ANNUAL REPORT

2024

Prepared for WARF and Morgridge Trustees, UW–Madison leaders and friends of the institute.

MORGRIDGE INSTITUTE FOR RESEARCH

WISCONSIN UNIVERSITY OF WISCONSIN–MADISON

WARF Wisconsin Alumni Research Foundation

How we can turn the tide on scientific mistrust

Of all the significant things that happened in 2024, the American research community may very well remember it as the year when America's trust in science took a beating.

This wasn't a passing trend or a political anomaly, or something that only came about because of the collective anguish of the COVID 19 pandemic. The numbers tell a different story.

According to the Pew Research Center's annual surveys of public confidence in science, 87 percent of Americans in the year 2020 expressed either a fair amount or a great deal of confidence that scientists act in the best interests of the public. In 2024, that number fell to 76 percent (a slight improvement after bottoming out in 2023 at 73 percent).

Projecting across the U.S., that's like losing the confidence of 35 million people in four years.

That shift in sentiment showed at the ballot box and is manifesting itself today in public policy. The narrative has moved from science being a great American success story worthy of bipartisan support, to an enterprise in need of deeper scrutiny and reform.

I would argue that a top priority for science in the years ahead will be regaining that public trust — and it starts with simple, fundamental aspects of human nature. We need to remember that as human beings, we establish trust based mostly upon what we do and observe. We learn when we're kids which people we can trust and which people we can't. We also quickly learn it's easier to lose trust than it is to earn it.

It might be tempting for scientists to be incredulous about this. After all, so much good has come from scientific discovery that has improved the human condition. We wear the white hats, right? But that's not the way human nature works; it's not all cold calculus. What we convey through our behaviors can have as big an impact as the end results of our work.

Here are some principles that I consider essential for science to get back on the right track.

- **Focus on the right metrics.** Universities and big research organizations often use grant dollars, papers published and citations as metrics for their success. It's in their interest to drive that number as high as possible, and be able to say to the outside world, 'Look how prestigious we are.' This can lead us to construct our researcher support mechanisms and even our research aims around maximizing the number of grant dollars we bring in, rather than on optimizing the likelihood that the discoveries we make will be true and impactful.

We have constructed a set of incentives that demands researchers come up with remarkable findings in a short time frame, instead of constructing things in a way that serves finding the truth. Measuring success based on the scale of papers published and grants attained is self-serving and fails to convey why science matters.

- **Learn from disagreements.** This is something we did poorly during the pandemic. It's important to recognize that disagreements are normal in science and they are ultimately productive. These disagreements can be very unpleasant, but they're more likely to help us find the truth than simply "agreeing to disagree" and retreating to our respective corners. Too often our pandemic impulse was to shut down or denigrate those with different assessments of the threat and the best way forward. That arrogance was not earned, and we're paying for it today.

- **Show more humility.** Like any other enterprise, science makes mistakes and operates best when in a state of continued self-correction, based on new knowledge. It's painful to think back on some of those mistakes. Eugenics, for example, was considered on the cutting edge of scientific thinking in early to mid-20th century, before being recognized as a flawed theory that perpetuated racism and caused tremendous human damage. History is littered with similar flawed thinking masquerading as scientific fact.

When we think of the best attributes of science we use words like "honesty" and "integrity," but I would put "humility" at the same level. The ability to say "Boy, I got that wrong," rather than doubling down to protect reputations, would help immensely. There's probably no surer way to guarantee that somebody is going to push back against you than conveying the attitude, "Here's the truth and you're a fool to disagree."

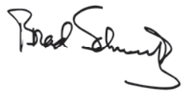
- **"Believe" in the scientific method, not in science.** It was common to see and hear the phrase, "I believe in science," throughout the pandemic. But science shouldn't be treated like a priesthood. Science is a method of understanding how much confidence we should have in our knowledge. It represents a continual state of asking questions, gathering evidence, making conclusions and repeating experiments to prove we know what we think we know. Scientists should work to demystify the scientific process with the general public, showing people that it is a rigorous extension of how all humans learn — through trial and error and experience.

- **Engage with the society that supports you.** Another remarkable fact from the Pew survey is that while 89 percent of the public says scientists are highly intelligent, only 45 percent say scientists are good communicators. This must change. We need to stop thinking of communicating our work as a nice "extra" if we can find the time, and more as an essential way to continue societal support for our work.

Much like curiosity-driven research, public engagement is a marathon and not a sprint. We are not going to see overnight results. The principles outlined above are things we should try to bake into our professional practices — things we make time for in our lab meetings and research goals, and things that are amply measured in our rewards system.

The topic of trust simply can't be over-emphasized. But in many respects we're talking about it now out of a sense of self-preservation. If society was still embracing us as the most trustworthy profession, we may not be paying as much attention.

That would be a mistake. It's something we can never take for granted.



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

MORGRIDGE, UW–MADISON PARTNERSHIPS

Putting Science in the Hands of School Kids

Morgridge and UW–Madison science outreach leaders partnered to bring more than

3,600

K12 STUDENTS

to campus in 2024.

A collaboration between the Morgridge Institute for Research and partners scattered across the UW–Madison campus is unlocking new, tailored science-learning opportunities for thousands of Wisconsin school children.

The partnership between science outreach offices streamlines the way K-12 field trips are scheduled and conducted, ensuring that teachers and students make the highest, most productive use of their time on campus to learn STEM concepts.

“We want to make it easy for the students and teachers to make it to campus,” says Wes Marner, Morgridge’s engagement, education and equity director. “We’ve brought it together as a cohesive set of STEM field trips, working together across campus to serve teacher and student needs, instead of having a whole lot of pop-up silos doing it on their own.”

In its pilot year, the collaboration brought about 3,600 students to campus, and that number is expected to grow to at least 5,000 a year.

In the past, K-12 classes might schedule a separate field trip to the Geology Museum and possibly try to set up another venue. But in the new, coordinated system, they can be more intentional and make their time on campus more fulfilling by conveniently arranging a whole day of activity.

Val Blair, Morgridge senior outreach coordinator, says science outreach staffers work together to set up customized field trip itineraries.

“We want to maximize the amount of STEM exploration they get in one day on campus,” Blair says. “We know transportation costs are high, so we want to make sure they get a great day filled with the experiences that their teachers feel will satisfy their curriculum.”

Julie Traxler, who teaches second graders at Madison’s Dr. Virginia Henderson Elementary School, says the new system made setting up her class field trip simple.

“I really appreciate how easy it was to coordinate and add on the fossil excavation, which I’d never heard of. I love going to one spot and finding all the available science trips,” she says.

The collaboration involves 11 science-related campus sites, including Morgridge, Chamberlin Hall’s Physics Museum, the Wisconsin Energy Institute, BioTrek in the Biotechnology Building, and others.

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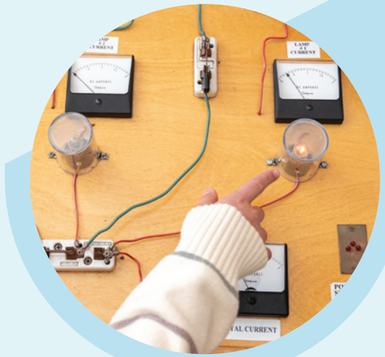


Partnership by the Numbers

8 LETTERS OF SUPPORT FOR NSF BROADER IMPACT PROPOSALS

Jason Cantor – Morgridge/ Biochemistry; Andrew Greenberg – Chemical and Biological Engineering; Chirag Gupta – Electrical and Computer Engineering; Junjie Hu – Biostatistics and Medical Informatics; Robert Jacobberger – Electrical and Computer Engineering; Jeff Martell – Chemistry; Yin Li – Biostatistics and Medical Informatics; Ophelia Venturelli – Biochemistry.

1 INAUGURAL POSTDOC EXPO

The first Wisconsin Postdoc Expo was held in November and was co-produced by Morgridge, UW–Madison Office of Postdoctoral Studies, Medical College of Wisconsin, and Versiti Blood Research Institute. The one-day virtual event garnered 400 registrants, including 220 who submitted resumes for future hiring consideration.

21 UW–MADISON STUDENT ORGANIZATION PARTNERSHIPS

Undergraduate Genetics Association; Catalysts for Science Policy; Neuroscience Training Program Outreach; Biomedical Engineering Society; Wisconsin Robotics; Molecular and Environmental Toxicology Program Outreach; Code to Connect; National Student Speech, Language, and Hearing Association; Biocore; SMPH Doctors Ought to Care; Atmospheric and Oceanic Science Graduate Student Association; Chemistry Graduate Student Faculty Liaison Committee; Society of Women Engineers at UW–Madison; Microbiology Doctoral Training Program Fermentation Club; Doctor of Audiology Program; SPIE/ Optica UW–Madison Student Chapter; Insect Ambassadors; Medical Physics Graduate Student Outreach; Materials Science and Engineering Graduate Student Association; UW–Madison ASBMB Student Chapter; Engineers without Borders.

5 MORGRIDGE PROFESSIONAL DEVELOPMENT EVENTS

These professional development seminars were open to campus participants, generating 487 registrations and 169 attendees from UW–Madison.

7 UW–MADISON COLLEGES &

22 DEPARTMENTS PARTICIPATED IN MORGRIDGE PROGRAMS

Liz Jesse, outreach specialist at the Biotechnology Building, says the system is gaining in popularity, with many field trip opportunities booked through the spring. It is also strengthening relationships with teachers.

“This has become a popular way for teachers to be easily able to get their kids on campus,” Jesse says. “If you can get yourself here, we can move you around campus and get you into a lot of hands-on, relevant experiences for free. And even the ones that charge are pretty low cost.”

In addition to helping enrich the student experience, the system helps campus science outreach offices better coordinate requests.

It also allows organizers to prioritize schools with the greatest number of students of economic need, with Morgridge able to defray transportation costs in some cases. And it can also prioritize schools that haven’t visited campus in a while.

Allison Bender, outreach program manager at the Wisconsin Energy Institute, says the institute lacked a comprehensive field-trip program prior to joining the partnership.

“We worked one-off with teachers, and we had so many requests that were beyond capacity,” Bender says.

“We can fit 24 to 30 students at one time at the Energy Institute, but many teachers wanted to bring their whole grade – maybe 100 kids at a time. Now, we can split up that group and send them to rotate in smaller groups to multiple campus venues at once.”

The program’s success has also influenced other outreach programs, such as summer camps, Blair says.

“When we’re bringing a lot of kids on campus during the summer, we use the same field trip process and had them moving around campus and exploring a lot of different things,” she says.

Marner says the partnership has broadened the impact that Morgridge, working closely with other campus units, can have with K-12 students.

WES MARNER

“It’s awesome that this group has come together so that the teachers from around the state can go to one spot and get things organized in a way that works for them. Community engagement is one of the spaces where a little bit of organization and a relatively small amount of funding can make a huge difference.”

WES MARNER, DIRECTOR OF ENGAGEMENT, EDUCATION AND EQUITY

New Cancer Imaging Startup Company Harnesses Wisconsin Expertise

An adult elephant has the body mass of about 100 human beings. Despite their enormous size, these remarkable creatures defy the odds by almost never getting cancer.

This paradox is still a mystery to scientists. It's also a source of inspiration for a promising new Wisconsin spinoff company, Elephas Biosciences, which has created a platform to predict whether patients will respond successfully to cancer immunotherapy.

Elephas was born in 2020 with major influences from bioimaging advances at the University of Wisconsin-Madison and the Morgridge Institute for Research. Morgridge Investigator Kevin Eliceiri, a UW–Madison professor of medical physics and biomedical engineering, has been working closely with Elephas leaders to help bring this promising new technology to fruition.

Immunotherapy treatments — essentially powering the body's own immune system to fight cancer — are the newest wave of cancer treatment and are generating great hope. More than 70 immunotherapy drugs are now in the clinical pipeline with more than 1,000 clinical trials nationally.

The National Cancer Institute estimates that about 20 percent of all immunotherapy treatments result in fully treating cancer. That means many people can go through months of treatment before they know whether it will work. The uncertainty also means that some patients who might be ideal candidates for immunotherapy do not get recruited.

Elephas is working to change that dynamic by testing drugs within "tumors in a dish" from a patients' own biopsy and predicting which candidates will have the best odds of success. A key aspect of this testing is using label free, non-invasive imaging modalities that can help determine cell state and viability without adverse effects on downstream drug testing.

"The problem is we're spending hundreds of millions of dollars on these great therapies, but there are no tools to guide decisions on who will benefit most," says Maneesh Arora, founder and CEO of Elephas. "And with all these immunotherapies coming to market, that is the big opportunity for Elephas."

The company completed some major milestones in 2024, including:

- A clinical partnership with Mayo Clinic in Rochester, Minn. This will allow a long-term study of whether patients' actual clinical responses to immunotherapies match the predictions that were created by the Elephas platform.
- A big infusion of investment capital. Elephas received $55 million in its most recent round of capitalization in December 2023 led by the Venture Investors Health Fund and the State of Wisconsin Investment Board (SWIB).
- Employee growth. Elephas now has more than 90 employees on Madison's near west side and has ramped up its testing through relationships with 13 different clinical sites around the country. They are receiving as many as a dozen live biopsies a week for testing.

"If we can tell clinicians in 72 hours what actually will happen (during treatment) three to six months later, that will be an incredibly pivotal moment and the single goal of everyone at our company," Arora says. "It's proving the platform can predict response to immunotherapy from a live tumor biopsy."

The technology behind Elephas uses live tissue from biopsies to preserve the complex tumor microenvironment in which cancer grows. This enables clinicians to look at how the variety of different cells — tumor cells, noncancerous cells, and immune cells — coordinate to either promote or suppress tumor growth. And they can measure the natural contrast generated by cell metabolism to determine how the microenvironment is responding to different drugs.

"The big challenge for us in harmonizing the biology, the engineering, the imaging and the software to deliver a single solution," says Arora. "All of these things need to come together."

Eliceiri says the Elephas story is a great example of how UW–Madison scientists and companies can work together. Ideas flowed through numerous informal discussions, and different expertise was tapped as questions arose. New collaborations are being explored including with Morgridge biomedical engineering PI Melissa Skala.

MANEESH ARORA

KEVIN ELICEIRI

"Having that direct interaction between companies and professors without layers is really important," Eliceiri says.

Elephas is part of a growing biotechnology startup company culture in Madison and is a direct beneficiary of the successful paths paved by others. One perfect example is Third Wave Technologies, a company that celebrated the 30th anniversary of its founding in December 2024.

In the early 2000s, Arora was an executive of Third Wave, a molecular diagnostics company that developed products for cervical cancer screening. That technology emerged from the labs of UW–Madison biomolecular chemistry professor James Dahlberg (also a member of the Morgridge Board of Trustees) and chemistry professor Lloyd Smith. Third Wave was purchased in 2008 by Hologic Inc. for roughly $600 million.

Third Wave produced another major success story. Its former CEO Kevin Conroy is now CEO of Exact Sciences, one of the biggest household-name biotech companies in Wisconsin that specializes in tools for the early detection of cancer.

And Third Wave was the Wisconsin Alumni Research Foundation's (WARF) very first foray into taking equity stake in a company, something they do commonly today (and have done so with Elephas). That full-circle impact is on full display today.

"Third Wave raised unprecedented amounts of venture capital for the times and played a significant role in the growth of venture capital availability in Wisconsin," says Jenni Li, principal of Venture Investors Health Fund. "They were the first biotech company to go public in Madison, forever altering the perception of Madison as a place to work and start a company."

Meet Our New Investigators

In 2024, we welcomed two new Morgridge investigators to our team. They bring new approaches, expertise, and deep curiosity which will drive our mission forward.

Ken Poss, a native of Green Bay, comes to Morgridge from Duke University where he was the James B. Duke Professor of Regenerative Biology. In his new role, he is director of regenerative biology at Morgridge and professor of cell and regenerative biology at UW–Madison.

Poss investigates fundamental rules of organ regeneration in zebrafish, which raises exciting questions about whether similar capabilities could one day be unlocked in humans.

Megan Spurgeon arrived from closer to home, where she was a senior scientist in viral oncology at UW–Madison's McCardle Laboratory for Cancer Research. She studies the newest identified human tumor virus, called Merkel cell polyomavirus (MCPyV), and hepatitis B.

She will join Morgridge's John W. and Jeanne M. Rowe Center for Research in Biology.

Both researchers shared their personal perspectives on how Morgridge will shape and advance their research.

New investigators at Morgridge further Wisconsin expertise in vital areas such as heart tissue repair and fighting cancers caused by viruses.

KEN POSS

Director of Regenerative Biology

I thought I had it made at Duke University. With 21 years of experience in a faculty position at its School of Medicine, I figured that I would keep my lab in the same place for the rest of my career.

I had invested years of work in creating collaborations, negotiating resources and facilities, fine-tuning lectures for coursework, and learning how to navigate campus policies and politics. In my case, I had also spent a lot of effort recruiting and building communities which work with the zebrafish model system, and who study the topic of tissue regeneration.

That's a lot of heavy lifting.

Given that backdrop, colleagues and friends often ask me, "Why give all of that up to move to the Morgridge Institute for Research?" For me, it came down to the philosophy and purpose of Morgridge.

It's a research institute designed to enable discovery. It's nimble and well-resourced in a challenging time for science, and its structure makes you feel like you truly can influence its direction.

My lab is free to explore the biggest questions in regeneration and see where that takes us, and collaborating with investigators here at the institute and the university with major strengths in computing and imaging will play an outsized role in that.

There are outstanding faculty in regenerative biology here and at UW–Madison as a whole. Regeneration is a clear interest and strength, and I feel we're becoming a destination for this topic.

I'm at Morgridge because I felt it's where I could make the most impact on my field and the local scientific community. As a bonus, I can live in a phenomenal city in my home state.

I continue to say that I am sincerely grateful to the Morgridges, and to the institute's leadership and scientists, for creating an environment that expands the bounds of science and giving me and my lab an opportunity to move here and contribute.

MEGAN SPURGEON

Assistant Professor of Oncology

As a newly minted postdoctoral associate in 2010, I watched from my office window across University Avenue as the finishing touches were being added to the Morgridge Institute for Research.

For almost 15 years, I continued to study tumor viruses at UW–Madison and watched as Morgridge grew in scope and influence. Its strong partnership with WARF and UW–Madison creates scientific opportunities that propel advances in human health.

As I considered my next career step, my familiarity with Morgridge told me that the open tumor virology investigator position in Morgridge's Rowe Center for Research in Virology was a once-in-a-lifetime opportunity too good to ignore.

I was right.

In my first few months at Morgridge, I have learned much more about this fantastic institute, its mission, and its growing contribution to science. Because of the vision and commitment of the TOSA Foundation, there are constant reminders of the positive impact that this institute will have on my research and career.

The financial startup support I received to establish my lab allows me to pursue the study of multiple tumor viruses and their roles in causing cancer using novel approaches.

The benefits associated with the Morgridge Postdoctoral Fellowship program helped me recruit an incredibly strong candidate who will be fully supported for three years. This support will have immediate impacts on my research and help further my development as a top researcher in the tumor virology field.

My research will be enriched by the vibrant collection of gifted Morgridge scientists who provide an array of new, interdisciplinary, collaborative directions.

I am proud to be part of an institute that values and fosters scientific engagement with the community, a mission integral to the future success of biomedical research.

I am also continually grateful for and impressed by how Morgridge invests in administrative, financial/grant, human resources, writing/presentation, mentoring/advising, and IT support.

Being part of a community seeking connection in scientific and local communities is a privilege.

It is thrilling to see what the future holds for my lab's work and for the work of my colleagues. I am honored for the chance to pursue scientific discovery at the Morgridge Institute for Research.

WELCOMING OUR NEW

Morgridge Postdoctoral Fellows

CHRISTOPHER COLLINS

Collins is a doctoral graduate from Washington State University. He works under the mentorship of Morgridge Investigator Megan Spurgeon and Assistant Professor Kavi Mehta in the UW–Madison Department of Comparative Biosciences, investigating how Merkel cell polyomavirus and human papillomavirus alter host DNA replication complexes. Using advanced techniques, his work aims to uncover therapeutic targets for virus-associated cancers.

BENJAMIN CHADWICK

Chadwick, who earned a doctorate at the University of Georgia, is a postdoctoral fellow working in the laboratories of Morgridge Investigator Joshua Coon, collaborating with Nancy Keller and Christina Hull at UW–Madison, focusing on fungal pathogenesis and antifungal drug resistance. His interdisciplinary work integrates cutting-edge technologies to provide critical insights into fungal biology to improve therapeutic strategies.

SABINA FARHADOVA

Farhadova is a postdoctoral fellow in Morgridge Investigator Melissa Skala's lab working on multidisciplinary research in stem cell and cancer biology, collaborating with Darcie Moore in the Department of Neuroscience at UW–Madison. She earned her doctorate in a joint program between the Azerbaijan National Academy of Sciences and the University of Montpellier. Her work integrates advanced imaging with stem cell biology to address critical questions in cancer therapy and neurobiology.

HADI RAZEGHI KONDELAJI

Kondelaji, with a doctorate from the Medical College of Wisconsin, will work with Morgridge Investigators Kevin Eliceiri and Randy Bartels and UW–Madison's Filiz Yesilkoy, an assistant professor of biomedical engineering. He integrates mid-infrared spectroscopy, Raman spectroscopy, and fluorescence lifetime imaging microscopy to create an imaging platform for Alzheimer's disease. He seeks to enhance early diagnostics and understanding of the disease.

The Morgridge Postdoctoral Fellows Program helps us attract talent from around the globe. These early-career scientists work with both Morgridge and UW–Madison investigators to advance top priorities in biomedical research.

Morgridge Milestones

Schwartz named AAAS Fellow

Brad Schwartz, Morgridge CEO and UW–Madison professor of biomolecular chemistry, was elected as a fellow of the American Association for the Advancement of Science, the world's largest general scientific society.

Schwartz was one of eight UW–Madison scholars, and more than 500 nationally, elected to the 2024 class. The honor recognizes efforts to advance science and society, with fellows chosen to reflect the highest standards of scientific integrity and professional ethics.

Schwartz was elected for distinguished contributions to the field of hematology, in particular in treating disorders of protease cascades, and for outstanding leadership and administrative services, including initiatives to increase diversity.

Sudip S. Parikh, AAAS chief executive officer and executive publisher of the Science family of journals, noted: "This year's class embodies scientific excellence, fosters trust in science throughout the communities they serve and leads the next generation of scientists while advancing scientific achievements."

Bioimaging experts gather in Madison to share expertise

BioImaging North America, co-chaired by Morgridge Investigator **Kevin Eliceiri,** attracted experts from around the globe to the UW–Madison campus for its 2024 Community Congress.

The group, headquartered at Morgridge, brought together bioimaging experts in a five-day conference under the theme of building community, tools, and expertise in the field. In addition to lecture and talks, participants toured campus facilities.

Imaging continuously proves to be a critical component in scientific advancement. Through its precise visualization, imaging drives breakthroughs and innovation across the many fields of science.

Morgridge Trustee James Dahlberg honored for entrepreneurial achievement

James Dahlberg, Morgridge trustee and former interim chief executive officer, was among three outstanding innovators to receive 2024 Chancellor's Entrepreneurial Achievement Awards.

The awards recognize individuals with UW–Madison ties who have contributed to economic growth and social good, served as entrepreneurial models for the UW community, and inspired the campus culture of entrepreneurship.

Dahlberg fused academics with entrepreneurship, translating basic research into technologies for leading startups. After joining UW–Madison's School of Medicine and Public Health in 1969, his research on DNA and RNA led to multiple patents through the Wisconsin Alumni Research Foundation.

Dahlberg co-founded Cambridge BioTech Corp., and in 1993, he co-founded Third Wave Technologies, which later went public and was sold. Its intellectual property was licensed by Exact Sciences, a leading cancer screening and diagnostics company.

"Jim never lost his commitment to an academic research career," said Morgridge CEO Brad Schwartz. "And along the way, he came up with something that would be useful, and he helped turn it into a company. That to me is an academic entrepreneur. And he demonstrated for everybody that it could be done."

UW, Morgridge welcome new Rita Allen Civic Science Fellows

Soobin Choi (left) and **Natasha Strydhorst** (right) were chosen as the 2024 Rita Allen Civic Science Fellows, helping bridge the disconnect in public discourse surrounding science topics.

"We're doing something new and exciting in this new joint effort by Morgridge and the Rita Allen Foundation," says Morgridge Investigator Dietram Scheufele, of the Science Communication Incubator Lab. "The fellows will work on exploring new pathways for more constructive societal debates about emerging biomedical science."

The Rita Allen Civic Science Fellows Program aims to engage with diverse individuals to support a culture of civic science.

Strydhorst received her Ph.D. from Texas Tech University where she researched scientific uncertainties and the rehabilitation of the concept in the public eye. "The Morgridge mission of 'inspiring scientific curiosity in everyday life' resonated with me; I hope my work can contribute to that goal," she says.

Choi comes from University of Michigan where she earned her PhD in Communication and Media. "I would love to develop an agenda on community-engaged research approaches to understand real-world implications and barriers of communication strategies that aim to increase public engagement with science and environmental issues," she says.

The Year In Discovery

Optical imaging yields a closer look at new ways to grow heart cells

Studying heart disease is hindered by the difficulty of growing heart muscle cells, cardiomyocites, in labs.

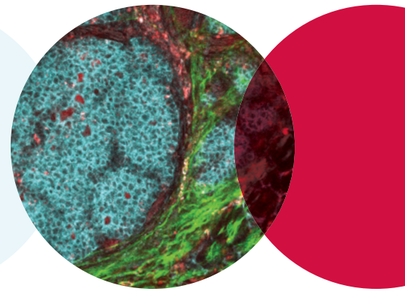
Morgridge Postdoctoral Fellow **Daniella Desa** adapted optical imaging techniques she learned with the Melissa Skala Lab to observe stem-cell derived cardiomyocytes grown in biosynthetic hydrogels and assess the ideal growth conditions.

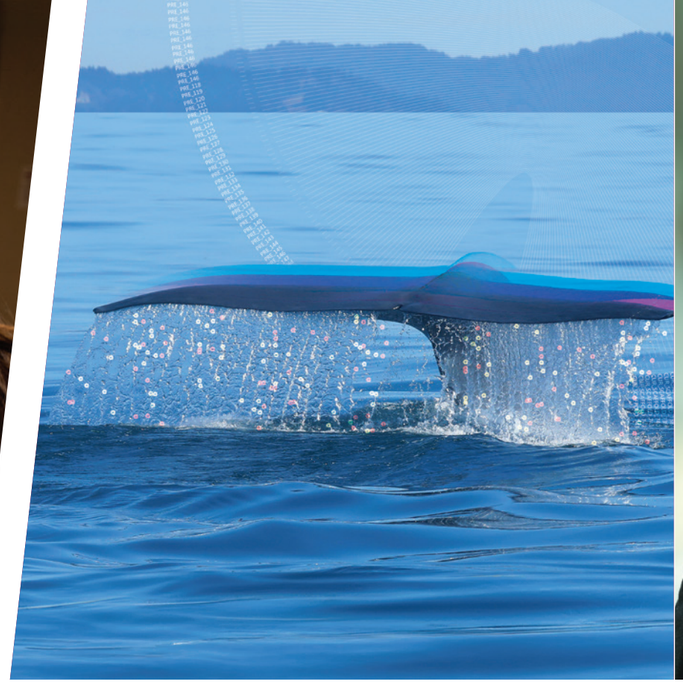
“The goal is having something that will be tunable and reproducible,” Desa says. “The dream application of using these synthetic materials would be for biomanufacturing, because you’d want something robust and repeatable.”

Collagen highway signs could show how to stop pancreatic cancer spread

Collagen, body’s most abundant protein, plays a role in the spread of cancer. Morgridge researchers, working with UW–Madison bioengineers, found that parallel-aligned collagen fibers acted as a highway for clusters of pancreatic cancer cells.

This finding is based on a combination of microscopy, patient samples and engineered scaffolds. The research led by the labs of Morgridge Investigator **Melissa Skala** and UW–Madison bioengineering Professor **Paul Campagnola** suggests that targeting collagen could be a strategy to combat cancer progression.





Advanced imaging uncovers a parasitic ‘kiss’

Using the power of optical metabolic imaging, Morgridge researchers revealed how a parasite that causes toxoplasmosis — a lifelong chronic infection — affects the metabolism of host cells during the course of an infection.

Assistant scientist **Gina Gallego-Lopez** spearheaded a collaboration between Morgridge Investigator Melissa Skala and Laura Knoll, a UW–Madison medical microbiology and immunology professor.

“One cell may be infected while the cells around it are not; it looks like the parasite ‘kisses’ those cells and then injects some proteins,” Gallego-Lopez says.

Genetic blueprints of creatures great and small

Size doesn’t matter in genome sequencing, as a team of Morgridge Institute researchers illustrated when assembling two new reference genomes — one from the world’s largest mammal — the blue whale — and one from one of the smallest, the Etruscan shrew.

“It’s important just for fundamental biological knowledge. … How do you build such a large animal? How can it function?” says **Yury Bukhman,** a computational biologist in the Ron Stewart Computational Group.

One practical application of this knowledge is in stem cell-based therapies.

Scientists more likely to engage with the public when supported by their research institutions

While productive scientists are more likely to engage in public scholarship, Morgridge’s Science Communication Incubator Lab found that institutional support is crucial for a sustained impact.

The lab surveyed 5,000 productive tenure-track faculty at major research institutions and found a positive relationship between productivity and willingness to participate in public scholarship. However, that slightly declined when research organizations failed to support engagement through monetary or career-related incentives.

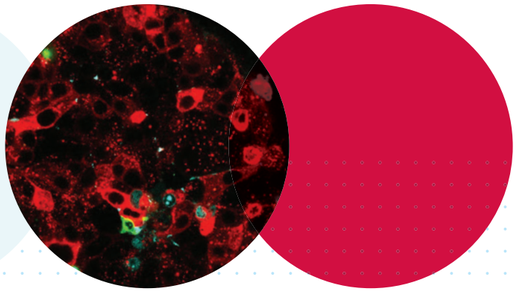
Morgridge Investigator **Dominique Brossard** says that by recognizing public engagement’s value and providing incentives, institutions can foster both research and public outreach.

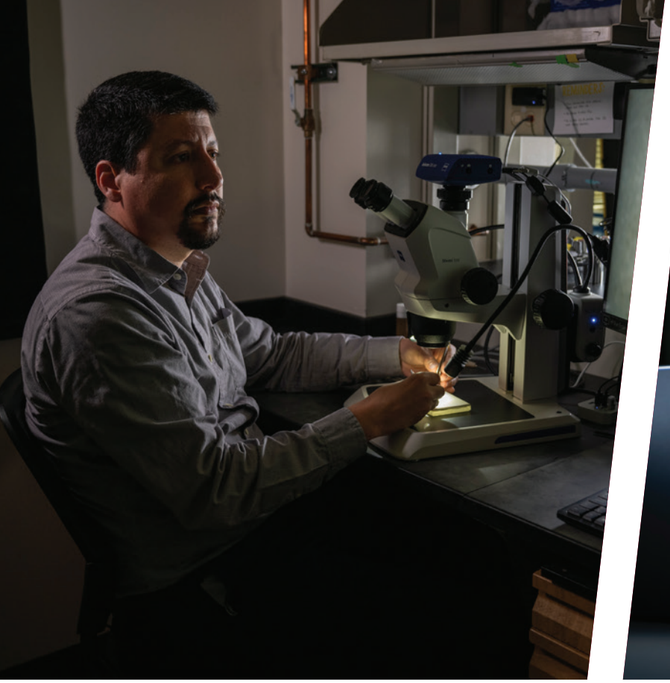
Morgridge scientist aims to shatter the ‘ballistic barrier’ in imaging

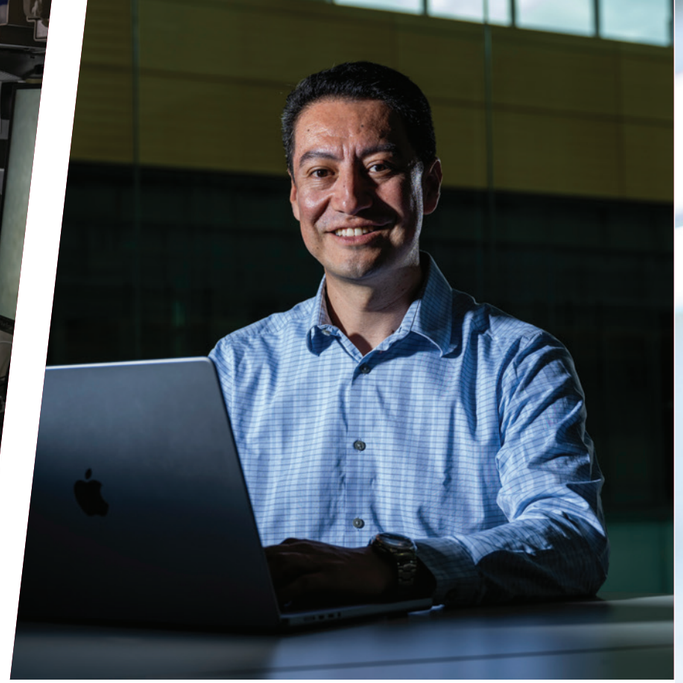
Harnessing scattered light may open unseen worlds in live biology imaging, according to Morgridge Investigator **Randy Bartels.**

Bartels, a biomedical imaging expert, received a 2024 award from the Chan Zuckerberg Initiative to develop a new approach to deep-tissue imaging. Bartels described current imaging challenge as the “ballistic barrier.”

The work offers new ways to unscramble, remap and control light exiting through the tissue. This technique has potential to expand imaging depths as much as five times beyond current methods.







Development in fertility research questions obesity as the leading cause of infertility

Research on high-sugar diet spearheaded by scientist **Rodrigo Dutra Nunes** in the lab of Daniela Drummond-Barbosa opens the door for breakthrough advancements in fertility research.

Their findings analyze effects of a high-sugar diet, obesity, and water intake on metabolism, oogenesis, and fertility in fruit flies. They found that a high-sugar diet, but not obesity, significantly reduces fertility by affecting egg development.

Researchers hope the study will inspire further research into possible human therapies to reverse the effects of the Western diet causing decreased fertility and other diseases.

A foundation model for bioimaging? A Morgridge scientist explores the possibilities

Juan Caicedo envisions another ambitious use of artificial intelligence: Tapping the power of foundation models for cellular imaging. Foundation models are powering the next generation of machine learning applications, such as ChatGPT.

Caicedo, a Morgridge biomedical imaging investigator and UW–Madison professor of biostatistics and medical informatics, is working on an image processing platform to analyze cellular data from any experiment to examine common features of cells.

“We want to create a machine learning model that can process any type of microscopy image, so biologists don’t have to retrain machine learning models for every experiment,” Caicedo says of the approach, which could be valuable in basic research and preclinical settings.

“Basic science allows scientists to ask questions about how the world works. And when you do that, you don’t know what you’re going to find. Most of the major breakthroughs in our understanding of human health came from looking at unexpected places.”

— MORGRIDGE PI PHIL NEWMARK

BRAIN TRUST:

The Power Of Partnership Works To Fight Cancer

Morgridge investigators are working to understand and fight cancer on many fronts, including advanced imaging, cell metabolism, tumor virology and research computing.

MELISSA SKALA MARK BURKARD

Powerful research collaborations involving Morgridge Institute for Research scientists are helping make cancer treatment more precise and personalized at the UW–Madison Carbone Cancer Center.

Two such projects, led by Melissa Skala, an imaging investigator with the Morgridge Institute for Research, and Mark Burkard, a medical oncologist at UW Health and UW–Madison professor, are using DNA technology and advanced imaging to tailor the best treatment for each patient.

Cancer treatment is based on several factors, including which drugs are most effective and the severity of side effects. It can take weeks to determine if a patient is responding well to treatment or needs a different approach.

“Cancers are hard to treat because they’re inherently part of a person,” says Burkard. “Something additionally happened that turned a healthy cell into cancer. If you want to find what’s driving an individual person’s cancer, you have to test the tumor itself.”

To better understand what treatments will work best for each patient, scientists are using organoids, small clusters of cells that function like a “tumor in a dish,” to better replicate the disease environment, according to Skala.

The Skala Lab uses novel imaging technologies to monitor treatment responses across scores of organoids generated from a patient. This allows them to identify which drug combinations are most effective at killing cancer with the fewest side effects.

Skala credits much of their work to productive collaborations with people at UW–Madison such as Burkard and Dustin Deming, also a medical oncologist, who developed the Precision Medicine Molecular Tumor Board at Carbone.

Through their services, genomic reports are generated from patients’ own tumor biopsy to inform care decisions.

“I like to think of them as a brain trust, all these smart people around a table thinking about what could be best for a patient based on their genomic report,” Skala says.

The Burkard Lab uses DNA sequencing technologies to answer a common patient question: “Now that the treatments are done, is my cancer gone?”

Cancer can result in distant recurrence, when metastatic disease develops in another part of the body many years later.

Burkard and his team are working on a new technology called minimal residual disease detection, which detects DNA that’s circulating in the bloodstream.

Skala and Burkard both agree that the most hopeful aspect to their work is the people — from stories of patients and their fight against disease, and thoughtful collaborators working toward better solutions.

They represent just two of the more than **115 oncologists** and surgeons at Carbone, which sees **30,000 cancer patients** each year. Carbone is the first cancer research center in the U.S. founded by a university and conducts more than **$100 million** in research studies annually.

“I’m inspired by people trying new things that you wouldn’t have thought would be blended, like engineering and oncology,” says Skala. Burkard adds: “I’m inspired by my patients who are living in unexpected ways. And it’s humbling every day to deal with this disease and to work with patients and to learn more.”

Morgridge Webinars

SPOTLIGHT SCIENCE'S VITAL ROLE IN SOCIETY

Public trust in science and the promise and pitfalls of the use of artificial intelligence in biomedicine were examined in a lively pair of Fearless Science Speaker Series webinars in 2024.

The webinars make scientific topics more widely available to researchers and the general public, through the continuing support of the TOSA Foundation. They feature Morgridge scientists and collaborators discussing innovative biomedical research and scientific viewpoints.

In October, a panel of experts discussed why trust in science is breaking down and what can be done to earn public confidence. **Brad Schwartz,** Morgridge CEO and UW–Madison professor of medicine and biomolecular chemistry, said a better public understanding of the underpinnings of science is essential.

"The scientific method at its heart is really an acknowledgement of uncertainty and the depth of uncertainty that we have," Schwartz said. "But if the scientific enterprise more habitually spoke of in terms of the uncertainty of what we know and admitted what we didn't know, I think over time, society would come to understand a little bit, come to appreciate more the degree of uncertainty that we have to deal with."

Pilar Ossorio, Morgridge investigator and UW–Madison professor of law and bioethics, said solution to the problem of public trust must be nuanced.

"My only idea approaching a solution is to think about ways to meet people where they are," Ossorio said. "If they've had diabetes in their family or cancer in their family, or some condition that has been helped by science and medicine; if they are here in Wisconsin and they have a farm, and there might be some way that we could be of really practical help to people. That's part of the way that you might approach people."

The March webinar featured artificial intelligence and its potential in the arena of biomedicine.

Biomedical imaging investigator **Juan Caicedo** delved into AI's application in cellular biology, particularly in analyzing microscopy images to decipher cellular activities. He emphasized the challenges posed by the complexity of biological systems and the need for AI to unravel hidden patterns in biomedical images.

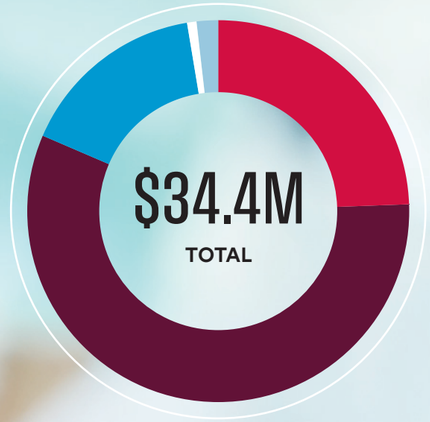
Speakers acknowledged advancements in AI, particularly in web data analysis and natural language processing. However, they emphasized the need for caution, highlighting instances where AI models produce inaccurate or even fabricated results.

Despite progress in AI, they warned of a margin for error that demands careful consideration, especially in critical areas such as medical diagnosis and drug development.

OUR MISSION

Improve human health through innovative, interdisciplinary biomedical discoveries, spark scientific curiosity and serve society through translational outcomes, in partnership with the University of Wisconsin–Madison.

FY24 | Revenue & Support



57%
INVESTMENT SUPPORT
$19.6M

24.4%
GRANT REVENUE
$8.4M

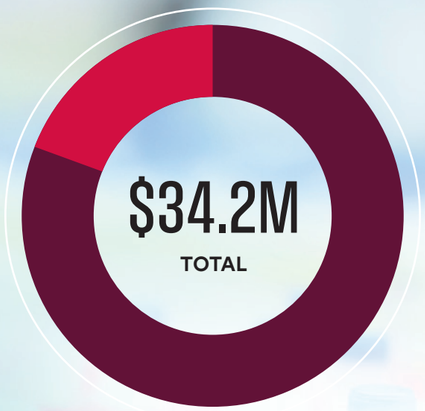
16.3%
FOUNDATION SUPPORT
$5.6M

1.7%
INTELLECTUAL PROPERTY REVENUE
$0.6M

0.6%
OTHER GIFTS
$0.2M

FY23		
Investment Support	$14.4M	53.9%
Grant Revenue	$5.8M	21.7%
Foundation Support	$6.0M	22.5%
Other Gifts	$0.2M	0.7%
Intellectual Property Revenue	$0.3M	1.1%
TOTAL	$26.7M	100%

FY24 | Operating Expenses



84%
RESEARCH
$27.2M

16%
GENERAL & ADMINISTRATIVE
$5.2M

FY23		
Research	$23.4M	83.0%
General & Administrative	$4.8M	17.0%
TOTAL	$28.2M	100%

Investigators

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Randy Bartels, Biomedical Imaging; UW–Madison professor of biomedical engineering

Brian Bockelman, Research Computing

Dominique Brossard, Science Communication; professor and chair, UW–Madison life sciences communication

Juan Caicedo, Biomedical Imaging; UW–Madison assistant professor of biostatistics and medical informatics

Jason Cantor, Metabolism; UW–Madison assistant professor of biochemistry

Joshua Coon, Thomas and Margaret Pyle Chair in Metabolism; UW–Madison professor of chemistry and biomolecular chemistry

Daniela Drummond-Barbosa, Regenerative Biology; UW–Madison professor of genetics

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Matthew Brown, Regenerative Biology

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Jan Huisken, Biomedical Imaging

Anna Huttenlocher, Biomedical Imaging

Laura Knoll, Metabolism

Abishek Kumar, Biomedical Imaging

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