in response to the pandemic. We deeply missed having high school students and teachers in the Discovery Building, but the new workshop series increased access and provided so many

new opportunities for students to talk to Morgridge scientists and imagine their own paths in science.

Those are just three stories made possible by your support.

As we look ahead, it is clear that the eyes of the world and our nation are on scientists and public health experts. Many of you have seen pandemic recommendations and safety guidelines change over these past few months. These changes can seem disconcerting and disconnected, but they reflect what we are learning about a new disease that we hadn't seen before.

Our reputation as scientists doesn't depend on always being right the first time. Our reputation relies on the integrity to never stop searching for answers and correcting our knowledge according to what we discover. This is the pursuit of fearless science.

Scientists are constantly building on an often incomplete understanding of how biology works. New information could — and does — change the way we think about something important. Morgridge scientists embrace these challenges because there is always more to understand, learn, and question.

I hope you enjoy this report. And I want to thank you for believing in the pursuit of science that will change lives. Your generosity invigorates us in this journey.

Brad Schwartz, M.D.
Chief Executive Officer
Morgridge Institute for Research

P.S. Your voice matters. If you have any questions about the stories in this report, please don't hesitate to contact me at giving@morgridge.org





HELPING HIGH SCHOOL STUDENTS FORM THEIR SCIENCE IDENTITY

DONORS SUPPORT A NEW, DIGITAL EXPERIENCE

Now in its 14th year, the Rural Summer Science Camp celebrated a new milestone: an entirely digital experience.

The camp, which typically enrolls 75 high school students and 15 science teachers from rural districts across Wisconsin, invites participants to the University of Wisconsin–Madison for a weeklong camp at the Morgridge Institute for Research.

But the novel coronavirus presented a significant hurdle in spring 2020. It would not be safe to bring students and their teachers to campus for the annual event.

Thanks to support from donors like you, the Discovery Outreach team

pivoted quickly. They created an entirely new, digital experience in the Summer Science Camp Workshop Series.

The workshop series, which wrapped up in late July, brought more than 100 students and 15 teachers “face-to-face” to learn online from scientists at the Morgridge Institute. The students and teachers logged on from 18 school districts in the Wisconsin Rural Schools Alliance and the Upward Bound program that focuses on underrepresented and first-generation pre-college students.

While the usual in-person, on-campus Rural Summer Science Camp focuses on hands-on activities, this year’s

digital workshop leaned heavily into storytelling and the diverse paths leading toward a career in science.

Over six weeks, the students and teachers clocked 400 engagements with scientists working in the fields of metabolism, regenerative biology, medical engineering, medical imaging, and more.

Through weekly Zoom calls, the students met with scientists, heard their personal stories, and began imagining their own paths into science, says Dan Murphy, outreach and lab manager at the Morgridge Institute.

“There isn’t one way, or the right way, to become a scientist,” says Murphy. “We don’t want to teach the students how to pipette. We want to teach them that they could be the pipetter.”

For many high school students, the annual summer camps are the first time they meet a career scientist.

During the workshop, students could select a morning or an afternoon lecture, and to Murphy’s surprise, many participated in both sessions. The students learned about the latest research at the Morgridge Institute, went on “behind-the-scenes” lab tours, and had Q&A time with the scientists.

“The students saw an example of someone they can relate to. They could see, ‘Oh yeah, that could be me. It’s possible, I can think like that! I can ask questions that I’m curious about,’” Murphy says.

The Discovery Outreach team is still collecting feedback from participants, but Murphy says personal storytelling

really helped students think about forming their own science identities this summer.

“The opportunity opens up new possibilities for students and gives them the idea that UW–Madison is attainable for anyone,” wrote a participating rural high school teacher. “I am so thankful that this opportunity existed this summer for our students.”

Ross Soens, a graduate student in the Cantor Lab, said the summer workshop was a great way to work on his science communication skills, and to remember where he started as a budding scientist.

“I, too, was once a high school student in Wisconsin, and it was through the efforts of committed and enthusiastic teachers that I found myself on my current scientific career path,” Soens says.

Soens added that science can sometimes seem “out-of-reach” or “too difficult” for a high school student. But he felt committed to showing how accessible science can be. And, Soens says, it’s always fun to tell students about the “awesome



science” happening not far from their hometowns.

It’s unclear what the next summer experience will be like, but Murphy isn’t dissuaded.

“It’s going to be something new. And that’s exciting,” he says. “We’ve learned more. We have new connections. We want to continue to expand the opportunities and access to everyone in Wisconsin.”

Teachers say the camps make a difference

Lori Martin, a science teacher at Kickapoo High School located just outside the Village of Viola, attended the camp in 2014 with five students. She says the experience propelled her students’ interest in the sciences and helped them understand possible careers — and the ways to get there.

During the 2014 camp, she was wowed by her students’ final poster presentations held on the last day. Martin was so impressed that she incorporated more opportunities for mini-posters or project presentations in her science courses.

“I felt this was my way of implementing some of the summer science camp activities in my own classroom,” Martin says.

That sentiment was also felt by Molly Carlson, a science teacher at Mauston High School, who attended the 2019 camp with six female students. Mauston enrolls just under 500 high school students, with about 40 percent of the families experiencing economic hardship.

Prior to attending the camp, Carlson had created a biotechnology class at Mauston. But she wondered, and worried, if the course was the right fit.

“I didn’t know if there was going to be enough interest,” Carlson says of the biotechnology class. “But after going through the camp, I was like, ‘I need to double down. This is great, authentic, important science.’”

Carlson adds that the summer experiences reinforce exploration and paths to science careers.

“That is super important to help the students visualize themselves and to say, ‘Hey, I can do this,’” Carlson says.



2020 Participating Schools

- ▶ Baraboo High School
- ▶ Blair-Taylor Middle-High School
- ▶ Clinton High School
- ▶ Forward Service Corporation – Upward Bound (7 program sites)
- ▶ Ithaca School District
- ▶ Kickapoo School
- ▶ Mauston High School
- ▶ Montello Junior/Senior High School
- ▶ Prentice High School
- ▶ Southern Door High School
- ▶ Tomah High School
- ▶ Waupaca Learning Center

About the Rural Summer Science Camp and the Summer Science Workshop Series

Since 2007, the summer experiences have helped more than 400 rural high school students from nearly 70 state high schools. The camps and workshop have always been offered free of charge thanks to the support of donors like you.

THANK YOU

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.

Donors like you provide critical, discretionary support in times of need.

Private support is a lifeline that helps scientists move quickly and safely into COVID-19 research.

Because of you, the Morgridge Institute has teams working on many aspects of the novel coronavirus, and we cannot thank you enough for the trust you've placed in us.

Here's a look at some of the projects underway made possible by your support.



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 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 positive for 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, while the paper is pending publication in a peer-reviewed journal. 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

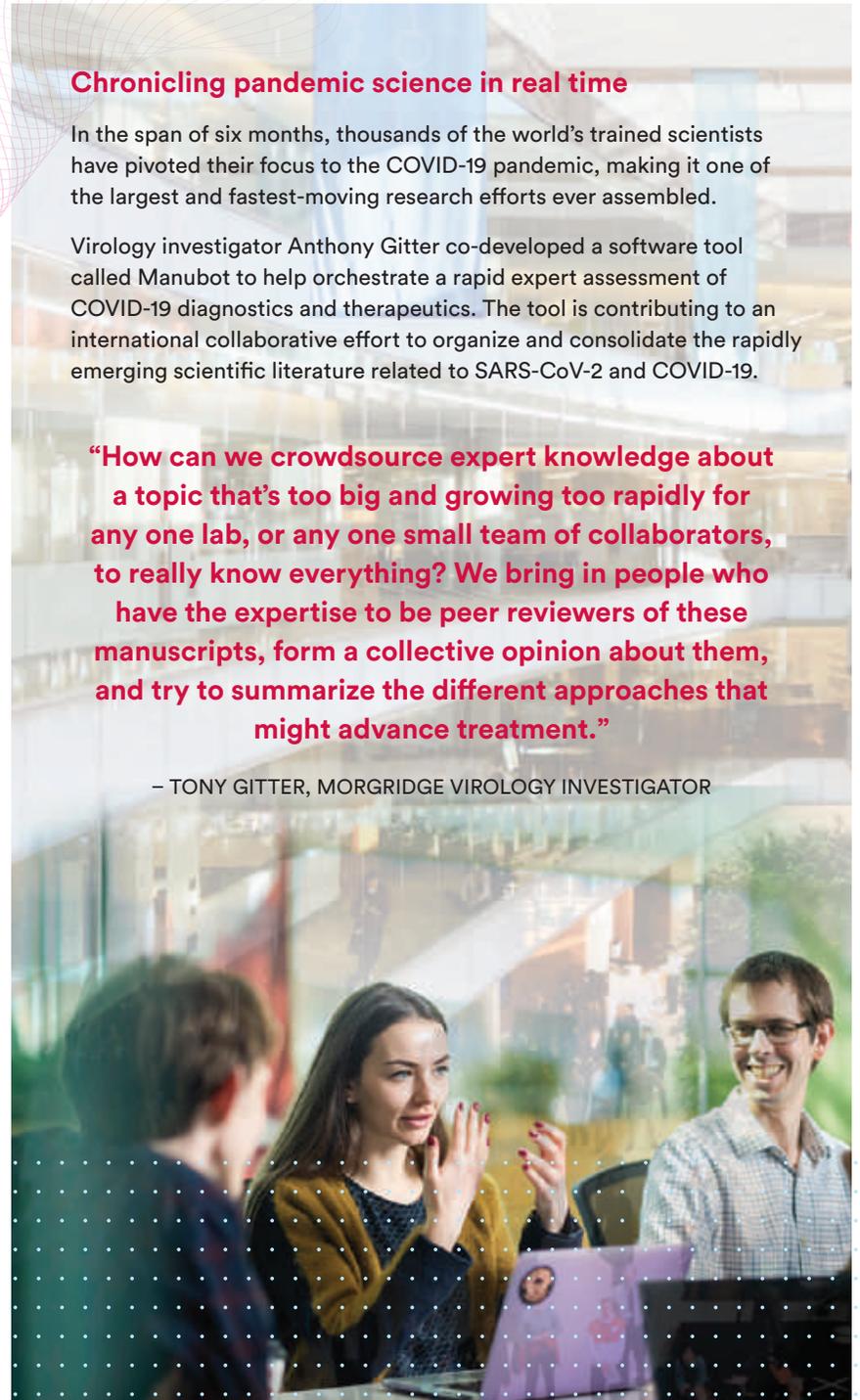
Chronicling pandemic science in real time

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.

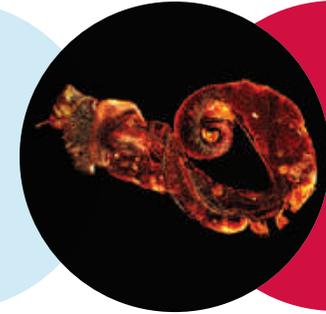
“How can we crowdsource expert knowledge about a topic that’s too big and growing too rapidly for any one lab, or any one small team of collaborators, to really know everything? We bring in people who have the expertise to be peer reviewers of these manuscripts, form a collective opinion about them,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

– TONY 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 “comorbidity.”

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

HOW DONORS LIKE YOU MAKE A DIFFERENCE

At the Morgridge Institute for Research, we explore uncharted biomedical research to go where the science takes us. By asking the right questions and following the highest standards of quality research, we will improve human health.

When you give, you are:



Exploring Science, Fearlessly

Donors like you help scientists pursue fearless science. Morgridge scientists are taking on new challenges to improve human health and go where the science takes us. Because of you, many scientists pivoted to work on COVID-19 and help stop the pandemic.



Changing Lives

Science is for everyone. Your gifts provide free and heavily-discounted science education and outreach programs for underserved children and families. In the past year, you helped increase access to the Rural Summer Science Camp when the program shifted to an entirely digital experience.

SCIENCE FOR ALL



When you establish a planned gift, you help inspire the next generation of scientists. Planned gifts through an estate or annuities help support science education and outreach activities, like the Rural Summer Science Camp.

Contact Bill Swisher, Chief Development Officer, today.

bswisher@morgridge.org
(608) 316-4364



“Every month new breakthroughs are published where people say, ‘Wow! How could we not have known this? And how could we have ever thought we could understand X without knowing this?’

There’s a huge need, but also a huge and growing opportunity, in that we’ve learned enough to advance further in increasingly powerful ways. So we can be very confident that investments in these critical arenas will pay off handsomely for society.”

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



MORGRIDGE
INSTITUTE FOR RESEARCH

THE DISCOVERY BUILDING
330 N. ORCHARD STREET, MADISON WI 53715

608.316.4100 / MORGRIDGE.ORG