

OWL RESEARCH & INNOVATION

FACES OF ADDICTION

Faculty on the Frontlines of the Opioid Crisis



PLUS:
A CARING LEGACY

Celebrating 40 Years

ROBOTIC DOG

Training Astro with AI



FALL 2019

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Faculty Research on the Frontlines

More than 40 faculty and staff at FAU combine efforts to combat the public health emergency of opioid addiction and overdose deaths.

This initiative, known as the Addiction Research Collaborative (ARC), collectively stimulates research, educational and policy initiatives to address the biomedical, behavioral, clinical, and social challenges involved in all forms of substance abuse. Through its combined efforts, the ARC also works with community partners, seeking to shift the trajectory of the epidemic in South Florida, where Palm Beach County was ranked among the state's worst for opioid-related deaths, as well as nationally.

Inside this issue, we take a closer look at some of the ongoing research – both inside and outside the laboratories – and at the stories of real people helped through our research.

In addition, this Fall 2019 issue of Owl Research and Innovation, takes time to talk with the university's new I-Health director, the College of Nursing's new dean, and many others to uncover the stories behind the incredible research happening in and around FAU — work that's impacting our daily lives.

Daniel C. Flynn, Ph.D.
Vice President for Research

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CURIOUS? ASK A SCIENTIST!

Listen as Your Top Science-related Questions are Answered

by Lynn Laurenti

Good ideas often seem to pop up out of nowhere. Take the recent experience of Ata Sarajedini, Ph.D., dean of the Charles E. Schmidt College of Science: "I was driving to work one morning, thinking about how to bring FAU into more prominence in the South Florida community. I had the radio on and was listening to a talk show. I thought, 'Wouldn't it be fantastic if the person hosting the show was talking about science at FAU? And if the people calling in were asking questions about science?'" In that moment, a project was born: the "Ask a Scientist" radio program, currently accessible on the college's website and possibly destined for a slot on South Florida's commercial airwaves.

Produced in cooperation with the "FAU South Florida Journal" podcast presented by broadcast journalism students of Kevin Petrich, Ph.D., the program has begun its life as a series of recorded Q&A sessions, with Sarajedini asking questions and selected College of Science faculty members providing answers. The first three shows feature Jeanette Wyneken, Ph.D., professor of biological sciences, discussing how nest temperature can affect the gender of sea turtles; Maria Fadiman, Ph.D., associate professor of geosciences, talking about the critically important relationship between people and plants, with a focus on conservation and sustainability; and Colin Polsky, Ph.D., professor of geosciences and director of the Florida Center for Environmental Studies, explaining how science is a tool used to better understand the natural world.

From this beginning, Ata hopes the program can move on to a live talk show format, giving listeners the opportunity to question FAU scientists on a wide variety of topics. "Recently, we've seen the rise of some skepticism about science," he says. "Direct dialogue will create greater understanding of what science is all about and build the community's trust in scientists."

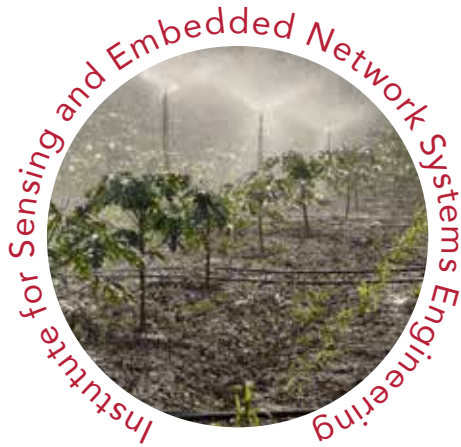
"Direct dialogue will create greater understanding of what science is all about and build the community's trust in scientists."

— Ata Sarajedini, Ph.D.

All that is needed now is recognition of the value of such a program by a South Florida radio station willing to add "Ask a Scientist" to its regular scheduling. "FAU scientists have a tremendous amount of knowledge to offer the community," Sarajedini said. "We look forward to giving radio listeners the opportunity to tap into this knowledge through 'Ask a Scientist.' "



DID YOU KNOW?



I-SENSE and K-Rain

FAU's Institute for Sensing and Embedded Network Systems Engineering (I-SENSE) and K-Rain, the fourth largest manufacturer of irrigation products in the world, are working together on an innovative university-industry partnership to develop next-generation products to help control and manage irrigation systems.

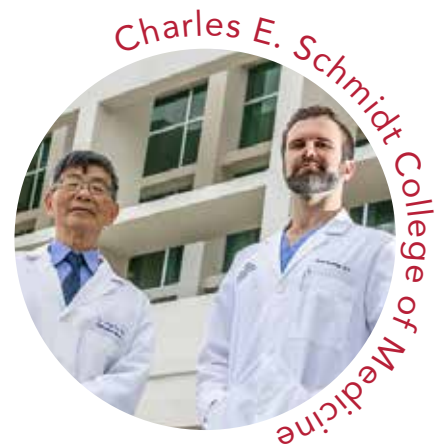
Lionfish Research Published

The *Journal of Experimental Biology* recently published an article by Katherine Galloway, Ph.D. candidate, and Marianne E. Porter, Ph.D., an assistant professor in the Charles E. Schmidt College of Science. The article, titled "Mechanical properties of the venomous spines of *Pterois volitans* and morphology among lionfish species," focuses on the red lionfish, an invasive species found along the South Florida Atlantic coastline, and the study of their spines. Galloway's artwork, right, was also used for the publication cover. In addition, Galloway presented this research at the poster competition for the FAU Graduate and Professional Student Association's 10th Annual Research Day earlier this year.



Collaboration Aims to Treat Strokes

Two researchers developed a breakthrough procedure for stroke that significantly reduces stroke-related disability and death with an FDA-approved drug called granulocyte colony-stimulating factor (G-CSF). G-CSF could be a powerful growth factor because of its ability to preserve the central nervous system, suppress cell death and at the same time elicit neurogenesis as well as angiogenesis, according to researchers Jang-Yen (John) Wu, Ph.D., left, a professor of biomedical science in the Charles E. Schmidt College of Medicine, and Brian Snelling, M.D., chief of cerebrovascular and endovascular neurosurgery and medical director of the Marilyn and Stanley Barry Center for Cerebrovascular Disease and Stroke at the Marcus Neuroscience Institute and Boca Raton Regional Hospital.





'Grouper Guard' to Protect National Undersea Security

Researchers from FAU's Harbor Branch Oceanographic Institute are using Goliath groupers as the focus of a smart sensing system that will remotely alert authorities of incoming manned and unmanned underwater vehicles.

With a nearly \$5 million grant from the Defense Advanced Research Projects Agency as part of the Persistent Aquatic Living Sensors program, this program, dubbed "Grouper Guard," will record and analyze vocalization cues from Goliath groupers and then send alerts to a remote end user. Goliath groupers, which can reach up to 700 pounds, generate characteristic low-frequency "boom" sounds when they mate as well as when they are approached by divers.

Top Lecture Prize Winner

Kelly Shannon, Ph.D., an associate professor of history in the College of Arts and Letters, recently won the 2019 Stuart L. Bernath Lecture Prize. The A prestigious award from the Society for Historians of American Foreign Relations, recognizes excellence in teaching and research in the field of foreign relations by younger scholars (under age 41). Shannon will also deliver the Bernath Lecture in New York City in January 2020 and the lecture will be published in the *Journal of Diplomatic History* in June 2020.



Judy Ewell Award

The Rocky Mountain Council for Latin American Studies (RMCLAS) recently awarded the Judy Ewell Award to Rachel Corr, Ph.D., an associate professor of anthropology in the Harriet L. Wilkes Honors College, for her book *Interwoven: Andean Lives in Colonial Ecuador's Textile Economy*. The Judy Ewell Award honors the best publication, book or article, on women's history or written by a woman, that began as a RMCLAS presentation.

Kavli Fellow Named

The National Academy of Sciences named Alex Keene, Ph.D., a Kavli Fellow at the recent 30th annual U.S. Kavli, Frontiers of Science Symposium. Keene is an associate professor for biological sciences in the Charles E. Schmidt College of Science. His research aims to understand the neural mechanisms of sleep loss in Mexican cavefish and the neural circuitry regulating taste memory in fruit flies.



FAU Wave Winners

The FAU Wave awards ceremony honors undergraduate applied research and entrepreneurial projects. This year, more than 100 attended, including FAU President John Kelly, Ph.D., Dan Flynn, Ph.D., vice president of research and Rabbi Merle E. Singer, guest speaker. Singer is working with engineering students to develop a speech-enhancing device to assist Parkinson's patients.

- First, \$1,500, Giannina Duran for "Owl Parking: Campus parking made easy."
- Second (tie), \$1,000, Vassilios Georgakopoulos for "Abrasion Resistant Nylon Polymer Fishing Line" and Taylor Leta, Jonathan Ortiz-Collazo and Ricardo Sanatan for "Assistive Speech Enhancer."
- Third, \$500, Alexis Base for "Developing a Solution to Ocean Acidification."



Graduate College



New Dean of the Graduate College

The Graduate College recently appointed Robert W. Stackman Jr., Ph.D., as the next dean. Stackman, whose research has focused on the physiology of memory processes, is a professor in the department of psychology in the Charles E. Schmidt College of Science and a member of the FAU Brain Institute. In addition, he was an associate dean of graduate studies in the College of Science, and served as the interim chair of the department of psychology.

Potential to Treat Breast Cancer

The Florida Department of Health's Bankhead Coley Cancer Research Program recently awarded \$801,000 to researchers to investigate the use of marine natural compounds as potential treatments of triple negative breast cancers.

Esther Guzmán, Ph.D., right, is an associate research professor at FAU's Harbor Branch Oceanographic Institute (HBOI), and the principal investigator of the study. Guzmán is working with HBOI collaborators Tara Pitts, a biological scientist, and Dedra Harmody, a research technician.



Entrepreneurs Earning Outside Awards

FAU Tech Runway companies are taking local competitions by storm with their innovative ventures. Take a look at these wins:

- Miami Herald Startup Pitch Competition finalists: ExtremeComms Lab, Venture Class 6; PQSecure Technologies and Tap2Open, both Venture Class 5
- USF's 2019 Frank and Ellen Daveler Entrepreneurship Program Award: SlideMap, Venture Class 5
- Cade Prize Competition finalists: Extreme Comms Lab, PQSecure Technologies, and SciKey Diagnostics, Venture Class 6
- Embry-Riddle's Launch Your Venture Competition finalist: ExtremeComms Lab
- Consulting-Specifying Engineers 2019 Product of the Year finalist: PowerCalc, Venture Class 3

New Technology to Examine Sickle Cells

Researchers have developed a rapid and reliable new method to continuously monitor sickle cell disease using a microfluidics-based electrical impedance sensor. Sarah E. Du, Ph.D., assistant professor, Department of Ocean and Mechanical Engineering, co-authors from the College of Engineering and Computer Science and the University of Miami published an article about their novel technology that can characterize the dynamic cell sickling and unsickling process without the use of microscopic imaging or biochemical markers.

Faculty Earns NATO Prize

The NATO Science for Peace and Security Programme recently awarded its Science Partnership Prize to Rainer Steinwandt, Ph.D., and his team. Steinwandt is a professor and chair in the department of mathematical sciences in the Charles E. Schmidt College of Science. He is also director of the Center for Cryptology and Information Security. Steinwandt and his team are working to create security solutions for encryption and digital signatures that remain secure in an era where attacks from powerful, large-scale quantum computers will soon become a reality. Quantum computers have far greater processing power than the computers available today, leaving current security and encryption vulnerable to attacks, he said.



Foundation Praises Community Artist

The Jim Moran Foundation Award recently presented a \$100,000 grant to George Gadson, a business consultant in FAU's Small Business Development Center, and self-taught artist entrepreneur. The grant is in recognition of Gadson's decades of uniting communities through art. He conducts community art engagements in underserved areas and provides art to students with disabilities and youth in foster and relative care.

Healthy Aging in Stressed Fruit Flies

Neuroscientists from Charles E. Schmidt College of Science are the first to report insight into healthy aging by investigating the effects of a foraging gene (PKG) on age and stress tolerance, using common fruit flies. The study was recently published in the *Journal of Experimental Biology*. Results from the study reveal that under anoxic stress (one percent of oxygen), flies that have high levels of PKG drop into a coma faster than flies with hypoxic conditions (three percent of oxygen), where flies have low levels of PKG, significantly increasing their activity during stress.



New Dean of Caring

By John H. Tibbetts

Safiya George, Ph.D., grew up in the Virgin Islands where she learned first-hand the therapeutic value of nature, a calm environment and the health benefits that being an attentive, caring person to others can yield.

Those valuable lessons will serve George well as she steps into her new role as dean of the Christine E. Lynn College of Nursing, which is recognized worldwide as a leading developer of the comprehensive philosophy of caring science.

"Caring science is integrated into everything we do here," George said. "As nurses, we have many things on our task list, but we need to listen to our patients and connect with them. Caring science is integrated not only into patient care, but also in how we care for ourselves, interact with each other and value everyone at the table."

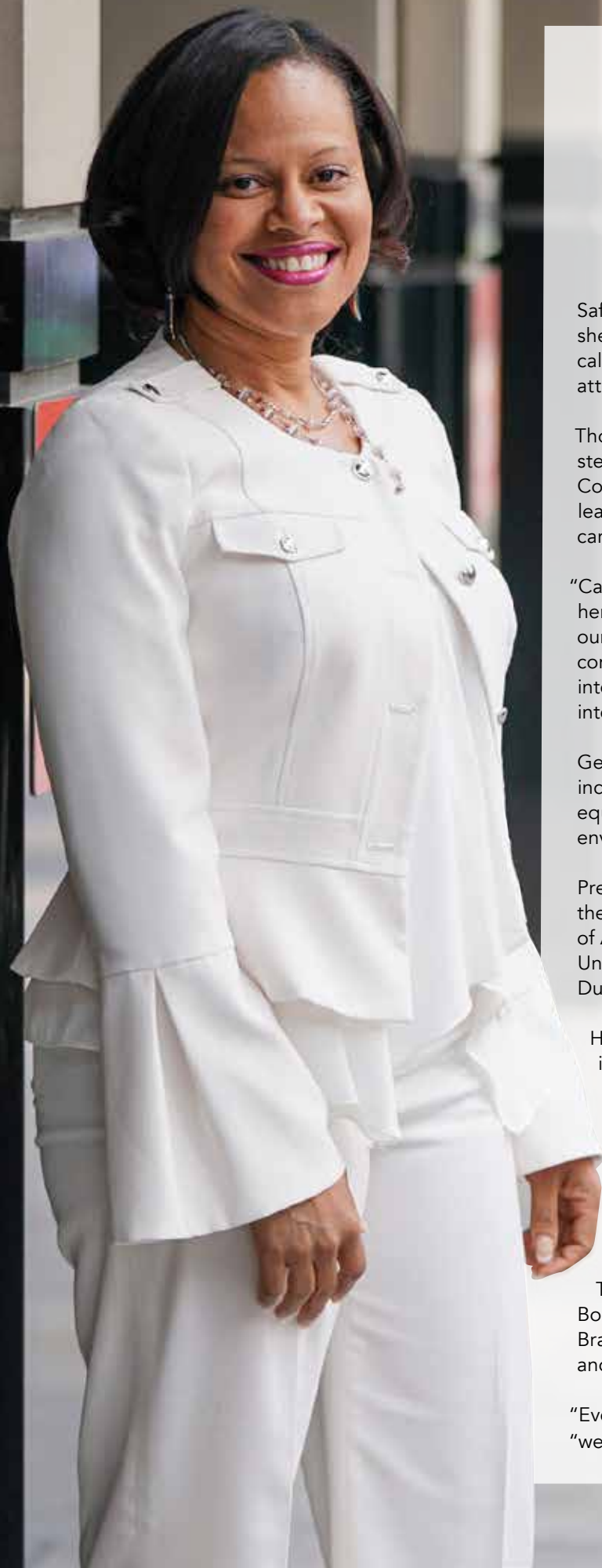
George oversees the college's research areas, which include healthy aging across the lifespan, health equity, holistic health and transforming health care environments.

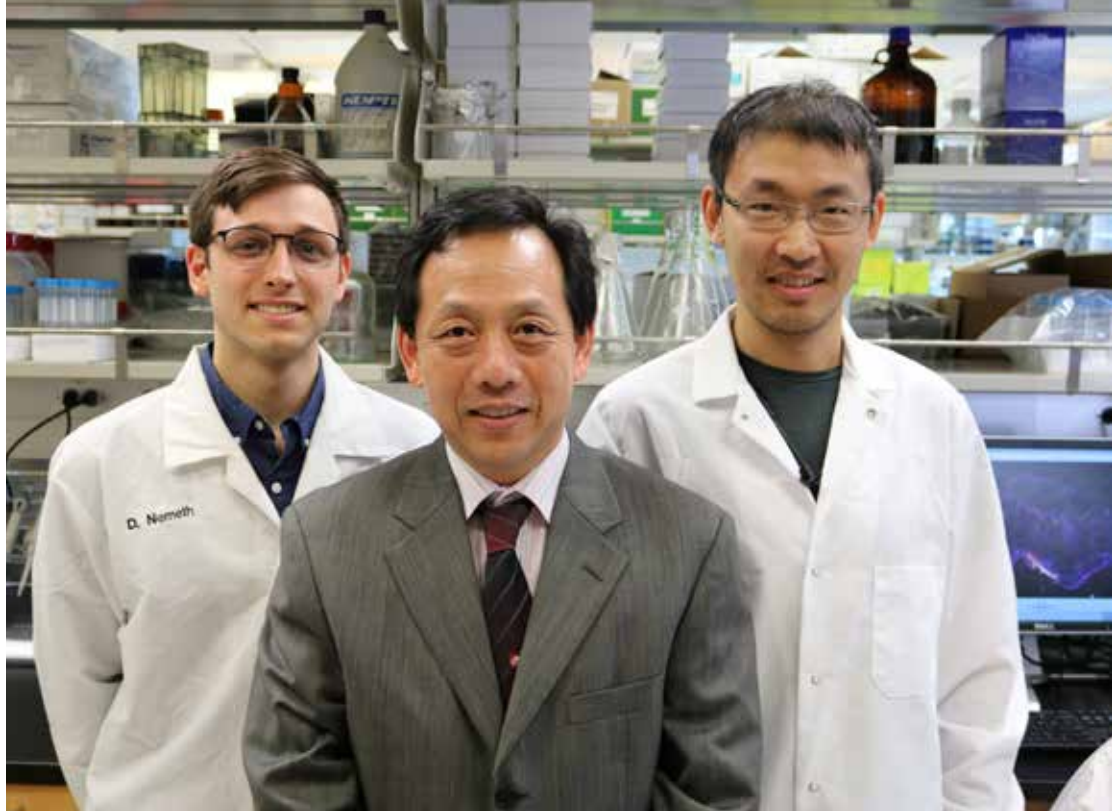
Previously, she was assistant dean for research at the Capstone College of Nursing at the University of Alabama. George earned her Ph.D. from Emory University and completed a postdoctoral fellowship at Duke University in religion and health.

Her recent research projects examine how variables in housing satisfaction or case management potentially affect the health and holistic well-being of individuals who have HIV/AIDS. "I have a great deal of experience and expertise in research," she says. "But as dean, my first and foremost goal is to understand the needs and priorities of faculty, staff, students, partners on campus and in the larger community."

The college enrolls more than 1,100 students on the Boca Raton and Davie campuses, as well as at Harbor Branch in Fort Pierce, offering bachelor's, master's, Ph.D. and the Doctor of Nursing Practice degree programs.

"Even though we live in a fast-paced world," George says, "we need to take time to value other people." ♦





Ning Quan, Ph.D., center, recently joined FAU. His lab members include, Danny Nemeth, left, graduate student and predoctoral fellow, and Xiaoyu Liu, postdoctoral fellow.

A Divine, Beautiful Orchestration

By Judy Gelman Myers

Scientific research often tweaks existing theories in small ways. Occasionally, research reveals something entirely new and ignites a theoretical revolution in its field. Ning Quan, Ph.D, works at the forefront of just such a revolution; his world-renowned studies of inflammation are helping to change how scientists understand the relationship between the central nervous system and the immune system.

"The greatest joy in the lab is digging a little deeper and finding the truth of something that was unexpected," said Quan, who recently joined FAU as a professor of biomedical science in the Charles E. Schmidt College of Medicine and member of the FAU Brain Institute. "Looking at totally unexpected but beautifully orchestrated biology, you feel like you're looking at the face of God. There's no other way to describe that kind of joy."

Until recently, the two systems were thought to function independently. A structure of tiny blood vessels surrounding the brain even earned the moniker "blood-brain barrier," indicating its supposed role in keeping pathogens away from the brain. Quan's research has revealed that far from being a barrier, the blood vessels act as molecular conduits or channels for communication between the

central nervous and immune systems. "These two systems intimately communicate with each other," Quan said. "Understanding how they connect can be really important for healing and maintaining health."

Quan became interested in this field about 20 years ago, when he came from China to earn his Ph.D. in physiology at the University of Tennessee. He did postdoctoral training in neuroimmunology at the National Institute of Mental Health, then became a tenured professor at Ohio State, where he set up a lab focused on neuro-immune communication and other links between immune and brain health, such as how immunological activity contributes to mental disorders. However, FAU's investment in cutting-edge neuroscience lured him to Florida.

Quan was introduced to the university's Brain Institute when he collaborated with Randy D. Blakely, Ph.D., executive director, on a project. "I had such a wonderful collaboration with Dr. Blakely that I went to FAU and talked to the chair of the biomedical sciences department, the dean of the medical school and the vice president of research about the university's investment in basic science," said Quan, who brought his National Institutes of Health-funded lab to the Jupiter campus in May. "I found that the condition for doing good research, especially in my field, is very favorable." ♦

JOINT HIRES WITH

H B O I

Teaching Robofish How to Swim

By David Lewellan

If a school of fish instinctively swims in the most efficient manner, Siddhartha Verma, Ph.D., hopes that a school of underwater robots can learn to do the same thing.

Verma joined FAU last fall semester on a joint appointment as an assistant professor of ocean and mechanical engineering in the College of Engineering and Computer Science and Harbor Branch Oceanographic Institute. Under the heading of fluid dynamics, he studies the specific fluid mechanisms of biolocomotion, or how fish swim. However, Verma spends little time on boats or hovering over tanks. "This is all very difficult to measure experimentally," he said. "So, we approach it from the computational standpoint." Computer models, he added, tested and improved against simple observational data, help create conclusions about more complex systems.

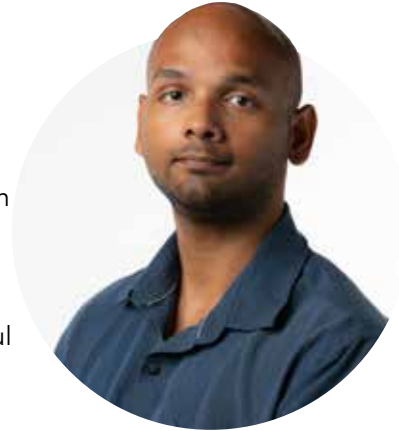
The data that Verma develops is used by other researchers at SeaTech – The Institute for Ocean and Systems Engineering. "They need people who can write code well, to control the experiments in a natural

setting," he said.

One application of the research would be to design a better robot that moves through water like a fish – or even a whole cluster of them, which would be useful for underwater search and rescue missions. The idea is not new, Verma said.

But in recent years, the technology has advanced so much that "if you didn't look closely, it would be hard to tell that it's not a real fish." A concurrent step to developing underwater robots is teaching them to move together, drafting off each other's wakes. Verma's work combines the traditional field of fluid mechanics with advanced machine learning, developing algorithms in which the robots themselves find the best way to move efficiently.

Verma, who earned his Ph.D. at the California Institute of Technology, comes to FAU from the Computational Science and Engineering Laboratory in Switzerland. Going from cloud-covered mountains to Boca Raton is "a big change," he said. ♦



What Happens After Corals Die? By Judy Gelman Myers

Andia Chaves Fonnegra, Ph.D., likes marine organisms that destroy the neighborhood — in other words, the "bad guys."

That's what she calls excavating sponges, which infiltrate and erode dying coral reefs. She fell in love with the plant-like animals as an undergraduate and has studied them ever since.

As a marine ecologist, Fonnegra studies how climate change affects

the interactions between corals, sponges and algae attached to the sea bottom. Her goal is to make it possible to better manage these ecosystems, which form habitats for other species, by studying changes to their structures. "Coral reefs are a very dynamic environment. We see them dying as a result of climate change," she said. "I'm interested in knowing what happens after corals die, and if the bad guys survive."

As warming ocean temperatures stress the animals that compose coral reefs, food-producing algae living in the animals' tissues depart. Eventually, the corals may starve to death or succumb to disease. A number of things can happen then. Fonnegra's beloved excavating sponges might bore into the reef, hollowing it out until the structure collapses. Macroalgae, like seaweed, might cover the dying corals. Other sponges might

Holography Offers 3D Views Within Algal Blooms

By John H. Tibbetts

In order to mitigate the harmful algal blooms plaguing Florida's waters, coastal managers need to better understand and monitor them. Aditya R. Nayak, Ph.D., of the College of Engineering and Computer Science, is developing tools to peer into blooms and suss out the dynamics that allow this dangerously high level of naturally occurring organisms to grow out of control.

During his doctoral studies in mechanical engineering at Johns Hopkins University, his advisor encouraged him to explore holography, an optical imaging technique that helps unravel mysteries in the ocean.

"Think of holographic imaging system as a microscope that provides a three-dimensional information about what's in the water," said Nayak, who began a joint appointment in 2018 as assistant professor in the department of ocean and mechanical engineering and FAU's Harbor Branch Oceanographic Institute (HBOI).

"The ocean is filled with billions of particles and holography is very effective in looking at spatial distributions of particles at very small scale," he said. "These particles could be phytoplankton, zooplankton, bubbles, oil droplets, sediments or detrital material — and they are incredibly patchy in nature. Characterizing their distribution and dynamics better is fundamental to addressing several critical questions."



Within a bloom, algal cells are distributed in the same patchy manner, he said.

Nayak is collaborating with a team of FAU researchers to develop an autonomous holographic camera system that could identify individual particles within a size range of 10 microns to 2 centimeters. The system could be installed in Florida's Indian River Lagoon, providing a record of the spatial distributions of algal species before, during and after harmful blooms.

A separate Nayak-led interdisciplinary team, including researchers at HBOI and FAU Institute for Sensing and Embedded Network Systems Engineering, plans to develop automated classification tools to analyze huge volumes of data produced by the underwater holographic system. The eventual goal is to develop an autonomous monitoring system for tracking and monitoring harmful blooms in near-real time.

Nayak characterizes his career as a series of fortuitous accidents: He came to oceanography by chance then discovered that he loved it. His good fortune has led him to an academic environment where new approaches like his are supported, he said. "FAU invests in new faculty so that they can succeed." ♦

move in and create a new three-dimensional framework. "I want to see what species of sponges could take advantage of the new environment and structure the

reefs in a different way," Fonnegra said. To do that, her lab uses a wide range of analytical and molecular methods like population genetics to study how species connect and mathematical modeling to predict future population change.

Before joining FAU, Fonnegra received her Ph.D. in oceanography and marine biology from Nova Southeastern University, then pursued post-doctoral research on coral reefs in

the Virgin Islands. She's currently outfitting her lab at FAU's Harbor Branch Oceanographic Institute, where she has a joint appointment with the Harriet L. Wilkes Honors College. Fonnegra said she wants to stop impacts wrought by climate change, such as decimation of reefs. But, strange as it may seem, she also sees an upside. "As a scientist, I have to see them as an opportunity to understand how changes occur," she said. "Only then, we can see if there's any way to restore these ecosystems." ♦

HUMAN MISSION^{TO}

MARS



By Lynn Laurenti

Have you ever wondered what it would be like to be on a NASA team that was planning a mission to outer space?

What skills would you need to contribute to the group effort?

What problems could you help solve?

What could you learn from your fellow team members?

This fall, the Charles E. Schmidt College of Science is offering a course that immerses students in the space mission experience to as great a degree possible without leaving planet

Earth. Human Mission to Mars, a three-credit course open to all majors, is the brainchild of Ata Sarajedini, dean of the College of Science, who holds a Ph.D. in astronomy from Yale University.

– *Ata Sarajedini, Ph.D.* “Mission to Mars came out of a desire to design a course that

helps students solve problems working in groups,” Ata said. “How do you address a general question that poses problems? Each student has different skills and abilities. Let’s teach them all there is to know about sending a human being on a journey to Mars and back, while solving all the problems along the way.”

The course is being team-taught by faculty members, from the College of Science, College of Engineering and Computer Science, Dorothy F. Schmidt College of Arts and Letters, and the College of Design and Social Inquiry. All together the faculty members

represent a wide variety of academic disciplines, including architecture, astronomy, biology, biochemistry, geosciences, sociology, psychology, physics and exercise science. Students working in small teams will tackle challenges such as timing of the launch, coping with the long-term physical and psychological effects of space flight on humans, building and maintaining a colony on Mars capable of sustaining human life and growing food on Mars. Workable solutions will be sought through use of the scientific method, which is based on data observation, formulation of hypotheses and predicted outcomes.

One inspiration for creation of the course is “The Case for Mars,” a book written by Robert Zubrin, who earned a B.A. in mathematics from the University of Rochester, an American aerospace engineer and president of the Mars Society. He believes that a permanent settlement on the red planet could be built in 20 years. Zubrin will make two appearances at FAU addressing the class as a guest lecturer and making a presentation that will be open to the public. His book is required reading for the class. “The Martian,” a science fiction novel by Andy Weir that was made into an Oscar-nominated film starring Matt Damon, is optional.

At the conclusion of the course, students will have gained experience in applying the scientific method to address challenges of many kinds and developing and testing hypothesis-driven solutions. They will have learned to use their creativity in generating hypotheses and not to fear failure, because in planning space missions as in every other area of human endeavor, the road to success is often paved with knowledge gained from earlier failed attempts. ♦

“Let's teach them all there is to know about sending a human being on a journey to Mars and back, while solving all the problems along the way.”

– *Ata Sarajedini, Ph.D.*

JOURNEY THROUGH THE HUMAN BRAIN

A Unique New Science Museum Exhibit

By Linda Holtz

Did you ever want to get inside someone's head? Now you can. A new interactive exhibit called Journey Through the Human Brain takes visitors on a tour of the brain and its different parts and functions, including what it is that makes us all human. The permanent exhibit at the South Florida Science Museum and Aquarium in West Palm Beach gives the public a better understanding of brain health, brain medicine and brain disorders.

"The exhibit is completely unique in its use of interactive and immersive features," said Randy Blakely, Ph.D., executive director of the FAU Brain Institute, professor of biomedical science in the Charles E. Schmidt College of Medicine and part of the brain power behind the creative exhibit. "It is the most high-tech thing going. What we have here exceeds some of the best brain exhibits in the world."

Blakely was recruited by Kate Arrizza, museum CEO, to serve as science advisor to the museum. Nicole Baganz, Ph.D., director of community engagement and programming at the institute; Esteban Parchuc, science center creative director; and Joseph Moore, chief exhibit consultant, rounded out the design team. Over the past three years, the two worked together to map out the blueprint for what has become a permanent high-touch and high-tech exhibit of the museum. The \$2.5 million exhibit was made possible by the Quantum Foundation and Stiles-Nicholson

Foundation, and with support from other foundations and private gifts.

The goal behind Journey Through the Human Brain was to avoid overwhelming its audience. It achieves this through carefully curated display signage written in clear and understandable language, colorful visuals, touchable models, and interactive features that explain some of brain science's most complex processes and characteristics. This exhibit is designed to engage a wide age range of people curious about how the brain works, as well as to entice the next generation of scientists into the field of neuroscience.

"This exhibit demonstrates a significant and successful long-term effort between researchers and museum curators, all who are passionate about community education," Blakely said. "What results is a compelling, fun and technically sophisticated exhibit. While the exhibit borrows some of its appeal from the world of 'edutainment,' at its core this is a science exhibit that successfully shows that the brain is the most complicated piece of matter in the universe – it is what makes us human." ♦



Inside the Brain Exhibit

The South Florida Science Museum and Aquarium's newly opened brain exhibit, called Journey Through the Human Brain, comprises approximately 30 different stations within a 2,500-square-foot area. Here's a look at just three of the must-experience centerpiece destinations along the way.

Deep Dive: A one-of-a-kind interactive exhibit takes you on a virtual journey deep inside the recesses of the brain using 3-D graphics, a joystick and touch screen controller. (Developed by the museum, FAU Brain Institute and Max Planck Institute of Neuroscience.)

Brain-Machine Prosthetics:

A visitor-operated myoelectric (electric properties of muscles) device shows how prosthetic devices can control limb movement. (Designed by engineers and computer scientists from FAU.)

**Concussive Impacts Sports
Helmet:** This hands-on exhibit addresses the issue of traumatic brain injury.



ASTRO

There's a New Dog in Town

By Robin E. Taber

Robo dog might look like a cross between Batman and the Terminator, but this four-legged, mechanical canine is being trained by to help people.

The Machine Perception and Cognitive Robotics Lab (MPCR) uses a combination of deep learning and artificial intelligence (AI) when programming the 100-pound super robot.



Astro could navigate rough terrain and climb over obstacles, just like a real dog. In addition, AI gives Astro the ability to do things that neither animals nor humans can do; and go places we would not want animals or humans to go.

Its programming will allow Astro to quickly see and search thousands of faces in a database, smell the air to detect foreign substances or hear and respond to distress calls that fall outside a human's audible range. Astro is being programmed by the MPCR team to have a large database of experiences to draw from when it needs to make split-second decisions on the fly.

The team consists of Elan Barenholtz, Ph.D., an associate professor in the Charles E. Schmidt College of Science and FAU Brain Institute member; William Hahn, Ph.D., a research scientist in the college and co-director of the lab, and their team of students that range from high school seniors to Ph.D. candidates. "We need psychologists, biologists, artists, sociologists. We need people with all sorts of skills and interests to contribute to this project; it's not just about having engineers," Hahn said.

Much like human learning, experiences for machines are logged into a neural network. "You have to start with data and train experience," Barenholtz said. The robot is outfitted with 10 sensors that will consume environmental input and onboard Jetson TX2 graphics processing units for a combined 4 teraflops of computing power. "That's four trillion computations a second."

The lab was sought out by Drone Data's Astro Robotics group for this rare opportunity because

of the lab's research into cognitive neuroscience, including behavioral, neurophysiological and embedded computational approaches to studying the brain. "These models, these deep learning layers, are inspired by the human brain," Barenholtz said. "That's what made this kind of revolution possible. The core ideas didn't come from the computer science world, it came from the brain departments around the world. And that's what we're really excited about."

"There are only a handful (eight) of these robots, and FAU has one. Google got the first one and FAU got the fourth," said Hahn, adding that Martin Woodall of Astro Robotics is supplying the body and FAU is supplying the brain. Barenholtz emphasizes the need for Astro to be allowed to make mistakes and learn from them. "We're putting that brain into a body and letting it engage in the real world. ... We're not going to tell it what to do all the time. It needs to explore its environment. It needs to grow up and figure out what kind of things lead to good outcomes or bad outcomes."

Hahn would like to democratize the technology as soon as possible. He believes this could address many dystopian fears that surround AI. People anticipate worst case scenarios because movies have promoted those ideas to sell tickets, but visionaries see AI as a tool that helps humanity, solving some of our most difficult problems and moving mankind to heights not previously imagined. ♦

"There are only a handful (eight) of these robots, and FAU has one."

– William Hahn, Ph.D.

What is AI?

Artificial Intelligence (AI) is the term used when machines perform tasks that normally require human intelligence such as game playing, navigating, even carrying on a conversation with a human. Like people, machines receive data from the world via sensors: light from cameras, sound from microphones, etc.

AI uses instructions written in computer code, called algorithms, to process all of the data and generate an output, such as a robotic action or a stream of speech. The most successful AI approaches to date use algorithms that learn from their mistakes in order to improve their performance.

THINKERS[®] AND MAKERS



Electronic Principles Pop in New Student Videos

By Robin E. Taber

Florida Atlantic University is beginning an educational video series designed to engage middle and high school students in computer science and engineering. They feature talented local students demonstrating basic principles of electronics, as well as showing off some of their own personal projects.

The series, titled “Thinkers and Makers,” gives bright Palm Beach and Broward county students a platform where they can shine and inspire others. “We created this series to ignite the imaginations of aspiring

computing and engineering professionals, and to convey



that computing and engineering pathways are available for everyone,” said Jason O. Hallstrom, Ph.D., director of FAU’s Institute for Sensing and Embedded Network Systems Engineering (I-SENSE) and professor in the College of Engineering and Computer Science.

The graphic-intensive series uses animation to give visual context and facilitate a more complete understanding of complex concepts. The episodes are short, less than five minutes, so they’re really meant to introduce a topic more than give a thorough lesson of it. Currently, most South Florida public schools wait until 12th grade to teach principles, such as Ohm’s Law, which is the fundamental relationship that describes how electricity works.

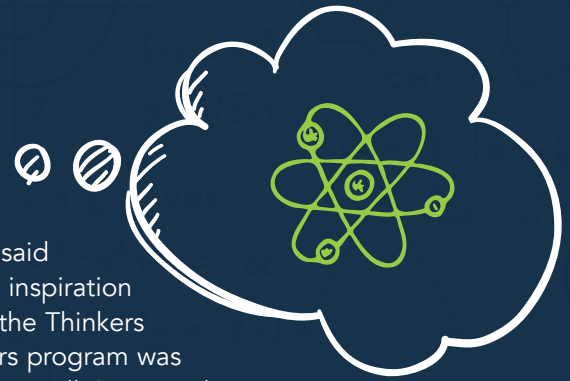
Four of the six students appearing in the new series attend FAU High School. One of those students is Devin Willis, who was one of the top 10 finalists

in the 3M Young Scientist Challenge and a guest on the "Tonight Show" to talk about his project. Another student, Julianna Wandell, 16, has two bachelor's degrees and is starting on her master's. All of these students are passionate about science, learning, inventing and helping others.

There is a national need for materials related to science, technology, engineering and mathematics (STEM) that can reach and inspire young audiences. "Science and Engineering Indicators," a publication of federal data on the state of U.S. science and engineering in a global context, shows a worldwide trend toward more knowledge-intensive economies, meaning a greater reliance on intellectual capabilities than on physical inputs or natural resources. Global collaboration and competition in these fields is increasing between businesses and nations. Bringing inventions or ideas to market has driven progress in everything from medicine to food, communication, national defense and social interaction.

According to the national Committee on Science, Engineering, and Public Policy, which addresses science-related concerns and requests, progress "is due to investments the nation has made in research and development at universities, corporations and national laboratories." And, a majority of future jobs will require advanced abilities beyond just a basic understanding of math and science.

Critical thinking, math, coding and an understanding of electronics principles will be a baseline, yet mathematics and science scores among U.S. students are, on average, lagging behind other developing countries.




Hallstrom said part of his inspiration to launch the Thinkers and Makers program was a quote from Bill Gates in the U.S. News and World Report: "When I compare our high schools to what I see when I'm traveling abroad, I am terrified for our workforce of tomorrow."

"It's hard to see the problem locally because we have a hidden gem in FAU High and Henderson schools in our backyard," Hallstrom said. "But those levels of computing and engineering excellence at the middle and high school levels are incredibly rare throughout the country."

These first five episodes were funded by I-SENSE and the Division of Research. External funding will be sought to continue the series and expand content on the website. "Working on a relatively small internal budget, FAU's (division of) research communications team produced a series we're all extremely proud of. Imagine what this will become when we secure external support," he said. "This was a labor of love for a big group, including our high school students (the stars of the show), our undergraduate researchers, the I-SENSE engineering team, creative services and the office of research communications. It took nearly one year to complete – and we couldn't be more excited to see these videos make their way into the communities FAU serves." ♦

**Subscribe to
FAU Thinkers and Makers
on Youtube.**



Octopuses are curious creatures. This octopus vulgaris (common octopus) is checking out the camera lens. They are unique animals with a complex nervous system. The common octopus has half a billion nerve cells - dogs and cats have only slightly more. However, the central brain has only one-third of the total number of neurons. So, where are the rest? At the base of each arm is a "mini brain" that can control some arm functions without communicating to the central brain. Neurons are also found in the octopus's skin and other organs.

Octo Girl

As part of her recent Ph.D. research, Chelsea Bennice studied how two different octopus species co-exist.

She developed a 24-hour camera to monitor the animals under the Blue Heron Bridge at Phil Foster Park in Riviera Beach, Fla., an area of the Lake Worth Lagoon, that is home to the two species in these photographs.

Under the pseudonym Octo Girl, Bennice hosts social media accounts, showcasing her work through photographs and videos. She also makes marine-inspired

jewelry for her Etsy shop, local dive shops and nature centers, donating proceeds to octopus research.

In addition, she hosts a campaign on FAU Springboard to help fund her next octopus research project.

Bennice earned a master's from FAU in 2012 and stayed to complete her doctorate work. She recently accepted a position at the FAU Brain Institute's ASCEND, an innovative program addressing the national shortage in STEM career-oriented students.

RIGHT: This is a close-up shot of this octopus' colorful skin. Octopuses can change their appearance in less than one second. This rapid color change is possible by the brain's direct neural control of millions of pigmented chromatophore organs. These chromatophores are like tiny balloons filled with orange, red, yellow or brown color. If the octopus wants to be red, the brain will tell the chromatophore with red pigment to expand. Octopuses also have iridescent cells (producing all colors) in their skin.



INSIGHTS

RIGHT: Octopuses have eight arms (not tentacles) that extend along the entire surface. Tentacles have the suckers concentrated toward the far end, but octopuses have around 200 suckers (sometimes more) on each arm. Arm suckers have important jobs such as tasting, feeding, attaching to a structure, or aiding in movement.

BELOW: The Macrotritopus defilippi (Atlantic longarm octopus) lives in sandy environments. It uses its long arms to create deep holes for its home, like a den. It also uses these long arms to reach down into sand holes to find crabs - the main menu item for this octopus.



BOTTOM: While the common octopus remains tucked away in its den during daytime hours, this species of octopus is active at night. Unlike the Atlantic longarm octopus, this species inhabits many environments (coral reefs, seagrass beds, rock/rubble areas). The orange snorkel on the side of the octopus is the octopus' funnel. This is where water, ink and waste are expelled.



A Caring Legacy

Christine E. Lynn College of Nursing Celebrates 40 years.

Since 1979

By Lynn Laurenti

Success stories abound at Florida Atlantic University, but few are as inspiring as that of the Christine E. Lynn College of Nursing, which is celebrating its 40th anniversary this year.

From its humble beginning in 1979, as a program serving an initial student body of 10 registered nurses seeking a bachelor of science in nursing degree, the college has grown to an enrollment of more than 1,100 students pursuing undergraduate and graduate degrees on the Boca Raton, Davie and Harbor Branch campuses. Even more impressive is the role the college has played in founding and developing a caring model of nursing practice.

The caring philosophy provides a holistic framework and set of values that focus on the human relationship between nurse and patient. This defining characteristic has long been at the heart of the college's educational, research and community outreach activities.

This year, U.S. News & World Report ranked the college's online graduate nursing program No. 23 nationwide — and No. 1 in Florida.

Throughout its history, the college has received sustaining support from philanthropist Christine E. Lynn, whose generous \$10 million gift in 2001 funded construction of its state-of-the-art headquarters facility on the Boca Raton campus.

The college has identified four key areas of research:

- Healthy aging across the lifespan
- Health equity
- Holistic health
- Transforming health care environments

This anniversary year provides an opportunity to take a look at selected research initiatives in each of the four categories, including notable work that began earlier in the college's history and recently funded new projects.

1979: The Bachelor of Science in Nursing program originated as a division within the College of Social Sciences.

1988: Master of Science Degree program is approved.

1970

1980

1984: Christine E. Lynn and Eugene M. Lynn provide a gift to create the first Christine E. Lynn Eminent Scholar Chair in Nursing, for the advancement of nursing knowledge.

1989: Nursing becomes a freestanding School of Nursing.

Healthy Aging Across the Lifespan

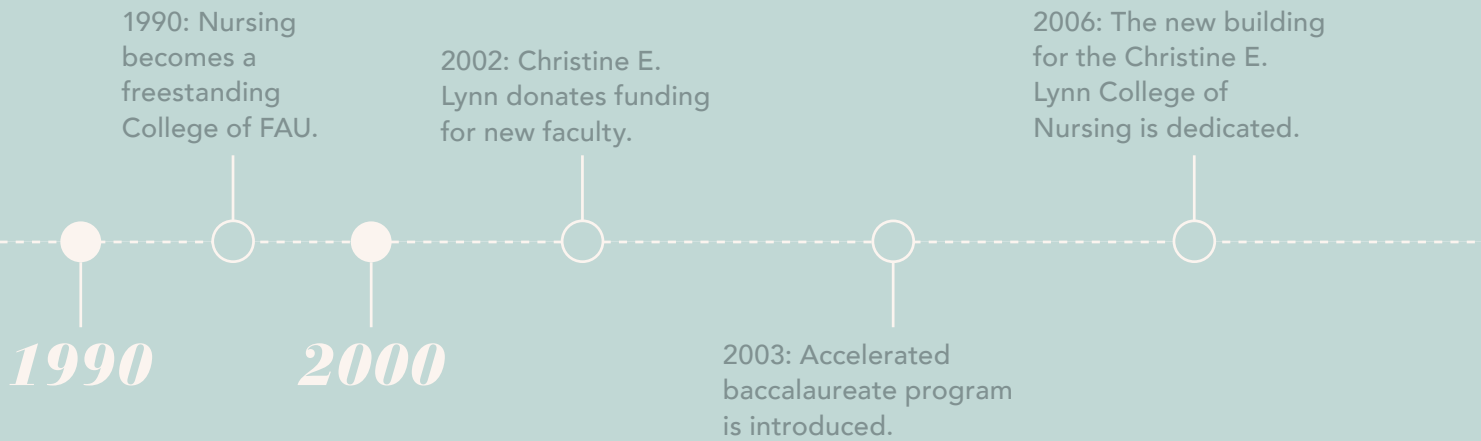
Then: The 2001 opening of the Louis and Anne Green Memory and Wellness Center, Boca Raton campus, capped years of pioneering research on memory disorders of older adults conducted by Ruth Tappen, Ed.D. Tappen was the center’s founding director, overseeing development into a vital community resource, offering an array of services to individuals with Alzheimer’s disease and other memory disorders, and providing support to their caregivers. Tappen, Christine E. Lynn Eminent Scholar, continues to make major contributions to enhance quality of life for older adults. Among other accomplishments, she has

worked to reduce rehospitalization of nursing home residents, producing a valuable decision guide that is disseminated across eight states. Tappen’s textbook “Advanced Nursing Research: From Theory to Practice” won the 2018 Book of the Year Award from the American Journal of Nursing.

Now: Lisa Kirk Wiese, Ph.D., an assistant professor, is focused on addressing the healthcare needs of rural populations, with special emphasis on reaching out to older individuals and their families who face a high risk for Alzheimer’s disease. She is leading a study on the effectiveness of home-based cognitive screening, with follow-up dementia-specific assessments and provider referrals by gerontological nurse practitioners. Wiese’s work builds upon the strong foundation established with Tappen, Christine Williams, DNSc, professor and director of the Ph.D. program; and David Newman, Ph.D., associate professor and statistician, both from the College of Nursing, in designing the Basic Knowledge of Alzheimer’s Disease survey for use in underserved populations. Wiese has presented this assessment tool to organizations, including the International Association of Geriatrics and Gerontology, Alzheimer’s Association and National Rural Health Association. It is also available in the Journal of Aging and Mental Health in her article titled “An Updated Measure for Investigating Basic Knowledge of Alzheimer’s Disease in Underserved Rural Settings.” Her research focuses on early dementia detection and management in underserved settings, thereby delaying costly institutionalization.



Patricia Evans, former director of nursing, presents an honorary degree in nursing to Christine E. Lynn, endowed an Eminent Scholars Chair in FAU’s Division of Nursing.



Health Equity

Then: John Lowe, Ph.D., a Native American tribal member and one of only 23 doctoral-prepared Native American nurses nationwide, devoted years to developing effective approaches to addressing drug and alcohol use among Native American/Alaska Native youth and young adults. In 2014, as faculty of the College of Nursing, he received a National Institutes of Health grant to design, conduct and evaluate an intervention program for Native American youth based on the traditional Talking Circle concept. The study utilized a web-based internet program to bring together sixth-graders from tribal communities in Minnesota, Oklahoma and North Carolina during virtual intervention sessions, with the aim of increasing participants’ sense of self-worth and cultural identity while decreasing their substance use. The success of the Talking Circle approach led the U.S. Department of Justice to name it a promising evidence-based program for the promotion of well-being among Native American and indigenous youth. Through this and other research, Lowe is having a positive impact on indigenous populations worldwide. Lowe went on to become the founding and current executive director of the Center for Indigenous Nursing Research for Health Equity at Florida State University.

Now: Tarsha Jones, Ph.D., an assistant professor, received a DAISY Foundation grant to understand the needs of minority women with breast cancer risk, particularly black and Hispanic women. She also received a National Cancer Institute grant through Columbia University to promote diversity in health-



Study abroad group in Guatemala.

related research. Black women in the U.S. are more likely than white women to get early-onset breast cancer before age 50, and twice as likely to be diagnosed with triple-negative breast cancer, an aggressive form of the disease associated with a BRCA1 gene mutation. They also have a 39 percent higher mortality rate. Jones also works with Hispanic women, who also suffer disproportionately from breast cancer. Both minority groups would benefit from genetic testing, but research findings indicate that this important risk assessment is underutilized in these populations. Jones is studying barriers to genetic testing of minority women who receive care in community health centers, with the goal of promoting increased use of genetic testing to identify individuals and families at risk for hereditary breast cancer. In her work with Columbia University, she studied more than 1,000 diverse young breast cancer patients diagnosed at age 50 and under to examine frequency and predictors of BRCA1/2 genetic testing among this group.

2007: Doctor of Nursing Practice is approved by faculty and university committees.

2014: The College of Nursing admits first freshman direct admit cohort.

2006: Doctor of Philosophy in Nursing replaces the Doctor of Nursing Science.

2008: Doctor of Nursing Practice program begins.

2010

2016: The College of Nursing established an Honors in Nursing program.

Holistic Health

Then: In 2011, researchers at FAU launched an examination of the effectiveness of Kristine Lee's Sit 'N' Fit Chair Yoga program on reducing pain and increasing physical function in older adults with osteoarthritis. Led by Ruth McCaffrey, Ph.D., DNP, professor emeritus of the College of Nursing, and JuYoung Park, associate professor in the Phyllis and Harvey Sandler School of Social Work, the results were encouraging, culminating in a National Institutes of Health grant in 2013 to continue the study through a randomized controlled trial. The researchers randomly assigned 131 older adults with osteoarthritis to either participate in the Sit 'N' Fit Chair Yoga or a health education program and 112 completed the interventions and the data collection after interventions. As reported in the Journal of the American Geriatrics Society, the chair yoga group showed a greater reduction in pain and pain interference with normal life activities. Another benefit is reduction of pharmacological treatment, which can have adverse effects. Chair yoga holds

promise to improve the quality of life for millions of older Americans suffering from lower-extremity osteoarthritis.

Now: The healing effect that the company of dogs can have upon sick and injured people has been recognized for centuries. Increasing understanding of that healing bond is at the heart of an initiative called Canines Providing Assistance to Wounded Warriors (C-PAWW), led by Cheryl A. Krause-Parello, Ph.D., a professor in the College of Nursing. Tragically, each year, about 7,300 military veterans suffering from post-traumatic stress disorder (PTSD), depression and other health, emotional and physical concerns, die by suicide. Krause-Parello and Erika Friedmann, Ph.D., of the University of Maryland, are working under a grant from the National Institutes of Health on a study using stress biomarkers to measure the effectiveness of a service dog training program for veterans with PTSD. Positive results could support changes in public policy, including allowing the classification of

service dogs as reimbursable medical expenses for veterans with PTSD. Krause-Parello was recently named an Edge Runner by the American Academy of Nursing in recognition of her pioneering work in the field of anthrozoology, the scholarly investigation of the human-animal bond.



First freshman direct nursing class standing in the College of Nursing building

2017: The College of Nursing is ranked No. 17 nationally and No. 1 in Florida on the List of “Best Online Graduate Nursing Programs for Veterans” in the 2017 U.S. News & World Report national rankings.

2019: The College of Nursing received a ranking of No. 32 for its Master of Science Nursing program and No. 54 for its Doctor of Nursing program by the U.S. News & World Report 2019 “Best Graduate Schools Guidebook.”

2018: The College of Nursing climbed to the No. 23 spot nationwide in the 2019 U.S. News & World Report national ranking for the “2019 Best Online Graduate Nursing Programs” and is the top-ranked program in the state of Florida.

2020

Transforming Health Care Environments

Then: It has been well documented that challenges such as increasing demands on the workforce, inadequate staffing and lack of an appropriately prepared workforce result in a healthcare system that fails to embody essential values held dear by those who choose to be members of helping professions. A 2004 research project conducted by Anne Boykin, Ph.D., professor emeritus; Susan Bulfin, Ph.D., associate professor and DNP director of practice teaching tracking both of the College of Nursing; John Baldwin, Ph.D., professor of biological sciences in the Charles E. Schmidt College of Science, and Rebecca Southern in the emergency department at Boca Raton Regional Hospital focused on transforming care from object-centered to person-centered. This transformation required a commitment to intentionally focus on creating a caring-based value system. The Dance of Caring Persons, a key concept in the Nursing as Caring Theory, was used to ground the evolution of an innovative practice model. This model, unlike the more traditional bureaucratic structure, envisions a circle of dancers in which all persons are valued, respected and supported in their roles without the encumbrances of power, authority and positional importance restricting their unique contributions to the dance. Through a commitment to live the value of caring, significant changes occurred and patient satisfaction significantly increased.

Now: Doctors, nurses, pharmacists, social workers and other professionals all interact with hospitalized patients, but communication among them has

historically been spotty at best. Both Terry Eggenberger, Ph.D., associate professor; and Kathryn Keller, Ph.D., professor, launched an interprofessional initiative to create a team-based approach to hospital care that could become standard practice nationwide. A project undertaken at Boca Raton Regional Hospital in 2015 focused on establishing a system for facilitating communication among the various health-care providers during patient rounds, with the aim of promoting collaborative care and improving patient outcomes. Eggenberger and Keller, advanced master trainers for Team STEPPS (Team Strategies to Enhance Performance and Patient Safety), have incorporated these evidence-based communication tools and techniques in a variety of education and practice settings. As the complexity of care needs increase and the focus shifts to value-based care, the need for interprofessional collaboration becomes increasingly important.

Future: FAU recently named Safiya George, Ph.D., as the new dean of the Christine E. Lynn College of Nursing. She is only the third dean to be appointed in the college’s 40-year history. “I have a passion for people, holistic health, caring and nursing science and I believe that I can contribute to and further support the impressive initiatives and programs at the college and across the campus,” George said. “I already have grown to love Florida Atlantic University and the Christine E. Lynn College of Nursing, especially the caring philosophy that transcends and represents everything about the college.”

Growing Up Scientist

Childhood Curiosity Leads to Successful Careers in Science

By Cammi Clark

Two prominent female primatologists – Jane Goodall, Ph.D., and FAU’s Kate Detwiler, Ph.D. – tell similar stories of investigating the natural world as young girls with encouragement from supportive parents.

The two have worked in the forests of Gombe National Park, Tanzania, Africa, living among chimpanzees and conducted groundbreaking studies. For example, Goodall discovering that chimpanzees use tools; and Detwiler uncovering two distinct species of monkeys producing hybrid offspring.

On an invitation from Detwiler, Goodall recently spoke at FAU, emphasizing the importance of protecting species and the environment, encouraging everyone to do their part, and sharing stories about her continuous inquisitive spirit. Goodall added that her love of animals started when she was a child, reading books like “Dr. Doolittle” and “Tarzan and the Apes.” (“Tarzan married the wrong Jane,” she quipped.) But the iconic 85-year-old scientist credits her mother for getting her on the right track to becoming a scientist.

“Luckily enough, I had a mother who supported me,” Goodall

said. “She didn’t even get mad when she came into my bedroom at night and found my bed full of Earth worms and Earth. She said, ‘Jane, you were looking at those worms as if you wondered how they walked without any legs.’”

Goodall also shared a pivotal story from when she was 4 and spent hours hiding to watch a hen lay an egg. “I go into an empty hen house and I wait. And I wait. And I wait. Which is fine for me, but my poor mother had no idea. And yet, when she sees her little girl, who has been away for four hours, running towards the house, with shining eyes, instead of getting mad ... she sat down to hear the wonderful story of how a hen lays an egg. ... If you think about that story, which is why I tell it again and again, it’s about the making of a little scientist — and a different mother might have crushed that early scientific curiosity and I might not have done what I’ve done.”

Like Goodall, Detwiler, associate professor in the Dorothy F. Schmidt College of Arts and Letters, was a precocious young scientist, who credits her parents with encouraging her curiosity. She grew up in a rural area of New Hampshire, in a house in front of a small pond that was home to many animals, including frogs. To a young child, a frog’s

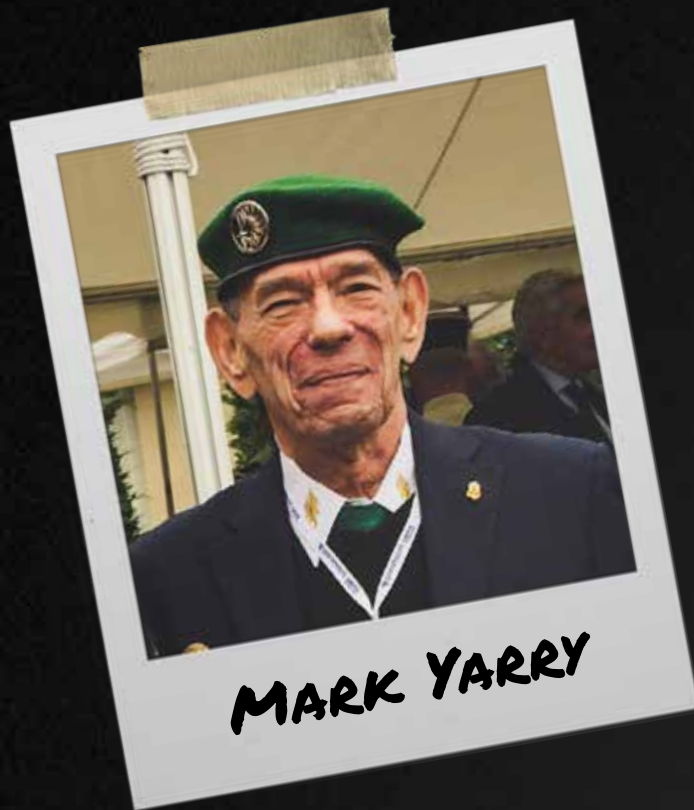
mating call might sound a bit like a duck quack, she said. “When I was a kid I kept saying, I’ve got to go find those ducks. So, I’d go out and look for the ducks, but they weren’t there,” quipped Detwiler, adding that, as a child, she spent a tremendous amount of time outside trying to catch and observe animals. She said she assumed she would follow in her father’s footsteps and become a medical doctor. Instead, she said, she had an “aha” moment in college when she discovered the science of animal behavior, which, of course, included Goodall’s chimpanzee research. ♦



Kate Detwiler's Discovery: As an undergraduate, Detwiler participated in a semester abroad program in wildlife ecology and conservation in Africa, where she began working in Gombe National Park. In 1994, Detwiler's research there led her to be the first to provide genetic evidence that two distinct species of monkeys inhabiting Gombe National Park, were mating and producing hybrid offspring. Using feces of red-tailed monkeys, blue monkeys and hybrids, Detwiler found that they all traced back to female red-tailed monkeys. For this lineage, it is the first time that science shows that not only is the DNA there, but so are the hybrids.



“Every four hours,
I was waiting,
watching my watch
to take another pill.”



Mark Yarry, 79, of Boca Raton, spent years addicted to prescription painkillers, which he began taking after being injured while fighting in the French Foreign Legion nearly 60 years ago. Decades later, he developed osteoarthritis in his hands, then spinal stenosis, and his dosage increased.

Faces *of* **Addiction**

FAU Faculty Fight Opioid Addiction From the Frontlines

By Wynne Parry

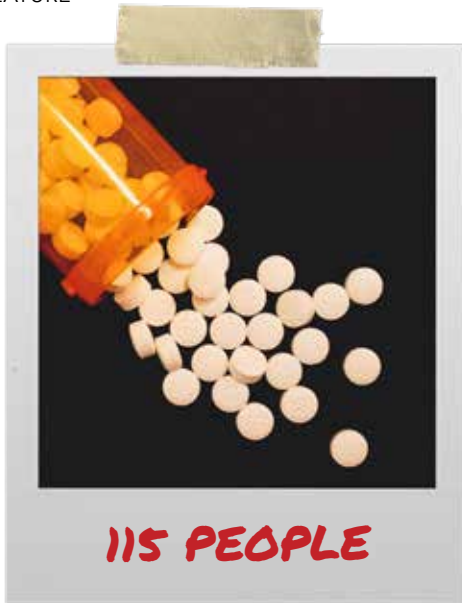
Over the past two decades, opioids — in the form of prescription painkillers, heroin and illicit fentanyl — have contributed to nearly 400,000 overdose deaths in the U.S. It is impossible to calculate the suffering these drugs have caused.

“Opioid addiction is a disease, and what we have seen in much of the nation is truly an epidemic,” said Jennifer Attonito, Ph.D., instructor in health administration in the College of Business, who studies policy related to addiction. “It’s been pervasive in life in the U.S., and uniquely so in Palm Beach.”

Palm Beach County became a hotbed for a fraudulent treatment industry, and it has ranked among the state’s worst in opioid-related deaths. A former substance abuse therapist who has lived in Delray Beach and Boca Raton, Attonito watched the epidemic flourish in her own backyard. Now, she and others are working to uproot it.

Attonito serves on the State Attorney’s Sober Homes Task Force, which, through arrests, new laws and regulations, has begun to successfully address the county’s crisis. She is also among 40 faculty and staff whose efforts are united by FAU’s Addiction Research Collaborative.

Some of these researchers investigate addiction and potential treatments in labs, while others go out into the community. Their work with those affected by opioid abuse, or at risk for it, illuminates the epidemic’s human toll as well as reasons for hope — in Palm Beach and beyond.



Today - and every day - at least 115 people will die from an overdose of fentanyl, hydrocodone, heroin or other opioid drug.

- National Institute on Drug Abuse, 2018

Better Together

When Niki Dietrich remembers her struggle to reunite with her toddler, she thinks of the Palm Beach International Airport. Once or twice a month for half a year, Dietrich flew back to her native New Jersey to see her daughter, who was in her sister's care, and to deal with the custody case.

After about a decade in and out of jail, psych wards and treatment for heroin and alcohol abuse, Dietrich had at last built a stable, fulfilling life in Lake Worth, Fla., and hoped to make her toddler part of it. But the judge, and her sister, resisted.

"They were not willing to accept me relocating to Florida, and I really truly believed what I was doing was right," she said. "I talked to a lot of people and I prayed about it."

Dietrich, 30, is one of three women given a handheld digital camera by Heather Howard, Ph.D., assistant professor in the Phyllis and Harvey Sandler School of Social Work. All

three are mothers coping with an opioid use disorder — the medical term for an addiction — who lost custody of their children. Howard and her collaborator, Marianna Colvin, Ph.D., also an assistant professor of social work, asked the women to document their experiences with the cameras and to envision change within the system that separated them from their children.

Howard studies the quagmire that women like Dietrich face: Pregnancy and the mother-child bond can offer powerful motivation for positive change. However, deeply ingrained stigma can make it difficult for them to ask for and receive support. Often, these mothers become entangled in a child welfare system that is prone to separate them from their children — with potentially negative consequences for both mother and child, Howard said.

"Much of my research focuses on the mother-infant dyad. Instead of polarizing an infant from the mother, we should be thinking about how we can we keep this mother and infant as a unit," Howard said.

In another project, she is tracking mothers with opioid use disorders after they are released from incarceration, and she plans to study the effectiveness of offering mothers peer support in long-term recovery. She and Colvin are recruiting more participants for the photography study.

After Dietrich refused to return to New Jersey, proceedings to terminate her parental rights began. But a caseworker intervened, even chaperoning visits to help Dietrich bond with

her daughter. Dietrich and her daughter now live in Lake Worth.

The other two mothers in the photo study group did not have such positive experiences. Discussions sparked by their photographs led the three women to decide to share their perspectives directly with the child welfare workers charged with deciding to remove a child, and others, like family court attorneys, who become involved later.

"My ultimate goal is that women are informed, that they can feel empowered to advocate for themselves and deal with child welfare systems, that they can heal from trauma," Howard said.

"Divine intervention"

After two arrests for possession of cocaine, Tracy Meredith naturally wanted to avoid felony charges and prison. So, she agreed to a two-year-long drug court program, a decision she regretted at first.

"As a get-out-of-jail-free card, it was appealing to me. I was desperate," she said. But the opportunity was anything but free. Drug court programs are intensive, and hers, in DeKalb County, Georgia, is especially so. In the beginning, it dominated her life with drug screens, nearly day-long classes, and constant threat of jail.

"I used to think all the time, what did I get myself into, I cannot do this," Meredith said.

For people like her — who have committed nonviolent crimes to feed an addiction — drug courts offer a deal: Complete strictly supervised treatment and training programs, and your charges will be dropped. "An arrest can be an

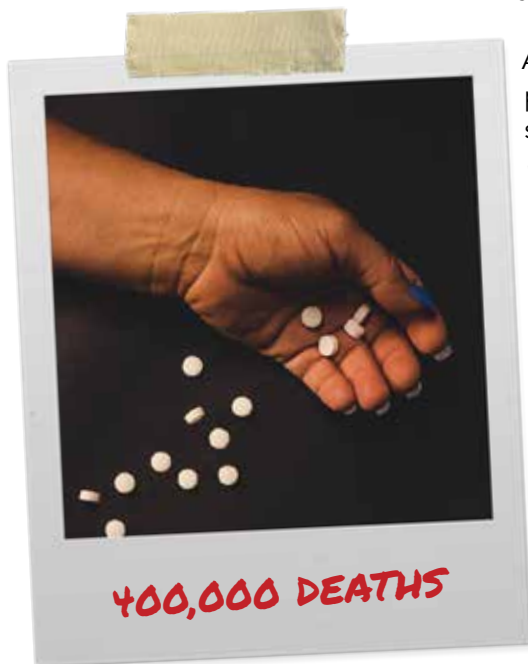


Niki Dietrich, center, struggled to regain custody of her young daughter, left, after coping with an opioid disorder and spending time in treatment centers for heroin and alcohol addiction. She now lives in Lake Worth with her toddler. Dietrich was part of research by Heather Howard, Ph.D., right, assistant professor of social work who studies the quagmire that women like Dietrich face: Pregnancy and the mother-child bond can offer powerful motivation for positive change.

opportunity for the criminal justice system to intervene in a positive way," said Wendy Guastaferrero, Ph.D., associate professor in the School of Criminology and Criminal Justice. "The pendulum swings between punishment and rehabilitation. Drug courts have demonstrated their effectiveness, and that has helped keep the momentum on the side of rehabilitation."

Guastaferrero studies best practices within these courts, such as efforts to improve parenting skills and the match between courts' offerings and participants' needs. She arrived at FAU in August of 2017; her recent research has focused on Georgia drug courts, including DeKalb County.

Meredith graduated in 2014, and now calls drug court "divine intervention." Without her arrests, she said, "I don't think I would have gotten help." (She did not participate in Guastaferrero's studies.)



400,000 overdose deaths from opioids in the U.S. in the past two decades.

- Centers for Disease Control and Prevention, 2018

The share of drug court participants with opioid addictions has increased, Guastaferrero said. Even so, few drug courts offer medication-assisted treatment (MAT), which prevents the agonizing withdrawal that occurs when someone with an addiction stops using opioids. Guastaferrero is examining the issue at a broader scale, looking at how frequently those involved in the criminal justice system get MAT if needed.

"MAT can save lives, first and foremost. Helping people physically is as important as helping them with social services," she said.

It starts with pain

For Mark Yarry, many years of addiction to prescription painkillers meant a fixation on time. "What happened was it made my watch the most important part of life," said the 79-year-old Boca Raton resident. "Every four hours, I was waiting, watching my watch to take another pill."

Aging often brings aches and pains. But the treatment many seniors receive — painkilling opioid prescriptions — can create new problems, including the risk of dependence.

"Seniors are different. They are not going out to the street to get heroin or fentanyl," said Juyoung Park, Ph.D., associate professor in the Phyllis and Harvey Sandler School of Social Work. "They have pain, perhaps from osteoarthritis, then they get a prescription. They get addicted later."

Long-term use of opioid pills increases the risk of addiction, according to the U.S. Centers

for Disease Control. Seniors may misuse their prescriptions to cope with isolation and depression, heightening the danger, Park said.

While a doctoral student in Baltimore, she studied misuse among seniors who, like Yarry, suffered from chronic pain. "A lot of people said, 'I don't know how to manage my pain without taking medication,'" Park recalled.

Yarry, who has not participated in Park's research, began taking pain medication after being injured while fighting in the French Foreign Legion nearly 60 years ago. Decades later, he developed osteoarthritis in his hands, then spinal stenosis, and his dosage increased. In fall of 2017, he went off the drugs cold turkey, an excruciating 11-day ordeal. Yarry now uses topical patches to soothe his hands.

Park studies another alternative: exercise. To treat chronic conditions, seniors average five to six daily medications. Such regimes create a risk of harmful drug interactions while stressing the liver and kidneys, she said. While opioid painkillers add to the dangers, exercise does not.

In a recent study, she and colleagues found that chair yoga, modified for seniors, can reduce pain and improve physical function among those with osteoarthritis, a common form of joint degeneration. Participants taking pain medication, including opioids, said they were able to cut back on pills. "We don't want to see seniors addicted to medication," Park said. "Certain types of exercise may help prevent that."



Science of **Addiction**

Larry Toll, Ph.D., a professor of biomedical science in the Charles E. Schmidt College of Medicine and a Brain Institute member, talks about the science behind addiction.

What is addiction?

"Addiction is defined as a chronic, relapsing disorder characterized by compulsive drug seeking, continued use despite harmful consequences, and long-lasting changes in the brain. It is considered both a complex brain disorder and a mental illness. Addiction is the most severe form of a full spectrum of substance use disorders, and is a medical illness caused by repeated misuse of a substance or substances."

- National Institute on Drug Abuse (NIDA)

What do opioids do to a person's brain?

Opioids do many things in many parts of the brain. Opioid receptors are found in brain regions involved in pain, respiration and reward, among others. In pain regions, opioids prevent pain signals from reaching the brain and from reaching peripheral sites, such as hands and feet, that sense the pain. In brain centers that keep you breathing, opioids block activation. This is why opioids cause respiratory depression and death by overdose. "Nearly all addictive drugs directly or indirectly target the brain's reward system by flooding the circuit with dopamine. Dopamine is a neurotransmitter present in regions of the brain that regulate movement, emotion, cognition, motivation and reinforcement of rewarding behaviors. When activated at normal levels, this system rewards our natural behaviors. Overstimulating the system with drugs, however, produces

effects which strongly reinforce the behavior of drug use, teaching the person to repeat it," according to NIDA. Ultimately chronic use causes poorly understood brain changes that lead to tolerance development to both its pain reducing activity and its rewarding activity, leading to a requirement for increased drug use. It also causes poorly understood changes that perhaps permanently modifies the reward system leading to a potentially lifelong relapse risk.

How quickly could someone become addicted?

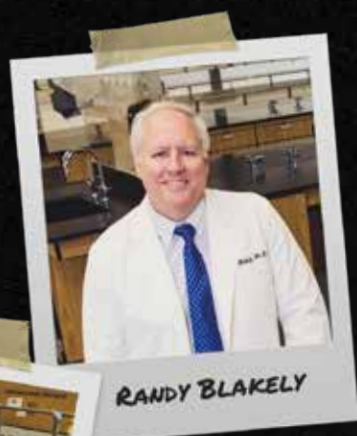
Addiction is considered approximately 50 percent environmental and 50 percent genetic. This means that different people will become addicted at different rates, and some people not at all. This is not to say everybody won't become dependent. Dependence means you will go through withdrawal. Everybody will do that after taking opioids for a moderate amount of time, and the longer you take them, the worse the withdrawal will be. Opioid withdrawal is bad and can lead to relapse. But that is not addiction.

Why is it so difficult to treat addiction?

Again, addiction causes real changes in the brain that leads to compulsive drug taking and poor decision making. There is evidence in the literature that it changes your reward "set point." In other words, you may feel bad "dysphoric" without drugs once becoming addicted. So, people take the drugs to feel normal. There is some reason to believe that some people take drugs in the first place because the drugs make them feel "normal" for the first time. These people probably become addicted more quickly or easily.

In the Lab:

FAU scientists, like those listed below, are parsing the biological underpinnings of addiction to better understand and treat the disease.



Randy Blakely, Ph.D., studies a class of brain proteins that clean up chemical signals called neurotransmitters. Drugs, including cocaine and amphetamines, target these so-called transporter proteins. His lab is exploring the pathways by which these drugs achieve their effects in order to intervene and potentially treat addiction. Blakely is the executive director of the FAU Brain Institute and a professor of biomedical science in the Charles E. Schmidt College of Medicine.



Lucia Carvelli, Ph.D., uses a worm as a simple model to study how amphetamines stimulate the brain's reward system. She has found that fetal worms exposed to these drugs were more sensitive to them as adults, a change they passed on to the next generation. This discovery has implications for understanding the human predisposition to addiction. Carvelli is an associate professor of biomedical science at the Charles E. Schmidt College of Medicine and a member of the FAU Brain Institute.



Predrag Cudic, Ph.D., is developing a new type of opioid-based pain medication that does not have the side effects and risk of addiction associated with conventional opioid painkillers. He has designed new analgesic molecules and a strategy for delivering them to their targets in the brain via an intranasal spray. Cudic is a professor of chemistry and biochemistry in the Charles E. Schmidt College of Science and an FAU Brain Institute member.



Janet Robishaw, Ph.D., is using data from 25,000 patients receiving opioids for chronic pain to identify the genetic variants linked to a high risk of addiction. By creating an "addiction risk score," she hopes to help doctors identify the 20 percent who are predisposed to addiction before they are given prescriptions. Robishaw is a professor and senior associate dean for research in the Charles E. Schmidt College of Medicine and a member of the FAU Brain Institute.



Lawrence Toll, Ph.D., investigates the signaling systems within the body that respond to opioids, whether they are drugs or molecules it produces naturally. He explores the biochemical basis for pain and drug addiction, and he is currently working on potentially less addictive pain treatments and new medications for drug abuse. Toll is a professor of biomedical science in the Charles E. Schmidt College of Medicine and an FAU Brain Institute member.



I-Health

Director Named for Institute for Human Health and Disease Intervention

By Cammi Clark

Gregg Fields, Ph.D., was recently appointed the executive director of the FAU Institute for Human Health and Disease Intervention.

Fields brings a wealth of research leadership, administrative experience and institutional knowledge to the position. He has served as the chair of the FAU Department of Chemistry and Biochemistry in the Charles E. Schmidt College of Science and as director of the Center for Molecular Biology and Biotechnology.

Previously, Fields was director of research and vice president of scientific affairs at the Torrey Pines Institute for Molecular Studies in Port St. Lucie. He will continue on in his role at the CMBB. Fields,

who holds seven U.S. patents and authored more than 250 scientific publications, was also named a fellow of the National Academy of Inventors. This distinction is given to academic innovators who have played a key role in creating inventions that have a tangible impact on quality of life, economic development and the welfare of society.

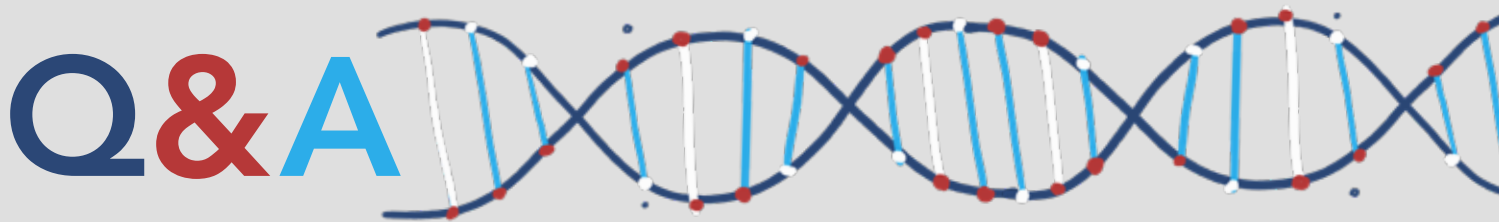
In becoming a Fellow of the National Academy of Inventors, Fields joined an elite group that includes 61 presidents and senior leaders of research universities and nonprofit research institutes and 21 members of the National Inventors Hall of Fame.

His research program has been continuously funded by the National Institutes of Health for 26 years. Fields has also received support from the American Cancer



Society, Department of Defense, Florida Department of Health and the Multiple Sclerosis National Research Institute.

Here's what Fields has to say about his research story, new appointment, and the trajectory of the Institute for Human Health and Disease Intervention.



Q. Did you always want to be a researcher or did you did you want to be something else? How did you end up here?

A. I always wanted to be a scientist. I had a chemistry set from when I was quite young, back in the day when chemistry sets allowed you to carry out really explosive experiments.

I came to FAU for the opportunity to work at a growing university, collaborate with researchers at The Scripps Research Institute and the Max Planck Florida Institute, and mentor undergraduate students.

Q What important skills, qualifications or experiences guide your research journey?

A. Like many researchers, my interests were shaped by personal experiences. Unfortunately, my family has an extensive history of cancer afflictions (all four of my grandparents, both of my parents and my sister).

The desire to better understand cancer, and design probes for both diagnosis and therapeutic purposes, has been a driving force in my research.

Q. What are you most proud of in your research/ studies/work?

A. Some of our research has resulted in commercial products that address societal needs in diagnosis and treatment. I am also proud of the achievements of former laboratory members, ranging from chief scientific officer at the Center for Disease Detection, San Antonio, Texas, to multiple associate professors.

Q. Talk about the purpose and structure of the new institute, and how you plan to broaden the definition of the clinical and translational research mission.

The institute will be structured to capture the strengths of research at FAU. Initially, there will be three focus areas:

- Cancer research and treatment
- Infectious disease diagnosis, therapies and patient awareness
- Neurodegenerative diseases, with initial consideration of Alzheimer's disease patient care and novel therapeutic approaches.

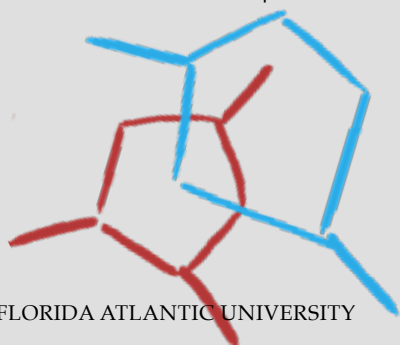
In addition to the Charles E. Schmidt College of Medicine, the institute will also partner with local hospitals and clinics. For researchers at FAU, the institute will facilitate the translation of basic research by providing access to the experiences of clinicians. In turn, clinical research will benefit from the access to new technologies and insights at the basic research level.

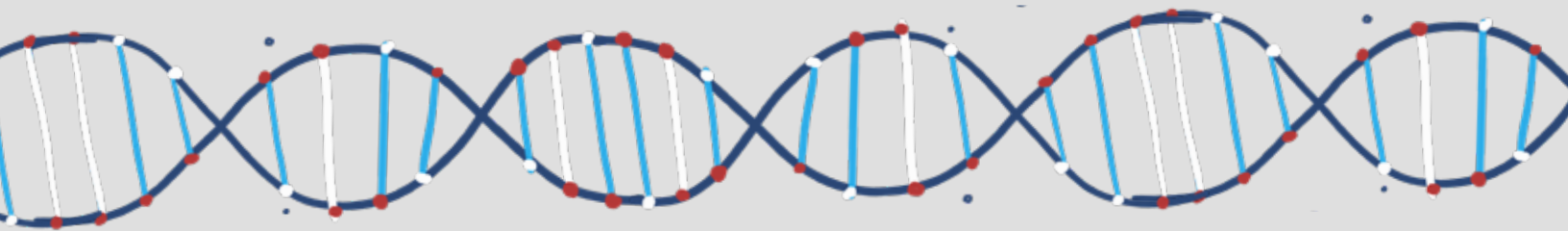
Q. What clinical areas will the institute focus on?

A. Initial targets are improvements in radiation delivery, Alzheimer's disease patient care and cancer diagnostics.

Q. There has been discussion about FAU partnering with a hospital. How do you envision the institute working with such a partner?

A hospital partner is critical to the institute's goals and ultimate success. Such a partnership will allow for a better understanding of patient needs and, directly relevant to basic research, access to patient data and tissue samples. Working with a hospital partner would also be key to creating a regional cancer center that incorporates basic and applied research and patient care. The Florida Department of Health has shown interest in the development of new cancer centers.





Following Fields

Gregg B. Fields, Ph.D., has degrees in chemistry from the University of Florida and Florida State University, and was a postdoctoral scholar with Ken A. Dill, Ph.D., at the University of California at San Francisco.

Fields joined the faculty at the University of Minnesota in 1991 as an assistant professor and was promoted to associate professor with tenure in 1995. In 1997, he achieved the rank of full professor of chemistry and biochemistry.

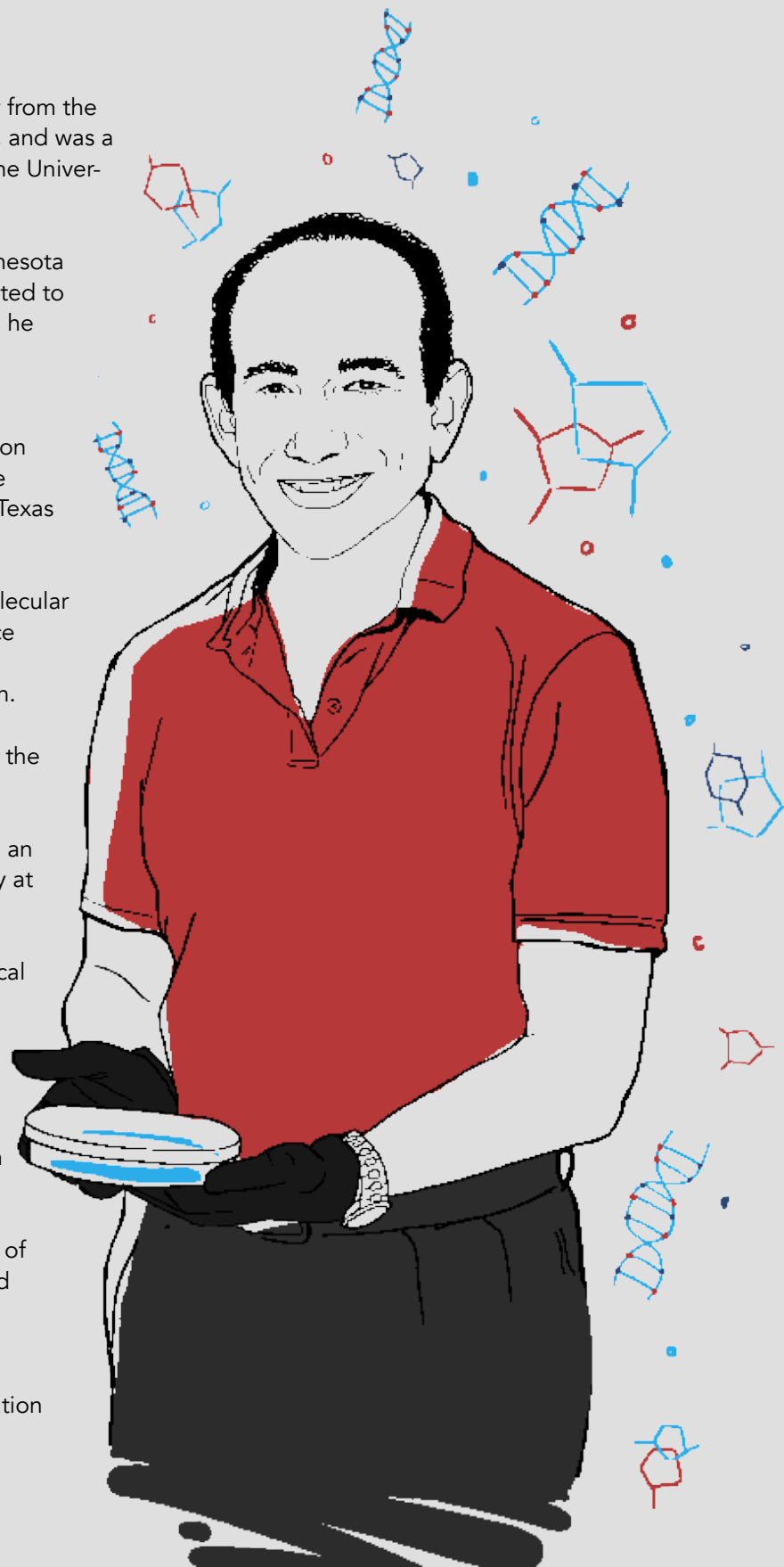
In 2008, he became a Robert A. Welch Foundation Distinguished University Chair in chemistry in the department of biochemistry at the University of Texas Health Science Center at San Antonio.

He relocated to the Torrey Pines Institute for Molecular Studies in 2011, where he was a full member, vice president of research and distinguished chair of metalloproteinase and multiple sclerosis research.

Fields joined FAU in 2014 as a full professor and the chair in the department of chemistry and biochemistry and the director of the Center for Molecular Biology and Biotechnology. He is also an adjunct professor in the department of chemistry at The Scripps Research Institute/Scripps Florida.

Fields' research interests are in the use of chemical approaches to better understand how protein three-dimensional structures influence cellular and enzymatic behaviors. Chemical approaches were used to develop "mini-protein" models for the study of cellular recognition processes, which in turn allowed for the mapping of protein domains involved in tumor cell binding and signal transduction. Mini-protein models were subsequently utilized to dissect the mechanisms of collagen catabolism, and in the process provided new avenues for protease inhibitor design.

Fields is also an elected fellow of the National Academy of Inventors and the American Association for the Advancement of Science.

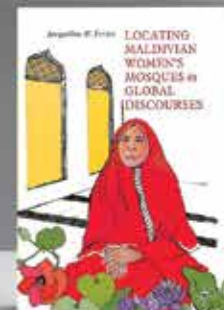
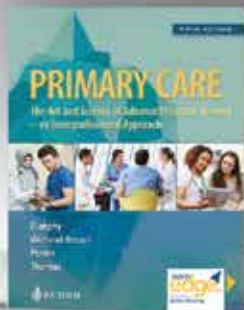


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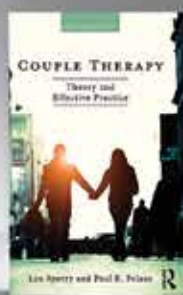
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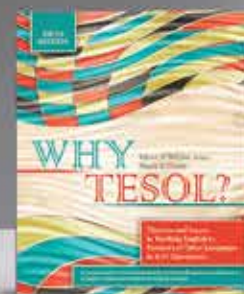
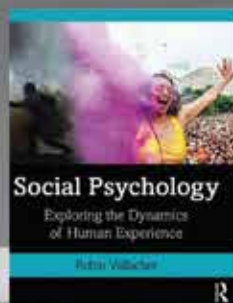
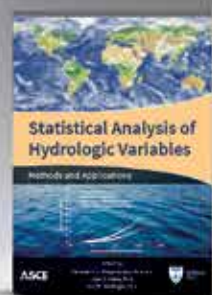
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Student working in a chemistry lab on the Boca Raton campus, 1960s.
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