
LIAM&MA

Unique PERSPECTIVES

William & Mary Students Share Diverse Stories

Whether it's an appreciation of tradition and community, an exploration of academic and personal discovery, or a chance to learn from and be engaged by exceptional faculty, students are called to William & Mary for different reasons, yet they share some common motivations for attending the university.

The stories of Maria Arellano '13, Augustine Kang '04, M.A.Ed. '06 and Max Miroff '16 are each different, but related by one commonality: Each of these students chose William & Mary because he or she believed, with hard work, the university would help prepare them to reach for goals they deeply value.

For video clips featuring each of these students, visit the online edition of the President's Report at www.wm.edu/presidentsreport.


Maria Arellano ’13

Helping Others

REALIZE THE AMERICAN DREAM

Before she was born, Maria Arellano's parents emigrated from Mexico to the United States to make a better life for their family.

Maria is the first person in her family to finish high school and attend college. She has high expectations of herself, to help realize her parents' goal of a better life for their children.

She secured scholarships to attend private schools from seventh grade and all through high school. A serious scholar whose appreciation for education was instilled by her parents, Maria considered her choices for college carefully.

"I come from a small town with a big sense of community, and that's what I found at William & Mary," she says. "I could tell that everyone here loved their school and was passionate about what they were doing. It's not something you see at many places."

Like the people she encountered on that visit to William & Mary, Maria has pursued her passion as an undergraduate. She reaches out to the Hispanic-speaking community, volunteering with the Community Partnership for Adult Learners (CPALs), a student-run organization that offers free English language classes for the Williamsburg community.

Maria's involvement with CPALs led to another opportunity — volunteering with Hispanic-speaking students at the local James River Elementary School in the Williamsburg area.

"The aim of the program is to help these students improve their native language, and as time went on, encouraging them to celebrate and appreciate their heritage became a large focus," Maria says. "I see a lot of myself in these kids, and I love that I'm able to help them be proud of where they come from."

As a double major in government and Latin American studies at William & Mary, Maria is able to pair these experiences outside the classroom with her undergraduate studies.

"The classes I've taken have opened my eyes to many issues that I had never thought about," she says. "William & Mary has definitely changed me."

Without financial assistance, Maria would not have been able to attend William & Mary. After graduation, she is considering law school or perhaps teaching. Whatever path she decides to follow, it will be one that allows her to effectively help the Latin American community.

"If my parents hadn't struggled, I never would have had this chance," Maria says. "I want to help other people who haven't had the opportunities I have been given. I know their struggles because they are the same struggles my family and I have faced. The American dream is big for us."

Augustine Kang ’04, M.A.Ed. ’06

Educational Leader

After completing both an undergraduate biology degree and a master's in education at William & Mary, Augustine "Auggy" Kang taught science for five years at two different middle schools.

During this time, Auggy came to appreciate how leadership can have a profound effect on the quality of schools. He decided to pursue a doctorate in education, again turning toward his alma mater, which he hopes will help provide him with the tools he needs to be an effective leader. Now in his second year of doctoral studies in the Educational Planning, Policy and Leadership program, and focusing on K-12 administration, Auggy feels especially confident about his decision to return to the School of Education.

"The most outstanding aspect of my experience at William & Mary has been the faculty," he says. "They are outstanding. They bring amazing experience to their teaching, yet they are so easy to talk to and approachable. The door is always open."

Auggy says he also benefits from his interactions with other students at William & Mary. "Everyone is passionate about what they are doing. We are all here because we care about education and children. When we get together, that's what we talk and think about."

Another factor in Auggy's decision to return to William & Mary was the graduate assistantship he received from the School of Education.

"The fact that I got a graduate assistantship made it possible for me to come back," he says. "I never could have paid out-of-state tuition. Now my tuition is covered and I have a small stipend."

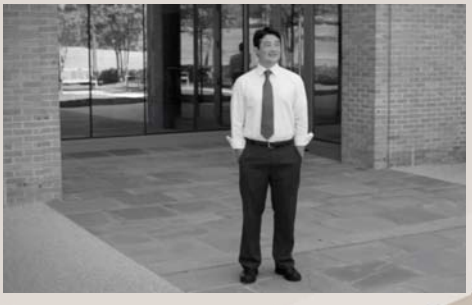
As part of his assistantship, Auggy works with Project Hope Virginia, which advocates for education for homeless students. He also serves as president of the Graduate Education Association (GEA) at the School of Education, a position that is allowing him to hone his leadership skills and to pursue his long-term goals while helping the school to connect with alumni.

Upon completing his degree, Auggy plans to return to the classroom.

"I love teaching middle school," he says. "You are reaching kids at a point in their lives when you can make all the difference."

However, after a few more years in the classroom, Auggy plans to move into an education administration position.

"I believe I can find the answer to the question, 'How can we turn our public schools around?'" he says. "Perhaps at some point in the future, I will return to William & Mary again with an answer to that question."



A Path for Growth and Discovery

Although he has been on campus only for a few months, freshman Max Miroff feels he chose the right place to pursue his undergraduate studies.

"I'm from Virginia and I know we have some of the best public universities in the country," he says. "Even among those schools, William & Mary stood out because of its size and its strong focus on undergraduates."

That impression was confirmed when Max visited campus and had a chance to meet with some members of the faculty.

"I really value the sense of community at William & Mary," he says. "Although I have only been here a short while, I have had plenty of chances to connect with faculty, students in the 1693 Scholars Program, and other students on campus."

The 1693 Scholars Program, William & Mary's elite scholars program, was another factor in Max's decision to attend.

"The tuition benefit is really important. Now my family doesn't have to worry about how we are going to pay for college," he says. "But the research opportunity is just as essential. The chance to fund a project and travel means a great deal to me academically."

In high school, Max, who is now considering a philosophy major, was a member of the policy debate team and organized weekly philosophical discussions with fellow students around a featured topic. As a writer, he has contributed to online blogs and had his creative work published by online literary journals.

At William & Mary, he already has had a chance to start on research.

When he visited William & Mary as a 1693 finalist, Max made a presentation to a faculty group about a possible idea for a future project. The project involves looking at the physical arrangement of educational spaces and the ways in which that organization affects teaching and learning.

"Broadly, I'm interested in the relationship between school space and the ideological assumptions of pedagogical practice. I'd like to look at how seemingly ordinary objects — things like desks, chairs, or hallways — exert force upon students and teachers to act in certain ways." Max says. "It's a very preliminary idea, but it's the kind of question that intrigues me and that has attracted me to studying philosophy."

The freedom William & Mary provides Max for exploring this and other novel research ideas, along with the perspective of its faculty and his fellow students, creates the potential for exciting growth and discovery throughout his four years on campus.

Max Miroff ’16

Assistant Professor of Biology Shantá D. Hinton works with student Ethan Harwood '13 to transfer agarose gel to plates for setting.

Building Breakthroughs

Medically related research at William & Mary contributes to solutions

For years William & Mary Professor John Delos had been conducting research on the hydrogen atom from his office in Small Hall with the help of undergraduate and graduate students.

But the course of this physics professor's research changed with an e-mail five years ago from a former student, Abigail Flower, who'd completed her senior project under him and had eventually wound up as a graduate student in biophysics at the University of Virginia.

"She was working with a cardiologist and a statistician and she needed a physicist to talk to about data they'd collected on premature newborns in the neonatal intensive care unit," Delos recalled. "She asked if I'd be interested in getting involved."

Now, Delos is helping to save the lives of premature babies with inventions that, by analyzing breathing and heart rate data, can warn doctors of the likelihood of a serious infection or the possibility of a major apnea episode in which the baby suddenly stops breathing.

"We're looking for non-invasive, purely electronic methods for detection and diagnosis of health and illness in premature infants," said Delos. "We're applying signal analysis and pattern recognition ideas to monitor the health of infants, using unexpected methods to get unexpected results. It's physics and engineering applied to a problem where you wouldn't think it would work."

It also highlights the fascinating, cutting-edge and potentially life-saving medically related research that is taking place in labs at William & Mary. From many corners of campus — and beyond — innovative work is occurring that may hold answers and promise for diseases from diabetes, tuberculosis and cancer to Alzheimer's and Parkinson's.

"Innovation? We've got that. We've really got that," said Dennis M. Manos, vice provost for research, graduate and professional studies at William & Mary. A physicist, Manos also is CSX Eminent Professor in both the physics and applied science departments. He has helped to lead a wide variety of campus research — on everything from turning algae into biofuel to the development of graphene as a high-capacity energy storage material — which has been awarded more than $22 million in grants and contracts since 1992.

"When I walk people through here who (attended college) here 50 years ago, they say, 'Holy cow!' We have equipment that is state of the art and our kids are being exposed to the frontiers as undergrads," he said. "It is one thing to read a book about things, but when you go into the lab and do it for yourself, you get a whole different level of experience and a very different view of what it means."

In August 2012, *Forbes* ranked William & Mary 21st among the nation's research institutions. For some, the news was surprising considering that the university doesn't have the big-school resources, such as a medical school or the engineering research focus that many top-tier research institutions such as Columbia, Harvard and Stanford universities possess. In the fiscal year that ended June 30, 2012, research and development expenditures at William & Mary totaled roughly $58 million. To put that in perspective, Johns Hopkins University, an institution known worldwide for its hospital and leading medical research, led the world with research and development expenditures of $2 billion in 2010, according to a March 2012 National Science Foundation report.

Dennis M. Manos, vice provost for research, graduate and professional studies at William & Mary, has helped to lead a variety of campus research.

Despite the major resource difference, both professors and university officials note that William & Mary has a solid reputation for the work it does and the students it produces.

Manos said he'd compare selected individual research projects at William & Mary to work at research powerhouses such as M.I.T. and Caltech any day. Manos, who came to William & Mary from Princeton University, said professors migrate to William & Mary because they see the potential to do great work without losing the close association with students — a hallmark of William & Mary.

"Although our portfolio is small compared to other universities, in our niches, we are superb at what we do. There's a subset of work here at the college that has to do with medical imaging and early diagnosis. It's an important area for the college and for society. We are at the cutting-edge of trying to advance it."

William & Mary students are highly sought after by graduate programs in the sciences — and they fare well in medical school admissions — in part because of the opportunities they have to learn and work in the labs on the Williamsburg campus.

The work of several faculty members highlighted here provides only a glimpse of the medically related research occurring at William & Mary — research that has enormous implications for prevention, treatment and understanding of disease.

LIZABETH A. ALLISON

Investigating traffic control

The thyroid gland, a small organ that straddles the vertebrae in the neck, plays a big role in how the body functions. It produces hormones that regulate metabolism, bone growth and the function of many other systems in the body.

"Thyroid hormone pretty much affects every tissue in the body," explained Lizabeth A. Allison, a molecular biologist and chair of William & Mary's Department of Biology.

For nearly 17 years, Allison has been researching thyroid hormone receptor, which responds to thyroid hormone and turns particular genes within the body on and off when it locates within a cell's control center, or nucleus.

"What we found early on is that (thyroid hormone receptor) moves into the nucleus, but it comes out again. It goes back and forth, and the question is why. If it's not in the nucleus, then it can't be directly regulating genes in response to the thyroid hormone."

This question of how "traffic control," as Allison calls it, can be misregulated is what drives Allison's research. With the help of about a dozen undergraduate researchers each semester in her lab at William & Mary's Integrated Science Center, Allison is investigating the signals that propel thyroid hormone receptor into and out of a cell's nucleus and how the signals are regulated.

"We've found that one of the cancer-causing variants, or mu-

Lizabeth A. Allison, a molecular biologist and chair of William & Mary's Department of Biology, is investigating the signals that propel thyroid hormone receptor into and out of a cell's nucleus and how the signals are regulated.

tants, of thyroid hormone receptor mislocalizes in the cell. It's in a compartment called the cytoplasm, which is outside of the nucleus," she said. "And it can take a normal receptor and bring it outside of the nucleus, too."

Her research, which is funded largely by the National Institutes of Health and the National Science Foundation, has major implications for understanding the progression of certain types of cancer, as well as understanding various thyroid hormone-related disorders.

In one such case, patients with normal levels of thyroid hormone become hypothyroid because they've inherited a genetic trait involving a mutation in their thyroid hormone receptor, Allison said. The resulting weakness, fatigue, depression, weight gain and other symptoms can be debilitating, according to public health officials.

As chair of the biology department, Allison is sensitive to William & Mary's mission of teaching and engaging undergraduate students in research. Yet faculty continually balance the pressure to produce — in both their research and publishing — to keep federal and outside research dollars flowing.

"It's very competitive," Allison said. "And we're competing with major research institutions with a different style of doing research that have graduate students and post-docs working at a faster pace."

To have a stronger level of base support from private sources would make a major difference, she said.

"For us, there are no boundaries between the teaching and the scholarship," she said. "Doing research with undergraduates is part of how we teach," including the expected turnovers and training needed for undergraduates to become proficient in a lab, Allison said.

For many students, it's their first experience conducting research and working in a laboratory. And for many, "this is the moment they realize what they want to do with their lives," she said.

"Whatever they end up doing, the experience of how you ask questions and how you design experiments, how you troubleshoot, how you interpret — that analytical component — is useful in many different areas," Allison said. "Students benefit by learning those skills, or by learning how to communicate — both in writing and in giving presentations. Those skills are valuable in any career."

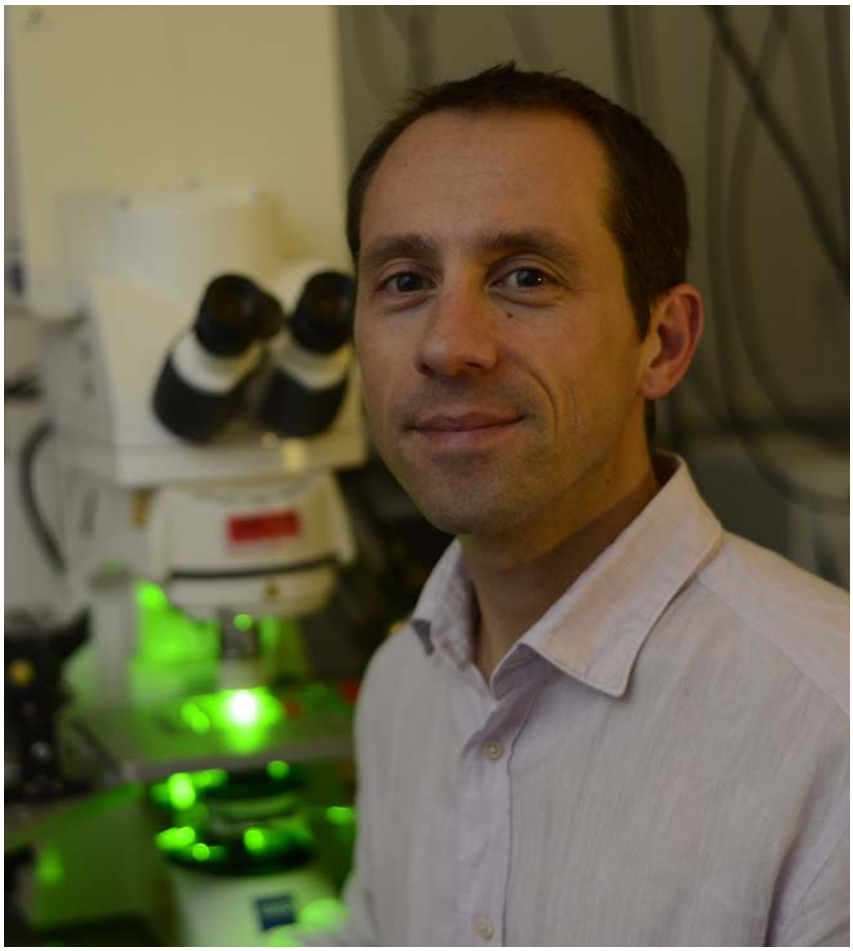
CHRISTOPHER A. DEL NEGRO

'Zapping' Technique Pinpoints Respiratory Failure Threshold

The long, hard road of Alzheimer's, Parkinson's and Lou Gehrig's disease often ends when the patient perishes from respiratory failure — not the disease itself. It can be a fatal side effect of the slow, progressive and cumulative effect of losing brain cells in neurodegenerative diseases.

When Professor Christopher A. Del Negro, a neuroscientist, became interested in the field more than a decade ago, researchers already knew the region of the brain where breathing originates. Yet Del Negro's steady and evolving work, backed by funding from the National Institutes of Health, has pushed the boundaries of knowledge in determining *which* cells in that region of the brain stem control breathing and *how* do they do it. His latest work goes even further to answer the question of *how many*.

"If you have a network that contains, let's say, 300 neurons that control the rhythm-generating system of breathing, how many of them have to die before the network fails?" Del Negro asked. "If we can find that point, then we can begin to develop strategies to ameliorate or improve that function."



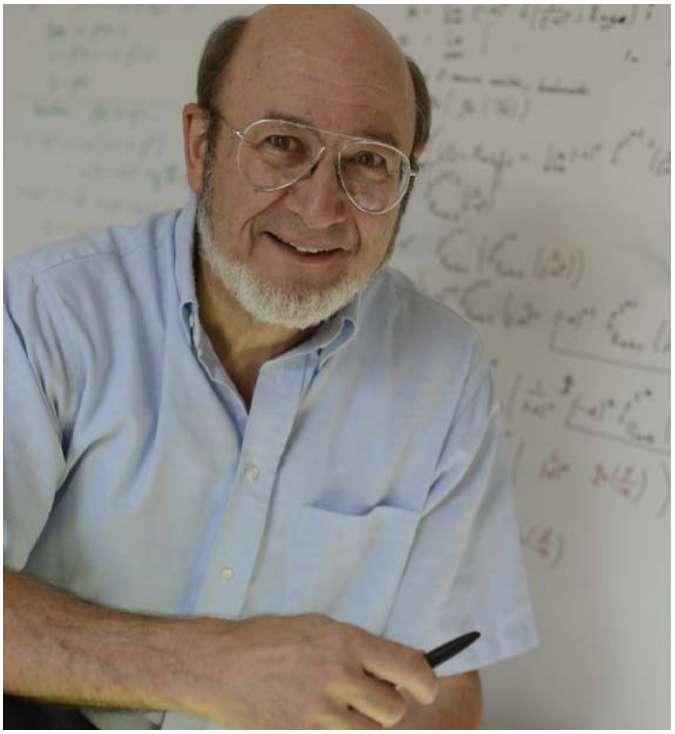
Christopher A. Del Negro works with a laser microscope purchased in 2007 for his research.

From four labs anchored by an office in McGlothlin-Street Hall by the Sunken Garden, Del Negro and his team of graduate and postdoctoral student researchers in the Department of Applied Science have developed a method of identifying and zapping brain cells that mimics the cell-by-cell destruction that accompanies neurodegenerative diseases.

His system uses a laser microscope to automatically detect the neurons and then delete them one at a time, in sequence, with the laser's full power. Previously, researchers had to hand-target the laser to zap particular brain cells, which was error prone and practicable only in simpler organisms with few brain cells – not mammals.

"They had to know what the targets are, take the time to hand-target them and then confirm each deletion on their own," Del Negro explained. "With our system, individual neurons can be detected automatically, deleted automatically and confirmed automatically through computer routines."

While the invention is in the process of patent protection, Del Negro said, he wants it to remain in the public domain so that researchers across the world can replicate the technique in their own laboratories and further study brain systems and neurodegenerative diseases.



Using signal and pattern analysis, John Delos, in his research, has developed a method of monitoring changes in heart rate that gives warning of infection (sepsis) up to 24 hours before any other clinical signs become evident.

"That's the way science advances," said Del Negro, who chairs the Applied Science Department at William & Mary. "What scientists produce are intellectual products. So for us, the payment is reputation. The more we give it away, the better."

Using the technique, Del Negro's team determined that the brain's respiratory rhythm-generating network fails if 18 percent of the neurons in the network are killed. Research results were published in May 2012 in the *Proceedings of the National Academy of Sciences*.

At a recent scientific conference in Madison, Wis., scientists and researchers from Sweden and Denmark to Canada and Japan expressed interest in the technique developed at William & Mary, Del Negro said.

"They definitely found the work compelling," he said. The zapping technique may be applicable to other models in the brain, such as the memory system and the motor systems of the spinal cord.

While he emphasized that real applications are down the road, Del Negro said he hopes the discovery will be applied.

"This is just the beginning," said Del Negro, who already has submitted an application for a major grant from the National Science Foundation for further neuroscience study using the invention. "I think we will probably need a few more years to work out the details," he said. "I don't expect this is the final answer."

JOHN DELOS

Early Warning System Saving Infants' Lives

The rate of sepsis was high among the 2- and 3-pound infants at the Charlottesville hospital's neonatal intensive care unit, where the highest-risk infants in the area are sent. The immune systems of the very premature babies are not fully formed, so they have trouble fighting the bacteria, virus or fungus that may invade their blood systems, causing sudden and severe infection and inflammation.

"Sometimes the bacteria win and the babies die," explained John Delos, a William & Mary physicist and professor who has been working with doctors and researchers at the hospital to analyze electronic heart rate and breathing rate data.

Cardiologist Randall Moorman wondered if heart rate monitoring offered an early warning of the potentially fatal infection.

"The answer turned out to be 'Yes!'" said Delos, who helped develop a new method for analyzing electronic heart rate signals for babies that provides an early warn-

ing for sepsis and ultimately saves lives. Using data from more than 3,000 newborns with and without sepsis, Delos and researchers from the University of Virginia came up with a computerized pattern recognition system that detects and measures the slowing heart rate patterns in babies that occur within 24 hours of the onset of illness.

"Storms of (heart rate) decelerations are a predictor of sepsis," Delos explained. "If you see seven or eight decelerations in a half hour, the baby is 10 times more likely than the average baby to have a septic event in the next 24 hours."

Because of his work, electronic monitors over the babies' bedsides in the Charlottesville hospital's NICU now send signals about heart rate that are analyzed every hour for clusters of deceleration. When those clusters appear, "it does not prove the baby has the illness. It shows that the baby is at high risk for illness," Delos said. "It says these are the babies you'd better watch."

With that information, medical doctors, nurses and other clinicians can take appropriate steps to help the high-risk preemies avert infection. The number of deaths in sample groups has declined by about 20 percent, Delos said.

The early-warning system methodology and technology has been patented jointly by researchers at William & Mary and the University of Virginia, with the potential for using it in medical centers across the nation.

Delos had been studying the hydrogen atom for years until his former student, Abigail Flower '99, then a graduate student in biophysics at U.Va., requested his help in analyzing electronic data that doctors felt held clues to why preemies, who had shown no visible signs of illness, suddenly appeared to be septic.

Additionally, Delos and other researchers at William & Mary and U.Va. are working to refine their new method for detecting apnea in premature newborns. In babies born before 30 weeks of gestation, the respiratory rhythm generators located in the brain stem may not be fully developed. Using signal analysis, pattern recognition and the power of William & Mary's SciClone network of computers in Jones Hall, Delos, his post-doctoral researcher Hoshik Lee, and a team of undergraduate and graduate researchers at William & Mary, are developing a new way of analyzing respiration rates and heart rates to detect and predict life-threatening apnea episodes.

The result is a sophisticated monitoring and data analysis system that catches many of the apneas that current monitors are missing. Delos and his team also are working to improve the electronic system so that it can provide real-time data and work in tandem with a vibrating mattress or shirt that gently can stir the baby into breathing again during an apnea episode.

Delos, whose prematurely born granddaughter, Sarah Rose, lived two weeks before dying, now makes this research his priority.

"What makes this special is that it's about babies and it's about physics," said Delos. "Studying the hydrogen atom was fun, but it didn't have the human factor like this and the impact on people's lives. If you have a baby who's not breathing and you can invent a warning system or an automatic system that can start the baby breathing again, then that's very cool.

"When we quantitative folks, who like to look for patterns in electronic signals, work together with physicians and we overcome the communication and knowledge barriers, important and unexpected advances in health care can be made," Delos said.

MARK K. HINDERS

Innovation leads to real-world solutions

From his basement lair — a machine shop-like laboratory nestled underneath the William & Mary Undergraduate Admissions Office on Jamestown Road — Professor Mark K. Hinders is revolutionizing the tools of dentistry.

Hinders and his students in the Applied Science Department have come up with a device that uses ultrasound technology to detect gum disease.

Instead of using a traditional, sharp metal pick to poke teeth and gums to detect gum disease, dentists can place the small, handheld probe next to the tooth and the gum line. It painlessly sends ultrasound waves — sound that is emitted at too high a pitch for the human ear to hear — through the

soft tissue. The resulting data is sent electronically to a pocket-sized black box that processes, analyzes and transmits it to a computer for diagnosis by the dentist.

Using the ultrasonographic probe, dentists can more accurately — and less invasively — determine whether a patient has periodontal disease. It also eliminates the pain and sensitivity some patients experience with the metal pick that can drive them to switch dentists or avoid dental care altogether.

Hinders said the technology and technique, which have been in development at William & Mary for about 15 years, have been refined through clinical research with dentists and patients at Old Dominion University's graduate program in dental hygiene.

"And because the equipment is very portable, we've used it in conjunction with very large and very small dental companies and dental schools mostly in Virginia," Hinders said.

The results are promising. Already, three companies are interested in commercial possibilities for the probe. Hinders' research also is looking at variations of the technology to detect cavities, cracks and de-mineralized precarious areas that may be prospects for fluoride treatments and healing before a cavity erupts.

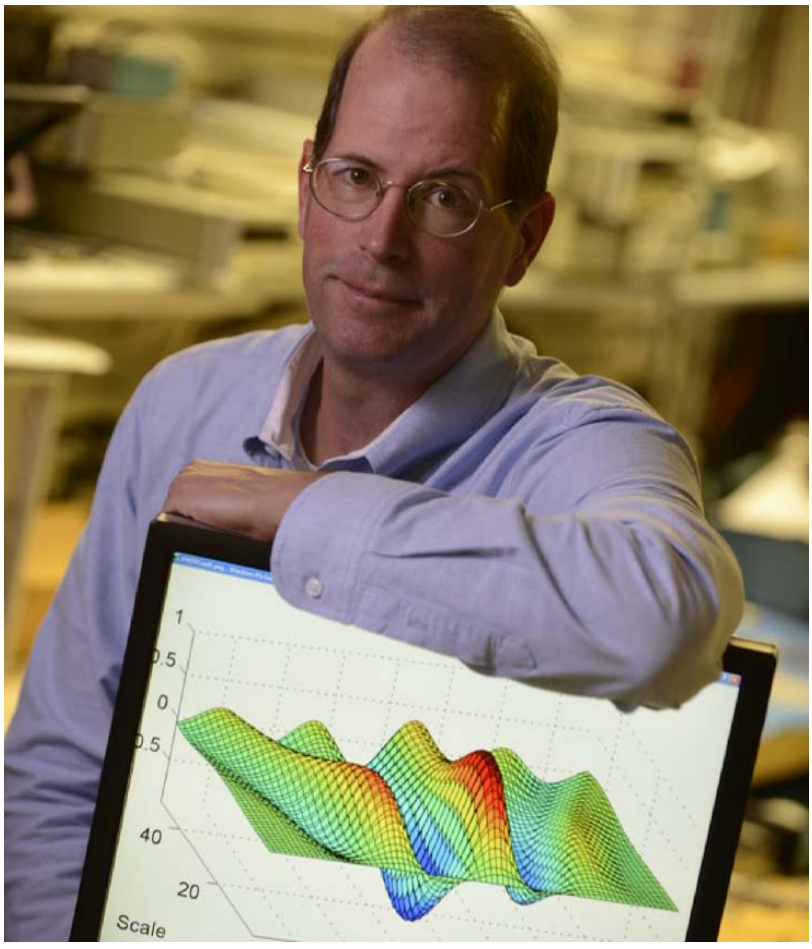
"There are lots of interesting problems in the dental office that ultrasound is suitable for," Hinders said, including exploring whether enough bone has grown around a dental implant that it's ready for the teeth to be set.

"Ultrasound as a technology also doesn't present the same health risks as X-rays. So it's safe, even in use with pregnant women."

The new instrument is not a far stretch for Hinders and the mostly graduate students who populate his lab. They were developing techniques for finding structural flaws in aircraft, spacecraft and advanced materials with their partners at NASA Langley Research Center in Hampton, Va.

NASA officials had asked Hinders and his lab at William & Mary to take over their project for the Navy of finding a better way to screen sailors for periodontal disease before they head out on a six-month deployment. Apparently, a ballistic missile submarine on a critical stealth mission had to surface to offload a sailor whose gum disease was so serious that he needed immediate attention on shore. The new technology may find a home in the Navy and in civilian life.

"Our goal is to allow a commercial entity to take the things the students and I have developed and



Mark K. Hinders, a professor in the Applied Science department, is using ultrasound technology to revolutionize dentistry.

package them in a way that solves a real problem in the real world," Hinders said. "Applied science means we're applying science to and developing technology that solves actual problems that are important out in the real world.

SHANTÁ D. HINTON

Analyzing MK-STYX Protein Communication

When Biology Professor Shantá D. Hinton explains her research on the protein MK-STYX with the uninitiated, she shows the same patience and enthusiasm embodied by the best William & Mary faculty as they steer young apprentices awakening to the world of scientific research.

Now in her third year on the William & Mary faculty, Hinton's lab is trying to determine the function of the protein MK-STYK in cellular communication.

"Just as we communicate as human beings, so do the cells in our body," said Hinton. "And just as human beings, if we have a miscommunication, it could lead to a disruption of our relationships with one another and people's feelings are hurt. In a cell, if a certain protein or enzyme doesn't do its job, then there is miscommunication and it can lead to diseases."

For MK-STYX (its prototype, STYX, so named for the mythological River Styx) and its super family of protein tyrosine phosphates, their role is a critical one in the body. Some are players that send the message that controls cellular processes. When they go wild, or don't know what to do, it

Biology Professor Shantá D. Hinton reviews films of the protein MK-STYX with Lauren Rusnak, a second-year master's student in biology.

tremendous contribution to this field."

With the assistance of six undergraduate student researchers and one graduate student, Hinton is working in her lab at the Integrated Science Center toward what may be a breakthrough for families across the globe. Understanding MK-STYX may help in drug development and other treatments for sufferers of many diseases.

Hinton became interested in the protein during her post-doctoral work at Cold Spring Harbor Laboratory in New York, where, in 1953, James D. Watson first publicly described the structure of DNA. Hinton has continued her work with MK-STYX as she teaches an upper-level biology course and sem-

research into a teaching lab at William & Mary that will allow more students to be exposed to the wonders of communication, from both the human and protein perspective. "For me, the greatest job is seeing these inexperienced students come into my lab. And after working one-on-one with them, they leave as accomplished scientists," Hinton said. "That's why a large majority of our students are accepted into M.D. and Ph.D. programs, because these universities trust that our undergraduates have had a true research experience. The community should understand that when we say we integrate teaching and research, it really is true."

Protecting William & Mary innovation, eyeing the marketplace

JASON MCDEVITT

The path from invention to development to the actual marketplace and use can be long and arduous.

That's where Jason McDevitt comes in.

McDevitt is director of Technology Transfer at William & Mary. His office is dedicated to getting the viable technology invented by William & Mary professor-researchers — including biomedical technology — into the public domain. He assists with obtaining patents to protect the researchers' invention and the university's interest. And he helps to find possible commercial avenues for the new product or technology. That may include licensing the technology for use by an existing company or helping to create a startup company.

For many medically related inventions, the process from invention to market can take anywhere from two years to 10 years or more, McDevitt said, because of health and safety concerns, possible clinical trials and required approvals from various agencies.

Currently, McDevitt's office is seeking patent protection for about 10 biomedical technologies created at William & Mary.

To encourage commercialization, William & Mary shares 50 percent of all money received from an invention's commercialization with the professor-researcher who invented the product or technology.

"A lot of people believe that the initial research and invention are the biggest steps in producing a product," McDevitt said. But that's really only the tip of the iceberg. "Development, engineering, marketing and intellectual property protection can all be the key to a successful product," he said.

"For most inventions, there's an awful lot of work to get it into a form that's convenient and inexpensive, or at least commercially competitive. And that's really hard to do," he said. "No matter how good your invention is, you have to have buy-in from (outside interests) willing to put up money to develop it. It's not always a straightforward path, even if your technology is better than what's out there."

Many larger research-focused universities have venture funds, where alumni and outside donors can contribute to a particular invention's development or a new technology startup, McDevitt said. These donations are different from typical contributions to an institution's foundation because of the donors' expected return on their investment.

Medical Research at William & Mary

This list of medically related research occurring at William & Mary attempts to paint a broad picture of work being done by faculty. Although this list is comprehensive, it is not necessarily complete.

APPLIED SCIENCE

Christopher A. Del Negro
http://people.wm.edu/~cadeln/Del_Negro_Lab_Homepage/Welcome.html
Studying the fundamentals of brain function, particularly basic physiologic functions such as breathing. The research has produced a new method of identifying and destroying brain cells to assess the resilience of brain functions. The discovery may have major implications for understanding the progression of Alzheimer's, Parkinson's and other neurodegenerative diseases.

Gregory D. Smith
http://wmpeople.wm.edu/site/page/gdsmit
Mathematical and computational aspects of normal and pathological calcium signaling pathways in the heart.

Mark Hinders
http://www.as.wm.edu/Nondestructive.html
Development of analysis techniques and measurement technologies related to diagnostic ultrasonography in dentistry, which would allow for more non-invasive imaging and less invasive probing with sharp steel instruments.

BIOLOGY

Lizabeth A. Allison
http://laalli.people.wm.edu/
Conducting research on the signals regulating traffic control of the thyroid hormone receptor and gene regulation in response to thyroid hormone. Disruption of this cellular communication process can lead to diseases such as cancer.

Eric Bradley
http://elbrad.people.wm.edu/
Investigations into the endocrine-disruptive effect of environmentally relevant levels of mercury contamination, with particular emphasis on reproductive impairment and metabolic disruption.

Mark H. Forsyth
http://mhfors.people.wm.edu/Forsyths_Website/Welcome.html
Studying the genetics of the gastric pathogenic bacterium, *Helicobacter pylori*, a major cause of peptic ulcer disease and some forms of stomach cancer. Studying the genetics, genomics, signaling pathways and the process of adhesion to host cells may shed light on the decades-long persistence of this infection.

Mark Forsyth, Margaret Saha and **Kurt Williamson** and **J.C. Poutsma,** chemistry
http://mhfors.people.wm.edu/Forsyths_Website/Welcome.html
http://wmpeople.wm.edu/site/page/mssaha
http://wmpeople.wm.edu/site/page/kewilliamson/people
http://people.wm.edu/~jcpout/faculty.html
Studying CrimD and other recently isolated bacteriophage as possible biological tools in the investigation of the genetics of bacteria such as those that cause tuberculosis.

Paul Heideman, biology and neuroscience
http://pdheid.people.wm.edu/
Testing for natural variation in neurons and hormones related to infertility in mice. The goal is to develop a model for the role of natural variation to infertility in other animals, including humans. Also developing methods, materials, and courses to improve learning by college premedical students and researchers.

Shantá Hinton
http://wmpeople.wm.edu/site/page/sdhinton
Protein research and its role in cellular stress signaling. Disruption of cell signaling can lead to cancer, diabetes and Alzheimer's.

John D. Griffin, biology and neuroscience
http://wmpeople.wm.edu/site/page/jdgri2
Control by the hypothalmus of the body's thermoregulation in response to fever.

Oliver Kerscher
https://sites.google.com/site/yeastgenetics/home
Studying how genetic information is maintained and transmitted during the cell division cycle. Specifically, errors in this process can lead to DNA loss and damage, which can result in health problems from cancer to Down syndrome to spontaneous abortions.

M. Drew LaMar
http://mdlama.people.wm.edu
Mathematical modeling and simulation of metabolic pathways in aorta endothelial cells, with a focus on understanding the changing role of dimethylated arginine and nitric oxide in severe malarial infection.

Matthias Leu, John Swaddle, Daniel Cristol and **Oliver Kerscher**
http://wmpeople.wm.edu/site/page/mleu and
http://www.wm.edu/as/biology/research/iibbs/
http://wmpeople.wm.edu/site/page/dacris
www.wm.edu/as/biology/people/faculty/kerscher_o.php
Conducting research on how forest fragmentation influences the distribution of ticks, tick hosts (birds and deer), and diseases carried by ticks, such as Rocky Mountain spotted fever. Understanding how ticks and their hosts respond to forest fragmentation will inform urban planning within a human-health context.

Margaret Saha
http://wmpeople.wm.edu/site/page/mssaha
Our research investigates how neural cells acquire their specific identities during embryonic development and how the nervous system recovers from environmental and genetic perturbations. This is relevant for developing treatments for neurological disease.

S. Laurie Sanderson
http://slsand.people.wm.edu/
Studying the fluid dynamics of biological filtration mechanisms relevant to blood and fluid flow in the human body, and the biomedical applications of industrial crossflow filtration.

John Swaddle, biology and Institute for Integrative Bird Behavior Studies,
http://jpswad.people.wm.edu/
Understanding the health consequences of exposure to low levels of mercury—levels equivalent to tuna fish. Researching how land management, bird behavior, and species biodiversity affect the risks to humans of contracting infectious diseases such as West Nile virus.

Matt Wawersik
http://wmpeople.wm.edu/site/page/mjwawe
How germ cells (cells that make sperm and eggs) develop into stem cells. This research is to help understand infertility and to develop new techniques for growth, maintenance and transfer of stem cells for therapy.

CHEMISTRY

Deborah Bebout
http://people.wm.edu/%7Edcbebo/faculty.html
Developing methods for investigating the mobility and sequestration of environmentally significant heavy metal toxins. The studies will help identify the physiological targets of heavy metals and inform the development of more effective therapies for acute and chronic exposure to them.

Randolph Coleman, chemistry and affiliated faculty in neuroscience
www.wm.edu/as/neuroscience/faculty/coleman_r.php
Developing computational studies and biochemical models of neurodegenerative diseases. Our mathematical/modeling approach allows us to better understand the disease state and how potential drug therapies might work to combat the disease. We also are applying these computational studies and biochemical models to learning more about certain cancers. This summer we began a study of renal cell carcinoma and hope to have a mathematical model completed this year. This model will allow us to probe the disease dynamics in a way difficult to achieve with human subjects.

Lisa M. Landino
http://www.wm.edu/as/chemistry/people/faculty/landino_l.php
Oxidative stress, protein damage and neurodegenerative diseases. Studies of microtubule protein oxidation and repair provide clues to early steps in Alzheimer's and Parkinson's.

J.C. Poutsma
http://people.wm.edu/~jcpout/faculty.html
Investigating the mechanisms of polypeptide fragmentation mechanisms. These studies will lead to improved computer simulation programs that will be used for differential proteomics studies of human disease.

Jonathan R. Scheerer
http://wmpeople.wm.edu/site/page/jrscheerer
Works with bioactive small molecules at the interface of chemistry and biology. He recently completed the synthesis of a new calmodulin (CaM) inhibitor that holds promising implications for the treatment of neurodegenerative and vascular diseases and cancer. Additional efforts from his lab are directed toward a family of natural insecticidal molecules originally isolated from fungal sources that appear to have low toxicity in mammals and might find application in organic farming (agricultural practices).

COMPUTER SCIENCE

Qun Li
http://www.cs.wm.edu/~liqun/
Developing ECG analysis system on small sensors and smart phones for 24-hour cardiac disease monitoring. The ECG sensors and smart phonescan automatically detect abnormal signals associated with cardiac diseases on a patient and remotely alert a doctor for assistance.

KINESIOLOGY AND HEALTH SCIENCES

Michael Deschenes
http://www.wm.edu/as/kinesiology/faculty/index.php
Investigates how muscle unloading (e.g., post-operative bed rest, crutches assisted ambulation) impairs neuromuscular function of the involved limb(s) and what strategies can be used to effectively mitigate those impairments, as well as how they are affected by aging.

M. Brennan Harris
http://www.wm.edu/as/kinesiology/faculty/harris_m.php
Exploring the molecular and physiologic effects of exercise that improve the decline in blood vessel function with age. These mechanisms also play a role in impaired blood vessel function in diabetes, hypertension and atherosclerosis.

Scott Ickes
http://www.wm.edu/as/kinesiology/faculty/ickes_s.php
Understanding the role of maternal agency on children's nutrition in low-income countries. Also, examining the impact of lowering the linoleic acid (omega-6) content of therapeutic foods for children suffering from malnutrition. The research can help inform products, interventions and policies that aim to improve child health in developing countries.

Ken Kambis
http://www.wm.edu/as/kinesiology/faculty/research/jbarf
Developing tests that can predict an individual's response to acute hypoxia and thus help prepare people for, and protect people from, Acute Mountain Sickness, a debilitating disorder caused by rapid ascent to high altitudes. This long-term study is being conducted as part of a Collaborative Research and Development Agreement (CRADA) with the U.S. Army Research Institute of Environmental Medicine.

Robin Looft-Wilson
http://www.wm.edu/as/kinesiology/faculty/looft_r.php
Studies how exercise changes gene expression in arteries. This will provide insight as to why exercise protects arteries from atherosclerosis.

MANAGEMENT INFORMATION SYSTEMS

Chon Abraham
http://mason.wm.edu/faculty/directory/abraham_c.php
Research healthcare information technology (HIT) implementation issues (e.g., for EMRs) and HIT policy.

MATHEMATICS

Larry Leemis
www.math.wm.edu/~leemis.
Developing algorithms for generating random variates for Monte Carlo simulation associated with the Cox proportional hazards model and the accelerated life model which incorporate the effect of covariates (e.g., gender, blood pressure) into survival models.

Jianjun Paul Tian
http://www.math.wm.edu/~jptian/
Developing mathematical models to study cancer initiation from stem cells and tumor growth with therapies.

Jesse Berwald and **Sarah Day**
http://www.math.wm.edu/~sday/
http://wmpeople.wm.edu/site/page/jjberwald/home
Developing fitness measurements for red blood cells and automated techniques for MRI data processing. This research may lead to improvements in the effectiveness of blood transfusions and increase the feasibility of real-time, MRI-aided surgery.

Tanujit Dey
http://tdey.people.wm.edu/
Working on predictive model for prostate cancer based on PSA level for prostate cancer survival. And we are working on building a predictive model for early detection of childhood obesity using the cohort of children from birth to age 2.

PHYSICS

Prof. John Delos
http://wmpeople.wm.edu/site/page/jbdelo/johnbdelos
We study heart rates and respiration of infants in neonatal intensive care units. The infants are vulnerable to a host of problems, including sepsis, apnea and other difficulties. We have developed a new method of monitoring changes in the heart rate that gives warning of bacterial infection up to 24 hours before any other clinical signs become evident. Also we have developed a state-of-the-art algorithm for apnea detection, which is far more reliable than the monitors that are currently in use.

Bill Cooke and **Gene Tracy**
http://wmpeople.wm.edu/site/page/wecook
http://wmpeople.wm.edu/site/page/ertrac
Developing new methods to identify cancer in its early stages by examining how the proteins in the body have changed as the disease progresses. In collaboration with John Semmes' group at EVMS, we have examined the proteins in tissue and blood and we have developed new methods of identifying the important disease-induced changes.

PSYCHOLOGY

Josh Burk, psychology and neuroscience program
http://jabur2.people.wm.edu/
Investigating the neural basis of attention and impulsivity, with implications for treatments for Alzheimer's Disease, schizophrenia and attention deficit/hyperactivity disorder.

Catherine Forestell
http://wmpeople.wm.edu/site/page/caforestell
Research focuses on the analyses of food and flavor preferences in children, as well as eating patterns and food-choice motivations in adults. Current research studies focus on the following areas: 1) how early flavor experiences affect taste, odor, and flavor preferences during weaning and throughout childhood; 2) development of strategies to promote acceptance of fruits and vegetables in infants and children; 3) analyses of the mechanisms involved in food choice in dieting adults. More insight into the "flavor world" of children and eating patterns of adults will aid in the development of evidence-based strategies for developing healthier eating behaviors throughout the lifespan.

Danielle Dallaire; **Catherine Forestell,** psychology and neuroscience; **Scott Ickes,** kinesiology and health sciences; and **Dr. Camilla Buchanan,** adjunct, kinesiology and health sciences
www.wm.edu/as/psychology/faculty/facultydirectory/dallaire_d.php
http://wmpeople.wm.edu/site/page/caforestell
www.wm.edu/as/kinesiology/faculty/ickes_s.php
Working with local jails to identify pregnant women and provide them with prenatal vitamins, nutritional counseling, and information about services in their area to utilize upon their release. By identifying pregnancy early in this population and providing support and nutritional education and supplements, we hope to improve birth outcomes in this high-risk demographic.

Catherine A. Forestell and **Cheryl L. Dickter**
http://wmpeople.wm.edu/site/page/flavor
Behavioral and psychophysiological analysis of the factors involved in the development of nicotine addiction in children and young adults. Results have implications for developing evidence-based strategies to prevent smoking initiation and improve smoking cessation programs.

Robert Barnet, Josh Burk, Pam Hunt, Catherine Forestell and **Cheryl Dickter**
http://www.wm.edu/as/psychology/faculty/facultydirectory/barnet_r.php
http://jabur2.people.wm.edu/
http://pshunt.people.wm.edu/
http://wmpeople.wm.edu/site/page/caforestell
http://wmpeople.wm.edu/site/page/cldickter
Analysis of how exposure to nicotine during adolescence affects brain systems important to memory, and examining early risk factors in nicotine dependence. Long-term goal is to inform pharmacological and behavioral smoking cessation therapies.

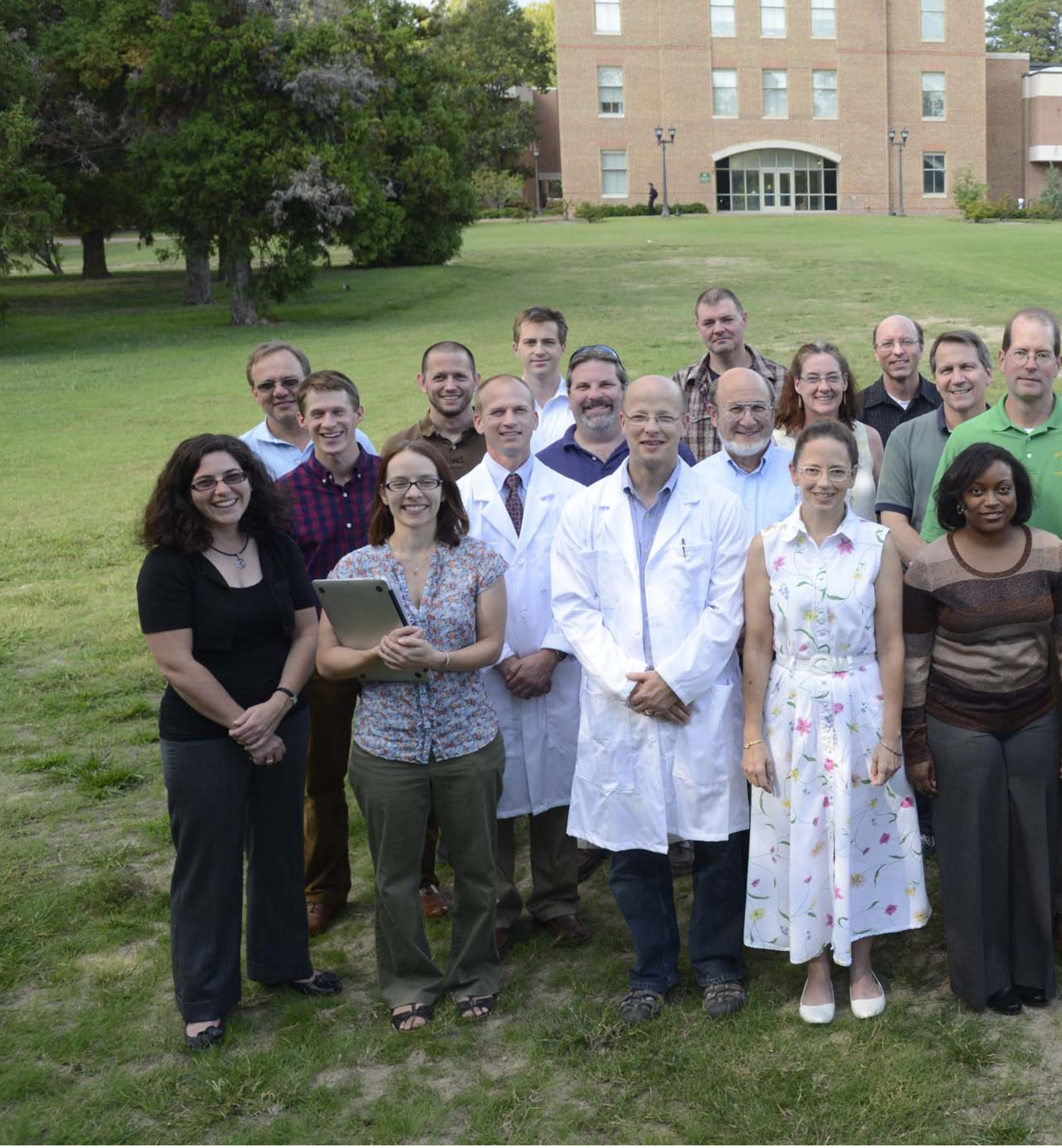
Pamela Hunt, psychology and neuroscience program
http://pshunt.people.wm.edu
Research on cognitive impairments, particularly in the domains of learning and memory, that result from fetal alcohol exposure, and investigations of possible treatments for fetal alcohol spectrum disorders.

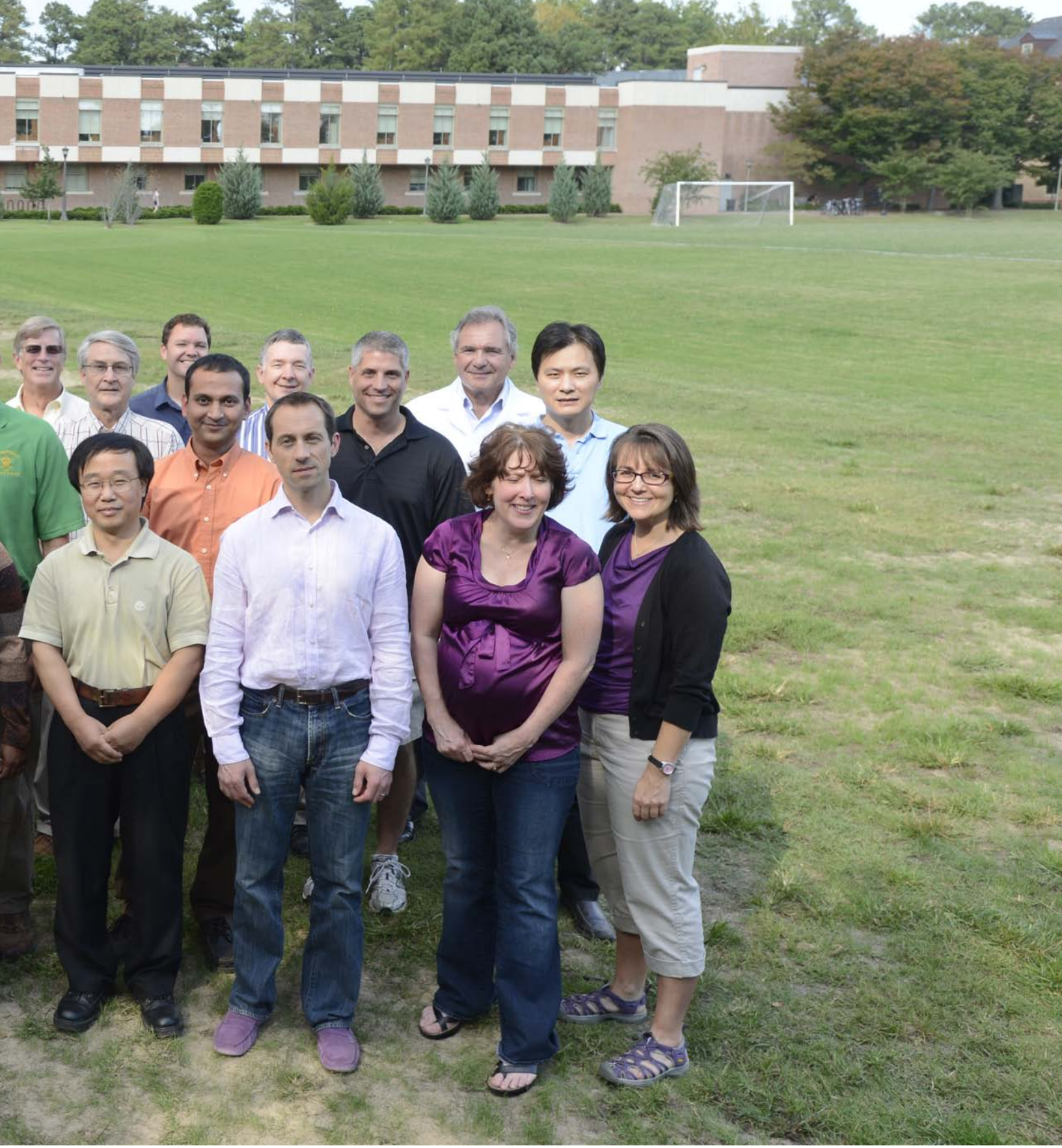
Paul Kieffaber
http://pshunt.people.wm.edu/
Developing procedures using electroencephalography (EEG) for the early assessment of cognitive decline associated with disorders of aging such as Alzheimer's disease.

SOCIOLOGY

Amy Quark
http://wmpeople.wm.edu/aaquark
Studying the effect of the World Trade Organization and international standardization organizations on domestic health policies.

David Aday, sociology and American studies
http://www.wm.edu/as/americanstudies/faculty/aday_d.php
Research focuses on community health and health care in the Dominican Republic and Nicaragua. Working with two student-initiated projects -- Student Organization for Medical Outreach and Sustainability and Medical Aid Nicaragua: Outreach Scholarship -- we provide twice annual medical services in each community and conduct research to understand underlying medical problems and to find long-term solutions.





Some of the William & Mary faculty engaging in medically related research gather for a group photo on Oct. 5, 2012.