RhodyRx

RESEARCH, INNOVATION & IMPACT

EVERY DISCOVERY

STARTS WITH A QUESTION

THE UNIVERSITY OF RHODE ISLAND COLLEGE OF PHARMACY

2026

A MESSAGE FROM THE DEAN

"From Alzheimer's to cancer to infectious disease, our research is transforming how we understand, detect, and treat the world's most urgent health challenges."

At the University of Rhode Island College of Pharmacy, we believe that when passionate people come together around a shared purpose, they can change the future of health care.

Every day across our labs, clinics, and classrooms, our faculty and students are working to tackle some of the most pressing challenges of our time. From Alzheimer's disease and cancer to infectious diseases and environmental health, their work is driven by a commitment to improve lives and make a lasting impact.

In this issue of *Rhody Rx*, you'll see the breadth of that work in action.

Our researchers are uncovering new insights into aging and neurological disease, developing innovative approaches to treat cancer and drug-resistant infections, and even looking to the ocean for new medicines. We are also harnessing tools like artificial intelligence to better understand complex diseases and transform how we predict and treat them.

What makes this work especially powerful is the role our students play. At URI, students don't just study science, they help shape it. Students work alongside faculty mentors, contribute to meaningful discoveries, and see firsthand how their work can extend far beyond the classroom.

None of this happens without the support of our community. Philanthropy fuels new ideas, supports student success, and accelerates research that has the potential to change lives.

As you read through this issue, I hope you feel the same sense of awe, purpose and possibility that drives our work every day.

Thank you for being part of this journey. Go Rhody!

Kerry LaPlante, Pharm.D., FCCP, FIDP, FIDSA
Dean, College of Pharmacy
University of Rhode Island

NEUROSCIENCE AND HEALTHY AGING

METABOLISM AND HEALTH

OCEANS AND HUMAN HEALTH

TACKLING CANCER

SUPERBUGS

ACCESSIBLE CARE

NATURE

IMPACT AND INNOVATION

THE HIDDEN FORCES SHAPING **BRAIN HEALTH**

The questions are just the beginning.

What if an eye exam could detect Alzheimer's early?

Retinal imaging is opening the door to more accessible, early diagnosis.

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Why do some parts of the brain break down before others?

Mapping the cellular environments that drive vulnerability to diseases like Alzheimer's.

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How do internal and external exposures influence brain health?

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Uncovering how blood vessels and protein buildup shape disease risk and progression.

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URI NEUROSCIENTIST EXPLORES RETINAL SCANNING TO DETECT EARLY-STAGE ALZHEIMER'S

URI researcher Jessica Alber is advancing retinal imaging as a low-cost, minimally invasive tool for early Alzheimer's detection

Jessica Alber, associate professor of biomedical and pharmaceutical sciences and George and Anne Ryan Institute for Neuroscience faculty member at the University of Rhode Island, is working to change the way physicians diagnose Alzheimer's disease, a change that could open new possibilities for treatment.

Alber received a five-year, $10.3 million grant from the National Institutes of Health to support her work using retinal imaging to screen for early changes associated with Alzheimer's disease. The project, "Longitudinal Validation of Retinal Biomarkers Against Cerebral Imaging in Preclinical Alzheimer's Disease," could help provide a low-cost, minimally invasive screening technique to detect the disease before symptoms appear.

While there are limited treatment options that can modestly slow the course of the disease, new developments in drug and lifestyle therapies indicate potential for success with earlier intervention. Yet one of the primary challenges in treating the disease is that it is difficult to diagnose. Clinicians can use positron emission tomography scans or lumbar punctures to detect the buildup of amyloid and tau proteins, or "plaques and tangles", that are hallmarks of the disease, but these procedures are invasive and expensive.

Using retinal imaging as a "window to the brain," Alber and her collaborators aim to develop a more affordable and accessible screening tool that could one day be part of a routine eye exam.

"In the near future, screening for risk in the general population will become increasingly important in order to treat people before they experience the devastating loss in quality of life and cognitive function that affects them and their families," Alber said. "The retina allows us to look at what might be changing in the brain in a cost-effective and minimally invasive way to identify people who are at high risk but not sick yet."

Alber's study also explores the potential for using blood plasma biomarkers in tandem with retinal imaging to improve the detection of early-stage disease. "We don't know yet if blood biomarkers can be used to identify preclinical disease, but we have seen some exciting developments in this area," Alber said. The study began in 2022, and Alber and her team recently completed baseline data collection to validate retinal biomarkers against gold-standard brain imaging and blood tests.

The ARIAS 2 study team is led by Alber and includes collaborators from multiple institutions, including Butler Hospital's Memory and Aging Program, Washington University in St. Louis School of Medicine, The Warren Alpert Medical School of Brown University, the University of North Texas Health Science Center, and the University of Alabama at Birmingham, as well as industry partner Heidelberg Engineering.

Founded in 2013, the George and Anne Ryan Institute for Neuroscience at URI focuses on investigating underexplored factors in Alzheimer's disease and other neurodegenerative disorders.

MAPPING THE BRAIN'S VULNERABILITY TO DISEASE

URI researcher Merina Varghese studies how cellular environments shape neurodegenerative disorders

Why certain parts of the brain are more vulnerable to aging and disease remains one of the most important questions in neuroscience. At the University of Rhode Island College of Pharmacy, Merina Varghese, assistant professor of biomedical and pharmaceutical sciences and George and Anne Ryan Institute for Neuroscience faculty member, is investigating the cellular and molecular mechanisms that make specific brain regions more susceptible to neurodegenerative and neuropsychiatric disorders.

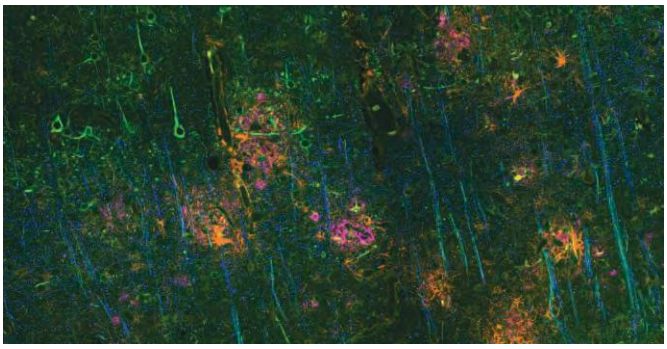
Varghese's research focuses on how the molecular features and physical structure of cells influence the development of diseases such as Alzheimer's disease. Her work examines how different cell types, cellular states, and surrounding microenvironments interact to drive regional vulnerability within the brain.

To answer these questions, Varghese uses advanced spatial imaging technologies that allow researchers to visualize proteins and metabolites directly within brain tissue. These tools provide an unprecedented view of how molecular activity varies across different brain regions and how these patterns change during aging or disease.

By combining disease biology with spatial molecular mapping, her research aims to identify biomarkers that could help detect neurological diseases earlier and uncover new therapeutic targets that may slow or prevent disease progression.

Varghese joined the URI College of Pharmacy in January 2025. Before joining URI, she served as an assistant professor in the Nash Family Department of Neuroscience and the Ronald M. Loeb Center for Alzheimer's Disease at the Icahn School of Medicine at Mount Sinai.

During her postdoctoral training at Mount Sinai, she investigated metabolic and synaptic changes that contribute to regional brain vulnerability in neurodegenerative disease. Using transgenic rodent models and human postmortem brain tissue, her research explored mechanisms underlying Alzheimer's disease, amyotrophic lateral sclerosis (ALS, or Lou Gehrig's disease), and neurodevelopmental disorders such as Phelan-McDermid syndrome.



This highly multiplexed immunofluorescence image from the brain of a person with Alzheimer's disease shows neurons (green) and myelinated axons (cyan) in the vicinity of amyloid beta pathology (magenta) surrounded by reactive astrocytes (orange) and microglia (yellow). The image was generated by Lisa Lowery, Elizabeth McDonough, and Dr. Dan E. Meyer (GE HealthCare Technology & Innovation Center, New York) through a collaboration with Dr. Jennifer Luebke (Boston University), Dr. Patrick R. Hof (Icahn School of Medicine at Mount Sinai, New York), and Dr. Merina Varghese.

Her studies also examined human brain samples from individuals with Alzheimer's disease, Prader-Willi syndrome and epilepsy, helping reveal how molecular changes within neurons contribute to disease progression.

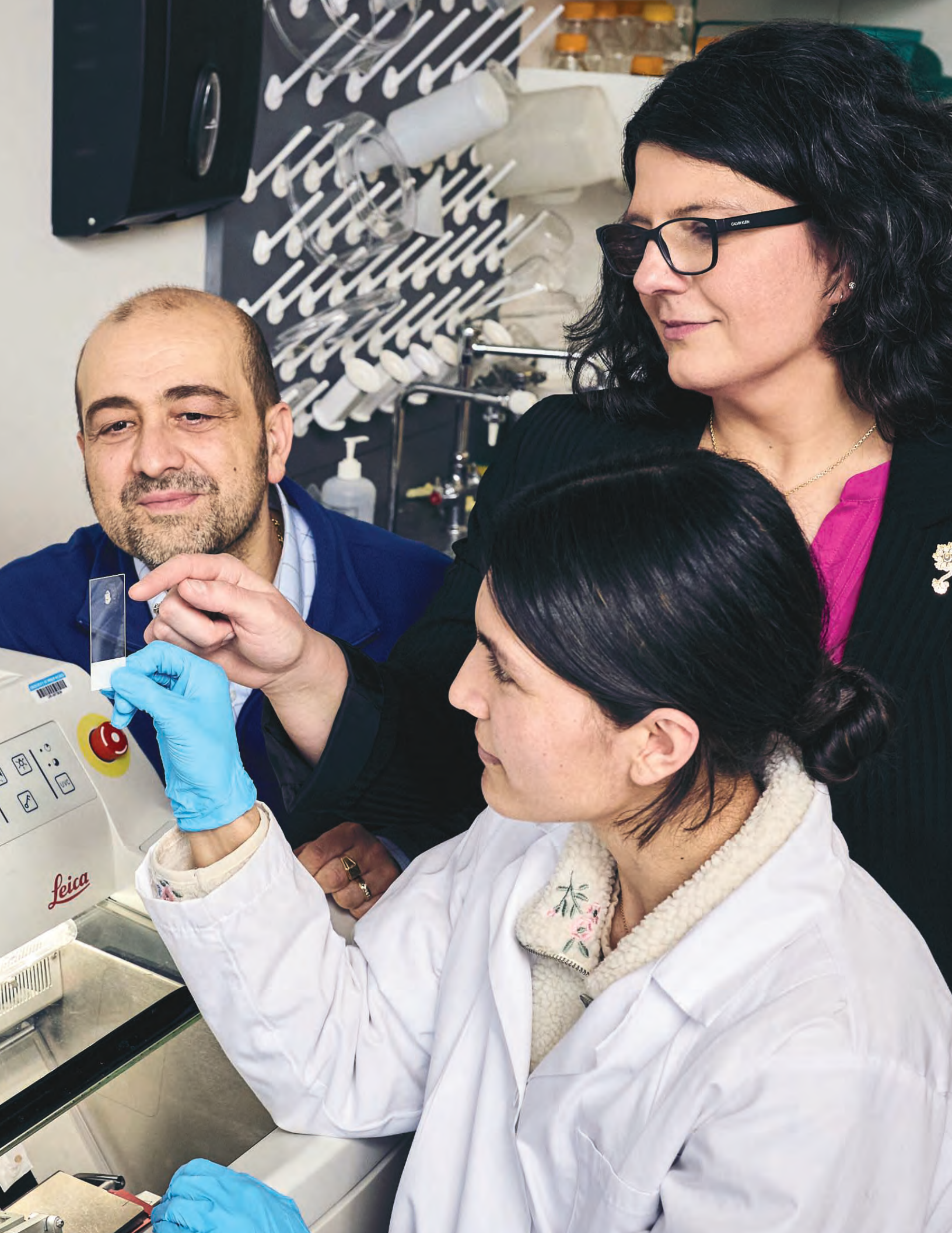
At URI, Varghese continues to expand this work by integrating molecular neuroscience, advanced imaging and systems biology approaches to better understand the earliest changes that occur in the brain during disease.

By uncovering why certain neurons are more vulnerable than others, her research aims to provide new insights into the biological pathways that drive neurodegeneration and ultimately guide the development of more targeted therapies for Alzheimer's disease and related disorders.

ENVIRONMENT, AGING, **AND THE BRAIN**

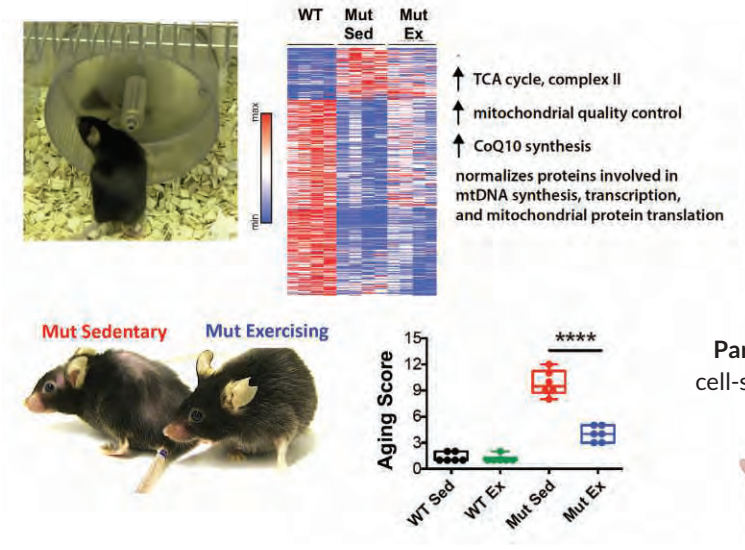
URI researchers examine how mitochondrial health and environmental toxins shape neurodegenerative disease

Dr. Jaime Ross (back, right) and Dr. Giuseppe Coppotelli (back, left) observe a cryosectioned brain slice collected by Ph.D. student Sajida-Jan Bibi alongside Ph.D. student Hannah Tobias-Wallingford.


Leica

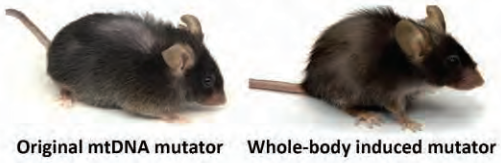
Exploring aging and lifestyle interventions using novel mouse models of premature aging due to impairment of mitochondrial

Exercise can rescue locomotion, mitochondria quality, proteomic profile



Developed a novel mouse model (i-PolgA) to study impaired mitochondria in time and space

Part I: Whole-body induced mutator (wb-PolgA) recapitulates the original mtDNA mutator mouse



Original mtDNA mutator | Whole-body induced mutator

Part II: Use i-PolgA mouse to generate tissue and cell-specific models, inducing impaired mitochondria at any time in any place in the body

Voluntary exercise slows the aging process, improves movement, and rescues deregulated proteins in a mouse model of premature aging (Ross and Coppotelli et al. *Aging Cell*, 2019). Ross and Coppotelli have also generated the first inducible mtDNA mutator mouse (I-PolgA), which allows for the induction of mitochondrial impairment in any tissue at any time (supported by NIH R21OD037651 and R01AG092603).

At the University of Rhode Island College of Pharmacy and the George and Anne Ryan Institute for Neuroscience, Associate Professor Jaime Ross and Research Assistant Professor Giuseppe Coppotelli are investigating two of the most pressing questions in brain health today: how cellular energy systems influence aging and how environmental toxins may accelerate neurodegenerative disease.

Their research focuses on mitochondria, the energy-producing structures inside cells that play a critical role in metabolism, inflammation and cellular survival. When mitochondria malfunction, the effects can ripple throughout the body. Mitochondrial dysfunction has been linked to a range of diseases, including diabetes, cardiovascular disease, cancer and neurodegenerative disorders such as Alzheimer's disease.

Ross and Coppotelli are studying how mutations in mitochondrial DNA contribute to aging and age-related diseases. Supported by a five-year, $2.8 million grant from the National Institute on Aging, their research uses innovative mouse models that carry mitochondrial mutations known to trigger premature aging.

In these models, mice begin to display aging symptoms early in life, including gray hair, hair loss and reduced mobility. The model provides researchers with a powerful tool for studying how mitochondrial dysfunction develops and how it affects tissues throughout the body.

One of the team's most striking discoveries involves the effects of exercise. When the genetically modified mice were given access to voluntary exercise through a running wheel, the results were dramatic. Exercising mice maintained healthy fur, moved more quickly and appeared significantly younger than sedentary animals with the same mitochondrial mutations.

"Exercise is the only intervention that can dramatically improve the phenotype in these mice so that you cannot distinguish a mouse that has this mutation from a normal animal," Coppotelli said.

Although exercise did not correct the underlying genetic mutation, it significantly improved health during the animals' lifespan. These findings suggest that physical activity may help cells identify and remove damaged mitochondria while promoting the production of new, healthy ones.

The team is now expanding this work using new models that allow them to study mitochondrial dysfunction in specific tissues such as the brain, heart and muscle. This

approach may help identify targeted interventions that improve cellular energy metabolism and delay the onset of age-related disease.

Alongside this work on aging, Ross is also investigating how environmental exposures influence brain health. In a recent study published in *Environmental Research Communications*, her team examined how micro- and nanoplastics affect cognitive function in mice.

Microplastics are increasingly present in food, water and air, and previous studies from Ross' lab have shown that these particles can cross the blood-brain barrier and accumulate in brain tissue.

To explore how this exposure may affect neurological health, the researchers studied mice carrying the *APOE4* gene variant, a genetic risk factor that significantly increases the likelihood of developing Alzheimer's disease.

After exposure to microplastics in drinking water, the mice exhibited measurable behavioral changes. Male mice displayed altered exploratory behavior linked to apathy, while female mice showed impaired memory when tested on their ability to recognize new objects.

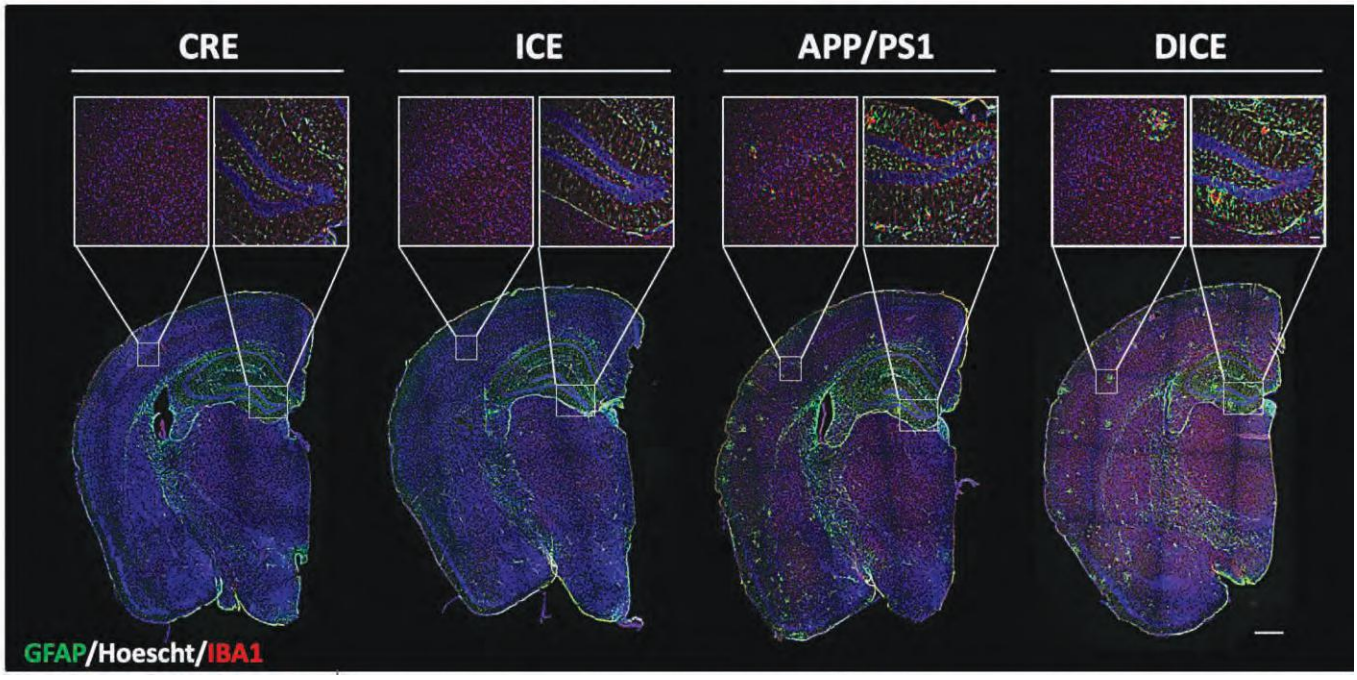
These sex-dependent behavioral changes closely mirror patterns observed in human Alzheimer's patients, where men often show greater apathy while women tend to experience more pronounced memory decline.

These findings suggest that environmental toxins such as microplastics may interact with genetic risk factors to accelerate neurological changes associated with Alzheimer's disease.

Ross continues to expand this research while advocating for increased study of the human health impacts of microplastic exposure. Indeed, Ross was invited to participate in a historic joint hearing between U.S. Environmental Protection Agency (EPA) Administrator Lee Zeldin and U.S. Department of Health and Human Services (HHS) Secretary Robert F. Kennedy Jr. announcing coordinated actions to address microplastics contamination, one of the most urgent and growing public health challenges facing Americans.

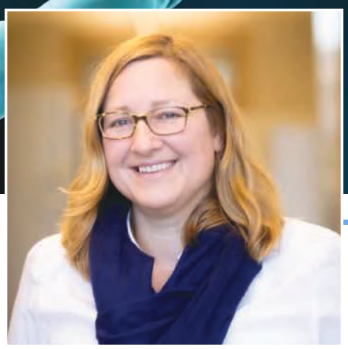
Together, the work of Ross and Coppotelli highlights how both internal biological processes and external environmental factors influence aging and brain health. By uncovering the mechanisms that link cellular energy metabolism, lifestyle factors and environmental exposures, their research aims to identify new strategies to protect the brain and improve health across the lifespan.

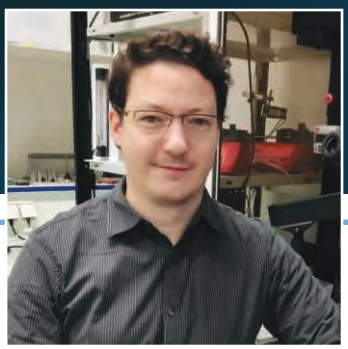
Does deregulation of genes (a driver of aging) induce earlier onset of Alzheimer's disease pathology?



Ross and team also study how changes in the epigenome affect the onset and progression of Alzheimer's disease. By generating the DICE mouse (Dementia from Inducible Changes in the Epigenome), they found an increase in amyloid plaques in the brain, suggesting that Alzheimer's disease pathology can be aggravated by deregulation of genes due to DNA damage (supported by NIH K99/R00AG055683).

PROPRIOCEPTION STUDY COULD UNLOCK TREATMENTS FOR SPASTIC CEREBRAL PALSY





Katharina Quinlan and Marin Manuel examine muscle spindles to better understand mechanisms of spasticity

When one thinks of sensation, most often what comes to mind are the different sensations felt on the skin: heat, cold, rough textures, soft fabrics, or pain. But there's more to sensation than the feelings people experience; human bodies are also constantly sensing their position in space by detecting the degree to which muscles are elongated or shortened.

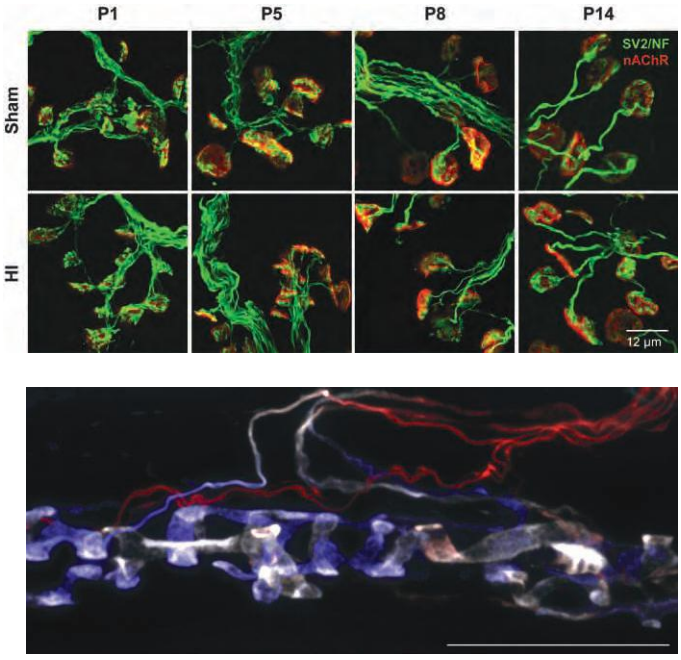
The sense is called proprioception, and it is recognized by neurons that are embedded in muscle spindles, muscle/nerve bundles located throughout the body. University of Rhode Island College of Pharmacy Associate Professor Katharina Quinlan is studying muscle spindles and other mechanisms contributing to spasticity in cerebral palsy in three separate projects, totaling ~$9 million, funded by the National Institute of Neurological Disorders and Stroke.

Spastic cerebral palsy is the most prevalent type of this disorder, affecting about 3 out of every 1,000 births worldwide. Caused by injury (such as lack of oxygen, infection, or neonatal stroke) to the developing motor cortex and pathways, it is characterized by movement dysfunction such as muscle spasms, stiffness, and weakness.

"It is well established that spasticity is driven by hyperactive stretch reflexes, but how these become hyperactive following a developmental injury has not been well studied," said Quinlan, who also holds an appointment in the George and Anne Ryan Institute for Neuroscience at URI. "In collaboration with the Manuel lab next door, we have a $3.1 million grant from the NIH to investigate all aspects of developing motor control, including muscle spindle structure and function, using an animal model of cerebral palsy." Assistant Professor Marin Manuel is also a faculty member in the College of Pharmacy and the George and Anne Ryan Institute for Neuroscience at URI.

Muscle spindles are vital to the reflex circuit and provide a great insight into how the human body's nervous system functions, Quinlan said. "Think of the knee-jerk reflex that may be tested in a doctor's office. These reflexes are a quick way for physicians to check on the proper functioning of our nervous system."

They can also be used to better understand the symptoms of cerebral palsy, part of Quinlan's broader research program studying the neural basis of movement. She aims to identify early morphological and electrophysical changes that precede motor deficits, and develop new biomarkers and pharmaceutical treatments for conditions such as ALS, spinal muscular atrophy, and cerebral palsy. Earlier identification of disease states could help lead to earlier diagnoses of neurological disorders, and, in some cases, allow preventative therapeutics to be developed.



Motor unit and muscle spindle development in cerebral palsy

Top: motoneuron axons (green) contact muscle fibers at motor end plates (red). Immature motor end plates are innervated by motoneuron axons at birth, but during postnatal maturation extra connections are pruned so each muscle fiber is controlled by just one motoneuron. Images from postnatal day (P) 1-14 from sham control animals (top row of images) and a hypoxia-ischemia animal model of cerebral palsy (HI; second row of images). **Bottom:** Muscle spindle with its annulospiral rings color coded to show depth. White color indicates foreground and red color indicates background. The sensory and motor axons are visible in the upper portion of the image, mostly in red.

"This research will provide new clues as to how to treat spasticity at the source, and possibly how to prevent it from occurring in children who are at risk for developing cerebral palsy," Quinlan said.

Overall, the Quinlan lab focuses on the changes in the activity of spinal neurons in neurodegeneration and neural injury. Specifically, changes in intrinsic and synaptic drive to motoneurons are studied in cerebral palsy, ALS and spinal muscular atrophy. The ultimate goal is to translate findings from the lab to the clinic to improve biomarkers and therapies for these conditions.

In a separate project, Quinlan's lab is studying primary afferent depolarization, also known as "PAD," a mechanism that causes a reflex response to vary depending on sensory input. (The knee-jerk you experience sitting on the examining table at the doctor's office, for example, would not be the same if the doctor tapped on the same spot while you were in motion.)

Quinlan wondered: Considering that PAD helps to shape this reflex response, what role does it play in cerebral palsy, which can cause spastic or exaggerated reflex responses? She found that PAD had never been studied in this context, so on a five-year, $2.8 million grant, she is investigating PAD in cerebral palsy, along with an intriguing idea: the potential to use transcutaneous electrical nerve stimulation (TENS) to help modulate hyperactive reflexes that can cause spasms through the PAD mechanism. An over-the-counter, low-voltage device, TENS is widely used to treat pain by manipulating the user's sensory input to interfere with their pain perception.

As opposed to invasive treatments, Quinlan is investigating whether using TENS to tweak sensory input could be an affordable and accessible way to reduce spasms.

"In spastic cerebral palsy, there is too much afferent input," Quinlan said. "One treatment involves surgically severing afferents. This reduces spasticity, but it can also cause loss of sensation and loss of control of various body functions. Using TENS would be a way to dampen the afferent input without surgically cutting nerve fibers."

Quinlan hopes her research, which also includes an additional $2.7 million National Institutes of Health grant to study pain in cerebral palsy, will lead to new hope for improved treatments and prevention.

> "Current treatments for cerebral palsy can be invasive yet ineffective. Our goal is to find a treatment that could translate to humans, where babies at risk could be treated for cerebral palsy before their nervous system matures in a dysfunctional way."
>
> -Katharina Quinlan, Ph.D.

Members of Quinlan and Manuel labs

CLEARING THE PATH TO BRAIN HEALTH

URI researchers William Van Nostrand and Joseph Schrader study how blood vessels and protein buildup drive Alzheimer's disease

University of Rhode Island College of Pharmacy professors and George and Anne Ryan Institute for Neuroscience faculty members William Van Nostrand and Joseph Schrader are uncovering how vascular and protein biology drive neurodegenerative disease.

Alzheimer's disease and related dementias affect millions of people worldwide and remain among the most urgent challenges in biomedical research. While scientists have identified many of the molecular features associated with these conditions, researchers increasingly recognize that brain health depends not only on neurons but also on the blood vessels and biological systems that support them.

At the University of Rhode Island College of Pharmacy, Van Nostrand and Schrader are leading research that explores these connections. Their collaborative work focuses on how interactions between proteins, blood vessels, and brain clearance systems contribute to neurodegenerative disease.

Through new experimental models, international collaborations and recent scientific discoveries, the researchers are helping scientists better understand how Alzheimer's disease and related disorders develop and how they might one day be prevented or treated.

Understanding protein accumulation in the brain

For decades, scientists have studied the role of amyloid beta, a protein fragment that accumulates in the brains of people with Alzheimer's disease. Van Nostrand, Herrmann Professor of Neuroscience at URI and co-director of the George and Anne Ryan Institute for Neuroscience, has been a leading figure in this field.

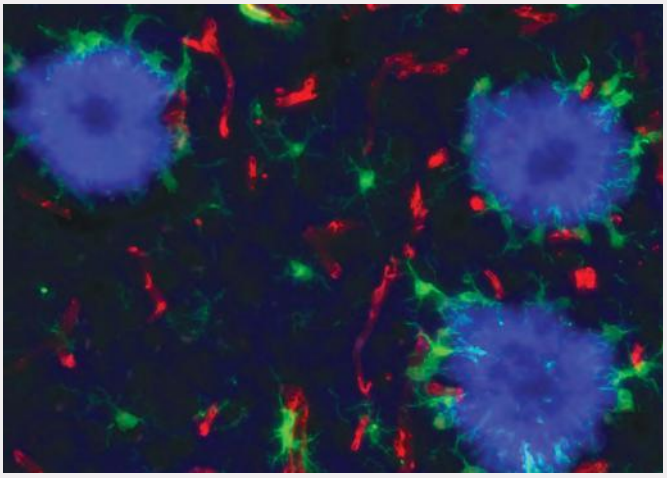
His research focuses on how amyloid proteins build up not only in brain tissue but also within the walls of blood vessels, a condition known as cerebral amyloid angiopathy, or CAA. This disorder weakens blood vessels and can cause microbleeds and hemorrhagic stroke. CAA is commonly found in individuals with Alzheimer's disease.

Van Nostrand's laboratory has developed specialized transgenic animal models that allow researchers to study how amyloid proteins accumulate in the brain and how they damage blood vessels over time. These models have become powerful tools for understanding the biological processes behind dementia and vascular brain disease.

Recent research from the team has examined how amyloid accumulation alters brain protein networks and disrupts normal biological pathways involved in cognition and vascular stability. Their studies continue to reveal new insights into how these protein deposits contribute to disease progression.

Studying the brain's waste-clearing system

One of the most important recent developments in Alzheimer's research involves the discovery of the brain's waste-clearing system, sometimes called the glymphatic or perivascular clearance system. This system helps remove toxins and metabolic waste from brain tissue.



Amyloid plaque (blue) surrounded by microglia (green), the primary innate immune cells in the brain, in a transgenic rat model of Alzheimer's disease and related disorders.

Van Nostrand is part of an international research consortium investigating how failures in this clearance system may contribute to cerebral amyloid angiopathy-CAA and other forms of dementia. The collaboration, supported by a five-year, $8 million grant from the Leducq Foundation, brings together scientists from the United States and Europe to study how the brain clears harmful substances such as amyloid proteins.

Researchers believe that when this clearance process becomes impaired, toxic proteins may accumulate in brain tissue and blood vessels, accelerating neurodegenerative disease. Understanding how this system works could help scientists develop therapies aimed at improving the brain's ability to remove these harmful molecules.

Linking vascular health and neurodegeneration

Schrader, an assistant professor in the Department of Pharmacy Practice and Clinical Research and a member of the Ryan Institute, works closely with Van Nostrand, contributing expertise in vascular biology and molecular neuroscience.

Recent collaborative studies from the team have explored how vascular dysfunction and protein accumulation interact in the brain. In 2024, the team published work examining proteomic changes in a transgenic rat model of cerebral amyloid angiopathy, identifying molecular pathways associated with vascular damage and cognitive impairment.

These studies help scientists understand how changes in brain blood vessels influence the progression of neurodegenerative disease. Reduced vascular integrity and impaired circulation may worsen the effects of amyloid buildup, creating a cycle that accelerates neurological decline.

By combining molecular neuroscience with vascular biology, the team is helping clarify how these interconnected systems contribute to dementia.

Evaluating new Alzheimer's therapies

The research has taken on new urgency as recently developed Alzheimer's immunotherapies begin to reach patients. These treatments are designed to remove amyloid plaques from the brain and slow disease progression.

While promising, these therapies may carry risks for some patients, including brain swelling or bleeding. Van Nostrand's group is using its experimental models to study why these complications occur and how they might be prevented.

Collaborations with pharmaceutical researchers are examining how amyloid removal affects blood vessels in the brain and whether certain patients may be more vulnerable to treatment-related complications. This work could help guide safer and more effective use of emerging Alzheimer's therapies.

Advancing collaborative neuroscience

The work of Van Nostrand and Schrader illustrates how modern neuroscience increasingly relies on interdisciplinary collaboration. Understanding diseases such as Alzheimer's requires expertise in molecular biology, vascular physiology, genetics and pharmacology.

At the University of Rhode Island College of Pharmacy and the George and Anne Ryan Institute for Neuroscience, these collaborations are helping researchers examine brain disease from multiple scientific perspectives.

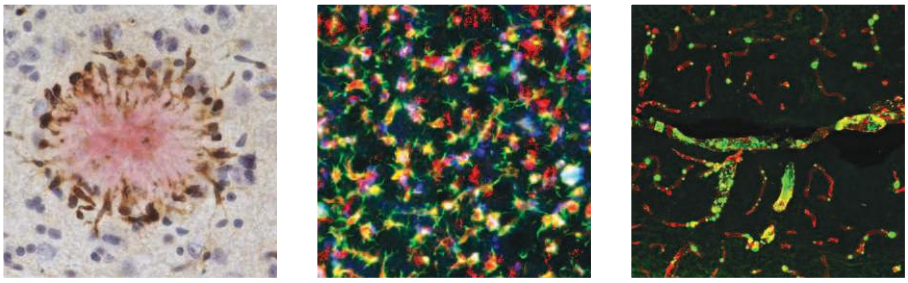
Recent publications from the team continue to shed light on how amyloid proteins, vascular health and brain clearance systems interact in neurodegenerative disease.

Toward New Strategies for Dementia

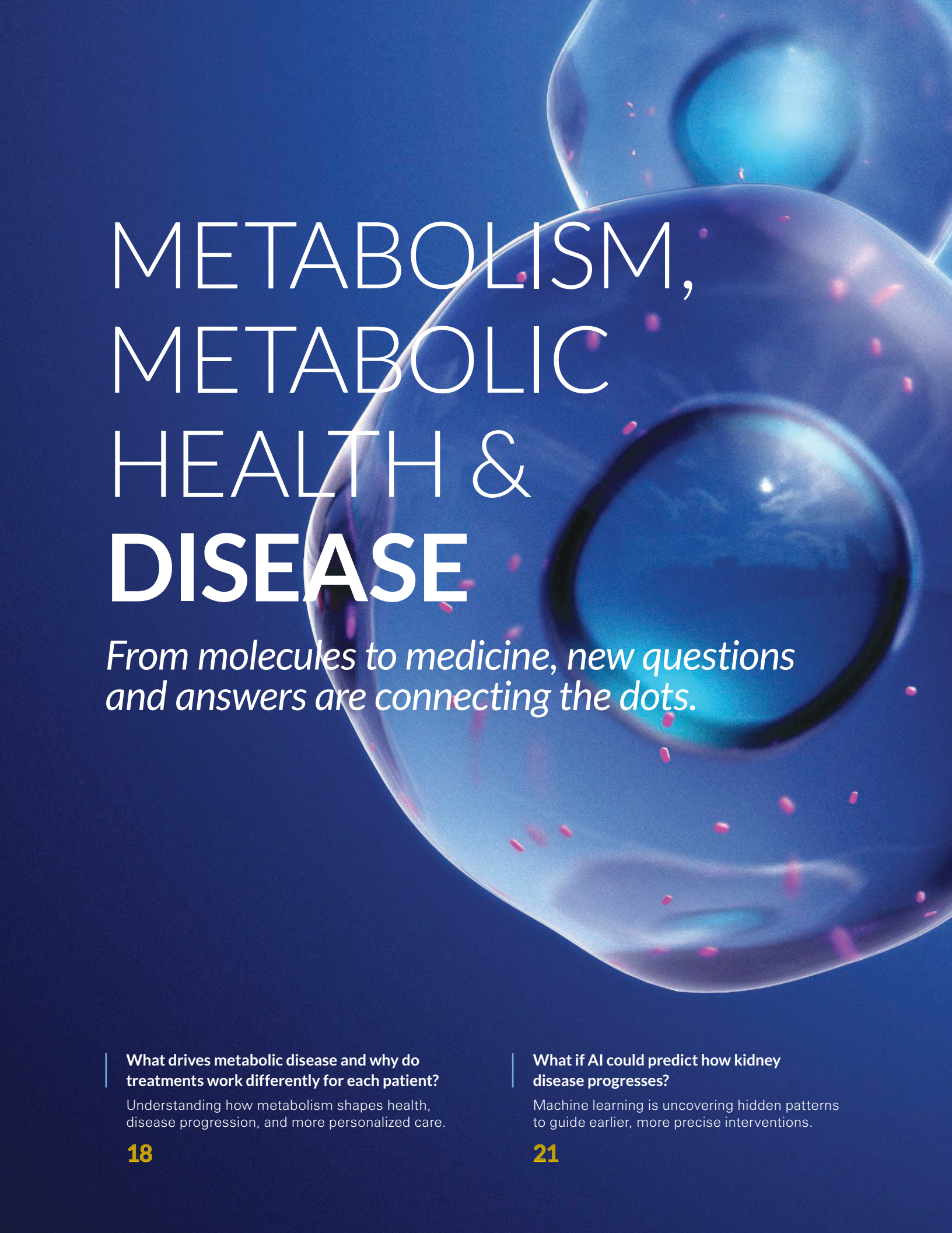
As populations age worldwide, the number of individuals affected by Alzheimer's disease is expected to grow dramatically in the coming decades. Addressing this challenge will require new scientific insights into the biological mechanisms that drive dementia.

Through cutting-edge experimental models, international collaborations and translational research, Van Nostrand and Schrader are helping move the field closer to that goal.

By uncovering how the brain clears harmful proteins and how vascular health influences neurological function, their work is opening new avenues for understanding and potentially treating one of the most complex diseases of our time.

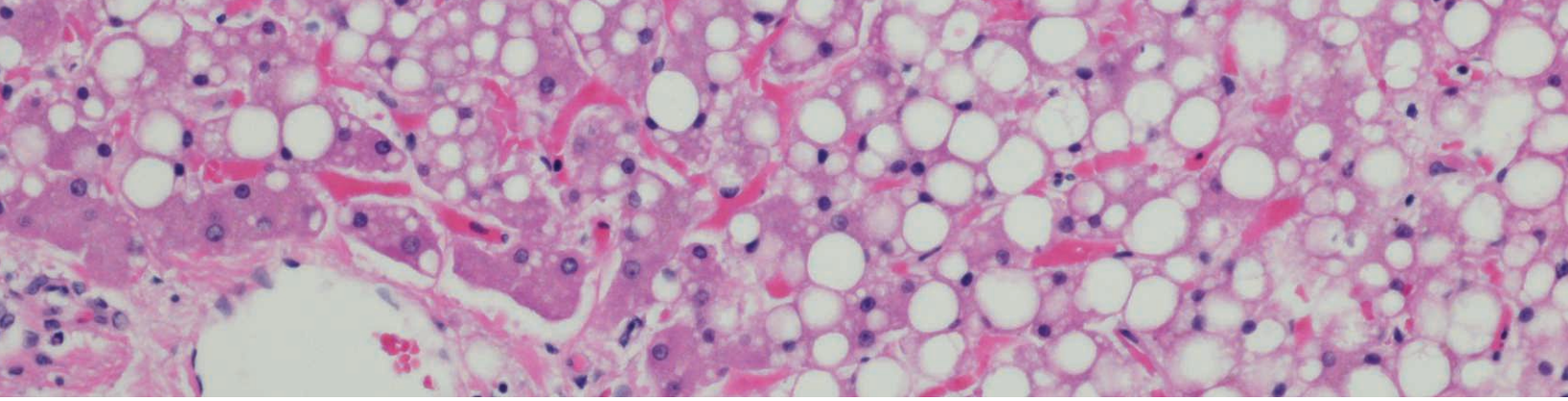


Transgenic rat model of Alzheimer's disease and related disorders. (Left) Amyloid plaque (red) surrounded by microglia expressing the cytokine TGF-b1 (brown). (Middle) Brain tissue labeled for amyloid deposits (blue), microglia (green), and inflammatory response regulator annexin A3 (red). (Right) Brain blood vessels (red) accumulate fibrillar amyloid b-protein (green).



METABOLISM, METABOLIC HEALTH & **DISEASE**

From molecules to medicine, new questions and answers are connecting the dots.



LINKING METABOLISM TO DISEASE, TREATMENT AND OUTCOMES

URI researchers Ruitang Deng, Nisanne Ghonem and Brahim Achour bridge molecular discovery, clinical care, and precision medicine to address metabolic health and disease.

Metabolic diseases, including obesity, Type 2 diabetes, metabolic dysfunction-associated steatotic liver disease (MASLD) and related cardiovascular conditions, represent one of the most urgent public health challenges of the 21st century. These disorders affect hundreds of millions of people worldwide and impose a significant clinical and economic burden.

Despite advances in therapeutic options, significant gaps remain in understanding why metabolic diseases develop, why they progress differently among individuals, and why patients often respond differently to treatments. Addressing these challenges requires research that connects fundamental biological mechanisms with clinical outcomes and patient care.

At the University of Rhode Island College of Pharmacy, researchers are tackling these questions through interdisciplinary investigations that span molecular biology, pharmacology, computational modeling, and clinical translation. Faculty members, including Professor Ruitang Deng, Associate Professor Nisanne Ghonem, and Assistant Professor Brahim Achour are advancing new insights into metabolic disease while developing strategies to improve treatment and patient outcomes.

Together, their work integrates molecular discovery, quantitative modeling and translational research to advance metabolic health.

Decoding metabolism in the liver

The liver plays a central role in regulating nutrients, cholesterol, and bile acids that maintain metabolic balance. Deng, professor of biomedical and pharmaceutical sciences, studies how disruptions in bile acid signaling and cholesterol metabolism contribute to liver disease and metabolic dysfunction. Bile acids are metabolites of cholesterol that function not only in digestion but also as hormone-like signaling molecules that regulate metabolic pathways through multiple receptors.

When bile acid regulation is disrupted, it can contribute to a wide range of diseases, including intrahepatic cholestasis of pregnancy, drug-induced liver injury, hepatocellular carcinoma, MASLD and diabetes.

One research project in Deng's laboratory investigates the molecular mechanisms that drive hepatocellular carcinoma (HCC), the most common form of liver cancer. Using genetically modified mouse models, his team has discovered that dysregulated bile acid signaling can alter expression of a gene known as ubiquitin-specific peptidase 2, or *USP2*.

USP2 is a deubiquitinating enzyme involved in protein stability, DNA replication, transcription and mitochondrial apoptotic pathways. Deng's lab found that bile acid dysregulation can cause abnormal USP2 activity in liver cancer patients. Under different biological conditions, USP2 may function as either a tumor suppressor or a tumor promoter during various stages of tumor development.

These findings provide a molecular basis for potential therapies targeting the bile acid and USP2 pathway to treat liver cancer.

A second research program in Deng's lab examines

the relationship between liver disease and pregnancy outcomes. Clinical evidence suggests that women with liver disorders such as intrahepatic cholestasis of pregnancy or MASLD face higher risks of complications, including preterm birth and stillbirth.

Deng's team recently identified that dysregulated bile acids can trigger pregnancy complications through specific receptor pathways. Using genetically engineered mouse models, the team is investigating therapies that may reduce these risks and improve outcomes.

Linking metabolic disruption to liver disease

Building on these insights, Ghonem, associate professor of biomedical and pharmaceutical sciences, studies how metabolic signaling pathways regulate liver injury and chronic disease.

Her research focuses on nuclear receptors and molecular regulators that control gene expression in response to metabolic signals. These receptors play key roles in lipid metabolism, glucose homeostasis and inflammation.

Ghonem's laboratory studies cholestatic liver diseases such as primary biliary cholangitis and primary sclerosing cholangitis, progressive conditions characterized by the accumulation of bile acids that can become toxic and cause liver injury. Over time, this buildup can lead to liver failure, cirrhosis and cancer.

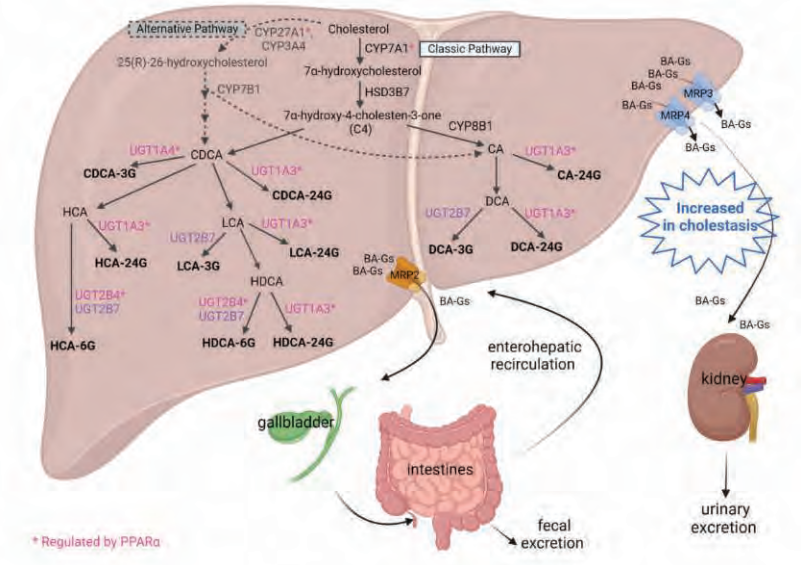
A major focus of her work is understanding how bile acid detoxification pathways help protect the liver. One critical mechanism is glucuronidation, a phase II metabolic process in which enzymes from the UGT family attach glucuronic acid to bile acids, making them less toxic and easier for the body to eliminate.

Nisanne Ghonem, Pharm.D., Ph.D. and Ruitang Deng, Ph.D.

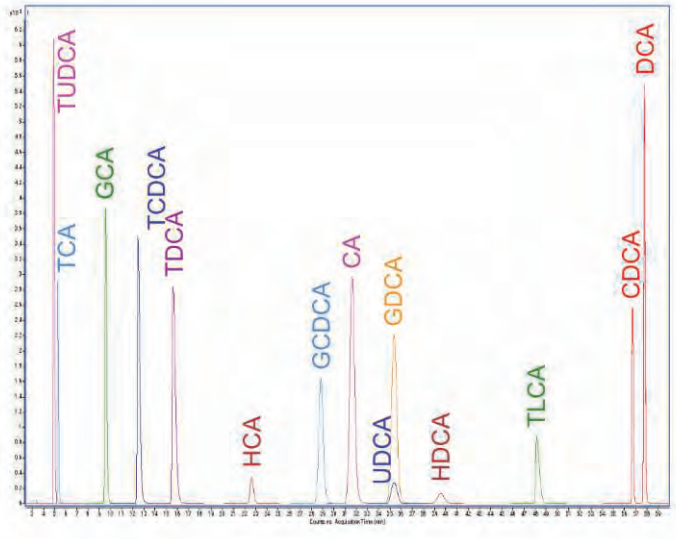
Her research investigates how these detoxification pathways function in patients with cholestatic liver disease and how they may serve as indicators of treatment response.

Ghonem's work also explores the therapeutic potential of peroxisome proliferator-activated receptor agonists such as fibrates. These drugs activate nuclear receptors that regulate genes involved in lipid metabolism, inflammation and bile acid homeostasis. Although early studies suggest that fibrates may reduce liver injury in cholestatic disease, their mechanisms remain poorly understood.

By identifying how PPAR signaling affects bile acid metabolism, Ghonem's research aims to guide the development of more effective treatments for these currently incurable liver diseases.



Two major bile acid biosynthetic pathways in the liver, including peroxisome-proliferator activated receptor (PPAR)-regulation of bile acid metabolism pathways during cholestatic liver diseases. Gallucci et al. *Cells.* 2024.



Representative chromatogram of bile acid standards to quantify human serum bile acids. Methodology performed using the Agilent 6470 LC-MS/MS system (RI-INBRE).

Personalizing treatment through precision pharmacology

Brahim Achour, assistant professor of biomedical and pharmaceutical sciences, focuses on how medications behave differently across individuals and disease states.

His work centers on pharmacokinetics and pharmacodynamics, the study of how drugs are absorbed, distributed, metabolized and eliminated in the body.

Achour applies advanced modeling approaches, including physiologically based pharmacokinetic modeling, to predict drug exposure and response in patients with metabolic disease and related conditions. Liver disease can alter the body's ability to metabolize medications, creating challenges for safe and effective dosing.

Using bioanalytical techniques and computational models, his research predicts how drugs and drug combinations behave in patients with MASLD, diabetes and lipid disorders.

This work helps inform clinical decision-making related to drug selection, dose adjustments and management of polypharmacy, particularly in patients with complex metabolic conditions. By integrating quantitative pharmacology with clinical data, Achour's research supports precision medicine approaches tailored to individual patients.

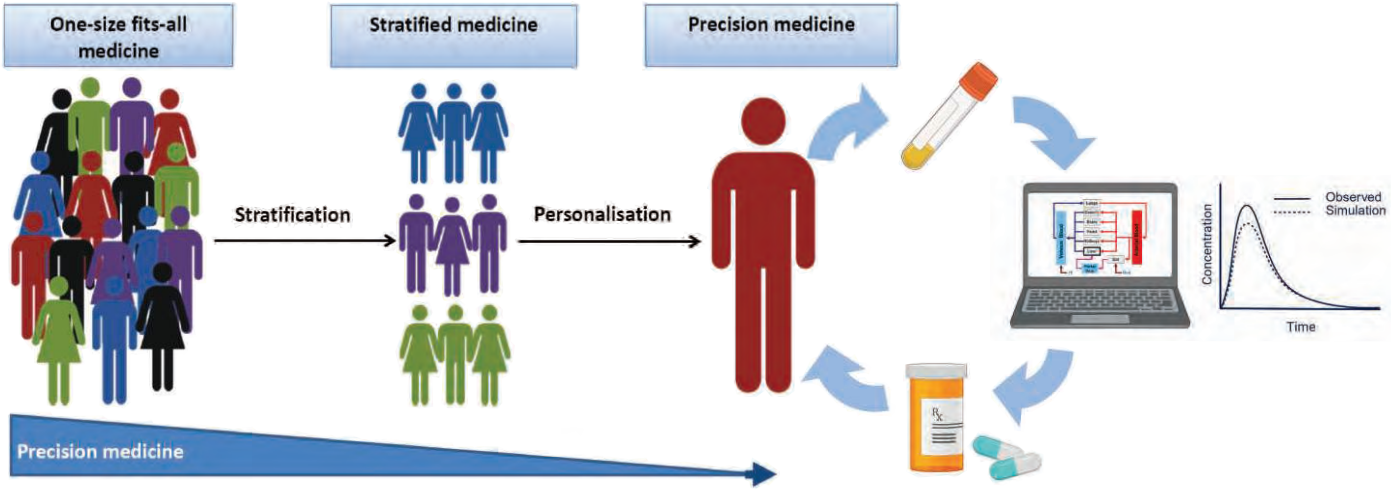
Bridging discovery and patient impact

Metabolic diseases arise from complex interactions among genetics, metabolism, inflammation, environment and pharmacotherapy. Understanding these conditions requires collaboration across multiple disciplines.

At the URI College of Pharmacy, researchers are advancing this effort by connecting molecular biology, quantitative modeling and translational science. Their work provides new insights into the mechanisms that drive metabolic disease while informing strategies to improve prevention, diagnosis and treatment.

By linking discovery with clinical relevance, these interdisciplinary research programs are helping move the field toward more precise and effective approaches to managing metabolic health.

Together, these efforts reflect a shared mission: translating scientific discovery into better therapies and improved health for patients and communities.



One-size-fits-all approach is the most common approach in clinical practice, followed by stratification of specific groups of patients, e.g. the elderly or children. The goal of precision medicine is to provide the right dose of the right drug to the right patient at the right time. In the Achour Lab, plasma samples from individual patients are analyzed with novel techniques (liquid biopsy technology and multi-omics), and the data are used in computer models to predict the patient's response to a drug.

USING ARTIFICIAL INTELLIGENCE (AI) TO UNDERSTAND CHRONIC KIDNEY DISEASE

Todd Brothers uses AI to uncover patterns in kidney disease that could transform care

Chronic kidney disease (CKD) affects millions of people worldwide and is a major contributor to cardiovascular complications, hospitalization and premature death. Yet the disease often develops gradually and presents differently across patients, making it difficult to predict who will experience rapid progression and who will remain stable. Understanding these differences is essential for improving treatment strategies and patient outcomes.

At the University of Rhode Island College of Pharmacy, Todd Brothers, Pharm.D., BCCCP, BCPS, clinical associate professor of pharmacy practice and clinical research and a critical care pharmacy expert, applies AI and machine learning to better understand this complex disease. His research focuses on developing computational tools that analyze large healthcare datasets to identify patterns that may not be apparent using traditional approaches.

One of Brothers' recent projects involves developing a machine learning framework to identify distinct phenotypes within chronic kidney disease populations. These phenotypes represent subgroups of patients with shared clinical characteristics, disease progression patterns and therapeutic responses. Despite classification based on kidney function, CKD exhibits significant variability in complications and outcomes. Machine learning enables the analysis of large, complex datasets to uncover patterns that may improve risk stratification and guide more t argeted treatment strategies.

Using electronic health record data, Brothers and his collaborators applied clustering algorithms and statistical modeling techniques to identify subgroups of patients with shared clinical characteristics. These models analyze a wide range of patient data, including laboratory values, medical history, medications and coexisting conditions. By comparing multiple machine learning approaches, the framework improves the reliability of the phenotypes identified through the analysis.

The results highlight how chronic kidney disease is closely connected with other health conditions, particularly cardiovascular disease. The research also revealed the role that acute kidney injury can play in accelerating long-term disease progression. Identifying these patterns helps clinicians better understand how kidney disease develops and which patients may be at higher risk of complications.

Brothers' work reflects a growing movement toward precision medicine, where treatment decisions are informed by deeper insights into individual patient characteristics. Machine learning models have the potential to help clinicians predict disease progression, tailor medication strategies and design more patient-specific interventions.

As health care systems generate increasing volumes of clinical data, AI is becoming essential for transforming this information into meaningful clinical insight. By integrating clinical pharmacy expertise with advanced computational methods, Brothers' research is advancing new approaches to risk identification, treatment optimization and ultimately improving care for patients with chronic kidney disease.

FROM OCEANS **TO HUMAN HEALTH**

Discovery begins with curiosity and sometimes, it leads to the sea.

What happens when “forever chemicals” enter the human body?

How PFAS build up in the body, affect health, and how exposure may be reduced.

24

What if the ocean held the next breakthrough in skin health?

Local seaweed is emerging as a promising source of new, natural skincare innovations.

25

What if the next antibiotic is hiding in the ocean?

Marine bacteria may unlock new treatments for drug-resistant infections.

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HOW PFAS AFFECT HUMAN HEALTH

URI researchers Angela Slitt and Fabian Fischer study how “forever chemicals” accumulate in the body and impact human health

Angela Slitt, professor and chair of the Department of Biomedical and Pharmaceutical Sciences, and Fabian Fischer, assistant professor in the Department of Biomedical and Pharmaceutical Sciences, study how PFAS (per- and polyfluoroalkyl substances), often called “forever chemicals,” affect human health.

While PFAS contamination is often discussed in the context of environmental and water systems, Slitt and Fischer’s research focuses on how these persistent chemicals accumulate in the body, how they interact with biological systems and how exposure may be reduced. Their interdisciplinary research program grew from more than a decade of collaboration with Rainer Lohmann, professor in the Graduate School of Oceanography and director of the NIH-funded Sources, Transport, Exposure and Effects of PFAS Superfund Research Center. Their teams have brought together trainees from oceanography and pharmacy to address complex issues surrounding PFAS.

PFAS enter the environment through industrial processes, consumer products and contaminated water systems, eventually moving through ecosystems and reaching people through multiple exposure pathways. Understanding what happens after these chemicals enter the human body is a central focus of the team’s work.

A recently accepted study from their laboratories analyzed 54 PFAS compounds in 211 human liver samples collected in the United States between 2000 and 2024. PFAS were detected in nearly every sample. The study found that overall PFAS concentrations declined substantially over time following regulatory phaseouts of several legacy compounds, demonstrating that policy actions can reduce human exposure. However, the research also showed that newer and less-regulated PFAS are increasingly contributing to the body’s overall chemical burden.

The research team is also investigating the biological mechanisms that allow PFAS to accumulate in the body. A recently funded NIH R01 grant examines how PFAS bind to albumin, a key blood protein that may play a major role in PFAS transport and retention.

Beyond understanding these mechanisms, Slitt, Fischer and collaborators are working to identify strategies to reduce PFAS levels in exposed populations. Through a Department of Defense clinical trial, the team is testing whether the FDA-approved medication colesevelam can help eliminate PFAS from the body by binding these chemicals in the intestine and preventing their reabsorption.

Additional studies focus on veterans, including research examining potential links between PFAS exposure, thyroid cancer and metabolic liver disease. Together, these projects aim to advance scientific understanding of PFAS while identifying practical approaches to reduce exposure and protect human health.

FROM INDONESIA TO RHODE ISLAND: **EXPLORING SEAWEED'S POTENTIAL** FOR SKIN HEALTH TO HUMAN IMPACT

Graduate student Chalissa Dibya Iranisha, working in Hang Ma's lab, explores how local seaweed could advance skincare

"Coming from Indonesia, I have always been fascinated by seaweeds and marine natural products. Studying seaweeds from the Rhode Island coast gives me the opportunity to explore how different marine environments can produce unique compounds with potential benefits for skin health."

- Chalissa Dibya Iranisha

Chalissa Dibya Iranisha, a Fulbright scholar from Indonesia, joined Hang Ma, Ph.D., research assistant professor, at the University of Rhode Island College of Pharmacy in fall 2025 to pursue a master's degree in medicinal chemistry and pharmacognosy. Her research reflects both her academic interests and personal connection to natural products.

Growing up in Indonesia, a country known for its rich marine biodiversity, she developed a fascination with seaweeds and their potential health benefits. At URI, she is translating that interest into scientific discovery.

As part of her thesis, Iranisha is studying the chemical composition and biological activity of seaweeds collected from the Rhode Island coast, exploring how kelp-derived compounds may contribute to skin health and future skincare applications.

Her work takes place in the Bioactive Botanical Research Laboratory, where she is supervised by Huifang "Shelly" Li, a postdoctoral researcher. The lab focuses on the discovery and characterization of bioactive compounds from plants and other natural resources. The college has established strong expertise in natural products chemistry and biomedical research, providing an ideal environment for studying their applications in health and wellness.

Connecting marine aquaculture and biomedical research

Iranisha's project highlights URI's interdisciplinary research environment. The work is conducted in collaboration with Azure Cygler, fisheries and aquaculture extension specialist at the Coastal Resources Center within URI's Graduate School of Oceanography. Cygler and her team cultivate seaweed in Narragansett, providing locally grown kelp samples for laboratory analysis.

This collaboration connects marine aquaculture with pharmaceutical sciences. By examining the chemical composition and biological activity of Rhode Island seaweed, the research aims to identify compounds that may be useful for cosmetic and health-related applications.

Supporting student innovation

The project received seed funding from the URI Research Foundation through the RISE-UP program, which supports student-driven research initiatives. With guidance from the foundation, the team secured $5,000 to support laboratory assays and preliminary chemical and biological analyses.

This early-stage funding allows Iranisha to generate foundational data that may lead to larger research grants and future collaborations.

Potential benefits for Rhode Island's blue economy

Beyond its scientific impact, the research may contribute to Rhode Island's growing blue economy. Kelp farming and seaweed aquaculture are emerging industries that offer sustainable opportunities for coastal communities.

By identifying high-value bioactive compounds from locally cultivated seaweed, the research could help create new applications in cosmetics, nutraceuticals and personal care products. These value-added uses may increase the economic potential of seaweed farming while supporting innovation in marine biotechnology.

A global perspective on natural products

For Iranisha, the project bridges her background in Indonesia with her research experience in Rhode Island. While Indonesia has a long tradition of using marine plants, she is now studying how seaweed from a different coastal ecosystem may contain unique bioactive compounds.

Her work reflects a broader trend in pharmaceutical and cosmetic sciences that looks to nature as a source of new compounds for health and wellness.

Through interdisciplinary collaboration and international programs such as Fulbright, Iranisha's research illustrates how graduate students at URI are advancing scientific discovery while contributing to local innovation and global knowledge.

"URI has particularly strong expertise in natural products chemistry and skin biology. Chalissa's research connects these strengths with Rhode Island's marine resources. By studying locally cultivated seaweeds, we are exploring new bioactive compounds that could support future skincare innovations."

- Dr. Hang Ma, Ph.D.

Azure Cygler
Fisheries and aquaculture extension specialist at the Coastal Resources Center within URI's Graduate School of Oceanography

SYMBIOTIC MARINE BACTERIA **MAY BE KEY TO NEW ANTIBIOTIC**

Bailey Miller studies marine symbionts to discover and engineer new antimicrobial compounds

Scientists around the world are exploring natural environments in search of novel treatments for drug-resistant infections. At the University of Rhode Island, Bailey Miller, Ph.D., assistant professor, is investigating marine symbiotic bacteria as a promising source of new therapeutics.

Symbionts are organisms that live closely with another organism, often in a mutually beneficial relationship. Miller's research focuses on wood-eating marine shipworms, bivalve mollusks similar to clams, and the bacteria that live within them.

These bacteria produce a wide range of chemical compounds, known as secondary metabolites, that may have potential as new drugs.

Before joining URI, Miller discovered a new class of molecules called turnercyclamycins while working in the lab of Eric Schmidt at the University of Utah. These compounds have demonstrated strong activity against gram-negative bacteria, including *Acinetobacter baumannii*, a highly resistant pathogen associated with serious infections in wounds, the bloodstream, the urinary tract and the lungs.

"*Acinetobacter baumannii* is a lethal infection that develops resistance very easily and is very hard to kill," said Miller. "We identified a compound produced by these symbionts that can effectively kill it. It works in animal models, not just in petri dishes, which makes it especially promising."

Miller harvests marine shipworms from driftwood found in the ocean, including from the nets of a fishing boat in Narragansett Bay. The mollusks bore into the wood to create a den, eating the cellulose in the wood, which their symbiotic bacteria help them digest. Those bacteria produce multiple metabolites including turnercyclamycins, for which Miller holds a federal patent as a co-creator.

"Maybe we can produce a valuable antibiotic, and the main feedstock going into it is paper waste or corn husks. You add some sea water to the bacteria, mix with metals and minerals it needs, then put in waste paper, and that paper will just dissolve. It's a potential way of mitigating some cellulosic waste and turning it into something that's value-added."

-Bailey Miller, Ph.D.

Fandra Kenelak
Junior, BPS student using a hammer and chisel to find marine wood-eating shipworms in a piece of wood that was collected from the bottom of Narragansett Bay.

In his laboratory, Miller and his team of graduate and undergraduate students are working to identify and genetically engineer the bacterial strains harvested from the mollusks' gills. Through genomic analysis, they have identified numerous genes that encode the enzymes necessary to produce potentially new antibiotics.

Their research focuses on activating these genes to increase production and better understand their biological activity.

"The more we sequence these genomes, the more potential we uncover," Miller said. "There are hundreds of biosynthetic gene clusters that may produce new compounds. By using genetic engineering to activate them, we can explore whether they have antibiotic, anticancer or anti-inflammatory properties. We're looking to leverage biodiversity to find new drugs, and trying to expand that research into new avenues."

In addition to drug discovery, Miller's work may also contribute to sustainable biotechnology. His research has shown that these bacteria can grow on waste materials such as paper, breaking down cellulose in the process. This approach could help convert waste into valuable products, such as new antibiotics.

"It's an example of green biotechnology," Miller said. "We may be able to produce valuable compounds using waste materials like paper or agricultural byproducts as the primary input."

At the core of Miller's research is a broader question about the role of chemistry in biological systems.

"I'm interested in understanding how chemical interactions shape relationships between bacteria and their hosts," Miller said. "At the same time, we are exploring how to harness those interactions for drug discovery."

By studying marine symbiosis and leveraging biodiversity, Miller's work is helping to uncover new pathways for developing treatments against some of the most challenging infections.

PRECISION SCIENCE **FOR BETTER CANCER OUTCOMES**

Breakthroughs begin by challenging what we think we know.

What if bacteria could be engineered to fight cancer from within?

Genetically modified bacteria could target hard-to-reach tumors like pancreatic cancer.

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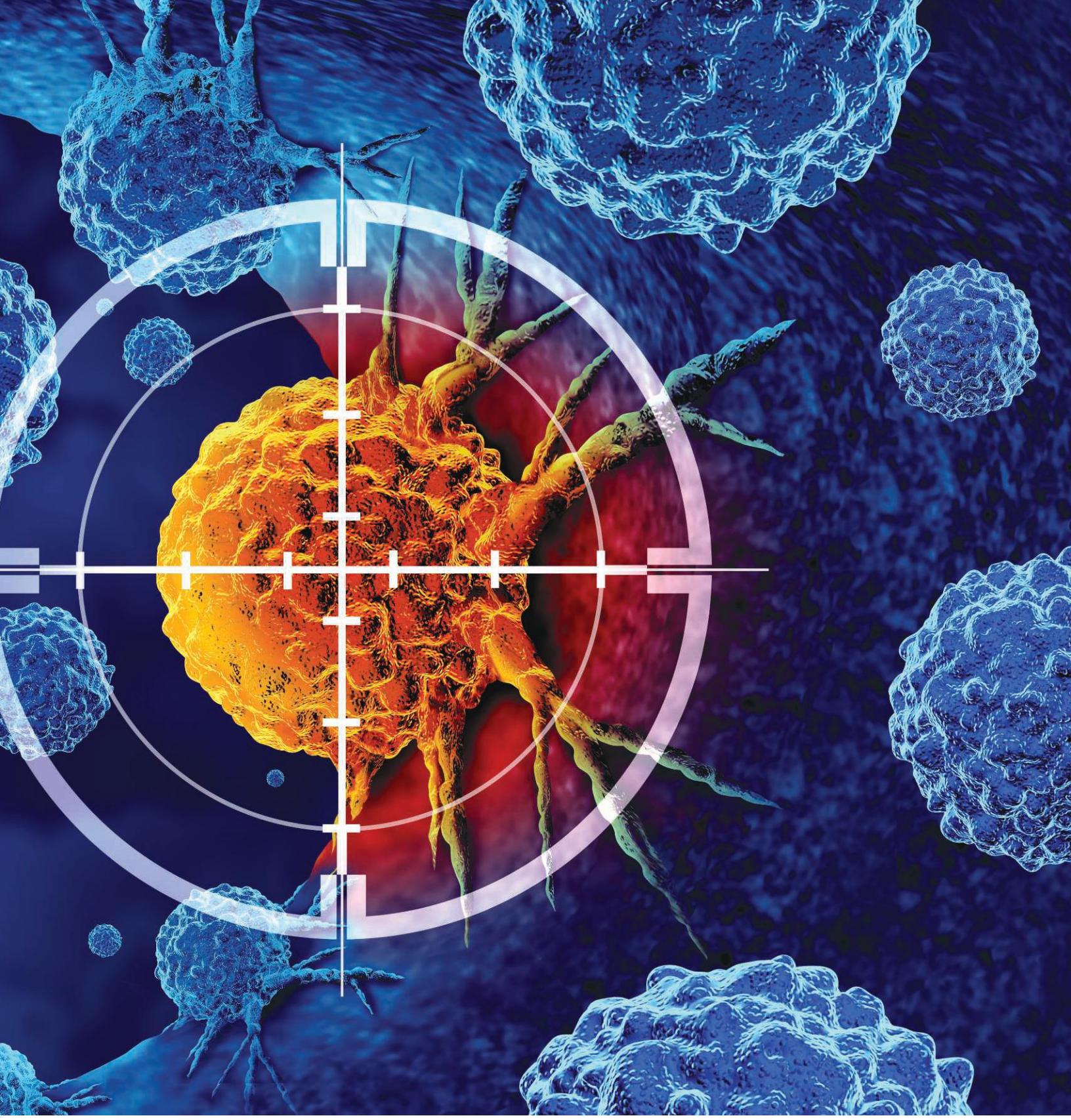
What if cancer treatment isn't just about the drug, but how it gets there?

RNA technologies and biomaterials are enabling more precise delivery and immune system activation.

34



What happens when DNA damage goes unrepaired?

Environmental exposures and molecular changes are driving mutations linked to cancer.

35

What happens after a breakthrough cancer therapy reaches patients?

Access, cost and real-world use determine whether innovations truly improve outcomes.

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Ting-Yu Shih, Ph.D. and Kaitlin Dailey, Ph.D.

TARGETING PANCREATIC CANCER
WITH GENETICALLY ENGINEERED BACTERIA

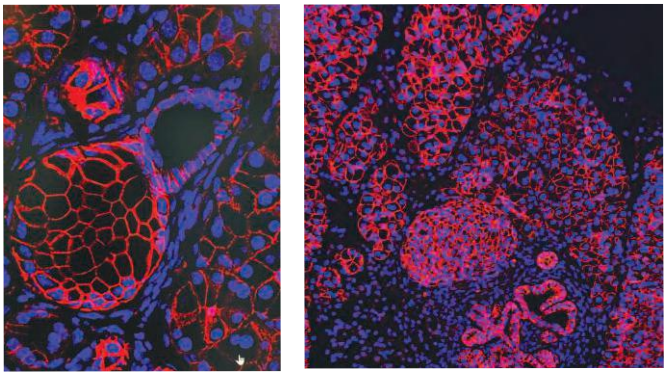
URI researcher Kaitlin Dailey is developing engineered bacteria to reach and treat hard-to-target and metastatic cancers

Cancers are masters of disguise that can evade the immune system, growing undetected while wreaking havoc on the body. However, a new approach using oncolytic bacteria - bacteria that target and destroy cancer cells - may offer a way to expose and attack these tumors.

When oncolytic bacteria are introduced into a tumor, the immune system recognizes and attacks the bacteria, triggering a broader response that also targets the cancer cells.

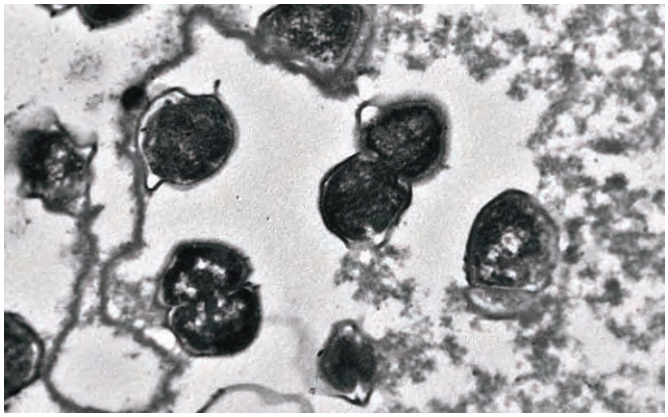
While previous research from Johns Hopkins University is successfully completing clinical trials, Kaitlin Dailey, Ph.D., assistant professor at the University of Rhode Island College of Pharmacy, is working to expand this approach to treat cancers that are difficult or impossible to access, including pancreatic cancer, one of the most challenging cancers to treat and cure.

Dailey's lab is working with the microorganism *Clostridium novyi*-NonToxic, reengineering the already non-toxic bacteria through a first-of-its-kind synthetic and engineering biology platform for targeted gene editing. These edits allow the bacteria to be injected into the bloodstream without causing sepsis, giving them a chance to access hard-to-reach tumors, including those that have metastasized, regardless of where the tumor is in the body.



Immunofluorescence microscopy of a human pancreatic ductal adenocarcinoma. The blue is DAPI - staining DNA and indicating the nuclei of cells, the pink is a molecular marker for ductal cells. (unpublished data)

"By using a bacterium as our therapeutic, we can re-prime the immune system so that not only are we able to directly target the tumor, we're also effectively vaccinating against reoccurrence," said Dailey, who is also an affiliate with the Legorreta Cancer Center at Brown University. "If we can target a tumor through intravenous inoculation, we have the opportunity to target both the primary tumor and any related metastatic tumors



Transmission electron micrograph of *Clostridium novyi*-NonToxic spores. (unpublished data)

(tumors that spread from the primary site). Essentially, we will have retrained the immune system to recognize a tumor as foreign and promote its destruction."

Dailey has already seen promising results targeting pancreatic cancer in mice trials. The next step is improving how the bacteria circulate in the bloodstream without being eliminated by the immune system before reaching the tumor.

She and her team of graduate and undergraduate students are developing genetic engineering strategies to help the bacteria temporarily evade immune detection until it reaches its target.

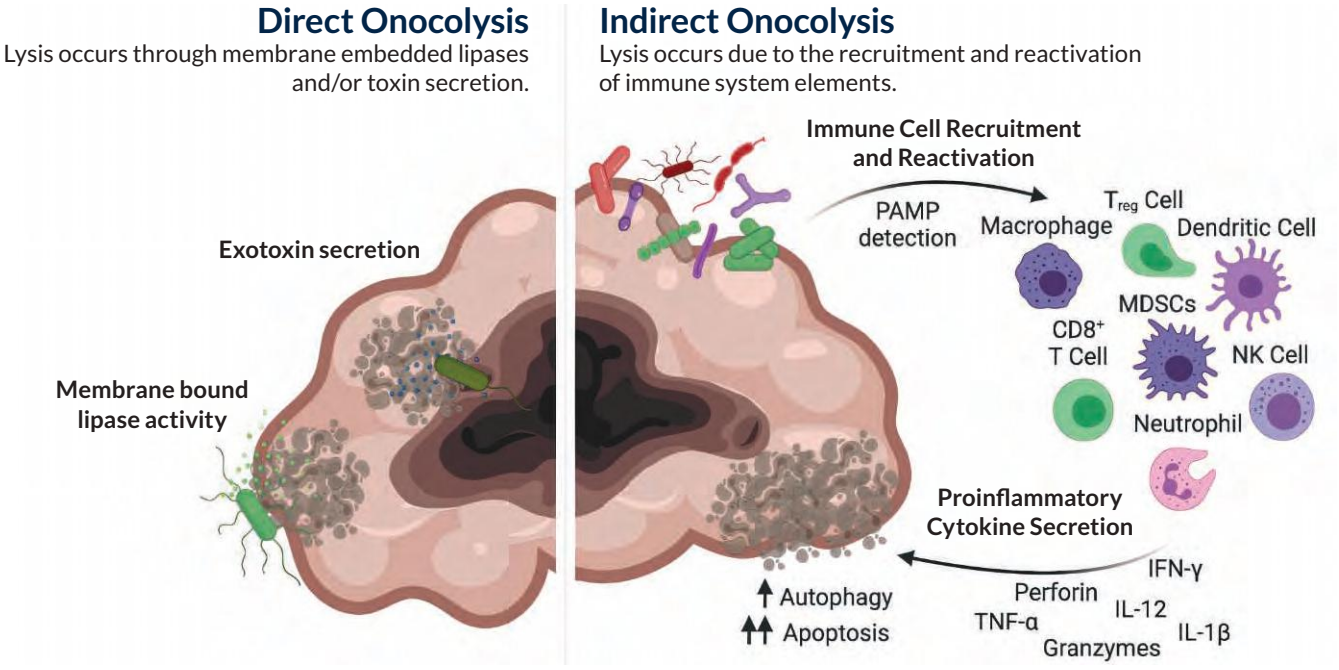
"It's a common pharmacy concept: How do we increase the amount of time that our therapeutic is in circulation?" Dailey said. "We want to safely increase the circulation time and subsequently the amount of bacteria that reaches the tumor site. That's where we are focusing our efforts right now because it's the most direct way to increase therapeutic efficacy."

Dailey's work on the development and clinical use of *Clostridium novyi*-NonToxic as an oncolytic (cancer-killing) bacterium represents a transformative approach to treating metastatic cancers, including pancreatic cancer and other solid tumors. Her research highlights the potential of translational synthetic biology to reshape cancer treatment.

After demonstrating that the bacteria can be modified while maintaining its cancer-targeting ability, her long-term goal is to advance the approach to human clinical trials.

"It might sound ambitious, but I am trying to cure cancer," Dailey said. "There are many steps along the way, but they are all focused on patient impact," Dailey said, noting that in the past she assisted in autopsies on patients who died of cancer.

"You know cancer is devastating, but seeing the extent of disease firsthand changes you,' she said. "You see that patients have no diaphragm left because the tumor has taken over their entire abdomen, or they have no liver left and it's made them cirrhotic. Nothing prepares you for those experiences. That's my guiding light. I couldn't help those patients, but I may be able to help others. Our lab's mission is to develop therapies that reach patients and ultimately help cure cancer."



*Some species are capable of both direct and indirect oncolysis

The schematic depicts an overview of the two main mechanisms in the current oncolytic bacteria literature, originally published in Dailey et al, *Future Microbiology* 2021.

INNOVATION IN RNA TECHNOLOGY, BIOMATERIALS FOR MEDICATIONS, AND CANCER CELL IMMUNE TARGETING

URI researcher Ting-Yu Shih develops advanced delivery systems to improve cancer treatment and prevent recurrence

Many cancer drugs are highly effective at killing cancer cells in laboratory settings, but are less effective once they enter the human body. Often, the challenge is not the drug itself; it is the effectiveness of how the drug is delivered, whether enough of the drug reaches the right place at the right time, or whether too much is delivered to the wrong place at the wrong time.

One potential solution lies in the use of biomaterials to improve drug delivery. Ting-Yu Shih, Ph.D., assistant professor at the University of Rhode Island College of Pharmacy, is working to enhance the safety and effectiveness of cancer treatments using biomaterials-based targeted therapies.

By using biomaterials such as lipids, peptides, polymers and proteins to encapsulate medications, Shih's approach helps guide therapies directly to tumors while reducing unintended effects elsewhere in the body. These materials act as protective carriers, allowing drugs to better reach and adhere to cancer cells while avoiding early detection by the immune system.

"Certainly, we can make better drugs, but our hypothesis is that it's a delivery problem." Shih said. "Biomaterials are a way to help us improve drug delivery. We essentially load the drug in a natural biological packaging, similar to a capsule, but at a microscopic level. The goal is to design the appropriate biomaterial as a delivery system to deliver the drug to the right place at the right time."

Encapsulation can help shield drugs from the immune system, preventing them from being cleared from the body before reaching their destination. These delivery systems can also be engineered to control sustained release of the drug, similar to time-release medications, increasing the drug's circulation time in the body and lessening the frequency a patient has to take a pill or go to a hospital to receive an injection.

"We can provide the right dose at the right time so we have good efficacy without causing toxicity," Shih said.

To further improve targeting, Shih's team is designing delivery systems that recognize specific features on tumor cells. Cancer cells often have proteins and sugars that are overexpressed on their surfaces compared with normal cells.

By coating delivery systems with targeting molecules, often antibodies, the therapies can bind more effectively to tumor cells and deliver medication directly where it is needed most.

Those proteins and sugars can also be used to introduce a training system for the immune system, using RNA technology as a cancer immunotherapy. Shih is incorporating RNA-based technology to help the body recognize and attack cancer cells. By introducing RNA that targets tumor-specific proteins, the immune system can be primed to generate a more precise and lasting response.

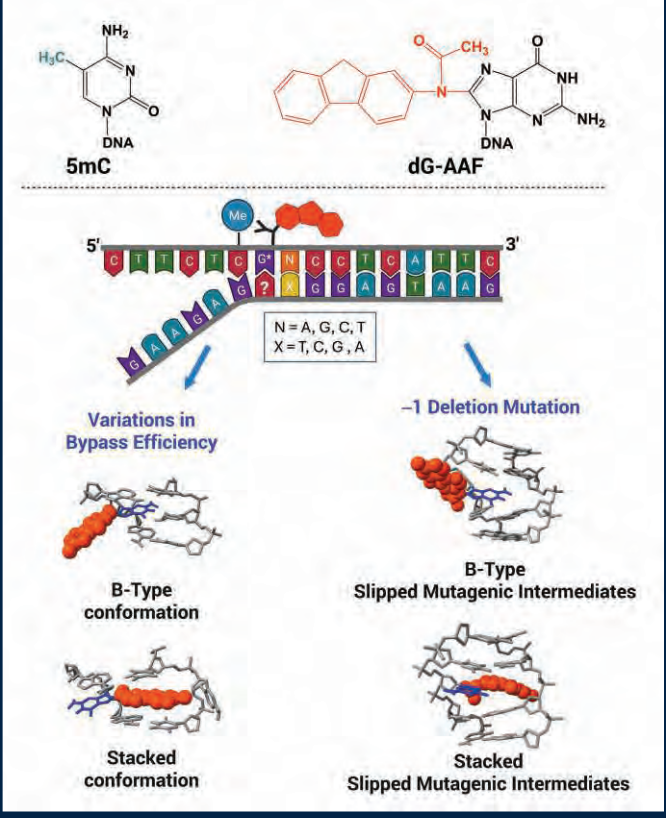
"The immune system has a memory, so even if some tumor cells survive the initial treatment, it can continue to be mobilized to eliminate those cells; you will still have immune protection," Shih said. "It's a way to attack and eliminate cancer cells. Cancer cells have a way to evolve and evade immune responses, so the potential to eliminate tumors and prevent recurrence is very difficult to achieve with traditional chemotherapy. With this system, we can potentially completely eliminate the tumor."

UNDERSTANDING CANCER THROUGH DNA DAMAGE AND REPAIR

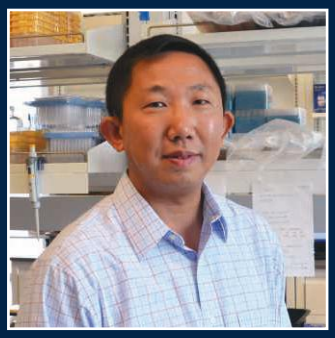
Bongsup Cho and Deyu Li study how DNA damage and repair shape cancer risk and mutation patterns

At the University of Rhode Island, Bongsup Cho, Ph.D., professor, and Deyu Li, Ph.D., associate professor, lead a collaborative research program focused on how chemical damage to DNA contributes to cancer. Their work examines how environmental toxins, therapeutic drugs and naturally occurring reactive molecules modify DNA.

By integrating organic synthesis, high-resolution structural biology, analytical chemistry and cell-based mutagenesis assays, their laboratories bridge chemistry and biology to uncover how subtle changes in molecular structure can lead to profound biological consequences. Their research helps explain why certain regions of the genome become hotspots for cancer-associated mutations.



Epigenetic modulation of bulky DNA damage: How a single methyl group on a neighboring cytosine can fundamentally rewrite the structural and mutational outcome of the dG-AAF lesion during DNA replication.



Their collaboration is supported by strong institutional support from the University of Rhode Island and the College of Pharmacy. Through sustained investment in research infrastructure, shared instrumentation, graduate education, and interdisciplinary collaboration, the College provides an environment where fundamental chemical biology can directly intersect with biomedical and translational sciences. Competitive internal programs, statewide research initiatives, and a collaborative academic culture enable the Cho and Li laboratories to pursue high-impact, externally funded research while training the next generation of scientists in cancer biology, toxicology, and medicinal chemistry.

Cho is internationally recognized as a pioneer in the field of chemical carcinogenesis and DNA structural biology. For more than three decades, his research has reshaped our understanding of how bulky DNA lesions adopt multiple conformations within the double helix and how those conformations dictate DNA repair efficiency and mutational outcomes. His work introduced high-resolution 19F NMR spectroscopy and other biophysical techniques as powerful tools to quantify lesion-induced conformational heterogeneity, establishing a new paradigm in DNA damage research.

He has published more than 90 peer-reviewed articles, many in prestigious journals, and has received continuous support from the National Institutes of Health and the American Cancer Society. His research has provided fundamental insight into how DNA damage recognition and nucleotide excision repair operate in a structure-dependent manner.

Li complements this work with expertise in chemical synthesis, DNA adduct biology, and cellular mutagenesis. Since joining URI in 2014, he has developed a nationally recognized research program in DNA and RNA damage and repair, securing multiple NIH grants.

His laboratory develops chemical and biological tools to synthesize site-specific DNA adducts, characterize their structures, and determine how they are processed by DNA polymerases and repair enzymes. Li has published

continued from page 35

extensively in high-impact journals, including the Journal of the American Chemical Society and Nucleic Acids Research, contributing to advances in understanding DNA repair mechanisms and mutation patterns linked to carcinogenic exposures.

Together, the Cho and Li laboratories form a uniquely integrated research team linking molecular structure to cellular function.

Recent collaborative papers highlight this integration. In these studies, they examined bulky DNA adducts derived from environmental carcinogens and determined how their three-dimensional conformations influence replication bypass and mutation formation. Their findings show that epigenetic methylation, specifically 5-methylcytosine at CpG sites, can dramatically alter lesion processing.

Depending on lesion size and sequence context, methylation either enhances or suppresses replication bypass and can promote distinctive frameshift mutations.

These findings reveal a previously unexplored interplay among DNA damage, mutagenesis, and epigenetic regulation, offering new insight into how environmental exposures contribute to cancer development.

Looking ahead, the team aims to expand this work from defined chemical structures to complex human disease models. Their future research will explore how DNA and RNA modifications, including environmentally induced adducts and endogenous lesions, shape mutation patterns in human cells and influence stress-responsive and repair pathways.

By combining chemical precision with genomic and cellular approaches, Cho and Li are working to connect small-molecule structure to large-scale biological outcomes, advancing our understanding of how nucleic acid modification drives cancer initiation and progression. Their goal is to translate these insights into improved strategies for cancer prevention, risk assessment and therapeutic intervention.

EXPANDING THE IMPACT OF CANCER INNOVATION

Ami Vyas studies how access, affordability and real-world use influence cancer outcomes

Over the past two decades, advances in cancer biology have transformed how many cancers are treated. Breakthroughs in targeted therapies and immunotherapies have opened new possibilities, allowing physicians to harness the body's immune system to attack cancer at the molecular level.

Yet even the most promising therapies cannot improve outcomes if patients cannot access them, afford them or maintain treatment over time.

At the University of Rhode Island, Ami Vyas, Pharm.D., Ph.D., associate professor, studies the critical links between innovation, access, and patient outcomes. Her research focuses on how cancer therapies are used in real-world settings and how clinical, economic, and social factors influence whether patients benefit from these advances.

Through large-scale data analysis, systematic reviews and population health research, Vyas is helping researchers and policymakers better understand how cancer care is delivered, accessed, and improved.

Understanding treatment beyond clinical trials

Clinical trials remain the gold standard for evaluating whether new therapies are safe and effective, but they are conducted under controlled conditions with carefully selected patient populations.

Vyas studies what happens when these therapies reach patients in everyday healthcare settings.

Using national health databases, including insurance claims and cancer registry data, she examines treatment patterns, healthcare utilization and patient outcomes. This type of research, often referred to as real-world evidence research, helps bridge important gaps between clinical trials and clinical practice.

Her research provides insights into how treatments perform across broader and more diverse patient populations and identifies barriers that may prevent patients from receiving or continuing therapies.

The challenge of oral anticancer medications

One key area of focus involves oral anticancer medications. As oncology has evolved, many treatments once administered intravenously in hospitals are now available as pills patients can take at home.

While this shift offers greater convenience, it also introduces new challenges. Oral therapies rely heavily on patients' ability to access, afford and consistently take their medications. Out-of-pocket costs, insurance coverage limitations and complex treatment regimens can all affect adherence.

Vyas studies how these factors influence whether patients begin and continue treatment as recommended. Understanding these patterns is essential to improving both effectiveness and outcomes.

Examining treatment patterns and quality of care

Vyas also investigates how cancer treatments are used across health care systems and whether patients receive therapies aligned with clinical guidelines.

Her research has explored treatment patterns among patients with conditions such as metastatic breast cancer, comparing real-world care with recommended treatment strategies.

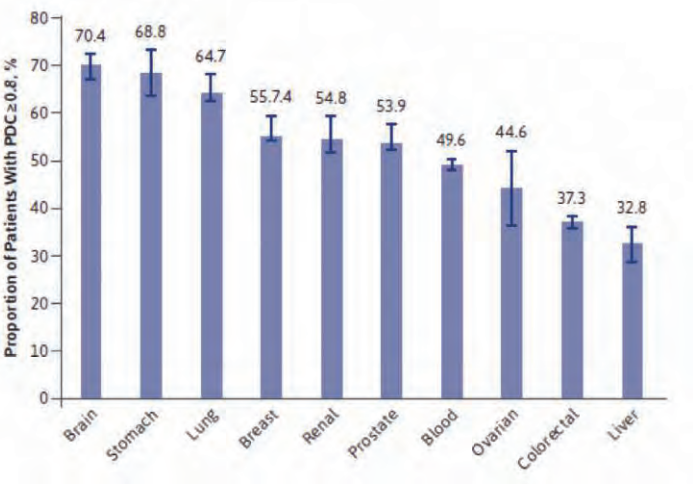
These analyses provide insight into how clinical decisions affect patient outcomes, costs and overall quality of care. By identifying gaps between guidelines and practice, her work helps inform strategies to improve care delivery.

Evaluating emerging cancer therapies

As cancer treatment continues to evolve, understanding how new therapies perform across diverse populations is increasingly important.

Vyas has contributed to systematic reviews and meta-analyses examining modern treatments,

Proportion of patients adherent to oral anticancer medications by cancer type



Adherence to oral anticancer medications varies across cancers, with slightly less than half of women with breast cancer not adherent to their anticancer medications.

including immunotherapies such as immune checkpoint inhibitors, which stimulate the immune system to attack cancer cells.

By synthesizing data across studies, her work helps clinicians and researchers better understand how these therapies perform in different patient groups and clinical settings.

From discovery to patient impact

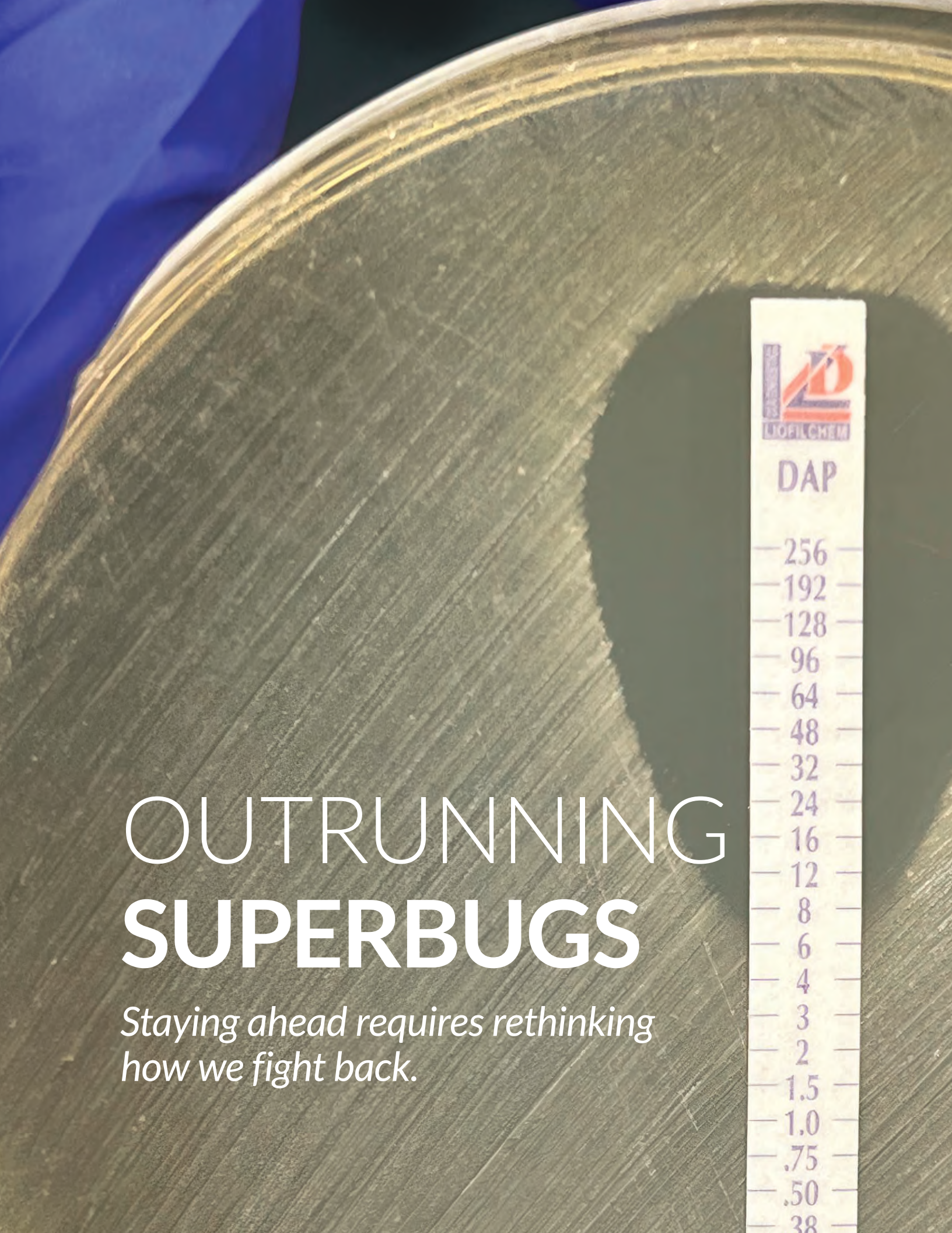
Cancer research spans disciplines from molecular biology and immunology to clinical medicine and population health. Vyas' work represents a critical link in this continuum.

While scientists develop new therapies in laboratories and clinical trials, health outcomes researchers evaluate how those therapies function once they reach patients.

By examining access, adherence, disparities and real-world outcomes, Vyas helps ensure that advances in cancer science translate into meaningful improvements in patient health.

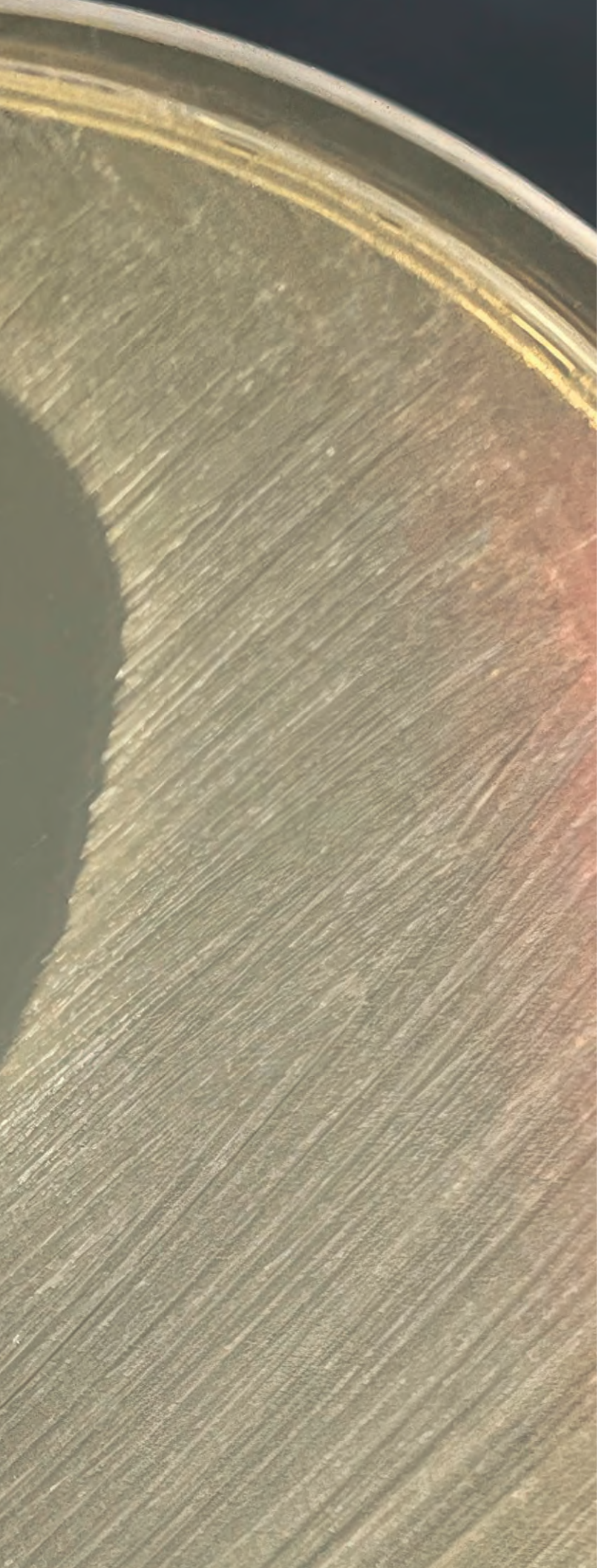
Her research underscores a central reality in modern medicine: Scientific breakthroughs are only part of the solution. How those discoveries are delivered, adopted and experienced by patients is equally important.

Through her work, Vyas is helping ensure that the promise of cancer innovation reaches the people it is intended to help.



OUTRUNNING **SUPERBUGS**

Staying ahead requires rethinking how we fight back.



What if viruses could help us fight antibiotic-resistant infections?

Naturally occurring bacteriophages are being harnessed to target dangerous superbugs.

40

What if we could edit harmful bacteria without disrupting the entire microbiome?

Precision gene editing could transform infection treatment while protecting human and environmental health.

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What if the key to fighting superbugs isn't a new drug, but using existing ones better?

Precision dosing strategies are improving outcomes against the most resistant infections.

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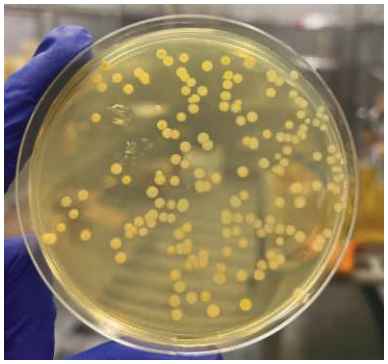
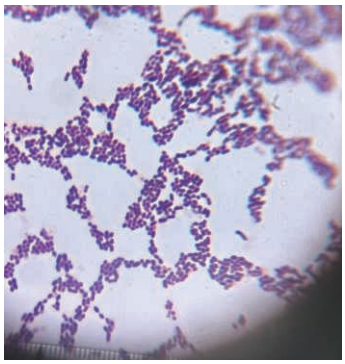
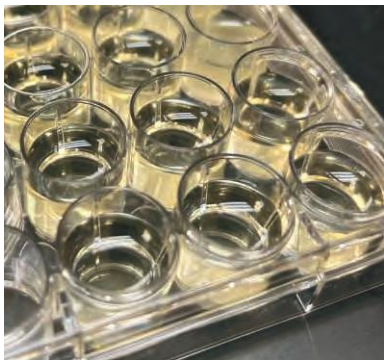




Above: Microbiologic techniques and translational in vitro and ex vivo assays used in our lab to study and combat antimicrobial resistance.

Below: Phage plaque spot assay demonstrating bacteriophage activity against a multidrug resistant (MRSA) strain.

'RHODY PHAGE COCKTAIL' AIMS TO HELP CONTROL SUPERBUGS

Callan Bleick is developing bacteriophage-based therapies to combat multidrug-resistant infections

The discovery of antibiotics transformed modern medicine, turning once-deadly infections into treatable conditions and saving millions of lives. But decades of overuse and misuse have accelerated antibiotic resistance, allowing certain bacteria to evolve into dangerous "superbugs" that evade even our most powerful drugs.

As multidrug-resistant infections become increasingly difficult to treat, researchers are urgently working to develop new strategies to combat these evolving pathogens.

At the University of Rhode Island, Callan Bleick, Pharm.D., assistant professor, is leading efforts to improve treatment for drug-resistant bacterial infections, particularly those caused by methicillin-resistant Staphylococcus aureus (MRSA), one of the most prevalent and challenging superbugs in health care settings.

"What motivates me most as a scientist is the growing public health threat of antibiotic resistance and the increasingly limited treatment options for patients with persistent infections," Bleick said. "I am especially interested in how novel antimicrobial agents interact with existing antibiotics and behave during active infection."

Bleick's research focuses on how bacteria adapt during treatment and how combining antibiotics with emerging therapies, including antimicrobial peptides, bacteriophages and natural products, may improve infection control and reduce resistance.

A central focus of her laboratory is the study of bacteriophages, viruses that naturally infect and destroy specific bacteria. Bleick and her team have collected phages from soil and water sources across Rhode Island and the broader New England region, identifying strains that effectively target MRSA.

The goal is to develop a customized "Rhody Phage Cocktail," a combination of bacteriophages paired with antibiotics to enhance treatment effectiveness and durability.

"I am driven by the question of why today's treatments often fail to clear drug-resistant infections and what we can do to make them work better," Bleick said. "Although phages are increasingly used in compassionate-use cases, there is still limited guidance on how to optimally combine them with antibiotics."

By studying the dynamics of these therapies, her research aims to generate data that support more effective treatment strategies, improving success rates while reducing resistance, side effects and infection recurrence.

Bleick has been building this research program for five years, beginning as a Doctor of Pharmacy student at URI and continuing through her postdoctoral training before launching her independent lab. Today, her research team includes undergraduate and graduate students who help design experiments and analyze data.

"Training the next generation of scientists while advancing solutions to urgent public health threats is one of the most meaningful parts of this work,"

"What motivates me most as a scientist is the growing public health threat of antibiotic resistance and the increasingly limited treatment options for patients with persistent infections"

-Callan Bleick, Pharm.D.

KILLING THE MICROBE, **NOT THE MICROBIOME**

Amanda Alker is advancing precision tools to edit bacterial DNA and reduce reliance on antibiotics

Whenever a patient presents with a bacterial gastrointestinal illness, the common response is to prescribe an antibiotic that kills the disease-causing bacteria, allowing the patient to recover. While effective, they often eliminate not only harmful bacteria but also beneficial microbes that support digestion and overall health.

Amanda Alker, Ph.D., assistant professor at the University of Rhode Island, is working to change that approach. Her research focuses on developing targeted microbiome-editing technologies that selectively modify harmful bacteria while preserving beneficial ones.

"Antibiotics indiscriminately kill the bacteria in your gut, including those that help us digest our nutrients and protect us," Alker said. "What if microbiome editing could be used as a targeted therapeutic that reduces the need for antibiotics? The potential is there, but significant foundational work is still needed. We are helping lay the groundwork for a new field."

Traditional methods in bacterial genetics typically require removing bacteria from their natural environment to manipulate their DNA. Alker's research builds on a newer technology known as CRISPR-associated transposons, or CASTs, which enable precise genetic edits directly within microbial communities.

The Alker lab inspects a petri dish containing bacteria with plasmids expressing colorful chromoproteins. **From L-R:** Elaine Rivera-Ortiz (Lab technician), Amalia Marjollet (Undergraduate researcher) and Molly Hardwick (Ph.D. student)

Her lab is working to adapt these tools to target specific bacterial species and genes associated with disease, without disrupting the broader microbiome or relying on antibiotics.

"My work focuses on understanding how bacteria interact with the environment, how they cause disease and how they can also protect against it," Alker said. "To study that, we often need to modify bacterial DNA to really understand how they function. These technologies allow us to do that within the microbiome itself, which was not possible before because we always had to remove the bacteria from their environment to perform these kinds of manipulations. We're excited to bring microbiome editing to different disease systems for the first time."

Beyond human health, Alker's research has applications for environmental and agricultural systems, including Rhode Island's growing blue economy.

One example involves oysters, a valuable regional food source that can sometimes harbor Vibrio bacteria, which may cause gastrointestinal illness, particularly in warmer months. Because antibiotic use is not a viable option in aquaculture due to concerns about resistance, Alker's lab is developing DNA-based tools that can selectively target harmful bacteria while preserving the surrounding microbial ecosystem.

Using controlled aquaculture systems, her team is testing whether these genetic tools can be delivered through water, taking advantage of oysters' natural filter-feeding behavior. As oysters filter water, they can ingest the gene-editing tools, which are designed to disrupt harmful bacterial DNA without affecting beneficial microbes.

"What if we could intervene so people don't get sick from eating oysters?" Alker said. "We are using this as a proof of concept to show that microbiome editing could become a powerful way to prevent and control disease."

If successful, this approach could extend far beyond aquaculture, offering new strategies to treat infections, reduce antibiotic use and better manage microbial ecosystems.

"We are developing genetic tools tailored to specific bacteria," Alker said. "Once we demonstrate that this system works, the possibilities are extensive."

"What if microbiome editing could be used as a targeted therapeutic that reduces the need for antibiotics? The potential is there, but significant foundational work is still needed. We are helping lay the groundwork for a new field."

- Amanda Alker, Ph.D.

ADVANCING PRECISION THERAPIES
FOR DRUG-RESISTANT INFECTIONS

Tom Lavoie studies how to optimize antibiotic use against multidrug-resistant bacteria

As antimicrobial resistance continues to rise worldwide, physicians are increasingly confronted with infections that no longer respond to conventional treatments. Multidrug-resistant gram-negative bacteria, including carbapenem-resistant Enterobacterales and *Acinetobacter baumannii*, are among the most difficult pathogens to treat and are considered urgent global health threats.

At the University of Rhode Island, Tom Lavoie, Pharm.D., assistant professor, is working to improve how these infections are treated by identifying the most effective antimicrobial regimens and optimizing how they are used in clinical care.

Lavoie's research focuses on translational pharmacotherapy, bridging laboratory discoveries with real-world treatment strategies. Through advanced pharmacokinetic and pharmacodynamic studies, his work evaluates how antibiotics behave in the body and how dosing strategies can be refined to maximize bacterial killing while limiting the emergence of resistance.

During his postdoctoral fellowship under infectious diseases researcher Kerry LaPlante, Lavoie developed expertise in in-vitro pharmacodynamic modeling, antimicrobial synergy testing, and PK/PD integration. These approaches allow researchers to simulate human drug exposures in laboratory models to evaulate how different antibiotic regimens perform against resistant pathogens.

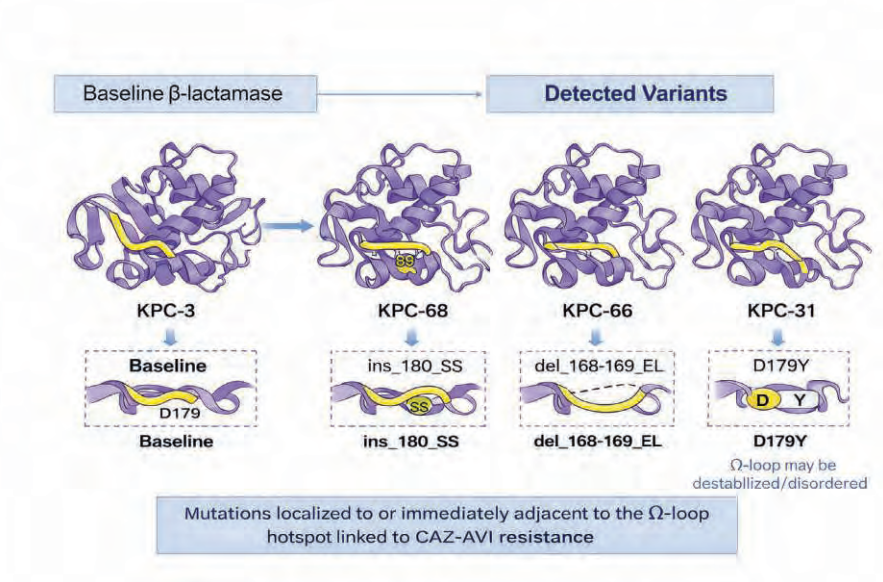
In recent studies, Lavoie examined the activity of several advanced antibiotic combinations, including meropenem-vaborbactam and ceftazidime-avibactam, against carbapenem-resistant Enterobacterales. Using simulated human drug concentrations, his research demonstrated the superior durability of meropenem-vaborbactam and a lower likelihood of resistance development compared with alternative therapies.

His research is also exploring how antibiotic effectiveness varies depending on where infections occur in the body. By simulating drug concentrations in epithelial lining fluid, a key site for respiratory infections, Lavoie showed that site-specific drug exposure can significantly influence antimicrobial effectiveness.

In complementary studies, Lavoie investigated treatments for *Acinetobacter baumannii*, another high-priority resistant pathogen. His research found that sulbactam-durlobactam combinations demonstrated greater antimicrobial activity and reduced resistance compared with traditional therapies.

As both a researcher and a clinical infectious diseases pharmacotherapy specialist at the Providence VA Medical Center, Lavoie brings a perspective that integrates laboratory science with patient care.

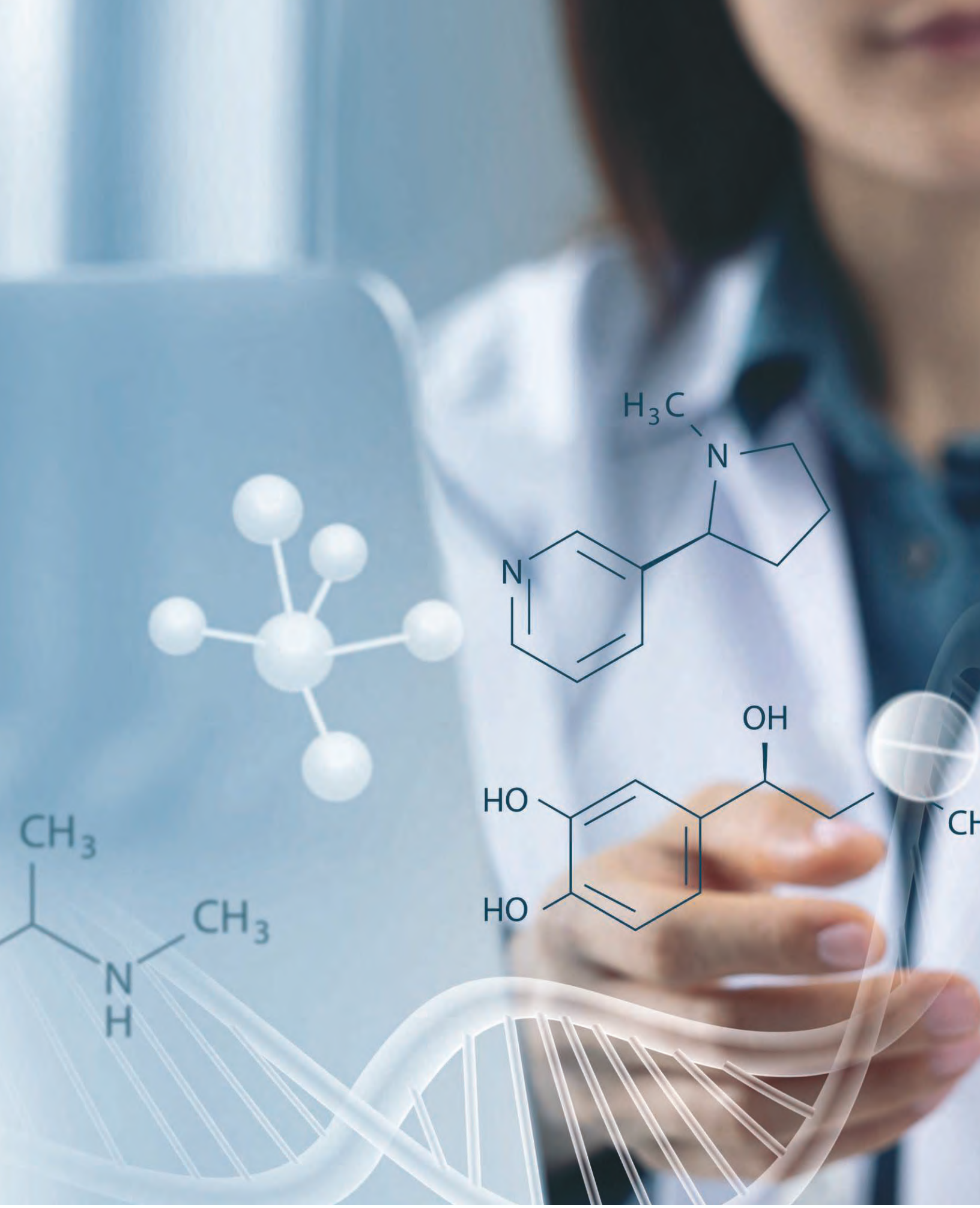
His ongoing work aims to develop precision dosing strategies that help clinicians select the right antibiotic, at the right dose, for the right infection. By combining clinical insight with advanced pharmacometric tools, his research is advancing new approaches to combat antimicrobial resistance and improve patient outcomes.



Emergence of antibiotic resistance (Ω-loop KPC variants) during simulated epithelial lining fluid exposure to ceftazidime–avibactam

PHARMACISTS LEADING THE FUTURE **OF ACCESSIBLE CARE**

Impact expands when solutions are within reach.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EXPANDING THE ROLE OF **PHARMACISTS** IN CHRONIC DISEASE CARE

Chronic diseases such as diabetes, hypertension and cardiovascular disease remain among the leading causes of illness and death worldwide. Managing these conditions often requires lifelong treatment, complex medication regimens and ongoing monitoring.

As health care systems search for ways to improve outcomes and reduce costs, pharmacists are increasingly recognized as key members of patient care teams.

At the University of Rhode Island, Joseph Nardolillo, Pharm.D., assistant professor, is helping advance this shift in care. A board-certified ambulatory care pharmacist, he focuses on improving medication management and chronic disease outcomes through pharmacist-led care in outpatient settings.

Through clinical research, direct patient care and pharmacy education, his work demonstrates how pharmacists can improve the quality, safety and effectiveness of healthcare.

Improving care in outpatient settings

Ambulatory care includes services delivered outside of hospitals, such as primary care clinics, specialty clinics and community health centers. For many patients with chronic conditions, these settings are the primary point of contact with the health care system. Community pharmacies also serve as important access points for both acute and chronic medication needs.

Nardolillo's work examines how pharmacists contribute to care teams in these environments. With specialized training in pharmacotherapy, pharmacists can optimize medication regimens, identify potential drug interactions and monitor patient responses to treatment.

In collaborative care models, pharmacists work alongside physicians, nurses and other health care professionals to help patients achieve better disease control. These teams can adjust medications, track treatment effectiveness and support patients in managing their conditions.

Research shows that pharmacist involvement in ambulatory care settings can improve cholesterol and blood pressure control, enhance diabetes management and reduce preventable hospitalizations, particularly among patients facing barriers to care.

In 2025, Nardolillo established the Innovation in Medication, Practice, and Care Transformation Lab, or IMPACT Lab, to support research focused on improving population health by expanding access to appropriate and effective medications.

Addressing challenges in medication management

For many patients, managing chronic disease involves taking multiple medications over long periods. These regimens can be difficult to follow, especially when dosing schedules, side effects and drug interactions vary.

URI College of Pharmacy researcher Joseph Nardolillo advances ambulatory care through patient-centered medication management

Nardolillo's research focuses on strategies that help patients manage these therapies safely and effectively. Through and pharmacist-led consultations, he works to improve patient understanding and confidence in following treatment plans.

These consultations may include reviewing medication schedules, discussing side effects and identifying ways to simplify regimens when possible.

Improving medication adherence is critical in conditions such as diabetes and cardiovascular disease. When medications are not taken as prescribed, patients face increased risks of complications, including heart attack, stroke and kidney disease.

By supporting patients in managing their medications, pharmacists can help reduce these risks and improve long-term outcomes.

Nardolillo also collaborates with partners across Rhode Island, New England and the United States to study patient perspectives on pharmacy services and gather insight from pharmacy professionals. This research helps inform how services can be implemented, scaled and supported through health care policy.

Advancing team-based care

Modern health care increasingly relies on interdisciplinary teams to address complex patient needs. Nardolillo's work highlights how pharmacists strengthen these teams by providing expertise in medication management.

In ambulatory care settings, pharmacists are often highly accessible providers who can answer patient questions, monitor treatment progress and communicate with physicians about medication adjustments.

This collaborative model improves coordination and allows care teams to address issues earlier, before they lead to more serious complications.

As health care systems move toward value-based models that emphasize outcomes and prevention, pharmacist-led care is becoming an increasingly important component of patient-centered care.

Preparing the next generation

In addition to his research, Nardolillo plays a key role in educating future pharmacists.

Through classroom instruction and experiential learning, he helps students develop skills in patient-centered care, evidence-based decision-making and interdisciplinary collaboration.

He also works with partners across Rhode Island, including Brown University, the Rhode Island Nursing Education Center and local public school systems, to increase awareness of pharmacy careers among students.

These efforts highlight the wide range of clinical and research opportunities available in the field.

Strengthening the future of care

As chronic diseases continue to place growing demands on health care systems, improving medication management and preventive care will remain essential.

Pharmacists are uniquely positioned to support these efforts. Their expertise allows them to help patients safely manage medications while working closely with other providers.

Through research, clinical practice and education, Nardolillo's work reflects an evolving vision for pharmacy — one in which pharmacists serve as integral members of care teams, helping improve outcomes and strengthen the health of communities.

EXPANDING OVERDOSE RESPONSE THROUGH COMMUNITY TRAINING AND ACCESS

Anita Jacobson leads a URI program bringing life-saving overdose response tools directly to communities

The Community First Responder Program (CFRP) is a community-based public health initiative developed through the College of Pharmacy at the University of Rhode Island to address the ongoing opioid overdose crisis through education, training, and the distribution of naloxone. The program delivers scalable, low-barrier overdose-response education through brief online modules, live seminars, and continuing education activities for healthcare professionals, equipping participants to recognize opioid overdose symptoms and administer naloxone (Narcan), a life-saving opioid antagonist. Individuals who complete the training can request free naloxone kits by mail, an innovative distribution model that expands overdose-response capacity beyond traditional healthcare settings, reaching individuals, families, and community organizations throughout Rhode Island and the broader New England region. To date, CFRP has partnered with more than 100 community organizations to distribute over 200,000 naloxone kits.

The program is led by Anita Jacobson, Pharm.D., a clinical professor in the URI College of Pharmacy who provides strategic direction and oversees program development. The operational team includes Catherine Ahern, MSW (Program Manager), Tammy Whan, BS, CPhT (Pharmacy Technician II), and Brad Thibodeaux, BA, CPhT (Program Coordinator),

Naloxone distribution booth events for the public (free Narcan)
Top: Anita Jacobson and Emily Lancor '24 at EMS Headquarters in Hope Valley **Middle:** Program Manager Katie Ahern, MSW at the Big Pride Flea Market in Providence **Bottom:** Jeremy Farias '25 at the Seafood Festival in Charlestown

who collectively manage training delivery, outreach initiatives, logistics, and naloxone distribution.

CFRP is supported through a combination of public funding, foundation grants, and institutional partnerships. Core support includes funding from the Rhode Island Department of Health as well as federal grants from the Substance Abuse and Mental Health Services Administration that support regional overdose-response training efforts. Additional philanthropic support, including grants from the Rhode Island Foundation, enables large-scale procurement and distribution of naloxone kits and overdose prevention supplies.

By combining accessible education, harm-reduction resources, and cross-institutional collaboration, the Community First Responder Program represents a scalable and replicable public health model aimed at mitigating the impact of the opioid epidemic through community empowerment and evidence-based intervention. The program plays a critical role in expanding access to naloxone and reducing opioid-related morbidity and mortality across New England.


"We need to invest in taking care of patients
before things are broken, instead of fixing things
when people already feel sick, sad or defeated."
-Virginia Lemay, Pharm.D.

EXPECTING PROTECTION: EVALUATING VACCINATIONS IN PREGNANCY

Virginia Lemay studies vaccine hesitancy and maternal health education

Despite recommendations from leading public health organizations that many vaccines are safe and effective for pregnant women, vaccine hesitancy among this population remains high throughout the United States.

Virginia Lemay, Pharm.D., clinical professor at the University of Rhode Island, is working to understand why many pregnant women decline vaccines and how education can improve confidence in immunization as a key tool in preventing infectious disease.

The Centers for Disease Control and Prevention recommends vaccination against influenza, Tdap and RSV during pregnancy, while the American College of Obstetricians and Gynecologists advises vaccination against COVID-19. Despite these recommendations, national data show that about 60% of pregnant women report hesitancy toward the influenza vaccine and 43% toward Tdap. Approximately half report hesitancy toward the COVID-19 vaccine, according to the National Institutes of Health.

Working with third-year professional students Emma Brouillette and Kayla Aquilante, as well as pharmacist colleagues Elizabeth Brilhante and Lisa Cohen, Lemay is studying knowledge and attitudes related to vaccination during pregnancy. Common barriers include misinformation, concerns about fetal safety and limited awareness of vaccine recommendations. Prior studies demonstrate persistent knowledge gaps, both in the U.S. and internationally, regarding which vaccines are recommended and why they are critical for maternal and infant protection.

To better understand these gaps, the team designed a 30-question cross-sectional survey of women aged 18 and older, assessing vaccine knowledge and attitudes across pregnancy stages (including childbearing age, preconception planning, pregnancy and postpartum). Their findings aim to identify key drivers of hesitancy and inform pharmacist-led education strategies to improve maternal vaccination rates.

"This research evolved from my commitment to preventive medicine and the role vaccines play in public health," Lemay said. "We need to invest in taking care of patients before things are broken, instead of fixing things when people already feel sick, sad or defeated."

Findings from the study will be presented at the American Pharmacists Association Annual Meeting in March in Los Angeles, with a manuscript in preparation.

Lemay has been a leader in vaccine education and outreach. It's a mission Lemay has held since her early career as a community pharmacist, one she continues with organizations including Walgreens and Visiting Nurse Home and Hospice.

Lemay also organizes annual immunization clinics at URI and across the Kingston campus, providing vaccines for influenza, COVID-19, RSV, pneumococcal disease, shingles, Tdap, mpox, meningitis B and HPV.

Her approach to care emphasizes prevention and whole-person health, integrating traditional medical care with wellness practices such as yoga, meditation and other supportive therapies.

Lemay's work has earned recognition both within the college and the broader community. A former president of the Rhode Island Pharmacists Association, she was named a Healthcare Hero by the Providence Business News. She was also selected by graduating students as Faculty Member of the Year.

"I am an advocate for vaccination as preventative healthcare," Lemay said. "I am equally passionate about teaching and research, particularly when it involves collaborating with pharmacist colleagues and mentoring student researchers. I started my career as a pharmacist and wanted to share the joy I have of pharmacy and caring for people with the students and hope to inspire them to embrace that same dedication and compassion."

PHARMACIST-LED CONTINUOUS GLUCOSE MONITORING **HELPS LOWER A1C, STUDY SHOWS**

Stephen Kogut leads research showing pharmacist-led monitoring improves short-term diabetes outcomes

Continuous glucose monitoring, or CGM, is an increasingly used technology that provides real-time glucose data to help manage diabetes. Despite its growing use, insurance coverage and cost remain barriers for some patients.

In a study involving researchers from the University of Rhode Island College of Pharmacy, clinic-based professional CGM (proCGM) was evaluated in a care model in which ambulatory care pharmacists used short-term CGM data to assess blood sugar patterns and make medication and lifestyle adjustments.

The findings showed that pharmacist-led proCGM services were associated with meaningful short-term A1C reductions, particularly among patients with poorer baseline blood sugar control who were not using insulin.

This project was conducted in partnership with the Care Transformation Collaborative of Rhode Island (CTC-RI), a consortium of medical practices focused on improving access, affordability, and equity in health care. In 2022, the URI College of Pharmacy, CTC-RI, and the Rhode Island Department of Health launched a quality improvement initiative to implement pharmacist-led proCGM services in six primary care practices.

Stephen Kogut, Ph.D., professor and an expert in medication outcomes research and pharmacoeconomics, led the evaluation. Doctoral student Natalya Salganik, Pharm.D., assisted with data analysis, and adjunct clinical professor Kelly Doherty Sanzen, Pharm.D., PAHM, CDOE, provided clinical direction and served as practice facilitator.

Ambulatory care pharmacists at each site recruited patients, placed sensors, reviewed CGM data and recommended or implemented treatment adjustments.

More than 400 patients across six primary care sites participated, wearing a glucose sensor for up to 14 days. Patients were eligible if they had suboptimal glucose control, discrepancies between lab results and home readings, a risk of hypoglycemia or a referral from a healthcare provider.

The sensor, about the size of a quarter, is worn on the back of the upper arm. A small filament beneath the skin measures glucose levels throughout the day, with data transmitted electronically for review. Pharmacists then met with each patient to discuss the results and adjust treatment plans.

The study showed improvements within weeks. Mean hemoglobin A1C levels, a standard measure of longer-term blood glucose control, decreased from 9.36% to 8.25%, and nearly half of all patients achieved a reduction of more than one percentage point. Statistical analysis found that baseline A1C was the strongest predictor of improvement, suggesting that patients with the poorest initial control may benefit most.

"It worked great. Many people had dramatic improvements in their blood sugar control," Kogut said. "Pharmacist-led proCGM services were associated with meaningful short-term A1C reductions, especially in patients not using insulin. This suggests that many patients who are not currently using a personal CGM device may benefit from periodic professional monitoring."

In addition to improved outcomes, the study examined patient and provider experiences. More than half of participants chose to continue using CGM devices after the program, recognizing the value of the data.

The care model was also well-received by healthcare teams. Among 51 care team members surveyed, 94% agreed or strongly agreed that the service had positively impacted patients and staff, and a majority believed the model could be sustained in primary care.

Results were published in the January 2026 issue of the Journal of the American College of Clinical Pharmacy.

"Laboratory A1C testing remains an important measure of overall glucose control. What CGM adds is insight into daily patterns, how glucose changes throughout the day, how patients respond to meals, activity, or medications. That additional information supports more precise and timely treatment decisions."

-Stephen Kogut, Ph.D.

PHARMACIST-LED RESEARCH
ADVANCING DIABETES AND CARDIOVASCULAR CARE

Tracey Taveira advances team-based care models to improve outcomes in cardiometabolic disease

Cardiovascular disease and diabetes remain leading causes of illness and death worldwide, particularly among vulnerable populations. Improving outcomes for these patients requires new care models that address both medical and social factors influencing health.

At the University of Rhode Island, Tracey Taveira, Pharm.D., professor, leads research integrating pharmacists into team-based care to improve outcomes in cardiometabolic disease. She also serves as director of interprofessional education and holds appointments with Brown University, The George Washington University and the Department of Veterans Affairs Medical Center.

Her work focuses on the prevention and management of cardiovascular disease, diabetes and related condi-

tions, particularly among veterans and individuals with limited access to coordinated care.

By integrating pharmacists into collaborative care teams, through shared medical appointments, telehealth and technology-supported medication management, she has demonstrated improved clinical outcomes, expanded access and stronger patient engagement.

Over her career, she has led and contributed to numerous externally funded studies, including work supported by the American Heart Association, the Rhode Island Foundation and the Veterans Affairs health system. Her research has informed care delivery models such as pharmacist-led telehealth group visits and large, multi-site studies in diabetes and heart failure.

Findings from her work have helped shape national policy within the Veterans Affairs health system, supporting shared medical appointments and expanding pharmacists' roles as providers with prescribing authority.

Taveira's impact extends to community and global health initiatives that address disparities in cardiovascular care, as well as to mentoring the next generation of researchers. She has also served on the American Diabetes Association Professional Practice Committee, contributing to the Standards of Care in Diabetes.

Through her research, clinical work and leadership, Taveira is helping redefine the role of pharmacists in modern health care, improving outcomes, expanding access and strengthening care for patients with complex chronic conditions.

EXPANDING THE REACH OF HIV PREVENTION

Ashley Buchanan studies how social networks can amplify the impact of HIV prevention strategies

Despite major advances in HIV treatment and prevention, young Black men who have sex with men continue to face one of the highest risks of HIV infection in the United States. Addressing this disparity requires new approaches that consider not only individuals but also the communities and social networks in which they live.

At the University of Rhode Island, Ashley Buchanan, Dr.P.H., associate professor, is leading a $3.5 million study funded by the National Institutes of Health to better understand how HIV prevention strategies can extend beyond the individual and protect entire communities.

Buchanan's research focuses on a concept known as "spillover," in which the benefits of a health intervention spread through social and sexual networks. For example, when someone uses pre-exposure prophylaxis (PrEP), to prevent HIV infection, it protects that individual while also reducing transmission risk among partners and others within their network.

Working with collaborators from the University of Chicago, Brown University, New York University, and Boston University, the research team is analyzing data from multiple studies involving young Black men in Chicago. By examining social connections, sexual networks, and neighborhood factors, the team aims to understand how prevention strategies can have a broader impact across communities.

The study also examines barriers that often limit access to care, including stigma, substance use and lack of access to healthcare services. Through advanced data analysis and collaboration with community organizations, the project seeks to identify more effective and culturally responsive HIV prevention strategies.

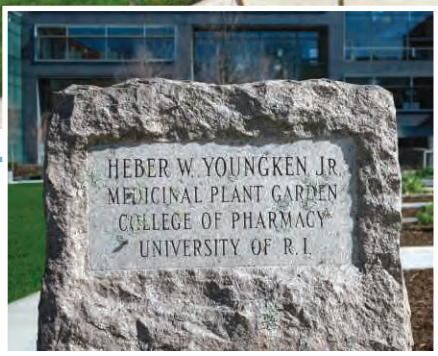
Buchanan's work supports the national goal of ending the HIV epidemic by designing interventions that reach beyond traditional health care settings. By understanding how prevention spreads through communities, researchers hope to expand the impact of life-saving tools and ensure that advances in HIV prevention reach those who need them most.

Her research highlights a critical shift in public health: Moving from individual-level interventions to strategies that strengthen entire networks and communities.

FROM NATURE **TO DISCOVERY**

The next solution may come from the most unexpected places.

FROM NATURE TO MEDICINE: A LEGACY OF DISCOVERY AT URI PHARMACY



The Heber W. Youngken Jr. Medicinal Garden connects plant-based traditions with modern drug discovery and hands-on learning

Long before modern pharmaceutical laboratories existed, many of the world's most important medicines began in nature. Aspirin traces its origins to willow bark. Digitalis, used to treat heart conditions, comes from foxglove. Even cancer therapies such as vincristine and vinblastine were first derived from compounds found in plants.

At the University of Rhode Island College of Pharmacy, this connection between nature and medicine has been central to research and education for decades.

That legacy began in 1958, when Heber W. Youngken Jr., the college's inaugural dean and a natural products chemist, planted the first medicinal garden after the college moved from Providence to the Kingston campus. As both a researcher and educator, Youngken wanted students to understand the natural origins of the drugs they studied.

The garden evolved over time, moving locations and expanding in scope before reaching its current home outside Avedisian Hall in 2013. Today, the Heber W. Youngken Jr. Medicinal Garden stands as both a living laboratory and a work of public art, created as part of Rhode Island's 1% for the Arts program and recognized with national and regional design awards.

A living laboratory for discovery

The garden contains nearly 300 plant species known for their therapeutic properties, including those historically used to treat pain, inflammation, infection and cardiovascular disease. Each plant is documented in a publicly accessible database, reinforcing the garden's role as both an educational and community resource.

For students, the experience goes far beyond observation. In experi-

ential learning courses, students collect plant samples, prepare extracts and analyze compounds using advanced techniques such as high-performance liquid chromatography and mass spectrometry. They then evaluate biological activity, gaining hands-on experience in the early stages of drug discovery.

The garden is also used across the curriculum, including courses in pharmacognosy, plant identification and the history of medicine, as well as interdisciplinary programs spanning plant sciences, landscape architecture, art and writing.

Through the HERBAL Academy, led by pharmacy professor David Rowley, Ph.D., high school students across Rhode Island are also introduced to biomedical research using the garden as a starting point. The program combines fieldwork with laboratory experience, helping students explore how natural compounds can lead to new therapies.

Building a tradition of natural products research

A key figure in advancing this work was Yuzuru Shimizu, Ph.D., a natural products chemist and expert in marine pharmacognosy. His research helped popularize the concept of "drugs from the sea," expanding the search for therapeutics beyond land-based plants.

Shimizu also played a vital role in shaping the medicinal garden itself. An avid gardener, he contributed plant specimens from his own collection and served as director of the garden. Even after his retirement, he remained actively involved, supporting the garden through volunteer work.

His influence continues today, both in the garden's living collection and in the college's broader focus on natural products research.

Connecting past and future

While the medicinal garden reflects centuries-old traditions, the science it supports is firmly rooted in modern research.

Natural products remain a critical source of new therapies, with more than 40% of approved drugs derived from or inspired by compounds found in nature. Researchers continue to study these molecules, modifying them to improve safety, effectiveness and stability.

At URI, students learn not only the history of plant-based medicine but also the scientific tools used to transform natural compounds into modern treatments.

Inspiring the next generation

Today, the medicinal garden continues to serve as a bridge between education, research and discovery.

For students, it offers a tangible connection between the natural world and the medicines they will one day help develop or dispense. For researchers, it remains a source of inspiration and inquiry. And for the broader community, it stands as a reminder that some of the most important scientific breakthroughs begin with careful observation of the world around us.

As scientists continue to search for new treatments for diseases ranging from cancer to infectious conditions, nature remains one of the most promising frontiers.

At the University of Rhode Island, that journey, from plant to medicine, continues to take root.

VIRTUAL REALITY LAB
INSPIRES THE NEXT GENERATION OF SCIENTISTS

David Rowley leads an NIH-funded program using virtual reality and hands-on research to engage high school students in biomedical science

Through a new virtual reality lab and hands-on research experiences, scientists at the University of Rhode Island College of Pharmacy are introducing high school students across the state to biomedical research and natural product discovery.

The program, called Hands on Education and Research for Biomedical and Analytical Learning (HERBAL), is supported by a $1.35 million Science and Education Partnership Award from the National Institutes of Health. Led by David Rowley, Ph.D., professor, the initiative combines virtual experiments with real laboratory experiences to spark interest in science, technology, engineering and mathematics.

Using VR headsets, students enter a simulated research lab where they investigate medicinal plants and the molecules they contain. In the virtual environment, students perform experiments such as biological assays and high-performance liquid chromatography, allowing them to explore advanced scientific techniques often unavailable in high school settings.

"The VR lab allows students to conduct experiments similar to what we do in real research laboratories," Rowley said. "It is an interactive way to introduce students to chemistry, biology and health sciences."

Students from Woonsocket High School, the Met School, and South Kingstown High School participate in the program through partnerships with URI faculty and students in pharmacy and computer science. After completing virtual experiments in their classrooms, students visit URI's Avedisian Hall during the summer to conduct research using professional laboratory instrumentation.

Working with plants from the Herbert Youngken Medicinal Garden, students investigate natural compounds that have inspired important medicines, including cancer drugs such as paclitaxel and antibiotics derived from natural products.

By combining immersive technology with real research experiences, the HERBAL program helps students build confidence in STEM fields while introducing them to careers in biomedical science.

"We see this program as a bridge between high schools and university research," Rowley said. "Our goal is to help students discover their potential as future scientists and healthcare innovators."

As the program grows, the team hopes to expand participation to additional schools and make the virtual lab platform widely accessible to educators across the country.

EXPANDING GLOBAL PARTNERSHIPS
FROM KINGSTON TO SEOUL

URI Pharmacy is strengthening international relationships to advance research, education and student opportunity

United States

South Korea

At the University of Rhode Island College of Pharmacy, research and education extend far beyond campus, reaching across borders to build partnerships that strengthen discovery and expand opportunity.

A recent university delegation to Seoul, South Korea, highlighted URI's long-standing global engagement and commitment to growing international collaborations. The visit brought together alumni, academic partners, industry leaders and prospective students to celebrate shared connections and explore new opportunities in research and education.

Dean Kerry LaPlante and other faculy members represented the College of Pharmacy, helping advance conversations around global learning and scientific collaboration. Meetings with university partners focused on expanding study abroad programs, research initiatives and cross-institutional partnerships.

The visit also marked the launch of the Rhody Abroad Seoul program, creating new pathways for students to study, intern and gain hands-on experience in South Korea. Programs like this reflect URI's broader commitment to preparing students for careers in an increasingly interconnected world.

"Education has no borders, and neither should our vision," LaPlante said during the visit.

For pharmacy students, these global connections enhance both education and impact. Exposure to different health care systems, research environments and cultural perspectives helps prepare graduates to work across disciplines and geographies.

These partnerships are more than academic exchanges. They strengthen research networks, open doors to new discoveries and create opportunities that benefit students, faculty and the communities they serve.

At URI Pharmacy, global collaboration is not just expanding reach; it is shaping the future of health care.

125 YEARS OF PHARMACY EDUCATION

The enduring legacy of the University of Rhode Island College of Pharmacy

For 125 years, the University of Rhode Island College of Pharmacy has prepared pharmacists, scientists, and health care leaders dedicated to improving human health. Today, the college is nationally recognized for its education and research, but its origins trace back to a small group of Rhode Island pharmacists who believed their profession needed stronger scientific training and higher ethical standards.

The college's story reflects more than a century of commitment to education, public health and innovation in pharmaceutical science.

A vision for pharmacy education

Efforts to establish formal pharmacy education in Rhode Island began in the late 19th century, as advances in chemistry and medicine reshaped the profession and created a need for structured scientific training.

In 1874, pharmacists from across the state gathered at the Franklin Society in Providence to form the Rhode Island Pharmaceutical Association. After receiving a charter from the state legislature in 1875, the organization became a driving force in raising professional standards and advocating for formal pharmacy education.

From idea to institution

Early efforts to establish a pharmacy school faced challenges, including limited organizational support. Still, interest persisted.

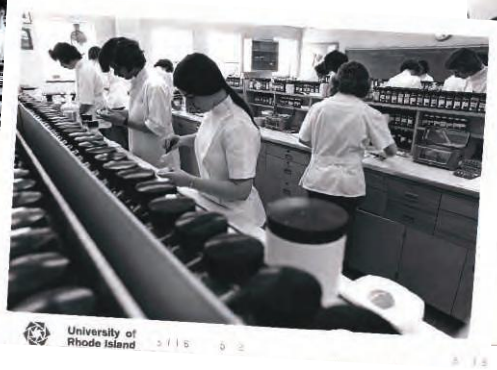
By the late 1890s, preliminary courses in chemistry and botany attracted strong participation, signaling growing demand for formal education in the field. When those efforts stalled, pharmacists took matters into their own hands.

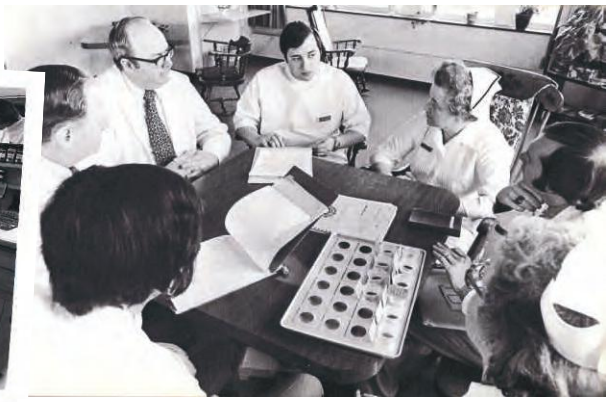
In 1902, the Rhode Island Legislature granted a charter establishing the Rhode Island College of Pharmacy and Allied Sciences. Classes began Oct. 7, 1902, in Providence, marking the start of formal pharmacy education in the state.

Humble beginnings, high standards

The early years were defined by determination and resourcefulness. With limited funding, the college relied on tuition and contributions from local pharmacists. Laboratories were modest, equipment was often secondhand and faculty frequently volunteered their time.

Despite these challenges, the college maintained high academic standards, emphasizing both scientific knowledge and practical pharmacy skills. Students were trained in chemistry, pharmacology and pharmaceutical compounding, ensuring they were well prepared for professional practice.





AND INNOVATION *(1902 TO 2027)*

Growth and impact

As the college expanded, it built strong relationships with Rhode Island's health care and public health communities. Graduates became known for their technical expertise, professionalism and commitment to ethical practice.

The college eventually became part of the University of Rhode Island, allowing pharmacy education to grow within a broader academic and research environment.

A continuing legacy

Today, the URI College of Pharmacy is a leader in pharmaceutical education and biomedical research. Faculty and students contribute to advances in drug discovery, clinical care and public health.

As the college approaches its 125th anniversary, its history reflects a consistent mission: advancing science, education and patient care.

From its beginnings in a small Providence classroom to its role today as a hub for innovation, the URI College of Pharmacy continues to shape the future of health care.

WHEN YOUR GIVING CHANGES A LIFE

INVESTING IN STUDENTS, TRANSFORMING FUTURES

At the University of Rhode Island College of Pharmacy, a scholarship does more than cover tuition. It removes barriers, opens doors and allows students to focus on becoming the health care leaders our communities need.

For many, financial support is the difference between getting by and fully engaging in the experiences that shape their future: clinical rotations, research, leadership and patient care.

"Receiving this scholarship meant I could focus on becoming the best pharmacist I can be," one student shared. "It reminded me that people believe in what we are working toward."

Many recipients are first-generation college students or are committed to serving rural and underserved communities. With donor support, they can say yes to opportunities that define their careers — instead of worrying about how to afford them.

Your support has a direct impact. URI graduates go on to care for patients, advance research and strengthen the health care workforce across Rhode Island and beyond.

Every scholarship opens a door. Every gift changes a life.

Your investment in our students today will transform the care patients receive tomorrow.

BY THE NUMBERS

$22.8M
in Research Funding
(FY2025)

#1
In New England for Research Funding*
(U.S. News & World Report)

Top 10%
Nationally in NIH-Funded Pharmacy Research
(Blue Ridge Institute, FY2024)

99%
of Pharm.D. Graduates Employed at Graduation

300+
Experiential Learning and Employment Partnerships

Top 10
Nationally for Total PGY1 Residency Matches

#1
First-year Residency Match Rate in the Northeast

THE
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