

ANNUAL REPORT
Bringing Ideas to Life



VCU Innovation Gateway

VIRGINIA COMMONWEALTH UNIVERSITY

Bringing Ideas to Life

14

Annual Report

COVER PHOTO:

Model of a Novel Dry Powder Inhaler

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and Innovation and the
Executive Director

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Mission

Our mission is to facilitate commercialization of university inventions; support university research through collaborative agreements; foster a culture of innovation and entrepreneurship at the university; and promote regional economic development and new venture creation.

LINKEDIN: VCU INNOVATION GATEWAY 

FACEBOOK: VCU INNOVATION GATEWAY 

TWITTER: @VCUINNOVATION 



Dear Colleagues and Friends,

This was a pivotal year for us.

We adopted a new brand name and started implementing our expanded vision to become a true Innovation Gateway for the university. And we are making it real with results that speak for themselves: Not only did we have a record year for issued patents (12) and for licensing revenues (~\$2M), but we also had a record number of licensing deals (17). The double-digit growth reflected in these numbers is evidence for our success. Furthermore, we have doubled the number of companies and investors visiting VCU and doubled the number of industry collaborations with VCU faculty.

We are pleased to report that one of VCU's start-up companies developing the only clinical drug that directly targets sickle cell disease was successfully acquired by big pharma. This drug is a telling example of productive collaboration between our translational research focused faculty, small business and NIH's National Center for Advancing of Translational Sciences to bring innovation from bench to bedside.

This past year was remarkable in another aspect. Last September we launched the VCU Venture Creation University, also known as VCU Squared. As many of you know, this is a university-wide strategy to support entrepreneurship and to harness the talent of our faculty, staff and students. Since last September, more than 170 VCU faculty and over 800 students attended our entrepreneurship training events, such as boot camps, pop-up pitches, start-up seminars and start-up weekends. We are very proud that in one year we have already spun-off several new faculty and students ventures.

In the following pages, you will find information on this university-wide strategy to support entrepreneurship and innovation.

Finally, we are at a pivotal point in the VCU relationship with the Virginia Biotechnology Research Park. The Research Park is re-branding and re-positioning itself as an important agent of change for the regional innovation ecosystem. In this annual report, you will learn about VCU president Michael Rao's vision for collaboration with the Research Park to promote innovation and economic development in RVA.

Thanks to the leadership of Dr. Rao, the talent of our multidisciplinary research faculty, and the creativity of our students, the VCU Innovation Gateway is bringing translation research and innovation to life.

We invite you to explore some of the highlights of 2014 in this report.

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

Shared Vision of a Regional Innovation Ecosystem

On a brisk January afternoon in downtown Richmond fifty local business trailblazers, educators and public leaders piled onto a bus at the Virginia Biotechnology Research Park for a tour of the region's budding innovation ecosystem.

Along for the ride, organized by the Greater Richmond Chamber, VCU Innovation Gateway and the Virginia Biotechnology Research Park, were VCU president Michael Rao, Ph.D., and Carrie Roth, president and CEO of the Research Park.

"If we could bring all of our resources together, the region could be explosive," Dr. Rao called the group to action. "No one of us can do it all alone. We need to work together to create a pipeline for the university research engine."

The tour highlighted the Research Park's commercial life sciences hub as well as VCU's innovation residences, multiple accelerators and co-working spaces in RVA. Since the university's renewed partnership with the Research Park in 2013, the two entities have worked in tandem to leverage innovations and discoveries to elevate the entire Richmond region.

Two major activities are on the agenda: establishment of a regional innovation council and elevating VCU Venture Creation University - VCU Squared. The innovation council is a focal point of the Research Park's new mission to grow the regional ecosystem through its non-profit Corporation Board. VCU Squared is a university-wide strategy for innovation and entrepreneurship. VCU has committed \$1.2 million for these efforts and is now encouraging community support and promotion for the projects.

"Taking the Research Park and the regional innovation ecosystem to the next level will require increased shared activity and revolutionary action for transformational change," said Roth. "VCU is an innovation, entrepreneurial and economic development driver for the region, and it is vital to leverage this asset in a meaningful way to strengthen the fabric of our collaborative community. The opportunity is ours."

"It's very clear that innovation is on the minds of many people in the Richmond region," said Dr. Rao. "The conversations I've had in many places across the innovation and entrepreneurial communities affirm the actions we are taking to establish a regional innovation system. And as VCU moves solidly into the top 50 public research universities nationally, the university's alignment with the Research Park is key."



Carrie Roth and Michael Rao, Ph.D.

14

FISCAL YEAR AT A GLANCE

Licensing Revenues	\$1,743,344
Invention Disclosures	98
Licenses/Options	17
Other Research Support Agreements	26
Start-ups	3
Patents Filed	138
Patents Issued	12
Copyrights	6
Material Transfer Agreements	338
Non-Disclosure Agreements	103

DEPARTMENTS WITH TEN OR MORE INVENTION DISCLOSURES

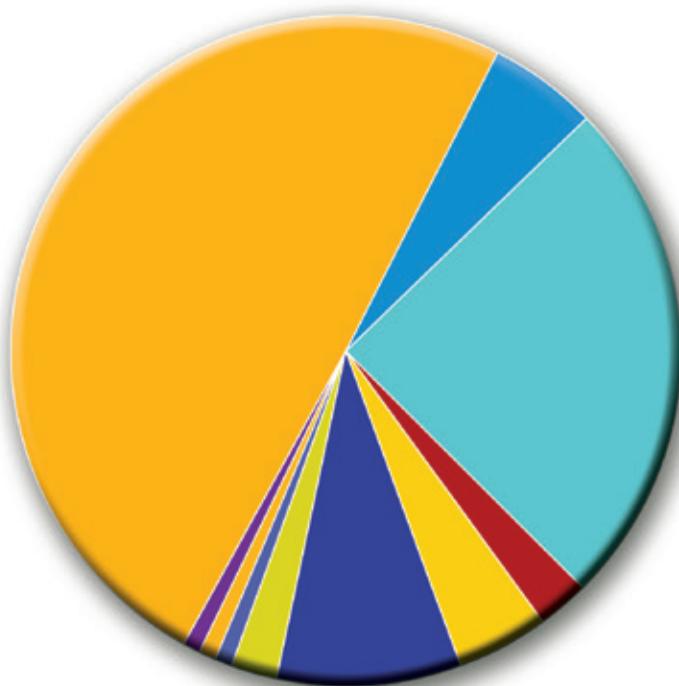
Internal Medicine	14
Biomedical Engineering	11
Chemical and Life Sciences Engineering	10

DEPARTMENTS WITH FIVE TO NINE INVENTION DISCLOSURES

Medicinal Chemistry	9
Mechanical and Nuclear Engineering	8
Emergency Medicine	6
Biochemistry	5

School of Medicine	66
College of Humanities and Sciences	7
School of Engineering	33
School of Art	3
School of Dentistry	6
School of Pharmacy	12
School of Allied Health Professions	3
School of Nursing	1
School of Social Work	1
Office of Research	1

DISTRIBUTION OF INVENTION DISCLOSURES



VCU PATENTS ISSUED

Issue Date	Patent No.	VCU Inventors	Title
6/24/2014	8,762,308	Kayvan Najarian, Ph.D. Soo-Yeon Ji, Ph.D. Kevin Ward, M.D. Roya Hakimzadeh, Ph.D.	Combining Predictive Capabilities of Transcranial Doppler (TCD) with Electrocardiogram (ECG) to Predict Hemorrhagic Shock
6/17/2014	8,753,806	Martin Mangino, Ph.D.	Organ Protection Solution and Method of Use
3/11/2014	8,669,105	John Tew, Ph.D. Mohey Eldin El Shikh, MD, Ph.D.	Methods for Assaying Response to Vaccines
1/22/2014	0102782.7	Ruey-min Lee, Ph.D. Peck-Sun Lin, Ph.D.	Induction of Tumor Hypoxia for Cancer Therapy
12/24/2013	8,613,909	Umesh Desai, Ph.D. Brian Henry, MD, Ph.D. Aiye Liang, Ph.D. Jay Thakkar John Mangrum, Ph.D. Ivo Torres Filho, M.D. Bruce Spiess, M.D.	Cinnamic Acid-based Oligomers and Uses Thereof
12/17/2013	8,609,360	Don Farthing, Ph.D. Lei Xi, M.D. H. Thomas Karnes, Ph.D. Domenic Sica, M.D. Todd Gehr, M.D. Martin Unverdorben, Ph.D. Lynne Gehr, M.D.	Method for Diagnosing Acute Cardiac Ischemia
12/17/2013	8,609,360	Don Farthing, Ph.D. Lei Xi, M.D. H. Thomas Karnes, Ph.D. Domenic Sica, M.D. Todd Gehr, M.D. Martin Unverdorben, Ph.D. Lynne Gehr, M.D.	Method for Diagnosing Acute Cardiac Ischemia
12/10/2013	8,602,034	Vishnu Sundaresan, Ph.D. Jayasimha Atulasimha, Ph.D.	On the Use of Magnetolectric Cantilevers in Minimally Invasive Surgery/ Magnetolectric Dampers
11/19/2013	8,586,345	Gary Bowlin, Ph.D. David Simpson, Ph.D. Gary Wnek, Ph.D.	Electroprocessed Collagen and Tissue Engineering
10/18/2013	5390189	Richard Marconi, Ph.D. Christopher Earnhart, Ph.D.	Polyvalent Chimeric OspC Vaccinogen and Diagnostic Antigen
9/3/2013	8,538,117	Kayvan Najarian, Ph.D. Simina Vasilache, Ph.D. Kevin Ward, M.D.	Accurate Pelvic Fracture Detection for X-Ray and CT Images
7/30/2013	8,497,408	Marcus Carr, M.D., Ph.D. Gary Wnek, Ph.D. Kelman Cohen, Ph.D. Gary Bowlin, Ph.D. Kevin Ward, M.D. Robert Barbee, Ph.D. Rao Ivatury, M.D.	Treatment for High Pressure Bleeding
7/23/2013	8,491,872	Umesh Desai, Ph.D. Brian Henry, MD, Ph.D. Aiye Liang, Ph.D. Jay Thakkar John Mangrum, Ph.D. Ivo Torres Filho, M.D. Bruce Spiess, M.D.	Cinnamic Acid-Based Oligomers and Uses Thereof
7/9/2013	8,479,728	Worth Longest, Ph.D. Jinxiang Xi, Ph.D. Michael Hindle, Ph.D.	Enhanced Delivery of Nanoparticle and Micrometer-Sized Pharmaceutical Aerosols to the Lung through Controlled Hygroscopic Growth

Martin Safo, Ph.D. and Richmond Danso-Danquah, Ph.D.



The Billy R. Martin Innovation Award

One Step Closer: A VCU Discovered Therapeutic Combats Sickle Cell Disease

Over 100,000 people in the United States alone suffer from sickle cell disease (SCD) and face an average life expectancy of just forty years. For patients in Africa and Asia afflicted with this hereditary blood disorder, the number skyrockets into the millions.

Now entering phase II clinical trials, an anti-sickling agent discovered at Virginia Commonwealth University is closer than ever to becoming the world's first approved drug to treat SCD.

A team from the VCU Institute for Structural Biology and Drug Discovery including Martin Safo, Ph.D., associate professor of medicinal chemistry; Richmond Danso-Danquah, Ph.D., assistant professor of medicinal chemistry; and Donald Abraham, Ph.D., emeritus director of the institute, developed the oral small molecule known as Aes-103.

Safer than hydroxyurea, the only drug currently used to alleviate the symptoms of SCD, Aes-103 works by directly blocking red blood cell sickling, thereby preventing life-threatening conditions such as anemia and stroke.

VCU Innovation Gateway served as the liaison between the university and AesRx, the start-up biopharmaceutical company focused on Aes-103's development. Baxter International, a global healthcare company with expertise in medical devices, pharmaceuticals and biotechnology acquired AesRx last summer.

With the successful completion of its clinical trial phase, in partnership with the NIH Therapeutics for Rare and Neglected Diseases program, Aes-103 stands to become a revolutionary new treatment for this debilitating disease.



DONALD ABRAHAM, PH.D., MICHAEL RAO, PH.D.,
RICHMOND DANSO-DANQUAH, PH.D. AND
MARTIN SAFO, PH.D.

"VCU Innovation Gateway and I built a close working relationship. I kept them up to date on major developments and challenges. As with any drug development program, there were unexpected twists and turns. However, because of our joint teams' collaborative spirit, VCU was willing to work with us to meet and overcome the obstacles we faced. They were a true partner with us along the way. The result was a huge success for everyone when Baxter acquired AesRx last summer. The program is in the hands of a partner who has the skill, resources and commitment to take Aes-103 as far as its results merit."

Steve Seiler
CEO, AesRX

Combining Imaging and Therapy – a Novel Approach in Cancer Care

"It was a pleasure working with Ivelina and her team at VCU Innovation Gateway in developing CTS. The interactions were very positive and professional, facilitating the licensing process and launching the new venture."

Paul B. Fisher, M.Ph., Ph.D.
*Professor and Chairman
Human and Molecular Genetics*





Paul B. Fisher, M.Ph., Ph.D.

For his bench to bedside research on cancer cell specific gene promoters, Paul B. Fisher, M.Ph., Ph.D., professor and chairman of Human and Molecular Genetics, director of VCU Institute for Molecular Medicine and Thelma Newmeyer Corman Chair in Cancer Research in the Massey Cancer Center, has been named the recipient of the 2014 Virginia Outstanding Scientist Award.

Along with co-inventor Martin G. Pomper, M.D., Ph.D., professor and deputy director of Johns Hopkins University's In vivo Cellular and Molecular Imaging Center, Dr. Fisher has created a new spin-off company, Cancer Targeting Systems (CTS). The company is focused on harnessing non-viral gene delivery techniques to offer cancer imaging and treatment.

"Cancer cell specific gene promoters offer a platform that can really move the whole area of gene-based

oncology products forward – for therapy, imaging and the combination of the two," said Will West, Ph.D., M.B.A., president and CEO of CTS.

Fisher and the team have shown imaging of cancer metastases with superior accuracy to any other imaging methods currently available. The technique involves triggering specific protein expression within the cancer cells to detect disease and subsequently to prompt tumor death.

"This research could potentially lead to earlier detection and treatment of metastases originating from a variety of cancer types," said Fisher.

Future applications of this discovery could include the delivery of therapeutic agents directly to tumor sites and the monitoring of drug delivery in real time.

Anticoagulants that Work: Reducing Surgical Risks by Timely Antithrombin Sensing



VCU School of Pharmacy Professor Umesh R. Desai, Ph.D. and an interdisciplinary team of researchers are battling one of surgery's biggest risks on two fronts. Unmitigated thrombin and antithrombin (AT) fluctuation can cause post-surgical clots to form in arteries, which may lead to full blockages and death. Anticoagulants, such as heparin, have not completely solved patient response variability and bleeding episodes.

To meet this need, Dr. Desai and his team developed a new synthetic anticoagulant, sulfated pentagalloyl glucopyranoside (SPGG), which retards blood clotting without the risk of variability and bleeding.

Dr. Desai and his collaborators from several VCU schools have also developed a new way to test AT levels in patients undergoing surgery. The AT

monitoring system, which uses uniquely designed metal nanoparticles coupled with a fluorescent marker, binds to AT present in blood and produces fluorescence proportional to its level. Through this process, AT is accurately quantified.

"The usage of AT in surgery will allow people to benefit from their own natural protein rather than heparin," said Dr. Desai. "From here, we can clearly see a road to generating a test strip, which can be dipped in blood or plasma and will reveal the patient's level of AT in less than five minutes."

This invention adds a new level of safety to surgery and the nanoparticle system could be easily modified for measuring the levels of other proteins in the blood.



Umesh Desai, Ph.D.

"VCU Innovation Gateway has been a tremendous resource in helping to convert my collaborative research efforts with Dr. Michael Hindle into marketable intellectual property."

P. Worth Longest, Ph.D.
Professor
Mechanical and Nuclear Engineering

Delivering what often amounts to life-saving treatment in emergency situations, dry powder inhalers (DPIs) are used to treat respiratory diseases such as asthma, chronic bronchitis, and emphysema.

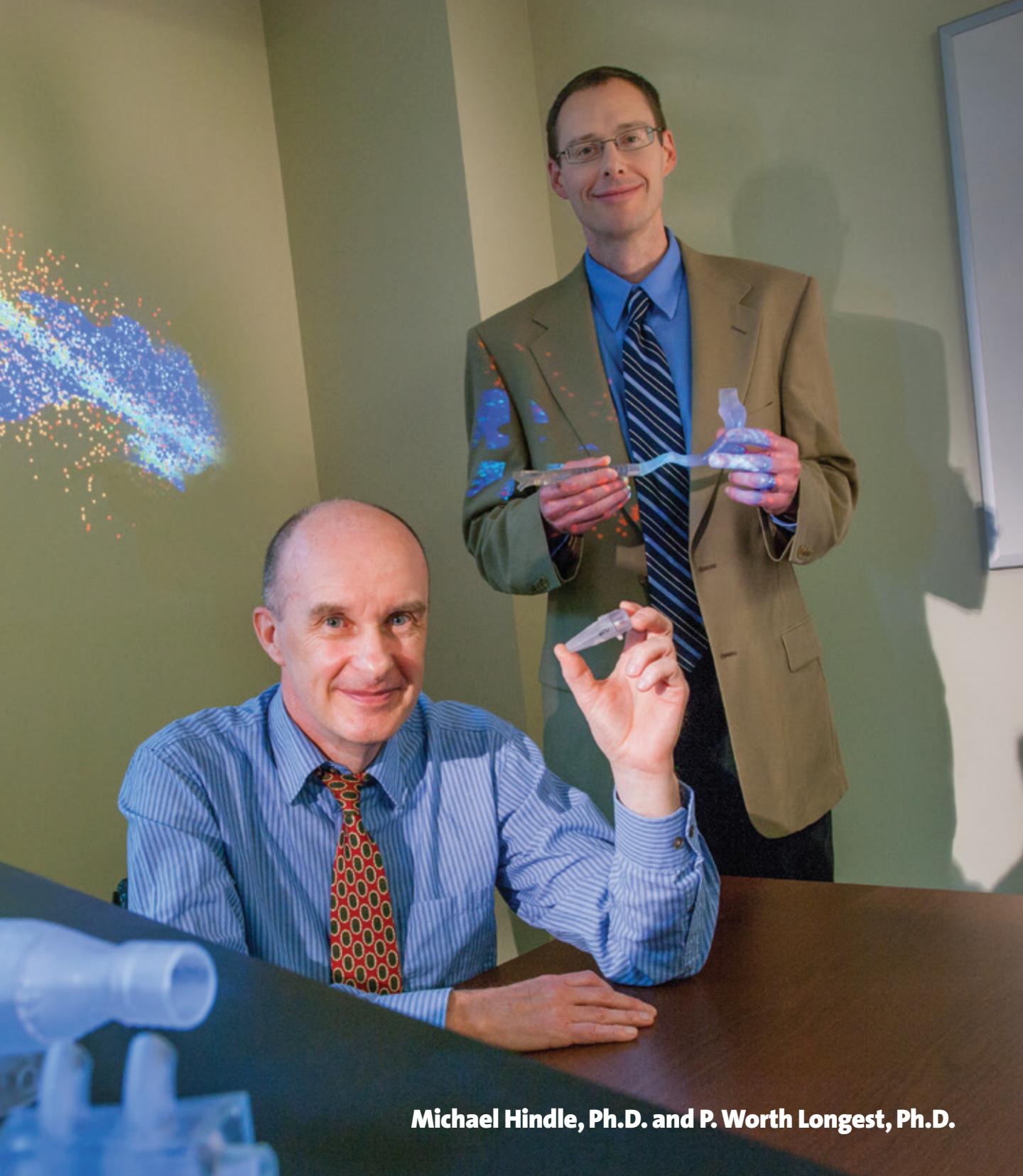
These devices work by converting a powder formulation into an aerosol so that it can be inhaled. By delivering medication directly to the lungs, side effects are reduced and the medicine acts more effectively. Current inhalers, however, are inefficient – wasting up to 90% of the drug through deposition in the mouth and throat, which contributes directly to side effects.

To address the need for high-efficiency DPIs, Worth Longest, Ph.D. from the School of Engineering and Michael Hindle, Ph.D. from the School of Pharmacy have created an innovative inhaler. The functionality of this novel respiratory drug delivery system lies in decreasing the size of the delivered aerosol to a nanoscale.

"The pharmaceutical industry has struggled for a long time to get smaller particles out of aerosol inhalers," said Dr. Longest. "What we have developed at VCU is a way to first create a submicrometer aerosol from a handheld DPI and then, once the aerosol is in the lungs, increase its size to provide targeted drug delivery. This inhaler and drug formulations open up the lungs as a way to effectively deliver medication to the body without needles."

Exciting advantages of this new inhaler include improved targeting of medications to the lungs, low cost, and a wide variety of design attributes that can be used to optimize performance.





Michael Hindle, Ph.D. and P. Worth Longest, Ph.D.

A Novel Design for Dry Powder Inhaler Provides Patients with Improved Drug Delivery

VCU Venture Creation University (a.k.a. VCU Squared) is a university-wide strategy for enhancing the culture of innovation and entrepreneurship at the university. VCU Squared focuses on building pathways that support entrepreneurial students, faculty, staff, and alumni. These efforts will expand the pipeline of innovation and entrepreneurial talent at VCU and strengthen RVA's innovation ecosystem.

Faculty Opportunity



2k VCU Faculty



\$250M Sponsored Research

Invention Disclosures

100/year



Entrepreneurial Pathways

Evaluate and Protect

Entrepreneurial Training

Validate and Fund

Connect and Commercialize

Get Funding

Get Help

Get Educated

Get Involved

Entrepreneurial Pathways



33k

VCU Students



50% Want to start a company

Have already started or starting a company

15% A play button icon inside a circle.

Student Opportunity

VCU Venture Creation University

- VCU IP Team
External IP Experts
- Start-up Weekends & Boot Camps
I-Corps Program
- Business Model Validation
Proof of Concept Funding
- Commercialization Advisory Panel
Industry and Investors Alliances
- Business Plan Competitions
VCU Innovation Fund
- Mentoring Programs & Boot Camps
Pre-accelerator Programs
- Venture Creation Certificate
Focused Entrepreneurship Courses
- Student Clubs
Pop-up Pitches





VCU Innovation Gateway Team

From Left to Right:

SEATED

JUSTIN KAUSZLER

SUSAN PATOW

CLARA SINE

STANDING

MAGDALENA MORGAN

AFSAR MIR

REBECCA CAFFREY

BRIAN A. SMITH

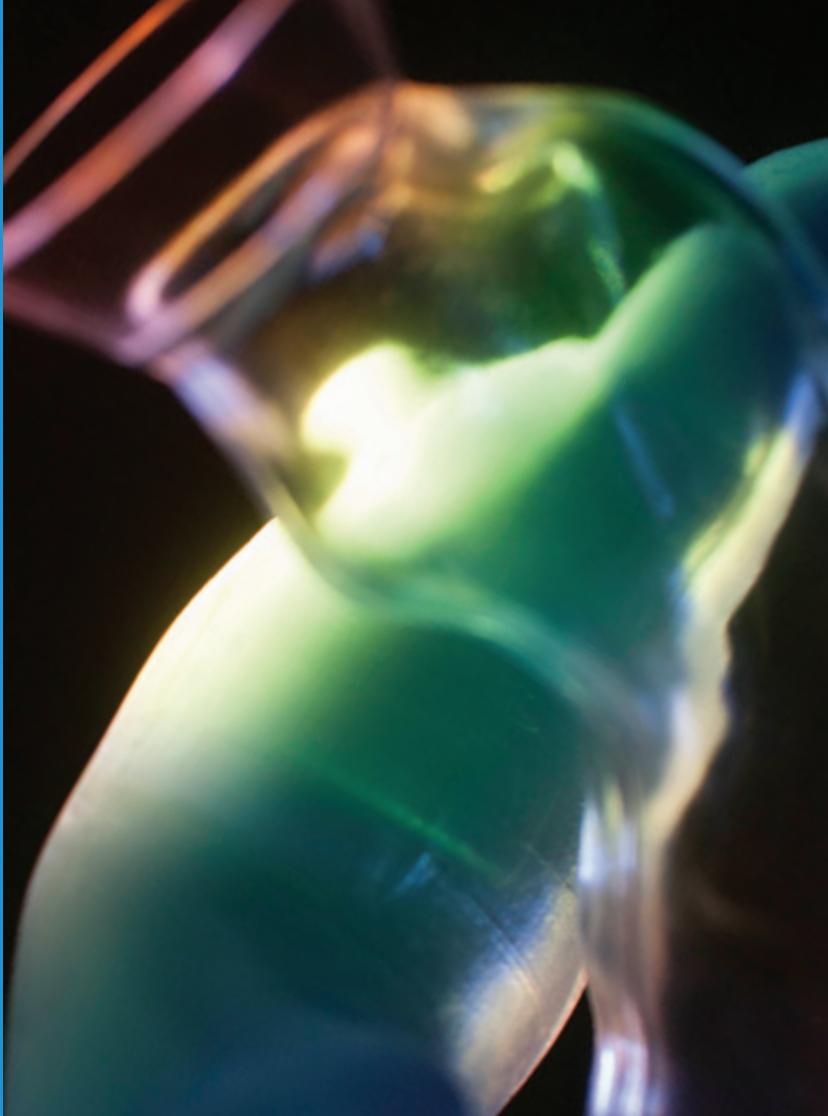
DIEGO ALVAREZ

IVELINA METCHEVA

LINDSAY CLAYTON

NICOLE COLOMB

TRISHA MASSENZO



VCU Commercialization Advisory Panel

David R Beauregard
Managing Director
Monument Square Advisors, LLC

Geoffrey D. Beecher
Senior Sales Specialist
Carticept Medical

L. Franklin Bost
Executive Associate Dean
VCU School of Engineering

Reinhold Brand
President
Evonik Goldschmidt Corporation
Consumer Specialties

Brian Carney
Principal
Harbert Venture Partners

William H. Daughtrey
Entrepreneur-in-Residence
Dominion Resources
Innovation Center

Alex Euler
Investment Director
CIT Gap Fund

Paul France
MeadWestvaco

James Fort
Associate Director
Pain Management
Product Development
Pfizer Consumer Health

Jeffrey M. Gallagher
CEO
Virginia Bio

Mike Grisham
President and CEO
Virginia Biosciences Health
Research Corporation

Graham Henshaw
New Richmond Ventures

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Cary Street Partners

Eric Martin
Founding Partner
80amps

Mike McGinley
Managing Partner
New Dominion Angels

T. Justin Moore, III
Partner
 Hunton and Williams

Todd Nuckles
VP of Business Development
EnterBridge Technologies
Managing Director
Lighthouse Labs

Neil Patel
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Content Strategy & Development
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President and CEO
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Research Park

Dennis Schafer
Life Science Management

Mike Whitham
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Whitham, Curtis, Christofferson
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