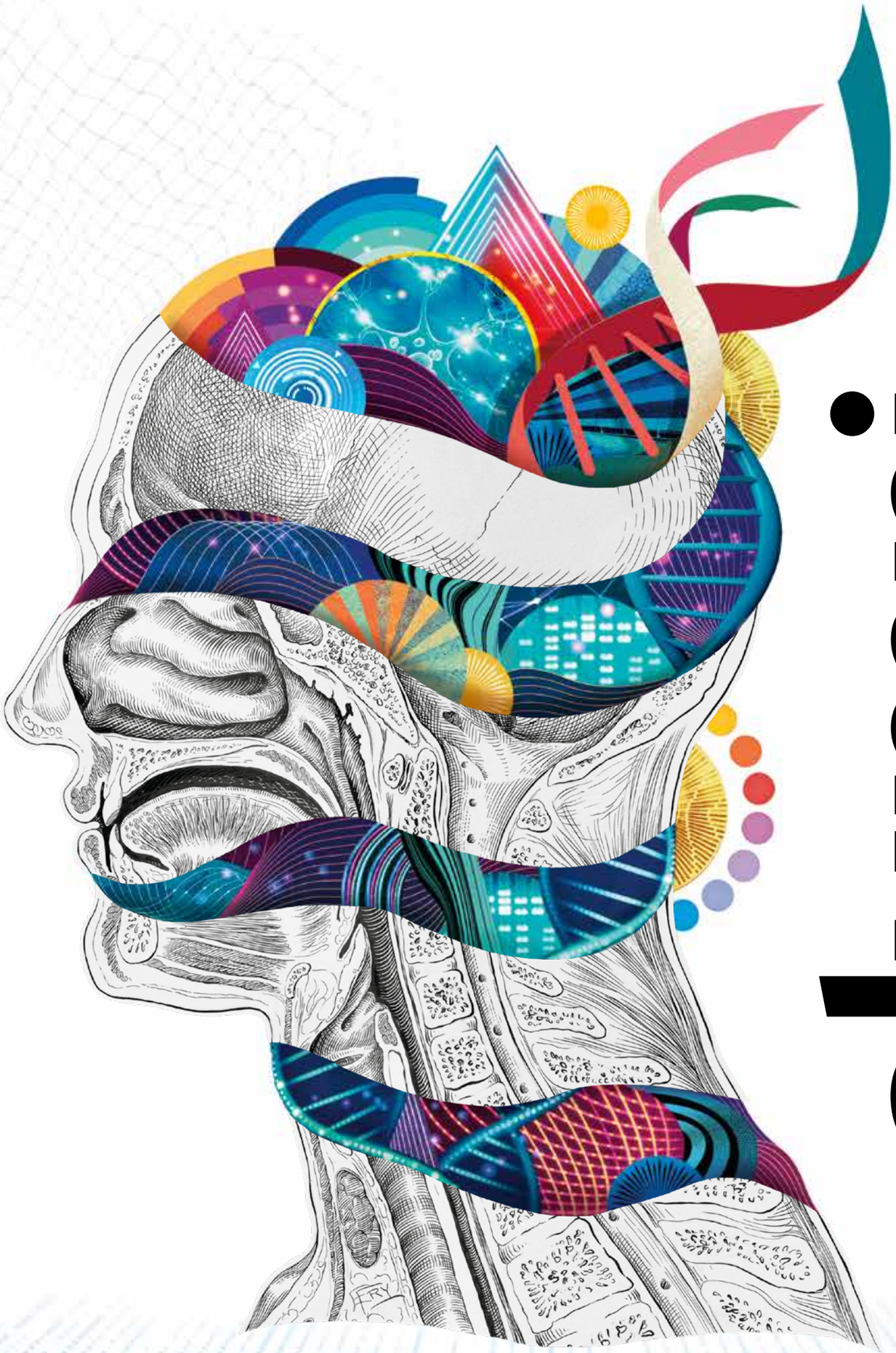
MAYO CLINIC



alumni

2025 • Issue 2

Letter from the **president**

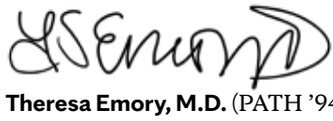
As a pathologist, I'm particularly excited to introduce you to this issue of Alumni magazine, which focuses on anatomy, pathology and laboratory science at Mayo Clinic.

From the moment I arrived at Mayo Clinic as an anatomic and clinical pathology resident 34 years ago, the core priorities of patient care, medical education, and scientific research amazed and inspired me. Our story on the evolution of anatomy education at Mayo Clinic shows that this three-shield emphasis is still alive and well today; read to learn about all the ways the anatomy department is furthering education, research and clinical practice.

After you've learned about everything that's happening in Mayo's anatomy lab, take a look inside Mayo Clinic Laboratories and catch up on the latest assays and advances. As a pathologist focused on the diagnosis, causes and treatment of disease, I was proud to read about how Mayo Clinic Laboratories has advanced laboratory diagnostics in collaboration with industry.

In this issue, you will also meet the recipients of the Donald C. Balfour and Edward C. Kendall Meritorious Research Awards, **Stephanie Syc-Mazurek, M.D., Ph.D.** (I '21, N '24, NAI '25), and **Laura Cacciaguerra, M.D., Ph.D.** (N '22). These amazing researchers are advancing our knowledge and understanding of neurological disorders affecting myelination, which have been some of the most challenging disorders to address.

Finally, I hope you will join us for the Mayo Clinic Alumni Association 74th Biennial Program, which will be held November 13–15 at The Ritz-Carlton on Amelia Island in Florida. This educational event is sure to offer opportunities to reconnect with friends and meet alumni in a beautiful and relaxing setting. In addition to the robust educational program, we will celebrate the installation of our next Mayo Clinic Alumni Association president, **Burkhard Wippermann, M.D.** (BIOM '87), who undoubtedly will continue to advance the Mayo Clinic Alumni Association. It has been my great honor and privilege to serve as president and I am grateful for your support. I hope to see you in Florida!



Theresa Emory, M.D. (PATH '94)
President, Mayo Clinic Alumni Association
Anatomic and clinical pathologist
Peninsula Pathology Associates
Newport News, Virginia

About the cover: The cover represents the evolution of anatomy education, research and practice at Mayo Clinic. The artist combined a 1916 anatomy drawing of a sagittal section of the head and neck by Eleanora Fry, one of Mayo Clinic's earliest medical illustrators, with vivid colors and shapes to depict the advancing study of anatomy as relevant and alive. Read more about Eleanora Fry on page 17.

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Photography by Mayo Clinic staff. Select photography by: The Duncan Entertainment Group ("The First Patient" documentary, page 8); Oxygen/Moment via Getty Images (droplet, pages 18–19); Dean Riggott Photography (Mayo Clinic Laboratories, bottom photo on page 2, pages 20 and 25); Charlie Neuenschwander (Melissa Munroe, M.D., Ph.D./Progentec Diagnostics, pages 26, 30–31); Olena_Z/iStock/Getty Images Plus via Getty Images (page 56).


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At Mayo Clinic, the study of anatomy is more than just dissection — and it's for more than just medical students

Anatomy reimagined

It's 2015 in the clinical anatomy laboratory at Mayo Clinic, and first-year Mayo Clinic Alix School of Medicine students are **opening their cadaver tables for the first time**.

The gross anatomy laboratory at Mayo Clinic in Arizona

They find the cadaver lying face down, covered in towels and protective sheeting. Soon it's time to uncover the back and make their first incision.

"That first cut is the most difficult to make because you shy away from it, you're nervous, you don't want to mess up," then-medical student **Nate Vinzant, M.D.** (MED '19, I '20, ANES '23, CANS '24), says in the 2018 documentary "The First Patient," which follows a class of Mayo Clinic Alix School of Medicine students and teaching assistants as they spend seven weeks in the anatomy lab.

But soon enough, "The First Patient" shows the students gain confidence and the lab becomes a busy hive of activity. Students describe the buzzing of saws, the bright lights, the smell of formaldehyde and the constant tension in the air as everyone tries "to learn as much as they can in as little time as they can about everything that they can," as one student puts it. There's a constant hum of discussion as students work together to decode the intricacies of the human body.

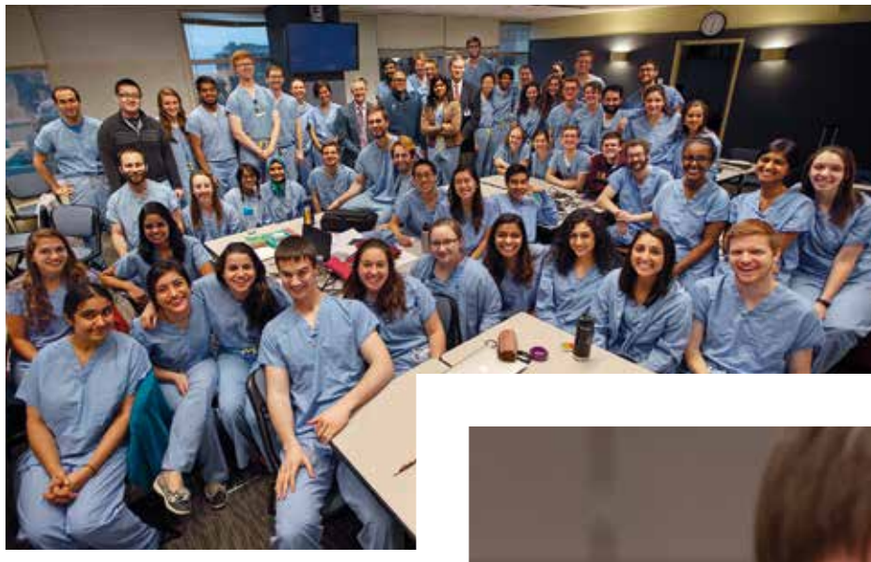
"Is this actually a thing?" one student asks.

"You think that's the thoracic duct? You sure about that?"

"Gee, this isn't normal size," one student says. "What in the world? That is crazy!" another exclaims in response.

"We may have cut through it." "We might have, yeah."

It's a scene familiar to medical professionals across generations, as novice-led cadaver dissection has long been considered the gold standard of medical student anatomy education and a rite of passage for future physicians.



Above: Mayo Clinic Alix School of Medicine students and instructors featured in the 2018 documentary "The First Patient," which follows the group as they spend seven weeks in the anatomy lab. Anatomy education at Mayo Clinic Alix School of Medicine has since evolved to include new technologies and multiple modalities for students to interact with and learn from the human body.

Right: Nate Vinzant, M.D., pictured in "The First Patient."

But if a documentary crew filmed an anatomy course in the clinical anatomy laboratory at Mayo Clinic today, they would find a different scene. Students interact with the human body in many ways, using multiple resources and technology — including ultrasonography, enhanced videography, 3D printing, virtual reality and more — but no longer engage in novice-led dissection.

Nirusha Lachman, Ph.D. (ANAT '07), chair of the Department of Clinical Anatomy at Mayo Clinic in Minnesota, says these changes have enhanced students' experience and opportunities for learning anatomy at Mayo Clinic.

"Cadaveric dissection is a trusted method for learning anatomy but is most effective when used by the right learner at the right time. It's just one of many tools for learners and trainees at all levels to study the human body," Dr. Lachman says. "There is only one gold standard for understanding anatomy: the human body — whether that comes from the patient, the donor or material that has been imaged."

And if documentarians wanted to get a full grasp on how anatomy is used at Mayo Clinic, they would have to venture outside of gross anatomy class. In fact, they could collect hours of footage of trainees, physicians and researchers working in multidisciplinary teams with clinical anatomists to innovate and answer pressing clinical and research questions.

"There is a misperception that anatomy is only for the first-year medical student," says Dr. Lachman. "In the Department of Clinical Anatomy, we have broken away from tradition — both in how we approach education and how we expand our understanding of anatomy."


"We have broken away from tradition — both in how we approach education and ***how we expand our understanding of anatomy.***"
– Nirusha Lachman, Ph.D.

Katie Van Abel, M.D., Department of Otolaryngology-Head and Neck Surgery at Mayo Clinic in Minnesota, uses a virtual reality headset to interact with anatomy.

A NEW VIEW

Though many of the recent changes to anatomy education at Mayo Clinic were part of the clinical anatomy department's long-term strategy, some of them were realized sooner than anticipated.

With the advent of COVID-19, the department worked quickly to implement an existing strategy for a hybrid learning platform. It would be easy to assume these changes resulted in a lower-quality student experience; across the country, many teachers at all educational levels had to make do with clunky video-conferenced classes.

But at Mayo Clinic, anatomy instructors successfully transformed a hands-on experience to a hands-off, virtual curriculum in real time, utilizing technologies like radiology, ultrasonography, 3D printing and virtual reality.

The traditional anatomy classroom was physically redesigned to allow for a team-based, immersive education experience. That included the introduction of a laboratory-based studio, staffed with full-time videographers and photographers working as the department's designated anatomical content capture specialists.

"How many of you stood around that cadaver in first year and agreed that you were seeing what your instructor was pointing at, even though you really didn't? You have 10 people around the cadaver and the instructor says, 'Here is the recurrent laryngeal nerve.' And students say, 'Yes, yes, recurrent laryngeal nerve,' despite having a less-than-adequate view or a very short time to view it," Dr. Lachman says.

In the clinical anatomy studio, instructors teach and dissect while content capture specialists provide targeted shots and views using a combination of overhead, hand-held and endoscopic cameras that are projected onto large screens in the lab. This means every student has the same high-definition, immersive view of the anatomy.

The studio also has the capacity to transmit video and images around the world. Additionally, livestreams are recorded and made available to all Mayo Clinic learners and trainees. These recordings can be rewatched later or loaded into a virtual reality headset, supporting the department's experiential learning strategy.

"Some people listen to learn. I read. Some people want to see the visual, some people want to go into that VR space. Anything we capture can be imported into an Oculus headset, so you can feel like you're walking through the posterior mediastinum, for example, if you want to," Dr. Lachman says. "The most important thing is that you want to provide people with many opportunities to interact with anatomy."

Anatomists through the ages have improved their craft with improving technology, Dr. Lachman says, utilizing drawing, block printing, photographs, atlases, video atlases — and today, virtual reality, 3D printing and more — to capture the human body.

"The issue is always one of: How do we use new-world technology to elevate an old-world subject?" she says. "I think I would be remiss as a clinical anatomist not to try to leverage the technology that we have to present anatomy in a way that becomes better and more meaningful."

NOT FOR THE NOVICE

Along with the laboratory studio, the hybrid learning environment facilitated another significant change to anatomy education at Mayo Clinic: Instead of novice-led dissection, medical students now participate in learner-driven, prosection-based education.

The use of prosection is neither new nor innovative, and both dissection and prosection are proven, effective tools for learning anatomy, Dr. Lachman says. But some argue that dissection experience is superior, believing it translates to dissection skill and deep anatomic knowledge. In popular perception of novice-led dissection, students arrive in the anatomy lab timid, squeamish pupils, and after weeks of carefully carving their way through the complete cadaver, they emerge toughened, proven physicians.

The reality is more complicated. It's true that some people love their dissection experience and benefit from the "humanistic value that actually interacting in the anatomy, the body, brings to you," Dr. Lachman says. But she believes that for most people, the traditional anatomy course doesn't adequately inform later clinical practice. Students with minimal anatomy knowledge and no dissection experience are expected to adequately and completely dissect a cadaver in just a few weeks.

"Dissection is not the best tool for novice learners," Dr. Lachman says. "It takes many hours of dissecting and a solid theoretical and clinical understanding of anatomy to be able to effectively learn through dissection."

Today, Mayo Clinic Alix School of Medicine students can take an anatomy selective using prosected donors after they've completed their first-year anatomy course. Those who want more exposure to dissection can serve as teaching assistants, and those entering specialties that benefit from a strong knowledge of anatomy can take a fourth-year anatomy elective that focuses on their clinical specialty of interest.

Regardless of whether a student chooses to dissect, the goal for every student is the same, Dr. Lachman says: "constant engagement with anatomy" through multiple modalities.

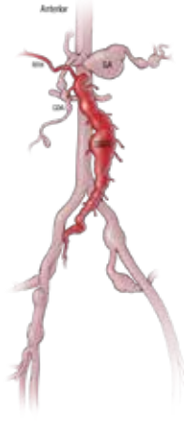
ANATOMY FOR ALL

Like most other academic medical centers, Mayo Clinic's clinical anatomy

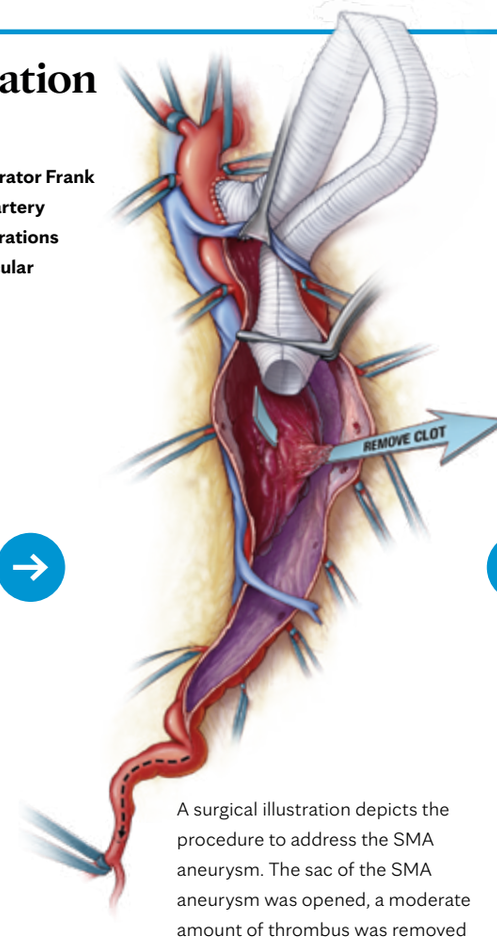
Using 3D imaging and illustration to illuminate anatomy

These images were created by Mayo Clinic senior medical illustrator Frank Corl, M.S., for a case report on a patient with multiple visceral artery aneurysms and the surgical repairs of the aneurysms. The illustrations were published alongside the case report in the Journal of Vascular Surgery, providing readers with enhanced anatomical context.

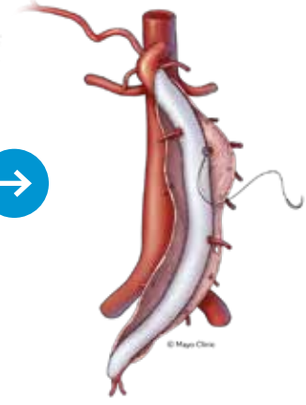
This 3D reconstruction of computed tomography (CT) angiography imaging shows a bilobed splenic artery (SA) aneurysm and superior mesenteric artery (SMA) aneurysm.



The 3D CT reconstruction was used to create this illustration of the SMA aneurysm and its arterial branches.



A surgical illustration depicts the procedure to address the SMA aneurysm. The sac of the SMA aneurysm was opened, a moderate amount of thrombus was removed and reconstruction was performed using a polyester graft.



An illustration shows the graft placement and arterial branch reimplantation.

Above: Punnose Kattil, M.B.B.S., M.D., and Wojciech Pawlina, M.D., teach a class of medical students using a skeleton model to go over the relevant anatomy before proceeding to the cadaver.

department historically focused on educating medical students. Today, that's just a fraction of what the department does.

Of the approximately 250 donors that the Mayo Clinic body donation program receives each year, about eight or fewer are used in the medical school curriculum, says department administrator Jonathan Torrens-Burton. Some of the rest support health science education, residency education and research, but most support the practice — a reality reflected in the department's official name change from the Department of Anatomy to the Department of Clinical Anatomy.

"As a Department of Clinical Anatomy, our mission is to transform patient care through education, research and practice innovation," Dr. Lachman says.

The department wants to use its anatomical knowledge, imaging and donor materials to help Mayo Clinic physicians better understand patients' often-complex anatomy and how that anatomy relates to clinical outcomes.

For example, when physicians devised a new tool to conduct a minimally invasive approach to carpal tunnel release, they partnered with the Department of Clinical Anatomy to test it on cadavers, improving the procedure and the tool in the process.

The department also assisted **Samir Mardini, M.D.** (PLS '06), leader of the team that successfully performed Mayo Clinic's first-ever face transplant. Dr. Mardini is the chair of the Division of Plastic and Reconstructive Surgery at Mayo Clinic in Minnesota. Dr. Mardini and his team spent countless weekends and weekdays in the clinical anatomy lab simulating the entire face transplant procedure and gaining a better understanding of the intricate anatomy of the face, including the entire bony structure, muscles, arterial and venous branches, and nerves that provide feeling and movement.

"Without the ability to collaborate with our incredible colleagues in the

History of anatomy lab at Mayo Clinic

Mayo Clinic's original anatomy lab was not the state-of-the-art facility it is today; it consisted of one room in the basement of a funeral home, without sufficient lighting or ventilation. Even so, the lab led to important medical advancements.

John Lundy, M.D. (ANES 1924, deceased 1973), the first chair of the Section on Anesthesia at Mayo Clinic, proposed the idea of a Mayo Clinic anatomy lab in 1925 and William J. Mayo, M.D., approved the idea later that year.

Dr. Lundy saw the anatomy lab as a way to recruit and train surgical fellows as well as physicians in anesthesiology. More anesthesia professionals were sorely needed; in 1925, there were just 26 anesthesia physicians and nurses across Mayo Clinic's four hospitals in Rochester who were responsible for over 20,000 surgical patients.

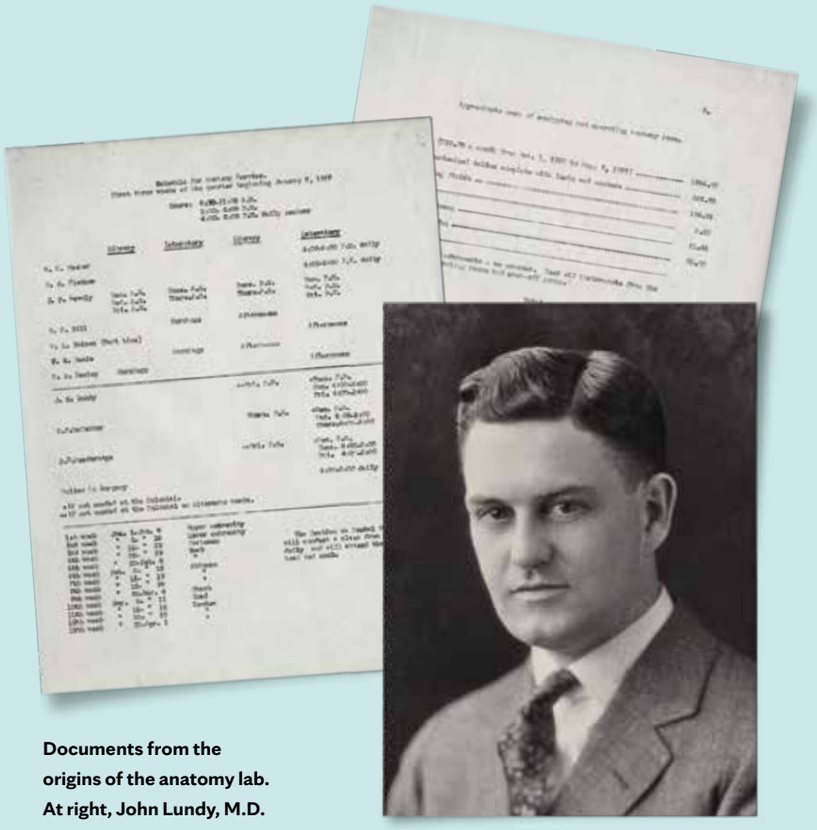
In addition, Dr. Lundy correctly believed that the increased use of regional anesthesia techniques would reduce potentially dangerous depths of inhaled anesthesia like ether for many surgical procedures, improving patient safety. An anatomy lab was needed to advance the study of nervous system anatomy, thus improving regional anesthesia techniques.

The lab was dramatically successful in refining and expanding the use of regional anesthesia techniques at Mayo Clinic and subsequently worldwide. Additionally, Dr. Lundy used the lab to simulate a surgical environment so that fellows could practice a variety of procedures on cadavers, not just regional anesthesia techniques. All in all, it was a "success on every level," according to a 2004 article in the Journal of Clinical Anesthesia, with first author **Terry Ellis II, M.D.** (ANES '02).

"Lundy's efforts exceeded all expectations," the article says. "During the first full year of operation, the staff and fellows spent 2,035 hours in the laboratory. In the second year of operation, the staff spent more than 6,600 hours in the laboratory."

Recognizing its success, Dr. Lundy hired a full-time anatomy instructor, found money for more equipment, added to the curriculum and remodeled the lab, beginning a long history of evolving anatomy education at Mayo Clinic.

Thanks to Dr. Lundy and his advocacy for improved patient safety and the education of surgeons, anesthesia physicians and nurses, the Mayo Clinic anatomy lab became a model for surgical and anesthesia education.



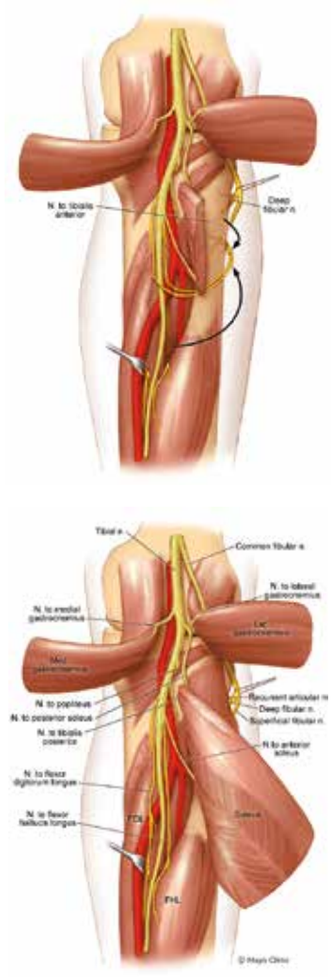
Documents from the origins of the anatomy lab. At right, John Lundy, M.D.

The clinical approach to anatomy education at Mayo Clinic inspired Kale Bodily, M.D., to redirect his career goals from surgery to radiology.

Department of Clinical Anatomy, the face transplant would not have been possible," says Dr. Mardini.

The Department of Clinical Anatomy and Division of Plastic and Reconstructive Surgery continue to work together on many innovative projects to restore function with facial reconstruction.

The Department of Clinical Anatomy also wants to be as responsive as possible to clinical needs. For example, surgeons operating on a patient with complex congenital heart disease may only have a day or two of lead time to prepare for a procedure. They can call the Department of Clinical Anatomy and get immediate access to donor material and images or



Illustrations by former Mayo Clinic artist David Factor, M.S., based on the anatomical research of Kale Bodily, M.D. At top, a proposed method for direct nerve transfer. At bottom, a posterior view of the dissected right leg.

even perform dissections before the surgery.

"Anatomical variations that are patient-specific can impact clinical outcomes," Dr. Lachman says. "This is an area of immense opportunity for interpreting patient anatomical data."

KEYS TO THE KINGDOM

Though the department has recently emphasized partnering with the practice, it has long been working with Mayo Clinic physicians, allied health providers and students.

When **Kale Bodily, M.D.** (MED '05, RD '10), was a Mayo Clinic medical student taking gross anatomy in the 2000s, **Robert Spinner, M.D.** (MED '89, NS '00), a consultant in the Department of Neurologic Surgery and the Burton M. Onofrio, M.D., Professor of Neurosurgery, visited the class and gave a presentation on nerve transfers in the upper extremities to treat certain types of peripheral nerve injuries.

"They did a great job in that program of providing clinical correlation to help us see the relevance of what we were learning," Dr. Bodily says.

Later, when Dr. Bodily's anatomy class progressed to dissecting the lower extremities, he wondered: Was anyone doing nerve transfer surgeries in the leg?

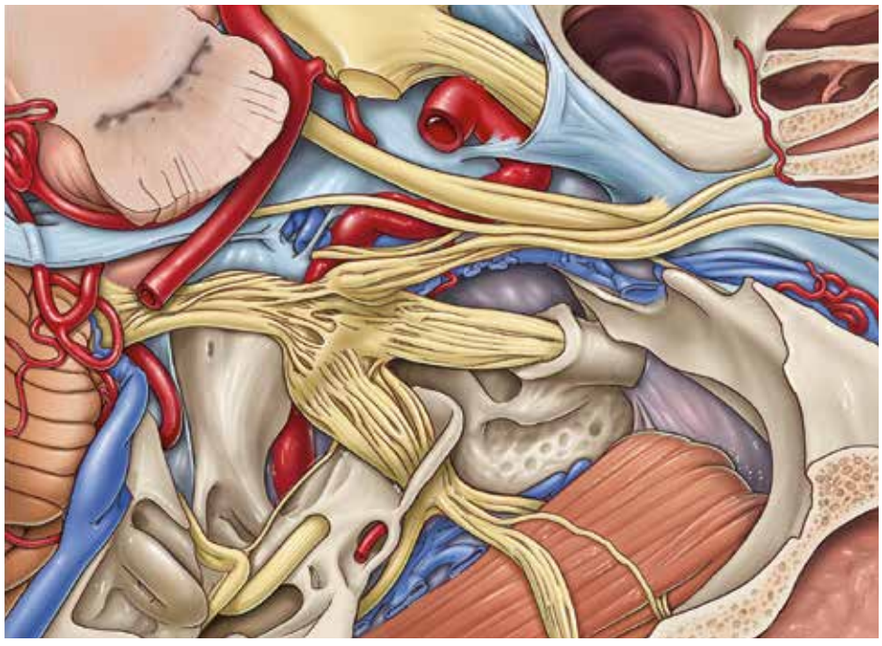
The answer was no. After discussion with Dr. Spinner and former anatomy department chair **Stephen Carmichael, Ph.D.** (ANAT '82), Dr. Bodily soon found himself entrusted with 10 cadaveric legs to explore the issue. He spent hours dissecting in the evenings, characterizing and measuring the nerves and muscles in great detail, trying to determine whether the anatomy would be potentially conducive to nerve transfer surgery.

His findings were published in Clinical Anatomy alongside beautiful illustrations created by a Mayo Clinic medical artist. Eventually, Dr. Spinner began a trial of lower extremity nerve transfer procedures, with Dr. Bodily present in the operating room to lend his anatomical expertise.

"That experience was extremely unique: To get input from a world-class

*"There is only **one gold standard for understanding anatomy**: the human body — whether that comes from the patient, the donor or material that has been imaged."*

– Nirusha Lachman, Ph.D.



Top: A lateral overview of the middle cranial fossa and its contents created by Mayo Clinic senior medical illustrator Steven Graepel, M.A., in collaboration with Mayo Clinic neurosurgeon Maria Peris Celda, M.D., Ph.D.

Left: A simulation operations specialist demonstrates use of the Anatomage virtual dissection table in the J. Wayne and Delores Barr Weaver Simulation Center at Mayo Clinic in Florida.

Right: Various 3D-printed models allow Mayo Clinic learners to touch and see accurate anatomical representations.

neurosurgeon as we were learning anatomy, and then to be curious and ask a question, and then have the strong support from an anatomy professor and a neurosurgery professor, and the resources to answer that question," Dr. Bodily says. "It's a great privilege to be a student at Mayo Clinic. You have the keys to the kingdom, so to speak. That applies across the board, but it applies in anatomy too."

In Dr. Bodily's case, his experience learning anatomy redirected his career goals.

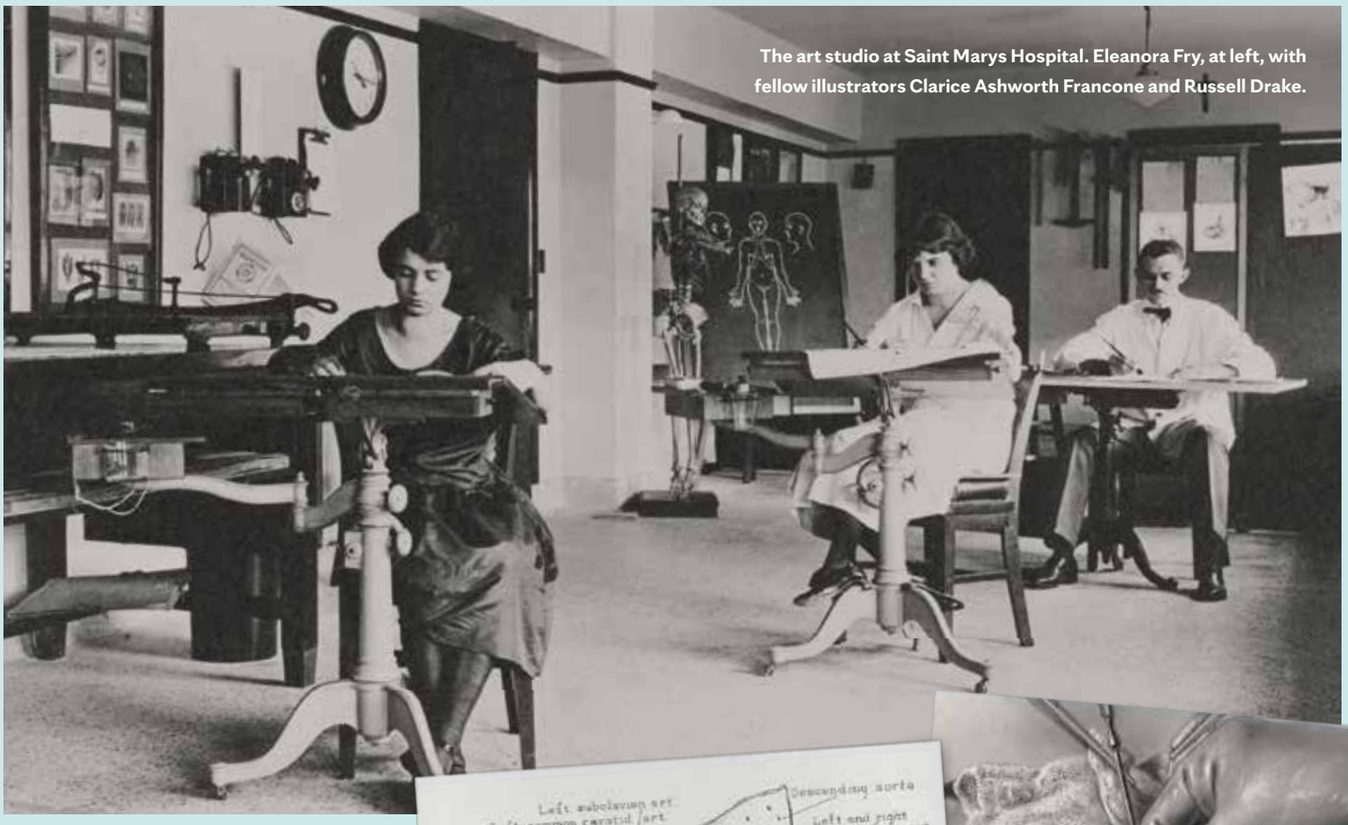
"I was just trying to decide what kind of surgeon I was going to be, but I fell in love with all of the anatomy," he says. "As a radiologist, I work with anatomy throughout the body every day, all day long. The clinical approach to anatomy education at Mayo Clinic had a very real impact on my career path, and I absolutely love what I do."

LOOKING FORWARD

The Department of Clinical Anatomy is doing a lot of exciting work, but it will continue to evolve to keep up with the field — an idea that often surprises people, Dr. Lachman says.

"People say, 'What in anatomy has changed? Anatomy is anatomy,'" Dr. Lachman says. "Our knowledge of anatomy and our capacity to apply it in clinical practice is dependent on asking the right questions and enhanced by engaging in different views of what we already know."

As Mayo Clinic continues to translate anatomical knowledge from the bench to the bedside and back, she says, the subject of anatomy remains relevant and alive. •



The art studio at Saint Marys Hospital. Eleanora Fry, at left, with fellow illustrators Clarice Ashworth Francone and Russell Drake.

Eleanora Fry and the history of medical illustration at Mayo

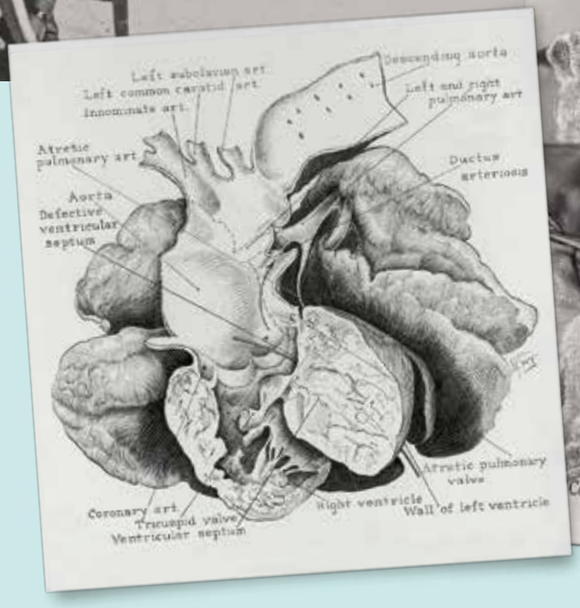
The vintage anatomical drawings used in the cover illustration and on pages 4 and 5 were created by Eleanora Fry, one of Mayo Clinic's earliest medical illustrators.

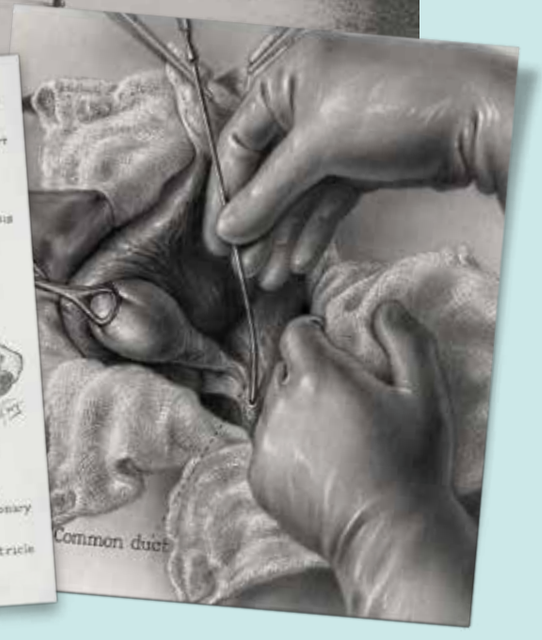
Mayo Clinic established an art studio at Saint Marys Hospital and hired its first full-time medical artist, Florence Byrnes, in 1907. In 1912, Mayo Clinic hired New York illustrator Eleanora Fry, who became head of the studio.

As medical illustrators like Fry worked with surgeons like Drs. William J. and Charles H. Mayo, they were able to "elegantly, yet concisely describe the pioneering surgical procedures being developed at the Mayo Clinic," medical illustrator Rebekah Dodson wrote in a brief 1989 biography of Fry.

This collaboration between Mayo Clinic physicians, surgeons and medical artists resulted in illuminating illustrations, compelling journal articles and beautiful works of art that survive a century later.

Today, Mayo Clinic's Division of Biomedical and Scientific Visualization employs medical illustrators, animators and support staff. They continue to partner with physicians, surgeons, educators and researchers to clearly convey medical information to patients, medical students and professional audiences.





Left: An illustration by Eleanora Fry depicting atresia of the pulmonary artery.

Right: An illustration by Eleanora Fry showing the placement of sponges during an operation to address stones in the common bile duct.

Read more about Eleanora Fry and the history of medical illustration at Mayo.

THERE'S A **LAB FOR THAT**

Mayo Clinic Laboratories works relentlessly to bring innovative and enhanced diagnostics to patients

The flashiest medical news stories often revolve around treatments, with headlines heralding successful cancer vaccine trials, new Alzheimer's disease medications and blockbuster diabetes drugs.

These achievements are certainly worth celebrating, as patients find relief from chronic and potentially fatal conditions. But this narrative tends to skip over an entire step in the advancement of healthcare: The path to appropriate, effective treatment starts with an accurate diagnosis.

"I've always been passionate that diagnostics and laboratories have such an importance in healthcare that's often underrecognized," says **William Morice II, M.D., Ph.D.** (MDPH '94, IMM '94, PATH '98, SGPA '99, HEMP '00).

Dr. Morice is CEO and president of Mayo Clinic Laboratories (MCL), a diagnostic company and reference laboratory that offers a catalog of 4,400 tests and pathology services in partnership with the Department of Laboratory Medicine and Pathology at Mayo Clinic. That number continues to climb as MCL relentlessly innovates on behalf of patients through collaborations with Mayo Clinic physicians, other healthcare systems, biopharmaceutical companies and healthcare research organizations.

"When I look back across my career in medicine, just the pace of change and what's happening now in diagnostics and healthcare, I don't know if I would have conceived of these innovations back when I came to Mayo as an M.D.-Ph.D. student in 1987 or when I joined the Mayo Clinic staff in 2000," says Dr. Morice.

Read on to learn about some of the latest labs that are improving the lives of patients around the world as MCL partners with Mayo Clinic innovators and others to bring new tests and solutions to the market.

William Morice II, M.D., Ph.D., CEO and president of Mayo Clinic Laboratories

Robin Patel, M.D., is a consultant in the Division of Clinical Microbiology and the Elizabeth P. and Robert E. Allen Professor of Individualized Medicine at Mayo Clinic in Minnesota.

CNS PATHOGEN TESTING

When a diagnosis **is elusive**

When a patient has a suspected central nervous system (CNS) infection, there's often a very long list of possible causes, including bacteria, fungi, viruses and parasites — and limited time and means to narrow down the list of suspects.

The longer the infection goes untreated, the greater the risk of seizures, permanent physical and cognitive disabilities, and even death.

"Central nervous system infections can be devastating," says **Robin Patel, M.D.** (I '92, INFD '95, CM '96), a consultant in the Division of Clinical Microbiology and the Elizabeth P. and Robert E. Allen Professor of Individualized Medicine at Mayo Clinic in Minnesota. "For many, specific treatment is available. But we need to know what the diagnosis is so that we can deploy the right treatment. Therefore, the sooner we can make an accurate diagnosis, the better."

Standard laboratory tests can identify many — but not all — of these infections.

"The need for better diagnostics is compelling, because there's little room for error or waiting with central nervous system infections," says Dr. Patel. "No one wants a poor outcome of a brain infection that could have been cured but wasn't because a correct diagnosis wasn't made."

To prevent these poor outcomes, MCL offers standard and sophisticated tests for CNS infections — including a metagenomic assay recently developed at Mayo Clinic that can identify more than 1,000 pathogenic organisms in cerebrospinal fluid (CSF).

THE USUAL SUSPECTS

Finding the cause of a CNS infection typically involves running a spate of tests on CSF, including cell count and differential, protein and glucose concentrations, along

with cultures — which only detect live organisms — and antigen and polymerase chain reaction (PCR) tests — which detect targeted microorganisms.

MCL offers a multiplex PCR pathogen panel that can rapidly detect the nucleic acid of 14 of the most common causes of meningitis and encephalitis. Even so, running all these tests may leave the patient and physician without answers.

"Some disease-causing microorganisms are so unusual that we don't have a commonly used diagnostic for them," Dr. Patel says.

In these cases, MCL's metagenomic assay may be a strategic next step. Using a patient's CSF and a technique known as metagenomic sequencing, the test extracts every bit of nucleic acid in the CSF sample. The nucleic acid DNA is directly sequenced, and the nucleic acid RNA is converted to DNA and sequenced. Then a complex bioinformatic analysis is used to remove human sequences, and the remainder of the sequences are analyzed to determine whether there is evidence for the presence of potentially pathogenic microorganisms.

"A metagenomic approach for infectious diseases diagnosis allows us to look for potential pathogens without the bias of having to think about which type of organism this might be and ordering a specific diagnostic test," says Dr. Patel. "It opens the door for us to ask open-ended questions."

Dr. Patel worked with senior developer Matt Wolf, Department of Laboratory Medicine and Pathology at Mayo Clinic in Minnesota, to develop the assay — an example of team-based innovation advancing diagnostics. Test developers, clinician-researchers, laboratory technologists and microbiology experts at Mayo Clinic regularly collaborate to run experiments, review and interpret assay results, and recommend treatment approaches. MCL is then able to make those innovations broadly available to clinicians around the world to better care for patients.

"Operationalizing technological advances for clinical use requires a dedicated team to design and build our tests, validate them and standardize them in a way that they can be handed off to the clinical laboratory to run. Not every institution in the United States or in the world has that kind of operational setup," Dr. Patel says. •

Matt Wolf and Robin Patel, M.D., worked together to create a metagenomic assay that can identify more than 1,000 pathogenic organisms in cerebrospinal fluid.

There's also a lab for ...

An expanded genetic panel to enhance
PARKINSON'S DISEASE DIAGNOSIS
(Mayo ID: PARDP)

Genetic testing to help pinpoint the cause of
SUDDEN UNEXPLAINED CARDIAC DEATH
(Mayo IDs: PMAOG, PMARG, PMCAG, PMCMG, PMHLH and PCMSP)

An assay that identifies patients with
EPITHELIAL OVARIAN CANCER
eligible for a new treatment
(Mayo ID: AFOLR)

An innovative panel to evaluate for
BILE ACID MALABSORPTION
(Mayo ID: BAMRP)

An artificial-intelligence-augmented test for
REFINED KIDNEY STONE ANALYSIS
(Mayo ID: KIDST)

An augmented solid tumor panel to better profile
TUMOR PATHOGENESIS
(Mayo ID: MCSTP)

A unique urine assay to screen for
PERIPHERAL NEUROPATHY
(Mayo ID: SORD)

Melissa Munroe, M.D., Ph.D., chief scientific officer and principal investigator at Progentec Diagnostics

LUPUS TESTING

Transforming the **patient experience**

As a rheumatologist and lupus researcher, Donald Thomas, M.D., knows how difficult it is to put lupus in a box.

"If I lined up 100 of my patients, every single one of them would be different," says Dr. Thomas. "One person might come into the hospital with blood clots and a stroke and fatigue. Someone else might have a lot of protein in their urine and chest pain from pleurisy. Someone else could just have some low blood counts picked up on some routine tests but feel amazing."

Systemic lupus erythematosus (SLE) is an autoimmune disease that can attack multiple organ systems, often at the same time. This results in a wide variety of clinical manifestations that may overlap with other autoimmune diseases like rheumatoid arthritis, fibromyalgia and Sjögren's disease.

Management of lupus can be complicated. For many, the disease waxes and wanes, and severe flares can require hospitalization and medications like immunosuppressants and corticosteroids to bring them under control — all of which increase the risk of permanent organ damage.

Yet, there's no definitive, single laboratory test that can classify a patient as having SLE, measure disease activity, or predict or assess a disease flare. Dr. Thomas doesn't mince words: the traditional laboratory tests for lupus are "downright horrible," he says.

"I just think any disease that can take several years to diagnose, it just screams to me we have to continue to innovate to get better tools," says Dr. Morice. "From a laboratory and a clinical perspective, it's something we should really be vigilant and passionate about for the sake of our patients."

To that end, Mayo Clinic Laboratories teamed up with Progentec Diagnostics, a digital health and biomarker technology-based company focused on autoimmune conditions, to increase testing accessibility for providers and patients across the U.S. and select global markets. Progentec has produced two biomarker blood tests for proactive lupus management that characterize disease activity and flare risk.

MITIGATING FLARES

Assessing the risk of disease activity and a lupus flare is not straightforward. Increased anti-double-stranded DNA (anti-dsDNA) titer and/or low complement levels (C3 and C4) may indicate increased lupus disease activity. Although laboratory findings such as rising anti-dsDNA and falling C3 and C4 over time have been used in an attempt to assess flare risk, these tests are imprecise. Not everyone with lupus will experience increased anti-dsDNA or low complement levels. According to Melissa Munroe, M.D., Ph.D., chief scientific officer and principal investigator at Progentec, SLE patients who do exhibit these signs have an equal chance of remaining clinically stable or experiencing an impending clinical disease flare.

That started to change when Dr. Munroe and Judith James, M.D., Ph.D., a leading lupus expert at the Oklahoma Medical Research Foundation (OMRF), evaluated how immune system changes related to disease activity and flare risk in SLE patients. Dr. Munroe, Dr. James and OMRF colleagues published papers in 2014 and 2017 looking at retrospective cohorts of lupus patients. They found that detectable immune system changes occurred before clinical changes that resulted in a lupus flare. Progentec built on this knowledge by studying prospective cohorts at sites including Mayo Clinic, evaluating patients every three months for disease activity and flares.

William Morice II, M.D., Ph.D., CEO and president of Mayo Clinic Laboratories (MCL) pictured at one of MCL's operational facilities.

"It's both gratifying and humbling to be able to work with Progentec at Mayo Clinic Laboratories, because the ultimate goal for me as a laboratory medicine professional is to find ways that the clinical laboratory can make ***more of an impact in an individual's life****."*

— William Morice II, M.D., Ph.D.

The result is the DX Lupus Flare Risk Index, which uses 11 blood biomarkers and an advanced algorithm to predict the likelihood of a clinical disease flare within the next 12 weeks. If the assay shows a flare is likely, providers can take steps to mitigate or prevent it, such as reinforcing or changing treatment.

Dr. Thomas, who serves on the lupus scientific advisory board for Progentec Diagnostics, has already seen these benefits in his practice.

"One of my patients was in clinical remission on therapy, and his flare test came back highly positive, which surprised me," he said. "That spurred me to talk to him. Come to find out he was missing doses of his immunosuppressant, he wasn't using his sunscreen religiously and he was under a lot of stress."

After Dr. Thomas talked his patient through healthy strategies to manage his disease, the patient did not flare and felt markedly better.

"We would love if it would completely prevent flares, but at the very least if we can diminish the flares or intervene early with something other than high-dose steroids, we can prevent some toxicities, so that down the line we can prevent organ damage," says Dr. Munroe.

Progentec Diagnostics is a digital health and biomarker technology-based company focused on autoimmune conditions.

Donald Thomas, M.D.

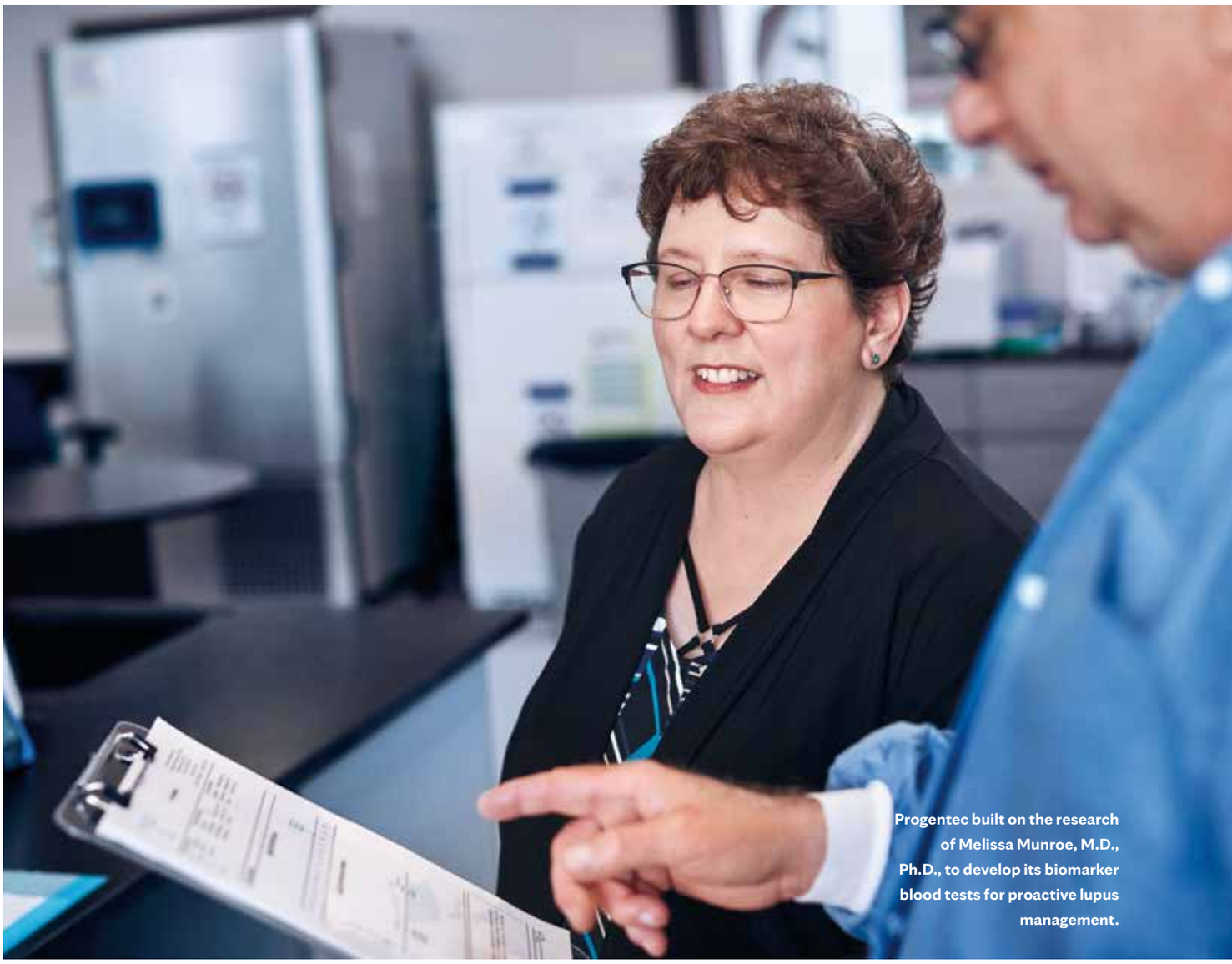
MEASURING DISEASE ACTIVITY

Management of lupus is also complicated by the fact that a lupus patient may have lupus-like symptoms that don't actually stem from lupus.

"When I have a patient with symptoms, the big question I have is, 'Is this due to their lupus or is this due to something else?'" Dr. Thomas says. "I have to confirm whether it's lupus or not because the treatments may be very different."

A prime example: Dr. Thomas had two patients with tender, painful joints, fatigue, and normal complements and anti-dsDNA. He didn't know whether their symptoms were due to lupus or fibromyalgia and, subsequently, was unsure how to treat them.

The Progentec DX Lupus Disease Activity Index assay uses 10 biomarkers to characterize current immune dysregulation and quantifies disease activity risk as low, moderate or high. This can help determine the frequency of care assessment, guide disease management and evaluate early response to treatment.



Progentec built on the research of Melissa Munroe, M.D., Ph.D., to develop its biomarker blood tests for proactive lupus management.

In the case of Dr. Thomas' patients with tender joints, both patients' disease activity tests came back stating low probability of disease activity. With this knowledge, Dr. Thomas felt much more confident prescribing a fibromyalgia treatment plan.

Additionally, using Progentec's tests can help monitor a patient's response to changes in treatment, such as lowering a patient's medication dose.

All of these uses of Progentec's tests are in service of Mayo Clinic's primary value, Dr. Morice says. That's why Mayo Clinic partnered with Progentec to bring the tests to market and make them available to clinicians working to manage their patients' lupus.

"It's both gratifying and humbling to be able to work with Progentec at Mayo Clinic Laboratories, because the ultimate goal for me as a laboratory medicine professional is to find ways that the clinical laboratory can make more of an impact in an individual's life," he says. •

ALZHEIMER'S DISEASE

Providing reliable, **accessible testing**

Post-mortem diagnosis of Alzheimer's disease has long been definitive and relatively straightforward. The autopsy criteria were initially established when Alois Alzheimer reported the disease's neuropathology in 1906: it requires the histopathologic identification of amyloid plaques and neurofibrillary tangles in the brain.

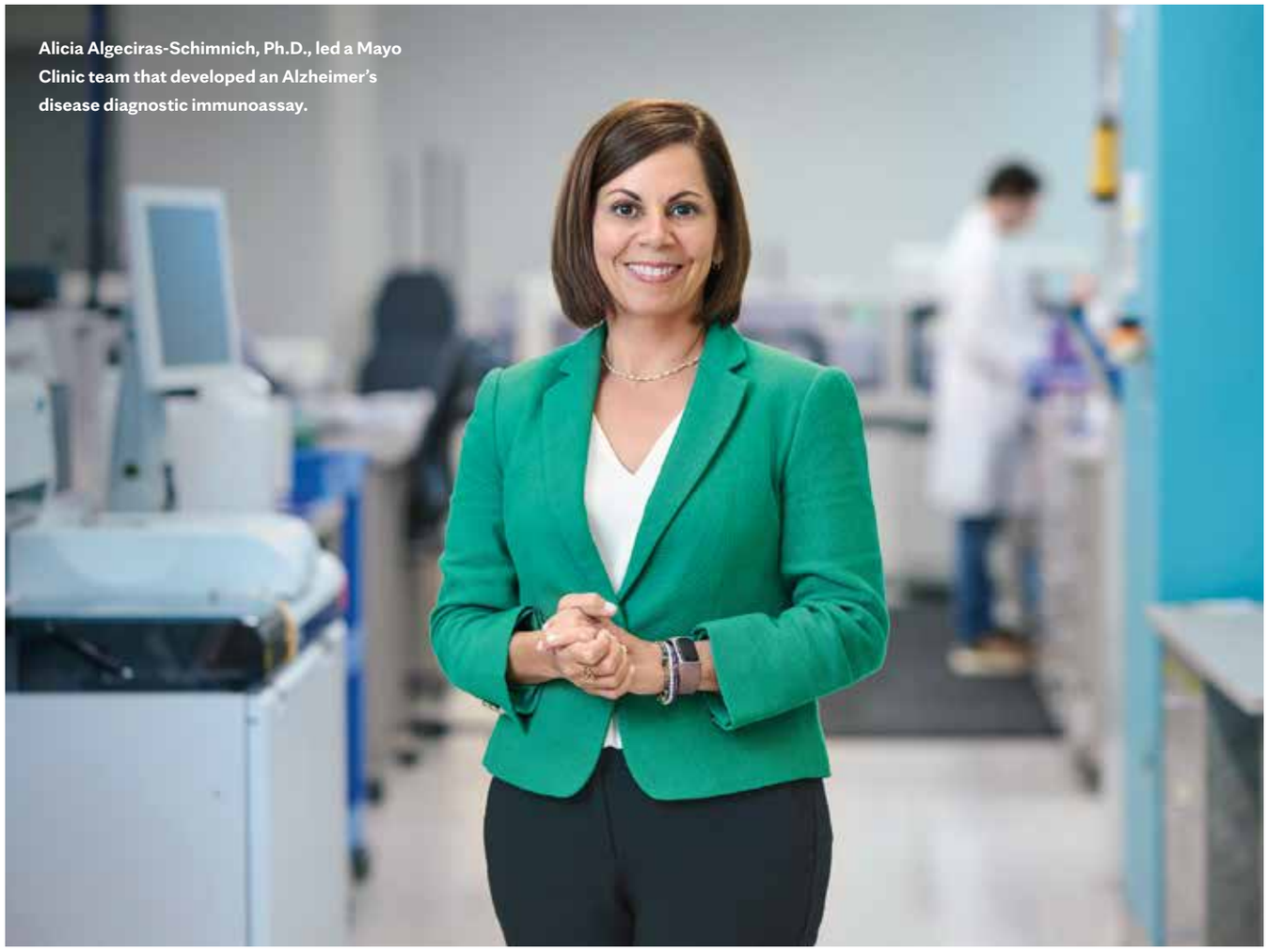
The challenge has been to diagnose living patients. Physicians have used advanced brain imaging such as positron emission tomography (PET) scans, as well as cerebrospinal fluid (CSF) biomarker testing, to assess Alzheimer's neuropathology. But these tests aren't ideal — they're not always available, can be expensive and CSF assays are invasive.

Additionally, some questioned the practical use of these tests. As a disease for which no disease-modifying therapies existed for over 100 years — and a disease that came with plenty of stigma — some believed there was little to gain and a lot to lose from an official Alzheimer's diagnosis.

That's changing with the advent of disease-modifying therapies such as lecanemab and donanemab, intended for those with mild cognitive impairment or mild dementia. These treatments target amyloid beta accumulation, so it's required that patients have proven presence of amyloid pathology to be considered for the drugs.

Alicia Algeciras-Schimnich, Ph.D., at right, consults with a colleague. Dr. Algeciras-Schimnich is a consultant in the Division of Clinical Biochemistry and Immunology at Mayo Clinic in Minnesota.

The p-Tau217 plasma biomarker test is an Alzheimer's diagnostic assay from Mayo Clinic Laboratories. It identifies phosphorylated Tau 217 (p-Tau217) protein in plasma and is intended for individuals aged 50 and older who present with cognitive impairment.



Alicia Algeciras-Schimnich, Ph.D., led a Mayo Clinic team that developed an Alzheimer's disease diagnostic immunoassay.

"That's really pushed laboratory science to explore: How do we make a diagnosis of Alzheimer's disease?" says Dr. Morice.

This push for diagnostics has resulted in commercially available Alzheimer's disease blood biomarker tests. They're noninvasive, rapid and cost-effective. But there is a lot of variation in how these tests perform clinically. Some have lower diagnostic accuracy and, consequently, more frequent false negative and false positive results.

The life-changing nature of an Alzheimer's diagnosis makes it especially necessary to be mindful of a test's specificity and sensitivity, Dr. Morice says.

"As these tests become available, it becomes even more important for us in the laboratory to be a voice about how they should be used, or else people will be misinformed," he says. "The whole purpose of the lab is to help people and their healthcare teams make informed choices."

CLINICALLY VALIDATED

When Mayo Clinic sought to offer an Alzheimer's diagnostic assay, sensitivity and specificity were of primary importance.

A team led by **Alicia Algeciras-Schimnich, Ph.D.** (IMM '99, LABM '00, CLCH '08), Division of Clinical Biochemistry and Immunology at Mayo Clinic in Minnesota, worked in collaboration with physicians and utilized a sample cohort drawn from the Mayo Clinic Study of Aging and the Alzheimer's Disease Research Center.

"At Mayo, I have worked very closely with the behavioral neurology practice," says Dr. Algeciras-Schimnich. "This allows us to evaluate the clinical validity and performance of these biomarkers before bringing them into clinical practice."

The result: an immunoassay that identifies phosphorylated Tau 217 (p-Tau217) protein in plasma, intended for symptomatic individuals aged 50 and older.

Along with having high diagnostic accuracy, it was also important for

Susan Ashrafzadeh Kian, senior developer in the Department of Laboratory Medicine and Pathology at Mayo Clinic in Minnesota, handles the p-Tau217 plasma biomarker test.

the assay to have a short turnaround time and measure a stable biomarker. Dr. Algeciras-Schimnich and her team found that p-Tau217 is a very stable biomarker in plasma, which allows providers to send refrigerated samples with no need for special sample collection or processing.

Test results are returned in 1 to 5 days and are qualified as positive, negative or intermediate. Intermediate results signal the need for additional confirmation testing such as CSF biomarker assays or PET scans. Although it's estimated some 15% to 20% of patients will be classified as intermediate, the benefit of this approach is a high diagnostic accuracy (>90%) for the detection of amyloid pathology.

"We wanted to make sure that when we classify a result as positive or negative, we are very certain that amyloid beta pathology indeed is or is not present," Dr. Algeciras-Schimnich says. "It's a conservative approach to prevent people being misclassified as having amyloid pathology when in reality they don't have it."

The result is a fast and reliable diagnostic test that "hopefully will be positioned as one of the first tests performed in patients presenting with symptoms of cognitive decline," Dr. Algeciras-Schimnich says.

PATIENTS FIRST

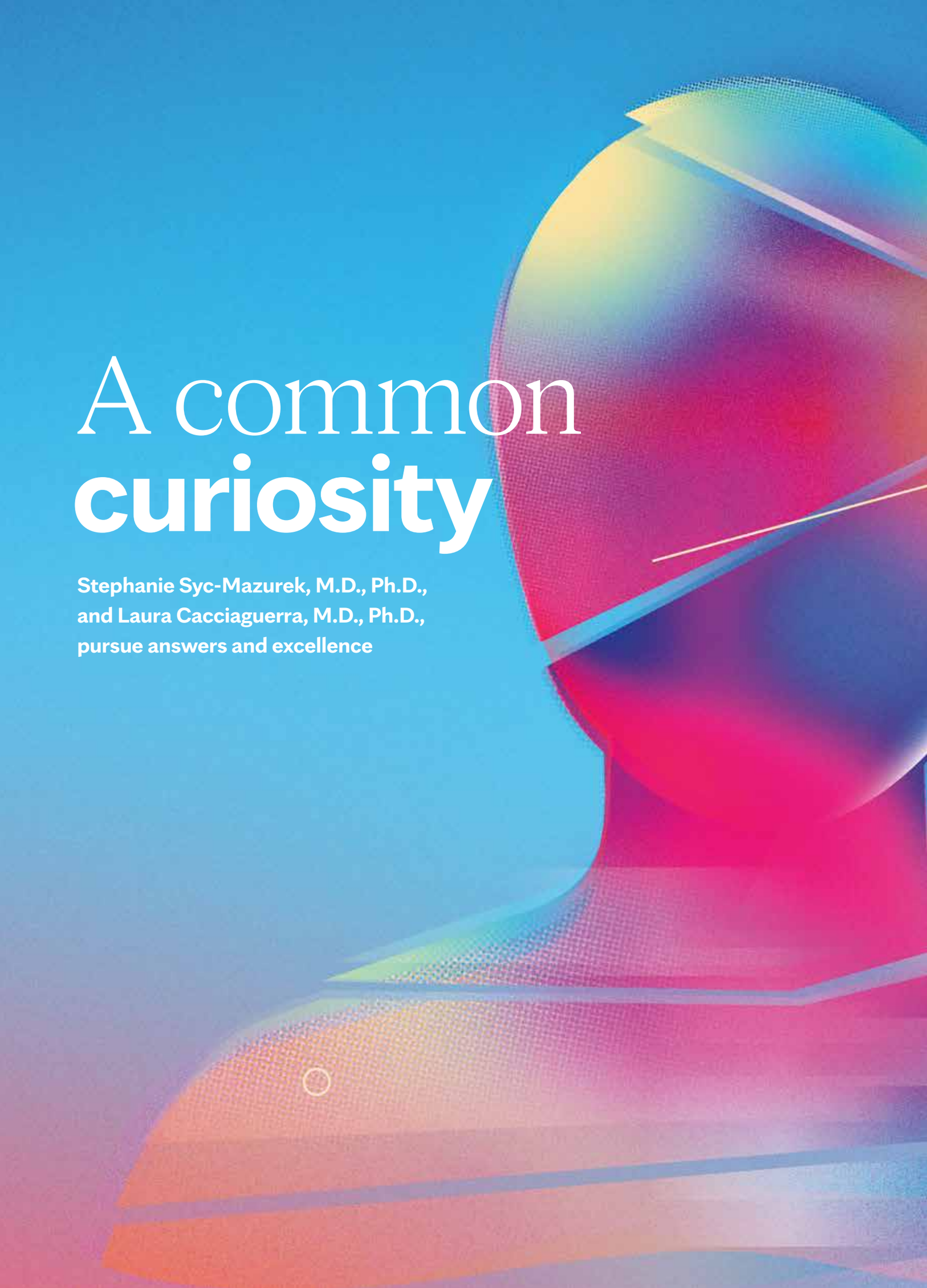
The p-Tau217 assay is a shining example of in-house innovation, but it's just one available Alzheimer's test at MCL. MCL also offers C2N Diagnostics' family of Precivity blood tests, which are new blood tests intended for use in patients 55 and older with signs or symptoms of mild cognitive impairment or dementia. These tests help clinicians detect amyloid plaques in the brain and inform care decisions.

The Journal of the American Medical Association recently published a study examining the ability of C2N Diagnostics' PrecivityAD2 blood test algorithm to improve the diagnostic accuracy of Alzheimer's disease in primary care settings. This is where most patients initially turn with cognitive and memory loss concerns. The study found similar robustness for the PrecivityAD2 test algorithm in patients who saw memory care specialists. The PrecivityAD2 result delivered a highly statistically significant accuracy of over 90% at a predefined, single binary cutoff compared to CSF analysis or amyloid PET analysis.

MCL's strategic collaborations with companies like C2N and Progentec result in a broad array of testing options — meaning clinical providers that work with MCL can utilize the latest innovations and tailor testing needs to each patient.

The resulting advancements in diagnostics for conditions like Alzheimer's are incredible to consider, says Dr. Morice.

"At the beginning of my career, Alzheimer's was really only diagnosable by autopsy. Now, as we push innovation in the clinical laboratory, we're at the point that we may not even need to do a spinal tap, but just a blood test," says Dr. Morice. "These blood tests can inform a patient that they may be developing cognitive impairment — and are actually able to do something about it." •



A common **curiosity**

Stephanie Syc-Mazurek, M.D., Ph.D., and Laura Cacciaguerra, M.D., Ph.D., pursue answers and excellence

Stephanie Syc-Mazurek, M.D., Ph.D. (I ’21, N ’24, NAI ’25), and **Laura Cacciaguerra, M.D., Ph.D.** (N ’22), have a lot in common. They’re both fellows in autoimmune neurology at Mayo Clinic in Minnesota. They share a research mentor, **Eoin Flanagan, M.B., B.Ch.** (I1 ’09, N ’12, NMS ’13, NAI ’14, NBN ’15, CTSA ’16), chair of the Division of Multiple Sclerosis and Autoimmune Neurology at Mayo Clinic in Minnesota. They’ve each made significant contributions to the study of demyelinating diseases. They’ve published articles together. And they both have a deep intellectual curiosity and a methodical approach to satisfying that curiosity, Dr. Flanagan says.

“They’re so interested in finding out answers for questions that arise in patients,” he says. “They both definitely have that in abundance.”

Now they have one more thing in common: They are the recipients of the 2025 Mayo Clinic Alumni Association research awards. Dr. Syc-Mazurek is the recipient of the Donald C. Balfour Award for Meritorious Research and Dr. Cacciaguerra is the recipient of the Edward C. Kendall Award for Meritorious Research.

Of course, there’s plenty that sets Dr. Cacciaguerra and Dr. Syc-Mazurek apart. They’ve each carved out their own research niches within the world of demyelinating disorders. Dr. Syc-Mazurek is interested in discovering novel mechanisms of eye injury and disease associated with vision loss in the autoimmune and neuro-inflammatory realm, Dr. Flanagan says. Dr. Cacciaguerra is more involved in the MRI aspects of antibody-mediated demyelinating diseases and novel ways of assessing those to understand pathogenesis and inform clinical care. But the effects of their research have similar scope and impact.

“Both of them are really bringing research very much to immediate patient care; it’s immediately translatable to the clinic,” Dr. Flanagan says. “They’re informing diagnostic criteria, clinical trials and future patient care.”

Stephanie Syc-Mazurek, M.D., Ph.D., Laura Cacciaguerra, M.D., Ph.D., and Eoin Flanagan, M.B., B.Ch.

More to **explore**

Laura Cacciaguerra, M.D., Ph.D., isn't afraid to venture into the unknown

If Laura Cacciaguerra, M.D., Ph.D. (N '22), had been born a few hundred years ago, she would likely be the one boarding the ship or hacking through the jungle to explore places beyond the map.

As a scientist of the modern age, she instead found herself drawn to neurology.

"There is so much that is unknown, and I like that part," she says. "There's a lot to discover."

This is especially true in her area of study: the rapidly evolving field of demyelinating disorders. In her research, she's not afraid of unexpected results that don't match her hypotheses — they just signal that there's more to explore.

"There is so little known in this field that you cannot take (any information) for granted," she says. "Even if prior literature had a different hypothesis, I take that into consideration, but it doesn't bother me if I see something different. I think that's the exciting part: when you see something you didn't expect."

This willingness to venture into new scientific territory has paid off, leading her to become an internationally recognized expert in the imaging of two recently recognized central nervous system demyelinating diseases that mimic multiple sclerosis (MS): myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD) and neuromyelitis optica spectrum disorder (NMOSD).

"Dr. Cacciaguerra pursues research not based on external assignments, but on her own observations and ideas," says her research mentor, **Eoin Flanagan, M.B., B.Ch.** (I1 '09, N '12, NMS '13, NAI '14, NBN '15, CTSA '16), chair, Division of Multiple Sclerosis and Autoimmune Neurology, Mayo Clinic in Minnesota. "Rather than relying on following prior lines of research, she believes in a systematic approach aimed to reconstruct each disease's unique pathophysiology based on its unique features and differences from (other diseases)."

Today, Dr. Cacciaguerra is a research fellow in autoimmune neurology at Mayo Clinic in Minnesota and is affiliated with Mayo Clinic's Center for Multiple Sclerosis and Autoimmune Neurology. She is the 2025 recipient of the Mayo Clinic Alumni Association Edward C. Kendall Award for Meritorious Research.

"Dr. Cacciaguerra's contributions to our understanding of epidemiology, imaging and immunopathology of MOGAD and autoimmune neurological disorders of the central nervous system are not only significant but also transformative," says research mentor **Sean Pittock, M.D.** (N '02, I1 '03, NMS '04), the Glenn W. and Katherine K. Hasse Chair of Neurology at Mayo Clinic in Minnesota. Dr. Pittock is also the Applebaum Family Professor of Neurosciences and the Marilyn A. Park and Moon S. Park, M.D., Director of the Center for Multiple Sclerosis and Autoimmune Neurology.

THE BEST PLACE TO BE

When Dr. Cacciaguerra realized she wanted to study demyelinating disorders, she knew Mayo Clinic was the best place to be.

For one thing, a team of Mayo Clinic researchers led by **Vanda Lennon, M.D., Ph.D.** (LABM & PATH '78), a consultant in the Division of Clinical Biochemistry and Immunology at Mayo Clinic in Minnesota and the Dorothy A. Adair Professor, discovered the pathogenic AQP4-IgG autoantibody that causes and is a biomarker for NMOSD.

"That discovery definitely changed the history of demyelinating disorders," Dr. Cacciaguerra says. "Now they have found an extremely effective treatment which is tailored to the pathophysiology. It's one of the few examples of autoimmune neurological disorders where you know exactly what is going on and how to treat it."

Dr. Cacciaguerra came to Mayo Clinic in 2021 as a visiting research fellow and quickly became a prolific member of the Mayo Clinic team. She's now a permanent research fellow and has produced 39 peer-reviewed articles currently published or in press since arriving at Mayo, including multiple first-authored

Laura Cacciaguerra, M.D., Ph.D.

Research fellow in autoimmune neurology

Mayo Clinic in Minnesota

Postgraduate: Ph.D., molecular medicine, Vita-Salute San Raffaele University, Milan, Italy

Residency: Neurology, Vita-Salute San Raffaele University, Milan, Italy

Medical school: University of Padova, Padova, Italy

Hometown: Trieste, Italy

Top: A childhood photo of Laura Cacciaguerra, M.D., Ph.D., in her hometown of Trieste, Italy

Bottom: Laura Cacciaguerra, M.D., Ph.D., dining with colleagues in Amsterdam at the 2022 European Committee for Treatment and Research in Multiple Sclerosis (ECTRIMS) meeting. Her research mentor Sean Pittock, M.D., sits on the far left, and her research mentor Eoin Flanagan, M.B., B.Ch., appears second from the right.

articles in top-tier, high-impact neurology journals such as Neurology, Annals of Neurology and Multiple Sclerosis Journal. Her work has already garnered over 1,000 citations. She has given platform and poster presentations at national and international conferences and meetings, including the annual meetings of the American Academy of Neurology (AAN) and of the European Committee for Treatment and Research in Multiple Sclerosis (ECTRIMS).

Throughout her time, she has been impressed by Mayo Clinic's patient-centric focus.

"Sometimes we are talking about rare disorders, but the numbers don't really matter. At Mayo, they believe every single patient counts," she says.

IMPACTING CLINICAL CARE THROUGH RESEARCH

Though early in her career, Dr. Cacciaguerra already has a long list of significant research findings.

At Vita-Salute San Raffaele University, she proposed a clinically feasible MRI-based algorithm to discriminate between MS and NMOSD. The MRI features she identified were externally validated in two separate cohorts and are now known internationally as "Cacciaguerra criteria."

In addition, Dr. Cacciaguerra's work helped illuminate the complex MRI correlates of NMOSD pathophysiology, a disease that targets aquaporin-4 (AQP4), the protein that regulates brain water homeostasis. She used a new proxy technique for measuring brain water content in NMOSD and found that water content increased in direct relation to disease activity. This has implications for clinical practice, given that there are no recognized radiological biomarkers of early disease activity in NMOSD. The work earned her the Investigation Award at the 2021 European Academy of Neurology meeting.

She has since further delved into NMOSD pathophysiology, attempting to reconstruct the biological pathways of the disease starting from its MRI findings. Her work merges the distribution of brain damage with spatial transcriptomic data, which contains information on how thousands of genes are actively expressed in specific locations.

At Mayo Clinic, Dr. Cacciaguerra has focused on MOGAD, which was officially recognized as a separate entity with published diagnostic criteria in 2023. However, instead of developing new methodologies

*"Her study will likely **impact the lives of many MS patients**."*

– Eoin Flanagan, M.B., B.Ch.

and looking for specific biomarkers of MOGAD, much of the research translated the clinical and scientific assumptions established in MS to MOGAD, Dr. Cacciaguerra says.

But Dr. Cacciaguerra found that unlike other demyelinating diseases, MOGAD acute lesions often resolve completely, at times quickly and without treatment, as part of the disease's natural history. In a first-author paper, she found that 10% of symptomatic MOGAD patients present with initially normal, lesion-free MRIs. Like MS patients, MOGAD patients often undergo MRI scans during disease remission, but she demonstrated acute scans are more informative.

These findings are "already shifting the current radiological surveillance paradigm in this disease," Dr. Flanagan says. Dr. Cacciaguerra's paper on the subject was published in Neurology with a positive editor's note. The study is one of her proudest accomplishments, as it came with an important clinical message not to disqualify MOGAD in the case of a normal MRI, she says.

She is also the first author of the first MOGAD epidemiology study from the U.S., and she has made significant findings related to MS imaging. Current MRI spinal cord imaging guidelines for MS say that sagittal images are sufficient and axial images are optional. But Dr. Cacciaguerra's study — presented at the 2023 ECTRIMS annual meeting to great acclaim — showed that axial spinal cord MRI images in MS detect twice as many lesions as sagittal images.

"These practice-changing findings will allow earlier MS diagnosis, help guide treatment decisions and improve prognostication in MS, and lead to a changing of these guidelines," Dr. Flanagan says. "Her study will likely impact the lives of many MS patients."

Dr. Cacciaguerra is grateful for all the support she has received along the way.

"I would like to thank my mentors Dr. Flanagan and Dr. Pittock for the support, guidance and opportunities given to me through these years at Mayo Clinic and for showing me every day what it means to be passionate about research and patients' care," says Dr. Cacciaguerra. "A special thanks also to Maria Assunta Rocca, M.D., and Massimo Filippi, M.D., from my time in Milan, who first introduced me to neuroimaging and still help me even from a distance."

"THERE'S A LOT OF HOPE"

Looking forward, Dr. Cacciaguerra wants to study whether the disappearance of lesions in MOGAD — which points to possible remyelination — can be translated to other disorders. She'd also like to use novel tools like artificial intelligence (AI), proteomics and transcriptomic atlases of the brain, and she's taking Harvard University courses to expand her AI and computer science knowledge. By using a similar approach to her work researching NMOSD pathophysiology, she wants to use atlases in combination with the distribution of MOGAD lesions to uncover more about remyelination.

"Understanding the underpinnings of greater remyelination in MOGAD could be a first step towards the holy grail of targeting remyelination in MS," Dr. Flanagan says.

The possibility of contributing to a discovery with a potentially huge impact on patient wellness is just another example of what motivates her to work in this ever-evolving field.

"There's a lot of hope when you see things changing so quickly," she says. •

Kendall Award nominees are M.D.s or Ph.D.s on any Mayo Clinic campus who received a doctoral degree in the past five years and have a postdoctoral research training appointment (includes research fellows and research associates but not fellows eligible for the Balfour Award or visiting scientists) approved by the Mayo Clinic Research Committee or have completed the appointment in the past year.

A need **to know**

Stephanie Syc-Mazurek, M.D., Ph.D., wants to answer questions for her patients

Stephanie Syc-Mazurek, M.D., Ph.D. (I '21, N '24, NAI '25), has always been curious.

"Even in elementary school and high school, finding out why things happen was always important to me," she says.

As a kid, her curiosity and creativity were focused on subjects like poetry and creative writing. Today, she wants to know why and how people develop autoimmune neurologic diseases, particularly those affecting the eye — and how they could be treated.

"We don't have cures for a lot of these diseases that affect the eye and the immune system," Dr. Syc-Mazurek says. "So much has come to be known over the last years and decades, but pushing things forward certainly is motivating."

The answers are not just for her own benefit; she is deeply passionate about using research and expertise to answer her patients' most pressing questions about the course of their disease, their projected quality of life and the hope for cures.

"Clinically, she has an incredibly deep knowledge base and pairs that with the warmest bedside manner, where she translates complex situations in an understandable and calming way," says **Elizabeth Coon, M.D.** (I1 '10, N '13, MD '14), Division of Autonomic Disorders at Mayo Clinic in Minnesota. "She has potential to transform the field of neurology as an exceptional clinician, scientist, educator and leader."

Dr. Syc-Mazurek is a clinical fellow in autoimmune neurology at Mayo Clinic in Minnesota and is affiliated with Mayo Clinic's Center for Multiple Sclerosis and Autoimmune Neurology. She will start the Neuro-Ophthalmology Fellowship at Mayo Clinic in 2025. She is the 2025 recipient of the Mayo Clinic Alumni Association Donald C. Balfour Award for Meritorious Research.

"It's just an honor to care for people both here in our community and around the world — and also have the opportunity through research to try to make an impact beyond our walls," says Dr. Syc-Mazurek.

ASKING QUESTIONS

As an undergraduate studying neuroscience, Dr. Syc-Mazurek's curiosity was focused on the brain: Why do humans think the way they do? How does the brain impact human behavior?

After graduating, she worked as a research coordinator under the mentorship of Peter Calabresi, M.D., a multiple sclerosis expert at the Johns Hopkins University School of Medicine, as he conducted imaging research and clinical trials in patients with neuroinflammatory diseases.

She was trying to decide whether her next step should be medical school or graduate school. In Dr. Calabresi's lab, she started to appreciate the power of research to not only improve patient outcomes and satisfy her own relentless curiosity, but to answer patients' toughest questions.

"We can use research to advance what we can do for patients and give them answers to questions like, 'What will my life look like in 10, 20 or 30 years?'" she says. "I think that combination was really what made me fall in love with medicine and decide to do the M.D.-Ph.D. dual degree."

The debate between a research and clinical career was settled: she would do both. But she was slightly nervous about entering a doctoral program, as her prior research efforts had all been patient-centered and clinically focused.

"Going into the Ph.D., I had never completed an independent basic science research project," she says. "But knowing the strength that the lab and translational research brings for answering those questions that our patients want to know — I wanted to learn how to do that. So I took the leap."

During her Ph.D. program in the lab of Richard Libby, Ph.D., at the University of Rochester in New York, she studied the molecular mechanisms of cell death in the eye. She identified key molecules that govern cell death in the retina and degeneration in the optic nerve using animal models and thereby identified future potential therapeutic targets to prevent vision loss. After completing her doctoral degree, she was interested in studying the immunology of the

Stephanie Syc-Mazurek, M.D., Ph.D.

Clinical fellow in autoimmune neurology

Mayo Clinic in Minnesota

Residency: Neurology, Mayo Clinic School of Graduate Medical Education, Rochester, Minnesota

Postgraduate: M.S. and Ph.D., neuroscience, University of Rochester, Rochester, New York

Medical school: University of Rochester, Rochester, New York

Undergraduate: Brown University, Providence, Rhode Island

Hometown: Lake Forest, Illinois

"There's so much to learn. *How can we better help our patients from a disease-therapy standpoint? How can we better educate them?"*

– Stephanie Syc-Mazurek, M.D., Ph.D.

eye and how it could inform other neurologic diseases. She also knew she wanted a translational science career in neurology with a focus on imaging modalities. When she came to Mayo Clinic for her interview on a cold January day, she found what she was looking for.

"The idea that the needs of the patient come first really spoke to me," she says, and a conversation with **Lyell Jones Jr., M.D.** (I1 '01, N '04, NEMG '05), Department of Neurology at Mayo Clinic in Minnesota and current dean of Mayo Clinic School of Graduate Medical Education, solidified her good impression.

"I remember Dr. Jones saying, 'We're here to develop leaders in neurology and whatever that means to you is what's important for us. We're invested in you from step one,'" she says.

Dr. Syc-Mazurek has certainly developed into a leader of neurology, and her time at Mayo Clinic has been prolific. She has published 13 peer-reviewed articles since arriving at Mayo Clinic, with eight as first or second author. She has first-author publications in top-tier neurology journals including Brain, Neurology, Neurology Neuroimmunology & Neuroinflammation, and Stroke. Altogether, she has published over 50 abstracts and 33 peer-reviewed publications with over 2,500 citations. She is also on the editorial board of Neurology's Resident & Fellow Section, a highly selective position within the American Academy of Neurology.

She says she's grateful for her clinical and research mentors — particularly **Eoin Flanagan, M.B., B.Ch.** (I1 '09, N '12, NMS '13, NAI '14, NBN '15, CTSA '16), chair of the Division of Multiple Sclerosis and Autoimmune Neurology at Mayo Clinic in Minnesota, and **John Chen, M.D., Ph.D.** (OPH '14), Department of Ophthalmology at Mayo Clinic in Minnesota — for their support and for the opportunity to participate in research projects, as well as Dr. Jones and Dr. Coon for leadership opportunities within the residency program.

DIFFERENTIATING DISEASE

Dr. Syc-Mazurek's work has focused on utilizing imaging metrics to characterize a nervous system demyelinating disease known as myelin oligodendrocyte glycoprotein antibody-associated disease (MOGAD). She has helped differentiate MOGAD from its major mimic, multiple sclerosis (MS).

A prime example: Dr. Syc-Mazurek was first author of an article published in Neurology that found that patients with MOGAD rarely develop asymptomatic lesions as seen on MRI, a marked contrast to MS.

"This result was paradigm-shifting, as it suggests that regular MRI surveillance outside of clinical attacks in MOGAD is unnecessary, differing majorly from multiple sclerosis where this is standard of care, with important cost savings for MOGAD patients and the healthcare system," says Dr. Flanagan.

This research also indicated that MRI metrics are not ideal biomarkers of disease activity in MOGAD, which had implications for ongoing clinical trials. Another study identified the MRI characteristics that differentiate patients with MOGAD from MS at the time of clinical attack and remission.

Dr. Syc-Mazurek's other research of note includes evaluation of optic nerve changes during acute optic neuritis, defining the clinical presentation and etiologies of optic

The research of Stephanie Syc-Mazurek, M.D., Ph.D., has focused on nervous system demyelinating diseases.

perineuritis, and a novel case presentation of a patient with MOGAD and metastatic melanoma. Her studies offer valuable insights into the underlying pathophysiology of MOGAD with the promise of identifying potential biomarkers for disease progression and targets for therapeutic intervention.

SMALL VICTORIES

Looking to the coming years, Dr. Syc-Mazurek is excited to put together the clinical and translational aspects of her research and utilize the skills she's accumulated over the past decade. She hopes to do more work at the intersection of the immune and visual systems in MOGAD and similar diseases. And of course, she has more questions to answer.

"Can we better differentiate these diseases earlier? Can we figure out better ways of predicting disease outcomes? Can we come up with better ways of intervening from a molecular mechanism?" she says. "There's so much to learn. How can we better help our patients from a disease-therapy standpoint? How can we better educate them?"

Knowing that these questions will take years — or perhaps decades — to answer, Dr. Syc-Mazurek uses small moments to stay on track.

"It's really motivating to help someone who was hospitalized to get back to doing something that they love," she says. "It's taking those small victories, whether it's the small victory you find in the dataset or the small victory in the lab with what you see in a slide — or, most importantly, the small victory in the patient." •

Balfour Award nominees are residents or fellows on any Mayo Clinic campus who have a clinical appointment — or have completed an appointment in the past year — in medical and laboratory specialties, surgery and surgical specialties, or internal medicine and medical specialties.

Mayo Clinic School of **Graduate Medical Education awards**

Each year, Mayo Clinic School of Graduate Medical Education recognizes excellence among residents and fellows. This year's awards include the following:

MAYO BROTHERS DISTINGUISHED FELLOWSHIP AWARD

Recognizes qualities associated with William J. Mayo, M.D., and Charles H. Mayo, M.D. Six trainees are chosen to receive this award based on outstanding clinical performance, humanitarianism and scholarly activity.

Prasanth Balasubramanian, M.D. (THDC '25)
Department of Critical Care Medicine
Mayo Clinic in Florida

"Dr. Balasubramanian's selfless drive to advance medical science, promote medical education to his immediate surroundings as well as those far away, and provide exemplary care to his patients is truly awe-inspiring."
— **Neal Patel, M.D.** (I '07, THDC '10), Department of Critical Care Medicine, Mayo Clinic in Florida

Patricia (Patty) Lu, M.D. (S '25)
Department of Surgery
Mayo Clinic in Arizona

"Dr. Patty Lu is the doctor that you want as your surgeon, your colleague, your collaborator and your friend. Her curiosity, steadfast character, exemplary technical skills, passion to educate and research, and pure joie de vivre is, I believe, the embodiment of what the Mayo brothers would hope for to carry on the torch of their mission."
— **Megan Nelson, M.D.** (S '16), Department of Surgery, Mayo Clinic in Arizona

Bridget Findlay, M.D. (U '24, GURS '25)
Department of Urology
Mayo Clinic in Arizona

"Dr. Findlay embodies all facets of a three-shield surgeon. She continually displays the highest integrity, treats everyone with respect and is a true servant-leader."
— **Boyd Viers, M.D.** (PRES '12, U '16), Department of Urology, Mayo Clinic in Minnesota

Sarah Lund, M.D. (M '18, CI '22, S '25)
Department of Surgery
Mayo Clinic in Minnesota

"Dr. Lund is an exemplary physician. Her achievements in education, research, leadership and clinical practice illustrate her dedication to the field of medicine and her potential to drive meaningful change in surgical education."
— **Mariela Rivera, M.D.** (CCMS '11), Division of Trauma, Critical Care and General Surgery, Mayo Clinic in Minnesota

Jennifer Gile, M.D. (I '22, HEMO '25)
Division of Medical Oncology
Mayo Clinic in Minnesota

"Her clinical excellence, compassionate and humble nature, prolific and productive research, passion for education, and commitment to humanitarianism set her apart as a leader at Mayo Clinic and in the broader field of hematology/oncology."
— **Timothy Hobday, M.D.** (MED '94, I '97, HEMO '01), Division of Medical Oncology, Mayo Clinic in Minnesota

Lauren Webb, M.D. (MED '21, I '22, N '25)
Department of Neurology
Mayo Clinic in Minnesota

"Dr. Webb is an outstanding clinician, community leader, educator and future academic neuro-oncologist. I am grateful for the opportunity to be her program director and while my praise may seem effusive, it is earned and still does not do justice to what this young neurologist can do and will do in her career."
— **Elizabeth Coon, M.D.** (I1 '10, N '13, MD '14), Division of Autonomic Disorders, Mayo Clinic in Minnesota

BARBARA BUSH DISTINGUISHED FELLOWSHIP AWARD

Recognizes outstanding clinical performance and scholarly activity with a particular emphasis on humanitarianism. The award is named to honor the contributions of Barbara Bush, former U.S. first lady and former Mayo Clinic trustee.

Katie Dunleavy, M.B., B.Ch., B.A.O. (GI '24, GIBD '25)
Division of Gastroenterology and Hepatology
Mayo Clinic in Minnesota

"Dr. Dunleavy stands out for her humanitarian efforts to better the lives of community members and patients and provide educational opportunities to trainees from limited-resourced countries."
— **Douglas Simonetto, M.D.** (I1 '10, I '12, GI '15, HEPT '16, CTSA '25), Division of Gastroenterology and Hepatology, Mayo Clinic in Minnesota

PATIENT SAFETY AND QUALITY IMPROVEMENT AWARD

Recognizes an outstanding patient safety project or an outstanding clinical or nonclinical quality improvement project.

Garrett Ungerer, M.D. (U '26)
Department of Urology
Mayo Clinic in Minnesota

"Dr. Ungerer's commitment to the culture of patient safety and continuous quality improvement at Mayo Clinic is an outstanding example of how trainees can use their front-line observations to drive meaningful change through multidisciplinary collaboration and leadership."
— **Kevin Koo, M.D.** (U '20), Department of Urology, Mayo Clinic in Minnesota

DIVERSITY AWARD

Recognizes individuals or projects that have significantly contributed to greater Mayo Clinic School of Graduate Medical Education diversity and support recruitment or retention of diverse learners.

Brittany Jackson, M.D. (I '25)
Department of Internal Medicine
Mayo Clinic in Florida

"Dr. Jackson has been intentional in promoting diversity and inclusion not only across the Mayo Clinic in Florida campus but also within the Mayo Clinic enterprise and nationally through her participation in Student National Medical Association events."
— **Mary Hedges, M.D.** (I '07, CMR '08), Division of Community Internal Medicine, Mayo Clinic in Florida

WELL-BEING AWARD

Recognizes individuals or projects that have significantly contributed to greater MCSGME or overall clinical care team well-being.

Rosalie Sterner, M.D., Ph.D. (IMM '20, MDPH '21, S '25, PATH '26)
Department of Laboratory Medicine and Pathology
Mayo Clinic in Minnesota

"The pandemic years really reinforced how important well-being and mental health are in a training program. Dr. Sterner's Pathology Pet Show was such a creative idea for a well-being activity and I am thankful for her initiative in pulling this together."
— **Reade Quinton, M.D.** (LABM & PATH '19), Division of Anatomic Pathology, Mayo Clinic in Minnesota

HEALTH CARE DISPARITIES AWARD

Recognizes an outstanding healthcare disparities project.

Harry Park, M.D. (P '24, PCON '25)
Department of Psychiatry and Psychology
Mayo Clinic in Minnesota

"The outcomes of Dr. Park's project can be replicated across the Mayo Clinic enterprise by implementing similar data-driven approaches to identify and address healthcare disparities in other departments."
— **Nick Allen, M.D.** (P '18, PCON '19), Division of Hospital Practice, Mayo Clinic in Minnesota

Read more about this year's awardees online.

Mayo Clinic Update


Fergus Couch, Ph.D.

Researchers resolve uncertainty in BRCA2 testing

Findings from a multi-institutional, international study led by researchers from the Mayo Clinic Comprehensive Cancer Center have significantly advanced the understanding of genetic alterations in the BRCA2 gene, a key player in hereditary cancer risk.

The researchers completed a comprehensive functional assessment of all possible variants within the crucial DNA-binding domain of BRCA2, resulting in the clinical classification of 91% of variants of uncertain significance (VUS) in this part of the gene. This finding dramatically improves the accuracy of genetic testing and will allow healthcare professionals to offer more precise risk assessments and personalized treatment plans for people carrying these variants.

The study, published in Nature, utilized CRISPR-Cas9 gene-editing technology to analyze the functional impact of almost 7,000 BRCA2 variants, definitively identifying those that increase cancer risk and those that do not. This new information will eliminate much of the uncertainty surrounding VUS, allowing for more informed decisions regarding cancer screening, preventive measures and treatment strategies.

"This research is a major advancement in understanding the role of many BRCA2 variants in cancer predisposition," says **Fergus Couch, Ph.D.** (LABM & PATH '97), chair of the Division of Experimental Pathology and Laboratory Medicine and the Zbigniew and Anna M. Scheller Professor of Medical Research in Honor of Dr. Thomas J. McDonald at Mayo Clinic in Minnesota. "Until now, patients who carried VUS often worried if they would develop cancer, but now with the classification of these variants, we can provide a clearer picture of cancer risk and tailor both prevention strategies as well as breast cancer treatment accordingly."

The findings have immediate implications for genetic testing laboratories and healthcare professionals, aiding them in offering more precise and personalized care to patients with VUS. Many people with VUS may be notified about the reclassification of their VUS as the ClinVar BRCA1/2 expert panel and testing laboratories use the new information in testing reports and updates. In addition, this new insight will aid in identifying patients with breast, ovarian, pancreatic or prostate cancer who might benefit from targeted therapies such as PARP inhibitors.

"We now have a catalog of every possible VUS in this part of BRCA2 that can be used to guide clinical care," says Dr. Couch.

The researchers say that this research lays the groundwork for future studies characterizing and classifying all BRCA2 variants across diverse populations and cancer types, improving risk assessment for everyone.

Breakthrough shows promise in the fight against glioblastoma

An innovative treatment approach may improve overall survival in older patients with newly diagnosed glioblastoma while maintaining quality of life, a recent Mayo Clinic study reports. Results of the phase 2, single-arm study were published in The Lancet Oncology.

Glioblastoma is the most lethal type of primary brain cancer due to its aggressive nature and its treatment-resistant characteristics. Standard radiation therapy is commonly used to treat glioblastoma and can be effective but also exposes healthy brain tissue to radiation.

Sujay Vora, M.D. (RADO '00), chair of the Department of Radiation Oncology at Mayo Clinic in Arizona, led a team of researchers investigating the use of short-course hypofractionated proton beam therapy incorporating advanced imaging techniques in patients over the age of 65 with newly diagnosed World Health Organization (WHO) grade 4, malignant glioblastoma.

Mayo investigators mapped the target area in the patient's brain by combining advanced imaging technologies, including ^{18}F-DOPA PET and contrast-enhanced MRI. Treatment was completed in one to two weeks instead of the traditional three to six weeks. Results showed that 56% of participants were alive after 12 months and the median overall survival was 13.1 months.

"As compared to prior phase 3 studies in an older population having a median survival of only six to nine months, these results are promising," says Dr. Vora. "In some cases, patients with tumors that have favorable genetics lived even longer, with a median survival of 22 months. We are very excited about these results."

A larger, randomized clinical trial is now underway at Mayo Clinic,

Sujay Vora, M.D.

William Breen, M.D.

with **William Breen, M.D.** (MED '17, RADO '22), Department of Radiation Oncology at Mayo Clinic in Minnesota, as principal investigator. The clinical trial, known as SAGA, or stereotactic ablative radiation treatment for glioblastoma, includes patients from Arizona, Florida and Minnesota.

"We are now adding another component that builds upon Dr. Vora's work to help us best visualize the tumor," says Dr. Breen. "Our goal is to transform the way we treat glioblastoma using shorter courses of radiation to minimize the burden on patients and their families and help them complete safe and effective treatment in a shorter amount of time."

American Hospital Dubai to establish medical school with Mayo Clinic guidance

American Hospital Dubai and Mayo Clinic have announced an enhanced collaboration, including the establishment of Dubai's first Doctor of Medicine (M.D.) medical school, designed with guidance from Mayo Clinic College of Medicine and Science. The medical school's curriculum, aligned with global best practices, will feature state-of-the-art facilities, faculty development programs and immersive learning experiences.

Jorge Pascual, M.D.

American Hospital Dubai has been a Mayo Clinic Care Network member since 2013. The strengthened collaboration will optimize clinical practices, improve operational efficiencies at American Hospital Dubai and integrate cutting-edge technology to elevate the quality of care. This includes developing a healthcare simulation center for advanced medical training, streamlining workflows and enhancing subspecialty service lines to address complex medical needs, further cementing American Hospital Dubai's position as a leading healthcare provider in the region.

Mayo Clinic's expertise will help American Hospital Dubai establish a clinical research infrastructure. Mayo Clinic will also assist with optimizing resources, integrating research and clinical operations, and developing new treatment protocols aligning with international standards.

"By combining Mayo Clinic's expertise with American Hospital Dubai's capabilities and vision, we deliver innovative solutions that elevate patient care while establishing new medical education and research benchmarks. This collaboration reflects our mutual commitment to improving healthcare outcomes for the benefit of patients and communities," says **Jorge Pascual, M.D.** (I '94), Division of Pulmonary, Allergy and Sleep Medicine at Mayo Clinic in Florida and Mayo Clinic International executive medical director of the Americas.

Mayo Clinic researchers to study causes of rapidly progressive dementia

A new study at Mayo Clinic aims to determine why a small subset of patients with Alzheimer's disease and Alzheimer's Disease Related Dementias (ADRD) develop rapidly progressive dementia (RPD), leading to dementia within one year and complete incapacitation within two years of symptom onset.

"The factors that give rise to extreme, rapidly progressive clinical traits are unknown," says **Gregg Day, M.D.** (N '20), Department of Neurology at Mayo Clinic in Florida. "These cases are challenging to treat in practice because there are many possible causes and diseases to consider, many tests that can be done and a clear need to coordinate evaluations rapidly."

Dr. Day will lead a team of researchers from Mayo Clinic in Florida and Minnesota to study the biology of RPD through a project funded by the National Institute on Aging of the National Institutes of Health (NIA/NIH). Specifically, the research team and collaborators aim to:

- Determine the factors that make patients with Alzheimer's disease and ADRD susceptible to RPD.
- Study the contributions of amyloid and tau toxic proteins and vascular changes in the brain to rates of progression in patients with Alzheimer's disease and ADRD.
- Identify cellular pathways that contribute to rapid declines in patients with Alzheimer's disease and ADRD.

Gregg Day, M.D.

The researchers plan to collect clinical and genomic information from 120 diverse patients with rapidly progressive Alzheimer's disease and ADRD over the next three years. Findings in patients with RPD will be compared with data from participants with typical progressive Alzheimer's disease and ADRD.

Findings will be validated through expansive protein analyses in cerebrospinal fluid from an independent group of patients with autopsy-confirmed rapidly progressive Alzheimer's disease and ADRD. Results will be extended to identify biomarkers and disease-modifying targets that may improve diagnosis and treatment of patients with Alzheimer's disease and ADRD.

"We hope the results of our research will inform new approaches, diagnostic tests and treatment targets that will improve outcomes in patients with AD/ADRD," says Dr. Day. "The ultimate goal is to slow down the pathologic progression of disease in these patients, independent of their rate of decline."

William Palmer, M.D., named Dean of Mayo Clinic School of Continuous Professional Development

William Palmer, M.D. (I '13, GI '15, HEPT '16), Division of Gastroenterology and Hepatology at Mayo Clinic in Florida, has been selected as the dean of Mayo Clinic School of Continuous Professional Development (MCSCPD), succeeding **Mitchell Humphreys, M.D.** (U '06), chair of the Department of Urology at Mayo Clinic in Arizona. Dr. Palmer is a professor of medicine and serves as the medical director for the Hereditary Hemochromatosis Clinic at Mayo Clinic in Florida. He has been associate dean of Mayo Clinic School of Continuous Professional Development in Florida since 2021.

Dr. Palmer has made significant contributions to medical education, including developing and directing 15 accredited continuing medical education courses locally, regionally, nationally and internationally over the last four years. He has published over 120 peer-reviewed articles and abstracts and has been recognized with numerous awards, including the Mayo Brothers Distinguished Fellowship Award, the Karis Award and the University of South Carolina Distinguished Physician Alumni Award.

William Palmer, M.D.

Mayo Clinic awards named professorships — its highest academic distinction

Barry Borlaug, M.D. (CV ’06)
William J. and Sharon A. Schoen Professor of Cardiology
- Division of Circulatory Failure, Department of Cardiovascular Medicine
- Division of Interventional Cardiology, Department of Cardiovascular Medicine
- Mayo Clinic in Minnesota

Chris Adams, M.D., Ph.D. (ENDO ’21)
George M. and Edna B. Endicott Professor of Medicine
- Division of Endocrinology, Diabetes, Metabolism and Nutrition, Department of Internal Medicine
- Department of Biochemistry and Molecular Biology
- Mayo Clinic in Minnesota

Francisco Lopez-Jimenez, M.D. (CV ’01)
Roderick H. Cushman Professor of Cardiovascular Sciences
- Chair, Division of Preventive Cardiology, Department of Cardiovascular Medicine
- Division of Cardiovascular Ultrasound, Department of Cardiovascular Medicine
- Mayo Clinic in Minnesota

Konstantinos Lazaridis, M.D. (I ’96, GI ’00)
Ting Tsung and Wei Fong Chao Professor of Individualized Medicine Research
- Division of Gastroenterology and Hepatology, Department of Internal Medicine
- Department of Clinical Genomics
- Mayo Clinic in Minnesota

Nilüfer Ertekin-Taner, M.D., Ph.D. (NSCI ’03, I1 ’04, N ’07, NBN ’08)
Roy E. & Merle Meyer Professor of Neuroscience
- Department of Neurology
- Enterprise chair, Department of Neuroscience
- Mayo Clinic in Florida

Celine Vachon, Ph.D. (QHS ’99)
Regis Professor of Breast Cancer Research
- Division of Epidemiology, Department of Quantitative Health Sciences
- Mayo Clinic in Minnesota

Julie Heimbach, M.D. (TRNS ’04)
Stuart W. Harrington Professor of Surgery
- Division of Transplantation Surgery, Department of Surgery
- Mayo Clinic in Minnesota

Obituaries

Dale Anderson, M.D. (S ’65), died May 11, 2024.
Kenneth Anderson, M.B., Ch.B. (PATH ’77), died April 20, 2024.
Ronald DeCesare, M.D. (S ’70), died Feb. 26, 2025.
David Feliciano, M.D. (S ’71), died Jan. 4, 2024.
Robert Henderson, M.D. (RD ’68), died March 20, 2025.
Sherwin Kornblum, M.D. (OR ’63), died Feb. 28, 2025.
Keith Kramlinger, M.D. (MED ’82, P ’85), died Feb. 19, 2025.
Ed Laurnen, M.D. (OR ’68), died March 12, 2025.
Kenneth Lloyd, M.D. (RADO ’85), died Dec. 18, 2024.
Edward Meadows, M.D. (RD ’50), died Sept. 12, 2023.
Daniel Palmer, M.D. (DERM ’62), died Oct. 14, 2024.
Owen Peck, M.D. (I ’58), died Sept. 7, 2022.
Mark Wholey, M.D. (RD ’58), died Feb. 25, 2025.
Mark Withrow, M.D. (MED ’76), died Feb. 5, 2025.

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Laboratory medicine, anatomy and pathology professionals do important work behind the scenes.

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