To maximize the impact of U.Va.’s innovation assets via commercialization, while providing high levels of customer service, value-added business development activity and an intent focus on driving quality transactions.
DIRECTOR’S MESSAGE

On November 1, 2013, University of Virginia President Teresa A. Sullivan announced the U.Va. Cornerstone Plan – U.Va.’s strategic plan to set the course for the University’s third century. Innovation is a central theme throughout the Plan and is emphasized in one of its five pillars:

“Strengthen the University’s capacity to advance knowledge and serve the Commonwealth of Virginia, the nation, and the world through research, scholarship, creative arts, and innovation.”

Accordingly, the University’s commitment to research and innovation has never been stronger and the U.Va. Licensing & Ventures Group (LVG) is continuing to strive to deliver to U.Va. a world-class customer service, intellectual property management, business development, commercialization, and new ventures enterprise.

During the time since our last annual report, U.Va. LVG has bolstered its licensing team, implemented an already fruitful entrepreneur-in-residence program, delivered strong performance to key metrics, launched portfolio companies that have raised funds from high-quality partners like Pfizer and New Enterprise Associates, executed license and sponsored research transactions with many Global 500 companies, and strengthened our support of key translational research and support initiatives at U.Va. We are very pleased to share with you some of these exciting stories in the pages that follow.

Even in light of these considerable accomplishments, there is still so much more that can be accomplished. During the coming year, we look forward to working with established and new University leadership and U.Va. LVG’s expanded Board of Directors to optimize and broaden the resources and service offerings to the University community.

MICHAEL P. STRAIGHTIFF
Executive Director, U.Va. Licensing & Ventures Group
MESSAGE FROM PHILLIP A. PARRISH, Ph.D.
INTERIM VICE PRESIDENT FOR RESEARCH
UNIVERSITY OF VIRGINIA

The future of innovation at the University of Virginia looks exceptionally bright and highly promising.

“The U.Va. Licensing & Ventures Group (LVG) has emerged as one of the leading university discovery and innovation cultures in the nation, which others both nationally and internationally are seeking to emulate. In this report, you will see strong evidence of success based upon LVG’s new, risk-tolerant, long-term investment strategy, which is providing great service to the U.Va. community of researchers and innovators while developing a strong and highly sustainable foundation for long term growth and continued success. Disclosures, patents issued, deals being made and new startups are on exciting trajectories, providing strong confidence in LVG’s leadership team and its execution of the vision, which portends great success into the future. The New Ventures initiative to be launched in the coming year will accelerate and further enable U.Va.-based intellectual properties to have even greater social and economic impact, and serve as a key source of new, high value jobs through the new companies which it will enable to grow at an accelerated pace to greater levels of financial and operational performance.”
Board of Directors

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For J. Randall Moorman, M.D., collaboration is at the heart of many past and current medical innovations. In fact, he calls it “the engine of discovery.” It is with this mindset that he embarked in his clinical and academic work at the University of Virginia, connecting and partnering with other physicians and scholars to find more complete solutions to some of the most complex clinical challenges.

Moorman, a cardiologist and professor of medicine, biomedical engineering and molecular physiology and biological physics, was named the 2014 Edlich-Henderson Innovator of the Year in April 2014, in recognition of his body of research and, specifically, for the development of a predictive monitoring tool for early diagnosis of potentially fatal illnesses in infants.

The research at the center of his commercially successful venture, Medical Predictive Systems Corporation, founded in 1999, resulted in the development of the Heart Rate Observation System, or HeRO, a device that helps determine impending catastrophic illnesses through the analysis of heart rate characteristics.

This monitoring technology was primarily focused on premature infants in intensive care units—patients who weigh less than three pounds and who are more vulnerable to develop sepsis, a life-threatening bacterial infection of the bloodstream. Moorman looked at how an infant’s heart rate behaved and found that it displayed a very distinctive abnormality in septic infants between 12 and 24 hours before illness could be detected.

“The problem with sepsis in that particular population is that there is really no good way to tell that an infant is sick by looking at them,” said Moorman. “We figured that any early detection ought to be very useful because sepsis is, after all, an infection and antibiotics are effective on most infections.”

After the discovery, the team worked for several years to perfect the detection of abnormality and subsequently began the largest randomized clinical trial ever undertaken in very low-birth-weight infants. When monitoring was used, the mortality rate decreased by 22 percent.

Douglas E. Lake, Ph.D., associate professor of cardiovascular medicine and Moorman’s closest collaborator says that, “this collaboration has brought advanced mathematical thinking to the bedside of premature infants with the HeRO heart rate monitoring system and innovative new algorithms for detecting atrial fibrillation and predicting adverse events, like sepsis, in adults.”

The success of this monitoring technology and its results has prompted Moorman to launch another company, AMP3D, focused on developing tools for use with adults in ICU settings.
Robin A. Felder, Ph.D., is the quintessential serial entrepreneur. A professor in pathology and the associate director of clinical chemistry at the University of Virginia, Felder has launched nine companies out of U.Va. and has all intentions to start many more.

Felder was awarded the 2012 Edlich-Henderson Innovator of the Year award in recognition of his outstanding work in medical automation and biomedical research. One of Felder’s companies, WellAWARE Systems, provides seniors with the opportunity to live independently through passive sensor monitoring. More than 2,000 systems are currently installed in residences from Virginia to South Dakota.
Marcia A. Invernizzi, Ph.D., set out to improve children’s literacy and her research tool, Phonological Awareness Literacy Screening, or PALS, is changing the education landscape across the world. PALS assessment and teaching tools are designed to offer a child’s customized learning experience with focus on future reading fluency. The assessment tools are currently used in six countries and in all 50 states.

Invernizzi was named the 2013 Edlich-Henderson Innovator of the Year. She was the first faculty member from the Curry School of Education to receive the honor.
The Edlich-Henderson Innovator of the Year Award

The highest honor bestowed on University of Virginia innovators, the Edlich-Henderson Innovator of the Year award recognizes an individual or team each year whose research discovery is making a major impact.

Named for U.Va. Professor Emeritus Dr. Richard F. Edlich and Christopher J. (“Goose”) Henderson, a 25-year veteran of privately owned financial services businesses, the award is a tribute to their enduring support of and commitment to the University and its innovators.

In 2012, the award title and criteria were modified to be more inclusive of University innovators pursuing a variety of different paths to achieve impact for their discoveries. Eligible nominees are current University of Virginia faculty, staff or students whose research discoveries are making a major impact. Prior to 2012, the award was known as the Edlich-Henderson Inventor of the Year award. Award winners receive a $10,000 cash prize and formal recognition at a special awards reception.
AWARD WINNERS

2014  J. Randall Moorman, M.D.

2013  Marcia A. Invernizzi, Ph.D.

2012  Robin A. Felder, Ph.D.

2011  Boris P. Kovatchev, Ph.D.

2010  Kevin R. Lynch, Ph.D.
       Timothy L. Macdonald, Ph.D.

2009  John P. Mugler III, Ph.D.
       James R. Brookeman, Ph.D.

2008  George T. Rodeheaver, Ph.D.

2007  Wladek Minor, Ph.D.

2006  George T. Gillies, Ph.D.

2005  Benjamin M. Gaston, M.D.
       John F. Hunt, M.D.

2004  Haydn N.G. Wadley, Ph.D.

2003  William A. Petri Jr., M.D., Ph.D.
       Barbara J. Mann, Ph.D.

2002  Joel M. Linden, Ph.D.

2001  Doris Kuhlmann-Wilsdorf, Ph.D.

2000  Ronald P. Taylor, Ph.D.

1999  John C. Herr, Ph.D.

1997  Richard L. Guerrant, M.D.
       Timothy L. Macdonald, Ph.D.

1996  Jessica J. Brand
       Patrice G. Guyenet, Ph.D.
       Richard D. Pearson, M.D.
       Janine C. Jagger, Ph.D.

1995  Donald F. Hunt, Ph.D.
       Jeffrey Shabanowitz, Ph.D.
       George C. Stafford, Jr., Ph.D.

1994  Gerald L. Mandell, M.D.
       Gail W. Sullivan

1993  Joseph Larner, M.D., Ph.D.

1992  Robert M. Berne, M.D.
       Luiz Belardinelli, M.D.
       Rafael Rubio, Ph.D.
INVENTION DISCLOSURES BY SCHOOL

- 52% School of Medicine
- 35% School of Engineering and Applied Science
- 6% Arts & Sciences
- 4% Curry School of Education
- 2% School of Architecture
- 1% VP for Research

COLLEGE AND GRADUATE SCHOOL OF ARTS & SCIENCES INVENTION DISCLOSURES

- 51% Chemistry
- 20% Biology
- 28% Physics
- 3% Astronomy
SCHOOL OF ENGINEERING & APPLIED SCIENCE
INVENTION DISCLOSURES

- 26% Systems and Information
- 15% Electrical and Computer
- 14% Materials Science
- 10% Mechanical and Aerospace
- 8% Biomedical
- 3% Civil and Environmental
- 2% Computation Intensive Center
- 2% Web Development Center
- 1% Engineering and Society
With an increased emphasis on risk tolerance and an entrepreneurial investor approach, the Licensing and Ventures Group is making steady progress in facilitating knowledge transfer and business development around University research and innovation. Its enhanced commercialization activities, such as the creation of an entrepreneur-in-residence program, provide resources to a wider array and greater number of potential commercial technologies, startup companies and licensees. As a result, LVG has experienced increased disclosures, issued patents and startup activity, all indicators of a robust technology transfer program.
Engines operate at their best and most efficient at very high temperatures. Sustained high temperatures, however, have shown to break down materials and ultimately affect performance. A reliable solution has been found in ‘thermal barrier coatings.’ This coating allows engines to run at high temperatures while protecting delicate components. Application of these thermal barrier coatings creates an opportunity to optimize turbine engine efficiency.

The current standard uses a rare-earth material that is expensive and not abundantly found in the United States but found under the earth’s crust in China.

Patrick E. Hopkins, Ph.D., has engineered a new material using strontium niobate that has exceptionally low thermal conductivity compared to current standard thermal barrier coatings. “We have designed this material that forms naturally,” said Hopkins, assistant professor in the Department of Mechanical and Aerospace Engineering. “In theory, this means that we have a thermal barrier coating that provides better insulation and that will allow engines to operate at higher temperatures,” roughly at 300 or 400 degrees higher than the current operating temperatures.

This coating can be as thin as tens of nanometers to as thick as it is needed and because it will oxidize it is stable even in highly corrosive environments.

Created via chemical solution deposition, strontium niobate films have shown impressive results—they form a crystallized thin layer that is used as a coating on a variety of different surfaces. Hopkins explained that “boundary scattering” from materials that are designed with multiple interfaces is the key for engineering heat transfer in nanotechnology. It is this designed structure that revealed that the material is naturally layered and stable at high temperatures. “Nature is actually working for us. In a lot of cases, one tries to trick nature in nanotechnology, but in this case, we want to use it to our advantage,” he said.

These features increase the markets in which this material can be successfully utilized. “We are primarily focused on either chemical insulation of materials or thin film protective layers, barriers to electronic devices and sensors that would normally break down in the atmosphere,” said Hopkins.
Groundbreaking advances in the performance of computer chips have considerably slowed in recent years. The principal culprit is heat. With current conditions, cooling electronics and data centers is set to become cost prohibitive and environmentally damaging.

Hossein Haj-Hariri, Ph.D., with graduate student Reza Monazami, has discovered a way to reduce the environmental and financial cost of cooling the devices and make high-performance computer chips perform more efficiently.

According to the Natural Resources Defense Council, data centers consumed an estimated 91 billion kilowatt-hours of electricity in 2013. The trend is set to continue to grow – to 140 billion kilowatt-hours in 2020, or $13 billion.

This technology, which was awarded two rounds of funding by the Virginia Innovation Partnership's i6 Challenge, a statewide innovation competition that sought to identify and support concepts with potential for future commercialization, has the demonstrated promise of extracting greater than an order of magnitude more concentrated heat than the current state-of-the-art devices.

“We are not going to make heat disappear, a cold reservoir is still needed to receive the heat, but what we are doing better than anybody else is that we can take a hot spot and we spread it out, faster and at a lower temperature drop,” said Haj-Hariri, professor and chair of the Department of Mechanical and Aerospace Engineering.

The design of competing devices is such that heat has to fight to reach the evaporation site-evaporation is hard to obtain and the temperature of the device may become too hot resulting in pool boiling.

“Typically, that’s what kills the operation of heat pipes. You get pool boiling, the liquid doesn’t come back, temperatures go up and devices fail,” said Haj-Hariri. His proposed evaporator utilizes an alternative, ‘flipped’ configuration. The hottest part of the device touches the liquid, drastically lowering the thermal resistance of the device, and allowing for the heat to travel a shorter distance to an evaporation site.

The device is intended to be integrated in the substrate of the computer chip, allowing for it to operate at its full potential with a constant temperature that is lower than the state-of-the-art. At the same time, the reduced thermal resistance results in higher quality heat, hotter, to be dissipated.

“This elevated temperature drop allows for the recovery of some energy using thermal devices that can take the temperature gradient and convert it into electricity,” said Haj-Hariri. “Efficiency is gained by putting a lot more power onto a smaller footprint on the computer chip, and energy is saved because some of the spent energy may actually be recovered.” Haj-Hariri explained that the industry trend has for some time been directed towards multi-core chips, and the reason is more dependent on necessity than preference. Intensive mathematical calculations are better executed in one core if the chip is at its fastest speed. “But if you run them really, really fast, they get really, really hot. That’s why people have gone into multiple cores,” he said.

Areas of focus for the use of the technology are electronic cooling and concentrated photovoltaics, which capture the sun’s energy for consumer consumption.

Based on the revolutionary nature of the discovery, this technology is primed for commercialization.
The complex struggle for domestic energy independence has been a recurring theme in American discourse for some time. T. Brent Gunnoe, Ph.D., and his collaborators are addressing the challenge with a technology that has been developed to convert, or partially oxidize, natural gas into liquids to be used as fuel or as precursors to high-end chemicals.

The process takes advantage of the abundance of natural gas in the United States. If this innovation can be fully developed and commercialized, the United States could be poised to become energy independent for many decades and, possibly, an exporter of energy to the world.

“Methane, the primary component of natural gas, is extremely difficult to use either as a fuel or by the chemical industry, and a primary reason is that it is expensive to transport,” said Gunnoe, professor of chemistry in the College of Arts & Sciences. “The cost of creating infrastructure that could handle and compress the gas into a liquid for transport is prohibitive. It’s multi billions of dollars.”

Gunnoe explains that the current solution is to burn off the natural gas in what are called ‘flares.’ As oil is tapped, natural gas is also tapped, but the lack of transport infrastructure prevents it from being captured and utilized. Instead, the gas is lit on fire.

Much of the national and global reserve of natural gas is ‘stranded.’ “The state of Alaska, for example, has a tremendous amount of natural gas, but there is no way to use it, so it’s just trapped there,” said Gunnoe.

Gunnoe and his collaborator, John T. Groves, Ph.D., from Princeton University, along with postdoctoral researcher George Fortman, Ph.D. at U.Va. and graduate student Nicholas Boaz at Princeton, have discovered that by taking simple oxidants like iodate and adding sodium chloride, or simple table salt, the light alkanes that make up natural gas can be converted into substances that will become liquid alcohols: methanol, ethanol and propanol.

The alcohols can be transported inexpensively and can be used not only as fuel, but also be converted into materials used in the plastics and pharmaceutical industries.

“This was an entirely unexpected discovery,” said Gunnoe.

Although the exact role that chloride plays in the reaction is the focus of on-going research, Gunnoe says it is an efficient process that converts natural gas into the preferred product. “We can very quickly convert 20 to 30 percent of alkanes with selectivities greater than 80 percent, and in a newly developed variation we can convert close to 50 percent of methane, again in very high yield,” he said.

The potential benefits of this technology are both financial and environmental. Instead of spending billions of dollars creating new infrastructure, the technology allows for the construction of much less expensive reactors that will convert natural gas to liquid fuels that can be added to the current pipeline infrastructure. Environmentally, this technology could stop the flaring of natural gas, thus eliminating the release of large quantities of carbon dioxide.

The research was funded by the Department of Energy under the Energy Frontier Research Centers (EFRC) through the Center for Catalytic Hydrocarbon Functionalization.
The current treatment for patients with idiopathic knee pain, cerebral palsy and other orthopedic and muscle-related ailments is greatly based on external measurements of gait, body strength, and muscle movement without complete information of how the actual muscles are faring. Silvia Salina Blemker, Ph.D., Craig H. Meyer, Ph.D., and Joseph M. Hart, Ph.D., have developed an MRI tool to diagnose muscle impairments that will allow surgeons to have very detailed information and images before recommending treatment.

“People can use the rich information from an MRI to visualize muscle in a new way and get quantitative information that allows comparisons to be made,” said Meyer, professor of biomedical engineering and radiology and an MRI world expert. He explains that doctors will now be able to image legs from above the hip all the way to the feet in a very short period of time.

“The technology allows for an intuitive way to look at muscles and quantify how a person compares to other people; how a person’s right leg compares to the left leg and how a person changes over time,” he said.

During her research, Blemker, associate professor of biomedical engineering, observed children with cerebral palsy being assessed by manual testing and surgery was often the only treatment. This MRI tool can image kids with cerebral palsy and help create a treatment plan with a significant collection of data. Without this technology, physicians who surgically operate on children’s muscles “have to guess what is actually going on with the muscles,” she said. “For those kids, the goal is really to improve the outcomes of their surgeries.”

After having tested many healthy patients and those with medium to serious muscle impairments, the researchers began exploring additional applications for the technology. The sports market seemed a logical leap.

“Athletic trainers and strength and conditioning coaches are trying to tell their athletes how to train their muscles, but with limited information about those muscles,” said Blemker.

The response from the sports community has been positive and immediate. The technology has the potential to maximize the athletes’ performance and significantly reduce their injury. Blemker, Meyer and Hart worked with several U.Va. teams, their coaches and athletic trainers to collect data. This innovation was the basis for the creation of a spin-out company, Springbok, aptly named after a fast-running, high-jumping antelope.

“I think this is a good example of how technology can move from the university and be supported by a variety of different mechanisms and move on towards the sports market, but eventually address other broader markets,” said Meyer.
The current focus for Springbok is to perfect the technology, making it faster—getting feedback in a few hours, instead of days—and portable. “We have lots of ideas about how to use this data and the ever growing database of what peoples’ muscles look like and use them to make new insights into how an athlete should train, how an athlete should prevent injuries and how an athlete should recover,” said Meyer.

Springbok received funding from the Wallace H. Coulter Foundation, the National Science Foundation, and the Center for Innovative Technology’s Commonwealth Research Commercialization Fund. This technology is a unique interdisciplinary collaboration and one of the first U.Va. startups to come out of three different schools: School of Engineering and Applied Science, the School of Medicine, and the Curry School of Education.
The University’s commitment to research and innovation has never been stronger.
Companies
EpiEP, Inc. almost never was. The medical device company, based on technology developed initially by University of Virginia faculty members George T. Gillies, Ph.D., and Srijoy Mahapatra, M.D., was founded in late 2008, just a few short months before the financial system “fell off a cliff,” says EpiEP, Inc. CEO Pamela Bunes. Luckily, early funding from the U.Va. Patent Foundation (now the Licensing & Ventures Group) Royalty Distribution Program, the Ivy Biomedical Innovation Grant Program, and the Wallace H. Coulter Foundation allowed the team to get the technology off the ground.
Today, EpiEP, Inc. is healthy and successful. An early move to Connecticut, following a series of significant investments, primed the company for pre-clinical trial milestones and additional infusions of funding. “We knew how much money we needed to raise and at the time, we couldn’t put it together either in Virginia, the Carolinas or elsewhere within the region,” said Bunes.

EpiEP, Inc. announced in November 2014 that its first product, the EpiAccess system, received 510(K) clearance from the U.S. Food & Drug Administration.

“Of the many milestones critical to the successful commercial development of a new medical device, none is more important than obtaining the necessary regulatory approvals for its use in patients,” said Gillies, research professor of mechanical engineering, biomedical engineering and physics at U.Va..

The EpiAccess system incorporates a pressure-guided needle designed to give physicians a clear path to the epicardial space during electrophysiology procedures aimed at treating ventricular tachycardia, and for use in left atrial appendage occlusion procedures, among other applications.

“What we are doing is providing additional pressure information that allows physicians to know more precisely where the needle tip is located, almost like GPS,” said Bunes. “It’s designed to reduce risks.”

The current state-of-the-art is a device employed for reaching the outer wall of the heart called the Tuohy needle, a hollow hypodermic needle slightly bent at the end. It has no means of helping the physician guide the needle inside the epicardium, a membrane that surrounds the heart and roots of the major vessels.

EpiEP, Inc. is poised for more innovation to the EpiAccess system in the next 18 to 24 months that may include a visual component and a needle with a smaller diameter.

The markets for the ailments that the EpiAccess system can address are growing rapidly. Ventricular tachycardia counts for an average of 21,000 patients per year, but it’s growing at a 20 percent rate year after year. Left atrial appendage occlusion cases are also growing steadily. Bunes explains that the company is embarking on the development of several additional products. “The first is our Epicathode device that can be placed in the pericardial space and used in atrial fibrillation ablation procedures to protect the esophagus,” said Bunes.

The second is a catheter for epicardial pacing and the third is the pericardial tending needle, which recently was granted a U.S. Patent.

Bunes realized quickly that this product was needed. “The University and the U.Va. Licensing & Ventures Group have been extremely helpful with the intellectual property strategy, assisting with the protection of the existing technology, and building a firewall around it through outside counsel,” said Bunes.

Gillies is grateful for the opportunity to see the early laboratory work undergo successful commercial development. “It has been a great pleasure to work with many students, clinicians and others at U.Va. and EpiEP, Inc., to develop the EpiAccess system, which is the central element for the ‘epicardial tool kit’ we envision for use in treating these challenging medical problems,” he said.
BrightSpec is on the heels of a breakthrough in the field of analytical chemistry. The research team is trying to introduce a new measurement technique into one of the most conservative fields in science: molecular rotational resonance spectroscopy.

“Our challenge is to identify trace levels of molecules directly in gas mixtures,” said Chief Scientist Brooks H. Pate, Ph.D., Professor of Chemistry at the University of Virginia.
For many industrial applications, the goal is to detect the presence or absence of key molecules that may indicate a positive or negative event. BrightSpec is building the first commercially offered molecular rotational resonance spectrometer.

Founded in 2012, BrightSpec’s technology is based on Pate’s research and that of his graduate students. Four patents have been filed with the U.Va. Licensing & Ventures Group (LVG) and licensed by the company.

“The trick behind BrightSpec and the work in my lab was developing ways that improved the sensitivity of the technique—the detection of molecules in low amounts,” said Pate.

The original driver for the research in Pate’s laboratory was the need of astronomers to have instruments for rotational spectroscopy with which to identify molecules in space. Pate worked with radio astronomers at the National Radio Astronomy Observatory (NRAO) in Charlottesville and the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts to develop techniques that would aid in identifying and studying matter in outer space.

Bob Lloyd, BrightSpec’s co-founder and CEO, pointed to several elements that were fundamental for the creation of the company. Most important is the network of key relationships: a “cluster of expertise” in Charlottesville.

“Largely because of NRAO and defense research here, Charlottesville is among the top places in the world for what we do,” he said.

A critical advantage in starting the company was the availability of a team of graduate researchers who had trained and worked together with Pate at U.Va or at NRAO.

“We were fortunate in that a handful of key individuals were ready to transition from graduate research and wanted to see their ideas developed in a company. Our team had a shared conceptual framework in talking about a problem,” said Lloyd.

The founding team was accepted into the National Science Foundation’s Innovation Corps, or I-Corps, a lean launchpad start-up process for evaluating the company’s possible markets. “At the end of the I-Corps program, we had a team, a network of suppliers, proprietary IP licensed from U.Va. LVG, and an initial set of target customers who offered to guide our efforts,” said Lloyd.

BrightSpec’s markets and applications span several fields: impurities in industrial gases, food chemistry, pharmaceutical development and defense. The company was awarded Small Business Innovation Research (SBIR) contracts from the U.S. Army and from the National Science Foundation (NSF). With the Army contract, BrightSpec is building an instrument that can evaluate when a missile propellant is beginning to degrade.

Pharmaceutical process analysis is the company’s major focus. Producing pharmaceutical products utilizes chemical reactions performed in a set of chemicals solvents. The amount of residual solver in the final product is regulated both in the United States and Europe.

“Quantitative analysis of the amount of solvent is a very slow process using the existing state-of-the-art technology, but it’s something that our instruments can do very rapidly,” said Pate.

In late 2014, the company licensed an important complementary technique from Harvard University. With this addition, BrightSpec is able to use one of its products for chiral analysis. A chiral molecule is right- or left-handed, depending on the direction that it rotates, which can have major determinative effects when used as a drug therapy.

“This opportunity came to us because of the momentum we have created at BrightSpec. It gave us another market opportunity with drug companies—chiral analysis for pharmaceutical development,” said Lloyd.

“We are not building the next generation of known technology. We are building the next generation of a new technology. The goal in five years is that I would love to no longer see a blank look in people’s faces when I say ‘we do it by rotational spectroscopy’,” said Pate.
PhosImmune has the potential to revolutionize the immuno-oncology space by identifying and characterizing new cancer-specific targets.
Based on technology developed by University of Virginia faculty Donald F. Hunt, Ph.D., and Victor H. Engelhard, Ph.D., and Mark Cobbold, Ph.D. from the University of Birmingham, U.K., PhosImmune can test treatments on an ever-growing catalogue of phosphopeptide tumor targets (PTTs), proteins or fragments of proteins on the surface of cancer cells. When phosphate groups are added to the cell, they control the major signals for the cell nucleus’ most important reproductive activities.

“They are very much markers of the cancer progression and the proteins within cancer cells become phosphorylated, a way that is not present in normal cells,” said Kevin FitzGerald, Ph.D., M.B.A., PhosImmune CEO.

FitzGerald explains that the fascinating evolution of the fragments of proteins that get transported to the surface of the cancer cell are displayed alongside a MHC (Major Histocompatibility Complex) molecule, whose attribute is to bind the peptides, thus enabling cancer cells to be targeted by antibodies, therapeutic entities and drugs.

“The pharmaceutical industry at the moment is very excited about the use of immunological methods to attack cancers and we think that our technology provides a new generation of targets for these types of immunological approaches,” said FitzGerald.

Although the oncology market is attracting a lot of interest from companies and research labs, PhosImmune stands alone in narrowing its efforts to the relationship of phosphorylated peptides.

“I don’t think there is anybody else out there that is actually generating or suggesting phosphorylated peptides coming from proteins involved in the development of cancer could be ideal targets for new immune oncology applications,” said FitzGerald.

More than 700 phosphopeptide tumor targets have been identified, developed and protected at U.Va. and the University of Birmingham. These PTTs have been shown to be common to a large number of different cancers, including melanoma, leukemia, and ovarian cancer, allowing for the creation of a therapeutic entity that is broad in scope and effective on cancer cells. Additionally, according to the company, hematologic cancers are sensitive to therapies in the immunology space.

Given the positive reaction from big pharmaceutical companies to PhosImmune’s innovative technology, FitzGerald is hopeful about the future. He explains that the company is primed for significant commercial activity.

“Big pharma companies are investing millions and millions of dollars into new oncology treatments and the thing they lack is really good tumor-specific antigens,” he said. “They recognized that, for a whole host of reasons, the targets that we have identified really tick all of the boxes they need ticking to become new, exciting therapeutics.”

In August 2014, PhosImmune received funding from the Center for Innovative Technology’s GAP Funds.
A recurring motif in the narrative of science is the idea that a research scientist’s work often yields breakthroughs with unexpected applications. John C. Herr, Ph.D., began his examination of oocyte cells in 1995 with the intent of discovering novel genes activated specifically in the unfertilized egg. Herr realized that a protein present within ovulated eggs was expressed in various cancer cells as well. Today, Herr’s company, Neoantigenics Inc., is developing selective cancer treatments that target cancer while bypassing the detrimental side effects in current forms of treatment.
The protein to which Herr’s team devoted their research—SAS1B—was expressed in several forms of particularly deadly cancers. Among normal healthy tissues, the only other place this protein was present was in the pool of growing eggs in the ovary.

“Because the SAS1B target is not anywhere else in the body among the healthy normal tissues and because it shows up on the surface of cancer cells, it allows us to selectively target the cancer cells,” said Herr, University of Virginia professor of cell biology, biomedical engineering, urology, and obstetrics and gynecology in the School of Medicine.

“These observations provide a way to get around the adverse effects of chemotherapy. I think this is the first truly tumor-selective biomarker with the exception of the pool of growing oocytes. This discovery of oocyte-cancer antigens is a U.Va.-originated research idea, and our team is proud to have spawned this new field.”

In 2011, Herr’s research attracted the interest of one of the world’s premier biopharmaceutical corporations, Pfizer.

“Pfizer shared its proprietary protocol for killing cancer cells with us,” said Herr. “After using their method, we realized that we could kill cancer cells that had the SAS1B protein present. This data provided the basis for forming a company.”


“Pfizer created a Seed Fund to invest in university-based research and in start-up biotechnology companies as a way to foster this early stage research. We were the first investment out of the Pfizer Seed Fund,” said Pollok.

Neoantigenics is working to produce an antibody-drug conjugate that is infused into the patient’s bloodstream. Upon delivery into the cancer patient, the antibody will seek out tumor cells by binding to SAS1B, with the cancer cell-killing payload released within the cancer cell. Since the antibody ignores the healthy cells within the patient’s body, the adverse side effects regularly associated with cancer treatment can largely be avoided.

While this therapeutic is revolutionary, the diagnostic practice that accompanies it is equally important for patient care.

“The diagnostic assays that we have developed determine exactly which tumors are positive for SAS1B, and these diagnostic tests allow us to pinpoint precisely those patients who should be treated with the targeted therapy,” said Herr.

Herr continues to think about the future of both his research and the company. “I like the idea of creating legacy companies that exist in the community for decades, providing jobs as well as capital that can be poured back into basic and translational research. Using U.Va.-originated discoveries to strengthen the local economy should be an ongoing economic development strategy,” he says.

The company initially raised funds from angel investors and through the direct investments made by Pfizer’s Seed Fund and the Center for Innovative Technology (CIT)’s GAP Fund. Non-dilutive grant funding supporting the company’s research program has come from CIT’s Commonwealth Research Commercialization Fund and from the Virginia Biosciences Health Research Corporation (an arm of the Virginia Economic Development Partnership).
Robert C. Pianta, Ph.D., co-founder of Teachstone, began conducting research on the nature, quality, and impact of relationships between teachers and students when he became a faculty member at U.Va. He identified the need for a more systematic and objective system for measuring teacher-student interactions in classroom settings.
Pianta, dean of the University of Virginia’s Curry School of Education and Novartis U.S. Foundation Professor of Education, focused his research on the effects of teacher-child interactions for children between the ages of 3 and 5.

“Previously, researchers had theorized that other factors, such as how attractive the room was and the equipment in the room, had the most to do with learning gains for young children,” said Pianta. “My co-founder, Bridget K. Hamre, and I initially looked into whether interactions with teachers were a valuable part of the early education experience and if they could be observed in a standardized manner.”

Pianta set out to create an observational system for measuring the nature and quality of teacher-child interactions in early education classrooms.

“We developed a set of tools for codifying teacher’s interactions with children called the Classroom Assessment Scoring System; or CLASS,” said Pianta. “CLASS proved to be the most strongly and empirically supported indicator of children’s experiences in preschool classrooms in relation to predicting their learning gains.”

The development of the CLASS system occurred in conjunction with a series of policy and regulatory changes implemented within Head Start, a Federal program that provides early education experiences for low-income children.

He was asked by congressional staffers and advised by several colleagues to expand CLASS from a research-only function to one that could be applied on a very large scale in monitoring the quality of Head Start programs.

“The need for standardized training and certification to use CLASS became astronomically greater and quickly overwhelmed our capacity within the university to manage all the transactions and develop the kinds of infrastructure you need to provide service on a larger scale. As a result, we founded Teachstone in 2008,” said Pianta.

One of the early partnerships that had a lasting impact on Teachstone was with First Five California, an initiative devoted to increasing the quality of early care in California. Teachstone was contracted to work with 10,000 teachers and education providers to implement the professional development supports around CLASS observations that were being conducted there.

“We learned a lot about the early stage implementation of these supports. The coaching model and other supports proved effective when it came to improving teachers’ knowledge and skills, but the implementation was suboptimal,” said Pianta.

Pianta saw the potential for providing training that improves teachers’ quality of interactions with children at a much larger scale by incorporating a number of technology features previously underused in the education field.

“Increasingly, we are moving Teachstone towards a model of ‘software as a service’ that delivers, on a subscription basis, a whole suite of supports so there’s much more fluidity and customizability for the user,” said Pianta.

Today, Teachstone employs 75 people who have trained more than 30,000 CLASS observers worldwide and provided many tens of thousands of teachers across the country with support and training programs. Turkey, Chile, and Australia are interested in adopting these training programs.
A world-class customer service, intellectual property management, business development, commercialization, and new ventures enterprise.
ACQUISITIONS

PocketSonics, Inc., an ultrasound company founded on technology of three University of Virginia biomedical engineering professors, was acquired in September 2013 by Boston-based Analogic Corporation, a leader in healthcare technology solutions. Analogic has held a minority stake in the company since 2010. PocketSonics, Inc.’s flagship product is the Sonic Window, an ultra-portable, pocket-sized imaging device with an integrated display.

In October 2013, Phthisis Diagnostics, a biotechnology company, was acquired by Microbiologics, a Minnesota-based manufacturer of ready-to-use biological controls and standards. In 2011, Phthisis launched its first product, the E-Sphere Stool DNA Extraction Kit, a kit that facilitates the extraction of DNA from samples prior to being analyzed.

ACCOLADES

HemoShear, a biotechnology company, was the recipient of the prestigious Tibbetts Award in 2014, a recognition from the U.S. government’s Small Business Innovation Research (SBIR) Program for having achieved “a visible technological impact on the socio-economic front and exemplifying the very best in SBIR achievements.”

In July 2013, U.Va. Innovation appointed Brian A. Pollok, Ph.D., as its first entrepreneur-in-resident (E-I-R) in an effort to expand resources and expertise to aid U.Va. startups and researchers on their path to commercialization. The E-I-R position was created to mentor researchers who are interested in venture creation by developing business strategies and fundraising goals.

In 2014, the U.Va. Licensing & Ventures Group appointed Ed Rogers as its new E-I-R to work closely with faculty in the engineering and physical sciences areas.

U.Va. Innovation was named a 2014 IP Champion by the Global Intellectual Property Center (GIPC) and was credited with “leading the way to bridge education with hands-on entrepreneurship, proving that learning goes far beyond any textbook or classroom.”

PROGRAMS

The Virginia Innovation Partnership, a state-wide network of higher education institutions, was created to enhance the Commonwealth’s entrepreneurial profile and to attract out-of-state investments for the region’s ever-growing startup ecosystem. The Virginia Innovation Partnership’s i6 Challenge was a statewide innovation competition that identified and supported business concepts with potential for future commercialization. Funded in part by the U.S. Department of Commerce, the two-year competition awarded $1 million per year to 18 selected early stage business concepts for 2012-2013 and 18 new projects with 4 renewals for 2013-2014. Awards ranged between $40,000 to $80,000 per project.

FUNDING

PsiKick, a Charlottesville ‘systems-on-a-chip’ company based on technology developed by Benton Calhoun, Ph.D, associate professor of electrical and computer engineering at U.Va., and his colleagues at the University of Michigan and the University of Washington, secured a major Series A investment by New Enterprise Associates (NEA), one of the nation’s top venture firms.