

ANNUAL REPORT

Bringing Ideas to Life

15



**VCU** Innovation Gateway  
VIRGINIA COMMONWEALTH UNIVERSITY

Bringing Ideas to Life

# 15 Annual Report

**COVER PHOTO:**  
SELF-INITIATED PRONE PROGRESSIVE CRAWLER (SIPPC)



Letter from the VP for Research and Innovation and the Executive Director	1
The Year at a Glance	2
Inventor of the Year	4
Detection of Movement Disorders	6
Game Changing Football Helmet	8
Preventing Heart Injury	10
Green Battery	12
Go For It!	14
I-Corps	15
VCU Innovation Gateway Team	16
Advisory Panel	17

## Mission

*Our mission is to promote innovation and entrepreneurship at VCU, to facilitate commercialization of university inventions, and to support regional economic development and new venture creation.*

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FACEBOOK: VCU INNOVATION GATEWAY 

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### Dear Colleagues and Friends,

This was a very successful and exciting year for VCU Innovation Gateway. We have completed the strategic transformation from VCU Tech Transfer into VCU Innovation Gateway in our endeavor to serve better a research university, more relevant for the 21st century. In addition to technology commercialization, our office now leads the efforts to enhance the culture of innovation and entrepreneurship at VCU, to promote university-industry collaborations, and to grow the region's innovation ecosystem.

Innovation Gateway finished the year with record licensing revenues for the last eight years — \$2,579,491 — almost 50% increase over the previous year. We see an upward trend in the growth of licensing revenues that have been increasing by a double digits rate for several years now. During the year, a total of 14 licenses and options were executed with a record number of licenses to start-up companies, 7, which is more than double the previous number of 2-3 start-ups per year. The number of issued patents reached 17, 40% higher than in 2015.

This past year, we continued to build on our strategic industry engagement program, which puts an emphasis on actively marketing of VCU research capabilities and attracting industry partners at the earlier stages of the innovation cycle. The result was a significant number of meetings, 20, with strategic industry partners, investors and entrepreneurs. These activities generated a substantial value to VCU by spawning collaborations, sponsored research of more than \$1.5 million, licensing, and new venture creation.

One of the most remarkable successes this year was the selection of a VCU invention to participate at the 2015 USPTO Smithsonian Innovation Festival. The festival was held at the National Museum of American History in Washington, D.C., where Dr. Peter Pidcoe of VCU's Department of Physical Therapy, together with the Innovation Gateway team, showcased his invention, the Self-initiated Prone Progressive Crawler. The invention was one of 13 from companies, universities, government agencies and independent inventors selected by a juried panel to participate in the festival.

VCU Venture Creation University™ (a.k.a. VCU Squared) is now recognized throughout VCU as a university-wide initiative to grow an entrepreneurial population of students and faculty, and ultimately promote new venture creation. It has become a major theme of the updated university strategic plan. As part of the VCU Squared strategy, in 2015 VCU Innovation Gateway piloted a 12-week pre-accelerator program through a unique partnership with the College of Humanities and Sciences and Lighthouse Labs. Through a competitive selection process, seven promising student start-ups each received a stipend of \$5,000 each and admittance into the summer program. By the end of the program, the student companies have generated over \$360,000 in revenue or investments.

Innovation Gateway is committed to becoming an even more relevant player for the economic growth of the region. We are collaborating with the Innovation Council, established by the Virginia Biotechnology Research Park and with other regional innovation partners, to expand the innovation activities in Greater Richmond and to create a regional innovation ecosystem.

Finally, we are proud to be part of the progress in establishing VCU as a leading research university with a tangible impact on people in Richmond and beyond. As Dr. Rao said, "At a more-relevant university, knowledge has purpose and scholarship has impact." We are looking forward to working with you over the next year.

With sincere gratitude,



Francis L. Macrina, Ph.D.  
Edward Myers Professor of Dentistry and  
Vice President for Research and Innovation



Ivelina Metcheva, Ph.D., MBA  
Executive Director, VCU Innovation Gateway

# 15

## FISCAL YEAR AT A GLANCE

Licensing Revenues	\$ 2,579,491
Invention Disclosures	93
Licenses/Options	14
Other Research Support Agreements	16
Start-ups	7
Patents Filed	130
Patents Issued	17
Copyrights	4
Non-Disclosure Agreements	59

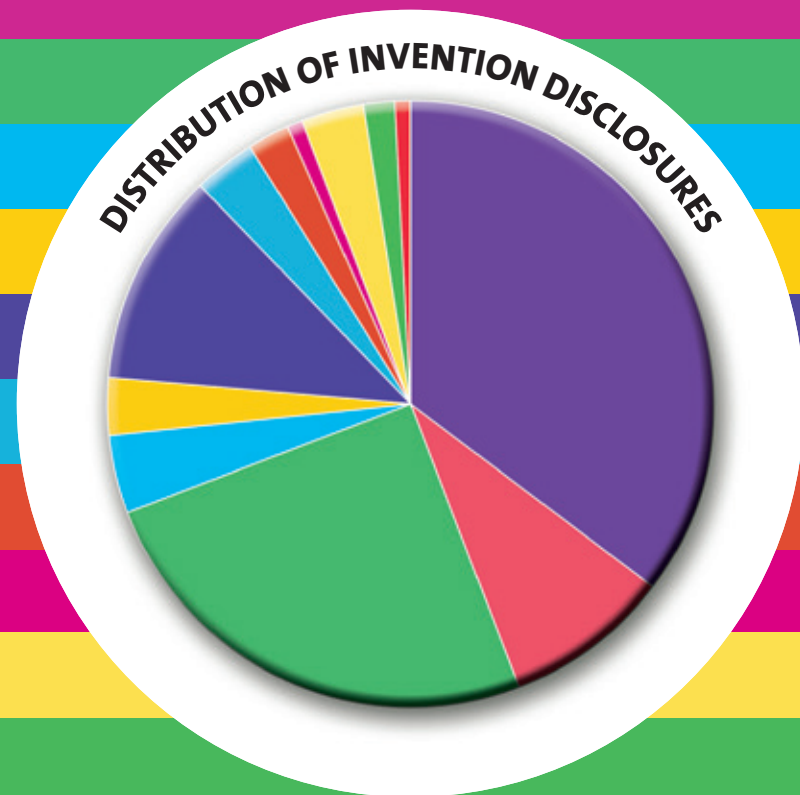
### DEPARTMENTS WITH TEN OR MORE INVENTION DISCLOSURES

Chemical and Life Sciences Engineering	10
Mechanical and Nuclear Engineering	10

### DEPARTMENTS WITH FIVE TO NINE INVENTION DISCLOSURES

Medicinal Chemistry	9
Internal Medicine	7
Human Genetics	7
Biochemistry	7
Biomedical Engineering	6

School of Medicine	44
College of Humanities and Sciences	11
School of Engineering	31
School of Art	5
School of Dentistry	4
School of Pharmacy	14
School of Allied Health Professions	4
School of Education	3
School of Social Work	1
VCU Life Sciences	4
VCU Qatar	2
School of Business	1



## VCU PATENTS ISSUED

Issue Date	Patent No.	VCU Inventors	Title
7/3/14	8,741,642	Masoud H. Manjili, Ph.D. Harry D. Bear, M.D. Maciej Kmiecik, Ph.D.	Composition and method for immunologic treatment of cancer, prevention of cancer recurrence and metastasis, and overcoming immune suppressor cells
7/8/14	8,772,308	Yan Zhang, Ph.D. Dana E. Selley, Ph.D. William Dewey, Ph.D.	Nonpeptidyl, potent, and selective mu opioid receptor antagonist
7/15/14	8,778,352	Richard Marconi, Ph.D. Christopher Earnhart, Ph.D.	Polyvalent chimeric OspC vaccinogen and diagnostic antigen
8/12/14	8,805,051	Kayvan Najarian, Ph.D. Rosalyn Stacy Hobson, Ph.D. Kevin R. Ward, M.D. Sumeyra Ummuhan Demir Nazanin Mirshahi	Image Processing and Machine learning for Diagnostic Analysis of Microcirculation
8/19/14	8,808,705	Richard Marconi, Ph.D. Christopher Earnhart, Ph.D.	Polyvalent chimeric OspC vaccinogen and diagnostic antigen
10/28/14	8,871,171	M. Samy El-Shall, Ph.D. Victor Abdelsayed, Ph.D. Hassan M.A. Hassan, Ph.D. Abd El Rahman S. Khder, Ph.D. Khaled M. Abouzeid, Ph.D. Qilin Dai Parichehr Afshani, M.S. Frank Gupton, Ph.D. Ali R. Siamaki, Ph.D. Zeid Abdullah M. Allothman Ph.D. Hamad Zaid Alkhathlan Ph.D.	Production of Graphene and Nanoparticle Catalysts Supported on Graphene Using Microwave Radiation
12/30/14	8,921,962	Jayasimha Atulasimha Ph.D. Supriyo Bandyopadhyay Ph.D.	Planar Multiferroic/Magnetostrictive Nanostructures as Memory Elements, Two-Stage Logic Gates and Four-State Logic Elements for Information Processing
1/7/15	1,561,888	Kevin Ward M.D.	Method and Apparatus for Determining Critical Care Parameters
1/27/15	8,942,874	Peter Pidcoe, PT, DPT, Ph.D. Hlapang A. Kolobe PT, Ph.D. FAPTA	Self Initiated Progressive Crawler
2/3/15	8,946,678	Supriyo Bandyopadhyay, Ph.D. Saumil Bandyopadhyay Pratik Agnihotri	Room Temperature Nanowire IR, Visible and UV Photodetectors
2/3/15	8,946,254	Yan Zhang, Ph.D. Kurt F. Hauser, Ph.D. Dana E. Selley, Ph.D.	Bivalent Ligands for the Treatment of Neurological Disorders
2/10/15	8,952,048	Jamie Lynn Sturgill, Ph.D. Daniel Harper Conrad, Ph.D.	Treatment of Immune Disorders Using Kainate Receptor Antagonists
3/17/15	8,980,908	Yan Zhang, Ph.D. Dana E. Selley, Ph.D. William Dewey, Ph.D.	Non-peptidyl, Potent, and Selective Mu Opioid Receptor Antagonists and Their Use in Treating Opioid Addiction and Opioid Induced Constipation
3/31/15	8,993,620	Umesh R. Desai, Ph.D. Brian L. Henry, M.D. Ph.D. Aiye Liang, Ph.D. Jay Thakkar John B. Mangrum, Ph.D. Ivo Torres Filho, M.D. Bruce D. Spiess, M.D. FAHA Masahiro Sakagami, Ph.D. Bhawana Saluja	Cinnamic Acid-Based Oligomers and Uses Thereof
5/19/15	9,034,859	Shunlin Ren, M.D. Ph.D.	Sulfated Oxysterol and Oxysterol Sulfation by Hydroxysterol Sulfotransferase Promote Lipid Homeostasis and Liver Proliferation
6/23/15	9,060,790	Jennifer S. Wayne, Ph.D. Robert S. Adelaar, M.D. Hieu T. Ta Bradley W. Zentgraf	Tibiotalar Arthrodesis Guide
6/23/15	9,060,914	Peter Pidcoe, PT, DPT, Ph.D. Jeffery A. Frankart Jessica Cortney Bradford	Spasticity reducing closed-loop force-feedback control for post-stroke GAIT training

# The Billy R. Martin Innovation Award

Peter Pidcoe, PT, DPT, Ph.D.

## Turning technology into hope

Peter Pidcoe, PT, DPT, Ph.D., creates technologies that change people's lives: a bike that lets a 7-year-old ride along with his older brothers despite his severe physical limitations; a data-capture system that allows a comprehensive physical therapy assessment; a robotic gait trainer that replicates walking motions for those sidelined by a stroke, traumatic brain injury or spinal cord injury.

Most recently, Dr. Pidcoe has developed a skateboard-like device that helps infants with motor-skill disabilities learn to crawl, explore and grow just like babies everywhere. This Self-Initiated Prone Progressive Crawler (SIPPC) was one of 13 selected by a juried panel to participate at the U.S. Patent and Trademark Office and Smithsonian 2015 Innovation Festival. The festival was held at the National Museum of American History in Washington, D.C., where Dr. Pidcoe, together with the Innovation Gateway team, showcased his invention.

Dr. Pidcoe is an associate professor and assistant chair in the Department of Physical Therapy in the School of Allied Health. He also holds joint appointments in VCU School of Engineering's Department of Biomedical Engineering and the School of Medicine's Department of Physical Medicine and Rehabilitation.

Last October, Pidcoe was honored with the 2015 Billy R. Martin Innovation Award during the 10th annual VCU Innovates celebration. "Pete's research celebrates the legacy established by Billy Martin and others who create new knowledge and constantly challenge themselves in terms of how that knowledge can be used to benefit society and the world," said Francis Macrina, Ph.D., vice president for research and innovation at VCU.



PETER PIDCOE, PT, DPT, PH.D.  
H. THUBI KOLOBE, PT, PH.D. FAPTA  
PHOTO COURTESY OF THE NATIONAL MUSEUM OF AMERICAN HISTORY



CARRIE ROTH  
MICHAEL RAO, PH.D.  
PETER PIDCOE, PT, DPT, PH.D.  
IVELINA METCHEVA, PH.D., MBA  
FRANCIS MACRINA, PH.D.  
PHOTO COURTESY OF UNIVERSITY RELATIONS

*"Dr. Pidcoe's innovations are a powerful example of VCU's commitment as a premier research university to creating and advancing knowledge that benefits people in Richmond and beyond."*

**Michael Rao, Ph.D.**  
President of VCU and VCU Health

*"This type of work is not done in a vacuum. I am fortunate to have the support of my department and school in this endeavor. The Innovation Gateway has also been instrumental in navigating the patent process and promoting the work."*

**Peter Pidcoe, PT, DPT, Ph.D.**  
Associate Professor and Assistant Chair, Department of Physical Therapy

*“The large number of tested patients proved that we could diagnose everything with incredible precision”*

**George Gitchel, M.S.**  
**Ph.D. candidate**  
*Department of Biomedical Engineering*



Some say that the eyes are the window to the soul. For a few researchers, the eyes are the window to diagnosing more than 20 neurological disorders, such as Parkinson's, essential tremor and traumatic brain injury.

Mark Baron, M.D., professor of neurology and interim director of the VCU Parkinson's and Movement Disorder Center, Paul Wetzel, Ph.D., associate professor of biomedical engineering, and George Gitchel, a Ph.D. candidate, are collaborating on an automated eye-tracking system to accurately differentiate and diagnose movement disorders where no such test currently exists.

This five-minute, non-invasive eye-tracking test generates a massive amount of data quickly and creates a way to purely quantify a disease

automatically, unlike with the electroencephalogram (EEG) or electromyography (EMG).

“It's incredibly simple,” Gitchel said. “Two head-mounted cameras use infrared light to follow the movement of a patient's eyes. Normal eye movements are highly regulated and follow well-defined patterns, but neurological disorders alter eye movements in a way that exposes an underlying condition.”

Having examined more than 3,000 patients over the years, the system's accuracy has improved remarkably from 75-80 percent to nearly 100 percent today. The system is not only noninvasive and inexpensive but it also produces data that do not need to be interpreted — it automatically generates a diagnosis.

***Eyes don't lie: early detection of movement disorders***

*“An idea that started off in the garage... this project has drawn the attention of the media and the NFL. Through all this the VCU Innovation Gateway’s staff has been extremely helpful in guiding me through securing our intellectual property thereby freeing up my time to do the science.”*

**Raymond Colello, Ph.D.**

Associate Professor

Department of Anatomy and Neurobiology

On any given game day, the football is caught, helmets collide, athletes fall, and we cheer. What fans don’t feel, however, are the lasting effects of that head-to-head impact. The average collegiate football player will take over 500 hits to the head in a season. Last year alone, there were an estimated 60,000 concussions reported among the 1.1 million active football players nationwide in high school, college and the National Football League.

“Helmet to helmet collisions are considered one of the primary means by which concussions occur in football,” says Ray Colello, Ph.D., associate professor of anatomy and neurobiology, and an avid football fan. Concussions occur at 100 G-forces, with some football players absorbing up to 160 Gs.

It was one of these gruesome hits playing out repeatedly via instant replay that got Colello drawing up a game-changing solution — magnets — to mitigate these high-speed collisions. Colello’s garage-testing led him to lining helmets with neodymium magnets, or rare earth magnets, which are the strongest type commercially available to date.

With support from the VCU Presidential Research Quest Fund, Colello is now hoping his helmet technology will soon go pro. This past November at the Society of Neuroscience, he demonstrated exactly how the powerful magnets generate repulsive forces of over 300-fold their weight to slow down impact. “They’re still going to make contact,” Colello says, “it’s like driving your car into a wall at 30 mph, but hitting the brakes right before you make contact.”



**Raymond Colello, Ph.D.**

***Game-changer: tackling the concussion crisis***

*"We are all very excited about this discovery because it truly represents a bench-to-bedside translational research. The small molecule was designed and synthesized in vitro by Dr. Zhang's group, it became a potential drug thanks to Dr. Van Tassell's group and eventually my team was able to show that it reduces the injury to heart following ischemia and reperfusion."*

**Antonio Abbate, M.D., Ph.D.**

*"James C. Roberts, Esq."* Professor of Cardiology  
VCU Pauley Heart Center

While more and more people are surviving heart attacks, many suffer severe heart injuries, which potentially lead to a second wave of heart trouble. However, those numbers could be drastically dropping if Dr. Antonio Abbate has anything to say about it.

Antonio Abbate, M.D., Ph.D., professor of cardiology and vice-chair of VCU's Division of Cardiology, Benjamin Van Tassell, Pharm.D., associate professor of pharmacotherapy & outcomes science and Shijun Zhang, Ph.D., associate professor of medicinal chemistry, have invented a new anti-inflammatory drug aimed at reducing the risk of heart failure during heart attack.

The trio has designed a novel drug that has been submitted for patent protection to VCU Innovation Gateway. When compared to widely-used anti-diabetic medication, Glyburide, this novel therapeutic requires lower doses while exhibiting anti-inflammatory properties, key to preventing heart injury and ultimately death.

"In clinical tests, it reduces the amount of injury to the heart by half," says Abbate.

Since 2008, Abbate and Van Tassell have received a total of more than \$3 million in funding, published more than 40 papers, and have collaborated on numerous clinical trials that explore the link between inflammation and heart disease.

This novel drug therapy presents a wide range of applications and may prove useful for treating numerous complex diseases such as gout, rheumatoid arthritis, diabetes, atherosclerosis, Alzheimer's disease and even cancer.

**Shijun Zhang, Ph.D.**  
**Antonio Abbate, M.D., Ph.D.**  
**Benjamin Van Tassell, Pharm.D.**



*Keeping the beat:  
novel drugs for heart  
injury prevention*

## *On a supercharged mission for a greener battery*

People now rely on numerous rechargeable devices to get through the day. The desire to stay connected drives a global demand for millions of lithium ion batteries, all of which contain toxic materials. That's why, for the past six years, the idea of producing a greener battery has energized the work of Dr. Puru Jena.

Jena, a professor in the Department of Physics in the VCU College of Humanities and Sciences, pioneered the concept of "superatoms." These are clusters of atoms that mimic the behavior of single atoms in lithium ion batteries — only without the chlorine and fluorine that make up the electrolytes of the battery. This discovery is the first step in producing a non-toxic lithium ion battery.

Jena is the recipient of the VCU 2011 Presidential Medallion and was named one of three Virginia's Outstanding Scientists of 2015 for his contributions to the theoretical understanding of nanomaterials with potential applications in clean energy, medicine and information technology. He has acted as principal investigator on projects totaling more than \$8 million in grant funding and has published more than 350 research papers in a number of academic journals.

*"This project is the first step in producing a non-toxic "greener" lithium ion battery."*

**Puru Jena, Ph.D.**  
*Distinguished Professor  
Department of Physics*



**Puru Jena, Ph.D.**



## Go For It! Getting student start-ups off the ground

For a select group of VCU students, school is anything but business as usual. Thanks to Go For It!, a new 12-week pre-accelerator initiative led by Innovation Gateway, teams of young entrepreneurs receive the initial backing and know-how to help get their start-ups off the ground.

The program's first class each qualified for up to \$5,000 in stipends. Business concepts included craft chocolate, a marketing consultancy, healthy teas, custom jewelry, a homebrew gaming website, foster care resource, and a cell phone case that has a compartment to store oral contraceptives.

"We invested \$35,000 and they have already either generated revenue or received investments totaling more than \$180,000," said Nicole Colomb Monk, enterprise and economic development executive with VCU Innovation Gateway. "That really shows how much passion and dedication these students have for taking their ideas to the next level."

Go For It! is structured around three month-long labs that emphasize the steps of launching a real-world business: customer and product development, creating a prototype, and perfecting their pitch. Their next phase is discovering the art of running a business, but they're not alone. Essential partnerships from 804RVA and Lighthouse Labs offer support, mentorship and investor connections throughout the Richmond region. Two of the student companies were accepted into the regional accelerator program and each received an additional \$20,000 non-dilutive investment.

Go For It! is an extension of VCU Venture Creation University™, which aims to enhance the entrepreneurial culture at VCU. Pathways for Transformation, The College of Humanities and Sciences' strategic plan, also played a major role with its support of students' co-curricular activities, such as undergraduate research, community service, internships, or becoming an entrepreneur.



ALEXANDER BURLINGAME  
PHOTO COURTESY OF UNIVERSITY RELATIONS



MICHELL POPE, PH.D. AND JASMINE ABRAMS, PH.D.  
PHOTO COURTESY OF UNIVERSITY RELATIONS

*"One of the great things about VCU students is the absence of the attitude of entitlement. They show up ready to roll up their sleeves."*

**Nicole Colomb Monk**  
Enterprise and Economic Development Executive  
VCU Innovation Gateway

## I-Corps: venturing beyond the lab

"Who is your customer? What is your product? Why will they buy?" Those are exactly the not-so-simple challenges facing participants in the I-Corps program.

VCU Innovation Gateway gives the faculty and staff interested in entrepreneurship opportunities to learn firsthand about the initial steps of venture creation for themselves. The I-Corps curriculum was developed, and is taught, by successful technology entrepreneurs from across the country.

The mini I-Corps program is an extension of DC I-Corps and is designed to foster, grow and nurture innovation in the region. Sponsored by the National Science Foundation, the DC I-Corps is jointly run by the University of Maryland College Park, George Washington University, Virginia Tech and Johns Hopkins University.

At its core, the workshop emphasizes customer discovery and dealing with the chaos and uncertainty of commercializing innovations. It's really about getting researchers to think as real world problem-solvers by getting out of the classroom. Participants are required to talk to at least 25 potential customers about their business problems and pain points. The teams seek a solid product-market need to validate the business model.

While the ultimate goal is to create a new venture or licensing opportunity, benefits also include a greater understanding of viable innovation, self-confidence boost, creatively approaching barriers to adoption and new market prospects.



**Edmund Pendleton, Director, DC I-Corps**



## ***VCU Innovation Gateway Team***

*From Left to Right*

*SEATED*

*TRISHA MASSENZO*

*ZENA SINGH*

*STANDING*

*ALLEN OWENS*

*V. LACY SPOTT*

*NICOLE COLOMB MONK*

*IVELINA METCHEVA*

*AFSAR MIR*

*MAGDALENA MORGAN*

*LIVIA HORTON*

*SUE PATOW*

*CINDY STRAIN*

## ***VCU Commercialization Advisory Panel***

**David R Beauregard**  
Managing Director  
Monument Square Advisors

**Geoffrey D. Beecher**  
Mid Atlantic Sales Manager  
Focal Therapeutics

**L. Franklin Bost**  
Executive Associate Dean  
VCU School of Engineering

**Reinhold Brand**  
Former President  
Evonik Goldschmidt Cooperation

**Brian Carney**  
Principal  
Harbert Venture Partners

**William H. Daughtrey**  
Executive Director  
RIC Technology

**Alex Euler**  
Investment Director  
CIT Gap Fund

**James Fort**  
Associate Director  
Pain Management  
Product Development  
Pfizer Consumer Health

**Jeffrey M. Gallagher**  
CEO  
Virginia Bio

**Mike Grisham**  
President and CEO  
VBHRC/ the Catalyst

**Michael Innes**  
Managing Director  
Cary Street Partners

**Mike McGinley**  
Managing Partner  
New Dominion Angels

**Todd Nuckols**  
VP of Business Development  
EnterBridge Technologies  
Managing Director  
Lighthouse Labs

**Neil Patel**  
Senior Vice President  
Content Strategy & Development  
The Martin Agency

**Carrie Roth**  
President/CEO and Executive Director  
Virginia BioTechnology Research Park

**Dennis Schafer**  
Life Science Management

**Mike Whitham**  
Patent Attorney  
Whitham, Curtis, Christofferson  
& Cook

**Eric Martin**  
Founding Partner  
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**T. Justin Moore, III**  
Partner  
Hunton and Williams



**VCU** Innovation Gateway

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