

VCU Research

Improving the
Human Condition



Virginia Commonwealth University

Office of the Vice President for Research and Innovation

2018 - 2019 Annual Report



VCU

Office of the Vice President for Research and Innovation

One **VCU** Research

On the left are VCU Health's clinical services and programs while on the right, the academic infrastructure of the university is shown. The overlapping circles show where VCU's chartered institutions bridge the two sides. •



Advancing excellence in VCU Research

The 2018-19 academic year represented a new milestone for Virginia Commonwealth University. For the first time, we reached \$310 million in sponsored research, an institutional record by 13%. We are among the top three ranked research universities in Virginia; nationally we rank 65th for all research by public universities. Our inaugural annual report features not only some of these important measures of success, but also noteworthy initiatives of a representative group of VCU researchers who significantly influence their fields.

These advances testify to the dedication of our faculty, staff and students who invest so much into research and innovation. In many ways, we continue to prove that we are a university of great conscience, that we take on what others find challenging, that we will engage in and advance the work that matters most. Our research is transformational and impactful in elevating human health, the environment and well-being of people, yet we recognize that there remains much work to address growing societal challenges and needs in these areas.

I realize that we must support VCU's rapidly growing research enterprise with the necessary resources and infrastructure. The Office of the Vice President for Research and Innovation (OVPRI) is adapting to ensure sufficient state-of-the-art services meet the varied needs. We continue to invest in our students and young investigators who represent VCU's future. We will advance our mission as a research university by

strategically focusing on humanity's greatest challenges using a "team science" approach.

As a premier urban public research university, VCU is committed to innovative and transformative learning, exceptional patient care, demonstrable community engagement and influential research. To enhance VCU's overall prominence, I convened the Strategic Research Priorities Planning Committee this fall to create a university-wide plan that is bold and ambitious. In the coming months, we will release details of this plan, including thematic programs and targeted focus areas. This committee's effort, aligned with VCU's strategic plan, Quest 2025: Together We Transform, will help streamline investments leading to increased funding and growth, ultimately advancing excellence in research at VCU.

As vice president for research and innovation, it's a privilege to work with VCU faculty, staff and students committed to enriching the human experience and an equitable society. The OVPRI will continue to assist and work where we can have the greatest impact, measured in sponsored research and community engagement, and where our curiosity and passion for discovery and innovation and our commitment toward economic development, inclusiveness, equity and social justice will elevate people everywhere.

Regards,

P. Srirama Rao, Ph.D.

Vice President for Research and Innovation



OVPRI Mission

To foster transformative research, discovery and innovation at VCU through excellence in service and advocacy.

Leading Virginia in addiction research



VCU is a state and national leader in the field of addiction research, with a long history of groundbreaking work ranging from basic science to new clinical treatments for patients with addiction. The university is the highest-ranking research institution in Virginia in addiction research funding from the National Institute of Health, with over \$21 million in funding in FY 2019.

VCU's addiction research focuses on a number of areas that are in the news as causes of drug-related mortality ranging from opioid to cocaine and tobacco addiction.

Research in the Institute for Drug and Alcohol Studies (IDAS) focuses on the neurobiology of addiction including opioid, cocaine and alcohol addiction. In collaboration with the Virginia Institute for Psychiatric and Behavioral Genetics (VIPBG), IDAS is the Virginia site for the Adolescent Brain Cognitive Development study, which will study 11,878 adolescents to examine the effects of substance use on brain development. The study is led by James Bjork, Ph.D., of IDAS, and Michael Neale, Ph.D., of VIPBG.

With escalating numbers of fatal opioid overdoses, VCU has several research projects underway to produce new and more effective treatments for opioid addiction. Grants totaling over \$2.6 million through the National Institutes of Health Helping to End

Addiction Long-term Initiative, or NIH HEAL Initiative, focus on developing new medications to improve treatment. These grants were developed by VCU's School of Pharmacy, School of Medicine, and C. Kenneth and Dianne Wright Center for Clinical and Translational Research. One grant examines a reformulation of an existing opioid treatment medication as an alternative to methadone, led by Qingguo Xu, Ph.D., assistant professor of pharmaceuticals in the VCU School of Pharmacy. The second grant supports efforts to identify a new treatment with fewer side effects, led by Yan Zhang, Ph.D., professor of medicinal chemistry in the VCU School of Pharmacy. If these projects meet preclinical milestones, VCU will receive additional funding for subsequent three-year clinical trials. F. Gerard Moeller, M.D., director of the Wright Center and division chair for addiction psychiatry, will oversee the clinical trial phase of both studies.

Another project funded by Virginia Catalyst and Indivior Pharmaceuticals within the Wright Center and the Department of Emergency Medicine is a Phase IV clinical trial called the Virginia Overdose Treatment Initiative (VOTIVE). This project seeks to determine whether initiating long-term treatment quickly after overdose with an injection of buprenorphine will reduce repeat overdose and deaths. The collaborative project involves Virginia Tech Carilion, Eastern Virginia Medical School and Inova Healthcare. •

Brain injury and concussion

VCU's research on the effects of traumatic brain injury and concussions transcends veterans hospitals or NFL football fields as the true, broader nature of the fallout from brain injuries becomes clearer.

Just six years after VCU received the largest federal grant in its history for brain injury research, David Cifu, M.D., chair of the Department of Physical Medicine and Rehabilitation and senior traumatic brain injury specialist for the U.S. Department of Veterans Affairs, and his team were awarded a \$50 million federal grant to oversee a national consortium that will study the long-term impacts of mild traumatic brain injuries or concussions on service members and veterans.

The Long-Term Impact of Military-related Brain Injury Consortium (LIMBIC) will bring together universities; VA hospitals, including Richmond's Hunter Holmes McGuire VA Medical Center; and the military to evaluate the impact of concussions suffered during combat, vehicle accidents, sports injuries and falls. The LIMBIC team previously discovered linkages between combat concussions and dementia, Parkinson's disease, chronic pain, opioid use and suicide risk.

Interest in this type of research intensified in 2009, when service members and veterans were returning home from Iraq and Afghanistan with long-term, ongoing effects from concussions experienced in combat.

President Barack Obama in 2012 created the National Research Action Plan on Traumatic Brain Injury and Psychological Health to promote research on post-traumatic stress disorder and traumatic brain injury. Under the plan, the initial VCU research was funded by a \$62 million grant – the largest in university history – from the Departments of Defense and Veterans Affairs.

This new grant allows the LIMBIC team to expand the analysis of the “big data” collected from millions of veterans and service personnel and broaden enrollment to more than 3,000 veterans and service members with multiple combat concussions.

The new project, which began Oct. 1, will continue for five years and the knowledge gained will help civilians, from youth athletes to older adults who injure their heads in falls as well as veterans and service members who suffer brain injuries. •



“The individual being studied is getting the most comprehensive evaluation of its kind because that is exactly what is required to finally understand these combat concussions and their linkages to symptoms and secondary conditions, like dementia.”

David Cifu, M.D.



VCU Research Highlights

Cybersecurity @ VCU

VCU continues to lead in cybersecurity initiatives. In June, the Virginia Research Investment Committee certified four regional cybersecurity nodes and named VCU the lead in creating the Central Virginia component. The regional nodes are part of the Commonwealth Cyber Initiative, which called for the establishment of an ecosystem of cyber-related research, education and engagement, created by higher education institutions and businesses. VCU's Departments of Electrical and Computer Engineering and Computer Science have major roles in the initiative. Amazon's move into Northern Virginia will create a huge demand for employees in cyber-related jobs over the coming decade. This effort will propel VCU in cybersecurity, cyber physical systems, data technologies, autonomy and related emerging technologies, said Erdem Topsakal, Ph.D., acting director of the Central Virginia node and professor and chair of the VCU Department of Electrical and Computer Engineering in the College of Engineering. A second area of VCU cyber research would protect the U.S. energy grid from hackers. Milos Manic, Ph.D., professor of computer science and director of VCU's Cybersecurity Center, along with colleagues at the Idaho National Laboratory, has developed a protection system that uses artificial intelligence to improve its effectiveness as it watches and learns from those trying to break into the grid. It was inspired by the body's autonomic nervous system, the largely unconscious functions that govern breathing, circulation and fight-or-flight responses. The U.S. Department of Energy is a major funder of the project. •

E-cigarettes face scrutiny

Even before the country's public health officials grappled with a growing number of deaths and hospitalizations connected with e-cigarettes, VCU researchers strove to gather information that would help guide policymakers about the phenomenon known as vaping.

VCU's Center for the Study of Tobacco Products received a nearly \$20 million grant through a partnership between the National Institutes of Health and the Food and Drug Administration to launch a five-year project focused on predicting the outcomes of government regulations of tobacco products, including e-cigarettes. The research is led by co-investigators Thomas Eissenberg, Ph.D., psychology professor, and Alison Breland, Ph.D., assistant research professor.

The center is one of nine Tobacco Centers of Regulatory Science across the country

providing guidance to those federal agencies to ensure U.S. tobacco regulatory actions and activities are based on sound and relevant scientific evidence. The grant builds on a five-year \$18.3 million grant awarded to the center in 2013 to study tobacco products, including e-cigarettes, and to develop evaluation methods to help inform regulatory policy.

Research by Michelle Peace, M.F.S., Ph.D., associate professor in the Department of Forensic Science, on the chemical contents of e-cigarettes garnered attention as vaping-related illness seemed epidemic, with one sickened teen receiving a double-lung transplant. With \$1.2 million grant from the National Institute of Justice, she studies how the process of vaping ethanol differs from drinking grain alcohol, while separately, she analyzes commercially available cannabidiol (CBD) liquids often used in vaping. •



Frozen gait

Nearly 60 percent of people with Parkinson's disease experience the sudden inability to walk, a phenomenon referred to as "freezing of gait." Five VCU researchers — led by Ingrid Pretzer-Aboff, Ph.D., associate professor and senior nurse researcher in the School of Nursing, and Leslie Cloud, M.D., associate professor and director of the Parkinson's Disease Program in the VCU Health Parkinson's and Movement Disorders Center — are testing a vibrating device worn inside a shoe that could end the freeze. The device, developed by a tech startup, is lightweight and Bluetooth-connected with a rechargeable battery. Its gentle, localized vibration to the ankle and foot may prompt movement in those experiencing trouble walking or stabilizing themselves. VCU is supervising a two-year clinical trial to determine the best dose and duration of vibration that will reduce the occurrence and severity of the freeze among patients with Parkinson's and then evaluate the device's efficacy and any improvements in patients' quality of life. A \$434,715 grant from The Michael J. Fox Foundation is funding the research. An estimated 1 million people in the United States live with Parkinson's and suffer symptoms including tremor, stiffness and impaired balance. •

LGBTQ+ homelessness

M. Alex Wagaman, Ph.D., associate professor of VCU School of Social Work, formed the youth research team, Advocates for Richmond Youth, wanting to change society's view of teen homelessness. Wagaman's research showed that people don't typically consider teenagers when they think of homeless individuals. Because Advocates for Richmond Youth consists mostly of homeless teens, its members have a personal understanding of the issue. The group collected data on area youth seeking services to understand the needs of teens who experience homelessness or unstable housing in hopes of finding ways to more effectively support them. Because of this group's efforts, Richmond was one of 10 cities awarded a portion of a \$1.5 million national Grand Challenge grant. The Richmond Grand Challenge project will practice "targeted universalism," or targeting the two communities that are at a higher risk for youth homelessness — LGBTQ+ youth and youth of color — which will then benefit all youth with an eye to eventually eradicate youth homelessness. •



Motor control, pain and VR

In a \$547,000 study funded by the National Institutes of Health and led by Motor Control Lab director James Thomas, Ph.D., researchers control moving targets in virtual reality games designed by the lab. Participants play dodgeball while wearing sensors and a VR headset. As a game progresses, researchers push participants to stretch their backs more by adjusting the trajectory and speed of targets. "We can change or manipulate the visual scenes to get individuals to move in the way that we believe is going to be therapeutically beneficial to them," said Thomas, a professor in the Department of Physical

Therapy in the College of Health Professions and collaborator in the Center for Rehabilitation Sciences and Engineering. The lab partners with faculty and students in the College of Engineering and the schools of medicine, nursing and the arts to make games more immersive and realistic. Engaging participants helps distract them from their pain while helping restore healthy spine motion and improve their quality of life. In addition to pain management, the lab uses VR games to study motor control in patients with Parkinson's disease. •

Art, avatars and pain

“We could see the possibilities, how it really brings a different kind of body perception.”

In a project with the VCU Department of Gerontology, Semi Ryu, an associate professor in the Department of Kinetic Imaging in the VCU School of the Arts, learned how avatars could help improve quality of life. Her latest research examines whether personal storytelling and virtual reality help terminally ill patients manage their pain and construct meaning for their lives.

Working with a team of kinetic imaging students and health care workers from VCU's palliative care unit, Ryu developed sets of avatars and environments designed to help patients connect with places and moments in their memories and imaginations. Through subtle shifts in the avatar's facial expressions, soundtrack and the weather in each environment, Ryu aims to trigger

shifts in patients' emotions, changing perceptions of pain and even mobility. One participant, whose cancer caused pain in her left arm, changed her perception of pain and increased her mobility by watching her movements through the avatar.

Ryu and collaborators Egidio Del Fabro, M.D., professor and Palliative Care Endowed Chair; Danielle Noreika, M.D., associate clinical professor; and research assistant Malisa Dang of the palliative care unit presented their work at the International Symposium on Electronic Art. They showed how the practice could be used to approach mortality and mitigate existential suffering for palliative care patients in the digital age. •



Biomes and births



Two new studies led by VCU researchers provide a comprehensive profile of the vaginal microbiomes associated with term pregnancy and premature pregnancy — groundbreaking work that may help assess the risk of premature birth, particularly among African American women. The research and a third article involving VCU landed on the covers of the journals *Nature Medicine* and *Nature*.

This microbiome data could help develop a predictive model for preterm birth that would allow clinicians to more accurately identify women with higher risk early in pregnancy and could help reduce preterm birth rates and global health disparities in preterm birth. These studies were conducted under multiple awards of more than \$20 million from the NIH Human Microbiome Project, which explores the connections of host-microbial interactions to health outcomes.

Many VCU researchers participated in the studies. Gregory A. Buck, Ph.D., professor in the Department of Microbiology and Immunology and Department of Computer Science at VCU, co-director of the Center for Microbiome Engineering and Data Analysis at VCU, and principal investigator

of Multi-Omic Microbiome Study-Pregnancy Initiative, a study which involved following the microbes of pregnant women throughout pregnancy and after childbirth, was corresponding author on both studies. Jennifer M. Fettweis, Ph.D., assistant professor in the Department of Microbiology and Immunology and the Department of Obstetrics and Gynecology, was lead author of the *Nature Medicine* cover article and project director of the MOMS-PI study. Co-authors included Kimberly K. Jefferson, Ph.D., associate professor in the Department of Microbiology and Immunology, and principal investigator of the MOMS-PI study; and Jerome F. Strauss, M.D., Ph.D., professor of obstetrics and gynecology, human and molecular genetics, biochemistry and molecular biology, and physiology and biophysics at the VCU School of Medicine, and principal investigator of the MOMS-PI study. Co-author Myrna G. Serrano, Ph.D., associate professor of microbiology and immunology and associate director of the VCU Genomics Core, was lead author of the accompanying manuscript.

Published the same day in *Nature* was a perspective piece Fettweis, Buck and Strauss co-authored with the NIH HMP Research Network Consortium. •

Breast cancer treatment



A phase 3 international clinical trial co-led by a VCU Massey Cancer Center researcher is expected to change the way an aggressive form of breast cancer is treated in certain patients. The trial, called KATHERINE, seeks to reduce cancer recurrence in HER2-positive breast cancer patients. Fifteen percent of all women with breast cancer are diagnosed HER2-positive, a type of cancer typically less responsive to chemotherapy. The findings, published in the *New England Journal of Medicine*, showed that the drug trastuzumab emtansine, in addition to regular chemotherapy, reduced recurrence by 50% in HER2-positive patients. The study involving almost 1,500 patients opened in 2013 and will continue to collect patient data until 2023. Charles Geyer, M.D., formerly of Massey, serves as global co-chair, and Harry Bear, M.D., Ph.D., chair in Surgical Oncology and a member of the Developmental Therapeutics research program at Massey as well as professor of surgery and professor of microbiology and immunology at the VCU School of Medicine, serves as the local principal investigator. Results were shared with health authorities around the world such as the U.S Food and Drug Administration and the European Medicines Agency. •

VCU Research Highlights

STEM teacher residencies

The Richmond Teacher Residency, aimed at improving the quantity and quality of STEM teachers in the metro area, continues to expand through its nearly \$5 million grant from the U.S. Department of Education. Richmond Teacher Residency, a program of the VCU School of Education, is an intensive, school-based teacher preparation program that integrates a research-supported approach for effective teaching with real-world classroom experience. Residents teach in local schools under the mentorship of a veteran teacher, while also earning a graduate degree in either education or teaching from VCU. Participants graduate with a master's degree, a teacher's license and experience in the classroom teaching science, technology, engineering and math. Residents then make an additional three-year commitment to teach in a high-needs, hard-to-staff school.

As part of the grant, VCU SEED (Supporting Effective Educator Development), the Richmond Teacher Residency program will recruit, prepare and support 190 new highly effective teachers in the local school districts, based on their most critical staffing needs. The grant will last for three years, with a possible two-year extension with additional funding. •



Pharmaceutical research

The VCU School of Pharmacy's Center for Pharmacy Practice Innovation, directed by Dave Dixon, Pharm.D., in collaboration with VCU Health, launched a five-year project supported by a projected \$1.3 million from the Virginia Department of Health and the Centers for Disease Control and Prevention. It will use telemedicine, remote monitoring, one-on-one coaching and community partnerships to improve health in residents with pre-diabetes from Richmond's East End. Looking to the future, the school, in partnership with the College of Engineering, launched the Center for Pharmaceutical Engineering and Sciences to support a new doctoral program in pharmaceutical engineering, the first known of its kind in the United States. This effort, led by Sandro da Rocha, Ph.D., and colleagues in the College of Engineering, will train researchers in cross-disciplinary and interdisciplinary science using a team-based approach to designing and manufacturing pharmaceutical products. The school also played a key role in the successful five-year renewal of the Central Virginia Center on Drug Abuse Research, directed by William Dewey, Ph.D., chair of the Department of Pharmacology and Toxicology at VCU School of Medicine. Under the renewal, the center will receive a total \$6.8 million from the National Institute on Drug Abuse. •

VCU GREAT student research

VCU Guided Research Experiences and Applied Training (VCU GREAT) is funded by a \$486,000 grant from the National Institute on Alcohol Abuse and Alcoholism. This intensive summer research experience focuses on the study of alcohol and related behavioral health outcomes for VCU undergraduates from underrepresented groups and seeks to create a pipeline for increased diversity in biomedical and behavioral research. The effort is led by Danielle Dick, Ph.D., a professor in the Department of Psychology and the Department of Human and Molecular Genetics and director of the College of Behavioral and Emotional Health Institute (COBE); Amy Adkins, Ph.D., an assistant professor in the Department of Psychology and director of undergraduate research at COBE; and Herb Hill, director of undergraduate research and creative inquiry in the Office of Academic Affairs. As part of VCU GREAT, roughly 10 students each summer will participate in an eight-week research experience — consisting of structured training and individual mentorship — designed to provide young researchers with foun-

dational research skills, experiential learning and responsible conduct of research training.

This past summer, the first cohort excelled in the training program and all nine fellows presented their research at a final poster symposium. For example, Emily Ramos, a psychology major, found that higher social support was weakly correlated with increased alcohol consumption. Psychology major Kayla McLean investigated the association between usage of alcohol/other substances and impulsivity among sexual trauma survivors. Andie Marino, majoring in interdisciplinary studies, researched the relationship between sexuality and alcohol usage/related consequences. Psychology major Jasmine Jones studied whether having an antisocial partner was related to one's own substance use and discovered that individuals involved with an antisocial partner consume more alcohol. •



Baby sturgeons are back

For several years, Matthew Balazik, Ph.D., research assistant professor, and others from VCU's Rice Rivers Center have surveyed the James River in hopes of finding Atlantic sturgeon, the once-plentiful ancient fish that was listed as an endangered species in 2012. While researchers have caught and released hundreds of adult sturgeon, and even some juvenile sturgeon, it was only in fall 2018 that the team spotted baby sturgeon. The imbalance between adult and younger fish was concerning because it indicated possible issues preventing survival at a rate to sustain the population in the James. Immature sturgeon leave the Chesapeake Bay tributaries to mature in the ocean, returning multiple times to spawn in the tributaries. Atlantic sturgeon, one of the oldest and largest fish (measuring as much as 14 feet long and topping the scales at more than 800 pounds) were once found in huge numbers along the Atlantic Coast before they were overfished. The Rice Rivers Center is at the center of the Virginia Sturgeon Restoration Team's effort to restore the sturgeon to its native range and historical stature within state waters. The center's work receives support from the National Oceanic and Atmospheric Administration and the Virginia Department of Game and Inland Fisheries. •

VCU Faculty Research Honorees

Tibbetts receives presidential honor



Katharine Moore Tibbetts, Ph.D., an assistant professor in the Department of Chemistry, received the Presidential Early Career Award for Scientists and Engineers, the highest honor bestowed by the U.S. government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in science and technology. Tibbetts' work focuses on understanding molecule decomposition to improve methods in detecting explosions and inform the design of new and better energetic molecules, such as ones that explode only under certain conditions. •

Krist elected to the National Academy of Medicine



Alex Krist, M.D., a professor of family medicine, was elected as a member of the National Academy of Medicine, one of the highest honors in the fields of medicine and health. Krist, a practicing family medicine physician, teaches at the VCU-Fairfax Family Medicine Residency and serves as vice chair of the U.S. Preventive Services Task Force, an independent, volunteer panel of national experts in prevention and evidence-based medicine. He is the co-director of community-engaged research at VCU's C. Kenneth and Dianne Wright Center for Clinical and Translational Research. •

Jason A. Carlyon, Ph.D.

Professor, School of Medicine
American Academy of Microbiology, fellow

Yana Cen, Ph.D.

Assistant professor, School of Pharmacy
National Science Foundation Faculty Early Career Development Award

Daniel E. Conway, Ph.D.

Associate professor, College of Engineering
Biomedical Engineering Society, Cellular and Molecular Bioengineering Special Interest Group, Rising Star award

Swadesh K. Das, Ph.D.

Assistant professor, School of Medicine
National Academy of Inventors, senior member

David Downs, Ph.D.

Professor, Alfred L. Blake Endowed Chair
Director, The Kornblau Institute, School of Business
American Real Estate and Urban Economics Association, George Bloom Award

B. Frank Gupton, Ph.D.

Floyd D. Gottwald Jr. Chair, Pharmaceutical Engineering Chair, Chemical and Life Science Engineering, College of Engineering
American Chemical Society, Award for Affordable Green Chemistry

Nancy Jallo, Ph.D.

Associate professor, School of Nursing
American Academy of Nursing, fellow

Shermaine Jones, Ph.D.

Assistant professor, College of Humanities and Sciences
Woodrow Wilson National Fellowship Foundation, fellow

Patricia Kinser, Ph.D.

Associate professor, School of Nursing
American Academy of Nursing, fellow

Milos Manic, Ph.D.

Professor, College of Engineering
*R&D 100 Award
Federal Laboratory Consortium Award*

Guadalupe Maravilla

Assistant professor, School of the Arts
*John Simon Guggenheim Memorial Foundation, fellow
Open Society Foundations, Soros Arts fellow*

Gary Matzke, Pharm.D.

Emeritus professor, School of Pharmacy
American Society of Health System Pharmacists, Award for Practice Research

Alexander McKay, Ph.D.

Assistant professor, School of Business
American Psychological Association, Frank X. Barron Award

D. Tyler McQuade, Ph.D.

Professor, College of Engineering
American Chemical Society, Award for Affordable Green Chemistry

Patrick Nana-Sinkam, M.D.

Professor and chair, Division of Pulmonary Disease and Critical Care Medicine, School of Medicine
American Society for Clinical Investigation, member

Jennifer Rhee, Ph.D.

Associate professor, College of Humanities and Sciences
American Council of Learned Societies, fellow

Jo Lynne Robins, Ph.D.

Associate professor, School of Nursing
NIH Clinical and Translational Science Award, Informatics category

Arun J. Sanyal, M.D.

Professor, School of Medicine
American Association for the Study of Liver Diseases, Distinguished Achievement Award

Wanchun Tang, M.D.

Professor, School of Medicine
National Academy of Inventors, fellow

Hong-Sheng Zhou, Ph.D.

Associate professor, College of Engineering
Google Faculty Research Award

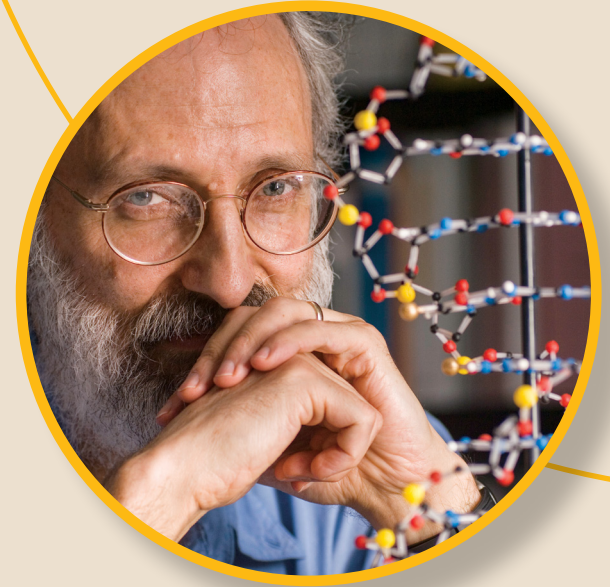
VCU researcher's worldwide impact

This year, VCU researcher Kenneth Kendler, M.D., learned that he ranks in the top 0.01% of all scientists, according to an article about a citation metrics author database published in PLOS Biology. Kendler is a world-renowned expert on the genetics of psychiatric and substance abuse disorders, which he studies mainly through large-population twin studies and molecular genetics.

The paper, from researchers at Stanford University, described a new ranking method used to produce a

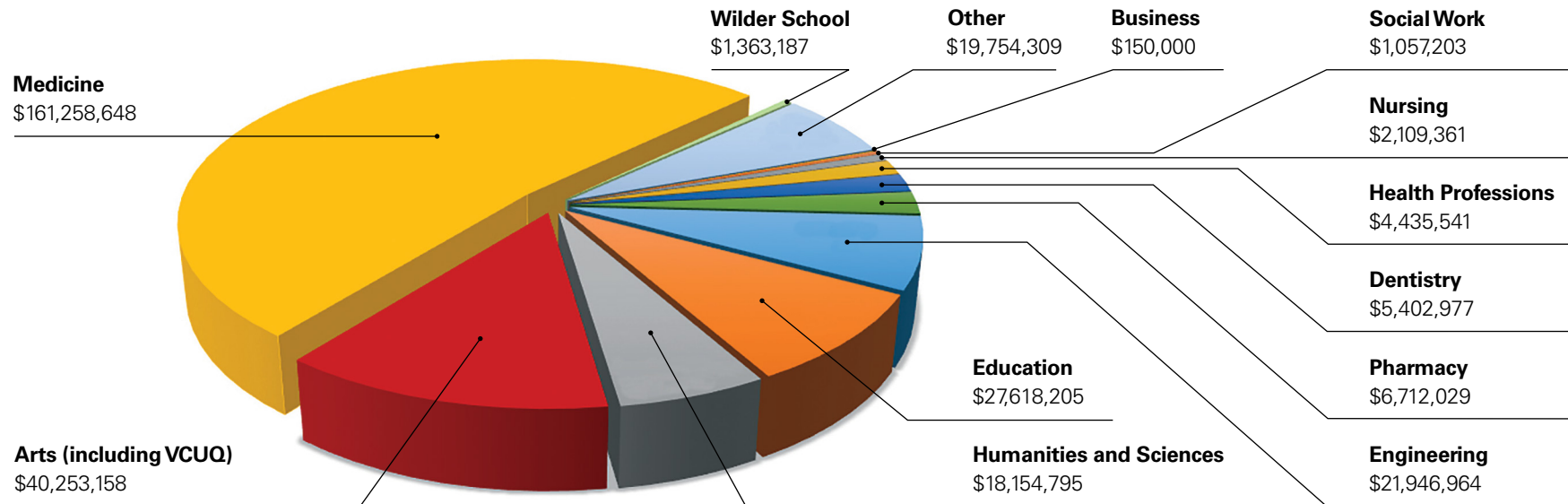
publicly available database of the 100,000 most-cited scientists worldwide from 1996-2017 across 176 scientific sub-fields. Kendler ranked 65th.

Kendler is the Rachel Brown Banks Distinguished Professor of Psychiatry; director of the Psychiatric Genetics Research Program; director of the VCU Alcohol Research Center; and director of the Virginia Institute for Psychiatric and Behavioral Genetics. •



Sponsored program awards FY 2019

This graph shows the breakdown of where VCU received sponsored program awards in FY 2019, totaling \$310,216,377.



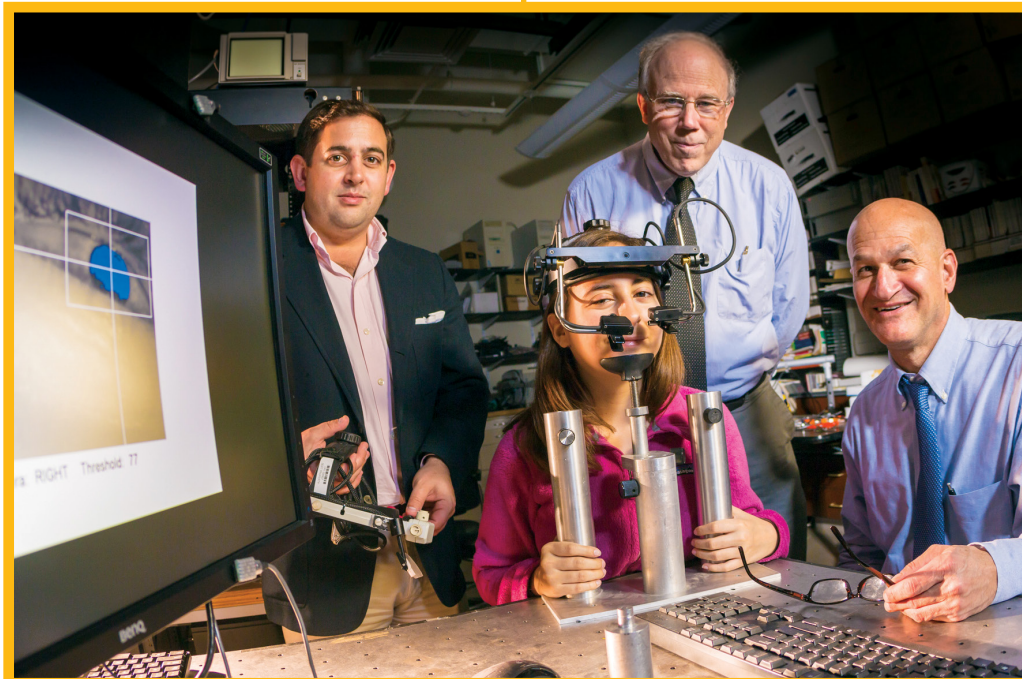
Innovators of the year

Thanks to the dozen cranial nerves that carry motor and sensory information directly to the human brain, eyes are windows to diagnosing more than 20 neurological disorders, such as Parkinson's disease, essential tremor and traumatic brain injury.

This year, VCU Innovation Gateway honored a team of researchers with the Billy R. Martin Innovation Award for developing a fast, noninvasive eye-tracking test that can screen for and distinguish between Parkinson's disease, essential tremor, traumatic brain injury and several other neurological conditions.

Honored were Mark Baron, M.D., professor of neurology and interim director of the VCU Parkinson's and Movement Disorder Center; George Gitchel, Ph.D., director of Clinical Research for McGuire VA Medical Center's Parkinson's Disease Research, Education, and Clinical Center; and Paul Wetzel, Ph.D., associate professor of biomedical engineering in the VCU College of Engineering. Gitchel was a graduate student in Wetzel's lab when they developed the technology.

"The mission of VCU Innovation Gateway is to transfer vital technology from discovery to the marketplace. That's precisely what this team has helped to do, and that's why they have been recognized as our Inventors of the Year," said Ivelina Metcheva, Ph.D., senior executive director of VCU Innovation Gateway.



The diagnostic test uses cameras and an advanced software platform to track the natural movements of the eye. A patient looks at a dot on a computer screen. Healthy patients watching the screen have regular, well-defined movements. Patients experiencing neurological problems have irregular movements that, thanks to the technology invented at VCU, can assist a physician in diagnosing disease. Compared to traditional diagnostics like PET or MR scans, this test is significantly quicker (about five minutes) and costs far less. Potentially, the ability to treat patients at very early stages of neurodegenerative diseases will lead to better outcomes.

This technology was funded in part by a \$1 million grant from The Michael J. Fox Foundation for Parkinson's Research. In 2016, RightEye LLC, a medical technology company specializing in eye tracking tools for health care, licensed the worldwide rights for this invention to take it into clinical practice. •

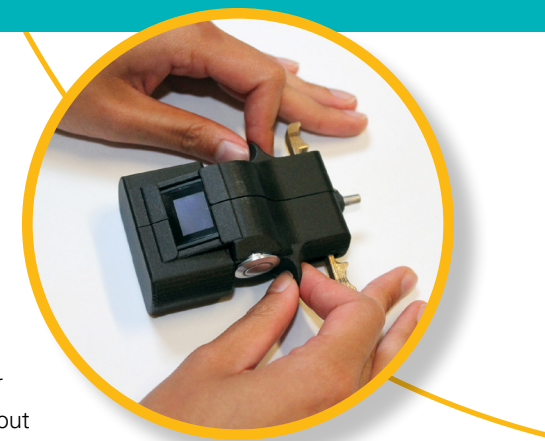
VCU Ventures Epinavigator

In her first semester at VCU, Alexandria Ritchie joined the Engineering Critical Patient Care Team within the Vertically Integrated Projects Program offered to VCU engineering students. Through the program, she heard about a proposal from VCU's Department of Nurse Anesthesia to revolutionize the administration of epidurals. Along with fellow students and alumni and other advisors, they formed the DuraSafe team and set out to lower the 17% failure rate associated with administering epidurals and the estimated cost of \$2 billion to hospitals in the United States. Their goal was to develop a device to help eliminate risk factors when injecting drugs into the epidural space surrounding the spinal cord.

The current process is subjective as the anesthesiologist uses a glass syringe to gauge the loss of pressure. A loss of pressure indicates that the needle has reached the epidural space and the medicine can be inserted. Until that drop of pressure, the anesthesiologist moves the needle millimeter by millimeter, keeping the needle straight and the glass syringe attached. This process leaves room for error and risk of punctures of the dura, the dense tissue surrounding the spinal cord.

The DuraSafe team's device, the Epinavigator, is a device that has the potential to alert

the administrator to the moment that the loss of resistance is achieved. It features an airtight compartment with a display screen designed to notify the provider when the space is reached. The Epinavigator fits onto the tip of an epidural needle without requiring the syringe used in the current administration method. The device also does not require using ultrasound technology during the procedure, which helps lower the costs.



Early laboratory tests suggest the device will lower the current failure rate. In 2018, the DuraSafe team was accepted into the VCU Venture Lab, a pre-accelerator program from the VCU Ventures office, to continue researching and validating different elements of their business model with industry experts. VCU Ventures supports faculty and staff startup companies and offers resources to guide faculty and staff through the startup process, navigates the university and regional commercial landscape and develops innovative programs to validate new ventures. •

VCU Ventures Partners

VCU Health, VCU and Activation Capital partnered in January 2019 to launch the Health Innovation Consortium. With initial funding from VCU Health, VCU's Office of the Vice President for Research and Innovation has provided significant resources to the consortium and currently leads its operations.

The consortium is a platform for improving patient care and quality of life for all by facilitating the commercialization of innovations solving significant problems in health. From concept to commercialization, HIC brings together each link in the commercialization value chain to build a collaborative ecosystem that represents a new model for translating health innovation. Some examples of the key resources provided

include discovery workshops and prototyping sprints all the way to startup acceleration, access to regulatory expertise, pilot testing sites and early stage funding through the consortium's partner venture fund.

For VCU faculty, HIC provides additional opportunities and builds on an already robust commercialization infrastructure that can more effectively support and retain the innovation our research enterprise produces. For VCU students, HIC provides valuable experiential opportunities as they have the opportunity to engage in health focused innovation challenges. Lastly, for our region and the commonwealth, HIC represents an asset that can attract health innovation at a global level. •

VCU research by the numbers FY 2019

\$310 million in combined awards for sponsored programs for research

1 of top 100 NSF-ranked research universities

95th among all institutions, public and private, in total R&D expenditures

65th in R&D expenditures among public institutions

\$159 million total federal funding

\$25 million from Gates Foundation

1 of 20 public institutions that is both a NCI-designated center and has an NIH Clinical and Translational Science Award

1 of 54 designated Community Engaged & "Very High Research Activity"

>120 undergraduate research scholars

Commercialization and economic development

114 invention disclosures

183 patents filed

22 patents issued

21 licenses

7 copyrights

70 industry engagements

15 proof of concept grants

\$2.6 million licensing revenue

51 technologies reviewed for start-up opportunities

34 teams/technologies supported for venture creation

14 total start-ups supported

6 start-ups based on VCU licensed technologies formed in FY19

17 start-ups based on VCU licensed technologies active in FY19

3 Small Business Innovation Research grants submitted

Clinical research

862 active clinical research studies across 11 units

575 clinical trials

5,108 clinical research participants

301 VCU-designed clinical studies



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