

# alumni

2022 • Issue 3

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# Letter from the president

Traditionally, fall is a time for homecoming. I have been back to Rochester so many times in the fall; it truly is a special time of the academic year. I encourage everyone to plan now to return to Rochester next September (2023) for a joyful homecoming at the Alumni Association Biennial Meeting. The event returns to Rochester\* to highlight the 50th anniversary of Mayo Clinic Alix School of Medicine. As an alum of the medical school (1980), you can be sure I am excited about that. The relationships I've made — and continue to make — at Mayo Clinic are among my most valuable possessions. Taking time away from a busy practice to attend meetings like this one is challenging, but I try to make time for what's important. I've never regretted a return to Mayo Clinic. It seems I always make new connections, renew old friendships, and fondly remember my experiences and mentors.

I hope you feel the same way. If you're reluctant to attend the Biennial Meeting because you may not know anyone, reach out to a former classmate using the Find Alumni feature ([alumniassociation.mayo.edu/people](https://alumniassociation.mayo.edu/people)) on the Alumni Association website. If you can't find anyone you know there, email the Alumni Association ([mayoalumni@mayo.edu](mailto:mayoalumni@mayo.edu)) to see if they have contact information for people you know and can put you in touch. Sometimes when I've attended meetings where I didn't know anyone, I've had the best time making new friends who share the common Mayo bond.

I hope to see you in Rochester next fall!



A handwritten signature in black ink that reads "Carl Backer". The script is fluid and cursive.

**Carl Backer, M.D.** (MED '80)  
President, Mayo Clinic Alumni Association  
Chief, Section of Pediatric Cardiothoracic Surgery  
Professor of surgery  
UK Healthcare Kentucky Children's Hospital  
Lexington, Kentucky

**About the cover:** Mayo Clinic is a leading accelerator in microbiome research and poised to move findings to the clinic, according to Purna Kashyap, M.B.B.S., co-associate director of the Microbiome Program in the Mayo Clinic Center for Individualized Medicine.

Image by Dennis Kunkel Microscopy/  
Science Photo Library

\*In odd-numbered years, biennial meetings rotate among Mayo Clinic locations in Arizona, Florida and Minnesota. The 2025 biennial will be in Florida; the 2027 biennial in Arizona.



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Joshua Wiedermann, M.D. (left)



Illustration on page 36 by Peter Grundi.

**COVID-19 photography disclaimer:** Some photos were taken before the pandemic. In others, individuals were alone in nonpatient care, nonpublic settings and were, therefore, in compliance with Mayo Clinic's COVID-19 safety guidelines while unmasked.







Mayo Clinic Graduate School of Biomedical Sciences Regenerative Sciences Track

# Training scientists to rebuild health

Experts predict that regenerative medicine will transform clinical practice. A conservative estimate is that 20% of future medical and surgical solutions will involve regenerative solutions. Regenerative medicine shifts the focus of medicine from fighting disease to rebuilding health. Regenerative medicine could improve human health span — the number of disease-free years — so a person's final years have better quality of life. It could cure diseases such as type 1 diabetes, regenerate the injured

spinal cord and joints, modulate the immune system to prevent rejection of transplanted organs and introduce biomaterials that improve organ regeneration.

Already, regenerative scientists at Mayo Clinic have discovered how to reprogram cells to manufacture any cell type, use cells to regenerate tissues and organs, use stem cells to modulate the immune system to alleviate disease, use cell-free products to regenerate tissue and restore function, and use 3D printers and electrospinning technologies to create scaffolds to build new organs.



*“Students in our program today are the **scientists who will move this field forward** for the benefit of patients everywhere.”*

– Isobel Scarisbrick, Ph.D.

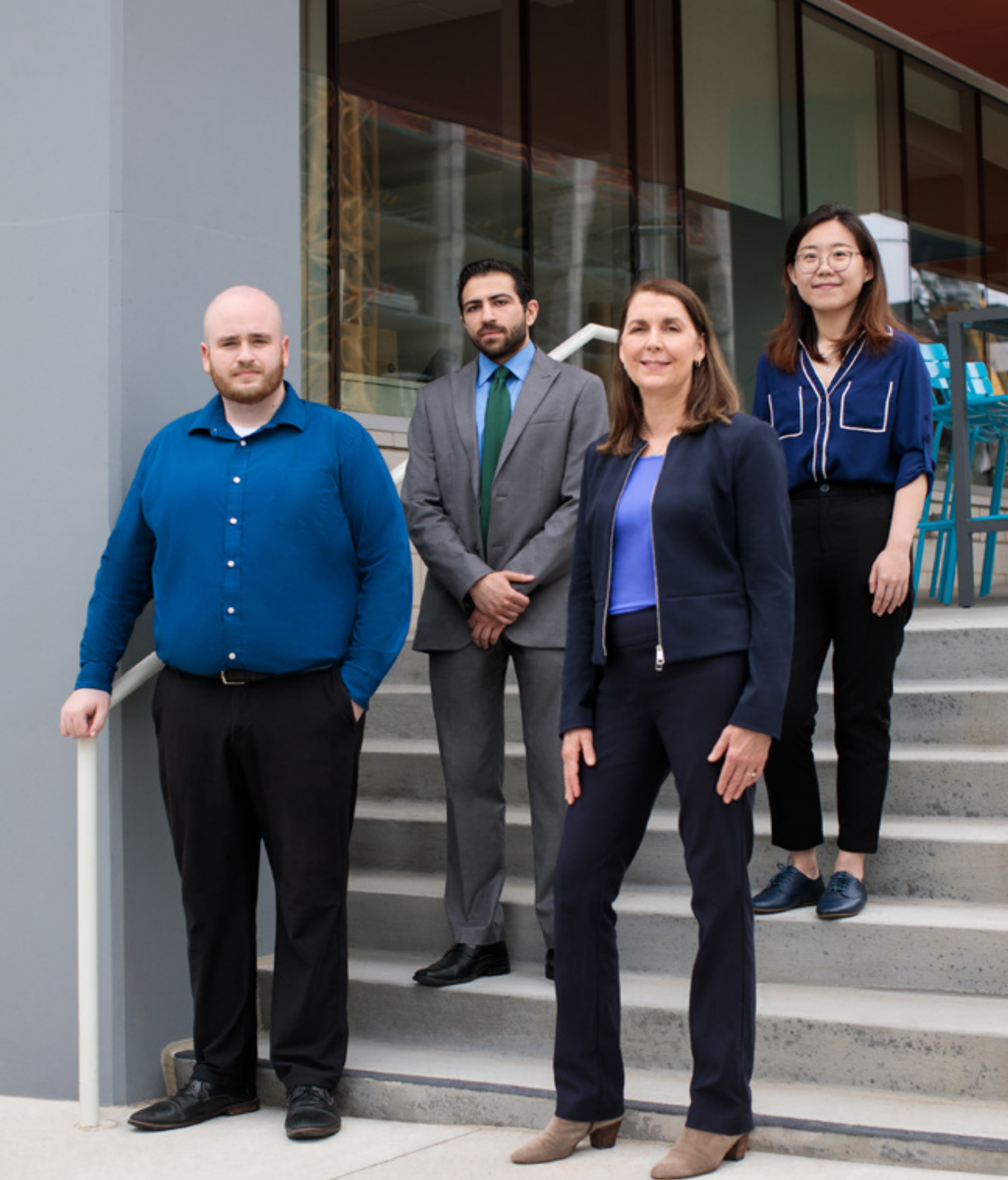
### A DOCTORAL TRAINING PROGRAM

To prepare the next generation of scientists to accelerate the discovery, translation, and application of cutting-edge regenerative diagnostics and therapeutics, Mayo Clinic Graduate School of Biomedical Sciences introduced a Regenerative Sciences Track in 2021 — one of the first regenerative sciences doctoral training programs in the U.S. The inaugural class includes six Ph.D. students and three M.D.–Ph.D. students.

Approximately 80 people applied to be in the first class of the program. **Isobel Scarisbrick, Ph.D.** (BIOC '96), Department of Physical Medicine and Rehabilitation at Mayo Clinic in Rochester and program director of the Regenerative Sciences Track, emphasizes the diversity of the students selected, with four of nine in the first

class from underrepresented backgrounds. “We need to have scientists from diverse backgrounds thinking about regenerative solutions to benefit our entire society.”

The program’s curriculum encompasses the spectrum of regenerative sciences topics: molecular and cell biology, stem cell biology, developmental biology, tissue engineering, biomaterials and nanomedicine, genome editing and gene therapies, regulatory and translational science, product development, biomanufacturing and entrepreneurship. Students can choose from labs at any Mayo Clinic location and receive full tuition, an annual graduate-level stipend and travel expenses to scientific meetings. Portions of the curriculum were trialed for several years with a cohort of students from other programs in the graduate school who were interested in regenerative sciences.



Isobel Scarisbrick, Ph.D. (front right), program director of the Mayo Clinic Graduate School of Biomedical Sciences Regenerative Sciences Track, with some of the first students in the program: Nathaniel Blackwell, Armin Garmany and Shan Gao.



Isobel Scarisbrick, Ph.D.

## DEVELOPING THE NEXT GENERATION OF REGENERATIVE MEDICINE SCIENTISTS

Dr. Scarisbrick describes the curriculum and training in the Regenerative Sciences program as transdisciplinary. “Leaders in regenerative sciences and medicine will need to understand various disciplines to find real regenerative solutions. Students get involved with the Mayo Clinic Center for Regenerative Medicine to understand the clinical needs and see the infrastructure necessary to move discoveries toward practice. Our program focuses on Mayo’s cure mission. Students in our program today are the scientists who will move this field forward for the benefit of patients everywhere.”

Dr. Scarisbrick completed a fellowship in biochemistry at Mayo Clinic after getting a Ph.D. in biology from the University of California, Irvine, and a master’s degree in

anatomy and cell biology from the University of Western Ontario in London, Ontario, Canada. Her research includes developing approaches to enhance the innate capability of the injured or diseased central nervous system to regenerate through pharmacologic, metabolic and exercise-related interventions. Her lab has identified protease-activated receptors as targets for therapies to promote neural regeneration, including stem cell expansion and myelin repair.

“Our work in neural repair and rehabilitation is exciting and significant,” she says. “But leading the Regenerative Sciences program multiplies the impact I can have on developing the next generation of regenerative medicine scientists. I’m impressed with their drive, curiosity and breadth of interests and can’t wait to see the regenerative solutions they engineer and bring to patients.”



## BUILDING LUNGS

**Nathaniel Blackwell** (REGS '26) became interested in regenerative sciences when he was treated for an autoimmune arthritis condition. He wanted to learn how the body could repair itself. His undergraduate research adviser at Missouri University of Science and Technology had worked at Mayo Clinic before pursuing her Ph.D. He says she raved about Mayo Clinic, making him want to apply to its graduate school. One year into the inaugural class in the Regenerative Sciences program, Blackwell says he could have done 10 rotations in each of the labs he's been interested in.

"I quickly learned that more work has been done in this field than I was aware of," says Blackwell. "Mayo Clinic programs reflect that in the breadth of regenerative sciences work being done across disciplines. It's such a big thing to tackle that no single group can do it all. It's very collaborative, with scientists challenging and pushing each other forward. That breadth is reflected in our training program, which constantly enhances our formal curriculum. That's part of what attracted me to regenerative sciences and to Mayo Clinic — a nontraditional environment that incorporates disciplines and is flexible and adaptive."

Blackwell joined the lung development and regeneration lab of **Douglas Brownfield, Ph.D.** (THDCC '21), in the Division of Pulmonary and Critical Care Medicine at Mayo Clinic in Rochester. Blackwell will focus on building lung organs on chip models, working with microfluidic chips to grow cells in a controlled environment, and replicating developing and adult organs.

"I'm interested in how we replicate the biology of human organs and build realistic human tissues outside of the body," says Blackwell. "That will help us better understand how lungs develop and regenerate. We'll use patient-derived cells to understand disease and explore drug targets."

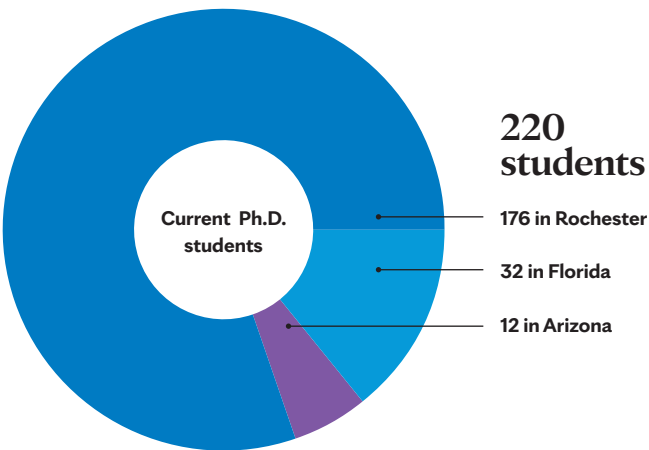


*"It feels like being on the ground floor of the computing revolution. No one understands the full potential, but **they know the potential is there.**"*

— Nathaniel Blackwell

## Mayo Clinic Graduate School of Biomedical Sciences

4,000+ degrees conferred since 1917, including 1,000+ Ph.D., 137 M.D.–Ph.D. and 3,100+ master's





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## Mayo Clinic Graduate School of Biomedical Sciences

# 58

M.D.–Ph.D. students

# 87

master's degree  
students in 14 tracks

# 30%

international students in  
incoming classes since 2010

# 19%

underrepresented students, including  
first-generation college students,  
in incoming classes since 2010

# 10%

of students participate  
in invention disclosures

Blackwell hopes he can bring valuable new perspectives to regenerative sciences work. “It feels like being on the ground floor of the computing revolution. No one understands the full potential, but they know the potential is there. Regenerative science could impact the way we think about medicine and treat disease — focusing on restoring function and quality of life instead of therapeutics. By studying tissue engineering, I can foresee working as a biomanufacturing expert who brings a viable platform for tissue engineers to grow organs in a scalable, efficient way.”

### REVERSING LUNG DAMAGE

**Shan Gao** (REGS '26) also is interested in pulmonary regenerative sciences research. A member of the inaugural class and the first international student in the Regenerative Sciences program, she's working in the lab of **Stijn De Langhe, Ph.D.** (THDCC '21), in the Division of Pulmonary and Critical Care Medicine at Mayo Clinic in Rochester. Gao's focus is on understanding the reason and mechanism of controlling differentiation of mesenchymal cells after injury and controlling fibrosis in the lung.

“The damage from idiopathic pulmonary fibrosis is not reversible,” she says. “The only solution in most cases is lung transplant, but many people die waiting for donated lungs. Being able to develop a cellular therapy to reverse the damage is a way to save more lives.”

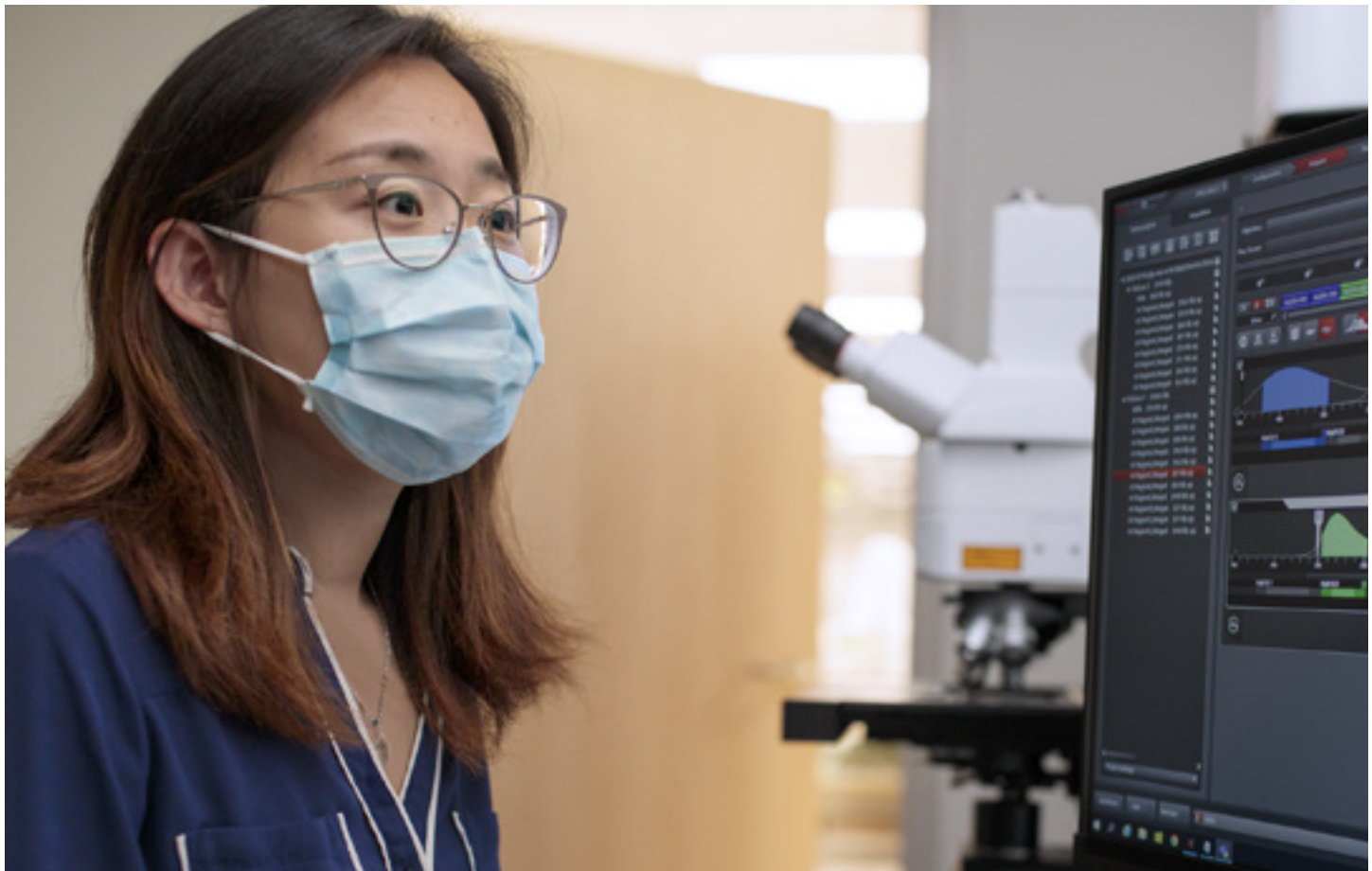
That goal is personal for Gao. Three of her grandparents died of pulmonary disease around age 60.

“I want to connect science with patient care,” says Gao, who earned a master's degree in biotechnology from the University of Alabama at Birmingham before coming to Mayo Clinic. “I looked for a Ph.D. program with a regenerative sciences track where I could study pulmonary disease. My master's degree mentor recommended Mayo's program, and I learned more through online research. The beauty of the Regenerative Sciences program is that it's tailored to each student's research interests, which are all unique. It's easy to pursue what you like and get the necessary support for your research. The degree of collaboration among campuses and labs is high. Everyone has been warm-hearted, and I'm so glad to be here, pursuing my research passion.”

### RESTORING CARDIAC FUNCTION

**Armin Garmany** (MDPH '26, MPET '26, REGS '26) saw how his physician parents contributed to their patients' lives and was drawn to medicine and science. He chose the medicine path and came to Mayo Clinic Alix School of Medicine – Rochester campus in 2018. During his first year in medical school, he decided to pursue a joint M.D.–Ph.D. degree and joined the Regenerative Sciences program after his second year. He is now in the fifth year of the program — starting the third year of the Ph.D. portion of his training.





**Shan Gao**

“I was impressed by the unparalleled research opportunities at Mayo Clinic and wanted to get involved in translational regenerative medicine research, which permeates throughout the institution,” says Garmany. “Caring for patients provides immediate gratification as you see patients benefit from your care. Research provides long-term satisfaction, with the opportunity

to help more people as the discoveries of today may help develop next-generation therapies. Thus, I became enamored with both.

“Mayo Clinic has incredible physician–scientist mentors who successfully do clinical care and research. They’re helping me develop the skills needed to develop new regenerative medicine therapies.”

## Mayo Clinic Graduate School of Biomedical Sciences Deans



**DEAN**  
**STEPHEN EKKER, Ph.D.**  
(BIOC '07), Department of  
Biochemistry and Molecular  
Biology, Mayo Clinic in Rochester



**ASSOCIATE DEAN**  
**NHAN TRAN, Ph.D.**  
(CB '16), Mayo Clinic Cancer  
Center, Mayo Clinic in Arizona



**ASSOCIATE DEAN**  
**EVETTE RADISKY, Ph.D.**  
(CB '05), Department of Cancer  
Biology, Mayo Clinic in Florida



**ASSISTANT DEAN**  
**WILFRIED ROSSOLL, Ph.D.**  
(NSCI '17), Department of  
Neuroscience, Mayo Clinic  
in Florida



Garmany is involved in cardiovascular research and works in the regenerative medicine lab of **Andre Terzic, M.D., Ph.D.** (CV '92), Department of Cardiovascular Medicine, a Marriott Family Professor of Cardiovascular Research and the Marriott Family Director of the Comprehensive Cardiac Regenerative Medicine Program in the Mayo Clinic Center for Regenerative Medicine.

“Advances in medicine and science have allowed more people to survive after a heart attack,” says Garmany. “I want to further the science to improve their quality of life after a heart attack. I would like to help ensure the therapeutic proficiency of cellular therapies for cardiovascular disease, reducing the heterogeneity of the therapeutic response.

“Cellular therapy could slow the progression of — and even restore — compromised cardiac function.

“Mayo Clinic is a pioneer in regenerative medicine education — important today as institutions realize the imperative of training the regenerative medicine workforce. This is an exciting, expanding field that can be a disruptive innovation to improve patients’ quality of life. The Regenerative Sciences program is a great way for interested graduate and medical students to develop skills to advance the field. There is nowhere I would rather do this than at Mayo Clinic, where I feel motivated every day to pursue translational research that can impact patients’ lives.” •

*“There is nowhere I would rather do this than at Mayo Clinic, where I feel motivated every day to pursue translational **research that can impact patients’ lives.**”*

— Armin Garmany



# 8 tracks

Mayo Clinic Graduate School of Biomedical Sciences has eight tracks in its Ph.D. programs to train future leaders in biomedical research and education.

## 1 BIOCHEMISTRY AND MOLECULAR BIOLOGY

Protein and lipid trafficking, genetic and epigenetic studies in monogenic and multigenic disorders, protein folding and disease, regulation of gene expression, cell signaling, aging, organelle function and dynamics, genome editing, musculoskeletal biology, cancer biology and progression

**PROGRAM DIRECTOR:** John Hawse, Ph.D. (BIOC '06), Department of Biochemistry and Molecular Biology, Mayo Clinic in Rochester

**ASSOCIATE PROGRAM DIRECTOR:** Matthew Schellenberg, Ph.D. (BMB '19), Department of Biochemistry and Molecular Biology, Mayo Clinic in Rochester

## 2 NEUROSCIENCE

Neurodegeneration, neuroregeneration, biochemistry, cell and molecular biology, genetics, imaging, behavior, neuropathology, virology, pharmacology, stem cells and transplantation, deep brain stimulation, clinical studies

**PROGRAM DIRECTOR:** Owen Ross, Ph.D. (NSCI '08), Department of Neuroscience, Mayo Clinic in Florida

**ASSOCIATE PROGRAM DIRECTOR:** Wolfdieter Springer, Ph.D. (NSCI '11), Department of Neuroscience, Mayo Clinic in Florida

## 3 MOLECULAR PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS

Cancer biology and therapeutics, regenerative medicine, pharmacogenetics and pharmacogenomics, drug discovery, biology and genetics of addiction, cardiovascular biology and therapeutics, therapy for neurodegenerative diseases, systems pharmacology, computational pharmacology

**PROGRAM DIRECTOR:** Richard Weinshilboum, M.D. (PHAR '74), chair, Division of Clinical Pharmacology, Mayo Clinic in Rochester; the Mary Lou and John H. Dasburg Professor of Cancer Genomics Research

**ASSOCIATE PROGRAM DIRECTOR:** Liewei Wang, M.D., Ph.D. (PHAR '03, MPET '03), Division of Clinical Pharmacology, Mayo Clinic in Rochester; the Bernard and Edith Waterman Director, Pharmacogenomics Program, Center for Individualized Medicine

## 4 BIOMEDICAL ENGINEERING AND PHYSIOLOGY

Biomechanics, biomedical imaging, molecular biophysics and biosensing, physiology

**PROGRAM DIRECTOR:** Kristin Zhao, Ph.D. (PMR '97), Department of Physical Medicine and Rehabilitation, Mayo Clinic in Rochester

**ASSOCIATE PROGRAM DIRECTOR:** Leigh Griffiths, Ph.D. (CV '16), Department of Cardiovascular Medicine, Mayo Clinic in Rochester

## 5 REGENERATIVE SCIENCES

Molecular and cell biology, stem cell biology, developmental biology, tissue engineering, biomaterials and nanomedicine, genome editing and gene therapies, regulatory and translational science, product development, biomanufacturing, entrepreneurship

**PROGRAM DIRECTOR:** Isobel Scarisbrick, Ph.D. (BIOC '96), Department of Physical Medicine and Rehabilitation, Mayo Clinic in Rochester

**ASSOCIATE PROGRAM DIRECTOR, ROCHESTER CAMPUS:** Quinn Peterson, Ph.D. (PHYS '17), Department of Physiology and Biomedical Engineering

**ASSOCIATE PROGRAM DIRECTOR, ARIZONA CAMPUS:** Clifford Folmes, Ph.D. (CV '12), Department of Cardiovascular Diseases

**ASSOCIATE PROGRAM DIRECTOR, FLORIDA CAMPUS:** Tsuneya Ikezu, M.D., Ph.D. (NSCI '21), Department of Neuroscience

## 6 IMMUNOLOGY

Cancer immunology and immunotherapy, autoimmunity and immune-mediated diseases, molecular biology and signaling in immune activation, immune system development and regeneration

**PROGRAM DIRECTOR:** Kay Medina, Ph.D. (IMM '05), Department of Immunology, Mayo Clinic in Rochester

**ASSOCIATE PROGRAM DIRECTOR:** Haidong Dong, M.D., Ph.D. (IMM '01), Department of Urology, Mayo Clinic in Rochester

## 7 VIROLOGY AND GENE THERAPY

Molecular biology of viruses, mechanisms of virus-host interactions, gene therapy, oncolytic virotherapy, cancer immunology, vaccine development, tissue engineering using viruses, genetic engineering using viruses

**PROGRAM DIRECTOR:** Michael Barry, Ph.D. (INFD '06), Division of Infectious Diseases, Mayo Clinic in Rochester

**ASSOCIATE PROGRAM DIRECTOR:** Autumn Schulze, Ph.D. (MMED '15), Department of Molecular Medicine, Mayo Clinic in Rochester

## 8 CLINICAL AND TRANSLATIONAL SCIENCE

Population-based translational science, patient-based translational science, laboratory-based translational science

**PROGRAM DIRECTOR:** Anthony Windebank, M.D. (N '82), Department of Neurology, Mayo Clinic in Rochester; the Judith and Jean Pape Adams Charitable Foundation Professor of Neuroscience

**ASSOCIATE PROGRAM DIRECTOR:** Felicity Enders, Ph.D. (HSR '04), Department of Quantitative Health Sciences







# Focus on community practice

Real-world research  
fuels better outcomes





It's a Catch-22. You can't **improve community practice** without **evidence-based research**, but it's challenging to incorporate research into a busy primary care practice. And there's a **paucity of researchers devoted to primary care.**

"We're busy seeing patients and trying to deliver the best care possible. It's hard to find time to pause, step back and figure out how to do things better at a bigger scale than just our clinic," says **Rozalina McCoy, M.D.** (CI '11, I '12, ENDO '15, CTSA '15), Division of Community Internal Medicine, Geriatrics, and Palliative Care. Dr. McCoy sees patients in the community clinic in northeastern Rochester and has started a new role as the vice chair for Research in her division. "Physicians in primary care are busy doing

clinical work. The infrastructure and resources haven't existed to support dedicated time for research. However, research — the spirit of inquiry, innovation, improvement and discovery — is at the core of everything we do at Mayo Clinic. It's important to use a rigorous academic approach to study models of care in the primary care setting and provide evidence of what works and will lead to improved patient outcomes."

Dr. McCoy is doing that. After residency and fellowship training as a clinician-investigator and a master's

degree in health sciences research — all at Mayo Clinic — Dr. McCoy joined the Mayo Clinic staff in 2015. As a clinician-researcher, she devotes most of her time to research. She knows how important it is that research in a primary care setting be minimally disruptive to the practice and not a burden for clinicians and staff.

"Improving community care and population health means studying it in real-world settings," says Dr. McCoy. "Many clinical trials take place in idealized settings that are highly controlled. That's not reflective of a



*“It’s exciting to see  
research at the  
**primary care level**  
being prioritized.”*

– Rozalina McCoy, M.D.





Registered nurse Christine Hunter has been a leader in diabetes work with Rozalina McCoy, M.D. As a care team nurse, Hunter helps patients with diabetes improve their health.

real clinical practice. Research in a destination practice where patients leave after treatment and continue their care elsewhere doesn't inform the primary care practice. Mayo Clinic Health System gives us opportunities to do pragmatic trials in a real-world care environment and follow patients longitudinally. It also helps us understand how to deliver care better because we can engage with patients over time, see what works and why, and continually improve."

**Prathibha Varkey, M.B.B.S.** (PREV '02), president of Mayo Clinic Health System, affirms the importance of research in Mayo

Clinic Health System. "Becoming a hub for community-based research and transforming rural health and population health are key priorities of our 2030 vision to become a category of one community health system. Transforming and studying care models while providing outstanding care is key to the same."

#### **ENHANCING THE DIABETES CARE MODEL**

A focus of Dr. McCoy's research is using real-world evidence to improve diabetes care. She analyzes data to understand patterns in care delivery

and conducts pragmatic trials to determine best practices. She also is studying how to deliver care to make sure no one is left behind. Patients in rural or low-income areas and those with greater racial/ethnic diversity have more health disparities, including higher rates of and complications from diabetes. To combat those trends, Dr. McCoy's work centers on improving access to care, developing new ways to deliver care effectively and safely, and addressing care disparities. In the last three years, Dr. McCoy has led the development, implementation and evaluation of a new model of care for patients with diabetes. The new model involves a care team nurse who supports patients who have diabetes, engages with them and others on the team, and works to identify and remove barriers to optimal care. The program launched in five Mayo Clinic Employee and Community Health clinics in Rochester and Kasson, Minnesota, that care for almost 8,000 adults who have diabetes. The program was expanded throughout the southeast Minnesota region of Mayo Clinic Health System to 10,000 patients who have diabetes.

Care team nurses identified patients who didn't meet diabetes quality indicators — glycemic and blood pressure control, nonsmoking, aspirin use for prevention of ischemic vascular disease, and statin use — with the goal of reviewing approximately 10% of patients not meeting those indicators each month. The nurses contacted patients for a diabetes review, discussed the care plan and patient needs, and continued longitudinal follow-up reviews until patients met the quality goals. A comparison of how this patient-centered, evidenced-based diabetes care model performs compared to the traditional care model showed substantial improvement in the new way. The Rochester and Kasson practices saw the proportion of their patients who have diabetes and met diabetes care quality goals increase from 45% to 51%. In the southeast

Minnesota region, they increased from 35% to 45%.

"This sustained improvement in diabetes quality has been striking, considering the challenges posed by the COVID-19 pandemic and that our clinics received no additional resources to support this work," says Dr. McCoy.

Priorities for this program in 2022 include continuing to expand it throughout Mayo Clinic Health System locations in southeastern Minnesota, engaging local champions to support the progress, implementing a process to allow patients to download their glucose monitoring data, and examining quality metrics by race/ethnicity and other social determinants of health. The enhanced diabetes care model provides a framework for improving other chronic conditions, including hypertension and tobacco cessation.

Dr. McCoy considers it a priority to improve access to care and health outcomes among patients in rural and socioeconomically deprived areas. People in those areas face multiple barriers to optimal care.

She conducted studies that concluded adult patients who have diabetes and live in more deprived and rural areas were significantly less likely to have high-quality diabetes care and lower rates of recommended cancer screenings compared to those in less deprived and urban areas. Those findings highlight the need for interventions that may include community partnerships, patient engagement, and geographically targeted efforts to improve care quality and health outcomes for these at-risk populations.

"It's exciting to see research at the primary care level being prioritized," says Dr. McCoy. "I think we'll see growth in research in Mayo Clinic Health System, with the community practices driving research questions and primary care clinicians driving the research and serving as investigators."

***"This sustained improvement in diabetes quality has been striking, considering the challenges posed by the COVID-19 pandemic and that our clinics received no additional resources to support this work."***

— Rozalina McCoy, M.D.



*“Community paramedics anywhere in the country can do this. **We’re showing what is possible** in and highly cost effective for rural and community practices.”*

— Rozalina McCoy, M.D.

### **TAKING DIABETES CARE TO THE PATIENT**

Dr. McCoy also is medical director of the community paramedic program of Mayo Clinic Ambulance Service, which serves 14 locations in eastern and central Minnesota and western Wisconsin. She has conducted research to employ community paramedics — the highest level of EMS certification — to extend primary care and help fill in gaps in health care in underserved communities. This includes serving an aging population with increasing needs for acute, chronic and preventive care; delivering care to people experiencing homelessness; providing patients who have diabetes with access to self-management education and support; and improving availability of health care services in rural areas.

According to a national survey, community paramedicine programs

deliver care at a lower cost, reduce use of emergency departments, reduce use of EMS and emergency department transport among people who frequently call EMS, reduce hospital readmissions, reduce unreimbursed care, extend primary care, improve chronic disease management, provide a bridge to home health services, improve patient satisfaction and improve performance on quality metrics.

Community paramedics are trained to make health status assessments and recognize and

manage life-threatening conditions outside of the hospital. They commonly perform, monitor and educate about chronic diseases and medication, provide immunizations and vaccinations, collect laboratory specimens, provide follow-up care after hospital discharge and perform minor medical procedures. Community paramedics practice under the guidance of a physician medical director and have training in nonemergency medicine including primary and preventive care, chronic disease management,



**53.3%**

reduction in primary care visits with community paramedicine program

**59.3%**

reduction in emergency room visits with community paramedicine program



patient education and social determinants of health — in addition to their paramedic certification in emergency care. Although Minnesota was the first state to define the community paramedicine role in state statute, at least 33 states offer community paramedic or mobile integrated health care programs.

In a seven-month pilot trial of community paramedicine in northwestern Wisconsin, a full-time paramedic provided 412 visits to 42 patients who had high rates of health care utilization. The service focused

on chronic disease management, preventive care, and prevention of emergency department visits and hospitalizations. The community paramedicine program reduced primary care visits by 53.3%, emergency department visits by 59.3% and hospitalizations by 60%.

Dr. McCoy subsequently partnered with Mayo Clinic Ambulance Service to scale the program to support the southeast Minnesota region, hiring additional community paramedics in a Mayo Clinic Center for Health Equity and Community Engagement

**Paramedic Andrew Torres visits patients in their homes in a community paramedicine program overseen by Rozalina McCoy, M.D.**



60%

reduction in hospitalizations with  
community paramedicine program

*“Scientific discoveries and innovations aren’t helpful to patients if we can’t figure out **how to deliver the right care to the right patients** and at the right stage of their disease.”*

– Rozalina McCoy, M.D.

Research-funded trial of this new care model for patients with uncontrolled diabetes.

Dr. McCoy spearheads another community paramedicine pragmatic trial, funded by the National Institute of Diabetes and Digestive and Kidney Diseases, that seeks to improve diabetes management among patients who have severe hypoglycemia. In an average of four visits per month, community paramedics work with patients on diabetes management to prevent emergency department visits and hospitalizations, reduce diabetes distress, and improve diabetes self-efficacy and quality of life. Community paramedics check how patients store, administer and dispose of medications; observe patients checking blood glucose and ensure glucose meters function properly; review glucose log with patients; discuss signs of and risk factors for hypo- and hyperglycemia; take stock of medication and supplies; identify areas for improvement; and review goals.

The community paramedicine program recently expanded to determine its effectiveness in shortening and preventing hospitalizations and emergency department care. This expansion is being studied in a large pragmatic randomized controlled trial conducted in the Rochester, Minnesota, and Barron,

Wisconsin, service areas. The trial is funded by a Mayo Clinic Pragmatic Trial Award, the Mayo Clinic Center for Clinical and Translational Science, and the Mayo Clinic Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery. In this trial, some patients will get care from community paramedics, and others will get traditional care. Outcomes include comparing the number of days patients remain at home, and their quality of life and satisfaction with care. A major component of the trial is to understand how best to research and conduct pragmatic trials in different practice settings, particularly in Mayo Clinic Health System. According to Dr. McCoy, this is the first large randomized controlled trial of community paramedics in the U.S.

“I’m continually awed by what our community paramedics can do. They deliver high-quality patient-centered care, with reduced ED visits and hospital admissions and improved quality metrics and high patient satisfaction,” says Dr. McCoy. “Community paramedics anywhere in the country can do this. We’re showing what is possible in and highly cost effective for rural and community practices.”

In addition, the academic model of community paramedicine offers career growth opportunities for

community paramedics and others on Dr. McCoy’s team. Community paramedics and clinician partners across the Ambulance Service and Mayo Clinic Health System can participate in these research studies, co-author peer-reviewed manuscripts, and contribute to the development and growth of this new care delivery model.

“In the last year, because of our enhanced diabetes care team process, more than 1,100 patients in southeastern Minnesota have had optimal diabetes care, making them less likely to lose their vision, need dialysis, have a heart attack or die,” says Dr. McCoy. “And because of the community paramedic service, we’ve brought urgently needed care to patients when, where and how they need it.

“Scientific discoveries and innovations aren’t helpful to patients if we can’t figure out how to deliver the right care to the right patients and at the right stage of their disease. All of the discoveries we make as scientists are lost if we can’t bring them to the practice. Mayo Clinic Health System allows for the ultimate translation of research to the patient. Trials such as these allow us to transform how care is delivered. I see Mayo Clinic Health System as a learning health system, and it’s exciting to envision what else we can learn, discover and transform as we continue this evolution.” •







# The future will be personalized

## Accelerating microbiome research

**W**e're in the midst of a microbiome research epidemic, according to Purna Kashyap, M.B.B.S. (GI '10), co-associate director of the Microbiome Program in the Mayo Clinic Center for Individualized Medicine.

"We started early and are pushing hard," says Dr. Kashyap.

"We're one of the top accelerators in the field and are well poised to move microbiome research findings to the clinic. We anticipate that happening in another decade or so."

Microbiome-related research at Mayo Clinic focuses on improving patient outcomes or bringing microbiome discoveries to clinical practice — an area in which Mayo Clinic leads. The Microbiome Program provides resources for Mayo Clinic researchers doing this work, providing knowledge and infrastructure assistance.





Purna Kashyap, M.B.B.S., and Nicholas Chia, Ph.D., are co-associate directors of the Microbiome Program in the Mayo Clinic Center for Individualized Medicine.

*“We’re one of the top accelerators in the field and are **well poised to move microbiome research findings to the clinic.** We anticipate that happening in another decade or so.”*

– Purna Kashyap, M.B.B.S.

“Microbiome research is young, vibrant and ongoing,” says Dr. Kashyap. “We don’t have all the answers yet, but we know the microbiome is a component of multiple chronic diseases and an important contributor if not always the inciting factor.”

Dr. Kashyap’s Microbiome Program co-associate director, **Nicholas Chia, Ph.D.** (NACF ’22), concurs: “There is mounting evidence that changes in the microbiome may be implicated in the development, progression and treatment of multiple diseases. Eliminating dangerous microorganisms or restoring normal microbiota may reverse this process. This is a critical possibility that we are still learning more about.”

Microbiome research at Mayo Clinic includes studying the role of bacteria, fungi and viruses in disease states ranging from cancer to obesity and everything in between. A large trial of cancer patients is analyzing whether the microbiome can be used as a biomarker to predict cancer treatment response and adverse events. In another project, Mayo Clinic has licensed a bacteria to a biotechnology company for further study about its role in suppressing multiple sclerosis and rheumatoid arthritis. Another project Mayo collaborated on resulted in a commercial product to provide microbiome-directed personalized nutrition to regulate blood glucose and prevent complications of diabetes and prediabetes.

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## The microbiome

Microbiomes are communities of bacteria, fungi and viruses that live in and on the human body and function in harmony with the host individual. They carry genes much like human genes and add to the ability to metabolize parts of our diet and even some medications. Different areas of the body — skin, colon, mouth, vagina, nose — and people have unique microbiomes.

The parts of a microbiome aren't genetically part of an individual but are intrinsically part of who a person is and how healthy or diseased the person is. Microbiomes are modifiable and can be influenced by medication and diet. Manipulating these intricate ecosystems may help prevent or treat diseases and transform precision medicine and patient care in the future.





*“The predictive performance resulted in 90% accuracy, demonstrating the proof of concept that the **integration of gut microbiome and AI could be an avenue to predict disease course in rheumatoid arthritis.**”*

– John Davis III, M.D.

Dr. Kashyap compares microbiome research to genome research. “The human genome was sequenced in 1991. In 2022, we use it to predict risk and tailor disease treatment. That was one genome. Microbiome complexity is much higher, and we’re trying to do the same thing in terms of sequencing and understanding. We’re making progress and, while we stumble along the way, we have learned from early failures that which has positioned us well for future success. One way in which the microbiome is particularly exciting is that it is modifiable whereas genes are not.”

He predicts that the first FDA-approved microbiome-related therapies will be stool substitutes to reset the microbiome of the colon in patients who have *Clostridioides difficile* (C. diff) infection.

“In the future, we’ll be able to look at a person’s microbiome and tell a patient their risk of developing a disease, much like we do now with commercially available human gene panels. This holds promise as a preventive strategy because, unlike our genes, the microbiome can be changed. What we already see across the horizon in diseases such as cancer and autoimmune conditions is the ability of an individual’s microbiome to predict which treatments will be effective or have the fewest side effects and how a person might respond

to different treatments so we can eliminate trial and error and start with the best treatment first. We also could try to change the microbiome with diet or prebiotics to improve chances of success with a treatment. But we’re not there yet. We’re moving at a fast rate, and I’m optimistic that we will have early wins by the end of this decade.”

In the meantime, Dr. Kashyap advises people interested in keeping their microbiome healthy to eat a high-fiber diet from diverse food sources. “Most chronic diseases have microbiomes that show low diversity. We know that a highly diverse state is more resilient to change, and a high-fiber diet will increase the diversity of your microbiome.”

Mayo Clinic Alumni magazine looks at some of the many microbiome research projects across Mayo Clinic campuses.

## MOVING THE NEEDLE IN GI MOTILITY

**D**r. Kashyap’s own research focuses on the role of the microbiome in disorders of the gut–brain interaction and how bacteria affect the functions of the intestine, such as motility, which can be altered in these conditions. His lab found that bacteria can convert tryptophan to tryptamine, which is

similar to serotonin produced in the gut. Researchers in the lab found that tryptamine activates a receptor in a mouse gut that normally responds to serotonin and increases secretions in the intestine, resulting in faster movement of food. They engineered a bacteria to produce high levels of tryptamine in the intestine as a designer probiotic that could benefit patients who have constipation. This needs to be tested in humans.

“Bacterially produced tryptamine quickly degrades in the intestine and doesn’t appear to increase in the bloodstream,” says Dr. Kashyap. “Our goal is to find treatments that act only in the GI tract without creating problems in other parts of the body.”

Dr. Kashyap’s lab also is studying *C. diff* infection and how this bacteria manages to remain in the intestine, causing disease again and again. Dr. Kashyap is exploring the possibility that *C. diff* sticks to the intestine by forming a biofilm on its surface and evades antibiotic treatment. His long-term goal is to develop new biomarkers and microbiota-targeted therapies to treat GI disorders.

“The next generation of probiotics may involve engineering bacteria to change the microbiome or influence its function, whether that’s producing large amounts of tryptamine or other molecules that affect GI function,” says Dr. Kashyap.



Jaeyun Sung, Ph.D., and John Davis III, M.D., collaborated on research that was featured in *Genome Medicine*. Dr. Sung describes the reaction to the study as one of the biggest he's seen in his career.

## ADVANCING PRECISION & PREDICTIVE MEDICINE IN RHEUMATOID ARTHRITIS

**M**ost patients who are diagnosed with rheumatoid arthritis respond to either the first or second line of drug therapies. However, some patients try multiple drugs without improvement in their condition. It can take as long as two years of suffering, disease progression and expense before landing on a medication they respond to.

**John Davis III, M.D.** (I '03, RHEU '06, CTSA '13), Division of Rheumatology at Mayo Clinic in Rochester, says that's not tailoring the right drug to the right person early enough. In an effort to shorten the interval to more effective treatment, he's studying the influence

of the gut microbiome on the course of rheumatoid arthritis and response to treatment. His research aims to identify features in the microbiome that are associated with and predictive of changes in disease symptoms after therapy. A recent study on which he is co-senior author, published in *Genome Medicine*, found that the gut microbiome is indicative of whether or not patients will show minimum clinically important improvement in rheumatoid arthritis symptoms. It was the first study that used gut microbiome data to predict clinical improvement in rheumatoid arthritis disease activity independent of the patient's condition or prior treatment.

"We're trying to develop new biomarkers based on profiles of gut microbes that will enable us to

predict who will respond to one drug versus another," says Dr. Davis. "The gut microbiome is highly dynamic and reflective of a patient's current state and history. The results of our exploratory study suggest that profiles based on the gut microbiome will tell better than any other clinical predictor how someone will do clinically in six to 12 months."

Dr. Davis, his research collaborator **Jaeyun Sung, Ph.D.** (S '17), Department of Surgery, co-senior author of the study and a computational biologist, and their team performed a comprehensive genomic analysis on stool samples of patients with rheumatoid arthritis at two separate clinical visits. The team investigated the connection between the gut microbiome and the smallest meaningful changes in



clinical disease activity and found several traits of the gut microbiome linked to prognosis.

“We observed significantly different microbiome traits between patients who eventually showed improvement and those who did not,” says Dr. Davis. “Using deep-learning artificial intelligence (AI), we examined if we could predict whether a patient would achieve clinical improvement. The predictive performance resulted in 90% accuracy, demonstrating the proof of concept that the integration of gut microbiome and AI could be an avenue to predict disease course in rheumatoid arthritis.”

The researchers hope the biomarkers will inform precision medicine in the clinic. They envision a future state in which assessing the gut microbiome is a part of a patient’s workup, helping clinicians determine which medication to select. They also would like to develop a screening test to identify rheumatoid arthritis as early as possible.

Dr. Sung says the response to this research from the patients with rheumatoid arthritis, rheumatologists and scientific communities is one of the biggest he’s seen in his career. “We’re not yet ready to make an impact on the practice, but we’re on the path to advancing precision and predictive medicine — utilizing microbiome data and learning how to intervene on and impact the gut microbiome to improve chronic disease.”

Dr. Davis notes that their clinical findings, when combined with AI, may have a huge impact on the way treatment is delivered in the decades to come. “We expect our work to be a cornerstone for a new suite of omics data-based clinical tools to aid in the early detection, diagnosis, prognosis and treatment of rheumatoid arthritis.

“When a patient comes in with symptoms, we’ll be able to use all types of omics data to determine if they’re at risk for rheumatoid arthritis, which subtype of the condition they have if they have the disease, and predict when their condition will flare up, when they need to be seen by a physician and when we need to be aggressive with their treatment. This could revolutionize how we deliver care to patients. Much remains to be done, but we’re on the right path toward advancing our understanding of this disease and to individualizing medicine for patients.”

## IDENTIFYING CONTRIBUTOR TO ENDOMETRIAL CANCER

**M**arina Walther-Antonio, Ph.D. (S ’15), Departments of Surgery and Obstetrics and Gynecology at Mayo Clinic in Rochester, is a pioneer in studying the role of the microbiome in women’s health. She’s investigating the possibility that a microbe her team has identified in the vagina and uterus is a contributor to endometrial

cancer. Most women don’t have this microbe, *Porphyromonas somerae* (*P. somerae*), in their vaginal or uterine microbiome. However, it is present in small amounts in 86% of women who have endometrial cancer.

Little research has been conducted about *P. somerae*. Several reports show it has been found in chronic bone and tissue infections of people who have diabetes. Dr. Walther-Antonio, a full-time faculty member in the Mayo Clinic Center for Individualized Medicine’s Microbiome Program, and her team are studying how this uncommon microorganism persists in the reproductive tract. They’ve completed three studies that link *P. somerae* to endometrial cancer.

*P. somerae* produces succinate, which can interfere with normal cellular functioning and accelerate cancer-causing pathways. *P. somerae* also is stimulated by estrogen exposure — a risk factor for endometrial cancer. One possibility Dr. Walther-Antonio’s team is investigating is that *P. somerae* invades endometrial cells in the uterus and produces succinate, compounding an individual’s risk.

Dr. Walther-Antonio and her team are the first to make this discovery, published in *Frontiers in Microbiology*. Now she wants to use this information to predict which women may develop cancer and find a way to intervene and prevent it.

“Our goal is to move the field beyond simple association and correlation and into proof of pathogenic

*“This will be a significant leap toward **understanding the role of the microbe in the disease** and places us one step closer to identifying new therapeutic targets and being able to help patients.”*

— Marina Walther-Antonio, Ph.D.

behavior,” says Dr. Walther-Antonio. “This will be a significant leap toward understanding the role of the microbe in the disease and places us one step closer to identifying new therapeutic targets and being able to help patients.”

In addition to therapeutic targets, Dr. Walther-Antonio would like to develop a test for endometrial cancer, using this finding of *P. somerae* as an early-detection biomarker.

“Most endometrial cancer is detected early because it’s symptomatic, with vaginal bleeding,” she says. “More severe cases, however, don’t manifest that way, so aggressive cases often aren’t detected until later stages

of the disease. Black women are more likely to have more aggressive cases as well as symptomatic fibroids, so they and their physicians may overlook bleeding as a concern.”

Dr. Walther-Antonio is planning work with Emory University and Johns Hopkins University to gain access to larger numbers of Black women for her research. She’s committed to addressing what she calls a serious public health problem with a disproportionate impact on minority populations.

“Endometrial cancer kills twice as many Black women as white women, making it the leading cancer-related

health disparity in women in the U.S. The current test for endometrial cancer is an endometrial biopsy, which can be painful and expensive. We envision developing a vaginal swab test for endometrial cancer biomarkers that a woman could take at home and send to a laboratory for PCR testing. That’s the ultimate translation of our research — providing those at greatest risk with an easy-to-use predictive test so we can intervene and treat them with therapeutic agents to stop cancer in its tracks.”

**Marina Walther-Antonio, Ph.D., is a pioneer in studying the role of the microbiome in women’s health.**







Kevin Ruff, M.D., is embarking on a project to map the microbiome of the small bowel.

### MAPPING ALL 22 FEET OF THE SMALL BOWEL MICROBIOME

**I**s the microbiome of the small bowel different from that of the colon? No one knows. That's because, until recent years, physicians could view only the top and bottom 10 to 20 centimeters, not the hundreds of centimeters in between. Thanks to balloon-assisted enteroscopy, physicians at specialized centers can now see the entire small bowel — all 22 feet of it.

That technology has opened the door for **Kevin Ruff, M.D.** (I '06, GIMO '07, GI '10), Division of Gastroenterology and Hepatology at Mayo Clinic in Arizona, to investigate and map the microbiome of the small bowel. He's taking samples from the length of the small bowel to determine if different areas of the organ have different microbiomes and how they correlate with the microbiome of stool samples.

He's completed a small study for proof of concept and is pursuing funding to continue this work and

collect samples from deep in the small bowel from a larger number of patients.

"I see patients who need balloon-assisted enteroscopy because they have bleeding blood vessels in the small intestine that are difficult to reach," says Dr. Ruff. "We don't know why some people have this condition and others don't. Perhaps something in the microbiome predisposes them to have a more sensitive intestinal lining that is prone to bleeding.

"Studying and mapping the small bowel microbiome will help us to classify a person's microbiome and,



*“We can’t modify a person’s or tumor’s genetic makeup, but we **may be able to re-engineer the microbiome** with probiotics and diet to **reduce the toxicity and side effects of cancer treatment.**”*

– Saranya Chumsri, M.D.

Saranya Chumsri, M.D., Maria Vazquez Roque, M.D., and Francis (Frank) Farraye, M.D., are studying the role of over-the-counter probiotics in cancer patients receiving immune checkpoint inhibitors as standard of care.

we hope, prevent these obscure GI bleeds from occurring by modifying the microbiome with diet or medication to create better health outcomes. We’re in the early stages of understanding the significant impact on health and wellness that altering the microbiome could have. But we’re relatively certain it has a major impact on the body’s overall state of inflammation and neurologic and immunologic systems. My work to determine if a stool sample is a great representation of the entire length of the small bowel is one small step in

improving our understanding of the microbiome.”

#### EXPLORING PROBIOTICS’ ROLE IN DECREASING CANCER SIDE EFFECTS & IMPROVING TREATMENT RESPONSE

**I**mmune checkpoint inhibitors (ICIs) have revolutionized cancer treatment but can lead to gastrointestinal symptoms including colitis in as much as 45% of patients. Approximately 30% of those

patients may need to discontinue this lifesaving therapy.

Patients who develop ICI-induced colitis typically have symptoms after the second or third dose of treatment. But histologic findings, including inflammation, may precede symptoms by as many as three weeks. Early recognition of ICI-induced colitis and timely treatment with immunosuppressant medication — and withholding ICIs — is important and improves outcomes.

Increasingly, evidence has demonstrated the relationship between the



gut microbiome and response to immune checkpoint inhibitors. Early data also suggests an association between gut dysfunction and ICI-induced colitis.

**Saranya Chumsri, M.D.** (HEMO '14), Division of Hematology and Medical Oncology at Mayo Clinic in Florida, and colleagues including the Division of Gastroenterology and Hepatology's **Francis (Frank) Farraye, M.D.** (GI '19), and **Maria Vazquez Roque, M.D.** (GI '06, CTSA '07, GI '11), are conducting a pilot clinical trial of over-the-counter

probiotics for cancer patients receiving immune checkpoint inhibitors as standard of care. Patients will be followed for six months during their ICI therapy. The researchers will analyze measures including hospitalization, dose reductions, treatment delays and use of immunosuppressant medication. They also will evaluate patients' stool and blood samples for changes in the gut microbiome and immune status at baseline and at points during treatment to determine if the

probiotics had an effect. The overall goal of the study is to evaluate the benefit of over-the-counter probiotics in preventing ICI-induced colitis. The results of the trial will provide a foundation for the development of larger randomized trials.

"We can't modify a person's or tumor's genetic makeup, but we may be able to re-engineer the microbiome with probiotics and diet to reduce the toxicity and side effects of cancer treatment," says Dr. Chumsri.

*"If we can manipulate pathogenic immunity through microbiota or targeted drugs, we **may be able to improve patient response to treatment**, whether it's the standard of care or immunotherapy."*

– Khashayarsha Khazaie, Ph.D.



In another research project, Dr. Chumsri is studying whether using probiotics to change the gut microbiome will alter a person's immunological response to breast and lung cancers. Her team will examine patient stool, blood and tumor samples before and after taking probiotics. She hypothesizes that taking probiotics before surgery will significantly increase tumor-infiltrating lymphocytes, particularly cytotoxic T cells in tumors.

"We learn more about the association between microbiome diversity and cancer outcomes every day," says Dr. Chumsri. "I hope one day we'll be able to use probiotics and diet to augment traditional cancer treatment to enhance its effectiveness."

## MANIPULATING THE GUT BACTERIA & IMMUNE SYSTEM IN COLORECTAL CANCER

**T**he colon claims the highest density of bacteria in the body. Those bacteria play an important role in the development of the GI tract and immune system.

**Khashayarsha Khazaie, Ph.D.** (IMM '14), Department of Immunology, Mayo Clinic in Arizona, is exploring the relationship between the gut microbiota and the immune system and how, in colorectal cancer, this healthy balance becomes pathogenic. The work is part of a long-standing scientific collaboration with colleague **Foetini Gounari, Ph.D.** A central focus of this study is the role of regulatory T cells. As their name suggests, these cells regulate immune responses, including to bacteria, injury and tumor growth. Change in the composition of gut bacteria alters immunity and vice versa. For example, tumor growth alters the gut microbiota, which then changes the immune system and can either promote tumor rejection or help the tumor grow and become more aggressive.

Dr. Khazaie studies how bacterial communities in the gut modulate

immunity in colorectal cancer. Learning how harmful bacteria manipulate the immune system could inspire the development of effective targeted cancer therapies. This is important for malignancies that depend on bacteria for their initiation and progression, particularly colorectal cancer.

Dr. Khazaie examines the role of two classes of microbiota in intestinal carcinogenesis — oral microbiota that serve as opportunistic pathogens in colorectal cancers and bile acid-metabolizing bacteria that promote the generation of regulatory T cells in the gut.

A collaborative study with the University of Paris identified strains of oral microbiota that contribute to the risk of colorectal cancer by introducing epigenetic changes in the gut epithelial and blood cells. The idea is that these epigenetic changes are responsible for the shift of immunity from protective to pathogenic.

In another study with the University of Illinois Urbana-Champaign, Dr. Khazaie investigates how a minimal community of eight strains of bile acid-metabolizing bacteria determine T regulatory cell functions in the healthy versus tumor-bearing gut. The researchers found that colonization of germ-free mice generates regulatory T cells that protect the mice against the onset of tumor growth. However, after tumor onset, the composition of bacteria and regulatory T cell functions change to favor tumor growth. The team examines how bacteria-induced changes in T regulatory cells cause pathogenic immunity and tumor growth.

"If we can manipulate pathogenic immunity through microbiota or targeted drugs, we may be able to improve patient response to treatment, whether it's the standard of care or immunotherapy," says Dr. Khazaie.

"Cancer is a systemic disease. In the coming decade, cancer therapy will specifically target the underlying systemic mechanisms of the disease. The future will bring intelligent, personalized intervention." •

*"Cancer is a systemic disease. In the coming decade, cancer therapy will specifically target the underlying systemic mechanisms of the disease. **The future will bring intelligent, personalized intervention.**"*

— Khashayarsha Khazaie, Ph.D.



# GLOBAL INQUIRY

## International research collaboration

**M**any Mayo Clinic investigators collaborate with researchers around the world to advance the science. Some of that activity is driven by the institution, but most is driven by the investigators themselves.

“Mayo Clinic International strives to advance the science of research and education, through engagement of our Mayo Clinic investigators,” says **Mohamad Bydon, M.D.** (NS '15), executive medical director for International Academic Affairs and the Charles B. and Ann L. Johnson Professor of Neurosurgery. “Never has it been more important to collaborate internationally to increase information-sharing for research and innovation, to ultimately solve complex questions for our patients.”


The two stories that follow showcase international collaborations by a seasoned investigator on the global stage and a more recent champion.

“These stories exemplify the high-quality research expected of and delivered by Mayo Clinic researchers,” says **Stephen Ansell, M.D.** (I '96, HEMO '99), chair, Mayo Clinic International Research Subcommittee, and the Dorothea W. and Grant L. Sundquist Professor of Hematologic Malignancies Research. “This expertise is sought throughout the world and is an extension of the Mayo Model of Care that Mayo Clinic International is taking to the world.”









*“If we can develop agents to target the fundamental aging processes, it could mean **living without pain and disability** as we age. Five or 10 years ago, we couldn’t even imagine this would be possible.”*

— James Kirkland, M.D., Ph.D.

# Senescence & aging research spans the globe — and beyond

A considerable amount of international collaboration at Mayo Clinic is generated by **James Kirkland, M.D., Ph.D.** (GIM '07), Division of General Internal Medicine at Mayo Clinic in Rochester and the Noaber Foundation Professor of Aging Research.

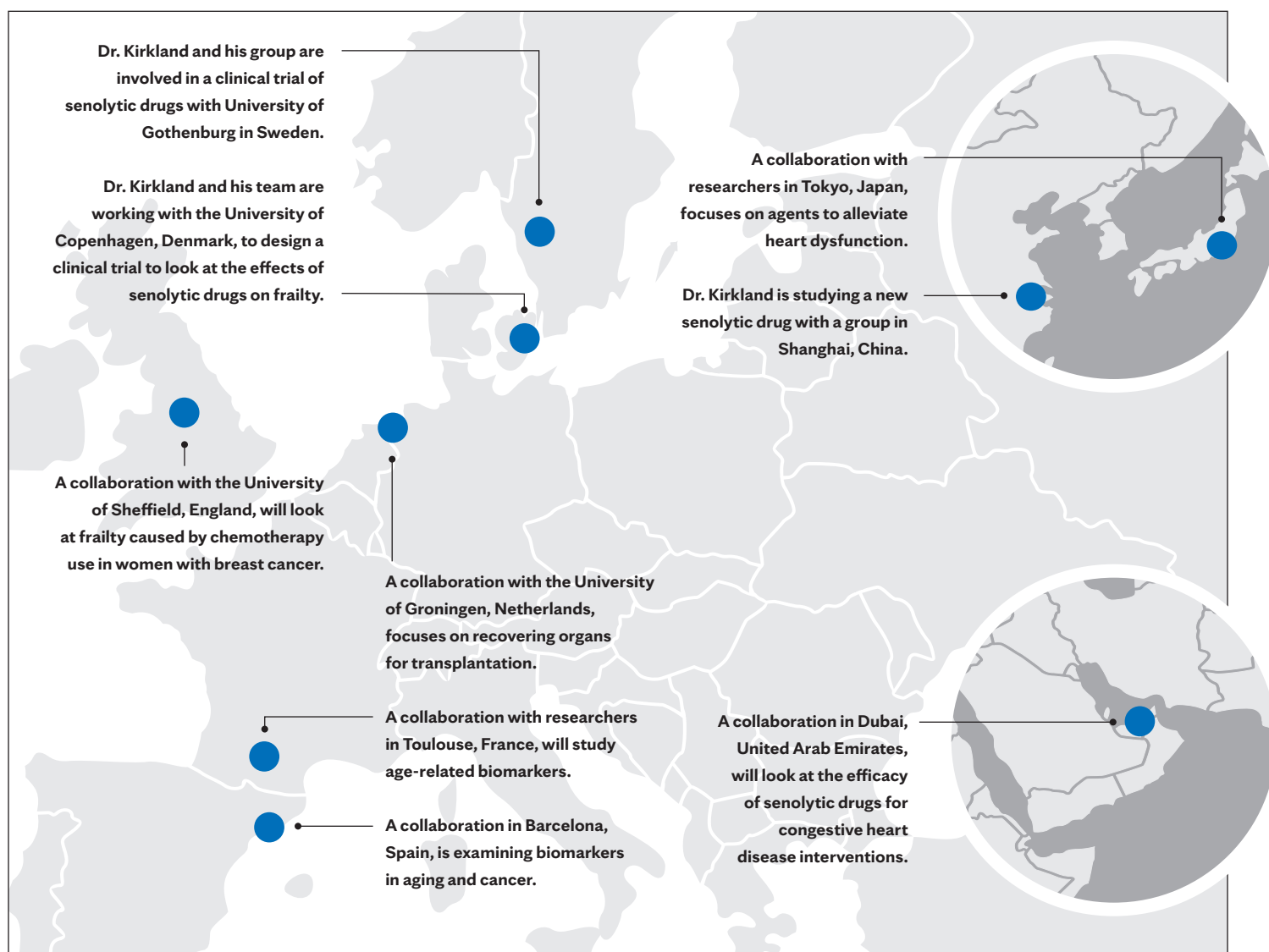
Dr. Kirkland’s research focuses on cellular senescence, which occurs when cells age and stop dividing. These cells don’t die but, instead, build up in tissue throughout the body and affect the aging process. Five or six years ago, the researchers heavily involved in senescence and its relationship to aging formed a relatively small, close-knit group. That population has exploded, with networks of researchers established in the U.S. and other countries. Mayo’s Dr. Kirkland was one of the originals. He and his Mayo Clinic colleagues discovered the first senolytic drugs, published in 2015 in *Aging Cell* and *Proceedings of the National Academy of Sciences*. Today, he’s considered the expert on senescence and aging. The GOAT, if you will.

“As a geriatrician, I got tired of ordering wheelchairs and assistive devices for aging patients,” says Dr. Kirkland, who has a joint appointment in the Department of Physiology and Biomedical Engineering. “I went back to school at the



# The world of senescence

James Kirkland, M.D., Ph.D., has devoted his career to studying the fundamental processes that contribute to aging and ways to prevent the negative health effects of aging. “This is a completely new field, so we want as many multiple linked, parallel trials going on at the same time as possible to help determine if these senolytic drugs, as well as drugs and lifestyle interventions targeting other aging processes, work.”



University of Toronto and got my Ph.D. so I could help figure out the causes of chronic conditions of aging — frailty, cognitive impairment, incontinence, falls. For the 200 most common acute and chronic conditions, aging is the most significant predictor. I began to wonder if we could modify the fundamental processes of aging. Increasingly, it looks like that may be the case.”

Senolytics are drugs that target and selectively remove senescent cells. In preclinical models and human cell culture and tissue explant models, these drugs can prevent senescence in the majority of cases. These agents could lead to interventions that delay, prevent, alleviate, or treat senescence- and age-related conditions in humans if

clinical trials continue to demonstrate effectiveness and low toxicity. These conditions include diabetes, dementias, atherosclerosis, cancers, arthritis, and others that account for the bulk of morbidity, mortality and health care costs throughout most of the world.

“If we can develop agents to target the fundamental aging processes, it could mean living without pain and disability as we age,” says Dr. Kirkland. “Five or 10 years ago, we couldn’t even imagine this would be possible.”

Dr. Kirkland is the principal investigator of the Translational Geroscience Network (TGN), a collaboration of researchers looking at clinical interventions that target fundamental mechanisms of aging to delay, prevent or

treat age-related diseases and disabilities as a group. Members include Mayo Clinic, Harvard University, Johns Hopkins University, University of Connecticut, University of Michigan, University of Minnesota, University of Texas and Wake Forest University. The network is supported by the National Institute on Aging.

## GOING INTERNATIONAL

Dr. Kirkland took the strategy behind the TGN and applied it to international collaboration — taking findings from the bench to the bedside with early-phase clinical trials. His lab collaborates with researchers in countries including England, Sweden, Denmark, Netherlands, France, China, Spain and Japan.

For example, a trial at University of Gothenburg in Sweden will test senolytic drugs developed at Mayo Clinic in first-degree relatives of people who have diabetes. Dr. Kirkland and his group helped develop the protocol and procedures for that trial.

Other collaborations with Mayo Clinic and the TGN involve the University of Copenhagen, Denmark; Oxford, King's College in London and the Universities of Birmingham and Sheffield, England; University of Amsterdam and University of Groningen, Netherlands; the Karolinska Institute and University of Gottingen, Sweden; and McMaster University, Canada. Requests to collaborate on basic science and clinical trial design come in by the week from researchers around the world. Networks based on the TGN are being considered in the United Kingdom, European Union and Japan.

By expanding the number of clinical trials that can be conducted in a coordinated way and through data sharing, these international collaborations could accelerate testing which interventions that target aging processes are the most effective for delaying, preventing, or treating disorders and diseases across the lifespan.

## MOVING AT LIGHTNING SPEED

Dr. Kirkland's more than 40 clinical trials and other global collaborations compare interventions — half with senolytic agents, half with other agents and minimal risk studies — and focus on conditions including frailty due to cancer treatment in children and adults, age-related frailty, COVID-19, atrial fibrillation, cancer, chronic diabetic skin ulcers, chronic HIV syndrome, chronic kidney disease, congestive heart failure, diabetes, Down syndrome, glioblastoma, idiopathic pulmonary fibrosis, improving organs before transplanting them, myeloma, obesity, osteoarthritis, osteoporosis and preeclampsia.

Dr. Kirkland describes this work as moving at lightning speed.

“This is a completely new field, so we want as many multiple linked, parallel trials going on at the same time as

By expanding the number of clinical trials that can be conducted in a coordinated way and through data sharing, these **international collaborations could accelerate testing** which interventions that target aging processes are the most effective for delaying, preventing, or treating disorders and diseases across the lifespan.



*“We need more time to determine if they work in humans the way they work in mice and who can benefit from them and in which format. Once we know that, **this research could be transformative for humankind.**”*

— James Kirkland, M.D., Ph.D.

possible to help determine if these senolytic drugs, as well as drugs and lifestyle interventions targeting other aging processes, work. Do senolytics safely destroy senescent cells and leave normal cells alone?” says Dr. Kirkland. “We need multiple shots on goal because only about 5% of the trials will prove to be successful. We’re desperately trying to find out if these drugs work because the diseases — from pediatric conditions to cancer — are horrible.

“We’re not aiming to help people live to be 120 and feel like 120. Rather, we’re exploring interventions that promote healthy aging with the long-term goal of postponing the onset of chronic diseases. It would be nice to be 95, be able to play tennis and just die peacefully in your sleep.”

## GOING TO SPACE

Dr. Kirkland’s collaborations extend beyond the international to outer space. He worked with the astronauts on the first-ever all-civilian flight to the International Space Station in April. Those astronauts hailed from the U.S., Canada and Israel. They provided blood and body fluid samples before and after their trip so Dr. Kirkland and his colleagues can examine them for markers of senescent cell burden. The astronauts also took along on the flight normal human cells in dishes so Mayo Clinic researchers can check them for signs of senescence.

“We know astronauts’ DNA is damaged after space travel, and astronauts who go on long missions die at a



younger age than others,” says Dr. Kirkland. “Zero gravity can induce senescence as can the cabin atmosphere. Space travel exposes astronauts to higher doses of radiation. Studying those who participate in low-orbit travel will help us understand how to prepare humans for the mission to Mars, where they’ll be exposed to solar flares and cosmic radiation outside of the Van Allen belts and, as a result, will have accelerated senescence. For travel to Mars to be possible, we must be able to clear senescent cells.”

## TRANSFORMING HUMANKIND

**Tamar Tchkonja, Ph.D.**, Department of Physiology and Biomedical Engineering at Mayo Clinic in Rochester and



Dr. Kirkland's co-investigator, predicts that the efficacy of senolytic interventions will be known in the next five to eight years and reach clinical practice in eight to 10 years. Most of the drugs being used today are already FDA approved but will require large-scale clinical trials for new applications. "I hope to see the results of our work within my lifetime," she says.

Dr. Kirkland cautions that the drugs belong only in carefully controlled clinical trials. "We need more time to determine if they work in humans the way they work in mice and who can benefit from them and in which format. Once we know that, this research could be transformative for humankind."

**Co-investigators Tamar Tchkonina, Ph.D., and James Kirkland, M.D., Ph.D., work on research with collaborators around the world.**



# The long game on **short-term surgical trip research**

**A** more recent champion of international collaboration is **Joshua Wiedermann, M.D.** (ENT '20), Department of Otorhinolaryngology–Head and Neck Surgery at Mayo Clinic in Rochester. Dr. Wiedermann's eyes were opened to the challenges of global medicine when he was a medical student at George Washington University School of Medicine in Washington, D.C. He spent a summer in Botswana with the Baylor International Pediatric AIDS Initiative, educating health care professionals. "I started thinking about ways to use my knowledge and training to promote education and enable others in health care around the world to become self-sustaining," he says.

## **'THE MOST DIFFICULT THING I'VE EVER DONE'**

After completing a fellowship in pediatric otolaryngology–head and neck surgery at Northwestern University's McGaw Medical Center and Lurie Children's Hospital, Dr. Wiedermann moved to Mekelle, Ethiopia, for a year and worked with the country's government to create a sustainable ENT surgical residency program. As part of creating sustainability in the residency program, he helped to develop a didactic program focused on bridging the gap between clinical knowledge and clinical practice.

"As a clinician in a high-income country, I didn't feel like I was using my expertise and training to their full potential," says Dr. Wiedermann. "I had a passion to teach, improve quality and be as useful as possible. Developing the residency to help serve a population of 10 million people was the most difficult thing I've ever done but also the most meaningful and fulfilling." However, in November 2020, a civil war began in Ethiopia, and communication with those involved with the residency program has since been

*"Developing the residency to help **serve a population of 10 million people** was the most difficult thing I've ever done but also the most meaningful and fulfilling."*

– Joshua Wiedermann, M.D.





In the future, Dr. Wiedermann foresees using the energy, passion and altruism of Western physicians doing short-term surgical trips in an organized way to **build educational, surgical and resource sustainability.**

limited. “The few communications I’ve had through this time suggests that the program is still going strong despite difficult environmental and social circumstances. I look forward to returning as soon as it is safe to do so.”

### CREATE EDUCATION, QUALITY IMPROVEMENT & SUSTAINABILITY

During his time in Ethiopia, Dr. Wiedermann says he observed short-term surgical trips and began to think about how they could be more effective. “Many short-term surgical trips do a lot of good, especially when they focus on education and quality improvement. Sometimes, big groups come in and take over the local hospital’s operating rooms and change the local environment, causing logistical burdens — local surgeons displaced and often not paid, local patients in other surgical specialties made to wait and many local staff temporarily displaced. Short-term surgical trips are most effective, I believe, when they’re coordinated, geared toward local needs, provide education that’s sustainable for local providers and improve the quality of care within the socioeconomic constraints of the local population.”



Joshua Wiedermann, M.D. (top), performs an open airway reconstruction on a child, assisted by local residents, at Ayder Referral Hospital in Mekelle, Ethiopia.

Dr. Wiedermann’s research asks if short-term surgical trips could be organized in a way that creates education, quality improvement and sustainability. He will now work with the ENTs of Zimbabwe to answer this question.

Dr. Wiedermann is organizing a consortium that will create a registry of otolaryngology–head and neck surgical patients in Zimbabwe to track their surgical outcomes over time. Physicians who come to the country for short-term surgical trips will be guided to provide focused teaching to local providers based on ongoing needs assessments. Patients will be followed by local ENT physicians over time. Dr. Wiedermann hopes to explore the effects of short-term surgical trips on local patients, surgical capacity, and institutional sustainability in the public and private sectors.

Without postoperative outcomes data, it’s difficult to improve quality or complete research. A major focus of this collaboration is figuring out how best to communicate with patients to get outcomes information. The consortium will work with a network of local providers and use grassroots telecommunications to gather the necessary postoperative data.

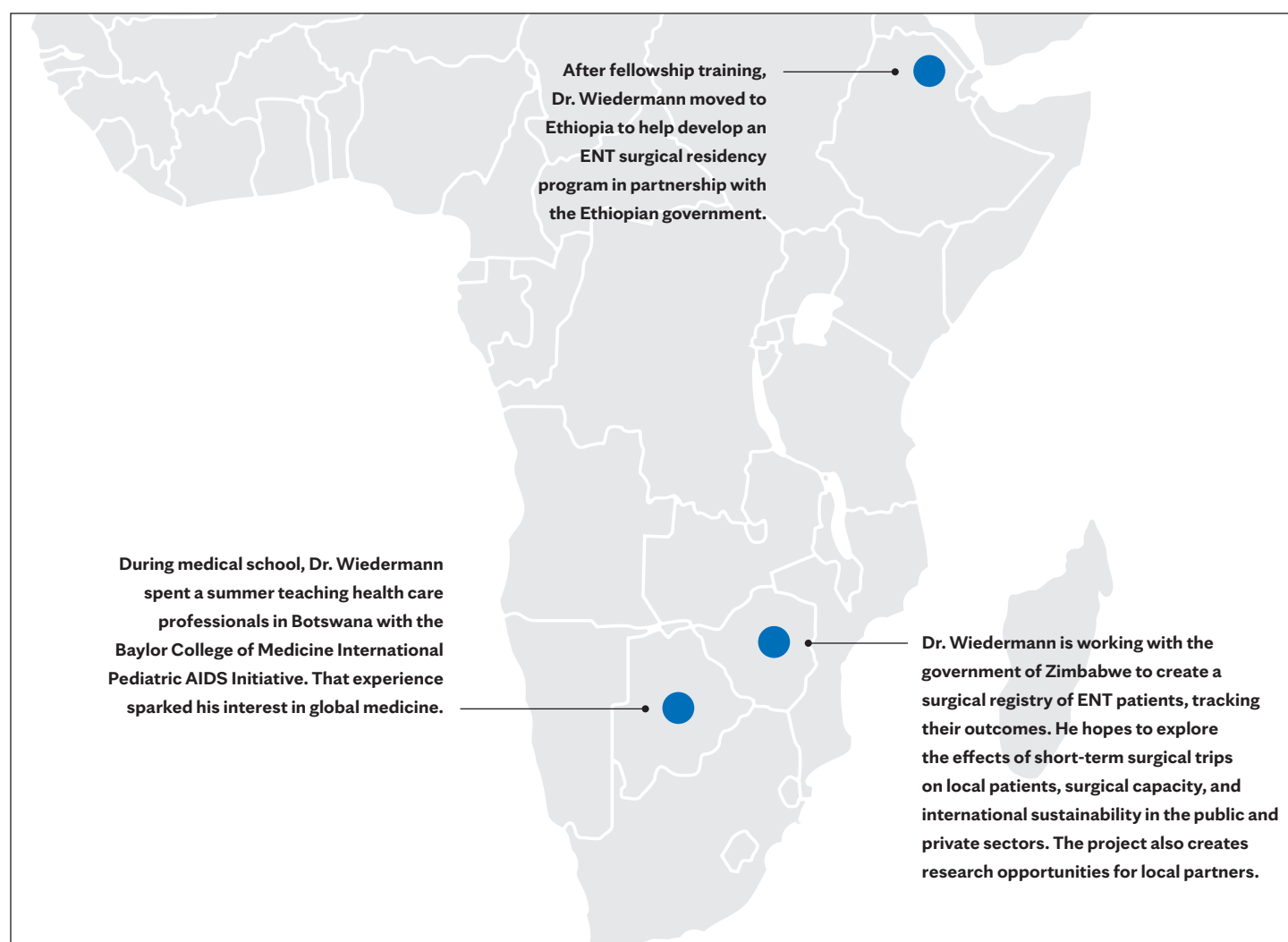
The surgical registry will be under joint ownership between Mayo Clinic and the University of Zimbabwe, with de-identified outcomes data made available to any surgeon joining on a short-term surgical trip. After the research has been completed and outcomes analyzed, local and visiting teams can identify areas for improvement in quality of care, education and resource sustainability.

In addition to clinical outcomes and patient satisfaction, the research aims to assess the impact of short-term surgical trips on local education and learning — measuring the clinical knowledge and surgical competency of local learners; and contributions to local capacity-building — determining if local institutions improve their capacity to provide an expanding cadre of surgical interventions.

While living in Ethiopia, Dr. Wiedermann also noticed the disparities facing local physicians attempting to enter the world of research. “Another benefit of this research collaboration will be its impact on basic research education. Very little formal training in study design, research ethics and medical writing skills is available in many low- and middle-income countries (LMICs). On top of that, surgical

## Into Africa

Joshua Wiedermann, M.D., is determined to use his knowledge and training to promote education and enable others in health care around the world to become self-sustaining. “As a physician in a high-income country, I didn’t feel like I was using my expertise and training to their full potential,” he says. He encourages others who share his passion to advance the science of airway surgery and increase access to quality surgical care worldwide to reach out.



research studies that are published about LMIC patient populations often include their local partners, but rarely in a meaningful way. Our collaboration, while studying surgical outcomes, will aim to teach our local partners the basics of research design and execution, while maintaining equity in publication. This will help create sustainable research practices and promote the careers of our hard-working local colleagues.”

### ‘I’M JUST GETTING STARTED’

In the future, Dr. Wiedermann foresees using the energy, passion and altruism of Western physicians doing short-term surgical trips in an organized way to build educational, surgical and resource sustainability. Already, neurosurgery and ophthalmology groups in Zimbabwe have asked to join similar collaborations.


“To date, very few people have been interested in global surgery research in ENT, and there are few grants to fund

it,” says Dr. Wiedermann. “I look forward to the day when there are dedicated clinical researchers studying this area of medicine and when the time and talent of physicians from high-income countries are optimized to help people in low-income countries in the most efficient, effective and transformative ways.”

Dr. Wiedermann introduced a podcast series dedicated to global surgery learning. (It’s available at [headmirror.com](https://headmirror.com), an open-source educational resource developed by Mayo Clinic ENTs.)

“I got involved in global surgery because I wanted to use my expertise and training in the most meaningful way,” says Dr. Wiedermann. “I joined the Department of Otorhinolaryngology–Head and Neck Surgery at Mayo Clinic because it was motivated to support global efforts. I’m just getting started and am deeply appreciative of Mayo Clinic’s support and that of residents and fellows who participate through the Mayo International Health Program.” •



A woman with long, curly brown hair is sitting on a wooden bench in a lush garden. She is wearing a dark blue blazer over a white top, dark blue trousers, and bright blue pointed-toe shoes. She is looking off to the side with a slight smile. The background is filled with green foliage and a body of water, creating a serene and natural setting.

*“I was drawn to how much **Mayo celebrates diversity in thinking and living**, resulting in a vibrant community of people with different backgrounds and perspectives.”*

– Colleen Bartman, Ph.D.



# The uncommon among the uncommon

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## Colleen Bartman, Ph.D.

Research fellow, Department of  
Anesthesiology and Perioperative Medicine,  
Mayo Clinic, Rochester, Minnesota

**Fellowship:** Postdoctoral, Department of  
Anesthesiology and Perioperative Medicine

**Ph.D.:** Cell biology, stem cells and development  
University of Colorado Anschutz Medical  
Campus, Aurora, Colorado

**Undergraduate:** The College of Wooster,  
Wooster, Ohio

**C**olleen Bartman, Ph.D. (ANES '18), says she was far from an outstanding student in college — that it took her time to mature academically. She struggled financially and worked odd jobs. And she grappled with a family member's chronic illness. She escaped into music with her violin and dreamed about a career in science. She wanted to understand why a person's biological systems could go awry. She wanted to advance scientific knowledge for therapies to help people.

### UNREALISTIC PURSUIT

Early on, she was told her dreams were unrealistic — that pursuing a career in science was probably out of her reach. Luckily, the challenges she faced didn't seem insurmountable to her.

"I wasn't a science whiz in college, but I knew deep down that I wanted to make my life purposeful," says Dr. Bartman. "I felt a sense of responsibility to make meaningful contributions to the world around me with the opportunities I had. It was never a question of if this path would be possible but, rather, how I could make it happen."

Dr. Bartman's persistence helped her receive the 2022 Mayo Clinic Alumni Association Edward C. Kendall Award for Meritorious Research.

"I didn't achieve mastery immediately," she says. "The resistance I faced to reach a level of mastery has made me value my capabilities more than if the path had been easy."



## AS LUCK WOULD HAVE IT

The violin played a role in Dr. Bartman being able to pursue her dream. Soon after being offered a research opportunity that required a move from her home state of Ohio to Colorado, she received an award for violin performance. The \$900 that accompanied the award allowed her to make the move to start her science career.

“My passion for the violin paid off in launching my research career,” she says. “I have my family to thank for that. They supported the intensity with which I pursued music and taught me that creativity is as natural as the sunrise. You get to choose your creative outlet each day, whether in music, science or life. Because of that mindset from them, things have worked out for me in a remarkable way.”

Serendipity played a role in her going to Mayo Clinic. Dr. Bartman was presenting her Ph.D. work on circadian clocks at an anesthesiology conference in Chicago in 2018. She met **Y.S. Prakash, M.D., Ph.D.** (PHYS '94, ANES '96, I1 '03, ANES '06), chair, Department of Physiology and Biomedical Engineering at Mayo Clinic in Rochester, and associate dean for Research – Midwest. He asked her if she could apply her circadian background to a different context. The two arranged a meeting in Rochester, Minnesota. Dr. Bartman says when she flew home after that meeting, she saw the pieces falling into place. She knew she'd become an independent scientist at Mayo Clinic.

## MISFIT FITS IN

“It was everything I'd been working toward,” she says. “I was drawn to how much Mayo celebrates diversity in thinking and living, resulting in a vibrant community of people with different backgrounds and perspectives. I've been a misfit my whole life in terms of how I think and make decisions. Mayo has a way of attracting the uncommon among the uncommon. My mindset and personality are celebrated at Mayo, not stifled.”

Dr. Bartman has used her postdoctoral training to merge her background in cellular circadian clocks with the intersection of oxygen and the developing lung. Premature infants face significant challenges as their underdeveloped lungs transition to life in an oxygen-rich environment outside of the womb. Interventions are necessary to help premature babies survive, but there are adverse effects. Approximately 15 million premature babies born annually around the world are at increased risk of developing chronic airway diseases later in life. While the importance of cellular circadian clocks in health and disease progression is widely recognized, the relevance of cellular clocks during lung development

has had far less attention. Dr. Bartman's work focuses on understanding how leveraging cellular circadian clocks in the developing lung could improve treatment strategies and outcomes for premature infants. Her research in this clinically relevant area has earned her numerous postdoctoral grants, awards, speaking invitations and publications.

## THE WORLD AT HER FEET

Dr. Bartman speaks highly of her mentor, Dr. Prakash. “He would never deter me from doing what's challenging. Rather, he joins me in the science arena and says, ‘Let's do this!’ Dr. Prakash sees me for who I am. Having that understanding with a mentor is incredibly valuable for me individually and for team success in the lab.”

The praise goes both ways.

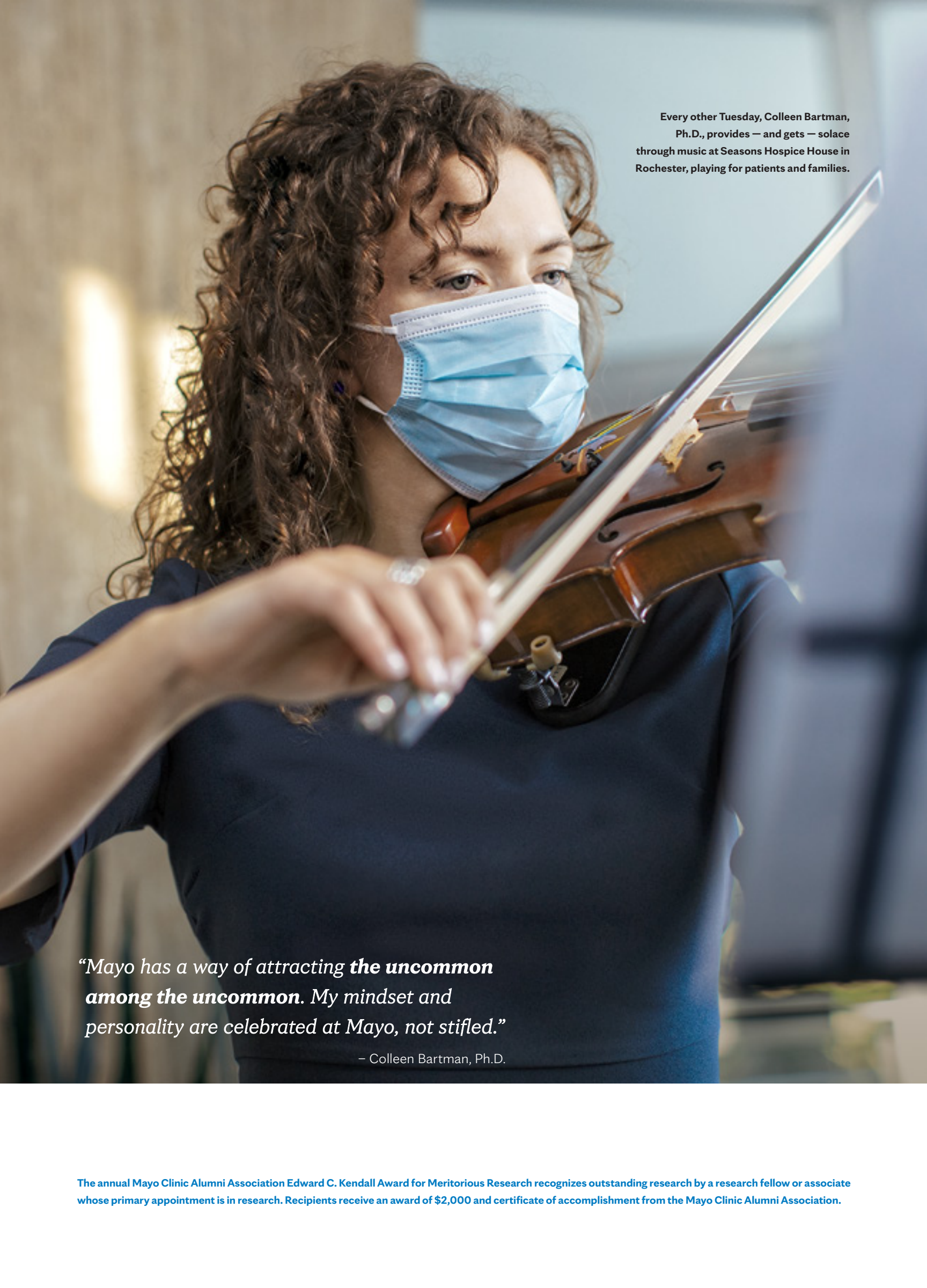
“Colleen is that rare gem of an individual who is just that natural fit for science and medicine because she has all the innate qualities to become a fantastic humanistic leader,” says Dr. Prakash. “Her hunger for knowledge, motivation, rare curiosity, enthusiasm for science, superb work ethic, resilience, and substantial accomplishments at an early career stage are every mentor's dream and a reassurance that the future of biomedical research is in good hands. Colleen is the type of future faculty that I proudly present as my mentee. Frankly, the world is at her feet.”

## SOLACE & CELEBRATION

The violin still features prominently in Dr. Bartman's life. Every other Tuesday, she plays for patients and families at a hospice center in Rochester. She describes a recent encounter where the patient was frail and couldn't speak but could move his arms.

“When I played, he moved his arms like he was conducting,” she says. “When I was done, I held his hand to thank him for letting me share my music with him. He shed a few tears and held on tight. It was incredibly powerful. I'm grateful to these patients and families for letting me share this time and space with them. It's a way to connect with people that I don't get as a scientist and puts perspective in my work. Patient interactions remind me why we do this work. I want to understand so we can improve quality of life for patients. My research focuses on premature infants, but what happens when you're young can affect you throughout your life.

“The violin and music have brought me a lot of solace and celebration without words. I'm happy to be able to share that with others.” •

A close-up photograph of a woman with curly brown hair, wearing a light blue surgical mask. She is playing a violin, with her bow raised and positioned over the strings. She is wearing a dark blue top. The background is softly blurred, showing what appears to be an indoor setting with warm lighting.

Every other Tuesday, Colleen Bartman, Ph.D., provides — and gets — solace through music at Seasons Hospice House in Rochester, playing for patients and families.

*“Mayo has a way of attracting **the uncommon among the uncommon**. My mindset and personality are celebrated at Mayo, not stifled.”*

– Colleen Bartman, Ph.D.

The annual Mayo Clinic Alumni Association Edward C. Kendall Award for Meritorious Research recognizes outstanding research by a research fellow or associate whose primary appointment is in research. Recipients receive an award of \$2,000 and certificate of accomplishment from the Mayo Clinic Alumni Association.



# Unique among stars

**B**y the time you read this, whatever number of publications is cited for **Amrit Kamboj, M.D.** (I '19, GI '22) — currently 102 — will probably be out of date. Don't take our word for it. Ask Dr. Kamboj's father, Kamal Kamboj, Ph.D., a clinical microbiologist at The Ohio State University.

"My dad probably checks my PubMed listing every week," says Dr. Kamboj. "He calls me to say, 'Did you know this publication came out? Now you're at 90.' He has maintained a binder with hole-punched printouts of all the articles. Each one of them makes him and my mom so proud."

The pride goes both ways. Dr. Kamboj mentions his parents among his strongest mentors. "They made so many sacrifices for my sister and me, including relocating across continents when they were middle-aged professionals. I can't imagine uprooting and starting all over. The credit for my success reflects back on them."



Amrit Kamboj, M.D.

The story, in a nutshell, is that his parents are from India and came to the U.S. to pursue their own education and training. The father, Dr. Kamal Kamboj, did his postdoctoral training, and the mother, Manmohan Kamboj, M.D., chief of the Division of Endocrinology at Nationwide Children's Hospital in Columbus, Ohio, completed her residency — both in New York City. The junior Dr. Kamboj was born there and moved back to India with his parents after they completed their training, when he was 6 months old. The family returned to the U.S. when Dr. Amrit Kamboj was 10, primarily so he and his sister could have better educational opportunities. The family subsequently moved from New York City to Michigan and then to Ohio. Dr. Kamboj's sister, Alisha Kamboj, M.D., is a third-year ophthalmology resident at the University of Minnesota.

"My sister and I saw our parents make a difference in the lives of others through their careers in medicine



and science,” says Dr. Kamboj. “I knew from an early age that I would pursue medicine. I knew others who had trained at Mayo Clinic and thought it offered unparalleled opportunities in education and research. **Dr. Amy Oxentenko** [(I ’01, CMR ’02, GI ’05), Division of Gastroenterology and Hepatology at Mayo Clinic in Rochester and chair, Department of Internal Medicine at Mayo Clinic in Arizona] was the residency program director and one of the main reasons I came to Mayo Clinic. It was evident from talking to residents that she was a fierce advocate for them. Given my interest in GI, I quickly found Dr. Oxentenko to be a strong role model, given her excellence in the field. I immediately knew I wanted to be in a program with a leader like that. Little did I know that in the coming years, I would have the opportunity to work with her on several manuscripts.”

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## Amrit Kamboj, M.D.

**Fellow, Division of Gastroenterology and Hepatology,  
Mayo Clinic, Rochester, Minnesota**

**Fellowship:** Gastroenterology, esophageal diseases  
Mayo Clinic School of Graduate Medical Education  
Rochester, Minnesota

**Residency:** Internal medicine  
Mayo Clinic School of Graduate Medical Education

**Medical school:** The Ohio State University  
College of Medicine  
Columbus, Ohio

**Undergraduate:** Wayne State University,  
Irvin D. Reid Honors College  
Detroit, Michigan



*“So many of us in academic medicine receive a large part of our **joy from working with younger physicians.** The joy that Amrit brings to a mentor will last a lifetime.”*

– David Katzka, M.D.

## UNDERSTANDING THE WHY

Dr. Kamboj wants to make a difference in the lives of patients like his parents have but also wants to understand the why — Why is this technique used this way? Why do we use this treatment?

“Asking why helps me understand and figure out the gaps in knowledge,” he says. “My best research projects have originated from my experiences with patients. When I come across a patient case that hasn’t been well investigated, it fuels my research. My mentors encourage me to determine if a question has been addressed with a resounding, ‘Let’s do it!’ My research ties back to the patient and, I hope, leads to better care for them and others.”

## HAVING WORLD-CLASS MENTORS

Dr. Kamboj’s research, which earned him the Mayo Clinic Alumni Association Donald C. Balfour Award for Meritorious Research, centers on microscopic colitis and esophageal disorders. He has completed multicenter studies on microscopic colitis in collaboration with Columbia University and Massachusetts General Hospital, including the condition’s association with colon polyps and various classes of medications, and differences in treatment outcomes between younger and older patients. His work also has described esophageal conditions including esophageal epidermoid metaplasia, a rare condition associated with squamous neoplasia; and acute esophageal necrosis, a condition due to ischemic injury to the esophagus. He identified predictors for repeated dilations in patients with Schatzki rings and showed that incidental uptake in the esophagus on a PET scan is associated with

inflammatory changes due to GERD. His work has already been highly quoted.

Dr. Kamboj says he’s succeeded in research due to having world-class mentors in the Division of Gastroenterology and Hepatology at Mayo Clinic in Rochester, including **Darrell Pardi, M.D.** (GI ’98, CTSA ’09), division chair; **David Katzka, M.D.** (GI ’10), Emeriti Staff; **Cadman Leggett, M.D.** (I ’12, GI ’15); **Conor Loftus, M.D.** (I ’01, GI ’04); and **Prasad Iyer, M.D.** (GI ’06, CTSA ’07).

“I came to my Mayo Clinic internal medicine residency interview with two publications on my CV and have worked with tremendous mentors over the last six years,” says Dr. Kamboj. A pet project with Dr. Loftus produced 36 one-page algorithms describing common GI symptoms — a resource for trainees and staff across the institution.

“When I was a resident and Dr. Loftus was an attending on the hospital service, I marveled at the way he taught us,” says Dr. Kamboj. “After each patient encounter, he stood outside the patient’s room and drew an algorithm that was easy to understand. I wanted to download the algorithms from his head to help me better understand things. We met weekly for a year to create the algorithms, which have been very well received and are now accessible to trainees.”

Educating and communicating with others is a priority to Dr. Kamboj. During residency, he completed a monthlong elective at ABC News in New York City. “Only a minority of medical research findings make it to the public,” he says. “Success in research isn’t just your number of publications or presentations at meetings. It also means being able to deliver findings to the public. I hope to be involved in addressing that shortcoming in research.”



Amrit Kamboj, M.D., reminisces about the sacrifices his parents made to give him — and his sister — educational opportunities. Their commitment and dedication have influenced his career choices.

Dr. Katzka, who has been involved with training fellows who have become internationally known basic science and clinical researchers and division chiefs, says, “Of all these remarkably talented and gifted physicians, Dr. Kamboj is the finest fellow with whom I have had the joy of working. He is the penultimate of enthusiasm and drive to achieve. He constantly asks questions and takes the next step with a logical, realistic approach. He has a maturity in recognizing the strength of team science that I have not seen at his level. He’s the only fellow I’ve worked with who pushes me. So many of us in academic medicine receive a large part of our joy from working with younger physicians. The joy that Amrit brings to a mentor will last a lifetime. He is unique among a group of Mayo stars. I can only hope I live for many more years to see the continued exponential ascent of Dr. Kamboj as a clinician, researcher and person in medicine.”

## LEARNING NEVER STOPS

Dr. Kamboj pays forward the mentorship he’s had, including mentoring residents, fellows and research trainees. “I let them take the lead, with me as guide. I want to give back and be as helpful as possible for others. Then when they’re in my position, they’ll pass it on to others.”

Dr. Kamboj aims to be a clinical scholar, with a GI practice built on taking care of patients in the clinic and endoscopy suite, with clinical research and education as central components of his career. “I want constant reflection to be a hallmark of my career — Did I make a difference in the care of that patient? Did I guide that trainee through that research project? With each patient I care for or trainee I mentor, I learn. And I never want to stop learning.”

Dr. Kamboj’s father might need to get a bigger binder. •

The annual Mayo Clinic Alumni Association Donald C. Balfour Award for Meritorious Research recognizes outstanding research by a Mayo Clinic School of Graduate Medical Education resident or fellow whose primary training is in a clinical field. Recipients receive an award of \$2,000 and certificate of accomplishment from the Mayo Clinic Alumni Association.





# The Mayo Clinic necktie at 47 years

The Mayo Clinic-logo necktie was introduced in 1975 after being approved by the Alumni Association Board of Directors the previous year. Since then, thousands of ties in dozens of designs have graced the necks of alumni, trainees, students and others around the world. Since 1998, more than 17,000 ties have been sold.

*Mayo Clinic Alumni offers a look back at the October 1975 magazine story about the neckties.*

## THE NEW NECKTIE

“Each day as I go through the hospital surrounded by younger men, they give me of their dreams and I give them of my experience, and I get the better of the exchange.”

When William J. Mayo, M.D., responded to the greetings of the president and the fellows of the American Surgical Association on the occasion of his 70th birthday, he spoke with these words of his respect for younger physicians. That posture is yet daily fresh in Rochester as older consultants strive to help their younger colleagues overtake them

(to the full enjoyment of both) or counsel them when new or old ideas must be aired.

Early in 1972, representatives of the Mayo Fellows' Association proposed an investigation into the creation of a Mayo Clinic necktie for fellows, staff and alumni.

**Bryan Mendelson, M.B.B.S.** (S '75, PLS '77), a surgical resident with Australian heritage, accepted the challenge to lead the idea to fruition. And challenging it was, for as one researcher noted, "To create a design for a tie, negotiate for the weaving or printing of fabric and the subsequent manufacturing of the material into finished ties is a complex, costly and time-consuming process." Further, there was no official Mayo crest, there were no official colors and there remained the question of who might give institutional approval.

The office file titled Mayo Necktie is a thick but intriguing collection that documents Dr. Mendelson's initial inquiry, progress through the Mayo committee system and the eventual assumption of the project by the Alumni Association late in 1972.

From that time, the docket of every Alumni Association business meeting bore a Mayo Necktie entry as the slow planning and progress were reported. Terms such as shadow weave, motif, blade, ground weave and heading became familiar ones. And here and there appeared some gentle suggestions from the alumni ladies to enliven the design from drab to patterned accent.

The Alumni Association Board of Directors approved a final proposal in 1974. Soon thereafter the initial order for the Mayo Clinic Alumni Association necktie was sent to London with high hopes that routine delivery would allow alumni to purchase them prior to Christmas.

But Mayo's researcher had been wise indeed in his estimates of complexity and time consumption as British economy, production problems, Atlantic transportation, customs and handling procedures left in turn their calendar marks.

It was in May of 1975 at Washington, D.C., when **Robert Coffee, M.D.** (I '36, S '38), retiring president of the Alumni Association, was presented the first official necktie as an additional token of appreciation for his leadership during the previous two years. Perhaps denoting a certain surgical flavor of the entire operation were the presenter's words: "It was a tough case, Bob, but we finally got it off the table."

The result of this "operation," which lasted nearly three years, was typical of Mayo. It was modest, subtle and quietly consummated by a group of individuals working within a deliberately complex but successful system. In many ways, the Mayo Clinic Alumni Association necktie reflects the whole family of Mayo's people, in Rochester and away. Even as the now-familiar segmented shield that adorns the tie denotes the important enlacing of practice, education and research, so to many it represents the essential camaraderie of physicians, students and associates.

Of all of these vital people and their continuing efforts to serve mankind, surely Dr. Will would have said, "They still have their imagination, their vision: the future is bright before them."

The tie was available in three colors, for \$7.50. •

To order Mayo Clinic neckties:  
[alumniassociation.mayo.edu](http://alumniassociation.mayo.edu)

## The advocate



Bryan Mendelson, AM, FRCSE, FRACS, FACS, was at Mayo Clinic in Rochester from 1971 to 1977 as a surgical and then plastic surgery resident. He recalls being a representative of the Mayo Fellows' Association and mentioning that he noticed Mayo Clinic didn't have a logo tie.

"Coming from a country with a British colonial background, I was surprised that a prestigious institution such as Mayo Clinic didn't have a necktie, which was common in Australia," says Dr. Mendelson. "My medical school was only three years old at the time but had a university logo tie. At The Alfred Hospital where I was training, we were allowed to wear the tie of the Royal Australasian College of Surgeons once we were recognized as surgeons. So I raised this issue at a Mayo Fellows' Association meeting."

The rest is history. Fast forward almost 50 years, and Dr. Mendelson is poised to retire from practice at the Centre for Facial Plastic Surgery in Toorak, Victoria, this year. His accolades are many and, most recently, include The Order of Australia in the Category AM for exceptional service to aesthetic surgery and congresses within Australia and around the world. The award was announced on Australia Day 2021 and presented at Government House by The Honourable Linda Dessau AC. Dr. Mendelson also was awarded Surgeon of the Year by The Royal College of Australasia for surgical excellence across specialties, and was the Jacques W. Maliniac, M.D., 2021 Memorial Lecturer at the meeting of the American Society of Plastic Surgeons (ASPS). This lectureship was established to introduce the ASPS to outstanding speakers from countries other than the U.S.





## Senolytic drugs boost protein that protects against aging & disease

**A** Mayo Clinic study indicates that senolytic drugs can boost a-klotho, a key protective protein that protects older people from aspects of aging and a range of diseases. The findings demonstrate this in mice and human studies.

Senolytics developed at Mayo Clinic can clear the bloodstream of senescent or “zombie” cells. This study shows that removing senescent cells significantly boosts the production of a-klotho.

“We show that there is an avenue for an orally active small-molecule approach to increase this beneficial protein and amplify the action of senolytic drugs,” says **James Kirkland, M.D., Ph.D.** (GIM '07), Division of General Internal Medicine at Mayo Clinic in Rochester, the Noaber Foundation Professor of Aging Research and senior author of the study.

The researchers first showed that senescent cells decrease levels of a-klotho in human umbilical vein endothelial cells, kidney cells and brain cells. The researchers also demonstrated that using the senolytics desatinib and quercetin in three types of mice increased a-klotho. Similarly, a-klotho increased after desatinib and quercetin were administered to clinical trial participants with idiopathic pulmonary fibrosis.

“We are first to link the potential impact of fat-resident senescent cells on brain a-klotho,” says **Yi Zhu, Ph.D.** (I '14), Department of Physiology and Biomedical Engineering at Mayo Clinic in Rochester and first author of the study. “This may open another avenue to investigate the impact of peripheral senescent cells on brain aging.”

The protein a-klotho is important to maintaining good health because it tends to decrease with age and especially decreases in Alzheimer’s disease, diabetes and kidney disease. Animal studies have shown that decreasing a-klotho in mice shortens life span, and increasing a-klotho in mice by inserting a gene that causes its production increases life span by 30%.

Discovering ways to increase a-klotho in humans has been a major research goal but has been difficult because of the protein’s size and instability. Introducing it directly is problematic because it would have to be administered into a vein instead of by mouth.

This study shows that senolytics, which can be administered orally, increase a-klotho in humans with idiopathic pulmonary fibrosis, a senescence-associated disease that leads to frailty, serious breathing difficulties and death.



**James Kirkland, M.D., Ph.D.**



**Yi Zhu, Ph.D.**

# Low-dose aspirin to prevent heart issues not beneficial for some

**T**he U.S. Preventive Services Task Force has issued a final recommendation on the use of aspirin in cardiovascular disease prevention. The task force's updated recommendation revises its previous recommendation on who should take aspirin to prevent heart disease.

"Scientific evidence is pointing to the fact that we don't see much, if any, benefit from using low-dose aspirin to reduce cardiovascular risk in patients who don't already have cardiovascular disease," says **Demilade Adedinsowo, M.B., Ch.B.** (CV '20), Department of Cardiovascular Medicine at Mayo Clinic in Florida. "Further, the evidence has shown increased bleeding risk in older patients, specifically those older than 60 who take low-dose aspirin for primary prevention."

Dr. Adedinsowo says these are the recommendations about aspirin use:

- Patients, particularly those older than 60, with no history of cardiovascular disease and who have not started a low-dose aspirin regimen for heart disease or stroke prevention should not begin taking a

low-dose aspirin without consulting their health care team.

- Patients with documented cardiovascular disease and those who have artificial heart valves or stents in their arteries should continue their aspirin regimen as prescribed by their health care professional. If patients are unsure if they have heart disease, they should discuss with their provider whether taking low-dose aspirin is appropriate.

Dr. Adedinsowo says the Preventive Services Task Force's guidance specifies low-dose aspirin should not be administered for primary prevention of atherosclerotic cardiovascular disease among adults 60 or older, or at any age if patients are believed to have an increased bleeding risk. While low-dose aspirin might be considered in select higher risk adults ages 40 to 59, the decision to use aspirin for primary prevention of cardiovascular disease needs to be evaluated on a case-by-case basis.

"In the cardiovascular world, we've known that statins have a stronger cardiovascular benefit for



**Demilade Adedinsowo, M.B., Ch.B.**

primary prevention than low-dose aspirin, especially in the last three to four years with the release of three very large aspirin trial results," says Dr. Adedinsowo. "These research studies drive home the point that the benefits from low-dose aspirin were minimal to none and came at the cost of high bleeding risk."

The recommendations are based on new evidence that has been published since previous guidance was last issued in 2016. Dr. Adedinsowo says it is not unusual for guidelines to change. "Everything that we do in medicine is evidence-based, so if there are more contemporary studies, more contemporary research that provides additional, stronger evidence, the guidelines tend to evolve."

## Yolonda Colson, M.D., Ph.D., is president, American Association for Thoracic Surgery

**Y**olonda Colson, M.D., Ph.D. (IMM '85, MED '89), is the 103rd president of the American Association for Thoracic Surgery and the first female president of the association.

Dr. Colson is the chief for the Division of Thoracic Surgery at Massachusetts General Hospital, the Hermes C. Grillo Professor in the Field of Thoracic Surgery and a professor of surgery at Harvard Medical School.

Dr. Colson has clinical interest in improving the identification and treatment of lung cancer, increasing access to curative therapies, extending the chance of cure through

novel technologies and broadening understanding of the unique differences of lung cancer in women. She is co-inventor on three awarded patents and has received more than 20 foundation grants. Her research focuses on the development of unique mechanisms of polymer and nanoparticle recurrence and the investigation of novel methods to identify a hidden tumor that has spread to nearby lymph nodes.



**Yolonda Colson, M.D., Ph.D.**





The Mayo Clinic campus in Florida, with new areas to come in blue.

## Mayo Clinic invests in facilities in Florida & Mayo Clinic Health System locations

In support of its Bold. Forward. strategic plan to transform health care over the next decade, Mayo Clinic announced major campus enhancement projects at Mayo Clinic in Florida and Mayo Clinic Health System locations in La Crosse, Wisconsin, and Mankato, Minnesota.

“The COVID-19 pandemic has challenged and impacted all in so many ways, but it also has enabled advances in how we best deliver care,” says **Gianrico Farrugia, M.D.** (I ’91, GI ’94), Mayo Clinic president and CEO. “Together with our digital strategy, we are purposefully upgrading physical spaces and integrating technology in ways that better enable our staff to focus on what matters most. People come to Mayo Clinic from all over the world for the care only we can provide, and we are committed to expanding and creating inspired spaces that deliver on our promise of hope and healing.”

In Florida, the expansion will transform the hospital infrastructure by creating much-needed capacity to address significant growth.

- \$432 million expansion
- Construction begins this year and will be completed by late 2026
- Five new floors atop existing hospital tower — 121 new inpatient beds, including 56 ICU beds, with shell space for future growth
- Joins other transformational projects including construction of first carbon ion therapy facility in North America

Mayo Clinic Health System projects will help achieve the strategy of transforming community care. The La Crosse and Mankato projects will incorporate telehealth, digital health and artificial intelligence technologies, along with



Mayo Clinic leaders break ground for a new hospital in La Crosse, Wisconsin.

design elements and efficiencies to support innovative care models and enhance the patient and staff experience.

- \$353 million investment
- Construction began spring 2022 and will be completed by 2024
- Replace La Crosse hospital building with new six-level, 70-bed hospital connected to the Cancer and Surgery Building; includes surgical and procedural floor adjacent to current operating rooms; endoscopy suites, cardiac catheterization labs and interventional radiology, medical-surgical units, flexible ICU and progressive care unit, new Family Birth Center, unfinished shell space for future growth
- 121-bed expansion in three floors to be added atop Mankato emergency department, cancer center and specialty clinic foyer; hospital floors in new tower will link to existing hospital and include new and expanded ICU and progressive care unit, new medical-surgical unit, new Family Birth Center

# Nonprofit cofounded by Mayo Clinic to manufacture affordable insulin

**C**ivica Rx, a nonprofit generic drug company, plans to manufacture and distribute affordable insulin. Mayo Clinic joined a coalition of seven hospitals to launch Civica Rx in 2018. The goal was to help patients by addressing supply shortages and high prices for medications.

Civica plans to set a recommended price to the consumer of no more than \$30 per vial and no more than \$55 for a box of five pen cartridges.

Civica will produce three insulin types — glargine, lispro and aspart, which will be interchangeable with Lantus, Humalog and Novolog, respectively. Each insulin type will be available in vials and prefilled pen cartridges. Civica will codevelop and manufacture these insulin types, and will complete clinical trials and applications for FDA approval.

The insulin types will be manufactured at Civica's plant that is being built in Petersburg, Virginia. The

facility will be able to produce a substantial amount of the insulin needed in the U.S., with additional space to increase production if necessary. Civica anticipates that the first insulin type — glargine — will be available for purchase as soon as 2024. This timing is contingent on FDA approval.

## Patricia Pellikka, M.D., named editor-in-chief, Journal of the American Society of Echocardiography

**P**atricia Pellikka, M.D. (MED '83, I '86, CV '89), chair, Division of Cardiovascular Ultrasound at Mayo Clinic in Rochester, will become the fourth editor-in-chief of the Journal of the American Society of Echocardiography (JASE) on Jan. 1.

Dr. Pellikka is the Betty Knight Scripps Professor of Cardiovascular Diseases Clinical Research Honoring George M. Gura, Jr., M.D., professor of medicine in the Mayo Clinic College of Medicine and Science, and director of Mayo Clinic's Ultrasound Research Center.

Dr. Pellikka has published more than 500 peer-reviewed manuscripts and served on the editorial boards of major cardiology journals, including associate editor of the Journal of the American College of Cardiology. She served as president of the American Society of Echocardiography from 2012 to 2013 and recently served as chair of the group's Industry Relations Committee.



Patricia Pellikka, M.D.

## Obituaries

Obituaries are published upon notification from Mayo Clinic or the family. Publication is voluntary and isn't necessarily inclusive. Complete obituaries and alumni news: [alumniassociation.mayo.edu/people](https://alumniassociation.mayo.edu/people).

**Antonio Arana, M.D.** (N '78), died Dec. 17, 2021.

**Loren Barlow, M.D.** (I '55), died Feb. 2, 2022.

**John Carey, M.D.** (TS '54), died May 19, 2021.

**Cletus Frerichs, M.D.** (I '55), died May 6, 2021.

**William Glover, M.D.** (ANES '61), died Oct. 29, 2019.

**Paul Grosh, M.D.** (HEM '71), died Oct. 5, 2021.

**Philip Hacker, M.D.** (U '66), died Dec. 5, 2021.

**Thomas Henson, M.D.** (N '69), died Feb. 27, 2021.

**Thomas Johnson, M.D.** (OBG '65), died Nov. 4, 2021.

**Iqbal Krishan, M.D.** (PREV '74), died April 21, 2022.

**Martin McMullan, M.D.** (TS '73), died Feb. 23, 2020.

**J. Gordon Millichap, M.D.** (PD '60), died May 7, 2021.

**John (Jack) Miller Jr., M.D.** (ENT '69), died Feb. 26, 2022.

**Robert Murray Jr., M.D.** (PATH '63), died May 15, 2021.

**Alfred Sather, D.D.S.** (ODON '59), died May 20, 2022.

**Everett Shocket, M.D.** (S '55), died July 15, 2020.

**Janette Strathy, M.D.** (MED '81, OBG '85), died July 28, 2018.

**Fred Viren, M.D.** (I '59), died December 2020.

**Lorin Whittaker Jr., M.D.** (S '69), died Nov. 25, 2021.

**Byrn Williamson Jr., M.D.** (RD '75), died March 26, 2020.

**Anthony Wilson, M.D.** (CS '74), died Aug. 9, 2021.

**Virginia Wolff, M.D.** (MED '84), died Dec. 30, 2020.



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[alumniassociation.mayo.edu/events](http://alumniassociation.mayo.edu/events)

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## REFER A FRIEND

[alumniassociation.mayo.edu/resources/refer-a-friend](http://alumniassociation.mayo.edu/resources/refer-a-friend)

## STAY IN TOUCH WITH THE ALUMNI ASSOCIATION

Make sure we have your email address.

If you've registered your profile on the Alumni Association website, you can check and update your contact information:  
[alumniassociation.mayo.edu](http://alumniassociation.mayo.edu)

If you don't yet have an online profile, email [mayoalumni@mayo.edu](mailto:mayoalumni@mayo.edu) or call 507-284-2317 to update your contact information.

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## ABOUT THE MAGAZINE

Mayo Clinic Alumni magazine is published quarterly and mailed free of charge to physicians, scientists and medical educators who studied and/or trained at Mayo Clinic, and to Mayo consulting staff. The magazine reports on Mayo Clinic alumni, staff and students and informs readers about newsworthy activities at Mayo Clinic.

## EXECUTIVE EDITOR

**Judith D. Anderson**

## MANAGING EDITOR

**Melissa Abrams Caulfield**

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**RESEARCH IS MAYO CLINIC  
TRADITION & HALLMARK**

Research and innovation have long been paramount at Mayo Clinic. In the aerospace medicine program, which started in the 1930s, Mayo Clinic physiologists and altitude scientists developed several items vital to military pilot safety in the World War II era. Prior to pressurized aircraft cabins for commercial airline passenger flights, aircraft flew at relatively low altitudes to avoid hypoxic conditions. Mayo scientists developed an oxygen mask for pilots and passengers to wear during flights, allowing travel at higher altitudes above turbulent weather conditions, making flights smoother and more tolerable to travelers.

Here, a research team member is shown in the compression chamber.



Sept. 28–30, 2023

# Save the date

## 2023 Biennial Meeting Rochester, Minnesota

The Biennial Meeting welcome reception will be held at Mayowood Stone Barn. The historic grounds are a parcel of the 3,000 acres of the original Mayowood Farm of Charles (Charlie) H. Mayo, M.D.

Charles (Chuck) William Mayo, M.D. (SIP '75), and his wife, Alice, designed the Stone Barn based on European equestrian-style barns.

