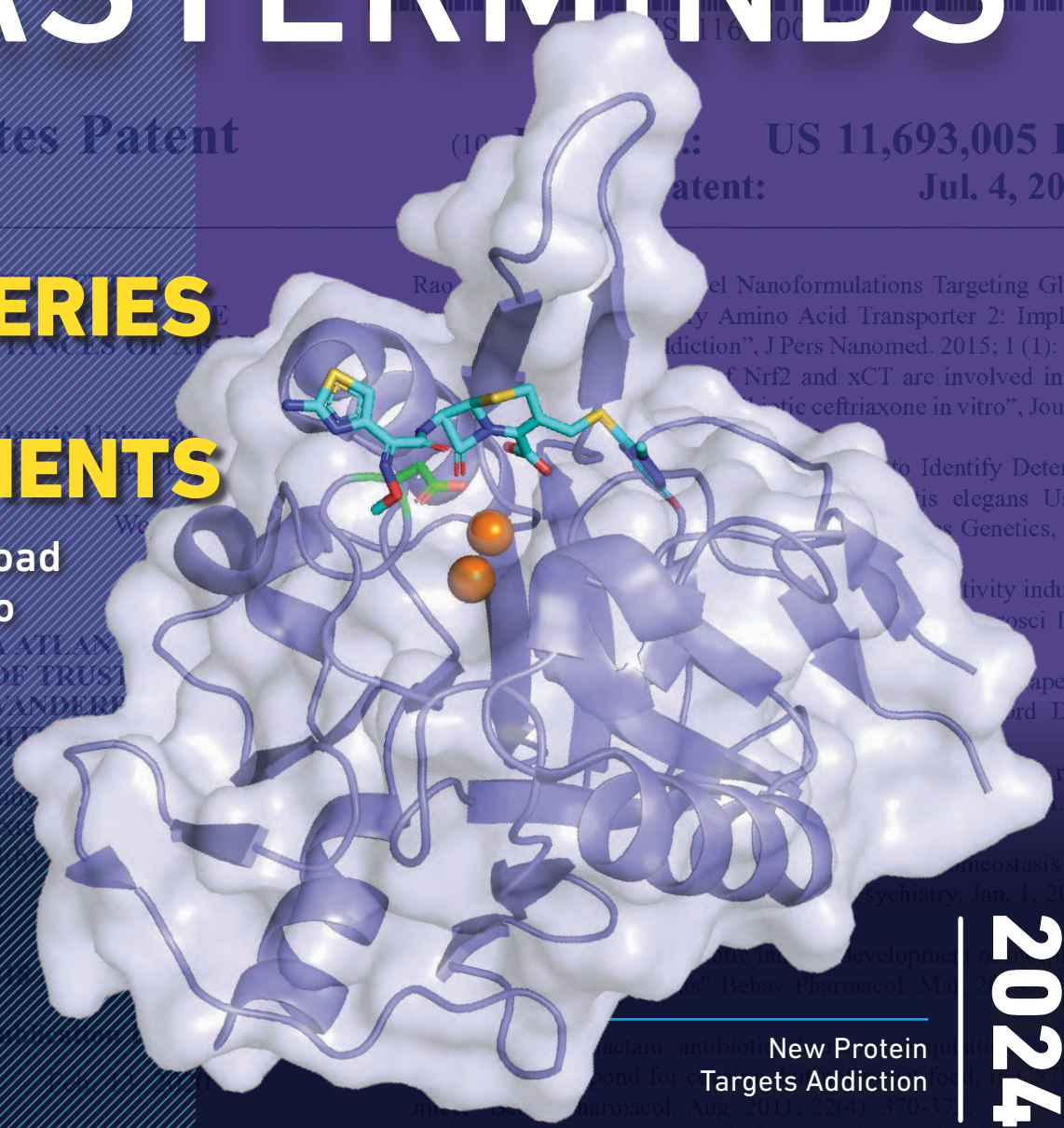
FLORIDA ATLANTIC
STILES-NICHOLSON BRAIN INSTITUTE

# MASTERMINDS

## Turning DISCOVERIES into TREATMENTS

### The Winding Road from Patents to the Clinic



New Protein Targets Addiction

2024

# MESSAGE FROM THE EXECUTIVE DIRECTOR

## WELCOME TO THE 2024 EDITION OF MASTERMINDS

Welcome to the latest edition of Masterminds. As in prior years, we highlight the cutting-edge research of the faculty and trainees affiliated with the Florida Atlantic Stiles-Nicholson Brain Institute that propels our understanding of the brain's complexities. We connect the reader to the efforts to move discoveries to the clinic, providing "a-ha" moments, discovering talents you might not have known we have, akin to the toddler realizing they might move the world. We also feature the award-winning members of our 2023 class in the Neuroscience Graduate Program (NGP) and note the ongoing efforts of some of the other high-achieving graduate students and postdoctoral fellows who energize our labs. Lastly, but certainly not least, we remind you of our committed community engagement programming that is reaching thousands of young and mature minds each year. Readers who wish to catch up on our full series of Masterminds issues can find them at ibrain.fau. edu or via the QR code on the next page.

A highlight of this issue is the Brain Institute's collaboration with the Ryan Licht Sang Foundation for Bipolar Disorder's amazing art exhibit, Insight VI. The exhibit represents the vision of Dusty and Joyce Sang, honoring their son Ryan, whose bipolar disorder took him from us, tragically, at age 24. Displayed at major galleries in Chicago, Ill., and Palm Beach, Fla., the foundation has provided Florida Atlantic with a special opportunity to host this one-of-a-kind exhibit at the Brain Institute in Jupiter, Fla. A special showing for the Florida Atlantic community is slated for March 15, followed by free, public opportunities on March 16, 18 and 19. We look forward to seeing you.

Researchers continue to chronicle the rise of an artificial intelligence-neuroscience-philosophy continuum at Florida Atlantic, with particular reference to last year's Mindfest program. The program is hosted by Susan Schneider, Ph.D., director of the Florida Atlantic Center for the Future Mind and Dietrich Professor in the Philosophy of


Mind. The center is a collaboration between the Brain Institute and Florida Atlantic's Dorothy F. Schmidt College of Arts and Letters. The 2023 event featured leading theorists and philosophers, including David Chalmers, Ph.D., professor, New York University, and Stephen Wolfram, Ph.D., computer scientist and mathematician, and creator of the program Mathematica. To further seed and lead the expansion of the discipline, the Palm Health Foundation funded awards in computational brain science and health for five fellowships to talented Florida Atlantic graduate students, whose inspired efforts and committed mentors are chronicled in these pages.

This past year, the Institute's continued efforts, through its Neuroscience Graduate Program, to attract first-rate graduate trainees was given a boost with a gift from Anna Ewing and John Capotosto, whose generosity allowed us to provide stipend-enhancing fellowships to four outstanding students entering as the class of 2023. With interests ranging from computational neuroscience to neuroimmunology to neurodegenerative disorders, these awards, were key reasons these brainiacs joined our program. An additional Presidential Award from the Florida Atlantic Graduate College to one of our trainees allowed the Ewing/Capotosto gift to be extended to the entire entering class. As we write, we are interviewing an even larger applicant pool for the 2024 class. Our fingers are crossed that the tireless efforts of our staff, faculty and students in bringing the NGP to national recognition is rewarded with additional stories of success in 2024.

While many of the activities of the Brain Institute faculty and trainees plumbed the depths of brain science fundamentals, others took opportunities to move discoveries to the clinic. We explore the path that Brain Institute scientists tread to develop new therapeutics drawn from discoveries in computational space, via gene cloning and with insights into how to transform FDA-approved medications into new therapeutics for devastating brain disorders. A common, and often bewildering step in moving basic research to the point where it may relieve suffering of those with brain disorders is the effort to secure the intellectual property rights needed to encourage companies to spend the millions of dollars to turn translate discoveries into therapies. We illuminate the partnership between our researchers and Dana Vouglitois, director of the Florida Atlantic Office for Technology Development, which has led to triumphs of securing patents.

At the next stage in the process, taking patented discoveries to the clinic, we highlight the efforts of Gregg Fields, Ph.D., Brain Institute member, who splits his spare time between his role as executive director of the Florida Atlantic Institute for Human Health and Disease Intervention and as interim vice president for Florida Atlantic's Division of Research. What Fields has led is truly inspirational. In collaboration with biotechnology company Insightec and clinical researcher Lloyd Zucker, M.D., Delray Beach Medical Center, the team has now applied focused ultrasound technology to allow for the penetration of medications into the brain that are otherwise stuck in the bloodstream, with implications for diseases ranging from Alzheimer's disease to brain cancer. As

if that's not enough, this year saw the arrival of Michael Dobbs, M.D., chair of the Clinical Neurosciences Department at the Charles E. Schmidt College of Medicine. It's certain that his faculty will make many exciting advances in the treatment of brain disorders which we will eagerly profile in future editions of Masterminds.

Once again, we provide engaging community educational programs in brain science and health, ranging from brain science lessons for children to lectures for adult learners. Although activities span the year, including our ASCEND and MobileMinds programs, a major focus of our efforts is our annual Brainy Days program, a full month of lectures and hands-on activities, sponsored this year by the Palm Health Foundation and the Cox Science Center and Aquarium. Two programs within the 2023 Brainy Days program deserve particular mention. The first was a compelling and fun lecture by naturalist and author Sy Montgomery, centered on her book "The Soul of an Octopus," which included a book signing. The second, featured a partnership of the Brain Institute, the Jupiter Osher Lifelong Learning Institute, and the Mind, Music and Movement Foundation for Neurological Disorders, involving science lectures on brain plasticity, neurodegenerative disease gene discovery, and a spirited program involving residents of Palm Beach County with Parkinson's disease demonstrating elements of dance and choral therapy. We learned so much and thank all who participated.

Welcome to the 2024 edition of Masterminds! Go team go!

**Randy D. Blakely, Ph.D.**
Executive Director, Florida Atlantic Stiles-Nicholson Brain Institute
Director, Neuroscience Ph.D. Program
David J. S. Nicholson Distinguished Professor in Neuroscience
Professor of Biomedical Science,
Charles E. Schmidt College of Medicine

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STILES-NICHOLSON BRAIN INSTITUTE

MASTERMINDS

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## World Leaders Converge at Florida Atlantic's Inaugural Mindfest

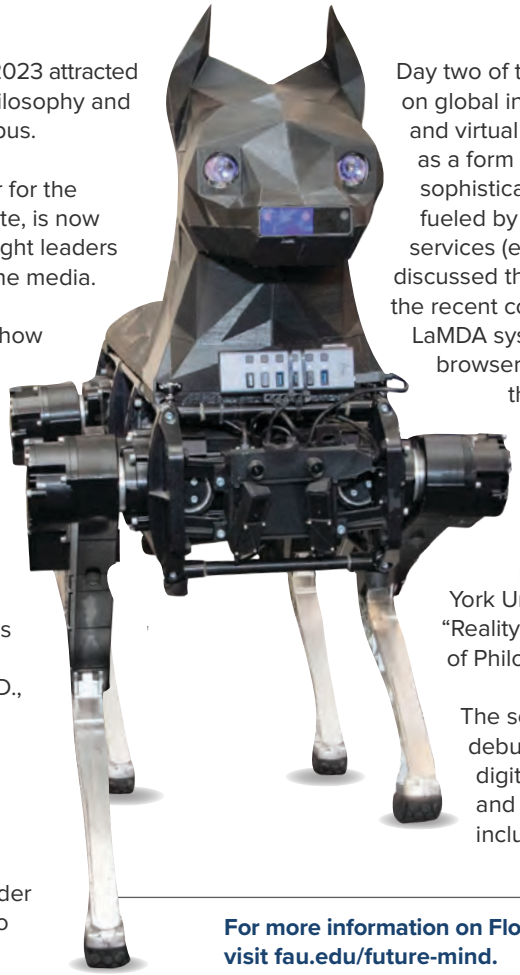
BY **Polly Burks**

Florida Atlantic's inaugural Mindfest conference in 2023 attracted more than 100 leaders in artificial intelligence, philosophy and neuroscience to the university's Boca Raton campus.

This annual conference, sponsored by the Center for the Future Mind and the Stiles-Nicholson Brain Institute, is now looked to as a place where world-renowned thought leaders bring important conversations to the public and the media.

The 2023 conference began with a reflection on how Indian philosophy illuminates the study of consciousness. Anand Vaidya, Ph.D., director of the Center for Comparative Philosophy, San Jose State University, shared how the concepts of consciousness can be expanded through analytic philosophy. This was followed by a panel on the puzzling nature of "Conscious Experience in Nonlinguistic Entities" with Claudia Passos-Ferreira, Ph.D., assistant professor of bioethics, New York University, Carlos Montemayor, Ph.D., professor of philosophy, San Francisco State University, and Garrett Mindt, Ph.D., assistant professor, Florida Atlantic's Dorothy F. Schmidt College of Arts and Letters.

In addition, center member Stephen Wolfram, Ph.D., CEO of Wolfram Research, discussed the development of large language models such as ChatGPT, and Ben Goertzel, Ph.D., CEO and founder of SingularityNet, spoke on "Three Viable Paths to True Artificial General Intelligence (AGI)."



Day two of the conference continued with a focus on global intelligence, machine consciousness and virtual worlds. Speakers explored the internet as a form of intelligence, consisting of various sophisticated chatbots and search engines fueled by large language models and other AI services (e.g., Gmail, Wikipedia). Participants then discussed the possibility of chatbot sentience and the recent controversy concerning both Google's LaMDA system and ChatGPT (on Microsoft's browser) possibly being sentient, together with the increasing ability of large language models like ChatGPT and Google's largest model, PaLM, to converse.

In a keynote, philosopher David Chalmers, Ph.D., professor of philosophy and neural science, New York University, discussed his recent book: "Reality+: Virtual Worlds and the Problems of Philosophy."

The second annual Mindfest conference debuted in February 2024 with the theme digital physics, chatbot epistemology and the future of AGI. Keynote speakers included Chalmers and others.

**For more information on Florida Atlantic's Center for Future Mind, visit fau.edu/future-mind.**

*From left: William Hahn, Ph.D., associate director, Rachel St. Clair, Ph.D., postdoctoral fellow, and George Musser, all of the Florida Atlantic Center for the Future Mind*

*From left: Michael Horswell, Ph.D., dean, Dorothy F. Schmidt College of Arts and Letters, Android Sophia, and Randy Blakely, Ph.D., executive director, Florida Atlantic Stiles-Nicholson Brain Institute*

*From left: Anand Vaidya, San Jose State University, Garrett Mindt, Ph.D., and Susan Schneider, Ph.D., both of the Dorothy F. Schmidt College of Arts and Letters, Android Sophia, Claudia Passos, New York University, and Carlos Montemayor, San Francisco State University*

*Stephen Wolfram, Ph.D., Wolfram Research*

*From left: Valery Forbes, Ph.D., dean, Charles E. Schmidt College of Science, Michael Horswell, Ph.D., Dorothy F. Schmidt College of Arts and Letters, and Stella Batalama, Ph.D., dean, College of Engineering and Computer Science*

# BRAIN BRIEFS

## Bringing Benefits to Broward

A new partnership between Florida Atlantic and the Community Foundation of Broward extends mental health-focused research and educational programs of the Stiles-Nicholson Brain Institute to Broward County residents, including veterans, children and adults.

Through a four-year, $400,000 grant from the Sharron and Joseph Ashby Hubert Fund, two research projects expand – one focused on stress in early life and one focused on post-traumatic stress disorder in veterans. In addition, the grant will fund the extension of the Brain Institute's MobileMinds program, bringing science, technology, engineering and math education through brain science and health lessons on the road and into Broward County classrooms. It also will endow a symposium on advances in brain research and mental health for both Broward's medical professionals and the public.

"Finding solutions and providing education are the most effective ways to save and improve the lives of those suffering with mental health and mood disorders, as well as reducing the negative impacts of mental health conditions on people, families and our community," said Randy Blakely, Ph.D., executive director of the Florida Atlantic Stiles-Nicholson Brain Institute, the David J. S. Nicholson Distinguished Professor in Neuroscience, and a professor of biomedical science in the Charles E. Schmidt College of Medicine.

"Knowledge increases awareness of conditions and symptoms and helps the community recognize when they or someone they know may be at risk."

VALERIY_G / ISTOCK.COM

**"The award from the Community Foundation of Broward expands our opportunity to reach thousands more with our programs."**

*– Randy Blakely, Ph.D.*


David Cinalli, Ph.D.


## Inaugural Chair

Michael Dobbs, M.D., is the inaugural chair of the Department of Clinical Neuroscience in the Charles E. Schmidt College of Medicine. The new department is strategically important to the Stiles-Nicholson Brain Institute faculty and the the translational alignment of projects, and with a significant interest in mechanisms and treatments for neurodegenerative disease. "Dr. Dobbs' hire couldn't come at a better time to provide our more basic research programs related to mechanisms and treatment of disorders such as stroke, Alzheimer's and Parkinson's diseases, as well as neuropsychiatric illnesses, a strong footing in the real world," said Randy Blakely, Ph.D., executive director of the Brain Institute.

# Searching for Solutions

**Computer Technology Provides Innovative Answers for Incurable Diseases**

BY **John Tibbetts**

Ilyas Yildirim, Ph.D., is designing computer-aided methods to help develop breakthrough treatments for genetic neuromuscular disorders such as myotonic dystrophy and Huntington's disease.

"We investigate the biology of biomolecular systems using theoretical and computational methods," said Yildirim, assistant professor of chemistry and biochemistry in the Charles E. Schmidt College of Science. "We have an interdisciplinary program at the interface of biology, physics, chemistry and computer sciences to tackle challenging problems related to human diseases."

"Drug treatments typically target proteins, but some incurable diseases do not respond to that approach," Yildirim said. Over the last 15 years, researchers have been increasingly studying how to develop treatments that can target RNA instead, he said.

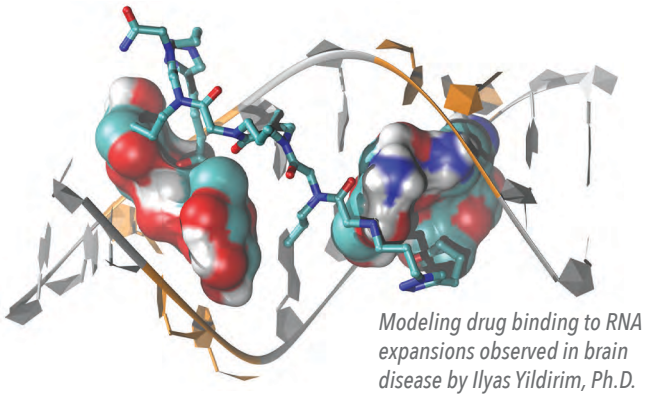
Human cells use RNA transcription to synthesize necessary proteins for proper functioning. In rare genetic cases, however, RNA can go haywire. For instance, in trinucleotide repeat expansions, also known as triplet repeat expansion, thousands of copies of a specific RNA sequence are transcribed. This leads to either the production of toxic proteins or interactions with cellular proteins, disrupting critical motor functions. Targeting these RNA molecules with small molecules can offer cures for these diseases. Several of these diseases include myotonic dystrophy type 1, a genetic disease of progressive muscle weakening and wasting; Huntington's disease, an inherited disorder that causes nerve cells in parts of the brain to gradually break down and die; and fragile X syndrome, a genetic disorder, where people do not make a protein needed for brain development.

"Currently, there are no identified solutions for many of these diseases in which the normal functions of RNA within the cell are compromised ," said Yildirim, who earned a doctorate and master's degrees in physics from the University of Rochester, New York. He earned his bachelor's degree in

> We don't do wet-lab experiments, instead, we employ computational methods to make predictions."
>
> *– Ilyas Yildirim, Ph.D.*

physics from Koc University in Turkey. Before coming to Florida Atlantic, he was a postdoctoral researcher at the University of Rochester, Northwestern University, and University of Cambridge in the United Kingdom.

RNA molecules have highly dynamic "loop" motifs, where therapeutic molecules can dock to stop genetic defects responsible for neuromuscular diseases. Yildirim and his team created novel computational methods to predict the mechanisms and reasons behind the binding of small molecules to RNA loop motifs, which can be applied in drug design.



*Modeling drug binding to RNA expansions observed in brain disease by Ilyas Yildirim, Ph.D.*

"We don't do wet-lab experiments," Yildirim said. "Instead, we employ computational methods to make predictions. We have developed a computational method called dynamic docking." This tool predicts the binding affinities and binding modes within the available energy landscape of an RNA binding site. By using this approach, researchers can determine whether small molecules are likely to target a binding site. "We believe it could predict the optimal binding mode of a small molecule that targets any type of an RNA motif," said Yildirim, who is also a member of the Stiles-Nicholson Brain Institute.

Randy Blakely, Ph.D., executive director of the Brain Institute, said Yildirim's research, which was recently published in *Biophysical Journal*, is groundbreaking and could change the future of treatment for brain disorders. "This research lays a foundation in making drugs to treat brain disorders via manipulations of RNA molecules," Blakely said.

# A New Link Between Labs

**Using Computational Neuroscience to Connect Neuroscience Specialties**

BY **Chelsey Matheson**

Advanced concepts of neuroscience, artificial intelligence, physics and mathematics can be accessible to anyone.

That's how Rodrigo Pena, Ph.D., said he approaches his work in computational neuroscience.

"I want to show people they don't have to be scared of math," Pena said. "But to expose them to this kind of research, you have to adapt the language to make it approachable and show the many opportunities for collaboration among different disciplines."

Pena discovered his interest in computational neuroscience as an undergraduate student at the University of São Paulo in Brazil. He began his studies in medical physics, but found himself drawn more to theoretical mathematics, physics and computer science.

"I didn't want to lose my connection to biology," he said, "but the hospital setting was not for me. That's when I found computational neuroscience and realized it's very interdisciplinary. It's an area where you need to have good communication skills to show that – despite all the math and physics – the questions we are trying to solve are always neurobiologically grounded."

Pena's research focuses on the computational modeling of ion channels, synapses, neurons, networks and systems, which involve many spatial scales and their interactions. He is also specialized in dynamical systems, stochastic processes, information theory and deep learning.

According to Pena, advances during the last 50 years have led to the creation of highly sophisticated mathematical models of different areas of the brain. As a result, biological neuroscientists can collaborate with computational neuroscientists to test new questions about the brain via a computer model first, allowing them to create a more educated hypothesis before they begin doing experiments in the lab.

Pena also sees computational neuroscience as a connection point between different neuroscience specialties.

> Now, with computational neuroscience, you can create models that combine data from different labs, which can lead to new understanding of the brain and new hypotheses."
>
> *– Rodrigo Pena, Ph.D.*

"Each lab's experiments are focused on a different temporal or spatial scale, which makes it difficult to connect data between different specialties," Pena said. "Now, with computational neuroscience, you can create models that combine data from different labs, which can lead to new understanding of the brain and new hypotheses."

Pena joined the faculty at Florida Atlantic in August 2023 as assistant professor in biological science in the Charles E. Schmidt College of Science and as a member of the Stiles-Nicholson Brain Institute.

Pena's lab is located on Florida Atlantic's John D. MacArthur Campus at Jupiter, a biomedical research hub that is home to the Stiles-Nicholson Brain Institute, Max Planck Florida Center for Neuroscience and the Herbert Wertheim UF Scripps Institute for Biomedical Innovation & Technology.

"I'm very busy at the moment, talking with all the different labs on campus and really trying to make those connections," Pena said. "I cannot do my work alone. I need those collaborations."

Pena's passion for collaboration is not isolated to advanced neuroscience research. One of his first initiatives on campus was to start a science and culture series, called "Synaptic Popcorn Cinema," which used films as an opportunity to get neuroscience out of the lab and classroom and make it accessible to everyone.

"The goal is to use cinema as a way to bring people together and to expose people with different backgrounds and interests to this kind of research," Pena said.

Each installment in the Synaptic Popcorn series matched a film to a research study. Attendees were encouraged to read the study ahead of the movie. Following each screening, Pena and other faculty led a discussion. Pena said the discussions encouraged attendees to think about the multiple connections neuroscience has to other disciplines, including artificial intelligence, computational science and psychology.

"There is a stereotype that a person who does math and computer science isn't very social," Pena said. "But my door is always open. I wanted to do Synaptic Popcorn so that people could interact with this kind of research in a relaxed setting where they could have discussions that would make these concepts accessible."

*From left: Andy Crider, Alina Dreps, Belle Krubitski, Tyler Sarovich, Tessa Dallo*

# New Fellows

**Budding Neuroscientists Access World-class Research Opportunities**

BY **Chelsey Matheson**

Five students recently joined the Florida Atlantic Neuroscience Graduate Program (NGP). The interdisciplinary program, administered by the Stiles-Nicholson Brain Institute (SBNI), immerses students in hands-on research that spans the breadth of neuroscience inquiry.

The NGP program provides one-of-a-kind training opportunities for those at the beginning stages of their neuroscientific careers, in three areas of emphasis: theoretical and computational neuroscience; cellular, molecular and biomedical; and neuroscience sensorimotor, cognitive and behavioral neuroscience.

During their first year, students are introduced to different areas of research through a series of three internship rotations in NGP faculty labs.

"I was attracted to the Ph.D. neuroscience program at FAU specifically for the outstanding faculty and cutting-edge research as well as opportunities for collaboration with the Max Planck Florida Institute for Neuroscience," said Belle Krubitski, a new NGP student. "I was also excited to have the ability to rotate and experience working in different labs and learning new techniques."

Krubitski was one of four new NGP students chosen as inaugural Ewing Capotosto fellows, funded by philanthropists Anna Ewing and John Capotosto to support students during their first year in the program with matching funds from the Brain Institute to support their second-year studies.

Anna Ewing

John Capotosto

"I started my career at the dawn of the digital age and have witnessed first-hand how technology can revolutionize our lives," Ewing said. "With advancements in big data and artificial intelligence, we have

## Gratitude In Their Words

"The generosity of Ms. Ewing and Mr. Capotosto enables me to focus on my studies and inspires me to make meaningful contributions to the field of neuroscience."

***– Tessa Dallo***

"The Ewing Capotosto Fellowship reduced some of the financial burden of a graduate degree and provided me the unique opportunity to attend academic conferences that may not have been feasible without it."

***– Tyler Sarovich***

"The Ewing Capotosto Fellowship played a pivotal role in my decision to come to FAU and has allowed me to pursue my academic goals with an unwavering focus and determination."

***– Belle Krubitski***

"With the help of the fellowship, I am now able to pursue my Ph.D. with significantly less financial burdens and focus entirely on my studies and achieving my career goals and dreams."

***– Alina Dreps***

## Presidental Fellow

**Andy Crider received a Presidential Fellowship from the Florida Atlantic Graduate College, a two-year award granted to first-year doctoral students who exhibit superior qualifications as determined by the NGP admissions committee**.

the opportunity to accelerate our discovery of new treatments and cures, and SNBI has a leading role to play in this journey."

Ewing also cited the NGP's interdisciplinary approach as an important factor in wanting to support students in the program.

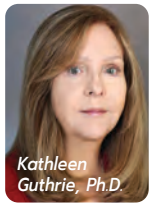
"The diversity of experience, coupled with cutting-edge research capabilities, facilitates new discoveries, and we want the best and brightest students to lead this research," she said.

Fellows were selected based on academic performance and high potential for success as graduate students, according to Randy D. Blakely, Ph.D., executive director of Brain Institute and director of the NGP. "This fellowship helps these promising young scientists shed some of the financial burden of pursuing their doctorates so they can focus on developing their knowledge and skills and take full advantage of the world-class research opportunities available to them at FAU," he said.

## Tracking Down Talent

Two women behind the recruitment of students to the Neuroscience Graduate Program (NGP), spearhead the educational program, including rotations, laboratory selection and awarding degrees.

Kathleen Guthrie, Ph.D., professor of biomedical science, Charles E. Schmidt College of Medicine, is the assistant director, Education, Florida Atlantic Stiles-Nicholson Brain Institute, and Linda Petersen, is a coordinator of the NGP.

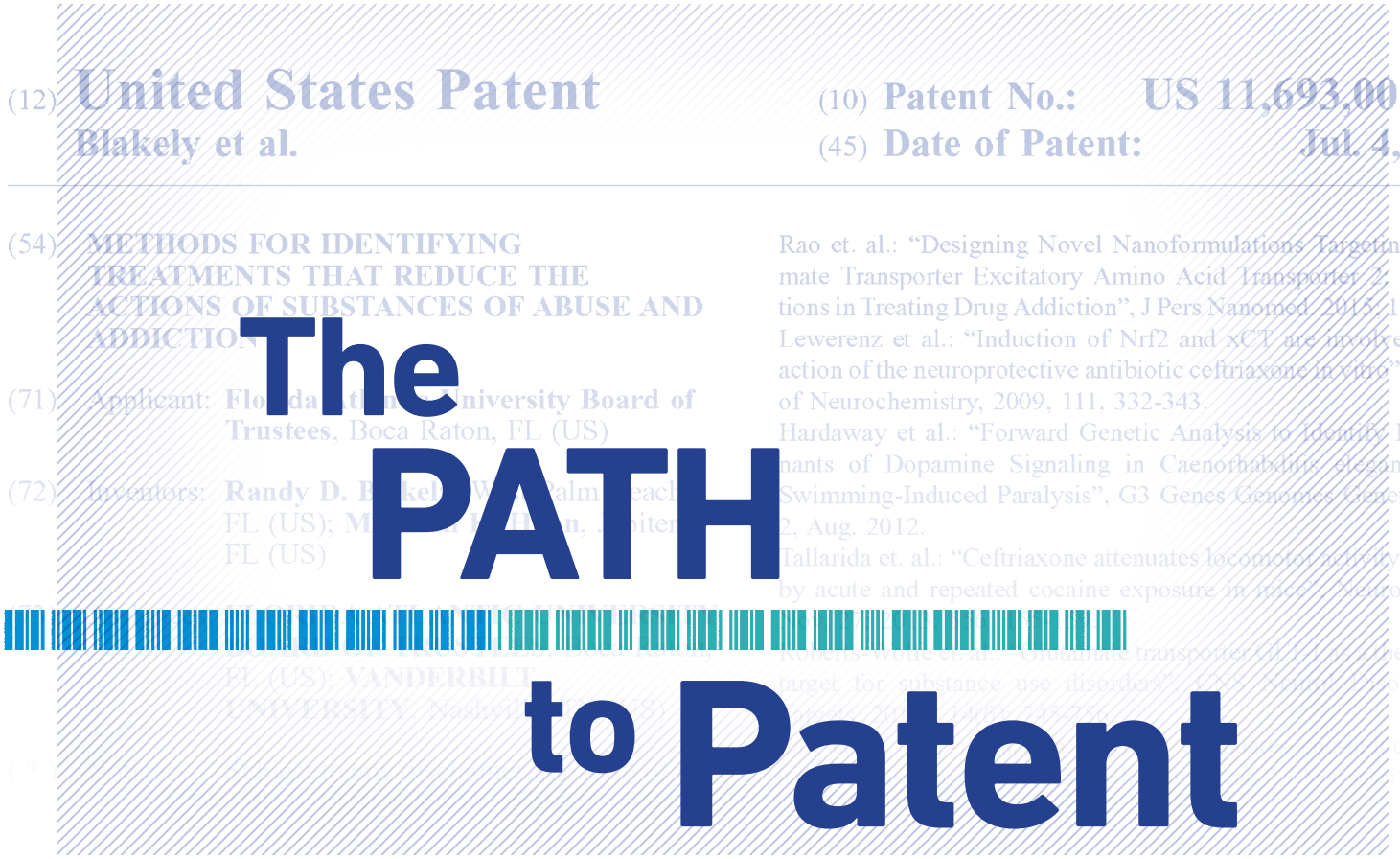


*Kathleen Guthrie, Ph.D.*

Guthrie, who earned a doctorate in neuroscience from the University of California, Irvine, leads the Guthrie Research Laboratory, which investigates the development and survival of new neurons in the adult brain in mouse models of neurological disorders, including Huntington's disease, epilepsy and autism spectrum disorders, said Randy Blakely, Ph.D., executive director of the Brain Institute. "Kate is an experienced researcher who knows what it takes to succeed in academic neuroscience and how to help the trainees make good choices as they move from their first steps in the program to walking across the stage with their diploma," said Blakely, adding she also serves on the editorial board of the *Journal Scientific Reports*.

*Linda Petersen*

Petersen earned a bachelor's degree in computer information science from Missouri State University, and began her career with the Missouri Department of Justice. Her career led her to Boca Raton, Fla., where she was in education for eight years at Spanish River Christian School. In 2014, she started working for the Graduate College and soon transitioned to the Brain Institute. "Linda brings experience from her prior role at the Graduate College to help manage recruitment of students and see them through to graduation," Blakely said. "Heir guidance is at the heart of the NGP program."


# The PATH to Patent

## Protecting Ideas to Inventions

BY **Jeff Brooks-Gillies**

For brain scientists chasing breakthroughs that could one day help patients of neurological diseases, their inventions face a long journey from the "eureka" moments to the market.

Before pharmaceutical companies are ready to take the risk of developing and commercializing new medicines, therapies or other tools that were born in the university laboratory, they'll need the peace of mind provided by patent protection.

Randy Blakely, Ph.D., is the executive director of the Florida Atlantic Stiles-Nicholson Brain Institute and has a dozen patents to his name. He knows how complicated the patent process can be, and he credits support from university personnel and resources with making it as painless as possible.

"A good technology transfer office and a good patent lawyer? In this process, they're worth their weight in gold," said Blakely, the David J. S. Nicholson Distinguished Professor in Neuroscience and a professor of biomedical science in Florida Atlantic's Schmidt College of Medicine.

At Florida Atlantic, the face of that process is Dana Vouglitois, associate director of the Office of Technology Development. Vouglitois is a patent attorney and the point of first contact for Florida Atlantic researchers with an invention that would benefit from intellectual property protection. She serves as a liaison between the researchers and the consultants, lawyers and industry partners who all play a role in patenting and commercializing a new discovery.


*Vouglitois holding the Chapter of Excellence Award, presented to Florida Atlantic's chapter of the National Academy of Inventors (NAI) during the national NAI Annual Meeting in 2023.*

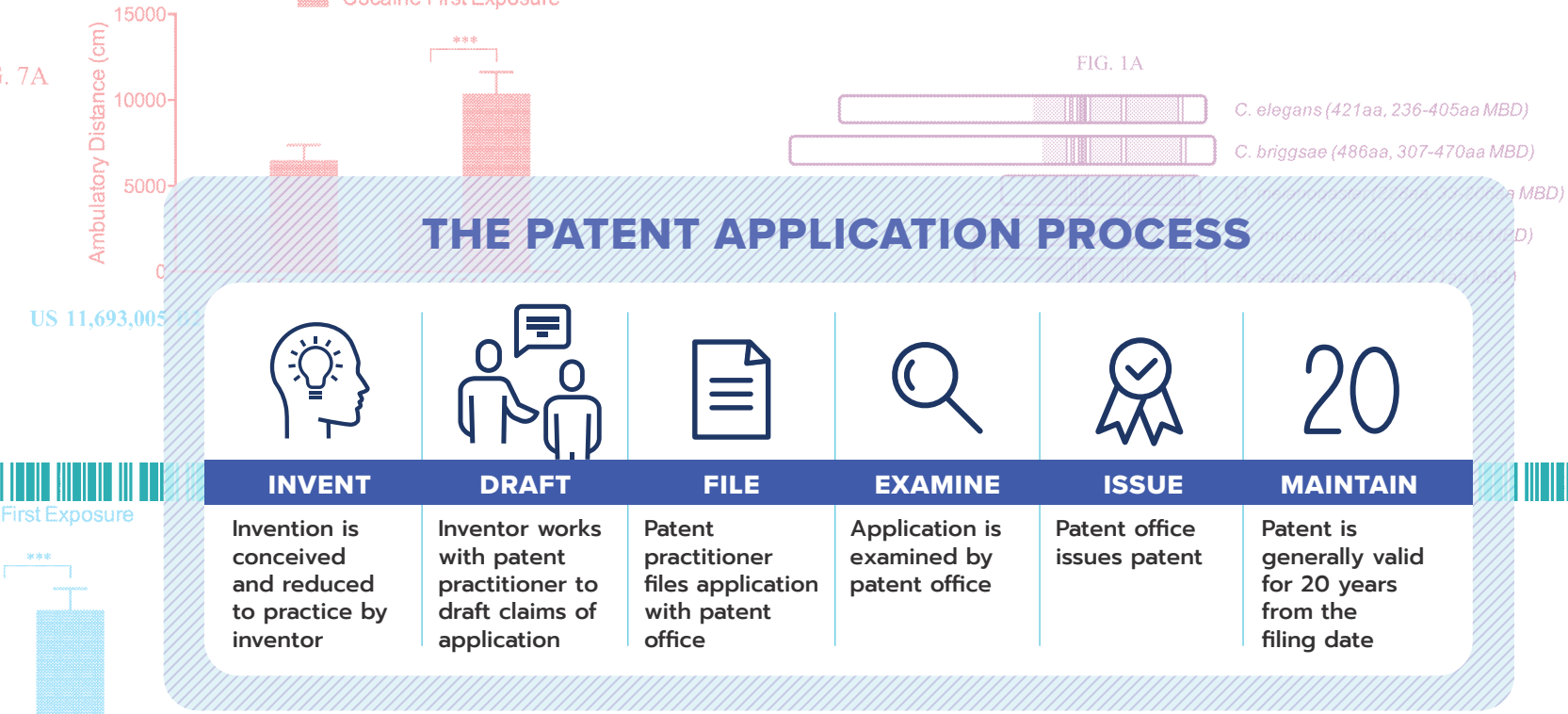
> It's my job to be able to communicate the technology transfer process in a way that academic researchers who might not have any experience in this area can understand."
>
> *– Dana Vouglitois*

"It's my job to be able to communicate the technology transfer process in a way that academic researchers who might not have any experience in this area can understand," Vouglitois said. "And vice versa: I need their assistance to understand exactly what it is that they've developed."

It's important to get an early start, Vouglitois said. A discovery's patentability can be impacted if it has been publicized, especially through academic papers or presentations. Publicly disclosing an invention bars patent protection in most of the world, while the U.S. allows a one-year grace period between disclosure and filing a patent application.

The first formal step in the university's technology transfer process is filing an invention disclosure. This is a confidential document where researchers describe the details of their invention and its development. It's a place to differentiate between their work and what's already in place, including how it might improve on existing solutions. They'll also report the sources used to fund their research, some of which may have terms that impact intellectual property rights.

After meeting with the inventors to ask questions, clarify and finalize the disclosure, Vouglitois works with an outside consulting firm to conduct an assessment of the innovation's commercial potential. The firm uses its international expertise of the market to advise whether the university should invest the tens of thousands of dollars required to obtain a patent.




"That's the objective resource that my office uses to make a judgment call as to whether we move forward with an innovation," Vouglitois said. "Or maybe whether we return it to the inventors and recommend they perform some additional research and development before we're ready to work with them."

If the market assessment is promising, the next step is typically to file a provisional patent application. This work goes to an outside law firm that specializes in working with university technology transfer offices and can match the invention with a patent attorney with the requisite expertise.

The provisional patent application is like a placeholder — a stake in the ground that establishes a filing date that grants priority over any others that may try to file a patent application for the same invention.

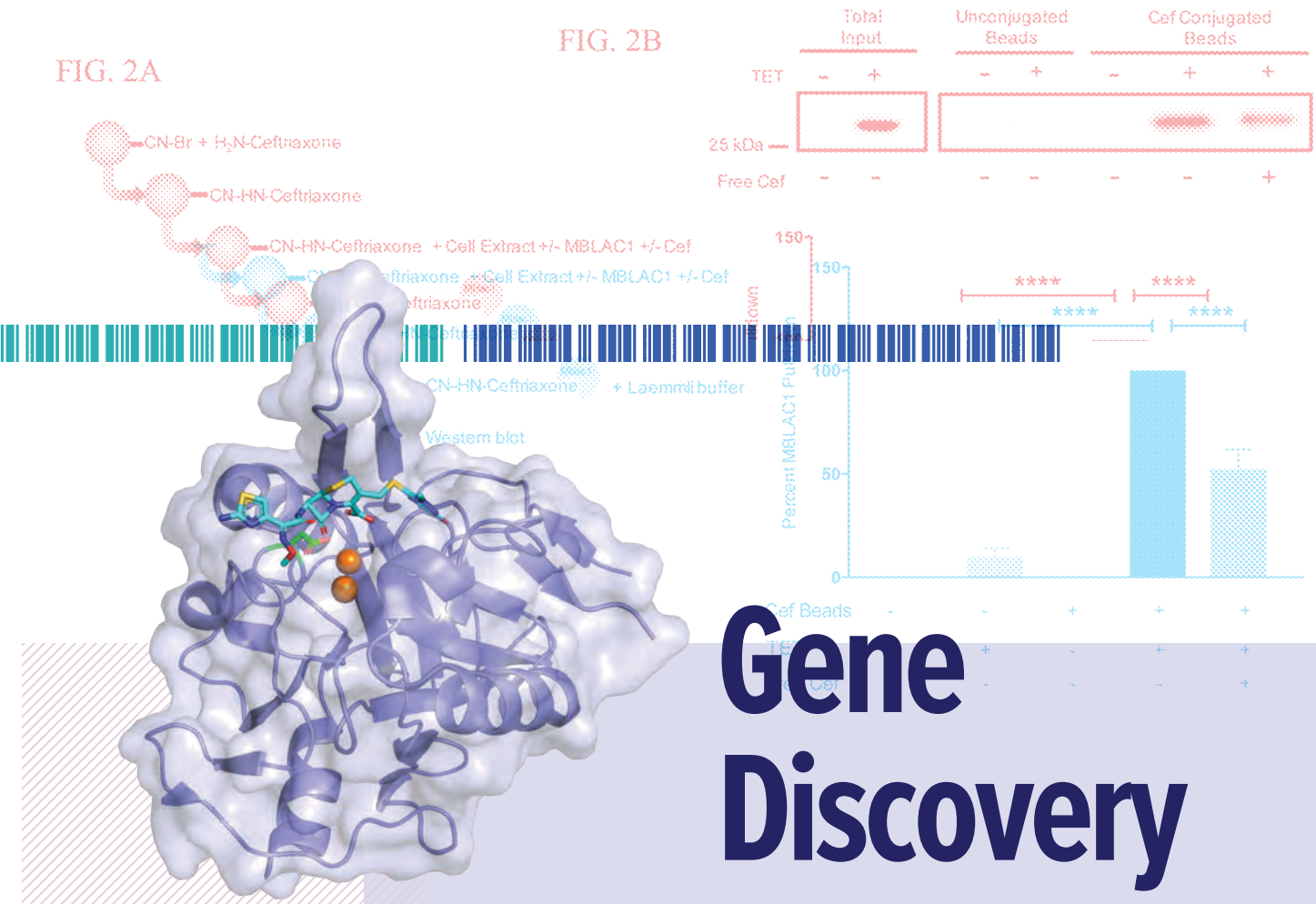
The patent attorney drafts the patent application with feedback from the researchers. Vouglitois strives to make this as collaborative and transparent for the inventors as possible. She makes sure the communication between lawyers and researchers is clear and thorough so they're aware of where things stand throughout the application.

In the meantime, the inventors continue to develop and improve their invention and generate more data, taking into consideration recommendations from the market assessment. Vouglitois prepares marketing materials, including a brief, nonconfidential summary that features a high-level description of the invention, its benefits and applications. She and the consulting firm will use this summary to pique the interest of companies that may be interested in pursuing a partnership with the university to develop the invention.

If a patent is awarded and the invention attracts interest from industry, one possible outcome is a license agreement between the university and a company. This gives the business permission to use the underlying intellectual property rights to commercialize the invention. The university maintains ownership of the patent, requiring the company to meet certain milestones and comply with other terms as it brings the invention to market.

A successful technology transfer process doesn't all come down to patents and license agreements. A company that doesn't yet see a viable commercialization opportunity could still seek another kind of partnership that could be just as fruitful for scientists and the university. That could mean sponsoring research in a faculty member's lab or providing internship and job opportunities for students.

"I want this to be a positive experience for everyone from start to finish," Vouglitois said. "Whether that's receiving a patent that provides them with opportunities for professional accolades, or building a partnership with a company that helps bring their idea to the market so that people are benefiting from it in a significant way. I want people to feel like there is a benefit to working with my office, because that's what I'm here to do."



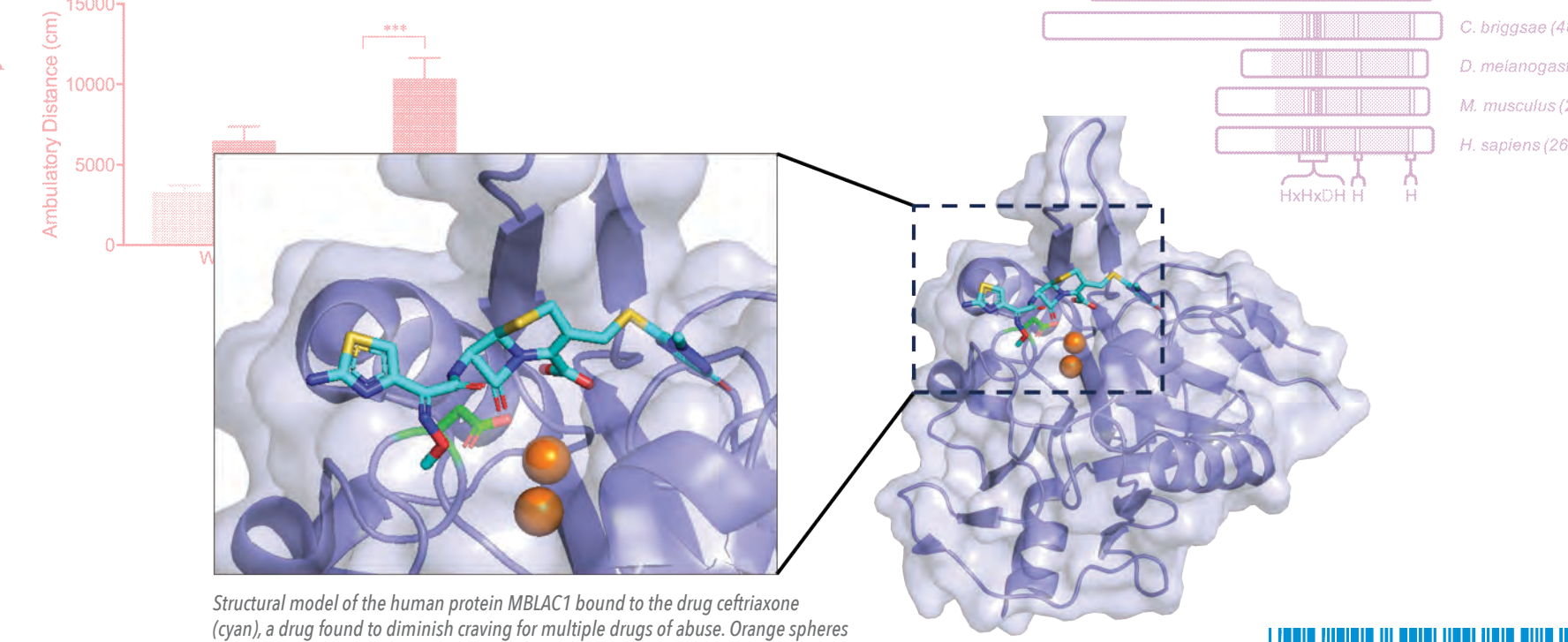

# Gene Discovery

Randy Blakely, Ph.D., executive director of the Florida Atlantic Stiles-Nicholson Brain Institute, and co-inventor Maureen Hahn, Ph.D., research associate professor of biomedical science in the Charles E. Schmidt College of Medicine, were awarded a patent in 2023 for a novel use of the protein MBLAC1 in screening for potential therapeutic agents to treat drug addiction.

Before their work on this patent, other researchers had shown the beta-lactam antibiotic ceftriaxone could diminish the signs of neurodegenerative disease and addiction in animal models, but they weren't sure how the repurposed antibiotic functioned. In 2018, the Blakely lab established that MBLAC1 is a major, if not exclusive, high-affinity target for ceftriaxone in the brain.

To investigate the potential for MBLAC1-targeted drugs to limit the effects of abused substances, the Blakely lab next developed a mouse with a disrupted MBLAC1 gene.

"The question was: if we preclude expression of MBLAC1 in mice, would we lose the beneficial effect of ceftriaxone in suppressing signs of chronic cocaine use," Blakely said. "And if that's the case, then we might have something with clinical potential, and something therefore we should patent."



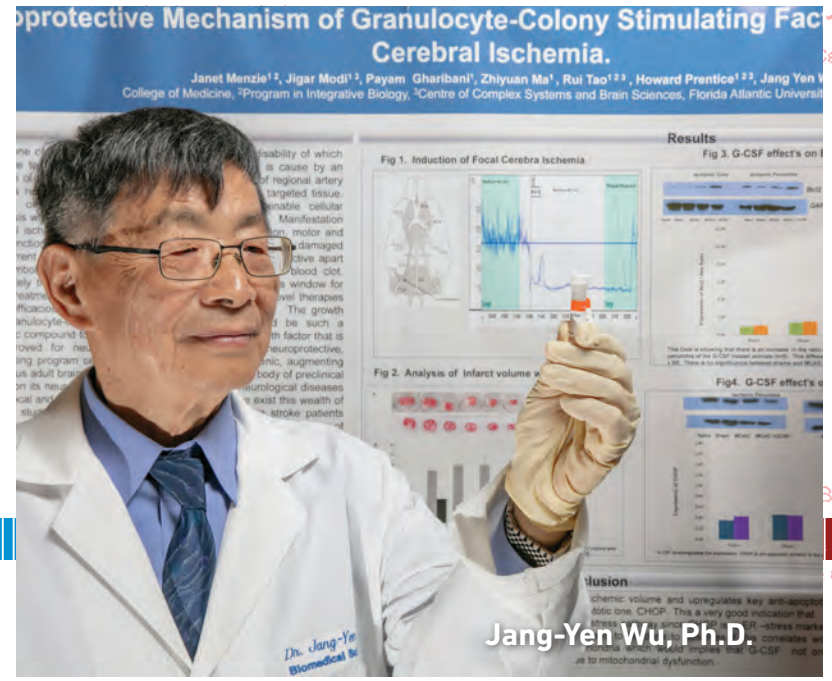

*Structural model of the human protein MBLAC1 bound to the drug ceftriaxone (cyan), a drug found to diminish craving for multiple drugs of abuse. Orange spheres represent two zinc ions that, along with an extension of the MBLAC1 protein (green), support the enzyme activity of MBLAC1 blocked by ceftriaxone. Model provided by Cristina Fenollar Ferrer, Ph.D.*

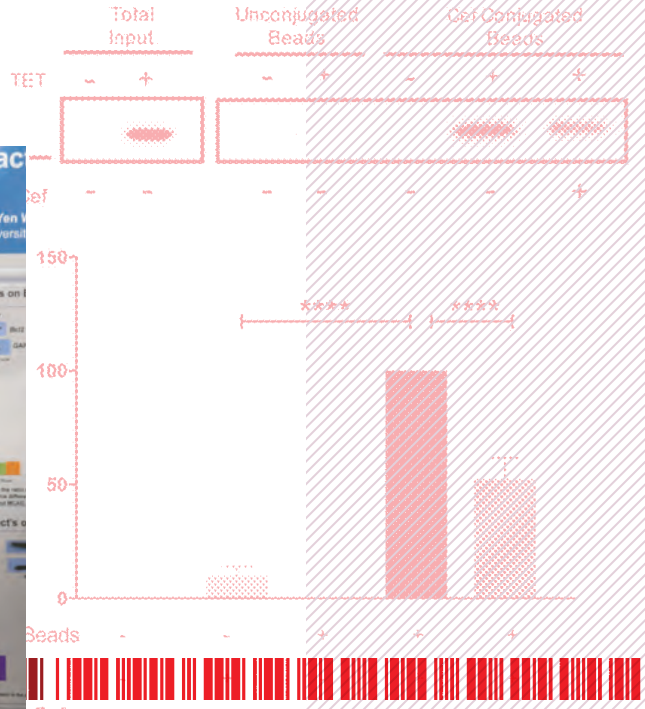

**Randy Blakely, Ph.D.** **Maureen Hahn, Ph.D.**

This proved to be correct: mouse studies led by Hahn comparing wild-type mice without MBLAC1 showed that the protein was necessary for ceftriaxone to mitigate behavioral effects of cocaine exposure, including an enhanced response to the drug that arises with cocaine withdrawal, known as sensitization.

Their awarded patent describes methods to use this discovery to screen for therapeutic agents that enter the brain more efficiently than ceftriaxone and can bind to MBLAC1 with even greater affinity in order to treat addiction symptoms.

"We have a patent on the use of MBLAC1 in the context of substance abuse, but there is so much more to do," Blakely said. "We only scratched the surface with respect to the targeting of MBLAC1, but we have cleared an initial, important hurdle in bringing this opportunity to improved drug screening in a disease with precious little to offer."




# Stroke Treatment

Jang-Yen Wu, Ph.D., a Senior Schmidt Fellow and professor of biomedical science in Florida Atlantic's Charles E. Schmidt College of Medicine, is a prolific researcher of neurological diseases and no stranger to the patent process.

"He's what I like to call a repeat customer," said Dana Vouglitois, associate director of the Florida Atlantic Office of Technology Development.

Wu's most recent discovery to earn a patent is a novel treatment for ischemic stroke. The patent describes the use of the compound carbamathione — called carb for short — to protect brain tissue and minimize the size of infarct associated with a stroke injury.

Part of what makes carb therapy for stroke so promising is that the compound is an active metabolite of the drug disulfiram, which has been approved by the Food and Drug administration since 1951 to treat alcohol dependence. As the byproduct of a drug that has been used safely for so long, carbamathione could be expected to similarly show minimal side effects.

Carbamathione targets the excess glutamate that is believed to be responsible for the death of neuronal cells following a stroke. While too much glutamate can cause excitotoxicity, it is an essential neurotransmitter for normal brain functions.

"Many glutamate antagonists have failed clinical trials because they blocked glutamate transmissions, which obviously has severe side effects," Wu said. "And the drug that we have just developed is unique in a sense that it only partially antagonizes the glutamate receptor activity."

# Silencing the Stigma

## Art Gives a Voice to Bipolar Disorder

BY **Cara Perry**

Building awareness and understanding of bipolar disorder are the key goals of the Ryan Licht Sang Bipolar Foundation, whose founders created a traveling art exhibit in 2017 of work by artists battling the serious brain illness.

The exhibit, called *Insights at the Institute: Creativity and the Bipolar Brain,* the sixth annual exhibit in the series, is coming to the Florida Atlantic Stiles-Nicholson Brain Institute as part of the annual Brainy Days, a month-long celebration of neuroscience research.

"Art is a powerful form of expression, and we are thrilled to join forces with our friends at The Ryan Licht Sang Bipolar Foundation in fighting social stigmas around this disease and underscoring the need for more early-onset bipolar disorder research," said Randy Blakely, Ph.D., executive director of the Brain Institute.

The Ryan Licht Sang Bipolar Foundation was founded by Joyce and Dusty Sang in memory of their only child, Ryan, who struggled with bipolar disorder and passed away at age 24. The foundation is dedicated to fostering awareness, understanding and research for early-onset bipolar disorder. The foundation's signature initiative, called Quest for the Test, is aimed at funding research to develop an empirical, biomarker test for bipolar disorder to aid early detection and intervention.

"Understanding the mechanisms and causes of mood disorders will open an enormous door through which new therapies and treatments will be discovered," according to Dusty Sang. "The work of FAU's Stiles-Nicholson Brain Institute, under the outstanding direction of Dr. Randy Blakely, has come online at a time when discoveries, once thought to be science fiction, are becoming a reality."

Joyce Sang agreed. "We are honored and excited to bring Insights VI to the Institute," she said. "Together, we are shining a bright light on the path to greater societal awareness and understanding of bipolar disorder."

IF YOU GO ...

WHAT:
**Insights at the Institute: Creativity and the Bipolar Brain, by the Ryan Licht Sang Bipolar Foundation**

WHERE:
**Stiles-Nicholson Brain Institute, Jupiter**

WHEN:
**Saturday, March 16, 1 to 5 p.m.,**

**Monday and Tuesday, March 18 and 19, 5 to 8 p.m.**

MORE INFORMATION:
**ryanlichtsangbipolarfoundation.org/insights-i/**

**Victoria Loeb**
Chicago, Ill.

**Title:** Face II | 2016

**Category:** 2-D Art
**Dimensions:** 14"H x 14"W x 0.01"D
**Materials:** Oil Pastels

**Christina D. Encinosa**
Boynton Beach, Fla.

**Title:** Fire and Water | 2016

**Category:** 2-D Art
**Dimensions:** 12"H x 9"W x 0.01"D
**Materials:** Colored Pencils on Paper

**Susan Martin**
St. Petersburg, Fla.

**Title:** Head in the Clouds | 2023

**Category:** 2-D Art
**Dimensions:** 30"H x 24"W x 1.5"D
**Materials:** Mixed Media on Canvas

**Margaret Minardi**
Fort Salonga, N.Y.

**Title:** Daydream | 2018

**Category:** 2-D Art
**Dimensions:**
30”H x 22”W x 0.1”D
**Materials:** Colored Pencils and Acrylic

**Judy Polstra**
Tamarac, Fla.

**Title:** She is Complicated | 2022

**Category:** 2-D Art
**Dimensions:**
16”H x 16”W x 0.5”D
**Materials:** Hand Embroidery on Antique Textile and Found
Photo Transfer

## KELLY MATHEWS

**Foundation Artist-in-Residence**
Chicago, Ill.

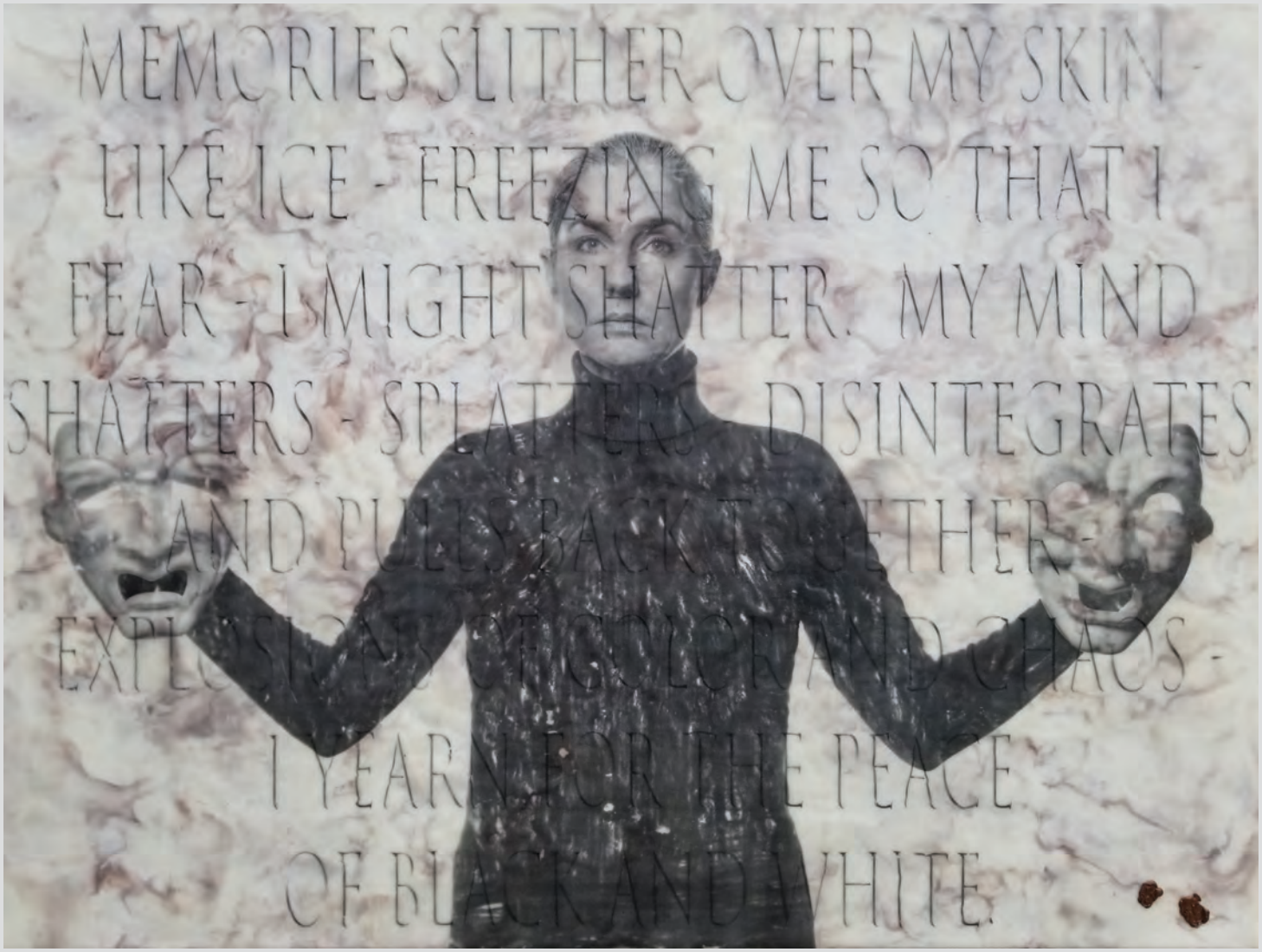
**Title:** Being Bipolar in a Polarized World #4*

**Category:** 2-D Art
**Dimensions:** 30” H x 40” W x 2” D
**Materials:** Encaustic, pastel, carbon

*Original photography by Michael Coakes, 2020

### Description:

Memories slither over my skin
Like ice
Freezing me so that I fear
I might shatter.
My mind shatters - splatters -
Disintegrates and pulls back together
Explosions of color and chaos
I yearn for the peace of black and white




## 'CREATIVITY AND THE BIPOLAR BRAIN'

Kelly Mathews is sharing her story with the world as an artist-in-residence during the upcoming Insights exhibit called Creativity and the Bipolar Brain, hosted at the Florida Atlantic Stiles-Nicholson Brain Institute.

Mathews' art reflects her experiences with bipolar disorder, addiction, rehabilitation and recovery in the traveling exhibit, sponsored by the Ryan Licht Sang Bipolar Foundation, built to create awareness and understanding of effective treatments for bipolar disorder.

Mathews said she is passionate about promoting awareness and understanding of bipolar disorder and giving hope to those affected by the illness.

"This is a very lonely, confusing and isolating illness," she said. "The stigma alone will cause many to reject a diagnosis and refuse treatment. Those who accept it are often made to feel broken or damaged. Just showing them that someone else has gone through what they're feeling, and survived, can be the first step in giving them hope."

# That 'A-HA' Moment

LENBLR / ISTOCK.COM

**Research examines how agency — or exerting purposeful control on one's surroundings — emerges in babies.**

*In the experiment, babies could move a mobile suspended above them by kicking. Certain movement patterns indicated that the infants came to understand that they controlled its motion.*

BY **Wynne Parry**

Whether flicking on a light switch or reaching for a drinking glass, we all act with agency — that is, we take actions intended to produce consequences we desire. To examine the emergence of this easily overlooked yet fundamental ability, a team at Florida Atlantic turned to babies.

Writing in the *Proceedings of the National Academy of Sciences*, the researchers document babies realizing that their kicking could spin a mobile, which was connected to one of their feet by a string.

"Our entry point was to look at the transition between spontaneous and intentional behavior, where it's very clear the infant actually makes something happen in the world," said J. A. Scott Kelso, Ph.D., Eminent Scholar in Science and professor of psychology and biological sciences in the Charles E. Schmidt College of Science.

### AGENCY EMERGES IN 3D

Over the centuries, scientists have defined natural laws to explain the physical world. Yet, these rules fail to fully explain the purposeful actions of living organisms.

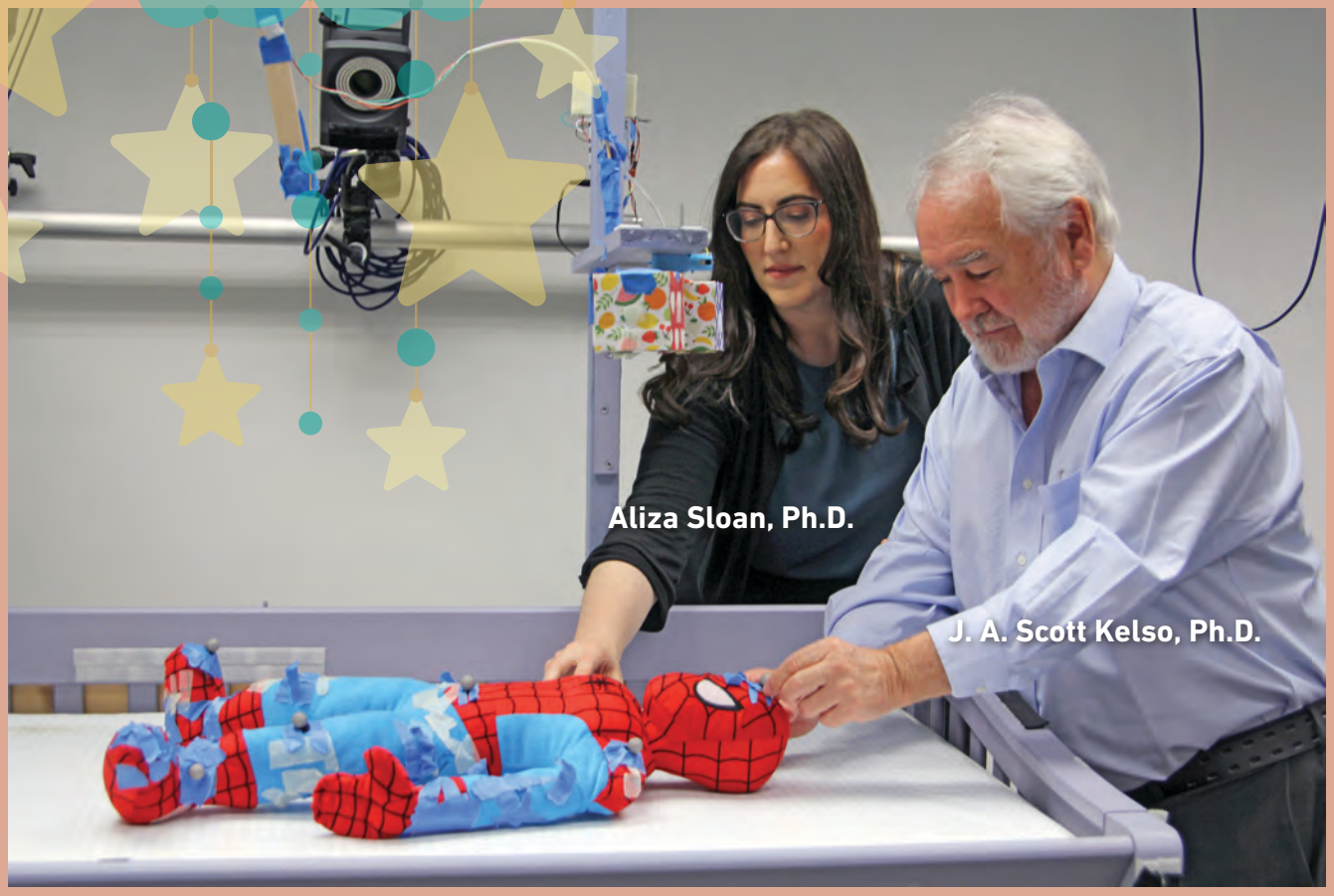
"We could say that agency is something that human beings have. But in the present state of science, agency exists nowhere within standard conventional physics and chemistry, and is somewhat controversial in biology," said Kelso, adding that he and his colleagues hope to extend natural law to include agency, the emergence of which he describes as a self-organizing dynamical process.

In this study, the researchers explore how this happens through the interaction of living things — in this case babies — with their environments.

"The background to the experiment that we did is quite old," said first author Aliza Sloan, Ph.D., a research assistant professor in the Human Brain and Behavior Lab, Florida Atlantic's Center for Complex Systems and Brain Sciences, College of Science. "It was one of the first paradigms used to show that young babies could understand relationships and remember."

For the experiment, researchers worked with 16 3-to-4 month-old babies. The babies were placed on their backs below a mobile connected to one of their feet. While in the past, researchers tallied infants' kicks on a clipboard, the Florida Atlantic team tracked the motions of the baby and the mobile in three dimensions 100 times per second using leading motion capture technology.

Over the course of interaction with the mobile, a healthy baby's kicking typically increases. In the past, this change was thought to be evidence of simple reinforcement — that is, the mobile's movement stimulates the babies to kick more, without them necessarily understanding that they control it. Sloan and Kelso suspected that the babies were doing more than responding to a sight they liked. Rather, the infants were realizing that they had the power to move the mobile.




## POWER OF PAUSES

In their analysis, the team noticed that the babies frequently paused their kicking, waiting for the mobile to stop moving before beginning to kick again. But if babies were merely responding to the motion of the mobile, as once thought, they should increase their kicking, Sloan said.

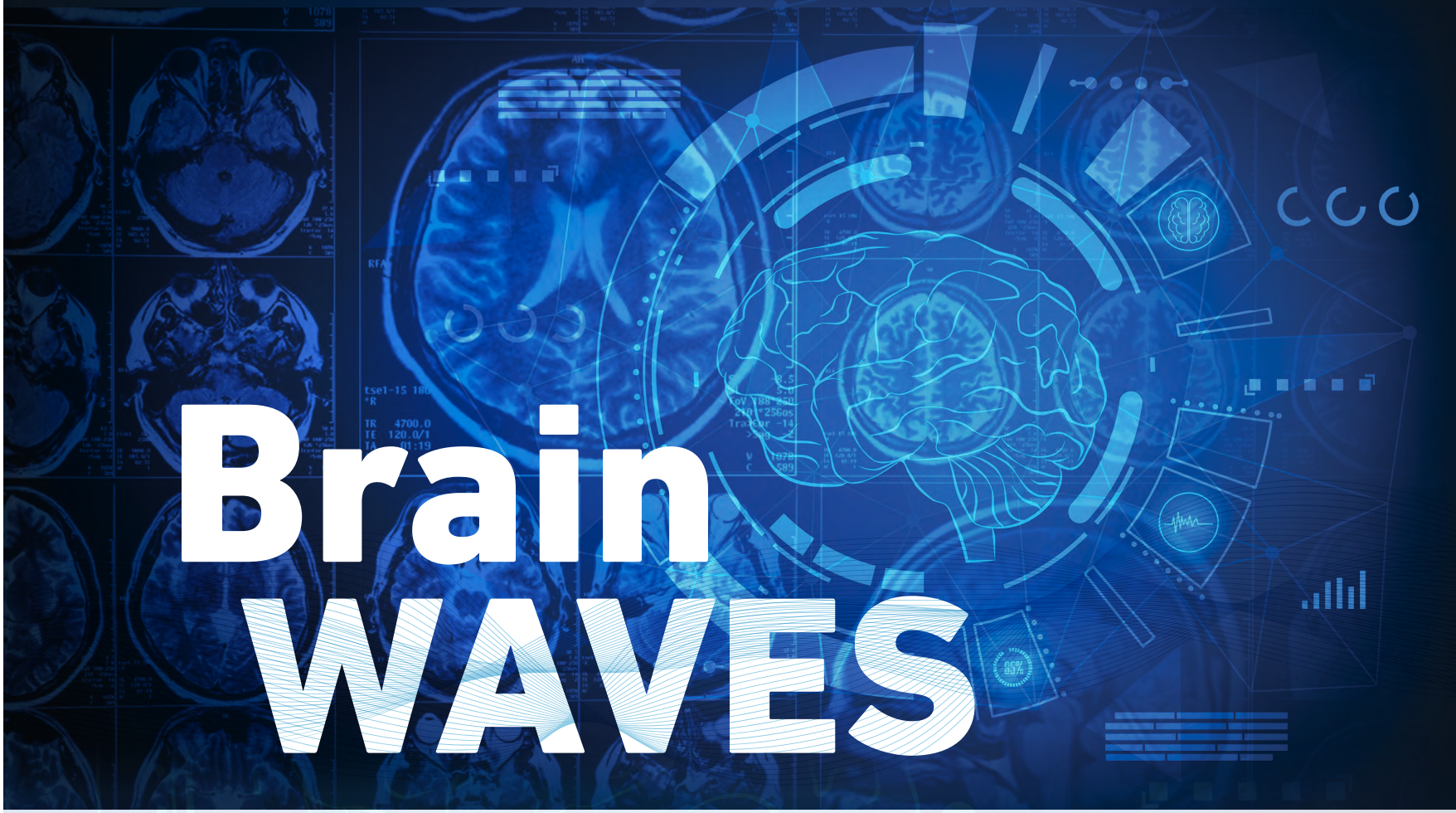
These pauses appear key to the infants' discovery of their own agency, according to the researchers. When they stopped kicking and the mobile stopped moving, the infants could see that they alone were moving it. And for several babies, bursts of kicking followed periods of relative calm.

Sloan also devised an analytical "a-ha detector." By pinpointing the greatest increase in a baby's rate of movement, she could identify when a baby suddenly realized he or she could control the mobile. Distinct patterns emerged with some babies experiencing their a-ha moments more quickly and others taking longer. One infant steadily increased her kicking but did not show the burst of activity linked with the discovery of her agency.

On its own, the infants' experience with the mobile is likely only a small step toward a bigger realization. "There are probably plenty of experiences that over time coalesce into a more stable sense of self as an agent," Sloan said.

As these infants grow, that knowledge will become a given, like the effects of gravity.

"We humans take a lot for granted as we're wandering around trying to understand the world we live in," Kelso said. "My thought on this is: You're an agent, but you haven't thought much about what underlies your own agency. Here is a window into it."



# Brain WAVES

## Harnessing Ultrasound to Treat Brain Disorders

BY **Judy Gelman Myers**

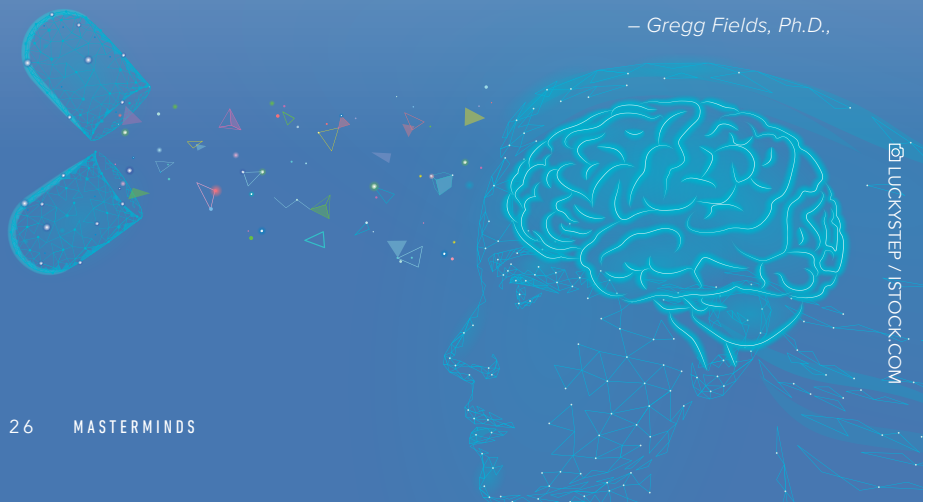
Though scientists have known for decades that ultrasound waves can be used for medical purposes, recent technological advances have brought ultrasound to the forefront of medical innovation. Clinicians, engineers and researchers are now using MRI to guide focused ultrasound waves in the treatment of various brain disorders — including Alzheimer's and Parkinson's disease, essential tremor, neuropathic pain and even brain cancer.

Florida Atlantic is part of this medical breakthrough, entering a new phase of its long-standing collaboration with Insightec, a pioneer in focused ultrasound. The two institutions have signed a Memorandum of Understanding to advance academic research in the area. Insightec will provide the ultrasound technology; Florida Atlantic will provide the MRI and clinical research.

"Ultrasound has the potential to be a gamechanger. We're incredibly excited to be partnering with Insightec," said Gregg Fields, Ph.D., interim vice president for research, who will oversee clinical research for the Florida Atlantic/Insightec collaboration. Fields is the principal investigator on a State of Florida grant that applies magnetic resonance-guided ultrasound to treat Alzheimer's disease patients and develops approaches to monitor the effectiveness of ultrasound treatments using blood drawn from patients.

PEAKSTOCK / ISTOCK.COM

> If you can improve drug delivery to the brain, you'd address a great variety of other neurological disorders, including brain cancer."
>
> *– Gregg Fields, Ph.D.,*



LUCKYSTEP / ISTOCK.COM

Scientists are finding numerous ways to use ultrasound. In general, the waves, typically guided by MRI, are focused on areas of the brain that cause a problem. They are then manipulated for different purposes: to noninvasively excise problematic tissue by causing a lesion; to disrupt dysfunctional processing; or to change the spatial configuration of nearby cells.

For instance, studies have shown that essential tremor — uncontrolled shaking of the hands, head or voice — can be alleviated by focusing thousands of high-intensity ultrasound waves on a tiny region in the thalamus, an egg-shaped structure in the middle of the brain that relays motor and sensory information from the body to the brain. The focused waves create a tiny lesion, eliminating the tissue responsible for the tremor. Research has shown that the procedure is also effective for tremor deriving from Parkinson's disease.


*Lloyd Zucker, M.D., a board-certified neurosurgeon and medical director of neurosurgery, left, and Hermes Kamimura, at Delray Medical Center, treating the first patient with Insightec's non-invasive focused ultrasound technology.*

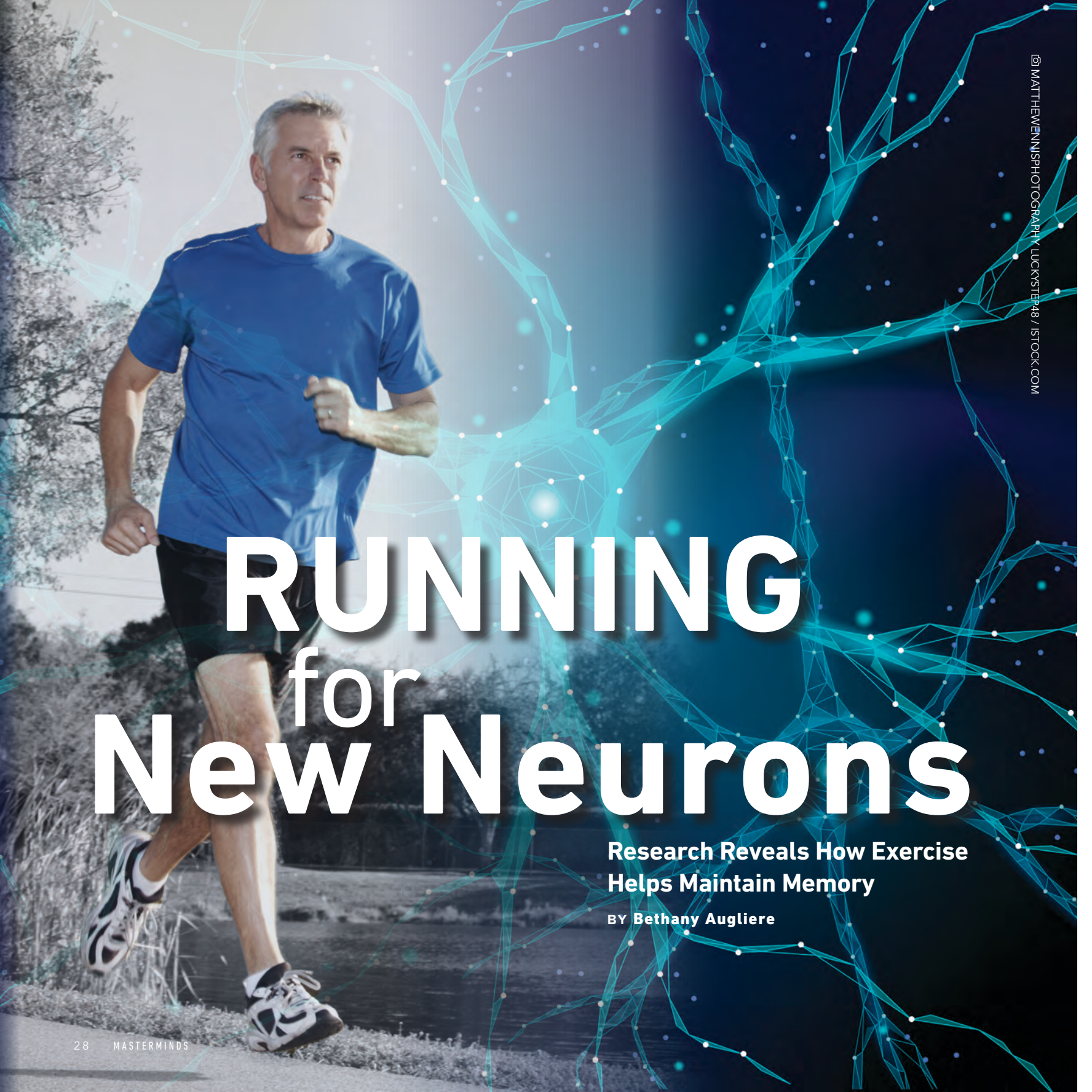
Scientists have also successfully used the technique to treat obsessive-compulsive disorder. In this case, ultrasound waves eliminate tissue in an area of the brain called the internal capsule, which transmits nearly all the information into and out of the cerebral cortex — home to reasoning, decision-making, emotion and personality.

But perhaps the most significant use of ultrasound lies in its potential to disrupt the blood-brain barrier (BBB). The BBB is a powerful evolutionary tool that first emerged 400 million years ago to protect the brain from toxins in the bloodstream. It comprises a lining of tightly packed cells in the brain's blood vessels, which let necessary chemical molecules in and keep bacteria and viruses out. The BBB also keeps out many life-saving medications that are too large to pass through it, including two new FDA-approved antibodies that reduce the plaque prevalent in Alzheimer's disease.

Florida Atlantic, in collaboration with Insightec and Delray Medical Center, is currently conducting the first phase of clinical trials evaluating the safety of a technique that uses low-intensity ultrasound waves to open the BBB, led by Fields, who is also executive director of Florida Atlantic's Institute for Human Health and Disease Intervention. With this technique, gas-filled microbubbles are injected in the bloodstream near the BBB. Ultrasound waves are focused on the microbubbles to make the gas expand. As the bubbles get bigger, they loosen the proteins keeping the BBB intact, opening a space large enough to permit the antibodies to enter. When the ultrasound is turned off, the bubbles contract and the BBB returns to its normal state. Previous attempts to open the BBB failed because the opening was too big and stayed open too long. Here the opening is temporary and targeted to specific areas of the brain.

Fields said he sees applications for the microbubbles beyond treating Alzheimer's disease. "If you can improve drug delivery to the brain, you'd address a great variety of other neurological disorders, including brain cancer."

Florida Atlantic's MRI is about to become fully functional. That capability could position the university to be the primary research site for Insightec. As summarized by Fields, "The application of low-intensity, focused ultrasound could provide the breakthrough needed to more effectively treat conditions that previously had poor clinical outcomes. The partnership between Florida Atlantic and Insightec brings this cutting-edge technology home to residents of South Florida."



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# RUNNING for New Neurons

## Research Reveals How Exercise Helps Maintain Memory

BY **Bethany Augliere**

Two decades of research show that running, brisk walking, swimming or cycling all help protect your memory as you age. But a new study by Henriette van Praag, Ph.D., associate professor in the Charles E. Schmidt College of Medicine, pinpoints that consistent exercise modifies and maintains connections in your brain.

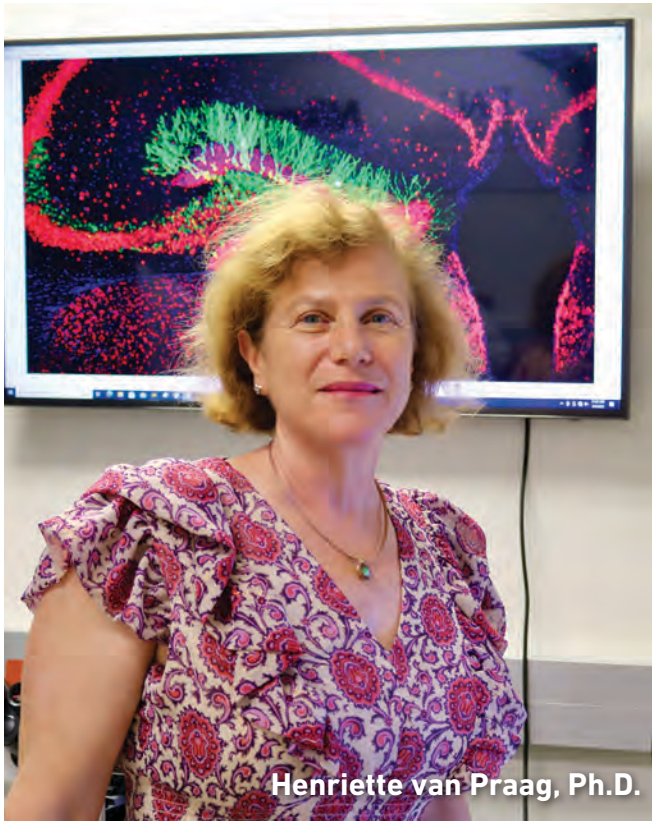
The hippocampus is a part of the brain that is essential for forming new memories and learning. Throughout a rodent's life, new nerve cells, called neurons, are added to this region, van Praag said, and that voluntary wheel running increases the number of new neurons. However, it is unclear whether the wiring of new neurons born in young adult mouse brains and their connections in the brain's network change with age. The results of her new study, published in the journal *eNeuro*, reveal that if mice exercise into midlife, the neurons generated as an adult survive in larger numbers and are connected in a manner that benefits memory.

"If you have any kind of electrical circuit, over time the wires can become frayed or you can lose the plugs," van Praag said. "We wanted to see if the exercise played any role in either maintaining that circuit or modifying it in some way that might be important for memory." In other words, this study was aimed at seeing if exercise changes the connections that these newly born neurons make, she said.

To study the long-term effects of running, van Praag and her team had a two-step process to examine the neurons generated in young adult mice, which are about 2 months old at the onset, once they hit middle-age to create a map of the neurons and their connections.

First, they injected a type of virus to tag stem cells in the hippocampus that would become neurons over the course of several weeks, and made the cells express a unique receptor, like a docking point, she said. Then, six months later when the mice were middle age, they injected a rabies virus engineered to selectively trace, or link up to, that docking point of the tagged neurons. "It's like a lock and key system," van Praag said.

With this tagging system of the neurons, the researchers could then quantify the neurons, their number of connections in the brain and where they were located. "We basically made a map of the network and show how it is modified by running."


Henriette van Praag, Ph.D.

van Praag and her co-authors found that in mouse models, exercise benefits areas in the hippocampus region of the brain that acquire new memories. However, van Praag said, the team also found that adjacent regions of the brain, called the peri- and entorhinal cortical region increased innervation of new neurons, which is "important for our ability to find our way in the world — to navigate. Also, in particular, it's important for us to remember the context or the circumstances of an event," she said. Running promoted the survival of adult-born neurons, but also helped them maintain their connections in these areas.

But can running get our brains to the finish line? van Praag's research is also exploring "how these circuits are maintained and formed over the lifespan, what happens if you stop running in midlife or before midlife, and how long are these network modifications maintained into old age?"

# New Talent, New Discoveries

**Postdoctoral Fellows are Vital Resources for Expanding Research**

BY **Chelsey Matheson**

Postdoctoral fellows play a large role in research and new discoveries at Florida Atlantic. From artificial intelligence to neurogenesis to neuroscience education, these early career scientists are making big contributions to the future of brain science, technology and medicine.

Here's a look at some of the postdocs contributing to discovery:

## Alexandra "Aly" Paz, Ph.D.,

is a postdoctoral fellow working with the Advancing STEM-Community Engagement through Neuroscience Discovery (ASCEND) program at the Florida Atlantic Stiles-Nicholson Brain Institute. Paz earned her doctorate in integrative biology in neuroscience from Florida Atlantic University. Her interest in neuroscience stems from a curiosity about the connection between neurological processes and animal behavior, she said. Paz said her passion for neuroscience education stems from volunteering for the ASCEND program. Now a full-time member of the ASCEND team, Paz supports the program's community outreach efforts, unraveling the complexities of neuroscience to inspire young people to take an interest in science, technology, engineering and math.

## Cássio Morais Loss, Ph.D.,

is a postdoctoral fellow at the Florida Atlantic Stiles-Nicholson Brain Institute in the lab of Henriette van Praag, Ph.D., an associate professor, Charles E. Schmidt College of Medicine.

A native of Brazil, Loss earned his doctorate in biological sciences from the Universidade Federal do Rio Grande do Sul.

His current research focuses on how neurogenesis, spontaneous or induced by physical activity, in the adult rodent brain affects cognitive behaviors. One

## Rachel St. Clair, Ph.D.,

is a postdoctoral fellow at Florida Atlantic's Center for the Future Mind. St. Clair researches artificial general intelligence, focusing on complex systems and neuromorphic learning algorithms. Her current work is focused on semiconductor solutions for artificial general intelligence and hyperscale computing with her company, Simuli Inc. Her main goal, she said, is to work on architectures that produce generally intelligent agents. St. Clair received her doctorate in complex systems and brain sciences from Florida Atlantic and participated in the Stiles-Nicholson Brain Institute's Graduate Neuroscience Training Program.

## Aline Guimaraes Santana, Ph.D.,

is a postdoctoral fellow in the lab of Claudia de Oliveira Rodrigues, Ph.D., associate professor in the department of biomedical science, Charles E. Schmidt College of Medicine. Santana specializes in biochemistry and molecular biology, including protein biochemistry and protein-protein interaction studies in tumor cells. She earned her doctorate in functional and molecular biology from the State University of Campinas in São Paulo, Brazil. The Rodrigues lab specializes in cardiovascular disease, as well as aging and multiple acute and chronic disease settings, including metabolic, lung, kidney and neurodegenerative diseases.

of his projects involves identifying how exercise or exercise-mimetic molecules can assist aging brains in forming new neurons and preventing neurodegenerative conditions like Alzheimer's disease. He is also engaged in projects examining the relationship between neurogenesis and cognitive behavior in neurodevelopmental disorders as well as in immune-related responses in the brain.

As a behavioral neuroscientist concerned with scientific reproducibility and ethics in laboratory animal research, Loss employs alternative methods to interpret animal behavior, aiming to enhance reproducibility. His approach includes detailed planning of experimental designs, gathering alternative behavior data, and utilizing unconventional statistical methods such as principal component analysis and generalized linear mixed models in data analysis. Both within and outside the lab, Loss advocates for best practices in research, emphasizing that combining animal welfare with experimental rigor can help to improve reproducibility.


# Advancing Brain Health

## Grant Funds Fellows' Neuroscience Research

BY **Gisele Galoustian**

Five Florida Atlantic doctoral students, whose work embraces computational neuroscience, were recently awarded the second round of Computational Brain Science and Health Graduate Fellowships.

A $1 million gift from the Palm Health Foundation, awarded through its Brain Health Innovation Fund, supports new technologies, treatments, resources and educational tools to advance brain health in the community.

"Through the generosity and continued support from the Palm Health Foundation, talented young Florida Atlantic scientists will have the opportunity to advance their important discoveries that benefit from computational approaches," said Randy D. Blakely, Ph.D., executive director, Florida Atlantic's Stiles-Nicholson Brain Institute, the David J. S. Nicholson Distinguished Professor in Neuroscience, and a professor in the Department of Biomedical Science within Florida Atlantic's Schmidt College of Medicine. "Their novel research is aimed at data-intensive investigations underlying autism, Huntington's disease, neurostimulation, a secure encryption method for large medical imaging file formats and elucidating the integral role the prefrontal cortex plays in complex behaviors."

Here's a look at the recipients and their research.

## Lindsey Riera-Gomez

**Neural Synchrony During Parent-infant Interactions in Infants At-risk for Autism**

This project will identify early markers for autism spectrum disorders during infancy, which may aid clinicians in providing earlier diagnoses and treatment at a time when the brain is most plastic. Research shows that coordinated behaviors, movements and neural activation between infants and their parents is an important developmental milestone predictive of social brain development, empathy and symbol-use, and may be disrupted in infants at-familial-risk for autism. Given that autism is a neurological disorder that disrupts social functioning, simultaneous brain scanning of both parent and infant during a social interaction approach could help to identify the neural underpinnings of social deficits in autism during naturalistic face-to-face interactions. An fNIRS neuroimaging approach could identify if the level of interpersonal synchrony that infants share with their parent is associated with their familial risk for autism.

## Gianna Cannestro

**Computational Approaches to Optimize Data Analysis for a Huntington's Disease Model**

Huntington's disease is a heritable, terminal, neurodegenerative disease with no known treatment or cure resulting in emotional, cognitive and motor dysfunction. Cannestro and collaborators plan to utilize methods of signal processing to tease apart electrical recordings into functional and connective differences between healthy and Huntington's cells. They will determine potential differences in electrical activity of individual cells, the connective characteristics as the state of intercellular connections, and the resulting network activity. Specifically, this project focuses on optimizing algorithms and developing a tailored computational analysis pipeline to handle and process the large amount of data recorded from multi electrode array experiments. Identifying such differences can aid in the development of diagnostic identification tools, as well as provide a framework for the development of disease detection and drug screening methodology.

GRANTS

## Jennifer Giordano

**Safeguarding the Brain: Secure Neuroimaging Data Encryption for AI-driven Brain Analysis**

The future of medicine is shifting to cloud computing, where health care providers can access patient information anywhere, any time. As the fields of artificial intelligence and neuroscience advance, the development of methods to interpret brain activity becomes increasingly imminent. Recent studies have already demonstrated the feasibility of such interpretation for specific brain regions. Decoding patterns of neural activity will unlock insights into the underlying mechanisms of cognitive function and behavior, potentially revolutionizing medical treatments. However, this also presents challenges to HIPAA regulation and raises concerns for potential intellectual property. Ensuring data security is crucial in protecting patients' privacy and encouraging participation in neuroimaging studies. Ultimately, the integration of AI and cloud computing could revolutionize various aspects of health care. Giordano's research addresses a vital step toward this goal: the creation of a secure encryption method capable of handling large medical imaging file formats while preserving the content and patient privacy.

"The research being conducted by some of the brightest minds in the nation will greatly contribute to our knowledge of brain function and brain health and will enhance the well-being of our communities in Palm Beach County and beyond. We are excited and proud to support these five Florida Atlantic graduate students selected to receive the Computational Brain Science and Health Graduate Fellowships, who are exploring unchartered territories in neuroscience and advancing scientific research to new levels."

*– Patrick McNamara, president and CEO of Palm Health Foundation*

Palm Health FOUNDATION

## Ryan Gallagher

**The Influence of Presentation Order and Duration on Learning Task Structure**

The prefrontal cortex plays an integral role in complex behaviors that enable individuals to adapt to ever-changing environmental demands. The Hierarchical Error Representation model proposes a unifying computational account of prefrontal cortex function that can replicate activity observed, while also producing behavioral evidence of more complex structured learning. Gallagher's research seeks to advance understanding of the neural mechanisms of prefrontal cortex and its role in behavior. To accomplish this, he has designed a series of experiments that manipulate various aspects of stimulus presentation (presentation order and duration on a learning task) to investigate how temporal and structural abstractions interact to govern how multiple sources of information are integrated. Findings from this research will provide information about the neural mechanisms that govern how multiple sources of information are integrated, which can then be used to refine theoretical models of the prefrontal cortex.

## Joseph McKinley

**Neural Entrainment: A New Complexity Science Paradigm for Healing the Brain**

Research shows neurostimulation, a therapeutic intervention whereby electromagnetic signals are used to disrupt pathological patterns of neural activity associated with brain disease and induce new healthier patterns, can treat many neuropsychiatric disorders. But the underlying mechanisms of such remain poorly understood. McKinley will develop a nonlinear dynamical theory of neurostimulation, with the goal of informing precise and individualized neurostimulation treatment, honing a new tool for healing the brain. This research has implications for a wide range of brain-based diseases, including neurological diseases such as Parkinson's and Alzheimer's, epilepsy, tinnitus and chronic pain, as well as psychiatric disorders including major depression, obsessive compulsive disorder, generalized anxiety, post-traumatic stress disorder, bipolar disorder and psychosis. This research will give clinical neuroscientists the precision to prescribe treatments based on the needs of individual patients according to their unique neural makeup and specific pathologies.

# Powerful Partnerships

The five doctoral student recipients of the Palm Health Foundation Computational Brain Health Graduate Fellowships will collaborate with faculty mentors to advance research and understand some of the most complex brain disorders to ultimately develop innovative methods, treatments and therapies.

"Graduate students often juggle multiple priorities from teaching to seminars to working in the lab. By funding their projects, we are helping to alleviate these challenges and providing them with the opportunity to focus on their important research," said Chad Forbes, Ph.D., associate professor, Florida Atlantic Charles E. Schmidt College of Science, and director of research development and diversity, Stiles-Nicholson Brain Institution, who spearheaded the selection process.

Here's a look at the partnerships.

**Teresa Wilcox, Ph.D., professor of psychology, Charles E. Schmidt College of Science**

Mentor for **Lindsey Riera-Gomez**

**Jianning "Jenny" Wei, Ph.D., associate professor of biomedical science, Charles E. Schmidt College of Medicine**

Mentor for **Gianna Cannestro**

**Christopher Beetle, Ph.D., associate professor of physics, Charles E. Schmidt College of Science**

Mentor for **Joseph McKinley**

**William E. Hahn, Ph.D., assistant professor of mathematical sciences, Charles E. Schmidt College of Science**

Mentor for **Jennifer Giordano**

**William Alexander, Ph.D., assistant professor of psychology, Charles E. Schmidt College of Science**

Mentor for **Ryan Gallagher**

GRANTS

## ‘New Horizons’

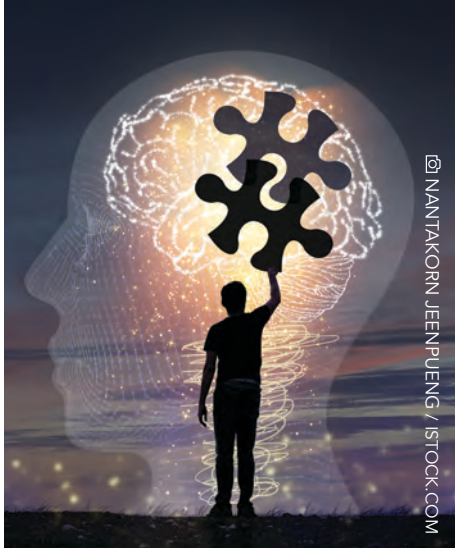
### Funding Collaborative Brain Power

The Florida Atlantic Stiles-Nicholson Brain Institute is part of a new pilot program aimed at funding interdisciplinary research of Alzheimer’s disease and related dementias.

The collaborative effort, called the “New Horizons in Alzheimer’s Disease and Related Dementias (ADRD),” has three initial awards which examine the impact of hereditary Alzheimer’s mutations, early diagnosis and discovery of Alzheimer’s risks, and determine potential use of non-invasive methods for diagnosis.

In late 2022, a one-day symposium for ADRD researchers, led to this university-wide effort. Here’s a look at the pilot awards.

- Contribution of HTRA1 and MT5-MMP to the Impact of Hereditary Alzheimer’s Disease Mutations ($37,500) to two Brain Institute members, Hongjie Wang, Ph.D., assistant research professor, Florida Atlantic Charles E. Schmidt College of Science, and member of Florida Atlantic’s Institute for Human Health and Disease Intervention; and Ning Quan, Ph.D., professor, Schmidt College of Medicine.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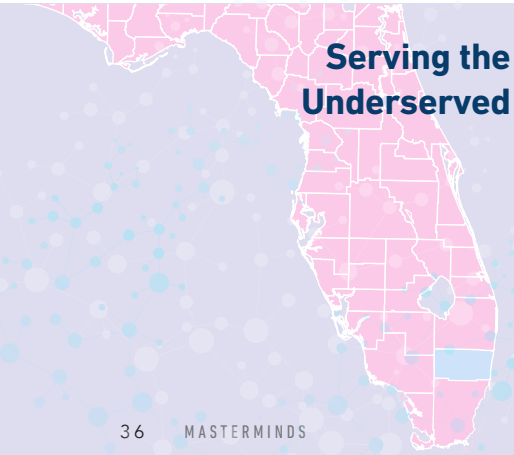
Results will help understand the role of HTRA1 in Alzheimer’s pathology and provide preliminary answers for its role in disease-associated oligodendrocytes function.

- Early Prediction of ADRD on Preclinical Assessment Data Using Machine Learning Tools ($37,500) to María de los Ángeles Ortega, DNP, APRN, associate dean, professor and director, Louis and Anne Green Memory and Wellness Center, Florida Atlantic Christine E. Lynn College of Nursing; Elan Barenholtz, Ph.D., associate professor, College of Science, and associate director of the Florida Atlantic Center for Future Mind; and Safiya George, Ph.D., dean; David Newman, Ph.D., associate professor; and Debarshi Datta, Ph.D., senior research fellow, all of the College of Nursing; and Subhosit Ray, doctoral student, College of Science.

  The study assesses effective clinical management for patients with ADRD, including early diagnosis, delay in the onset and slow progression. These include respite, psychotherapeutics, psychoeducation, counseling and support groups. With no direct cures, a better assessment of the disease prognosis can help plan and manage associated risk factors.

- Alzheimer’s Early Detection via Noninvasive Analysis of Retinal Vascular Dynamics ($25,000) to Ramin Pashaie, Ph.D., associate professor, College of Engineering and Computer Science, and fellow, Florida Atlantic Institute for Sensing and Embedded Network Systems Engineering; and Ruth Tappen , Ed.D., Christine E. Lynn Eminent Scholar and professor, College of Nursing.

Researchers will determine potential use of non-invasive retinal imaging as a viable and cost-effective procedure for Alzheimer’s screening. If successful, this research will lead to the clinical translation of the technology where Alzheimer’s diagnosis is done through a set of fully automated retinal imagining tests.



## Serving the Underserved

María de los Ángeles Ortega, DNP, recently earned a $1.3 million grant to advance health equity to underserved and marginalized communities in Broward County with specialized dementia services and support.

The project, titled Connecting Communities to Caring-Based Dementia-Specific Services and Supports, was created around the fundamental principle that all people, regardless of age or disability, should be able to live independently and participate fully in their communities.

Ortega, professor and associate dean of clinical practice, Christine E. Lynn College of Nursing, is the director of Florida Atlantic’s Louis and Anne Green Memory and Wellness Center, which provides services of care and education to those with memory disorders and their families.

# Growing Community Outreach

BY **Aly Paz, Ph.D.**

Pushing progress in neuroscience research was the underlying theme throughout year-round community outreach efforts for the Florida Atlantic Stiles-Nicholson Brain Institute.

"With all the developments and advancements currently exploding in neuroscience, this is an exciting time to be a neuroscientist," said Nicole Baganz, Ph.D., director of community engagement and programming for the institute.

The celebration of neuroscience during the month of March included the annual "Brainy Days" series with a kickoff debuting new insights into autism research, such as the importance of providing caregivers with early access to training.

The series continued with keynote speaker Sy Montgomery, naturalist and *New York Times* bestselling author of "The Soul of an Octopus." Montgomery shared her exploration into the intelligence and consciousness of octopuses.

Brainy Days' grand finale included a science-meets-arts event co-sponsored by the Mind, Music and Movement Foundation, featuring a panel of experts who discussed alternative therapies for neurodegenerative diseases like yoga and meditation. The event concluded with a performance by the Voices of Parkinson's Chorus and movement, dance and meditation demonstrations.

"Brainy Days is a spectacular way for us to spotlight developments in neuroscience research, explore topics that are of interest to the community and bring that conversation into a public space," Baganz said. "Our community programs are designed to spark curiosity in minds of all ages."

*(continued on page 38)*

## 2023 BRAINY DAYS RECAP


*From left: David Cinalli, Ph.D., Lindsey Wuest and Patrick J. McNamara*

That pique of curiosity begins when people are young. The Institute's Advancing STEM-Community Engagement through Neuroscience Discovery (ASCEND) program hosted its fifth year of the semester-long after-school program for middle school children called NeuroExplorers. Using cutting-edge digital tools, virtual reality and state-of-the-art technologies, neuroscientists lead students through hands-on lessons and experiments to inspire a new generation of junior neuroscientists.

ASCEND lessons were also "taken to the streets" through the MobileMinds program, which brings neuroscience activities to more than 2,500 students across Broward, Palm Beach and St. Lucie counties. These classroom activities allow neuroscientists to connect with students from varying backgrounds, introducing them to opportunities to explore brain science.

As part of the Institute's ongoing partnership with Palm Health Foundation, MobileMinds was also featured during "The Art of Learning: A Cross-Curricular Art Show & Symposium" held at Florida Atlantic's A.D. Henderson University School.

"It is an incredible honor to bring those discoveries and knowledge to our community," Baganz said. "Our goal is to advocate for brain research and to promote mental health."

*The Art of Learning: A Cross-Curricular Art Show & Symposium was hosted by Palm Health Foundation in partnership with Florida Atlantic Lab Schools and Stiles-Nicholson Brain Institute. The student artwork on display showcased the intersection of creativity and scientific discovery.*

## IF YOU GO ...

Here's a look at the 2024 speaker lineup for the Stiles-Nicholson Brain Institute's Brainy Days celebration.

**March 7 on the Jupiter campus**
**John Cryan, Ph.D.**
University College Cork, Ireland: Gut Microbiome-Brain Connection
https://www.ucc.ie/en/apc/people/johncryan/

**March 12 on the Boca Raton campus**
**Richard Davidson, Ph.D.**
**"Well-being is a Skill"**
University of Wisconsin: Neuroscience of Emotion and Mindfulness
https://www.richardjdavidson.com/

**March 21 on the Boca campus**
**Anjan Chatterjee, Ph.D.**
**"Art, Architecture, and Human Wellbeing"**
University of Pennsylvania: Neuroaesthetics
https://www.med.upenn.edu/apps/faculty/index.php/g275/p15498

# Community Partners

**Bringing a Holistic Approach to Research and Treatment for Degenerative Diseases**

BY **Chelsey Matheson**

In the spring of 2023, Florida Atlantic's Stiles-Nicholson Brain Institute and Charles E. Schmidt College of Medicine announced a partnership with the Mind, Music, Movement Foundation for Neurological Disorders (M3F). M3F is a Palm Beach County-based nonprofit organization that supports integrative, therapeutic programming for individuals living with neurodegenerative conditions such as Parkinson's disease, Alzheimer's disease, aphasia and multiple sclerosis.

"Our mission is to continue to build a multidisciplinary approach to wellness for people living with a neurodegenerative disease that embraces the community at large," said Beth Elgort, founder and CEO of M3F. "Having the affiliation with FAU, we hope to support a larger geographic area and introduce the research that supports the work that we do."

M3F programs encourage participants to keep their bodies in motion through activities like dance, yoga and boxing, and to use their voices through song.

"The main thrust of our work is to have an outlet for not just the person living with the disease, but for the caregiver," Elgort said. "We're touching lives because not only do our clients benefit from hopefully delaying some of the physical progression of all these diseases, but we also help address their mental health through socialization in a nurturing environment."

Florida Atlantic's partnership with M3F includes community and research components. M3F clients are participating in studies underway at the Schmidt College of Medicine, and the Brain Institute hosts M3F dance and wellness classes.

"Having this relationship with FAU is magnificent, because we're almost the live lab," Elgort said. "We really want to provide the motivation and the research to help a family living with a neurodegenerative disease live well."

Visit www.m3f.org to view the most current class schedules and locations.

*From left: Randy Blakely, Ph.D., Beth Elgort, Nicole Baganz, Ph.D.*

IF YOU GO ...

WHAT:
**Rhythms for the Brain, A NeuroArts Symposium, the Mind, Music, Movement Foundation's annual event**

WHEN:
**March 23**

WHERE:
**Kravis Center for the Performing Arts, West Palm Beach, Fla.**

SPEAKERS:
**Nicole Baganz, Ph.D., director of community engagement and programming for Stiles-Nicholson Brain Institute and Patricia Izbicki, Ph.D., affiliate assistant professor of medical education at the Charles E. Schmidt College of Medicine**

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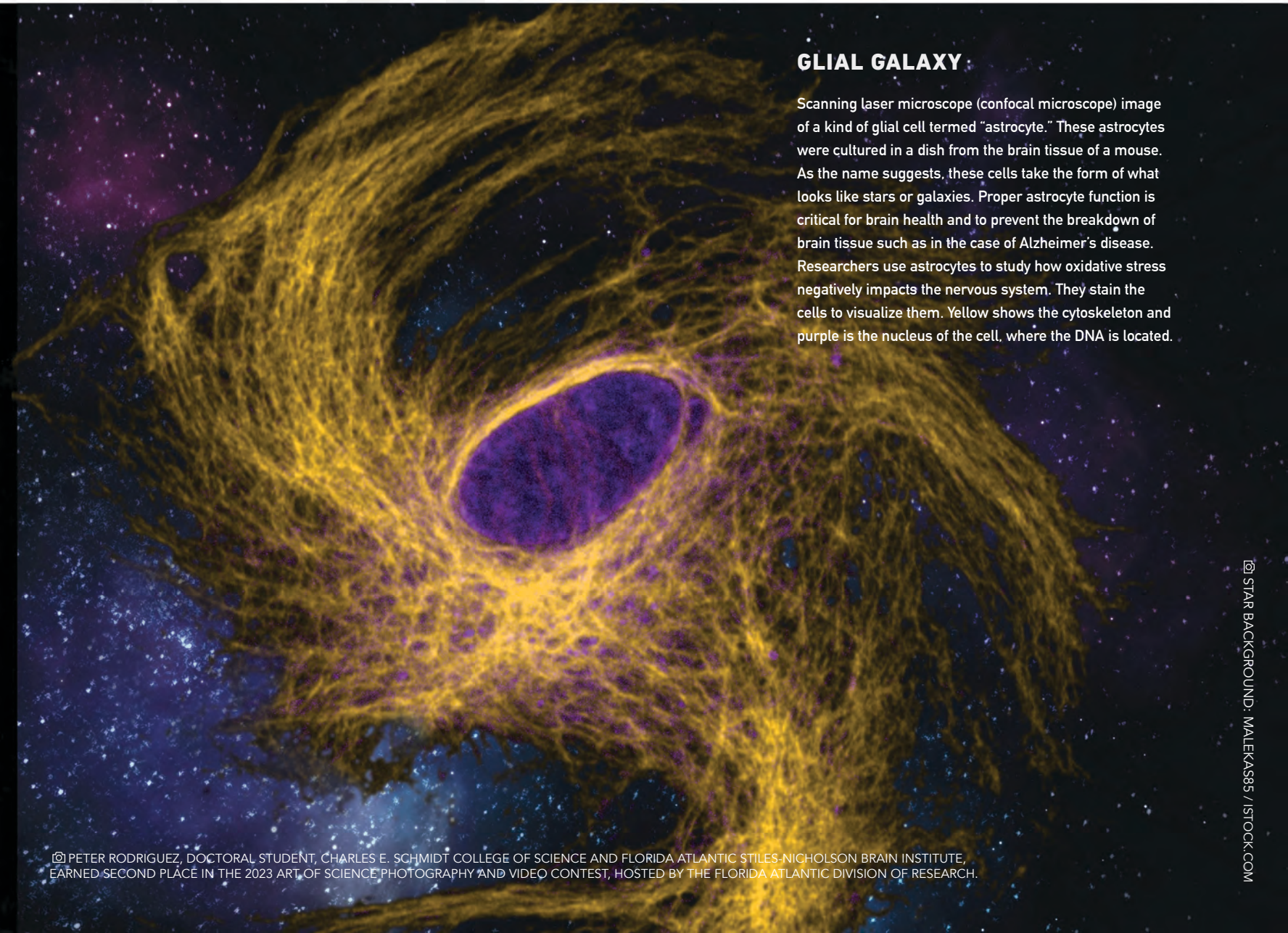
STILES-NICHOLSON BRAIN INSTITUTE



## GLIAL GALAXY

Scanning laser microscope (confocal microscope) image of a kind of glial cell termed "astrocyte." These astrocytes were cultured in a dish from the brain tissue of a mouse. As the name suggests, these cells take the form of what looks like stars or galaxies. Proper astrocyte function is critical for brain health and to prevent the breakdown of brain tissue such as in the case of Alzheimer's disease. Researchers use astrocytes to study how oxidative stress negatively impacts the nervous system. They stain the cells to visualize them. Yellow shows the cytoskeleton and purple is the nucleus of the cell, where the DNA is located.

PETER RODRIGUEZ, DOCTORAL STUDENT, CHARLES E. SCHMIDT COLLEGE OF SCIENCE AND FLORIDA ATLANTIC STILES-NICHOLSON BRAIN INSTITUTE, EARNED SECOND PLACE IN THE 2023 ART OF SCIENCE PHOTOGRAPHY AND VIDEO CONTEST, HOSTED BY THE FLORIDA ATLANTIC DIVISION OF RESEARCH.

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