

Turtles Without Borders

Sea Turtles Are Rebounding, But Much Work Remains





Extracts Research briefs



Turtles Without Borders

Sea turtles are rebounding, but much work remains



24

Center of Excellence

UF grows \$10 million grant into \$1.7 billion gene therapy company Brammer Bio

UF

Dr. Kent Fuchs President

Dr. David Norton Vice President for Research

Board of Trustees

Mori Hosseini, Chair David L. Brandon James W. Heavener Leonard H. Johnson Thomas G. Kuntz Michael C. Murphy Daniel T. O'Keefe Rahul Patel Marsha D. Powers Jason J. Rosenberg Robert G. Stern Ray G. Thomas Anita G. Zucker

Explore is published by UF Research. Opinions expressed do not reflect the official views of the university. Use of trade names implies no endorsement by the University of Florida. © 2019 University of Florida. explore.research.ufl.edu

Editor: Joseph M. Kays joekays@ufl.edu

Art Director: Katherine Kinsley-Momberger

Design and Illustration: Katherine Kinsley-Momberger Ivan J. Ramos

Writers: Joseph Kays Cindy Spence

Photography: John Jernigan Charlotte Kesl

Web Editor: Jewel Midelis

Copy Editor: Bruce Mastron

Printing: StorterChilds Printing, Gainesville

Member of the University Research Magazine Association www.urma.org



The Writing Life

The University of Florida's creative writing program nurtures and pushes its graduate students

Jay Ritter has spent his career

tracking the emergence of new

Mr. IPO

public companies

38

The Conversation Changing Tech's Face





David Norton Vice President for Research



The 2020 U.S. News top 10 public universities

- 1 University of California, Los Angeles
- 2 University of California, Berkeley
- 3 University of Michigan, Ann Arbor
- 4 University of Virginia
- 5 Georgia Institute of Technology*
- 5 University of North Carolina, Chapel Hill*
- 7 University of Florida *
- 7 University of California, Santa Barbara*
- 9 University of California, Irvine
- 10 University of California, San Diego

*= tie

Building a Better World

Being forward-focused on a worthy goal is an essential attribute of any individual or organization that seeks relevance and impact in a complex endeavor. While it's important to understand the past and appreciate the present, our focus must be on the future, on goals that extend beyond our current horizon.

Earlier this fall, UF Research recognized 32 faculty members as 2019 University of Florida Research Foundation Professors. Although these individuals represent just a small cross section of our faculty, their accomplishments demonstrate the forward-focused aims and impact of UF research.

Among this group are an entomologist developing new weapons in the fight against malaria and Zika, an ophthalmologist seeking cures for children suffering from congenital blindness, a psychologist advancing healthy aging, and a lawyer seeking to protect human rights worldwide.

There is a pediatrician focused on vulnerable newborns and on their families' ability to pay for treatments, a biomedical engineer developing tools for treating neurological diseases, and an agronomist fighting invasive plants.

Common in each of these is a recognized commitment and capacity to do even more, to focus forward. They are rightfully proud of what they have already accomplished, but even more energized by the possibilities that lie ahead.

This same forward-focused mentality can be seen within UF as a whole.

The university has enjoyed unprecedented external recognition and accolades in 2019. Since 2012, UF has seen its overall US News & World Report national rankings improve from 58th to 34th. Its standing among public institutions has risen from 19th to 7th. Our research expenditures have increased from \$697 million to \$865 million.

Yet even with that success, we are setting our sights even higher. We are seeking even better educational outcomes and additional funding to perform even more cutting-edge research and scholarship.

Why? The answer is simple. The University of Florida is not pursuing a specific place in the pecking order of peers. We are, instead, striving for something much more important. We are aiming to build a better world. Not just a better campus, a better laboratory, or a better college. We are building a better world.

The UF neuroscientist priming the human immune system to combat malignant tumors isn't worried about rankings. He is developing effective treatments for people everywhere battling cancer.

The computer engineer developing the next generation of high-speed computers isn't doing so simply to increase the number of times his papers are cited in academic journals, but to help preserve biodiversity.

And the education professor studying bilingual education isn't in it to win awards, but to ensure that teachers have the tools to help immigrant children succeed in the classroom.

The goal of the University of Florida is to create new and useful knowledge for humankind, and to train a generation of leaders committed to improving life not just for themselves or the people they see around them daily, but for people near and far, in times and seasons well beyond our limited horizons.

We aim to make the world better for all. To achieve this bold and worthy cause, we cannot rest on our accomplishments. We cannot spend time admiring the finite gains of yesterday.

We set our sights on the idealistic objective of making the world better tomorrow than it is today. We unlock new knowledge, seek cures for the incurable, invent life-changing technologies and illuminate the human spirit through the arts and humanities. By being forward focused today, we aim to make a better tomorrow.



DATIN VINIAC

"As one of Florida's leading environmental researchers, Dr. Frazer understands the unique water issues facing our state and the actions we must take to solve them."

-Governor Ron DeSantis

Chief Science Officer

UF ecologist Thomas Frazer is focused on the environment

Gov. Ron DeSantis has appointed UF environmental sciences Professor Thomas K. Frazer as the state's first chief science officer.

The chief science officer will coordinate and prioritize scientific data, research, and monitoring to ensure alignment with current and emerging environmental concerns most pressing to Floridians. The position of chief science officer was part of major water policy reforms announced in January.

"As one of Florida's leading environmental researchers, Dr. Frazer understands the unique water issues facing our state and the actions we must take to solve them," DeSantis said. "Since day one, my administration has been laser focused on addressing our pressing environmental challenges and commitment to science-based solutions. With science at the center, Florida can lead the world in environmental innovation and water quality improvement."

"We are excited to have Dr. Frazer join our team and lead the effort to ensure sound science is at the forefront of our mission to achieving more now for Florida's environment," said Department of Environmental Protection Secretary Noah Valenstein. "Dr. Frazer's impressive background and connection to our state's leading research institutions will be the perfect addition. Through collaboration and with science as our foundation, we are on the path to meaningful improvement for Florida's water quality."

"I am incredibly honored by this appointment and I thank Gov. DeSantis for naming me Florida's first chief science officer," Frazer said. "Our environment and waterways make Florida unique. I look forward to working with the governor and the Department of Environmental Protection on ways we can use sound science and research to improve our state's water quality and protect the environment."

Since 2012, Frazer has served as director of the University of Florida's School of Natural Resources and Environment and previously served as acting director of the UF Water Institute. His research focuses on the effects of anthropogenic activities on the ecology of both freshwater and marine ecosystems.



Hall of Famers

Computer graphics pioneer and chemistry professor honored

A University of Florida alumnus who co-founded the computer graphics company NVIDIA and a chemistry professor who invented a groundbreaking analytical instrument that is used daily in drug development are among the newest members of the Florida Inventors Hall of Fame.

Chris Malachowsky, an alumnus of UF's Herbert Wertheim College of Engineering, was selected for inventing the Graphics Processing Unit (GPU) that transformed the visual computing industry by creating a consumer-oriented 3D graphics market.

Under Malachowsky's leadership NVIDIA has evolved the GPU into a computer brain that intersects virtual reality, high-performance computing and artificial intelligence. He holds 35 U.S. patents.

"Chris Malachowsky embodies the attributes of a hall of fame inventor: creativity, leadership, integrity, professional excellence, and service to the local, state and global community," said UF engineering Dean Cammy Abernathy. "He remains firmly committed to the success of his alma mater and has been particularly pivotal in helping the college craft a vision around the coming 4th Industrial Revolution, which will help to position not only the university but the state of Florida as a leader in the creation of high tech innovation and jobs."



Chris Malachowsky



Chemistry Professor Richard Yost was selected for his invention of the triple quadrupole mass spectrometer, a groundbreaking analytical instrument that is used daily in drug development, disease testing, food safety and environmental studies. He holds 13 U.S. patents.

"Dr. Yost's research at UF, building on his invention of the triple quadrupole, has transformed tandem mass spectrometry from a niche research area, largely for fundamental chemistry studies, into a practical, widely available analytical technique," said David Norton, UF's vice president for research.

"Rarely has one invention or discovery in chemistry led to such a dramatic impact on human wellness and life, including the people of the state of Florida, as the triple quadrupole mass spectrometer."

Malachowsky and Yost joined six other inductees at the Florida Inventors Hall of Fame 6th Annual Induction Ceremony & Gala in September.

Honorees, who must have at least one U.S. patent and a connection to Florida, were chosen by a selection committee comprising distinguished leaders in research and innovation throughout Florida.

Joseph Kays

Richard Yost

Sun Burned

Did UV rays doom Neanderthals?



The extinction of Neanderthals and large mammals 40,000 years ago coincided with a weakened geomagnetic field that reduced protection from ultraviolet radiation, a new study shows.

"This tells us more about how our ancestors evolved within the mammal population," said UF geological sciences Professor James Channell. "Ultraviolet radiation was an important influence on mammal evolution."

Unlike Neanderthals, modern humans survived the prolonged UV radiation due to a key difference in their genome that better defended them from UVR. Scientists already knew that a protein called the aryl hydrocarbon receptor differed in Cro-Magnon and Neanderthals, but theorized the variation made Neanderthals more susceptible to environmental toxins such as those from cooking fires. Channell's study — done with Luigi Vigliotti of the Italian National Research Council's Institute of Marine Sciences — associates the different variants of AhR in Neanderthals and modern humans with different tolerance to UVR and correlates Neanderthal decline to weakened magnetic field and resulting UVR exposure.

Over generations, magnetic fields can spell the difference between extinction and survival: When the field is strong, it shields the Earth from solar winds that generate ozone-depleting chemicals, which weaken the ozone layer and allow more UV radiation to reach Earth's surface. Scientists can track magnetic field strength through time by sampling sea-floor sediments and ice cores.

During the last approximately 100,000 years, several episodes of low field strength — hence more intense UV radiation — affected large long-lived mammals, including Neanderthals, whereas smaller mammals were often able to cope. The timing of extinction was dependent on global magnetic field strength, the impacted locations (Australia, North America and Europe) and on the geometry of atmospheric ozone depletion.

"The effect was not a blitzkrieg, but a process that affected the genome over time," Channell said.

Channell and Vigliotti's study was published in the journal *Reviews of Geophysics*. Building on our understanding of fluctuating magnetic fields and their impact could unlock more secrets from prehistory.

"We need to know more about magnetic field strength in the past, how UVR affects the genome of mammals, and improve the chronology of mammal extinction," Channell said.

Alisson Clark



Good Genes

Florida panthers benefiting from genetic diversity



Efforts to increase genetic diversity in Florida panthers have helped the endangered animal survive and multiply since the mid-1990s, according to a new study by researchers with UF and the Florida Fish and Wildlife Conservation Commission (FWC).

"We show that panthers with greater genetic diversity are more likely to survive and reproduce than those with less genetic diversity," said Madan Oli, professor of wildlife ecology and conservation in the UF Institute of Food and Agricultural Sciences and a study co-author. "The findings can help inform Florida panther conservation in the years to come."

Panthers used to roam much of the southeastern U.S., but hunting and habitat loss greatly reduced their numbers and range. By the 1990s, only 20 to 30 panthers remained, all isolated in South Florida. With so few individuals, variation in the gene pool declined due to inbreeding. Inbred panthers suffered from higher rates of heart defects, infertility and other health issues that made them less likely to survive, the study's authors explain.

In essence, the Florida panther population needed "new blood." In an effort to improve genetic variation in the population, wildlife managers relocated eight female pumas from Texas to South Florida in 1995.

The pumas belong to the same species as the Florida panther. This conservation initiative mimicked the genetic exchange between panthers and pumas from Texas that once occurred naturally, before panthers became isolated in South Florida.

If the released Texas females mated with male Florida panthers, scientists hypothesized, then their offspring should exhibit more genetic variation, which in theory might improve their survival and reproductive rates.

But at the time, that theory had not been tested in a wild population of large carnivores, and scientists weren't sure it would work.

"There were some concerns expressed that breeding Florida panthers with Texas pumas could have a negative impact on the Florida panther population," said Dave Onorato, a research scientist with FWC and one of the coauthors of the study.

"With this study, we show that this particular concern was not an issue. Breeding between Florida and Texas animals improved fitness and led to the increase of the Florida panther population size from 20 to 30 in 1995 to 120 to 230 today," Onorato said.

In the study, researchers compared panthers with mixed ancestry — generations of offspring resulting from the initial breeding between the Texas females and Florida males — to those who had a pure Florida lineage. They found that those with mixed ancestry fared better in terms of survival and reproductive success.

The researchers were surprised to discover that this reinvigoration of the Florida panthers' genetics continues to benefit the population nearly five generations after the release in 1995.

"It was a pleasant surprise," Oli said. "Theory states that the benefit of new genes is expected to decline rather rapidly over time. However, there are no other comparable studies that continuously monitored a population over several generations. In this case, the Florida panther population continues to do well and the frequency of inbreeding traits remains very low."

In addition to assessing the fitness of Florida pan-

Tree **Traffic** Plantings along highways calm and beautify

thers, researchers developed a model to predict how the panther population would respond under different management scenarios, including the introduction of more animals from Texas.

They found that introducing five Texas pumas every 20 years would help prevent inbreeding and reduce the risk of extinction.

However, the authors emphasize that the introduction of new animals would need to coincide with meeting Florida panthers' habitat needs and would rely on continuous monitoring of the population.

"Without continuous monitoring and research, we would not know if or how genetics, survival and reproduction change, and wildlife managers won't be able to respond accordingly or in a timely manner," Onorato said.

The authors note that even though genetic management is an important conservation tool, conserving panther habitat is critical to their survival.

The study was co-authored by Madelon van de Kerk, Onorato, Jeffrey Hostetler, Benjamin Bolker and Oli.

Bolker is a researcher at McMaster University in Canada. Van de Kerk, now a post-doctoral researcher at Brigham Young University, and Hostetler, now with FWC, contributed to this study as part of their doctoral research under Oli in the Wildlife Ecology and Conservation Department at UF/ IFAS College of Agricultural and Life Sciences.

The study appears in the journal *Wildlife Monographs*.

Samantha Murray

Trees not only beautify highways, they can calm motorists down, says a University of Florida scientist. Furthermore, according to UF research, the trees planted along Florida's highways survive remarkably well, even after a period scientists call "transplant shock."

"Beauty and stress relief are probably the two most meaningful benefits trees bring to highways," said Andrew Koeser, an assistant professor of environmental horticulture with the UF Institute of Food and Agricultural Sciences.

"The trees enhance the experience of both tourists and residents as they drive to their destinations," Koeser said. "Additionally, there is research that shows folks who drive along tree-lined roadways have less stress compared to those navigating the concrete jungle without that green breakup."

Recognizing these advantages, the Florida Department of Transportation (FDOT) transplants many kinds of trees along the state's highways, including palms, the variety most widely associated with the Sunshine State. About 51 percent of the transplanted trees are palms. The rest include crape myrtles, buttonwoods and assorted other varieties. To assess the success of its tree-planting program, FDOT awarded Koeser grant funding to study how well the transplanted trees survive and thrive.

Koeser and his team surveyed 2,711 trees along rural and urban stretches of the state's highways. They found that more than 98 percent "established" themselves, surviving the hardships of planting and growing into the surrounding landscape.

"The establishment rate is among the highest on record," said Koeser, a faculty member at the UF/IFAS Gulf Coast Research and Education Center in Balm.

For instance, the success of Florida's highway tree transplanting program rivals that of a program in East Palo Alto, California, which had a 96 percent establishment rate. Florida's program also compares favorably to survival rates of trees in many transplanting programs along highways and urban areas worldwide, according to a 2014 study Koeser led.

FDOT contractors are responsible for tree maintenance, including watering, mulching, creating berms around trees to keep water close to roots and more. The FDOT inspects the contractors' work.

"Since the contractors say they will deliver what is promised, they are more eager to do the care needed to get the trees through the period of stress we call 'transplant shock,' " Koeser said.

Koeser's study is published in the journal Urban Forestry *& Urban Greening*.

Brad Buck



Self-Powered Sensors

Nano-wires react to create energy



University of Florida engineers have developed sensors that create their own electricity, extending automobile battery life.

The electrical energy from batteries powers not only the ignition system that turns the engine and moves electric vehicles but also powers almost every sensing feature of today's automobiles. Electricity turns on the car headlights for night travel, rolls the windows up and down, and senses numerous actions within the car to keep drivers aware and alert to their environment.

Today's autos come with many sensors—"door ajar," "seatbelt not fastened," "low tire pressure," and more. Newer autonomous sensors can even alert the engine to slow down and stop if the driver is inattentive or incapacitated. Each sensor requires just a little bit of energy from the car's battery, but all those little bits add up. As the industry begins to focus more on electric vehicles, networked vehicles, and passenger infotainment features, the number of sensors may increase significantly.

To deal with the problem of battery depletion, Jennifer Andrew, associate professor in the Department of Materials Science & Engineering at UF's Herbert Wertheim College of Engineering, and her team tackled the challenge of making sensors ever smaller in size and energy consumption.

Working with David Arnold, the George Kirkland Engineering Leadership Professor in the Department of Electrical & Computer Engineering, they have engineered a composite magneto-electric nano-wire array sensor that monitors automobile operations through electrical impulses generated by changing properties of the nano-wire itself. The sensor requires no external electric current at all to operate.

Each nanowire is made up of two halves—barium titanate, which exhibits piezoelectric properties, is paired with cobalt ferrite, a magnetostrictive material. In the presence of a magnetic field, such as the one present in the steel gears in a car engine, the cobalt ferrite undergoes a shape change, which imparts a strain to the piezoelectric barium titanate, thereby inducing an electrical polarization.

By connecting the nanowire array to a data-gathering source, the electrical impulses generated by the magnetoelectric can be used to sense the engine timing or detect a skid by the wheel speed. Functional magnetic field sensors are formed by connecting many nanowires in parallel.

Andrew's group reported that their nano-wires showed significantly stronger magneto-electric coefficients (indicating stronger electrical impulses were generated) than traditional magneto-electric material. These stronger electrical impulses mean that additional improvements to Andrew's device could result in even smaller sensors. The fact that the sensors use no external electrical energy source adds to their appeal for use in driver-attended and autonomous electrical vehicles.

UF Innovate | Tech Licensing has obtained a provisional patent on the technology and has filed for a U.S. utility patent. Allegro Microsystems, a global leader in power and sensing semiconductor solutions, has licensed the technology. Allegro has also become one of the first industrial partners of the Multi-functional Integrated System Technology (MIST) Center, a National Science Foundation Industry/ University Cooperative Research Center (I/UCRC) led by the University of Florida, which funded the team's work.

Andrew's research was published in *Nature's* online publication *Microsystems and Nanoengineering*.

Out of **Australia**

Perching birds originated Down Under

Perching birds, which include songbirds, make up more than 60 percent of the world's bird species. These birds — also known by their order name, passerines comprise more than 6,000 species, including familiar birds like cardinals, warblers, jays and sparrows.

While much is known about their birdsong, mating rituals and anatomy, the origin of passerines, which determines how different species developed and their relationship to one another, has never been fully explained or understood.

UF professors of biology Edward Braun and Rebecca Kimball were part of a large team led by researchers at Louisiana State University that proved all passerines originated in Australia. Previous hypotheses about passerine evolution and diversification purported that perching birds originated in South America. The research was published in the *Proceedings of the National Academy* of Sciences.

Braun, Kimball and their collaborators conducted genomic testing using technology that did not exist 10 years ago. They analyzed DNA data from the 137 families of perching birds. Kimball says that working together in a large research group is especially advantageous because each member provided an essential piece to this complex study that used museum samples, some as old as 100 years.

"Previous studies only looked at one or a few genes," said Braun. "What makes this study unique is one, the broad sampling across the genome, and two, the comprehensive nature in that we captured all major groups of perching birds. The third factor is the integration of the fossil records and biogeography, along with the comprehensive genomic sampling."

Using this genomic data, as well as knowledge of the Earth's shifting history when continents were closer to each other, the team discovered that this history was the primary factor in the evolution of passerines.

"A lot of people thought that factors that drove movement were radiation, expansion of numbers, things linked to climate change," said Kimball. "We've shown that is less likely."

"The evolutionary history of perching birds — when they moved, when they diversified — was very much shaped by Earth's history," said Braun. "They were passengers on parts of the planet. It was the history of the planet that determined when and where they moved."

"This study showcases the critical importance of museum collections in explaining the living world," said David Cannatella, a program director at the National Science Foundation, which funded this research. "By integrating modern, cutting-edge analysis of bird specimens with the legacy of natural history, the authors have uncovered valuable insights into how Earth history has influenced species diversity and what it means for the future of life on Earth."

Sequencing from these passerine genomes is the first paper that will contribute to Open Wings, a project funded by NSF that aims to understand the evolutionary history of all 10,560 named species of birds. Braun and Kimball are both principals on this project. "With Open Wings, our plan is to build on this. Hopefully, we will manage to have this tree to leap out to include all species of birds. That's a potential for the future," said Braun. "We need to know the broad brushstrokes before we focus in on every single group."

http://www.openwings.org/

Gigi Marino



Stopping Ebola

First vaccine moves closer to licensing



The European Medicines Agency, or EMA, has announced its conditional marketing authorization of a vaccine used to prevent the spread of the Ebola virus.

University of Florida researchers played an integral role in the design and analysis of trials testing the effectiveness of the vaccine, manufactured by Merck.

Conditional authorization brings the vaccine a major step closer to licensing, which will eventually make the vaccine more widely available to protect people who are at risk of contracting Ebola.

"The conditional authorization of the world's first Ebola vaccine is a triumph for public health, and a testimony to the unprecedented collaboration between scores of experts worldwide," said Tedros Adhanom Ghebreyesus, director-general of the World Health Organization (WHO).

The announcement by the EMA, the European agency responsible for the scientific evaluation of medicines developed by pharmaceutical companies, is the preliminary step before the European Commission, the executive branch of the European Union, decides on licensing. At the same time, the WHO will move toward prequalification of the vaccine.

"My hope is that we can now integrate the vaccine and ring vaccination strategy in a seamless manner with an approved product," said Ira Longini, a professor in the Department of Biostatistics at the UF College of Public Health and Health Professions and the College of Medicine, and a key figure in the design of the Ebola vaccine trial and the analysis of its statistical data. "This should make Ebola prevention and control even more effective than it is now and save even more lives."

A randomized trial for the vaccine, known as rVSV-ZEBOV-GP, began during the Guinea outbreak in 2015. Longini collaborated with Natalie Dean, a UF assistant professor of biostatistics, and an international team working with the WHO to use a ring vaccination approach to test the new vaccine.

With ring vaccination, people in contact with those who have contracted a virus — including family members, neighbors and co-workers — receive the vaccination. It is the same approach used in the consolidation phase in the eradication of smallpox.

In findings published in the journal *Lancet* in 2016, the researchers reported that the vaccine is nearly 100 percent effective at preventing Ebola when given 10 or more days before exposure.

The strategy is being used in the current Ebola outbreak in the Democratic Republic of the Congo. More than 236,000 people have been vaccinated, including more than 60,000 health and frontline workers in the country and neighboring countries of Uganda, South Sudan, Rwanda and Burundi.

The announcement of EMA's conditional approval will not have an immediate effect on how the vaccine is produced, accessed or administered in the Democratic Republic of the Congo. The vaccine will continue to be used under a research protocol known as "expanded access" or "compassionate use."

Longini continues to help the WHO with vaccination strategy and further assessment of the effectiveness of the rVSV-ZEBOV-GP vaccine in the Democratic Republic of the Congo.

"We now have learned how to design vaccine trials for important infectious disease threats, like Ebola, in a way that we can assess vaccine efficacy, apply for licensure and devise control strategies all within one study design," said Longini, a member of UF's Emerging Pathogens Institute. "This should lead to effective control strategies using vaccines and other interventions for future outbreaks of Ebola and other infectious disease threats such as Lassa fever, MERS, Nipah virus and chikungunya."

Jill Pease



Baby Food

Preemies do better without feeding tube test

Astudy at the University of Florida has found evidence that may invalidate a routine procedure that has been performed for decades on extremely pre-term infants.

Because extremely premature infants are too immature to feed by mouth, neonatal intensive care units nourish these babies through feeding tubes, which may be required for weeks and possibly even months. Gastric residual evaluation involves withdrawing the fluid in a pre-term infant's stomach through the tube before every feeding to determine how much of the previous feeding remains in the stomach. If residual content remains in the stomach, the providers then may decide to discontinue or shorten the next feeding.

The study found that infants who did not undergo the procedure had more positive outcomes, including more feedings, improved weight gain and fewer epi-



sodes of abdominal distension. Also, infants who did not receive gastric residual evaluation were able to go home eight days earlier than the infants who did receive the procedure.

"The significance of these findings is that we can omit a routine procedure that is done eight to 12 times a day on extremely pre-term infants taking place in neonatal intensive care units in this country and around the world," said Leslie Parker, an associate professor at the UF College of Nursing and the principal investigator on the study, published in *JAMA Pediatrics*.

"This will also save a substantial amount of the nurses' time that is currently devoted to performing these evaluations," she added.

Pre-feed gastric residual evaluation has been standard care for decades because large amounts of residual gastric contents have been considered to represent feeding intolerance, a risk for aspiration and ventilator-associated pneu-

Parkinson's Pictures MRIs can accurately diagnose disease

n an international study at 17 MRI centers in the U.S., Austria and Germany, a research team led by UF's David Vaillancourt used a non-invasive MRI method with 1,002 patients to develop an automated system to accurately diagnose Parkinson's disease and related but different neurodegenerative disorders.

In the study published in *The Lancet Digital Health*, researchers used diffusionweighted MRI, an imaging method that measures how water molecules diffuse in the brain and is particularly helpful in identifying where neurodegeneration is occurring.

Parkinson's disease and related disorders, such as multiple system atrophy and progressive supranuclear palsy, can present a challenge for accurate diagnosis because of shared and overlapping motor and non-motor symptoms. In fact, according to the new study, accuracy of diagnosis in early Parkinson's is about 58 percent, and more than half of misdiagnosed patients actually have multiple system atrophy or progressive supranuclear palsy.

The new results demonstrate the effectiveness of an automated method to provide a differential diagnosis of the various forms of Parkinson's.

"Our method may help to reduce the number of misdiagnosed cases in the future,' said Vaillancourt, professor and chair of Department of Applied Physiology and Kinesiology in the College of Health and Human Performance and a member of the McKnight Brain Institute. "Since these diseases require unique treatment plans and different medications, and clinical trials testing new medications require the correct diagnosis, getting it right is important for patient care."

monia or possibly a sign of a serious intestinal disease, said Parker. Until now, there has never been any substantial evidence that omitting gastric residual evaluation would impact patient outcomes or suggest that it was an unnecessary procedure.

"This study suggests that it is not necessary to do gastric residual evaluation before every single feeding," Parker said. "It's a question that has been frequently asked through the years, but we have always been too afraid we may miss something if we do not do it."

Through a \$1.4 million National Institutes of Health grant, Parker and a team of researchers completed a fouryear randomized clinical trial at the UF Health Shands Hospital neonatal intensive care unit, during which they enrolled 143 eligible infants who were born at 32 or fewer weeks' gestation. Seventy-four of the infants were randomized to undergo gastric residual evaluation for six weeks. while 69 of the babies did not receive the procedure before feedings.

Parker said she believes the babies who did not undergo the evaluation did better because they did not have their feeds discontinued. decreased or not advanced as a result of the amount of gastric contents aspirated, but that the procedure does still have merit in certain circumstances. For example, it is appropriate and necessary to do gastric residual evaluation in babies with signs of feeding intolerance, intestinal disease or other illness.

Anna Suggs Hoffman

Turtles With

Sea turtles are rebounding,

out Borders

but much work remains

By Cindy Spence

eleste McWilliams feels a surge of mother bear instinct each fall when her "babies" hatch. After monitoring their nests for weeks as part of the Sea Turtle Conservancy, often she is on hand to watch the tiny sea turtles scurry for the waves, off on a perilous journey.

"Sometimes, I want to dive in the water with them to be sure they're OK for the next 20 years," McWilliams says. "It's like having little reptile children."

As protective as she feels, she knows these turtles don't belong to her or to any of the hundreds of vigilant volunteers on turtle nest patrol. Nor do they belong to the University of Florida scientists and scholars so invested in their conservation. They may hatch in Florida—and, if the females live, return to Florida to lay their own nests—but Florida isn't exactly home.

Tom Ankersen, a UF conservation legal scholar, calls them turtles without borders. He has spent much of his career working on conservation law and international agreements to protect sea turtles, and on the surface, that global effort appears to be paying off. Green turtle nests in Florida, for example, have increased 80-fold since consistent counts began in 1989.



Karen Bjorndal and Alan Bolten

The surge in population has led some scientists to ask if certain sea turtle species still qualify as endangered, and others have begun discussing a new designation for one species, loggerhead turtles: species of least concern.

It's a designation that rankles biologist Karen Bjorndal, director of the Archie Carr Center for Sea Turtle Research, even as she acknowledges the current uptick in population.

"I just cringe at this designation," Bjorndal says, "because it trivializes the threats that these species still face."

Alan Bolten, associate director of the research center, says there is still plenty of reason for concern and points to a graph on his computer screen of loggerhead turtle populations. It zigs up then down, up then down, over several decades.

"We do not understand why it went down here," he says, pointing to a valley on the graph, "and we don't understand why it's going up here," pointing to a peak.

"And that concerns us."

The temptation to get caught up in the excitement—"thank goodness, the populations are rebounding"—is tempting, Bjorndal says, "rightfully so."

Legions of volunteers like McWilliams have put in decades of hard work, patrolling beaches every day during nesting season from May to October, protecting the nests. Around the world, thousands of people, Bjorndal says, have made real sacrifices in terms of not eating turtles or not selling them.

"It has hit people, culturally and economically," Bjorndal says, "so we need to celebrate; those sacrifices are paying off. We don't want to be all doom and gloom."



"If you analyze the graph, there's no trend. Over all those years, it hasn't increased, it hasn't decreased. It's stable, whatever that means. It's the most unstable stable curve you've ever seen."

–Karen Bjorndal

But the data still give her pause.

"If you analyze the graph, there's no trend. Over all those years, it hasn't increased, it hasn't decreased," Bjorndal says of the graph from the Florida Fish and Wildlife Conservation Commission. "It's stable, whatever that means. It's the most unstable stable curve you've ever seen."

Celebrate, yes, she says, but realize there's more work to be done.

PRACTICING PATIENCE

There are seven species of sea turtles, six of which are threatened or endangered, and five are found in Florida. About 90 percent of all sea turtle nesting in the southeastern U.S. occurs on Florida beaches, making Florida ground zero for conservation and a great home base for the Archie Carr Center.

The center is named for UF conservation pioneer Archie Carr, who began his work on sea turtles in the 1950s. Bjorndal and Bolten joined the research program in the 1970s. Decades later, they say, sea turtle science is a practice in patience.

Bjorndal and Bolten have some of the longest datasets on green turtles and loggerheads. Still, the creatures live 50 to 80 years, so the scientists may reach retirement before some of their subjects age out of their studies.

"When you have an animal that has a generation time of 50 years and that takes about 30 to 35 years to reach sexual maturity, you can't look at five- or even 10-year periods and draw conclusions," says Bolten. "You need to look at overall



Alexandra Gulick, left, and Laura Palma study the effect of rebounding sea turtle populations on seagrass beds.

population change over a generation."

If there is a rebound in nesting or populations, as for green turtles in recent years, pinpointing what caused it — or when that event happened — is excruciatingly difficult.

Rebounding populations also come with other research questions.

As sea turtles increase, so has their grazing of seagrass beds, much to the chagrin of other stakeholders, who got used to turtle-free seagrass beds, which shelter and feed a multitude of marine organisms that had the beds all to themselves when turtles were in decline.

"We have to keep in mind," Bjorndal says, "The natural state is the grazed state."

Two doctoral students at the research center are exploring the question of sea turtle impact on seagrass beds. Alexandra Gulick is investigating how turtle grazing affects the productivity of seagrass beds as a system. Early results show the grazing turtles do not decimate a seagrass bed, but Gulick would like to get a better idea of the carrying capacity of the beds.

"How did the seagrass beds once function when there were a lot of turtles?" Gulick asks.

Nerine Constant is studying fish assemblages in seagrass beds, in response to comments from fishers who are concerned about sea turtle grazing because their catches are declining. Using underwater video, she is surveying fish abundance and diversity in grazed and ungrazed seagrass beds to get the data needed to make management decisions.

Bjorndal points out that the ability to do such studies is a sign of success in itself.

"For years, it was almost impossible to find a natural grazing plot," Bjorndal says.

Years ago, one graduate student at the research center spent thousands of hours underwater, trimming seagrass with scissors to measure the potential impact of grazing if sea turtle populations rebounded. "Now, we have the luxury of going out and finding grazed seagrass beds, and in some areas, it's harder to find an ungrazed area than it is a grazed area," Bjorndal says.

"It's been such a revolution, just over my lifetime."

As green turtles and loggerheads recover and make themselves noticed in the ecosystem, people need to keep in mind that the turtles belong there, she says, even though they have not been present in such numbers for decades.

In August, Gulick and Constant also joined a Greenpeace expedition and teamed up on a research project on the Sargasso Sea, continuing the research center's long connection to the ecosystem.

For decades, hatchlings appeared to hatch and then disappear for years. Carr called those years the lost years and theorized the juveniles spent those important years growing and developing in the Sargasso Sea. Not long after his death, Bjorndal and Bolten proved it.



The Sargasso Sea is a sea with no shore. It sits in the North Atlantic gyre, bounded by currents moving clockwise: the Gulf Stream on the west, the North Atlantic Drift on the north, the Canary Current on the east and the North Equatorial Current and Antilles Current on the south. As the currents shift, the boundaries shift, but all the while corral sargassum, a nutrientrich golden brown seaweed, into a huge floating mat. The biodiversity of the sea earned it the nickname the golden rainforest of the ocean.

The same currents that corral the sargassum help steer the hatchling sea turtles into the Sargasso Sea, which is about 4.1 million square kilometers, a vast nursery where they find ample food and protection from predators.

Gulick and Constant knew the turtles were using the sargassum mats for refuge and food, but had another question: Could sargassum mats be providing a thermal advantage to help the tiny turtles grow? They sampled various locations and, indeed, the sargassum floating on the water was preventing lateral water movement and exchange, keeping the water in the mats warmer and potentially increasing the growth rate of the turtles, which are about 6 centimeters or so when they arrive.

Learning more about the temperature of the sargassum mats is particularly important in a warming world. While a warm watery world might help the turtles, researchers don't yet know if there is a heat threshold beyond which the turtles would be harmed.

Climate change isn't the only threat, though. The sargassum that shelters the turtles also traps tiny pieces of plastic. Bolten says more than 60 percent of the hatchlings coming off Florida beaches have ingested plastics after as little as two or three weeks in the water, and Constant saw evidence of that herself.

"When you swim through these mats, there's a rain of small plastic pieces, even here, 200 miles off Bermuda and 1,000 miles off the U.S. coast, in the middle of the ocean," Constant says. "We were seeing plenty of plastic."

While there are rules about polluting near-shore waters, there are only voluntary agreements not to degrade the Sargasso Sea. It falls in the High Seas, a sort of wild west of the ocean where no country has jurisdiction. And Ankersen is familiar with the intersection of jurisdictions and conservation law.

TURTLE LAWYER

Ankersen met David Carr, Archie's son, through his early conservation work and ended up in the late 1980s in Tortuguero, a Costa Rican beach famous for nesting by four turtle species. The conservation rules in Central America at that time were hit or miss. Some countries had protections, others were still building turtle canneries.





In the Sargasso Sea, Alexandra Gulick and Nerine Constant collected data on water temperature in sargassum mats. The warmer temperatures offer a thermal advantage to juvenile sea turtles as they grow. They also saw evidence of pollution with plastics, caught in the seaweed.



"Our model lighting ordinance has been adopted in some form or another by communities around the state."

- Tom Ankersen



From developing local ordinances to working on international treaties, Professor Tom Ankersen has used the law to protect sea turtles.

"I went to Tortuguero for a weekend, and I was sold," says Ankersen, who has seen major successes in turtle protection in the Caribbean.

Closer to home, there have been successes, too, with turtle excluders adopted by fishers to keep turtles from dying in commercial fishing nets and regulations passed to protect beaches where sea turtles nest.

One key success in the last decade is something any beachfront resident can help with: changing a lightbulb.

Light is the beacon that guides the silver-dollar-sized hatchlings as they run for the surf. In an age before electricity, the ambient light on the waves guided them across the sandy beach to the waves. In the modern world, lights on decks and porches often have the tiny creatures running not to the open ocean, but into dunes and decks and pilings, where they get stranded and become easy prey for other creatures.

Today, sea turtle-friendly lighting is gaining ground, and the fingerprints of the Conservation Clinic's work on that front show in state policies and local ordinances.

"Our model lighting ordinance has been adopted in some form or another by communities around the state," says Ankersen, who directs the Conservation Clinic, the experiential learning arm of the College of Law's environmental and land use law program. He also serves as director of the Florida Sea Grant legal program.

Technology, too, has caught up with policy. The type of light — blue, red or white — matters to sea turtles because of the wavelength. With long wavelength light — such as yellow or red — beachfront residents can keep the lights on and sea turtles can nest and hatch without artificial light beckoning them into harm's way.

"Biology and technology have converged to enable technological fixes to what had been human behavioral problems," Ankersen says.

Another project — coastal conservation easements — has met with less success, but Ankersen says the research in developing the project may lay a foundation for future work. Conservation



Sea turtles lay about 110 eggs in a nest, and average between two to eight nests per season.

Archie Carr began studying sea turtles in the 1940s and mentored generations of conservation scientists like Karen Bjorndal, who now directs the Archie Carr Center for Sea Turtle Research.

easements allow the state to acquire rights to land in the interest of wildlife and ecosystem protection. The landowners retain ownership but agree to forego certain uses of the property in exchange for payment or tax breaks from the state and federal government.

Conservation easements for wildlife corridors through vast ranchlands in the middle of the state have been popular, protecting thousands of acres. But coastal conservation easements have turned out to be more complicated.

"From a policy perspective, there's a preference for big, wild and connected," Ankersen says. "Our coastline is anything but big, wild and connected. Beach properties are small, domesticated backyards and disconnected."

The model easement that the Conservation Clinic developed offered a suite of options, and landowners could choose which options they wanted to put into practice. For example, a landowner could agree to keep domesticated animals, such as dogs, away from sea turtle nests and hatchlings. Another significant provision was agreeing not to armor the beachfront



by building a seawall, which would be a barrier to a nesting turtle.

During the research phase, the clinic surveyed coastal residents region by region to determine how receptive they would be to easements. A normal return rate for such a survey would be about 5 percent, Ankersen says.

"We had a 27 percent return rate. It's the most incredible return rate I've ever seen on a survey," Ankersen says.

Heartened by the response, the team set out to engage directly with landowners, and that's where it got more difficult.

"It's one thing to love sea turtles and think abstractly about giving over some property rights," Ankersen says. "Signing on the dotted line is more problematic."

Most people — or their heirs — were not willing to sign away their right to armor their beachfront against future sea level rise, storms or erosion. The team ended up with one easement, on a spit of undeveloped beachfront. Still, Ankersen says, it's important as a test case and may help in current work developing easements on privately owned islands in the Bahamas.

"The research, from tax law to property law to the surveying, was all done with students and faculty," Ankersen says. "And that's out there, and bits and pieces are being used." One approach that grew out of the research was to adapt the easement language for use in management agreements among consenting beachfront neighbors. The agreement does not entail transfer of property interests but it creates a common management approach for the beach. One such agreement exists in the Keys. A sea turtle-friendly model lighting easement that operates much like a façade easement in a historic district also has been developed.

The clinic is working on two other fronts as well, one on beach renourishment—sea turtles are picky about the beach slope and sand in which they nest—and another on surveying coastal park management plans to see how friendly they are to sea turtles. Again, Ankersen says, jurisdictions matter. If one coastal county has robust protections and good beach management, but the county to the south does not, then protection for sea turtles suffers.

In the meantime, Ankersen says conservationists rely on the army of sea turtle monitors like McWilliams, who watches both on the beach and online as she follows the travels of turtles equipped with satellite transmitters, who nest and return to the sea.

"I go online every day to see where my girls are," McWilliams says. "It's literally like having more of my own children."

Bjorndal, too, tracks turtles, watching as they whip through dozens of national jurisdictions.

"We released one, a sub-adult male from our major feeding area in the southern Bahamas, and he went straight south, into Venezuelan waters, circled north, went by Panama and off Costa Rica and did a whole circle then continued on up into Nicaraguan waters, where he stayed for six months," Bjorndal says.

The turtle's travels ended with an encounter with a fisher in the Caribbean, who returned the transmitter. More work to be done.

Karen Bjorndal

Distinguished Professor and Director, Archie Carr Center for Sea Turtle Research Department of Biology bjorndal@ufl.edu

Alan Bolten

Associate Director, Archie Carr Center for Sea Turtle Research Department of Biology abolten@ufl.edu

Tom Ankersen

Professor and Director, Levin College of Law Conservation Clinic ankersen@law.ufl.edu

Related websites:

https://accstr.ufl.edu/ law.ufl.edu/areas-of-study/experiential-learning/clinics/ conservation-clinic



"These turtles are already facing threats from global warming and plastics in the ocean. The additional peril from this disease can be quite devastating. It's an additional hurdle for them to overcome."

– David Duffy

Twille ER Sea Turtle Hospital addresses tumors

In 1938, when fibropapillomatosis was first reported in sea turtles in the Florida Keys, it seemed to be an anomaly.

By 2017, more than 250 sea turtles with the viral disease stranded in Florida and had to be taken to treatment facilities.

The explosion in fibropapillomatosis is likely due to human-caused changes in the state's coastal environment, says David Duffy, a molecular biologist who researches fibropapillomatosis at the Sea Turtle Hospital at the University of Florida's Whitney Laboratory for Marine Bioscience.

The viral disease causes tumorlike growths that can obstruct sea turtles' ability to see, feed or breed, impede the movement of their flippers, and even damage internal organs. The tumors can range from pea-sized to football-sized and have been reported in all seven species of sea turtle, although they are most common in green turtles. While green turtle populations are currently on the rise, fibropapillomatosis is "undermining conservation efforts across the globe," Duffy says.

"Rates of stranding have increased and the percentage of sea turtle populations with the disease has as well," Duffy says. "It is continuing to spread."

From its first report in the Keys, it took until 2010 for it to be reported in North Florida. Now, it has spread up the eastern seaboard into coastal South Carolina.

The increase in fibropapillomatosis is one of the reasons for the opening in 2015 of the Sea Turtle Hospital at UF, which got its start with funding from private donors. At the time, turtles stranded with the disease had to be taken to South Georgia or Central Florida, the transportation time adding to the burden of the disease. In its first year, the hospital treated and released about 60 turtles, and Duffy, a postdoctoral researcher in 2015, has been on hand since the beginning.

Now, as a newly hired faculty member, Duffy will open his own lab in February and focus on genetic features of the disease and the ways in which fibropapillomatosis shares characteristics with herpes virus in humans. Already, he and his colleagues at UF and at the Turtle Hospital in Marathon have discovered that certain drugs used to treat human cancers are therapeutic for diseased sea turtles.

The hospital uses the latest equipment, including lasers for surgery and scanning equipment to visualize internal tumors. Sixteen turtles at a time can be treated in 1,000-gallon tanks that are designed to keep them from becoming habituated to humans. The goal is to keep them wild so that when they are rehabilitated, they can be released into the ocean and fend for themselves.

Although the hospital is still new, Duffy says it could treat more animals if it could expand.

"But the Whitney Lab is also a research facility, so this is really an opportunity for us to not only treat individuals but actually conduct research that will let us determine what's driving this disease," Duffy says. Hatchling turtles and adults live in the open ocean, which appears to spare them the ravages of fibropapillomatosis, Duffy says. It is the juvenile turtles that get sick when they return to coastlines to forage. The virus occurs naturally in coastal waters, but the incidence of the disease goes up in highly populated coastal areas as opposed to pristine coasts, so Duffy and other researchers are hoping to identify which anthropogenic influences cause the disease to spike.

Unlike a traditional virus, the disease doesn't spread population to population, Duffy says.

"It's not enough to be exposed to the virus. The animal also has to be exposed to an environmental factor," Duffy says. "Clearly, there is a connection to people. Something we do changes the marine environment and allows the virus to spread. The rate of the disease is highest in areas with high human activity."

By using genetic sequencing, Duffy hopes to address the genetic causes of the tumors and perhaps spare the turtles rounds of surgery—sometimes as many as five or six—by identifying drug therapies that can aid recovery.

"These turtles are already facing threats from global warming and plastics in the ocean," Duffy says. "The additional peril from this disease can be quite devastating. It's an additional hurdle for them to overcome."

Cindy Spence

David Duffy Sea Turtle Hospital, Whitney Laboratory for Marine Bioscience duffy@whitney.ufl.edu

90%

of sea turtles in the Southeastern U.S. nest on Florida beaches

50 to 60 years

Sea turtles' average lifespan

Long wavelength light (yellow or red) is best on beachfronts for sea turtle nesting

Conservation Tips

- Report turtles struggling on the beach or in the surf to the Florida Fish and Wildlife Conservation Commission at 1-888-404-3922.
- Rethink plastics use sustainable shopping bags and refillable water bottles, skip straws, don't release balloons, properly dispose of fishing line.
- Leave the beach cleaner than you found it.
- Before heading home, put away beach furniture, fill holes and tear down sand castles.
- Be aware of lighting ordinances.
- Use caution when boating (and driving).

CENTER*of*EXCELLENCE

UF grows \$10 million grant into \$1.7 billion gene therapy company Brammer Bio

BY JOSEPH KAYS

Photography by John Jernigan

"It was the focus of my research in graduate school, at the companies I joined in the early '90s, and when I was on the faculty at Harvard," says Snyder, who was introduced to the field in the 1980s by UF eminent scholar Nick Muzyczka.

So, when some of the nation's leading gene therapy pioneers at UF's Powell Gene Therapy Center recruited him in 2001 to establish clinical manufacturing capabilities for the new genetic drugs they were developing, he jumped at the chance and joined the faculty in the Department of Molecular Genetics and Microbiology in the College of Medicine.



"UF's gene therapy research was world-renowned, thanks to the work of people like Ken Berns, Nick Muzyczka, Terry Flotte, Barry Byrne, Arun Srivastava, Bill Hauswirth and Mavis Agbandje-McKenna," Snyder says. "These scientists were innovating, creating these new medicines and demonstrating in animals that they worked."

Snyder's focus was to build a team and develop Good Manufacturing Processes, or GMPs, and analytics to grow adeno-associated viral (AAV) vectors that would be used to carry corrective genes to their targets in the human body. That manufacturing facility is still active today in UF's McKnight Brain Institute. In late 2003, Florida's leaders were making a big push to recruit major biotech players like the Scripps Research Institute, the Torrey Pines Institute for Molecular Studies and the Sanford Burnham Institute with hundreds of millions of dollars in incentives. The state also made significant funding available for university researchers.

"We knew that UF was a critical player in the state's biotech initiative, so we applied for a \$10 million grant to contribute to the state goals of being an international leader, and we won," says Win Phillips, currently UF's executive chief of staff and vice president for research at the time. "We needed a visionary leader and Richard Snyder was the clear choice. He seized the opportunity, expanded the vision, built the team and planned the laboratory."

Using the state grant and additional internal funds, the university purchased two buildings in Progress Park in Alachua in 2003 to house the Center of Excellence's new GMP manufacturing operation, called Florida Biologix, and the education center, called Biotility. Both the manufacturing and educational activities went live in 2006 after extensive building renovations.

"Richard Snyder's leadership resulted

in an outstanding success; from state investment and university partnership to the creation of a worldwide benchmark business," Phillips says.

The timing for the center couldn't have been better, Snyder says.

"A lot of things came together scientifically in the cell and gene therapy field in the 2006-2010 timeframe. People figured out the best way to deliver these new medicines, aligning the specific vectors to the appropriate tissues and diseases," Snyder says. "When those things started to get



Richard Snyder

locked in and there was real success in the clinic, that led to a push for commercial capabilities."

By 2014, demand on the Center of Excellence from private pharmaceutical companies for commercial support eventually outgrew the purview of a public university, Snyder says.

"We had been supporting these clients as they went through their phase one or phase two human trials, which is aligned to clinical research," he says. "But they needed a resource to go to phase three and on to the commercial marketplace, and that was something that we couldn't really support under the university mandate."

"People figured out the best way to deliver these new medicines, aligning the specific vectors to the appropriate tissues and diseases. When those things started to get locked in and there was real success in the clinic, that led to a push for commercial capabilities."

-Richard Snyder

So, the university spun out Florida Biologix, selling it to the investment firm Ampersand Capital in 2015.

David Norton, UF's current vice president for research, said the spinoff was exactly what the university, and the state, hoped would happen when the Center of Excellence was founded in 2003.

"We nurtured Florida Biologix until it was able to operate successfully on its own; now we're handing it off to the private sector," Norton said at the time of the sale.

As a private company, Florida Biologix continued to flourish, and in



Quality control scientist Karen Gilmore

2016 it merged with Massachusettsbased Brammer Pharmaceuticals to create Brammer Bio.

Snyder credits the addition of Mark Bamforth—who came to Brammer Bio as president and CEO after a 22-year career at biotech giant Genzyme and Gallus Pharmaceuticals—with filling out the executive team and catalyzing the explosive growth of the company.

"We had a pipeline of clients, a great team, and a viable business, but we really needed the horsepower that he brought to the equation in terms of his depth of knowledge and experience in commercial biopharmaceutical manufacturing," Snyder says.

Brammer quickly moved to expand, investing over \$200 million in new buildings and equipment in 2017 and 2018 at its Alachua clinical trial facility and at new commercial-ready facilities in Cambridge and Lexington, Massachusetts. Snyder said it was in discussions with investors to pay for additional capital investments when Thermo Fisher Scientific, one of the world's largest science support companies, offered to acquire Brammer for \$1.7 billion early in 2019.

"Brammer Bio will be an exciting addition to our pharma services business and will further strengthen Thermo Fisher's leadership in serving pharma and biotech customers," Marc N. Casper, president and chief executive officer of Thermo Fisher Scientific, said in a news release. "Gene therapy is an area of increasing focus for our customers and is fastevolving, given its potential to treat a range of genetic disorders. The combination of Brammer Bio's viral vector capabilities with our GMP production expertise and proprietary bioprocessing and cell culture technologies uniquely positions us to partner with our customers to drive the evolution of this

incredibly fast-growing market."

"We are proud to be pioneers in process development and manufacturing of viral vectors," Snyder and Bamforth said at the time. "Brammer Bio has executed more than 100 projects to supply first-in-human gene therapy clinical trials and establish commercialready processes, and we're excited to join Thermo Fisher to take our business to the next level. Our teams share a commitment to helping our customers succeed in delivering cutting-edge therapies to patients in need."

At the time of its acquisition, Brammer Bio had nearly 600 employees at its locations in Massachusetts and Florida. It is now part of Thermo Fisher's Pharma Services business.

Norton says the investment the state, the U.S. Department of Commerce and the university made in the Center of Excellence paid off many times over with Thermo Fisher's acquisition.



Quality control scientist Keith Green

"This was textbook technology transfer," Norton says. "We used the state's \$10 million investment to nurture this idea until it was commercially viable, adding hundreds of skilled jobs. Then we negotiated multiple deals that led to this \$1.7 billion acquisition."

Snyder—now vice president for science and technology, Pharma Services, Viral Vector Services at Thermo Fisher Scientific—says the success of Florida Biologix is a testament to UF's technology transfer ecosystem.

"I think it's absolutely world class. Whether you measure it by the success of the Sid Martin Biotech incubator in Alachua and the number of companies they have nurtured there and the millions of dollars that have been raised by those companies, or whether it is now the new Innovation Hub and all of the incredible work that's being done there, the connectivity of the university to the commercial ecosystem, and "This was textbook technology transfer. We used the state's \$10 million investment to nurture this idea until it was commercially viable, adding hundreds of skilled jobs. Then we negotiated multiple deals that led to this \$1.7 billion acquisition."

-David Norton

understanding how to actually transition inventions made at the university into business plans, and then ultimately real companies, has been remarkable really. I think UF was ahead of the curve and still is one of the leaders."

Snyder believes successes like Brammer have a significant impact on UF's reputation as a top 10 public research university, demonstrating the power of cutting-edge scientific research that is supported by a robust infrastructure and a supportive research administration.

"There are many factors that come

together to be a top public university, but I would like to think that the commercial activity coming out of UF Innovate and the university has to factor into the equation."

Snyder says he thinks the state's investment in UF in 2003 has paid off many times over, not just in the financial return on investment, but in helping to grow high-tech jobs and Florida's reputation as a biotech hub.

"I think it's been a big win for Florida," he says. "We had 100 university employees by the time we spun off



Tamara Mandell

Florida Biologix, and now we have a talented and dedicated team of nearly 300 in Alachua."

He adds that the success of the original center contributes significantly to ongoing efforts by the university and the Greater Gainesville Chamber of Commerce to grow the local biotech industry.

"I think the chamber has a lot of fuel to use in recruiting new companies to the area. When you come out to the business park in Alachua and the incubator is full and businesses are thriving and growing, it shows that we have a critical mass and people talk about that. Word of mouth is an incredibly important thing."

When the Greater Gainesville Chamber of Commerce named Brammer Bio its Manufacturing Company of the Year in 2018, chamber President/CEO Eric Godet said: "Having spun out of the University of Florida in 2015 and choosing to grow right here in Alachua County, Brammer Bio embodies the essence of Greater Gainesville. By continuing to expand and invest in both talent and facilities here, Brammer Bio is adding to our region's ever-growing biotechnology cluster."

Snyder is equally proud of the success of the other mission of the original Center of Excellence for Regenerative Health Biotechnology—to build a biotech workforce in the state. "Facilitating the discovery of exciting, high-growth career opportunities to these students while providing workforce talent for the industry creates a win-win for all stakeholders."

- Tamara Mandell

This educational component of the center continues as a UF entity called Biotility, led by Tamara Mandell.

Biotility offers certificate short courses for people working in the biotech industry to help them stay current and to assure regulatory agencies that company employees are trained in best practices. These same courses are frequently attended by graduate students and postdocs preparing to enter industry careers.

"Facilitating the discovery of exciting, high-growth career opportunities to these students while providing workforce talent for the industry creates a win-win for all stakeholders," Mandell says.

Biotility also developed and administers the Biotechnician Assistant Credentialing Exam (BACE), created in collaboration with Florida's bioscience industry organization, BioFlorida. The BACE documents mastery of knowledge and skill sets valued in entry-level positions, providing managers a mechanism for hiring qualified candidates and giving credential earners a competitive advantage for jobs.

"As other states began implementing a similar model of credentialing as Florida, they became very interested in the BACE," Mandell says. "We now have an actively engaged national advisory board representing a variety of bioscience industry sectors, and the credentialing exam is offered in 13 states and Brazil."

Snyder says it is particularly gratifying to see students who were trained at Biotility progressing to jobs at Brammer/ Thermo Fisher and other companies in the region.

"The training required for people who are manufacturing drugs is very specific to meet FDA compliance, and that is the sweet spot for Biotility," he says. 3

Richard Snyder

Vice President for Science and Technology, Pharma Services, Viral Vector Services at Thermo Fisher Scientific

Tamara Mandell

Director at Biotility tmandell@cerhb.ufl.edu



The Writing Life

The University of Florida's creative writing program nurtures and pushes its graduate students

BY CINDY SPENCE

Photography by Charlotte Kesl

"There is nothing to writing. All you do is sit down at a typewriter and bleed." —Ernest Hemingway

sk the would-be authors in the University of Florida's creative writing program the toughest thing about pursuing a master of fine arts, and a common answer is surprising, considering they've chosen to spend three years doing it.

Writing.

"Writing is not fun to me," says Jackson Armstrong, now in his second year. "I don't like it."

Even the pros, the faculty, understand the vulnerability of writing.

"It's very frightening sometimes. You're stuck in the work. The desire is beating down on you: write, write, write. You sit there two hours, three hours, four hours. You don't find anything to write," says Uwem Akpan, one of two new professors. "You've lost your powers. It is real, real terror."

Gardner Mounce, now in his third year, says the only safeguard against the vulnerability of writing is more writing. In spring of his second year, he started writing every day, and it made a huge difference.

"Writing every day helps because, as Jill [Ciment] says, writing is kind of like walking across a tightrope. If you take a day off, you risk looking down and not being able to start again," Mounce says. "So I took her advice and started writing every day."

For all its vulnerability, the students love the writing life. Armstrong says he can't imagine doing anything else. There is personal and professional growth in the crossed-out words and X'd out paragraphs, the pages that meet their fate with a tap of the delete button. One day, they hope, their false starts and mushy middles will lead to successful endings like those of Elliot Reed, MFA 2017, who wrote "A Key to Treehouse Living," or Rachel Khong, MFA 2011, who wrote "Goodbye, Vitamin," or Aaron Thier, who graduated in 2012 and has published three novels, "The Ghost Apple," "Mr. Eternity," and "The World is a Narrow Bridge." Three poetry students have won the prestigious Stegner Fellowship and one, Natalie Graham, won the Cave Canem Poetry Prize in 2016.

Those authors and poets are just some recent successes for a program that prides itself not only on providing the environment to write but connecting its students with the literary world—agents, journals, publishing houses and, of course, other authors.

Success can be many things, but one sure sign is publishing. Just since 2013, MFA@FLA alumni have published 161 books. The faculty, too, are prolific, modeling for the close-knit program what the writing life looks like, although they are not immune to second-guessing their own sentences.

Publishing, says Camille Bordas, also new to the program, is not inoculation against doubt.

"I'm never sure I'll ever write again. I'm never sure I should've started writing in the first place," Bordas says. "It sounds exaggerated to say it's a painful process; it's not physically painful.

"But the new work is just as hard as the first one," Bordas says. "There's a never knowing if it's good."



David Leavitt

Long history, new blood

The program's roots go back to 1949, making it one of the oldest creative writing programs in the United States. Its early history is one of fits and starts but also some renown. The author Andrew Lytle founded it, then went on to edit the Sewanee Review, the oldest literary journal in the United States. Pulitzer Prize-winning poet Donald Justice taught from 1982-92. For decades, names such as Padgett Powell and Harry Crews taught fiction, providing a southern literary flavor.

In poetry, the faculty stands at three: Ange Mlinko, an award-winning poet and Guggenheim fellow, Michael Hofmann, a renowned poet and translator, and William Logan, who is known both for his poetry and his criticism. In fiction and non-fiction are David Leavitt, a Guggenheim fellow who began publishing his work as a student at Yale, Jill Ciment, also a Guggenheim fellow, and the two new faculty members, Akpan and Bordas.

Logan, who started in 1983, is the longest tenured faculty member, while Leavitt, a faculty member since 2000, co-directs the program, known as MFA@FLA, with Hofmann. In 2006, Leavitt upped the profile of the program by using a grant from the UF Research Foundation to start *Subtropics*, a literary journal, with the radical idea that writers should be paid for their poetry and prose.

"I persist in believing—it's a matter of principle for me—writers deserve to be paid for their work," Leavitt says. "And it is something that distinguishes us from a lot of other literary magazines."

The magazine publishes both new and established writers. Students also get a chance to work on the magazine, reading manuscripts, managing social media, and interviewing contributors. A number of students who have worked on the





SUBTR°PICS

"I persist in believing — it's a matter of principle for me — writers deserve to be paid for their work. And it is something that distinguishes us from a lot of other literary magazines."

-David Leavitt



Third-year MFA student Gardner Mounce, above, says he found his rhythm in the program when he took the advice of a mentor and began writing every day. magazine have gone on to jobs in publishing, Leavitt says. MFA@FLA also hosts the annual Florida Writers Festival in the fall.

While rankings are quirky in such a subjective field, the program embraces one ranking, bestowed by Poets & Writers: #1 in job placement.

With funding from the provost, the program brought Akpan and Bordas on board, a recognition, Leavitt says, that no one on the faculty prior to their arrival celebrated a birth year more recent than 1969.

"It's an investment in the future of the program," Leavitt says. "I was worried that the time was going to come when everyone would retire, all at once."

The new faculty, Bordas, 32, a French author and translator, and Uwem Akpan, 48, a Nigerian author, joined the program in 2018.

Akpan had been a visiting scholar at a number of places following the success of his first collection of stories, "Say You're One of Them," in 2008. In sinking roots at UF, he says he found what he was looking for: a place with "top, top, top writers" who have "deep humanity."

"I wanted a place where there would be people I could talk with and really call colleagues," Akpan says.

Bordas' writing is rooted in a French tradition, in which authors tend to toil in isolation. She says the concept of an MFA program and the community it offers was foreign to her for much of her writing life.

"In France, there is no school that will teach you how to write, even though we have schools for fine arts and cinema and painting," says Bordas, who wrote her third book, "How to Behave in a Crowd," in English. "I always thought writers just read a lot, and one day they experiment, they try something and it works." Now the youngest faculty member, Bordas says she learned of the reputation of MFA@FLA as her awareness of MFA programs grew.

"I knew there were a handful of great creative writing programs in America, and that one of them was at the University of Florida," Bordas says. "It's a matter of who teaches there, and do they fund their students?"

The funding is critical to successful MFA programs, Leavitt says. Every student admitted gets a tuition waiver and a stipend, meaning they don't have to compete with each other for financial support, unlike students at many programs. Also unlike some other programs, the MFA@FLA is a true threeyear program, with funding guaranteed for the duration. Since students don't compete for funding, that allows students to cheer each other's successes and encourage each other in the face of failure. That collegiality, Leavitt says, is a hallmark of the program.

The third year is also critical to students' success. Leavitt says he recalls only four students who failed to complete a thesis by the end of the third year, and two of those returned later to finish. That makes for an extraordinarily good completion rate.

"Occasionally, people don't finish, and it's usually because of some sort of major writer's block," Leavitt says. "The last student who didn't finish ... honestly, I don't think his heart was in it. I think he realized he didn't want to be a writer."

There are moments, however, when he worries. In 2018, a student he advised was incommunicado, ignoring repeated emails about his thesis progress as the deadline approached.

"All of a sudden, this thesis lands in my computer," Leavitt says. "It's fantastic. He'd gone off and written it. What he needed was just to be completely alone."

The small group—36 students, 12 per cohort—makes for an intimate student-teacher ratio, especially compared to programs that admit 30 and 40 students each year. While the students choose a chair, they work with everyone, and that gives them a well-rounded view of their work from multiple discerning readers.

Mounce found mentors for his fiction when he clicked with Leavitt and Jill Ciment.

"David is fantastic. He is a super line editor. He writes the most beautiful sentences," says Mounce. "Jill is like a bigpicture wizard. You write a story and she can see the bigger picture better than you can. So, both of those experiences were transformative."

Settling on five or six students per genre after sifting through about 500 applications a year is not as daunting as it seems, Leavitt says. The process was more laborious during the economic downturn, when hordes of students flocked to





The program recently added two new faculty members: Camille Bordas, top, and Uwem Akpan. Right, poet William Logan is the faculty member with the longest tenure in the program.



WILL IS CAMILLE FORD

CAMILLE BORDAS

WILLIAM LOGAN

WILLIAM LOGAN

Borrowed Bio BY ANGE MLINKO

Where we'd recently lain, exchanging a kiss, stork consorted with crane, limpkin with ibis.

Was this as much wedding as there would ever be, the fowls' foot-webbing,

ring around a throat? Exchange of earth and air: not a vow but a vote of confidence a feather might tip by a single scale... That one's a raconteur, so much salt in his tale; this one's a countertenor,

lilting above the feast. The archon of his hectare _ spotted _ spotted least. Here's a little heckler...

penciled seagull in the margin. Following line by line the path you took, I imagine no print so fine.



UWEM AKPAN







MFA@FLA students regularly gather downtown at The Bull for readings by current and former students. Elliot Reed, MFA 2017, reads from a work in progress.

graduate school as refuge from a bad economy, but applications have tapered off to a more manageable level as the economy has strengthened.

The application asks students who their favorite writers are, but there is no answer that is an automatic disqualifier, although some set off "little alarm bells," Leavitt says. The writing samples—20 pages of fiction or 12 poems—are circulated and those that just don't suit are put aside. About 50 students per genre quickly emerge as contenders, Leavitt says. Comments are made and generally there is a great deal of agreement on the first cut. Then the negotiations begin.

"We get together and hash it out," Leavitt says. "There is a certain amount of horse-trading.

"Curiously enough, the poets are much more methodical about the score," Leavitt says.

Some law schools have higher acceptance rates than MFA programs. Leavitt says fiction admits 2 to 3 percent of applicants a year and poetry perhaps 7 percent.

"Then there are the people you didn't admit who go on to become famous," Leavitt says, "or the ones you admit who had a great story in their application, and it turns out they really only had that one story."

Workshop

Some students are kitchen table writers, others café writers. Some work before dawn, others late at night and still others in between. Then there's the procrastination: sitting down, getting up, getting a coffee, changing the thermostat, tuning out a barking dog, staring out the window, Googling random stuff. Waiting for words to flow. And after the words, comes workshop. Students bring their prose and poetry, the precious fruit of hours, even days, of toil, for the scrutiny of peers and professors. High hopes can go down the drain with an unexpected question or a look askance.

"No one comes out of workshop unscathed," Mounce says, "but I mean that in a positive way."

All students take four workshops, generally one with each faculty member in their genre, and it's a bit like speed-dating, Mounce says. What one professor or classmate likes, another may not.

"You go into workshop, and you know for an hour people are going to talk about you as if you weren't in the room," Bordas says. "The student does not speak in workshop."

The reasons behind the words cannot be explained. For better or for worse, workshop shows a writer how readers perceive his or her work.

But for all the nerves, no one would give it up because workshop is where students find their voice, says poet Erin O'Luanaigh, MFA 2018.

"That only comes after you've tried on all the other pairs of glasses the professors give you. Essentially they help you see a poem, so you can say 'Ange would make this change,' or 'William would cut this out,'" O'Luanaigh says. "With those perspectives in your head, you can revise—or not—and feel confident making your own decision."

Armstrong says he appreciates the criticism, even enjoys it. Mounce says it took most of his first year to transition from wanting to submit work that classmates would like to wanting to submit work to hear what needed to be improved.

MFA@

"If you're lucky enough to get the time to write, to put all the other aspects of life on hold and write...That's tremendous."

-Erin O'Luanaigh

"I just really wanted to be praised for the first year," Mounce says. "Now, I feel I'm in a healthier place for workshop."

Some students arrive on campus with "trunk stories," work they've brought with them, and submit those stories to workshop, perhaps feeling less vulnerable with more polished work. But the workshops are inexorable, and the story stash dries up.

"Eventually you run out. The workshops continue, and you just run out," Mounce says. "So you have to write."

Leavitt says he once submitted a story of his own to his workshop and agrees it was terrifying. But at its best, workshop saves a writer time.

"It might take a writer a year on his own to figure out where a piece is going wrong," Leavitt says. "A reader can help figure it out much more quickly."

Poetry students eventually run into workshop with Logan, whose unflinching criticism and reviews of poetry earned him the title "Samurai critic" from *The New York Times* and caused *Slate* to dub him "the most hated man in American poetry." Students, however, love him. "He goes out of his way to help students, so it kind of balances his critique," says Stephanie Maniaci.

O'Luanaigh says Logan provides plenty of feedback.

"He gives you back poems that are very, very heavily marked," O'Luanaigh says. "Beautiful lines, lines that you just love, will be crossed out."

But she adds: "The glasses William's workshop gave me allowed me to see a poem stripped down to its essence."

That's the goal, says Logan. He realizes students who know his reputation as a reviewer may have some trepidation signing up for his workshop and encourages them not to read his reviews.

"As a critic, you're criticizing something that is public," Logan says. "With a student, you're criticizing something that's private, and they're at an age when it's also very intimate."

One goal of the MFA program is for students to find colleagues who are good at editing and with whom they can trade poems. O'Luanaigh says it worked that way for her: she found her two most trusted readers in the MFA@ FLA program.

Logan doesn't continue to read students' work—"how crazy if you were editing your students' poems the rest of your life"—but O'Luanaigh says he gives his students a precious gift.

"One huge advantage of going to the University of Florida is that William will never review you," O'Luanaigh says. "He never reviews his former students. You're spared the chopping block forever."

His writing prompts, too, are famous, Maniaci says, with sometimes six or seven requirements. O'Luanaigh describes them as grueling. But Logan says structure frees the imagination. Without structure, students sometimes flounder.

"You get a poem that says, 'I looked out the window and saw ...' and about two months later you get another one that says, 'I looked out the window and saw ...' and you understand they're sort of living the design of the poem," Logan says. "I'm looking out a window and I have to report that I'm looking out a window. They're trying to frame it to be true to what they're doing, but that doesn't always make the best poetry.

"I get better poems if I make demands on them. So, I give them structure and other crazy things to put in. Then they stop thinking about what they're going to write and try to fulfill the assignment, and I get wonderful things from that."

With everyone at the same starting line, the students begin to notice differences in their styles and begin to think, "I wish I could do that."

"And that's jealousy, and jealousy is the great kick in the ass for writing," Logan says.

O'Luanaigh says the grueling prompts make the structure of poetry— quatrains, sonnets, stanzas, iambic pentameter—seem easier by comparison, like going downhill after an uphill slog.

At work on her first book of poetry, O'Luanaigh says she looks back at the MFA as a gift, a time to study under the masters. Prior to it, like many millennials, she worked several part-time jobs at once. Adding writing to her life would have been impossible.

"If you're lucky enough to get the time to write, to put all the other aspects of life on hold and write ..." O'Luanaigh says. "That's tremendous."

Leavitt says the very best advice is not about process or where to write, or when.

"Just write." 🛽 🛽 🛽

David Leavitt Professor and Director MFA@FLA dleavitt@ufl.edu

Related website: https://mfa.english.ufl.edu/

75.63

"One of the main things that I do for journalists is provide historical perspective and evidence. Responsible journalists like the kinds of facts I can provide."

-Jay Ritter

Mr. IPO Jay Ritter h tracking the public comp

Jay Ritter has spent his career tracking the emergence of new public companies

BY JOSEPH KAYS



F

L ick up *The Wall Street Journal* or *The New York Times* or turn on CNBC's Squawk Box or Bloomberg TV on any given day and if there's a story about companies like Uber or Lyft or Pinterest or Airbnb going public, UF finance Professor Jay Ritter is likely to be quoted.

The database of information about initial public offerings, or IPOs, that Ritter started building in 1979 for his doctoral dissertation has grown into an essential resource for journalists, investors, scholars and policy makers. Ritter has tracked so many variables about so many companies—more than 8,500 at last count—that he and his collaborators and students can answer just about any question that arises. Want to know the average first-day returns on IPOs? He's got it. The fraction of companies with negative earnings? Got it. The number of U.S. IPOs from Chinese companies? Yep.

And because he is able to provide up-to-the-minute data and easily digestible quotes, he is now known throughout the industry as "Mr. IPO." He has been quoted in *The Wall Street Journal* more than 180 times since 1989; nearly 100 times in *USA Today*; more than 50 times in *Bloomberg Business Week* and Bloomberg TV; and more than 40 times in *The New York Times*.

"Professor Ritter's research into, and data about, IPOs is without peer," says Mark Hulbert, a columnist at Dow Jones for MarketWatch, *Barron's* and *The Wall Street Journal.* "He also is unfailingly willing to respond to reporters' questions and help them understand the nuances of the historical record. I am in his debt for countless stories written over the last several decades that were infinitely better because of his insights."

"If I wasn't getting calls from journalists I probably wouldn't bother updating things on a weekly basis, but with a sufficient demand it makes it worth my while," says Ritter, the Joseph B. Cordell Eminent Scholar in UF's Warrington College of Business. "One of the main things that I do for journalists is provide historical perspective and evidence. Responsible journalists like the kinds of facts I can provide."

"Professor Ritter has for years provided his invaluable insight on the IPO market that helps members of the media find trends, explain the process and provide historical perspective amid the deal activity," says Leslie Picker, a reporter for CNBC who has covered IPOs for six years. "We've consistently used his data and comments on air and online to improve our coverage of the IPO market."

Ritter says he kind of stumbled into IPOs while searching for a dissertation topic.

"I had the good fortune to study under eight Nobel Prize winners at the University of Chicago," says Ritter. "But if I had been more knowledgeable about the real world when I was working on my dissertation or if my professors were paying more attention, I would have realized that the IPO market had been dead for six years. They would have told me not to do it, that nobody cares about it, and they would have been right. But I didn't know that, so I started working on IPOs at what turned out to be the start of a booming market."

A market that since 1979 has included such high-profile names as Apple (1980), Microsoft (1986), Amazon (1997), Google (2004) and Facebook (2012).

"These are now among the largest market cap companies in the world, and all of them are pretty young companies, reflecting the dynamics of the US economy," he notes.

What's An IPO?

While many people have heard the term IPO, a lot of them probably don't really understand what it means and even fewer have the resources or the access to invest in them, and Ritter says that's OK.

For the record, NASDAQ defines an IPO as "a company's first sale of stock to the public. Securities offered in an IPO are often, but not always, those of young, small companies seeking outside equity capital and a public market for their stock."

"There's no reason for everybody to be an expert, or even have minimal knowledge about how IPOs work, just as I don't need to know the intricacies of what's involved with the 5G network," Ritter says of the coming super-fast cellular network.

And, he adds, individual investors probably wouldn't want to invest in IPOs anyway.

"Smaller investors often suffer from what's called the winner's curse. If there's lots of demand, they're unlikely to get shares. If nobody else wants to buy, they're likely to get shares, but those shares probably aren't going to do very well. My view is that for most people investing in the stock market, buying and holding a low-fee index fund is the best strategy."

Ritter says journalists often ask him if he thinks it's fair that small investors can't really get into the IPO market.

"It would concern me if the limited partners who invest in venture capital funds were getting unusually high returns," he responds, "but generally they're not doing that much better than the average investor."

Ritter says that typically about 90 percent of IPO shares are bought by institutional investors such as mutual funds, but he adds that individuals will benefit indirectly if their 401(k) invests in successful IPOs. IPOs are important to the economy, however, Ritter adds.

"IPOs are part of a well-functioning capital market, just as the banking system is part of a well-functioning capital market," he says. "Raising equity capital from a public market of investors facilitates companies' ability to grow."

And, they enable the founders of the companies to cash in on their success.

"IPOs provide an opportunity for employees to sell some of their stock options, so that rather than just having big paper wealth they are actually able to buy a house and raise children," he says.

In fact, Ritter says IPOs have actually helped to change the profile of America's wealthiest people.

"According to Forbes, in the last 35 years the fraction of rich people who got their wealth through inheritance has plummeted," he says.

Although they have only recently appeared in the public conscience, Ritter says IPOs have a long history in the financial world, dating back to 1602 when the Dutch East India Company first offered shares to raise capital for its explorations.

"Thomas Edison was funded primarily by venture capitalists," Ritter cites as another example. "He was very oriented toward having his army of engineers and inventors and tinkerers work on things that he thought might be commercially viable, which would make him and his investors wealthier."

Fewer, Bigger Companies

After the Internet bubble burst in 2000, the number of IPOs in the United States dropped dramatically and has stayed low. According to Ritter, between 1980 and 2000, an average of 310 companies went public each year. Since then, that number has dropped to 110 companies. The difference, he says, between IPOs in the early 2000s during the "dot. com" boom and bust and today is that

Various Variables from *Mr. IPO*

Ritter's database compiles a multitude of variables across 8,500+ companies

Uber, Lyft, Pinterest and others are much bigger and more mature companies than was true of IPOs 20 years ago.

"Rather than just being a startup with an idea, these companies have a business model where they've demonstrated that people are willing to buy their goods and services," he says.

Ritter's data shows that the median age for tech companies going public in 1999 was four years, compared with 12 years in 2018. Median sales, meanwhile, were about \$12 million in 1999, compared with \$173.6 million in 2018.

"The reason that companies are waiting longer and growing bigger is that technology and globalization have in many industries made being big more important than it used to be, and getting big fast more important than it used to be," he says.

Another reason there are fewer IPOs is that many successful startups never do go public, Ritter says. Instead they get acquired by a bigger tech company. According to Andy Serwer, editor and chief at Yahoo! Finance who frequently quotes Ritter, "since 2012 Facebook has bought 77 companies. Since 1998 Amazon has bought 83 companies. Since





1998 Apple has bought 108—more than half over the past five years. And the granddaddy of them all, Google, has purchased 234 companies since 2001."

Although they may be older and bigger than in the past, most newly public companies still aren't profitable, Ritter says.

"About 83 percent of US-listed initial public offerings in 2018's first three quarters involve companies that lost money in the 12 months leading up to their debut," Ritter told *The Wall Street Journal* in October 2018.

While much of the focus is on wellknown service providers like Uber and Airbnb, Ritter says biotech companies account for a large fraction of IPOs, even though many of them might not have an actual product, like a new drug, for years.

"Most of them don't even have any revenue and they don't expect to be selling products for many years," he says, "but the market fully understands that and realizes that it's difficult to come up with a successful drug and that most of the companies are going to end in failure. But, at the right price it can be a good investment. Your most likely outcome is that you're going to earn a low return, even a negative return, but there's a lot of upside potential. Every once in a while somebody comes up with a blockbuster, and they're counting on that possibility."

Ritter argues that sales are a much better predictor of IPO success than profitability.

"Historically, companies that have gone public with less than \$50 million in sales have been disappointments," he says. "Companies that have demonstrated that they have a product or service that people are willing to buy, on average, have been decent investments, not necessarily beating the market, but not underperforming either."

Much of the IPO attention in 2019 was focused on the two ride-sharing giants—Uber and Lyft—and most of the news was bad. Uber lost nearly 8 percent of its initial \$45 per share price on its first day, which Ritter says was the worst opening-day performance in terms of money lost that he has ever tracked, costing investors \$617 million. On Nov. 1, it was trading at \$31. Lyft opened at \$72 per share and immediately started going down, by Nov. 1 it was at \$43. But Ritter has been predicting for months that those losses won't mean much if Uber and Lyft eventually merge, which he has called "inevitable."

Speaking on Yahoo! Finance in April, Ritter noted that Uber has a history of "calling a truce and merging" with rivals in other parts of the world, so he predicts that eventually the two competitors will become one.

Ritter says IPOs have provided a rich research environment for him and his students and he looks forward to continuing his tracking of companies that could lead the economy well into the 21st century.

"When I started working on IPOs 40 years ago, I had no way of knowing that the IPO market would boom," he says. "Being in the right place at the right time has worked out well for me—and for the last 23 years, Gainesville has been the right place."

Jay R. Ritter

Cordell Eminent Scholar, Department of Finance, Insurance and Real Estate jay.ritter@warrington.ufl.edu

Related website: https://site.warrington.ufl.edu/ritter/

THE CONVERSATION





Changing Tech's Face

BY CHRISTINA GARDNER-MCCUNE

Often when I speak with students who are majoring in computer sciences, many of them tell me that they have never taken a computer science course until college. This is especially true for the female, black and Latino students I've spoken with as a computer science professor.

But newly released data from the College Board suggests that things are beginning to change, especially for girls and students from groups that are underrepresented in computer science.

Specifically, the figures show the number of black high school students who have taken Advanced Placement Computer Science Principles-a class that involves both computer programming and the social impact of technology-rose 121 percent since the course launched in 2016, from 2,981 to 6,589. The number of black students who scored a 3 or higher on the AP exam for this course increased 118 percent since 2017, from 1,269 to 2,766 in 2019, according to a College Board representative.

A score of 3 or better often enables exam takers to get college credit and bypass introductory computer science courses in college.



The number of Hispanic/Latino students who have taken AP Computer Science Principles has increased 125 percent from 8,334 to 18,780, since the course began. The number of Hispanic/Latino students scoring a 3 or higher on the AP CSP exam increased 116 percent since 2017, from 4,742 in 2017 to 10,264 in 2019, according to the College Board.

Finally, in the three years since the launch of AP Computer Science Principles, the number of female students who have taken the course has increased 136 percent, from 13,328 to 31,458, the College Board has reported.

What do these figures mean? As a professor who studies ways to get more students interested in computer science—and as someone who helped develop and teach an early version of the AP Computer Science Principles course, as well as the exam—I believe these numbers will ultimately result in more students from diverse backgrounds being better positioned to major or minor in computer science. This in turn will help diversify the tech industry.

Why diversity in tech matters

Diversity in the tech field is important because computing technologies are pervasive in our daily lives—from the GPS we use to get around, to apps we use to bank, make hotel or flight reservations and check the weather. But if the people who design the technology don't include women, minorities, people with disabilities, or other individuals from diverse backgrounds, it could lead to technology that works for some or maybe even most but not all.

For instance, it recently came to light that the body scanners used by the Transportation Security Administration frequently set off false alarms for Afros, braids and other hairstyles worn by black women. This in turn subjects black women to more frequent and invasive screenings at the airport.

Problems like this are why it is important for software development teams to be as diverse and inclusive as possible to ensure technologies address the needs of all. As more students see people who look like them taking computer science courses in high school, more students will take notice and follow in their footsteps. Ultimately, this will enable them to become the software engineers and tech innovators of the future.

Christina Gardner-McCune

Assistant Professor, Computer & Information Science & Engineering Department gmccune@ufl.edu

To read more articles by UF faculty, visit https://theconversation. com/institutions/university-of-florida-1392



Explore Magazine Box 115500 Gainesville, FL 32611-5500 Non-Profit Organization U.S. Postage PAID Gainesville, FL Permit No. 94

Exposure



ernard Brzezinsł

A close-up view of some of the 319 individually controlled fans in the wind tunnel at UF's Powell Family Structures and Materials Laboratory. The upgraded system, which replaces one that used eight larger fans, will be even more capable of replicating extreme wind phenomena. The bulk of the technology was created in-house using 3D printers. The fans push wind over 1,100 individually controlled elements, known collectively as a terraformer, that allows fine control over turbulence close to the floor where the test subject is placed.