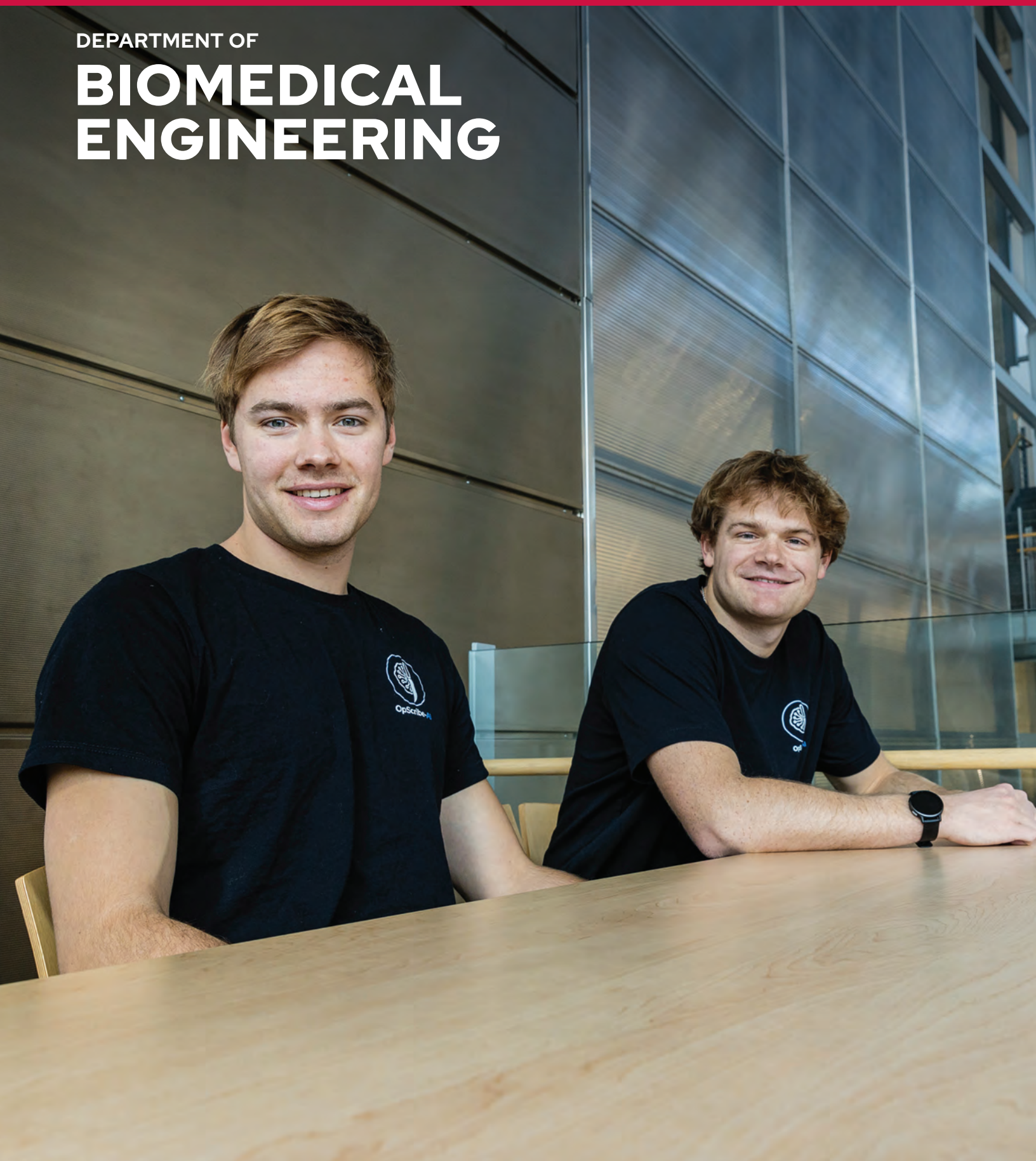
College of Engineering
UNIVERSITY OF WISCONSIN–MADISON

SPRING 2026 NEWSLETTER

DEPARTMENT OF

# BIOMEDICAL ENGINEERING



# Greetings from Madison!

As we near the end of this academic year, I would like to reflect on the successes our BME department has had in the last 12 months and highlight where we are going.

We had a record number of freshmen enter our program this year (around 270). We are now the third-largest undergraduate program in the college, and our BME program is now the largest in the Big Ten. We are proud of our students, who are conscientious, community-minded young people who break the typical engineering mold by pairing technical knowledge with communications skills. They are curious, well-rounded and dedicated to making a difference in peoples' lives.

To accompany this increase in students and to also increase our research profile, the department has been in a large hiring phase for new faculty members. We've hired nine over the last three years, including two senior hires. Several of these positions are in traditional areas of BME that will help fill our historical teaching needs, where we can now offer multiple sections of our most popular electives every year. We've made additional hires through the Wisconsin Research, Innovation and Scholarly Excellence campuswide initiatives on artificial intelligence (RISE-AI), focused on cellular engineering, and Transforming Healthspan through Research, InnoVation and Education (RISE-THRIVE). Importantly, we will now offer new courses in artificial intelligence and machine learning at both the undergraduate and graduate levels. We are among the first of our peers to have dedicated AI/ML courses within a BME department. These faculty will offer new courses in areas such as immunoengineering and biomolecular design. We will continue to hire new faculty over the next several years to better serve our students.

I hope you and your loved ones are well, and I thank you for your support of our department.

**On, Wisconsin!**

Paul J. Campagnola

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On the cover: Undergraduate students Ruffin Bryant, left, and Noah Kalthoff turned their BME design project, an artificial intelligence-powered tool for automated surgical documentation and pricing, into a startup venture. Read more on page 3. Photo: Joel Hallberg

## Can AI ease surgeons' workload? A BME student startup thinks so

Since they returned to Madison in mid-January for the spring 2026 semester, roommates Ruffin Bryant and Noah Kalthoff have settled into a familiar—if busy—rhythm.

Mornings: Class, like most of their fellow BME majors.

Afternoons and evenings: Working full-time hours on OpScribe-AI, a startup venture they're hoping will turn into a viable career option by the time they both graduate in May 2027.

As the name suggests, OpScribe-AI is an artificial intelligence-powered tool for automated surgical video analysis and pricing. It's designed to improve the accuracy and efficiency of surgical documentation and medical coding that are currently manually produced after every operation and used for pricing, insurance reimbursement and tracking patient health, while alleviating some of the administrative burden on surgeons. The latter is frequently cited among the leading sources of burnout in the profession.

"We literally met with a surgeon who said, 'The worst part of my job is writing reports.' It's not why they went to med school. It's not fun," says Bryant, a junior from Greenwich, Connecticut. "We make it a one- to two-minute review."

The nascent startup is an outgrowth of a project Bryant, Kalthoff and four other BME students undertook during the fall 2025 semester as part of the department's undergraduate design program.

Rather than training a new deep learning model from scratch, the students—on the advice of Assistant Professor Dhananjay Bhaskar, their project advisor—opted for an agentic, AI-based approach, integrating pre-trained large language models and deep neural networks into a family of AI agents that collaboratively process surgical videos to generate standardized operative reports and standardized medical codes.

To avoid erroneous results, any information the AI agents aren't certain of is left blank for the surgeon to complete. OpScribe-AI also pulls in information from the National Institutes of Health PubMed database to add context from medical literature and tailors the output to individual surgeons based on previous reports.

"That's where the technical sophistication lies: building an agentic AI system that is able to reach out into literature, retrieve medical context from surgical reports and other medical publications, and leverage all that context to build an operative report that accurately summarizes the medical procedures," says Bhaskar.

Importantly, the large language models in OpScribe-AI are open-source, self-hosted components that can work within a hospital system's digital infrastructure while complying with HIPAA regulations.

In addition to saving surgeons' time and mental energy, OpScribe-AI ensures more accurate billing; missed details cost hospitals when it comes to reimbursement.

To further develop their prototype, though, Bryant and Kalthoff need more robust data than the open-source videos they've used thus far. With that in mind, fellow design project team members Lucy Wyse and Kendall Witt have pulled together information for the group's Institutional Review Board application to access real surgical data.

The design project team, which also includes Wylie Lu and Evan Matthews, is also working on an academic journal paper based on data collected from the UW Health Clinical Simulation Program.

Since turning their design project into a business venture, Bryant and Kalthoff have filled their calendars with pitches to potential investors and applications for startup accelerator and incubator programs. In March 2026, they were accepted into the gBETA AI Startup Accelerator through Waukesha County Technical College's Applied AI Lab.

The students plan to recruit software engineering expertise to their team, to improve the user interface, and to explore methods for leveraging data to uncover actionable insights for healthcare decisionmakers—trends during particular procedures, for example—that could amount to another revenue stream down the road.

"Who knows where this is going to take us, but we both agree that fail or success or somewhere in the middle, the lessons and the amount of stuff we've learned is going to be so applicable to the next steps in our career," says Kalthoff, a junior from Delano, Minnesota.

Students Ruffin Bryant, left, and Noah Kalthoff first met as freshmen during move-in day at Dejope Hall. Photo: Joel Hallberg

FOCUS ON NEW FACULTY

# Monica Ohnsorg connects polymer science to biomedical research

As a ninth grader in Chanhassen, Minnesota, outside of Minneapolis, Monica Ohnsorg took an aptitude exam that pointed her toward a career as a biomedical engineer.

Now, nearly two decades later, she's starting her career as an assistant professor of biomedical engineering at UW-Madison.

Proving that winding educational journeys often produce uniquely qualified interdisciplinary scientists, Ohnsorg did not actually pursue a formal degree in biomedical engineering. But her studies and experience in adjacent fields—chemistry, chemical and biological engineering, and materials science—have positioned her well to pursue research and teaching at the intersection of polymer science and tissue engineering.

"I see myself bridging these two fields," says Ohnsorg, who joined BME in January 2026. "At UW-Madison, I'm being given the opportunity to be the expert in polymer chemistry amongst so many experts in biology. And, as a result, I can be infinitely collaborative with so many people."

Specifically, Ohnsorg develops synthetic polymer materials that mimic the mechanical and biochemical properties of human tissues, allowing researchers to study disease progression and assess treatments under more physiologically relevant conditions. In particular, she's interested in applying her materials to musculoskeletal diseases like osteoarthritis and osteoporosis.

Ohnsorg can trace her interest in science back to her grandfather, who taught the subject at the high school level in Richfield, Minnesota, and gifted her his teacher's edition chemistry textbook when she was in eighth grade.

She planned to follow the aptitude test's guidance as an undergraduate student at Hope College in Michigan, but her strong interests in nanoparticle drug delivery led her to a professor conducting nano-scale materials research in the Department of Chemistry. As a result, she instead wound up majoring in chemistry with a minor in engineering while working all four years in that research lab.

"It was very fundamental research, but that's where I learned how to ask scientific questions and to really have independence in the lab," she says.

> "Where are the current materials in biomedical engineering and in vitro models for three-dimensional cell culture letting us down? And how can we as polymer scientists and engineers come in and build novel materials that are informed by how our bodies behave, so we can best study and mimic different cell niches in the body?"

After graduating, she boomeranged back home to pursue her PhD in chemistry at the University of Minnesota under dual advisement of chemist Theresa Reineke and chemical engineer Frank Bates. It was a five-year deep dive into polymers—specifically "bottlebrush" polymers, useful molecules named for their appearance, with many chains attached to a central backbone.

She brought that knowledge with her to the University of Colorado Boulder, where she spent nearly four years as a postdoctoral researcher in the lab of Kristi Anseth, a decorated professor of chemical and biological engineering who works in tissue engineering. Ohnsorg began making hydrogels out of bottlebrush polymers, creating materials that more closely mirror human tissues' mechanical properties than many of the existing options for culturing cells in three dimensions.

"Where are the current materials in biomedical engineering and in vitro models for three-dimensional cell culture letting us down?" says Ohnsorg, who applied the technique to create synthetic materials that copy aspects of core components of cartilage, like collagen. "And how can we as polymer scientists and engineers come in and build novel materials that are informed by how our bodies behave, so we can best study and mimic different cell niches in the body?"

At UW-Madison, Ohnsorg envisions collaborations with tissue engineering researchers and BME colleagues like William Murphy and Wan-Ju Li, as well as biomechanics faculty such as Corinne Henak in the Department of Mechanical Engineering. She is also excited to join a resurgent polymer science ecosystem on campus, including recent faculty arrivals like Whitney Loo in the Department of Chemical and Biological Engineering and several engineering affiliates in the Department of Chemistry.

Drawing upon her research, Ohnsorg hopes to develop a course for undergraduates on polymers in medicine.

"I have high expectations for my students to reach learning goals," she says, "but also, I want to be someone who always has my door open for office hours and deep questions about what we're learning."

FOCUS ON NEW FACULTY

# Mehmet Orman uncovers secrets of drug-tolerant 'persister' cells

Genetic mutations can yield antibiotic-resistant bacteria that stifle medical treatments, drive recurrence of disease and cause patient deaths. But there's another, lesser-known way bacterial cells can thwart antibiotics—by essentially playing possum.

"Persister" cells lie low during antibiotic treatment, allowing them to evade death, before reanimating and even reverting to being sensitive to antibiotics once more. Mehmet Orman wants to know the how and why behind this phenotypical phenomenon.

"They become non-growing cells, or certain cellular functions become inactive," says Orman, who in January 2026 joined BME as an associate professor. "And if these functions are targeted by antibiotics, then these cells survive the antibiotic treatments because they don't have active antibiotic targets."

> "If we understand (persister cells') formation mechanisms or resuscitation mechanisms, we can design better drugs—either preventing them from becoming persisters or from becoming normal cells again and proliferating."

Orman came to UW-Madison from the University of Houston, where he spent the previous eight years on the faculty of the Department of Chemical and Biomolecular Engineering. While at Houston, he received a National Science Foundation (NSF) CAREER Award, as well as additional funding from the NSF and the National Institutes of Health (NIH), including an NIH K22 Career Transition Award.

Orman, who grew up in Malatya in east-central Turkey and earned bachelor's and master's degrees in chemical engineering from Middle East Technical University in the Turkish capital of Ankara, came to the United States in 2007. He completed his PhD at Rutgers University-New Brunswick in 2011, then got introduced to persister cells as a postdoctoral researcher at Princeton University. After working as a researcher at Memorial Sloan Kettering Cancer Center, he returned to academia at Houston in 2017.

His lab focuses primarily on bacterial persister cells, examining details such as metabolic activity, RNA expression and protein composition to try to better understand their transformations. More recently, though, Orman has expanded his research scope to include cancer persister cells, specifically the skin cancer melanoma.

"If we understand their formation mechanisms or resuscitation mechanisms, we can design better drugs—either preventing them from becoming persisters or from becoming normal cells again and proliferating," says Orman.

UW-Madison's facilities in imaging and single-cell analysis, plus the prospect of colleagues applying machine learning and artificial intelligence methods to biological questions, drew Orman north.

"Persister cells are rare, and it's so hard to study them," says Orman, who brought one PhD student and two postdoctoral researchers with him to UW-Madison. "The University of Wisconsin has a lot of really good facilities. They are using single-cell tools to characterize cells."

Coming from a chemical and biomolecular engineering department, Orman has taught large, required courses in thermodynamics and fluid mechanics, earning a teaching excellence award. He calls himself a hands-on mentor for the student and postdoctoral researchers in his lab.

"I really try my best to help them with everything, like for their research or for their future, whatever they need," he says. "I'm involved in their research. I give them a lot of suggestions. I always follow up on their experiments—if they do an experiment today, the next morning I go there and check the results. But I also respect them and listen to them."

## CRISPR with a 'dimmer' could elevate precision gene editing

In an ideal world, after the CRISPR-Cas9 gene-editing tool enters a cell's nucleus and cuts its targeted slice of DNA, it would disappear.

"You don't want the Cas9 protein to stick around too long," says Professor Krishanu Saha, who uses gene editing-based tools to develop precision therapies. "The longer Cas9 is in the system, the higher the chance it has to bind to unintended sites in the genome. These off-target sites are areas you didn't want to edit, causing serious collateral damage we don't want."

Currently, there's no easy way to turn off gene-editing activity. But CRISPR researchers like Saha are experimenting with "molecular-glue degraders" (aka, degrons) to tame the Cas9 protein responsible for cutting DNA—like a dimmer switch for a light.

In a recent paper in the journal *Molecular Therapy Nucleic Acids*, a UW-Madison research team led by Saha and Namita Khajanchi (PhD '24) demonstrated the effectiveness of one such system in a range of cell lines, including induced pluripotent stem cell-derived neurons. Saha and Khajanchi also spoke about their work on a podcast produced by the American Society of Gene and Cell Therapy.

Importantly, their system uses pomalidomide, a drug that's already approved by the U.S. Food and Drug Administration, to trigger degradation of the Cas9 enzyme. Pomalidomide is usually used to slow the growth of cancerous cells in multiple myeloma, a blood cancer that originates in bone marrow.

The degradation system could be particularly useful for treating heterozygous mutations, in which a patient inherits two different alleles of a given gene, one being a so-called "poison pill mutation" that needs to be edited. That's the case in two inherited retina diseases that Saha and collaborators are investigating through the National Institutes of Health-funded CRISPR Vision Program.

> "The longer Cas9 is in the system, the higher the chance it has to bind to unintended sites in the genome. These off-target sites are areas you didn't want to edit, causing serious collateral damage we don't want."

Conditions that are caused by a repeated segment of DNA, such as Huntington's disease, are another potential target. And, Saha notes, the ability to turn off gene-editing activity is crucial for controlling genomic instability—which can lead to cancerous cells. These cells pose problems in manufacturing cell therapies and are also a challenge for the precise editing required in CRISPR-enabled drug discovery.

"The degron approach is a platform technology, in that it can be adapted to many types of editors and many types of editing outcomes you might want," says Saha, whose lab is helping lead a UW-Madison collaboration with the manufacturer Cellares to produce CRISPR-edited CAR-T cells.

The degradation system involves adding a degron tag to the Cas9 protein, so that the addition of pomalidomide triggers machinery in the cell to gobble up the Cas9.

"The degradation system is kind of like Pac-Man," says Khajanchi, who now works for the gene-sequencing company Plasmidsaurus in Boston.

The researchers tested their system in human embryonic kidney cells, induced pluripotent stem cells (iPSC), hepatic (liver) cells and, finally, iPSC-derived neurons. They reported a three- to five-fold decrease in editing activity within four hours of induction—a timescale that Saha says is therapeutically relevant—as well as the ability to turn editing back on.

"This platform has the potential to 'dim' genome editing in a wide variety of contexts," says Saha, "not only inside the body, but outside the body, and also has implications for fundamental studies of how genome editing occurs in cells, in tissues, and in animals."

Top photo: Kris Saha holds the Retina Research Foundation Kathryn and Latimer Murfee Chair through the McPherson Eye Research Institute at UW-Madison. Photo: Joel Hallberg.

## DEPARTMENT NEWS

### Brockman honored with Shaw Early Career Research Award

Assistant Professor Joshua Brockman received the 2026 Shaw Early Career Research Award. This award provides $200,000 over two years to support early-career researchers in the fields of biochemistry, biological sciences and cancer research.

The funding aims to support innovative and high-impact research.

The Brockman Lab merges chemistry, bioengineering and imaging approaches to address questions in cancer immunotherapy and cellular mechanobiology.

### 'Quantum imaging' could open new window to nanoscale universe

As spectacular as modern imaging can be in illuminating the tiniest aspects of life, some avenues of biology are still cloaked in darkness.

Biological processes that happen over long periods of time—for example, exchanges of materials between cells—are hard to capture with conventional microscopy. Likewise, processes that occur quickly, such as interactions between organelles, lack sufficient resolution for researchers.

A team of physicists-by-training has a novel strategy for breaking through this roadblock: Merge modern light microscopy with the rules of quantum physics, to usher in a new era of super-resolution imaging that can aid in diagnosing and treating disease.

Professor Randy Bartels and colleagues at Colorado State University and the Colorado School of Mines have teamed together on a multi-year project to build a new generation of microscopes that marry both classical and quantum measurements. The project received support from the Gordon and Betty Moore Foundation.

### New tool interrogates machine learning models to uncover disease-leading biomarker interactions

Assistant Professor Yang Lu likes to say that searching the human genotype for a biomarker of a given disease is akin to trying to find a needle in a haystack. Or, more accurately, needles—the set of biomarker interactions out of millions of possible combinations that drive that disease's progression.

It's a monumental challenge beyond the analytical limits of the human brain. Artificial intelligence can help: Machine learning models can identify solutions from mountains of data, but they also look for shortcuts that can lead to false positives. And it's important that biomedical researchers can understand why the model generated its results when they decide which candidates to experimentally study.

With all that in mind, Lu and his collaborators have created a new method, called Diamond, for interaction discovery with rigorous error control. Detailed in a September 2025 paper in the journal *Nature Machine Intelligence*, the researchers' system works with a wide range of machine learning models to map genetic makeup (genotype) to genetic expression (phenotype). Diamond generates disease-specific hypotheses for researchers to further investigate.

"Biologists usually cannot afford to do experimental evaluation for 100 or 1,000 of these gene interactions," says Lu. "Due to budget limitations, they can only afford, say, 10. How do we make sure the 10 we provide them with are guaranteed to be the 10 most likely to trigger the disease?"

The project spans Lu's time as a postdoctoral researcher at the University of Washington, two-and-a-half years on the faculty at the University of Waterloo and his arrival at UW-Madison in fall 2025. He sees it as a significant step toward the "holy grail" of computational biology: Harvesting scientific discoveries directly from data, without requiring repeated rounds of experiments.

"AI models are powerful in building this genotype-to-phenotype mapping, by capturing subtle patterns," says Lu. "Once we have this model, it's not the end of the story. It's just the beginning of the story. We want to interrogate this model."

### Researchers look to advanced metabolic imaging to improve cancer immunotherapy

Chimeric antigen receptor (CAR) T cell therapy is transforming cancer care for patients with cancers of the blood, but has proven especially challenging to develop against solid tumors.

Researchers at the Morgridge Institute and UW-Madison published new research in the journal *Nature Biomedical Engineering* using advanced metabolic imaging to better understand how cells function within the tumor microenvironment.

"Metabolism is one of the many factors that affects how T cells function within the tumor microenvironment, and hopefully one of the key factors that could inform what can be made better for these CAR T cells in a solid tumor," says Dan Pham (MS '20, PhD '24), a postdoctoral researcher in the lab of Morgridge Investigator and Professor Melissa Skala and first author of the study.

The tumor microenvironment is harsh and suppressive to immune cells with limited oxygen and glucose, both important elements for T cells to perform their function. However, during manufacturing, CAR T cells are grown in an artificial environment with unlimited nutrients and oxygen.

"When we put them in the body, we're asking them, in a way, to survive in the wild," says Skala. "Kind of like how you think of a captive lion being released into the wild—they don't do so well."

The Skala Lab uses a sensitive label-free imaging technique called optical metabolic imaging (OMI) to capture metabolic activity within the cells. A major benefit is being able to image a sample directly across many timepoints.

It also analyzes at the single-cell level, which can help differentiate populations that have stronger functional responses.

"This study hopefully supports the application of OMI to fill in the gaps in the analytical tools that people use for CAR T cell manufacturing," says Pham. "Our measurements complement other metabolic assays from our collaborators so we can be certain in our validation."

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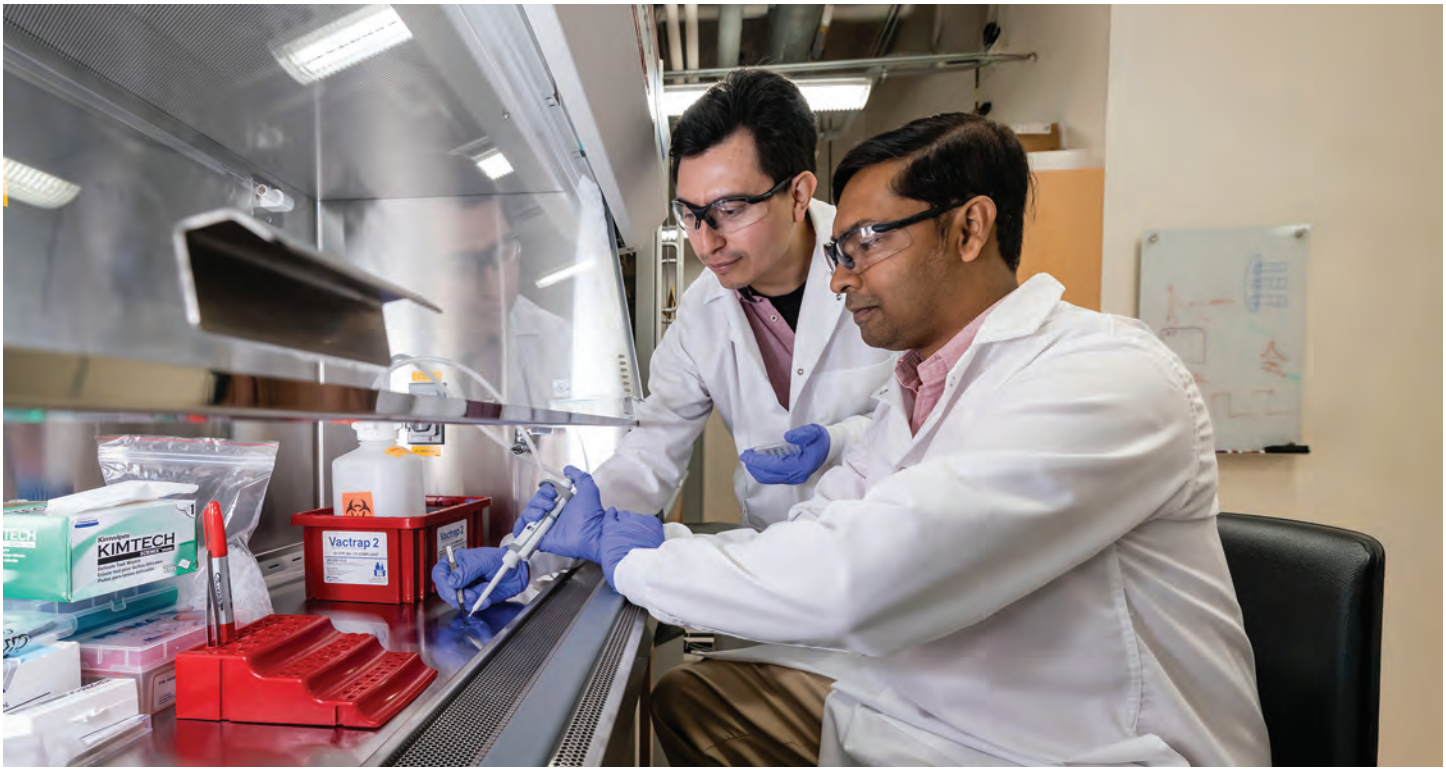


Recent BME graduate Samir Rosas (PhD '25) and Shovasis Kumar Biswas, a PhD student in electrical and computer engineering, were joint first authors on a paper in the journal *Advanced Materials* detailing a unique metasurface that traps light and allows researchers to better analyze biological samples in the mid-infrared range of the electromagnetic spectrum. The work, led by Assistant Professor Filiz Yesilkoy, could allow for deeper screening of biological samples that could uncover early warning signs of diseases like ovarian cancer. Photo: Joel Hallberg.