



uncg research

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Research, Scholarship and Creative Activity

MOVEMENT FOR HEALTH

*Kinesiology shows its
game face **page 2***

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UNCG embraces higher education's traditional values in teaching, research, and service. But I have always been particularly proud of our institution because we take our work one step further, consistently deploying the expertise of our faculty, students, and partners to address the major issues facing our communities. This issue of *UNCG Research* illustrates that commitment to community and improving quality of life by highlighting work that moves beyond applied research to become both translational and transformative.

Our researchers translate findings within academe to make an impact in the realms without — moving ideas from the shelf, the lab, the office, and the studio into the home, the classroom, the clinic, and the larger community. This is no more clearly evident than in the comprehensive kinesiology efforts outlined in our first feature. Smart-phone apps that diagnose concussions in the field, explorations of the impact of physical activity on cognitive performance as we age, and the identification and treatment of gender differences in ACL and collision injuries reflect the best in implementation science.

We work at the intersection of science and practice for the purpose of making a difference. When you read about our collegiate ADHD research, you will find that we identify and quantify a previously unexplored and important problem, but we don't stop there. We are also developing life-changing interventions, thanks to our funders and partners, and employing rigorous methodology to perfect them.

Translational and transformative research, by its very nature, requires such partnerships. Flip to our STEM briefs to learn how UNCG mathematicians and biologists are working together and, with universities across the nation, beginning to unravel questions of unparalleled complexity. Read about the work of our chemistry department chair, who is unlocking the pain controlling properties of cannabinoid receptors, with international collaborators and about three decades of NIH R01 funding behind her. Stop in with our Junior Research Excellence Award winner, who is leading the Natural Products and Drug Discovery Center in academic and industry partnerships to develop the next generation of treatments for cancer and infectious disease.

From stories about our most established faculty to stories about undergraduates just starting out, no matter where you turn, you will find UNCG researchers leveraging partnerships and interdisciplinary activity to enhance the collective impact of their discoveries.

TERRI L. SHELTON, PHD

Vice Chancellor for Research and Economic Development



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MOVEMENT FOR HEALTH



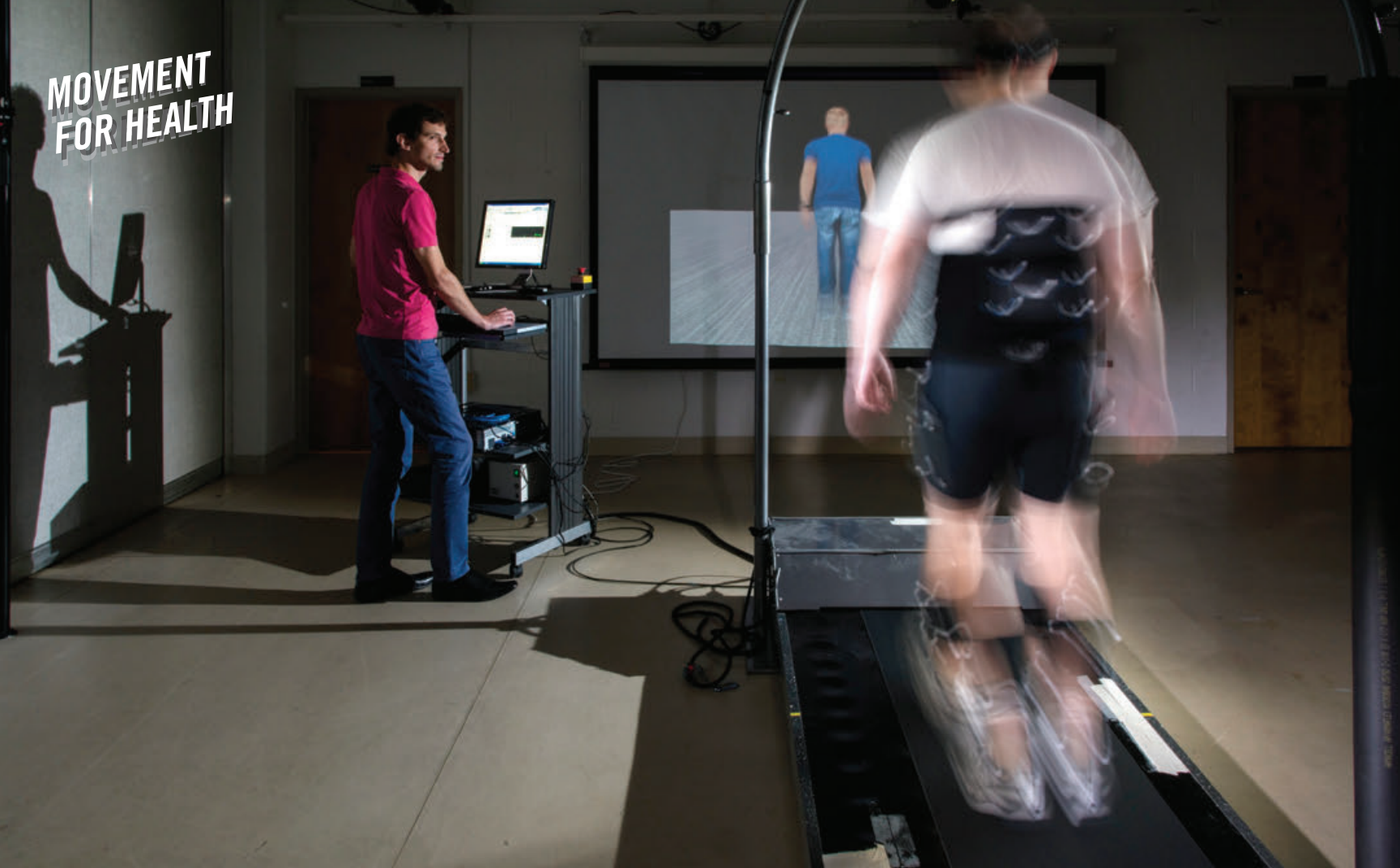


Setting the pace nationally in kinesiology

EVER SINCE ITS EARLY DAYS, UNCG has had a strong reputation for excellence in sports, sports medicine, and movement-related health. Today's kinesiology department has not let that legacy fade. Instead, the faculty are picking up the mantle and carrying it to exciting new places.

Maintaining optimal movement is crucial at any age. It's vital that we know what impacts motion, how we can preserve it, and — in the worst case scenarios — how to recapture it after injury. Unexpectedly, the big answers aren't coming in the form of little pills or injections. They're taking shape as high-tech solutions merged with interventions based on personal physical effort.

At every turn, UNCG is leading the charge not only for the healthy to hold onto their capabilities, but for the injured and cognitively-impaired to reclaim their abilities as well.



VIRTUAL REALITY — NOT JUST FOR VIDEO GAMES ANYMORE

If you walk into Dr. Chris Rhea's research lab, you might think you've walked onto an animated movie set or into the planning stages for video game graphics. At any given point, there's likely someone covered in reflective dots, walking on a treadmill, or being filmed by a 3D high-definition camera that records the body as a stick figure.

But what you're really seeing is novel, state-of-the-art research into how individuals who've suffered a stroke or had an amputation might learn to reclaim their normal walking patterns.

Rhea's lab is one of roughly 10 nationwide contributing to this type of research. The main tool supporting his work is virtual reality, or VR. VR itself isn't new, but it's just now being applied to this type of medical research, making Rhea's investigations groundbreaking.

To help individuals who've suffered strokes, Rhea pairs the treadmill with a complicated mathematical pattern recognition algorithm and a software program. The software measures the body's angles, trunk rotation, and limb symmetry to record exactly what the walker does and then runs that data through the algorithm.

Doing so creates an objective, baseline assessment, he says, that is used to build an avatar, which is projected on a split-

screen alongside the participant's walking pattern. Individuals use the avatar as a guide, trying to copy its movements to retrain their bodies into healthy walking patterns.

"Most healthy people have a range of movements within certain signatures, but if you get outside that range, it increases your risk for an injury due to a fall. That's what we see with stroke patients," he says. "The software and algorithms give us a quantitative way to measure walking patterns in different clinical populations and help them make changes."

So far, Rhea's team has mostly tested this technique with undergraduate students — approximately 600. But nearly 100 participants recruited from local doctors' offices have contributed as well.

Rhea also works with individuals with amputations, but in a slightly different way. Working closely with clinicians, he and his students designed a VR program that helps these individuals learn how to walk with prosthetic devices without falling. Input from the community clinicians who treat these individuals frequently is critical, he says, to creating a program that pushes a participant's abilities without exhausting him or her too quickly.

These participants wear a headset, called the Oculus Rift, which simulates a walk through the woods or down a street, so individuals can move at their own pace. Obstacles appear at intermittent times and heights, and participants must navigate around or over them to successfully complete the task.



REHAB AT HOME? As Rhea's VR research advances, the technology is becoming more accessible. The group's original VR headset was \$37,000. Today, the smaller, more portable Oculus Rift exists for a fraction of the cost. (Left, Rhea lab in 2015. Right, Rhea lab in 2012.)

"The goal with this project is to see if we can train these individuals in a virtual environment to step over objects," Rhea says. "And can they transfer that ability to the real world?"

As with the research with stroke patients, the lab is still fine-tuning this technique, using undergraduate students to tweak the methods. It won't be ready for clinical use until the team has identified which programs are most effective and efficient.

The wait, though, has its benefits. Over the next few years, Rhea's VR rehabilitation advancements will likely be more affordable and accessible for the broader clinical community. Not only is the software required to run the programs rapidly becoming open-source, meaning it's freely available to anyone, but the Oculus Rift headset the participants with amputations use to simulate walks is much cheaper than similar equipment purchased in previous years. For example, when Rhea's group purchased a VR headset in 2011, its price tag was \$37,000. Today, the smaller, more portable Oculus Rift exists for a fraction of the cost — \$350.

Rhea's lab has also invested in a new omnidirectional, low-friction, bowl-shaped treadmill called the Virtuix Omni that is roughly half the size of a standard treadmill. When paired with the lower-cost Oculus Rift, the \$500 Virtuix creates an effective rehabilitation system for less than \$1,000, well within the budgets of most clinics.

Other elements of Rhea's work have applications far outside the traditional clinic. With \$1 million in funding from the U.S. Department of Defense, his team is designing a smartphone-based app to test whether soldiers injured in the field have sustained a concussion severe enough to be removed from duty.

"This research is important because concussion can range

from mild to severe, with the mild version being more difficult to detect — yet it could still have serious implications on balance and cognitive ability," he says. "There's not really a good way to test in the field for mild concussions. But the last thing you want is someone with a concussion making life-and-death decisions for themselves or their entire unit."

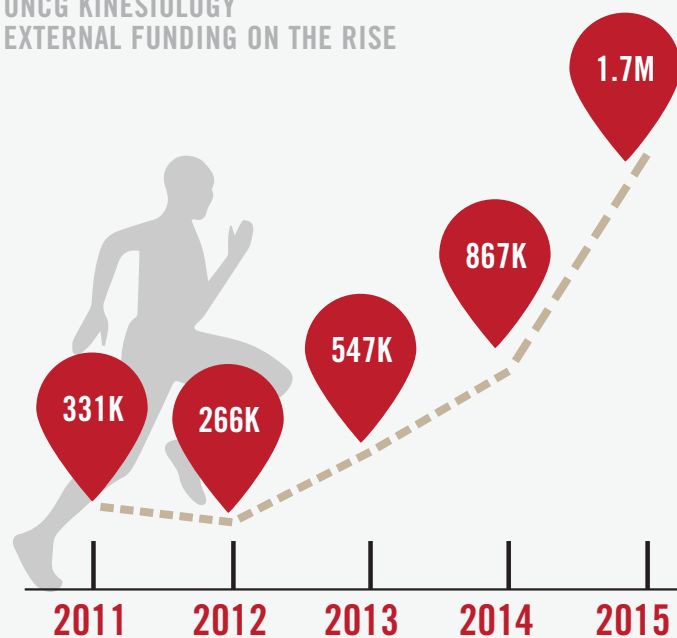
Time available to test whether a soldier has sustained a concussion is limited in a combat zone, and usually a combat medic, not a doctor, is the only medical personnel available. Consequently, the military needs an easy-to-use, accurate tool that can diagnose concussion severity within minutes. Rhea's team is using existing smartphone technology to create one.

Most smartphones contain accelerometers, devices that detect speed, as well as orientation changes. That means they can pick up on subtle balance shifts, Rhea says, making them perfect tools for concussion diagnosis. A field medic can simply Velcro a smartphone with this app to the injured soldier's thigh and have him or her walk in place for two minutes while the phone collects data on acceleration and side-to-side movements. After 15 seconds of analysis, a green, yellow, or red light will appear, signaling whether the soldier should be removed from duty and given medical attention.

This app could also be useful on the sidelines of high school and college football games, he adds.

Rhea's team is currently collecting data from and testing the app with civilian patients, some who are healthy and some concussive, as well as with healthy and concussive military personnel. He hopes to have a perfected app to the Department of Defense in less than two years.

UNCG KINESIOLOGY EXTERNAL FUNDING ON THE RISE





BODIES AND MINDS Etnier found that exercise has positive effects on recall among adults aged 50 to 65, undergraduates, and children in elementary and middle school.

EXERCISE FOR A LEAN, STRONG MIND

Physical activity has always been important to Dr. Jennifer Etnier, but she never wondered about how it might impact mental capacity and thought processes until her parents repeatedly asked her to help program their VCR to record football games. Her mother eventually grasped the concept, but her father never did.

"I wondered if there were differences in older adults' ability to learn and retain novel tasks and whether exercise and physical activity influenced that," says Etnier. "Can exercise and physical activity help preserve cognitive ability into advanced age?"

To date, that answer has been unclear. Being able to say "yes" could make it easier to motivate older adults to exercise more — if they're concerned about maintaining their cognitive capacity. Now, Etnier is beginning to do just that. Initial results from her two-year National Institutes of Health-funded research study show staying active can safeguard mental capabilities. In fact, that benefit extends all the way down to school-age children.

To delve into how exercise impacts cognitive performance, Etnier and her team have designed studies with older adults, college students, and elementary pupils.

With adults, Etnier explores whether exercise can safeguard mental faculties of individuals at genetic risk for Alzheimer's disease. In her study, 54 adults between ages 50 and 65 exercised three times weekly (walking and strength-training). They also completed cognitive evaluations at the study's start, at four months, and at eight months. The evaluations included recalling

words from a list of 15 words read aloud and a Stroop test, where a participant must say the color of ink a word is written in instead of reading the word itself.

Everyone benefited.

"Overall, the group showed improvement in cognition associated with physical activity. This suggests that even those with a genetic risk will receive the benefit," Etnier says. "It's very exciting to see how long-lasting these benefits are — could we, perhaps, delay the effects of Alzheimer's so that someone will die of other causes?"

Her team is also analyzing participants' blood samples to examine brain-derived neurotrophic growth factor, a protein that is simultaneously responsible for strengthening synapses in the brain and pruning those the brain no longer uses. If physical activity is increasing production of this protein, the researchers may have identified one of the pathways by which physical activity is affecting cognition.

It's clear, though, she says, that not all exercise is created equal. There could be a sweet spot — an optimal duration

and intensity that evokes the best response. Working with UNCG undergraduates, she found those factors do matter, as does the timing of exercise relative to a mental task.

Participating students reviewed a 15-word list and recited the words after three 30-minute sessions on the treadmill at low, medium, and maximum capacity. They then returned 24 hours later to repeat the same word list. The students repeated the activity as a whole five times. Based on their performance, Etnier found that moderate and maximal exercise offered the greatest short-term benefits, but maximum exertion prompted the best performance the next day.

Etnier found further evidence of the importance of timing when studying children in the second, fourth, and sixth grades. Her team tested students after they exerted their maximum effort to complete a one-mile run (fourth and sixth graders) or an eight-minute run (second graders). Half of the children tested reviewed a 15-word list before the run, and half reviewed the word list after the run. They returned and were tested on their word recall 24 hours later. Those who ran prior to hearing the list remembered more words than those who ran after.

"Historically, there have been teachers who were afraid that if students exert themselves highly that it would hurt their academic performance," she says. "We found that they actually performed better when they ran just before being asked to memorize the words than when they didn't."

These findings, she says, support the inclusion of physical education sessions early within the school day.



INTERNATIONAL VOICE

Women in Sport and Physical Activity Journal — the world's only peer-reviewed journal dedicated to highlighting issues facing women and girls in sports — now resides at UNCG.

The university's Department of Kinesiology manages and publishes the journal with Dr. Diane Gill as editor-in-chief and Dr. Donna Duffy as managing editor. The publication was acquired for \$1 from the National Association for Girls and Women in Sports.

The association asked UNCG to acquire the journal, Duffy says, because of the school's history as a women's college. Fusing UNCG's expertise with women's sports and the journal's focus will significantly further what is known about how women play and the challenges they face.

"Purchasing and publishing the journal has elevated our status and the visibility of the program. We have a presence on the international stage," says Duffy. "We'll be helping women in sports, physical activity, recreation — in anything where movement is involved."

In addition to continuing the journal online, UNCG has also resurrected the print version of the journal. After hosting a women's hockey team from Pakistan, Duffy learned that slow Internet speeds and government controls in some countries significantly limited journal access. Providing print copies circumvents that problem.

RUN THEN READ Timing of exercise can be important. Kids who ran prior to reviewing a word list retained the words better than kids who ran after reviewing the list.

OFFICIAL RESEARCH ARM OF THE WOMEN'S FOOTBALL FOUNDATION

It's no secret that playing football puts players at risk for sustaining a concussion. Research on this topic has accelerated over the past decade, with most work focusing on male players. But women play collision football too, and their numbers are growing.

This rise has researchers asking whether women experience concussions differently and if they need different assessments, treatments, and guidelines. Dr. Donna Duffy and her colleagues are trying to find these answers. It's imperative, she says, because female football players are just as physical as their male counterparts while facing a high risk of injury.

This year, UNCG became the official research arm for the Women's Football Foundation, or WFF. With WFF support, Duffy and her collaborators want to investigate whether female collision sport athletes have different normal neurocognitive and neuromotor performance. She also wants to determine whether women's performance drops after sustaining a concussion, how long those changes will last, and whether there are any long-term effects.

"We have a real opportunity to work with the Women's Football Foundation in their overarching goal to improve the safety of women's football — to make it safer and to address issues that haven't otherwise been looked at," says Duffy, who is also director of UNCG's Program for the Advancement of Girls and Women in Sport and Physical Activity. "We hope that our work will inform players, coaches, and league stakeholders."

Ultimately, Duffy hopes to create sex-specific guidelines for when players can return to the game. The researchers also want to craft return-to-work recommendations to ensure that working-age women don't return to a full workday before they're healthy enough.

Most current women's sports research focuses on contact sports, such as soccer or lacrosse, where concussions happen by accident. Duffy's research is different, highlighting concussions from collision football that result from intentional, aggressive contact. In many instances, concussions in women are blamed on weaker neck muscles, but that assumption doesn't hold true among female football players, Duffy says. Other factors contribute. For example, she says, pilot data collected from videotaping games of 50 women on two football teams in North Carolina — the Durham Phoenix and the Charlotte Queens — showed that most women play more than one position. This increases time spent on the field and risk of injury.

Duffy's team assessed the players' neurocognitive and neuromotor functions at the start, middle, and end of the season, with additional assessments of players diagnosed with a concussion. This year, the researchers plan to gather data from five more teams. All results will be collected in a database and used to determine whether any neurocognitive and neuromotor changes are related to concussion, as well as how collisions that don't result in diagnosed concussions can impact cognitive function.

Duffy and her team also conducted a women's health survey with 30 out of the 31 WFF teams. Approximately 700 women answered questions that touched on biological and psychosocial issues women in sports face, including how women portray and negotiate their femininity when not playing a sport. The survey gathered data about a player's individual and family injury history and broached questions of equity and how women have been treated in their roles as female collision sport athletes.

When all the research is merged, Duffy says, a new picture of female athletes will emerge. "We're looking to debunk the myths about the stereotypical understanding of what female athletes look like and are built like."



ACL INJURY — FEMALE HORMONES AT FAULT?

Researchers have known for decades that women are more likely than men to suffer injury to the anterior cruciate ligament (ACL) — the ligament responsible for stabilizing the knee during jumping, landing, pivoting, and changing speeds. But the reasons behind this difference are still fuzzy.

Dr. Sandra Shultz has been at the forefront of these investigations since the late 1990s, looking specifically at how hormones might affect knee laxity in women.

"We've learned that laxity varies greatly among men and women," Shultz says. "Women naturally have greater laxity than men. That's important because research shows that greater laxity increases the risk of injury."

Laxity refers to the amount of existing ligament looseness. With knees, laxity impacts stability. People with greater laxity tend to land more stiffly, and the knee collapses inward. Injuries occur when the force of impact on the knee overwhelms what the ACL can handle — often, the ligament just isn't strong enough.

Shultz is investigating the potential for hormones to influence that laxity. Past research has shown that more injuries occur during the first half of a woman's menstrual cycle compared to the second. Shultz's team hypothesized that the reason might lie in fluctuations in estrogen, progesterone, testosterone, and possibly relaxin, the hormone most responsible for ligament laxity during pregnancy.

To test these changes, the team gathered blood samples from female undergraduate students, measuring their knee laxity on the same days the samples were drawn. They then identified the days of minimum and maximum laxity in each female's cycle. On those days, subjects were asked to perform a landing maneuver while the researchers measured their lower extremity movement patterns. As expected, on days of maximum laxity, subjects exhibited movement patterns that are associated with a higher risk for injury.

The researchers assessed each subject's hormone levels and other blood markers on days of minimum and maximum laxity. What they found? Not only do hormone changes correlate with changes in observed laxity, they also correlate with changes in collagen metabolism — in a way that can alter the makeup and structural integrity of soft tissue. These changes most likely contribute to a structurally weaker ligament and render the knee less mechanically stable at certain times of the month.

Dr. Randy Schmitz, Shultz's colleague, is also adding to what researchers know about ACL injury and recovery. He's following women who've had surgery for ACL injury to observe how their knee cartilage changes in the six months post-operation. He wants to know whether those early changes can predict how the subjects will walk over time. Such knowledge could impact rehabilitation. Figuring out better ways to treat or possibly prevent ACL injuries in females is critical, Shultz says, because the impact is lifelong. The majority of ACL injuries happen between ages 14 and 15, and arthritis sets in within 10 years to 15 years. That means injured young women can have arthritic knees — and face a future of knee replacements — by age 30.

Having a greater understanding of the variability of who's at risk will help Shultz and her team better understand who to target for intervention. "These injuries add up to missed time in sports and activities and an increase in potential long-term complications,"

Shultz says. "Ultimately, we want to understand what factors increase knee laxity, and then determine if laxity can be changed or not through prevention and strengthening, since some evidence suggests that more muscle mass around the knee is associated with less knee joint laxity."

Taken together — and individually — the ongoing work inside labs led by Rhea, Etnier, Shultz, and Schmitz continues to move the needle in the right direction for what we know about healthy movement and how the human body and brain can help themselves. Over time, their investigations hold great promise for combatting and, potentially, preventing and conquering some of the most common causes of impaired motion that both men and women face. **📌**

By Whitney L.J. Howell • Photography by Martin Kane, contributing photography by Amanda Berg • Learn more about the Department of Kinesiology at <http://uncg.edu/kin>



FLEXIBLE TO A FAULT Shultz says, "Women naturally have greater laxity than men. That's important because research shows that greater laxity increases the risk of injury."



THE MAN IN THE MUCK

Dr. Nicholas Oberlies is a professor of chemistry, with specialized expertise in medicinal chemistry and pharmacognosy. UNCG's 2014-2015 Junior Research Excellence Award winner investigates biologically active compounds in nature and their potential for the treatment of disease. Funded by three major National Institutes of Health grants, Oberlies is an exceptionally productive researcher. His team at UNCG has produced more than 60 peer-reviewed papers since he joined UNCG in 2009, and he has published more than 100 papers overall. He also directs UNCG's Natural Products and Drug Discovery Center.

THE POWER OF NATURAL PRODUCTS

When you walk into your neighborhood drugstore, a quarter of all the prescription and over-the-counter drugs you see there come from nature. If you're looking specifically at anti-cancer drugs or antibiotics, that number jumps to closer to 60 percent. Penicillin is probably the best known example. It came from a fungus, and if it hadn't been discovered, 40 percent of us wouldn't be here. I mean that literally. Our grandmother would have died or our great-grandfather would have died along the way from something that today we think is just a little infection.

INSPIRED BY CANCER-FIGHTING DRUGS

I earned my undergraduate degree in 1992, and Taxol — a chemotherapy medication for breast and ovarian cancer — was approved as a drug in January 1992. It was developed from molecules taken from a tree, and it's had a huge impact on human survival. If you had ovarian cancer prior to the discovery of Taxol, your chance of surviving five years was about 15 percent. Today, your chance of survival is 85 percent. Taxol's not solely responsible for that incredible improvement, but it's had a lot to do with it. So I was all excited, thinking, "Man, that is what I want to do in chemistry."

A UNIQUE PATH TO UNCG

I'm a little non-traditional for a professor at UNCG. I've been here since 2009, but prior to that I spent 11 years working at the Research Triangle Institute, or RTI, which is a private nonprofit that focuses on research and development globally. RTI is where Taxol was discovered, and I was fortunate enough to work for the research team at RTI who originally found it. During my time at RTI, I morphed away from looking at plants as a source for new drug leads to focusing on fungi.

THE ATTRACTION OF FUNGI

What I really like about fungi is that we can grow them in a lab; it's hard to develop natural products if you need a rare plant to do it. With fungi, we can often produce sizable quantities by optimizing the fermentation techniques and that could provide enough material to start pre-clinical studies on a promising compound. Moreover, we have the opportunity of tweaking the growth conditions, perhaps by adding materials that stress the fungus, essentially tricking it into making new derivatives of lead compounds. Humans have been using fungi for fermentation for longer than recorded history. So I have confidence that we can develop ways to make our most promising fungi work for us in a productive manner.

UNTAPPED, UNDER OUR NOSES

Just as significantly, there's somewhere between 1.5 and 5.5 million fungi in the world. Only about 100,000 have been named and a much smaller number have been studied for anti-cancer or antibiotic leads. We have this vast, vast resource that's almost totally under-investigated. We've published papers about samples we've found in a stream that runs right behind UNCG's Music Building and in Lake Brandt in Greensboro. Everywhere we look, we find new fungi, and I believe that when you find new fungi you'll start discovering new chemistry that may impart exciting biological activity and may have pharmaceutical potential.

SEARCHING FOR THE NEXT BIG DRUG

We're trying to find the next Taxol or the next penicillin that's going to make life better for a lot of people. Our biggest project is funded by the National Cancer Institute, and we're partnering on it with The Ohio State University, the University of Illinois — Chicago, Columbia University, and Mycosynthetix, a biotechnology company in Hillsborough, North Carolina, to identify fungi that might help treat cancer. We're also looking for ways to thwart MRSA, the strain of drug resistant strep that now kills more people in America annually than HIV/AIDS. We have a sense of both urgency and realism about how long this will take. Natural products have led to countless life-saving drugs. However, their development time is a minimum of 10 years, and it is not uncommon for it to take 20 to 30 years. So it may take a while for the leads we discover today to be translated to the clinical setting. But as I always tell my research team: this work is not a sprint, it's a marathon.

Interview by Stephen Martin • Photography by Martin Kane, fungi images by Huzefa A. Raja • Learn more at <https://uncg.edu/che>

Check back in our spring issue for a profile on 2014-15 Senior Research Excellence Award winner Dr. Eugene Rogers



MATHEMATICIANS WALK ON THE **WILD SIDE** IN GROWING UNCG FOCUS



MATH MEETS BIO IN UNCG COLLABORATION Rueppell, Rychtář, Shivaji, Pauli, Kalcounis-Rueppell, and Rowell (left to right).

What do California field mice, delphacid planthoppers, and honeybee queens have in common? UNCG mathematicians.

At UNCG, an emerging cluster of mathematicians and their students are collaborating with biologists here and at other universities. The field is called math biology or biomathematics.

They are working together to analyze massive stores of scientific data, model how animals behave, and better understand how life functions at every level — from the interior of a cell to the borders between ecosystems.

"Math biology is a very hot applied field," says Ratnasingham Shivaji, H. Barton Excellence Professor and head of the Department of Mathematics and Statistics. "It's different from previous, traditional applications of differential equations in physics and engineering. Ideas and techniques from many

diverse branches of mathematics are needed to answer questions arising in biology. It's an exciting challenge."

Over the last 20 or 30 years, technological advances have opened up new opportunities for mathematicians to collaborate with biologists, physicians, and others in the life sciences. Biological systems — whether it's how the microscopic parts of a cell interact with each other or how animals behave — are extraordinarily complex. But with advances in computing power, it's become possible for researchers to formulate those systems mathematically and actually solve those complex problems.

What would have been impossible to solve on a chalkboard a few decades ago can now, often, be run on a computer. The results allow mathematics to describe and predict many biological phenomena and also provide

biologists with new tools and insights to approach their work.

MOUSETRACKER PROGRAM SNARES STUDENTS

Some of the earliest formal math biology work at UNCG began with a 2006 National Science Foundation grant to fund the Interdisciplinary Training for Undergraduates in Biology and Mathematical Sciences (UBM) program. That grant helped put together biology professor Matina Kalcounis-Rueppell and mathematics professor Sebastian Pauli. Kalcounis-Rueppell studies the behavior of nocturnal animals; Pauli is focused on number theory.

Kalcounis-Rueppell showed Pauli thermal video images she had of California field mice, which are active at night. She also had audio recordings. She wanted to better understand the mice's behavior and how the sounds they make — mostly above the range of human hearing — might be related to that behavior.

But sitting through thousands of hours of video, cataloging mice movements, and trying to tie movements to the sounds they

make was a gargantuan task. And once that was complete, it would still be a challenge to extract useful data from the results.

"We needed a way to automate and quantify both spatial and temporal aspects of the behaviors that were in the video," Kalcounis-Rueppell says.

Enter Pauli. "I said, 'I know we can automate that.' The computer can watch them and process the data in different ways."

Pauli's students wrote software that could identify mouse images on the video, distinguishing them from other objects, and then track their movements over time. Computer science professor Shan Suthaharan was also involved.

The software must distinguish mice from other moving objects in the frame and also do things like keep track of a specific mouse if it disappears behind a tree for a few moments. When it re-emerges, it should be tracked as the same mouse, not a new animal.

The software allows Kalcounis-Rueppell to answer questions such as "do the vocalizations of the mice change when they're near their nest?"

"We are interested in understanding the behavioral context of when mice make ultrasonic sounds," she says. "Are the sounds being made when the mice are close to the pups in their nest? If they are, then those ultrasounds may be useful for parental care."

As Kalcounis-Rueppell's research questions evolve, Pauli helps undergraduate students write new computer code to perform the analyses that she needs. He helps them think about how to frame their approach both from a software standpoint and, importantly, from a mathematical standpoint.

"It really gives them an opportunity to apply things they have done," Pauli says. "They actually produce something real, not just an assignment, but something that means something."

GROWING INTO A NEW FIELD

For math faculty members, opportunities for interdisciplinary collaboration in math biology have bloomed in the last few years.

Dr. Jan Rychtář came to UNCG in 2004 expecting to focus on functional analysis but within a few years found himself pulled toward problems in biology. "There is something at UNCG that allowed the switch and made the

switch possible," he says. He cites opportunities to collaborate with colleagues in the life sciences, as well as research funding that encourages interdisciplinary work. "The collegiality between professors is really good here."

At least eight faculty in the Department of Mathematics and Statistics are currently working on math biology projects.

The newest of that group is Jonathan Rowell, an assistant professor who came to UNCG in 2012 to focus on math biology. He has an extensive background in the field. He earned his PhD in applied mathematics at Cornell University and picked up a minor in ecology along the way. He then did a yearlong postdoc at the University of Tennessee's Department of Ecology and Evolutionary Biology and spent three years in the biology department at UNC-Chapel Hill before coming to Greensboro.

For Rowell, it's not about math for math's sake. "It becomes really important as someone who is a biomathematician to figure out, 'What is the implication? What does that mean biologically?'"

Currently, he's focusing on how individual animal movements affect animal populations as a whole. "There's a lot of promise here," he says of the math biology focus at UNCG.

HOW MANY MATES FOR THE QUEEN?

That promise of math biology not only means opportunities for faculty, but also for students, including undergraduates.

Recently, five undergraduate students, working under the supervision of Rychtář and biology professor Olav Rueppell, tackled honeybee queen mating behaviors.

After learning some basic honeybee biology, the students — a biology major, a physics major, a computer science major, and two math majors — built a mathematical model of how genetic diversity in a honeybee colony changes depending on how many times the queen mates.

Mating, in evolutionary terms, is expensive, Rueppell explains; there are costs and benefits. And with scientists and others worried about declining bee populations, new insights on honeybee mating could have important practical implications.

"That was a very productive project," he adds, "with implications for general mating behavior in insects."

The end of summer 2015 marked the close of UNCG's second NSF-funded Math-Bio Research Experience for Undergraduates. The program, which has hosted approximately



20 undergraduates thus far, lets students stretch beyond their disciplines, conduct laborious research, and deliver presentations on their findings.

However, the undergrad research collaboration is actually in its ninth year when you factor in the seven-year UBM program that preceded it. That program took in eight UNCG undergraduates every year, partnering math and biology students in interdisciplinary research teams. UBM resulted in 25 awards, 41 papers, 57 international presentations, 50 national and state level presentations, and over 150 presentations at the regional level.

Over nine years, these students have applied math to study different aspects of insect behavior, examined the evolution of cooperation in social organisms, developed a new way to analyze and understand gene sequences — and more.

UNDERGRADUATE OPPORTUNITIES Rowell, Rueppell, and Rychtář head up the NSF-funded Math-Bio Research Experience for Undergraduates. UNCG undergraduate math-bio collaborations are now in their ninth year.



Rychtář says the work on genetic sequences, in particular, has huge potential across a range of fields to improve how scientists analyze how genetic sequences are expressed in living organisms.

As Rychtář and his students develop mathematical models for biological systems or behaviors, biologists like Rueppell conduct experiments and collect real-world data. The researchers see if the data match what the model predicts, or

decision making, was made famous by mathematician John Nash, the subject of the movie *A Beautiful Mind*. It has traditionally been applied in economics, but it also applies to all sorts of biological questions — including honeybee mating.

"What sort of mathematics is used to solve the problems is not that important," Rychtář says. "It's the application of mathematics that is important."

Montgomery, has won federal funding to study how boundaries affect migration patterns and behavior. Boundaries, in this case, are the edges of a region that's hospitable to an animal.

The goal is to develop mathematical models that describe three major scenarios:

- **WHAT HAPPENS WHEN AN ANIMAL GETS CLOSE TO A BORDER? WHAT AFFECTS ITS DECISION TO CROSS OR NOT CROSS?**
- **WHAT FACTORS INFLUENCE ANIMALS THAT MOVE BETWEEN TWO REGIONS THAT ARE SEPARATED BY AN INHOSPITABLE AREA?**
- **WHY DO TWO SPECIES THAT DON'T INTERACT INSIDE A REGION COMPETE AT A BOUNDARY?**

The math, Shivaji says, that describes this will be a reaction-diffusion process — a type of differential equation. Reaction-diffusion equations are used in physics and engineering, for example, to understand how heat spreads through a surface.

Animal behavior near a boundary represents a similar model. Animals diffuse (move) through the region, but what happens when they get to the boundary? What factors cause different responses?

While Shivaji, working with PhD students at UNCG and his collaborators in Alabama, develops mathematical models, his collaborators in Louisiana will be working in the field to collect real-world data about actual animal movements in these environments.

The researchers will study two species of insects — delphacid planthoppers and blessed bugs — that live in the salt marshes of the Atlantic and Gulf coasts. Both species feed on smooth cordgrass, which often grows in patches, creating, in effect, habitats for the insects that are separated by boundaries of water, sand, or other

marsh terrain.

The data will be used to refine the mathematical models. If successful, the research could give biologists mathematical tools to predict how these species move about in the wild in varying circumstances. And over time, it might lead to mathematical models that allow scientists to describe the movements of all sorts of animals in all sorts of environments. Shivaji and his collaborators also plan to develop models that focus on predation and harvesting.

Such models will have a variety of applications. Resource management, for example. Fisheries managers have to decide how many fish fishermen should be able to catch. Those calculations could be improved if biologists had better tools for understanding the impact of fishing and other factors on fish populations.

Just as important as the scientific advances that come out of the boundary work will be the opportunities it provides for a new generation of scientists to work across disciplinary lines.

"Our way of thinking, in this particular proposal, is that from the start of undergraduate and the graduate level research we want to start that interaction," Shivaji says. The grant funding requires one-week workshops — one at LSU and one at UNCG — where the students and faculty learn more about each other's fields.

For Shivaji — decades into his career as a mathematician — this project will be his first foray into work that includes collaborations with biologists. His hope is that for his students it will be the beginning of many such collaborations that shape their careers.

By Mark Toszczak • Photography by Mike Dickens • Learn more:

<http://math.uncg.edu>
<http://bio.uncg.edu>
<http://uncg.edu/cmp>



BUILDING A BETTER MOUSETRACK Kalcounis-Rueppell and Pauli created software to identify and track mouse movements in thermal video recordings.

if the mathematical model needs to be refined.

Rychtář's work with undergrad students during the summer research projects is just a fraction of his math biology work. He has other collaborators on campus, as well as at universities around the world. He's working on projects related to plant-pollinator interactions with researchers in China, cockroach behavior with zoologists in the Czech Republic, and disease vectors with faculty at UNCG and Bennett College.

He has also co-authored a book with Mark Broom from City University London called *Game-Theoretical Models in Biology*. Game theory, the study of optimal

SEEDING INTERDISCIPLINARY COLLABORATIONS

It's those applications that drive the interdisciplinary work that is the hallmark of math biology.

A just-funded project will bring UNCG math faculty and graduate students together with biology professors and graduate students from other universities to examine animal movements near habitat boundaries.

Ecologists have studied for decades what drives such movements — changes in the environment, food supplies, predation, and more.

Shivaji, working with collaborators at Louisiana State University and Auburn University-



UNLOCKING NEW MEDICINES

UNCG scientists are the first in the world to create a compound that targets just one signaling mechanism in cannabinoid receptors, cellular-level structures that influence all sorts of neurological and physical functions.

The discovery could lead to new medicines for treating a wide range of illnesses — glaucoma, chemotherapy-induced nausea, post-traumatic stress syndrome, autoimmune disorders, and more, says Dr. Patricia Reggio, Marie Foscue Rourk Professor of Chemistry.

Reggio is the prime architect of the new compound, which she hopes will unlock a long-standing puzzle about how cannabinoid receptors work and open the door to new medical treatments. But to get there, Reggio is tapping collaborators in France — and their rats.

Researchers need to discover, you see, if the new compound will get the rats high.

Until this point, scientists have been unable to target the cannabinoid receptor without causing psychoactive side effects. The cannabinoid receptor is so

named because THC, the active ingredient in marijuana, activates it.

"It's just an accident that something in a plant hits it," says Reggio, who heads the UNCG Department of Chemistry and Biochemistry and who has been studying cannabinoid receptors for 30 years.

If researchers could target cannabinoid receptors without causing psychoactive effects, it would open up a whole new arena for drug research. Drug regulators and pharmaceutical manufacturers have been mostly unwilling to explore drugs that use the receptor out of fear of their potential psychoactive effects.

"Marijuana is still illegal in lots of states," Reggio says. "The Food and Drug Administration has a really hard time approving drugs that hit the cannabinoid receptor because they think the drugs have a high potential for abuse."

That may be about to change.

PROTECTIVE MECHANISM

Cannabinoid receptors are present throughout your body — in your brain, in your immune system, and in many other places. In

evolutionary terms they've been around a long time and, as such, are present in rats as well as humans. They play a vital role.

"It's there as a protection mechanism for your brain," Reggio explains. If synapses start firing too fast, the cannabinoid receptors can calm that down, preventing a kind of brain cell burnout. "I don't think an organism could survive without them."

The receptor also affects appetite, nausea, intraocular pressure in the eye, memory, and numerous other functions. That means that any compound that activates the receptor could have therapeutic effects.

A few years ago scientists discovered that the cannabinoid receptor has two signaling mechanisms that can be activated — think of them like biochemical locks. THC activates (or opens) both of them — the beta-arrestin mechanism and the G-protein mechanism.

But Reggio and other researchers wondered what would happen if you could design a molecule that activated one signaling mechanism but not the other. Activating just one could

provide therapeutic effects without the psychoactive side effects that doom any chance of an FDA approval.

To find out, the team designed a likely compound and ran a three-year-long computer simulation.

The simulation software, run on the high-performance computing cluster the UNCG Department of Chemistry and Biochemistry purchased with a 2009 \$311,000 grant from the North Carolina Biotechnology Center, allows the researchers to predict exactly how any potential molecule and the cannabinoid receptor will interact.

This is not a program you could run on your laptop.

The cannabinoid receptor is a big, complicated molecule containing about 5,000 atoms. The simulation calculates what happens when the receptor and a potential new drug interact and, crucially, whether the drug molecule activates only one of the two mechanisms or both.

To understand how it works, the researchers have to look at the cannabinoid receptor as it exists in nature — embedded in the lipid bilayer that forms a cell

membrane. A computer simulation of the receptor immersed in a lipid bilayer and surrounded by water molecules must track the positions and potential interactions of about 95,000 individual atoms. The cluster — a collection of computers connected together so they function like a single, super powerful machine — calculates the position of each of these atoms every two femtoseconds.

18-month stopgap measure that gives researchers enough time to figure out if it's worth doing further research and worth the time and expense of patent filings in various countries around the world.

UNCG pays the bills for the initial patent filing, usually several thousand dollars, says Staton Noel, director of the university's Office of Innovation Commercialization.

It's not always so simple. Noel's first step in evaluating a new technology or discovery for commercial potential, he says, is to ask a lot of questions.

"I talk to people in the field," he says. "Invention is one thing, but innovation is another. There needs to be a commercial pathway. We're not the 'office of patenting,' we're the Office of [Innovation] Commercialization."

Noel and his office also do a market analysis to assess the commercial potential and look at other patents — also known as prior art — to see if the technology can be patented in a way that would allow for commercialization.

In many ways, the Office of Innovation Commercialization behaves like an early-stage venture capital funder. If some invention — a new drug, software, or something else — is commercialized and successful, it could represent significant revenue for the university. But not all inventions will be commercial successes.

Future revenue from patent licenses or other commercialization opportunities are split 50-50 between the inventor(s) and the university. Of the university's share, some of the money goes back to the department and school where the technology was developed. Some goes to Noel's office, where it's reinvested in new commercialization efforts.

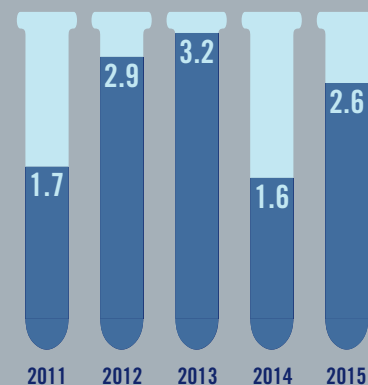
MEDICINAL BIOCHEMISTRY AT UNCG

Reggio isn't the first UNCG researcher who has brought potential new drugs to Noel.

Several compounds — fungal metabolites — from the UNCG Natural Products and Drug Discover Center have been patented, Noel says. They're derived from plants and fungi, rather than designed from scratch the way Reggio's molecule was.

"That group has a lot of

MEDICINAL BIOCHEMISTRY EXTERNAL FUNDING (MILLIONS)



interesting potential compounds," Noel says. "Over half of pharmaceutical drugs, I believe, come from natural products. They're usually very complicated molecules to synthesize. That's a great starting point for developing further drugs and formulations."

In the last decade, UNCG's efforts to develop new drugs have blossomed. Reggio was recruited to the university 11 years ago in part to launch and nurture the PhD program in medicinal biochemistry in the Department of Chemistry and Biochemistry.

The department has acquired critical equipment for doing drug development research, including two nuclear-magnetic resonance spectrometers, several mass spectrometers, the high-performance computing cluster, and other equipment.

"Chemistry's really expensive, and it's because of all these instruments that it's so expensive," Reggio says.

But, as her work and that of other UNCG chemists demonstrates, that investment is paying off.

By Mark Toscak • Photography by Martin Kane • Learn more at <http://uncg.edu/che>

HOW SHORT IS A FEMTOSECOND?

Really short. It's about one millionth of one billionth of one second. For every two femtoseconds that Reggio's simulation ran, a beam of light would move just two ten-thousandths of an inch.

The simulation revealed that their compound did indeed activate just one mechanism, the beta arrestin signaling mechanism.

The achievement is notable because of its medical potential, and also because it's the first molecule we know of that activates just one signaling mechanism on the cannabinoid receptor. Which brings us to the French rats.

AVOIDING THE HIGH?

The rats will be injected with the compound and their behavior observed. There are several simple tests the French researchers can do to tell how and if the new molecule is having effects similar to THC.

"When they're taking cannabinoids they're not moving around a whole lot," Reggio summarizes.

If the compound doesn't display psychoactive effects, the molecule can move to the next stage of research, exploring potential medical applications.

UNCG, through its Office of Innovation Commercialization, has already filed for international patent protection for the compound. The filing is an

Licenses of the technology would pay for further patent costs.

CALCULATING COMMERCIAL POTENTIAL

Noel is himself a veteran of drug development research, having spent 20 years at pharmaceutical giant GlaxoSmithKline. His job is to review research and decide whether it's worth university time and money to pursue commercialization.

"My first thoughts were of skepticism, because a lot of companies had tried to move forward with cannabinoids," he said. Side effects and regulatory barriers have discouraged many drug companies. "In the pharmaceutical industry we were really gun shy of this being a medicinal target."

Though he was initially skeptical of the new compound, after he reviewed all the information, it was an easy call.

Reggio's science was solid — something that was relatively easy for Noel to verify thanks to his pharma background — and Reggio already had interest from a French drug company.

A hand is shown holding a piece of wood, with a small blue and white striped object (possibly a pen or pencil) resting on it. The background is a collage of various images, including a close-up of a tree trunk, a person's face, and other abstract patterns. The overall theme is hands-on learning and research.

MAKING OUR MARK

You learn best by doing.

When undergraduates roll up their sleeves and conduct research, they learn more and they understand more deeply. They prepare themselves for their future careers or graduate studies. They make a positive change in our world.

Undergraduate research makes an impact.
One young scholar at a time.

MAKING
OUR MARK





WHAT DO YOU LEARN DOING UNDERGRADUATE RESEARCH? THE MONTAGNARD PROGRAM PREPARES STUDENTS FOR:

- Ethical research with human participants
- Literature searches
- Research protocols, including questionnaire design, interviewing, and documentation
- Working in collaborative teams, across disciplines
- Community engagement, cross cultural competence, and multi-disciplinary approaches
- Writing, editing, and data analysis and dissemination
- Submitting papers to professional journals
- Public speaking on health and family related topics in the community and at conferences

A HEALTHY COLLABORATION

MORE THAN A DOZEN UNCG UNDERGRADUATES have made a big impact in the Greensboro Montagnard community in the last two years. And their work is ongoing.

The Montagnards, also known as Dega, supported U.S. forces during the Vietnam War and have suffered political persecution and violence in the region ever since. From the 1980s onwards, Guilford County has welcomed many hundreds of refugee Montagnard families. But their healthcare needs are a concern.

UNCG, in collaboration with Guilford College and NC A&T State University, is helping address this problem through community-engaged research. The day-to-day outreach work is often led by undergraduates.

"These kids will mentor and train each other. They get it done," says Dr. Sharon Morrison, UNCG associate professor of public health education and research fellow at UNCG's Center for New North Carolinians. "Students ready at 7 a.m. on Saturday mornings, for a full morning of work at Montagnard churches?" she asks incredulously. "That's impressive."

More than 20 students, some from other states, worked on the Montagnard health projects over the summer of 2015. A variety of majors participate, but a common goal unites them — the desire to make a real impact in the world through engaged research.

The students collect hair and saliva, explains Jalisa Horne, a senior nutrition major. "Everyone helps out with the biological measures." They use the samples to detect cortisol, which indicates levels of stress and can be an indicator of health issues. Then, they give the results to each participant, so the participants can take the information to a health professional. High cortisol levels, high blood pressure, or the results of a survey the students helped create can be reasons for concern and follow up.

Horne and senior public health major Branda Mlo worked together, supported by a Community Based Undergraduate Research and Creativity Award from the UNCG Undergraduate Research, Creativity, and Scholarship Office, also known as URSCO. "We've teamed up to develop a portion of the survey for young adults regarding hypertension," Mlo explains.

"I wanted to do research!" exclaims Horne (pictured left), who sought out the professors and the project. She studied in Botswana as a UNCG student two years ago, and now she is applying for a Fulbright fellowship to work in Botswana to help young adults with HIV.

Mlo, who is a Montagnard, says, "It's given me a way to be fulfilled. It links us to all these resources that Montagnards would not know how to access — and it's being done by college students." After graduation, she plans to continue work with the Montagnard community. She adds, "I did not know I wanted to do research until I did this project."

The project is unprecedented at UNCG, Dr. Sudha Shreeniwas says, particularly with regards to this much undergraduate involvement. It's experiential learning, the associate professor in the Department of Human Development and Family Studies explains, with a student group diverse in every way. "Our students go out and graduate more competitive in their careers. The students' names are on publications. They go to conferences."

With funding from an URSCO Globally Engaged Undergraduate Research and Creativity Award, Oyediya Akaronu researched the use of plants in health management — including hypertension — among Guilford County Montagnards. Through the grant, she also analyzed data collected by Guilford College students the previous summer in Vietnam on plant and herb use in health and hypertension. Impressively, Akaronu was one of only a few undergraduates presenting research at the North American Refugee Health Conference in Toronto this past June.

CONDUCTING RESEARCH, LITERALLY

He's graduating in December, after three and a half years, with a BA in theater and a minor in business. "My background was arts administration," he explains.

While carrying a full load, he's writing for the News & Record, the Classical Voice of North Carolina online arts journal, and the Carolinian student newspaper.

And he spent the fall directing the UNC-CH Pauper Players production of *A Chorus Line* in historic Playmakers Theatre. He is the first student outside of Chapel Hill to be selected to do that. He's that talented.

How does Jackson Cooper keep it all straight? "I have a Moleskine planner that helps a lot."

The senior took a break at the UNCG Music Building's garden and reflected on his summer. A grant from URSCO had given him the funds to be the full music director and conductor for the summer Greensboro Light Opera and Song production in Manteo — *Beauty and the Beast*. Professor and opera program director David Holley was there to advise and mentor. Cooper also observed Holley prepare the Gilbert and Sullivan opera *Iolanthe*.

"I researched conducting techniques," Cooper notes. He also learned about the styles of teaching musical opera and operettas.

Holley explains that, in music, the creative activity is the research. "Our rehearsal room is the lab." In this case, Cooper's primary research activity was the conducting.

The summer broadened Cooper's perspective. "The grant allowed me to see research is cross-disciplinary. It's not exclusively one thing." He adds, "It didn't stop at this summer. I saw some things David Holley did in *Iolanthe* that I'm bringing into *A Chorus Line*. And it affects my writing."

Holley references another UNCG music alumnus, Dom Amendum, most known for conducting *Wicked* on Broadway. "I see a lot of Dominick in Jackson," he says. "He's got a way to knock on people's doors and say, 'teach me.'"

Aside from Holley, Cooper cites two mentors — William Henry Curry at the North Carolina Symphony and Rob Berman, who conducts the Encores! series in New York's City Center. How did he meet Berman? "I just sent an email. I'm a big fan — I'd love to get lunch." He and Berman have lunch just about every time the senior gets to the Big Apple. "The last time, I saw his rehearsal of *Paint Your Wagon*."

How did Cooper develop his passion for music and theatre? Growing up in Wake County, Cooper saw a show — and zeroed in on the conductor. "One guy is keeping this whole show together — and he's smiling," he thought. By 7th grade, Cooper's school band conductor let him conduct. His classmates were fine with it. He went on to assist conductors at North Carolina Opera and Meredith College. He was orchestra assistant for the NC Theatre and the Hot Summer Nights series. He conducted the North Carolina Symphony Youth Symphony. And he did internships in administration with Carolina Ballet and NC Theatre.

And now he is taking what he has learned to inform his writing.



ART CRITIC, CONDUCTOR, UNDERGRADUATE RESEARCHER "My passion? To expose people to good art," says Jackson Cooper.

Cooper is writing for the Perform book series. His essay about networking in the digital age is designed to help the next generation of artists. His more immediate deadlines are in the press and media, and his research has polished his writing of reviews and features for the popular press and arts sites.

"After studying about the old — Gilbert and Sullivan — now I'm writing about the new."

Over the summer, he was enlisted to write for Classical Voice of North America, a publication of the Music Critics Association of North America that has broad reach. "I was writing about a new music group doing world premieres." He was in New York, with music he was unable to research — he typically does that as a first step. But he was able to rely on all he has already learned and absorbed to create the reviews.

Each experience is new. As he graduates, he plans to move to a large "arts" city, perhaps New York, Chicago or LA. "My passion? To expose people to good art." He has developed the tools to do just that.

"I'd like to be an artistic producer or a critic. I'd like to take Ben Brantley's job at the New York Times," he says with a smile. At age 21, with his undergraduate research underpinning his artistic foundation, he has a growing wealth of artistic perspective to share.

"It'll be a lot of fun."

URSCO: THE VALUE OF RESEARCH

In the Undergraduate Research, Scholarship and Creativity Office, Dr. Lee Phillips has just wrapped up a session with a rising senior, reviewing his ongoing project. It may not make an impact on other scholars or on our world — or maybe it will. Regardless, the director explains, the student is learning skills and approaches that will make an impact on him.

His perception of himself as a scholar engaged with real-world issues will likely spur his career. His abilities will only grow.

The undergraduate projects Phillips' office actively supports — more than 50 currently — are diverse. UNCG undergraduate research isn't just for the lab sciences. It's far-ranging, with projects in virtually every discipline. Student researchers range from freshmen to seniors, and while some contribute to faculty members' existing research

programs, some generate their projects independently.

The office focuses on providing quality opportunities for students to engage in undergraduate research experiences and helps them disseminate the results of their research. The office is also currently working to gauge the value of those experiences. Internal studies have shown that students involved in research or creative inquiry sharpen their academic skill sets and expand their understanding of the subject, Phillips explains. That translates to higher grade point averages than many of their contemporaries. These students are graduating faster as well.

Since 1997, URSCO has invested more than \$1 million in undergraduate research and supported more than 1,000 undergraduate student researchers. The office not only encourages motivated

students to work closely with a faculty mentor on their research, scholarship, or creative projects, they also encourage faculty efforts to involve undergraduates in their research.

Phillips, a professor himself, mentors undergraduates in his discipline, geology. He knows what research projects — and the mentoring that inevitably goes with them — did for him when he was a student. The experiences helped spur him toward where he is now.

"It makes a difference for each student, whether that's in grad school or in their career."

Mark your calendar for the 10th Annual Carolyn and Norwood Thomas Undergraduate Research Expo on March 29, 2016, all day in Cone Ballroom, Elliott University Center.

MAKING A DIFFERENCE IN A DISASTER

Two upperclassmen spent their spring break week in Mexico, researching the aftermath of an environmental disaster.

The students joined UNCG anthropology professor Art Murphy, who was already in Mexico on a Fulbright grant. Murphy was writing a book on families' tragic experiences following a devastating daycare fire in 2009 that killed 41 children in Hermosillo, Sonora, Mexico. But in August 2014, a massive mine spill filled the newscasts, and Murphy's Mexican colleagues asked him to shift focus to the anthropological effects of the spill.

The mine's retaining pond held a lot of heavy metals, and the pond dam broke about 35 miles south of the U.S. border, the water flowing southward. "The mine spilled two million gallons of copper sulfate in the Rio Sonora," Murphy explains. Officials closed the river for irrigation; they barred the use of wells. "They were in dire straits."

Undergraduate Jennifer Plouffe began working with Murphy from Greensboro, researching the mine company and the political landscape in the region for him. Then she and undergraduate Kimberly Najarro secured URSCO Globally Engaged Undergraduate Research and Creativity Awards and traveled to Mexico in March 2015. The two worked with graduate students from the University of Sonora, interviewing scores of families along the river.

They helped assess how the spill affected the citizens downstream economically, with their water supply, and in their daily lives. They found many people traveling long distances to get clean water — their tap water was contaminated. The families' lives were disrupted;

they were uncertain of the future.

The students' research will help officials better plan for and react during future disasters in the region. Preparation is important. Whether man-made or natural, disasters — Murphy's research forte — are always a possibility.

Collecting data and conducting interviews expanded the students' range of experience, as did working in a foreign culture. Plus they made a lot of great professional contacts. The two students plan to publish their research on health and environmental issues in the coming months.

"My experience was wonderful," Najarro says. "Getting to know the people was my favorite part." They knocked on a lot of doors and met a lot of people. The graduate students from Rio Sonora University are now her lifelong friends, she says.

Najarro will graduate in December in anthropology, with a minor in geography, and will go on to graduate school. The research experience has opened her eyes. "I definitely want to explore more — to study the world."

Plouffe graduates in December too. This experience, she says, solidified her plans for graduate school.

"It's a wonderful experience: to learn, to get published, to make a difference. It sets you apart when you go to grad school or apply for that job."

You get a perspective you just can't get on a campus, she explains. "The classroom is not how it is out there. You can only learn so much in a classroom.

"It changes you. It's not just a disaster or chemical spill ... It's people."

A STUDIO ROOM WITH A VIEW

Florence has wonderful Michelangelos. Rome has spell-binding Da Vincis.

"But in Siena, you'll see bold colors, geometric patterning, and quirky spatial experimentation. The presence of these characteristics in painting is particularly Sienese." Art professor Barbara Campbell Thomas points to circular patterning in a 15th century Giovanni di Paolo work as beautiful proof.

If you're an admirer of abstract art — from throughout the centuries — Siena is your art mecca. Especially if a UNCG summer course in Siena lets you be a part of Siena Art Institute's portfolio development offering. When your studio overlooks the tile roofs of the city, what could be more inspiring for an artist?

Anna Stewart, Alison Lindley, and Emily Clark-Kramer took part in the educational adventure led by Dr. Campbell Thomas. The journey was funded by URSCO Globally Engaged Undergraduate Research and Creativity Awards. The art they produced in the studio was site-specific — it was created for that unique space. There was no reason to bring it home. But they took away a lot more.

"I grew as an artist during that month," Clark-Kramer says, adding that she loved having her own space. Viewing the medieval art in the city and creating her own reinforced her viewpoint as an artist. "There is value in abstraction. You see that in the medieval paintings." And it enhanced her work ethic as an artist — "to only work on art." It prepared her for graduate school on the West Coast.

The students toured the great works in the major Italian cities. But the masterworks in the small city of Siena were perhaps most magical. These works taught the students about use of geometric designs, which they used in their art.

In Siena, they could readily visit the Pinacoteca Nazionale and the Palazzo Pubblico, a short walk away. Clark-Kramer was struck by the large 14th century fresco *Allegory of Good and Bad Government* by Ambrogio Lorenzetti there. She was taken by its depiction of

the landscape and the city of Siena of that era — and how the artist depicted interior and exterior scenes.

The relatively diminutive *Castle by the Sea* by Sassetta also made its mark on her. "It has a magical aura to it, for a medieval painting," she says.


Clark-Kramer had been to Italy once, but never Siena. "Being at Italy at that particular time — we were able to visit Florence and Rome and the Biennial in Venice. That was amazing, to see contemporary artists, to see what is huge in Venice."

Campbell Thomas explains that the exposure to art beyond the United States can change a young artist's life. It inspires and broadens their perspective. "It was real and impactful. You can see people change," she says. "They were energized."

Stewart entered graduate studies at New York University this fall. She wants to be a creative art therapist and have her own studio. The Siena experience has already influenced her art, she explains. She once concentrated on two-dimensional static painting; now her focus is temporary installations — sculptural works made for a particular space.

She was particularly inspired by the angel's wings in an annunciation scene in an immense fresco in the Pinacoteca Nazionale. "I made an installation piece on that," she says. Her piece mimics the wings.

Now a graduate student at the Pennsylvania Academy of Fine Arts, Lindley explored the use of soil and brick of Siena - the basic matter of the city. She used the soil underfoot in an interactive installation - and pulverized the brick to use as a paint.

She was struck by the "intimidating responsibility" of having her own studio space. Her own studio — in Siena — to create and display her art. "It felt like, in some ways, turning my brain inside out and exposing it for everybody to see." 

By Mike Harris • Photography by Martin Kane • Learn more about UNCG undergraduate research at <http://ursco.uncg.edu>



INSPIRATION Clark-Kramer and her professor Barbara Campbell Thomas at Emily's Fall 2015 studio space at UNCG. The Siena experience has helped prepare Emily for graduate school on the West Coast.



THIS FALL, UNCG RESEARCHERS BEGIN WORK ON A \$3.2 MILLION GRANT TO STUDY ADHD treatment programs for college students. It will be the first large, randomized, controlled treatment outcome study of college students with ADHD that doesn't involve medication.

The college outlook for most students with Attention Deficit Hyperactivity Disorder (ADHD) is dim. According to research by ADHD scholar Dr. Russell Barkley, only 20 of every 100 clinically diagnosed children with ADHD will get into a four-year college. Only five of those 20 will finish college. And the five who do make it through will often have lower grade point averages, change majors and universities more frequently, and take longer to graduate.

What's behind these numbers? Why do college students with ADHD perform so poorly? Until recently, well-researched answers to these questions were few and far between. But UNCG Professor of Human Development and Family Studies Arthur D. Anastopoulos is changing that. He is one of the first researchers to systematically study ADHD in college students and has been the recipient of several major grants to further this work.

And his efforts are paying off — in the form of new knowledge, effective interventions, and changing lives.

UNCG AND ADHD

Dr. Anastopoulos has dedicated his career to uncovering the mysteries of ADHD. His interest in the field began in 1972, while he volunteered with a local mental health clinic. His assignment was a hyperactive 7-year-old boy who put him through the wringer during their two-hour meetings. Although exhausting, three years of demanding sessions with his young charge inspired Anastopoulos' curiosity about hyperactivity, impulsiveness, and short attention spans.

Anastopoulos went on to study child development at Tufts University, earned his master's in psychology at Wake Forest University, and completed his doctorate in the field of clinical psychology at Purdue. He came to UNCG in 1995 after working at the University of Iowa and the University of Massachusetts Medical School.

For the past 20 years, Anastopoulos has made great strides to put UNCG at the forefront of ADHD research and treatment. In 1996, he established UNCG's ADHD Clinic, which provides state-of-the-art mental health care services and education to the university community, the Triad region, and the state. It has increased understanding of ADHD through clinical research and provided clinical practice training to numerous graduate students and other health care professionals. Through the years the clinic has provided services to thousands of community residents and students.

"Years ago we began doing ADHD evaluations of college students, and I became intrigued," says Anastopoulos. "Most clinically referred kids with ADHD do not enroll initially in four-year colleges."

"We looked to the literature and there wasn't much there for college kids with ADHD. And what was available wasn't high quality or trustworthy. There seemed to be an opening in the college student arena to conduct better research."

THE TRAC STUDY

That gap in the literature and his previous work in the field led Anastopoulos, along with collaborators Dr. George DuPaul at Lehigh University and Dr. Lisa Weyandt at the University of Rhode Island, to

the TRAC (Trajectories Related to ADHD in College) project, now in its fourth year. TRAC is funded by the National Institutes of Health, and follows students with and without ADHD from their freshman year onward to determine how the disorder impacts educational, cognitive, psychological, social, and vocational functioning through the college years.

The five-year, \$3 million, multi-site longitudinal study recruited 456 college freshman across the three campuses (UNCG, Lehigh University and University of Rhode Island), with participants with ADHD carefully evaluated to make sure they met rigorous criteria for the diagnosis. Every year, the students receive a comprehensive evaluation, which looks at ADHD symptoms, executive, emotional, vocational and social functioning, and use of treatment services.

The findings of the TRAC study shed light on the difficulty students with ADHD experience when transitioning from high school to college. For those with ADHD, it's a perfect storm, says Anastopoulos. They leave the shelter of high school where many things are managed for them — school work, meals, laundry, money management, appointments — and enter a world they have to manage on their own. In clinical terms, it's called self-regulation, the ability to manage one's behavior across different settings in the service of reaching personal goals.

“ People get stuck on just having ADHD and are not aware of the increased risk for depression and anxiety, which can make success in college even more difficult to attain.”

The transition from high school to college can be overwhelming even for students without ADHD, much less those that have a deficit in self-regulation, as is often the case in ADHD. "Their gap between demands and capacity for self-regulation is much greater for them than it is for others who do not have ADHD," Anastopoulos says. "There is a substantial mismatch."

In high school, a student with ADHD might have an Individualized Education Plan. Mom and dad might have been monitoring their behavior and activity. Perhaps they were even receiving counseling and taking medicine. But that often stops at college.

Students don't want to be different than their peer group, so they might stop taking the medication. "And the last thing they want to do is go to a disability service office, publicly acknowledge they have a problem and ask for help," says Anastopoulos. Complicating the college situation is the fact that even if students fully accept their diagnosis and seek assistance, most campus resources are inadequate to address all their needs.

And then there is the complicating factor of co-morbidity. The TRAC project has shown that 55 percent of college students with rigorously defined ADHD have a second or third diagnosis, relative to 11 percent of college students without ADHD. The other diagnoses are mainly major depressive disorders or anxiety disorders that will likely become worse during college. "Quite commonly, people get stuck on just having ADHD and are not aware of the increased risk for depression and anxiety, which can make success in college even more difficult to attain," says



TRAILBLAZER Dr. Anastopoulos is one of the first researchers to systematically study ADHD among college students.

Anastopoulos.

To manage these situations best, Anastopoulos and his colleagues recommend that co-morbid conditions need to be managed before a student reaches a college campus.

What that means is that parents and teachers of high school students need to become more aware of these additional problems while the student is still in high school. They need to get on top of these problems with treatment — not just treatment for ADHD — while in high school and then during the transition into college for continuity of care.

Parents should also initiate a gradual process of having their son or daughter assume increased responsibility for managing themselves in preparation for the increased demands for self-regulation that come with college.

ACCESS

For Anastopoulos and his colleagues, the findings of the TRAC study confirmed that colleges need more treatment services for students with ADHD. And that's where the ACCESS (Accessing Campus Connections and Empowering Student Success) program was born.

Anastopoulos, his colleague Dr. Kristen King, and some former graduate students initially designed the ACCESS program in 2011 thanks to a \$3 million grant received by UNCG and two other North Carolina universities to aid college students with learning style differences. The funding came from Oak Foundation and GlaxoSmithKline along with \$500,000 in matching support from local Triad foundations.

The grant charged each university with creating programming for college students with learning challenges. UNCG focused on ADHD, but right off the bat, they hit a snag.

"The challenge was, there were no well-done studies of treating college students with ADHD for us to review," says Anastopoulos. "So we turned to the adult ADHD literature. We borrowed from adult cognitive behavioral treatment programs and tailored it to college students."

For participants like UNCG senior Meredith Anderson (name changed), who joined the ACCESS program in the fall of 2012, the program has improved her skills and her comfort level.

"I knew many of the things we talked about skill-wise, but the program gave me a place to implement them in my life in new ways as an independent person while providing wonderful support and accountability," says Meredith. "My awareness was heightened as I understood for the first time some things I did and ways I felt socially that are related to ADHD."

The ACCESS program begins with an eight-week active treatment program in the first semester, where students participate in eight 90-minute group therapy sessions. They learn about ADHD knowledge, behavioral strategies and cognitive therapy techniques. Staff from different support services on campus come in to educate the students. "The point is to demystify the campus services so students are more comfortable with them," says Anastopoulos.

"The most comforting and empowering moment sometimes in a small group was the moment someone said, 'You do that?! Me too!'," says Meredith. "It crushed the lies that we are alone in our struggles or that no one understands. It reminded me I'm doing better than I sometimes may think I am."

At the same time they have an individual mentor, whose job is to reinforce what's learned in the group. The mentor evaluates them and helps facilitate their entry into campus support services, and they provide personal coaching.

INITIAL RESULTS FROM THE ACCESS PROGRAM PRESENTED AT THE 2014 AMERICAN PSYCHOLOGICAL ASSOCIATION MEETING

Significant increase in:

- ADHD awareness
- Self-reported organizational behaviors and adaptive thinking
- Use of support services

Psychotherapy use increased from 18 to 30 percent

Pharmacotherapy use increased from 55 to 80 percent

Disability services registration increased from 38 to 70 percent

Disability services usage increased remarkably from 15 to 63 percent



ALL ACCESS Human Development and Family Studies graduate student Kaicee Beal mentors participants in the program.

ACCESS is composed of three main parts: knowledge of ADHD, behavioral strategies, and cognitive therapy techniques.

The first part of the program is the knowledge element. Most students come to college with poor knowledge of their own disability. "On our ADHD awareness test, those with ADHD average about 25 out of 50 correct. The comparison group, those without ADHD, score 23 out of 50 correct. If you understand your disability, you accept and manage it better. We thought we had to increase their knowledge of ADHD."

The second part is a behavioral piece, looking at skills like time management, planning, organization, scheduling, and tracking. "Students with ADHD need to have these skills or they are in big trouble," says Anastopoulos. "We teach skills that help them not only in the educational domain but also the social and emotional aspects of college life."

The third part of the ACCESS program is cognitive therapy. The way people think affects the way they behave and feel. Many college kids with ADHD have maladaptive beliefs, like "I do better at the last minute" or "I can never do well in school." The program teaches them to be aware of these thinking errors that can lead to depression and anxiety. Cognitive therapy strategies help participants deal with existing anxiety and depression and head off anxiety and depression that can present itself.



EVIDENCE-BASED Dr. Kristin A. King, ACCESS Project Coordinator, demonstrates how to lead a cognitive behavioral therapy group.

"The mentoring was the most crucial part of my experience, and the aspect of the program I have used the most," says Meredith. "Having someone I could share places I was struggling with, and who knew the science of what I was dealing with, and had the skills to help me by helping me figure out how to do it myself was such a good experience for me.

"She was also so faithful to point out when I was doing really well at handling a situation or when I had improved in an area," says Meredith. "Communicating that meant so much because she saw my struggles deeper than I let others see them and still saw wonderful things in me. It made me a lot more confident in who I am and that my life is not defined by my illness."

The second semester of the ACCESS program is the maintenance phase. Group therapy sessions are reduced to one and mentoring is reduced to five or six sessions. "We don't want to create young adults that are dependent on us," says Anastopoulos. "We more provide oversight to make sure they have the skills before we let them go.

"The thinking is that if we see improvement/change in these behaviors and knowledge, we'll see improved school, social, and emotional functioning."

But the study has its limitations. There was no comparison group and only a limited period to gather data. "We don't know how these numbers go over time," says Anastopoulos.

So Dr. Anastopoulos worked in concert with Dr. Joshua Langberg at Virginia Commonwealth University, or VCU, to apply for a grant from the U.S. Department of Education, Institute of Education Sciences, to continue the ACCESS program. In March 2015, they were awarded \$3.2 million for a program that began this fall. It will be the first large, randomized, controlled study of college students with ADHD that doesn't involve medication.

THE NEW STUDY

The study is a two-site project jointly undertaken by UNCG and VCU, with UNCG as the lead institution and Anastopoulos as the lead principal investigator.

Over the course of five consecutive semesters, 240 students will be enrolled, 120 of those at UNCG. Of these 120, half will immediately begin the ACCESS program, and half will be delayed by two semesters in order to create a control group.

Everyone in the program receives a thorough evaluation of ADHD and comorbid conditions free of charge. And each student receives \$70 for taking the evaluation and a written summary that they can take to treatment services — even those in the delayed treatment control group.

While waiting for treatment, students can still seek other treatment on their own before starting ACCESS. "Their actions will be seen as treatment as usual and compared with active participants," says Anastopoulos.

To determine whether ACCESS treatment works, researchers will collect information at the beginning of the semester, at end of the semester of active treatment, and at the end of maintenance phase. Then, a fourth evaluation is conducted six months after treatment has ended.

"We aren't saying ACCESS is the be all and end all of ADHD treatment. We're saying to effectively treat ADHD in college students, you need multiple treatments in combination," says Anastopoulos. "ACCESS adds another layer to the treatment landscape. It encourages students to get the other assistance they need."

For students like Meredith, it's had a big impact. "I still have all the materials from the sessions and I feel so much more confident to deal with my ADHD now than in the past." 🗣️

*By Mary Leigh Howell • Photography by Mike Dickens & Martin Kane •
For reasons of confidentiality, no research participants were photographed.
Learn more at <http://adhd.uncg.edu>*



Who Tells My Story? Race and Representation Through the Lens of Children's Lit

Seventy-five years ago, a 6-year-old African-American boy named Clay McCauley Jr. asked a simple question about the books he read: "Why don't any of the people look like me?"

The woman to whom he posed this question was Stella Gentry Sharpe, a neighbor and schoolteacher in Hillsborough, North Carolina. She responded by creating a children's book featuring African-American children — one of the first to depict African Americans in ways that challenged demeaning stereotypes. The book *Tobe*, published in 1939, features a series of striking photographs of children living and working on a rural farm in the time of the Great Depression.

Publisher UNC Press hired Greensboro photographer Charles Farrell to capture the images for the book. It was these photographs — found in the North Carolina Collection archives at UNC Chapel Hill — that first captured the attention of UNCG Professor of History Benjamin Filene. "Who were these people?" he wondered. "How did these images come about, and what did the people in the pictures think about their portrayal?"

These questions and more led Filene to Hillsborough and then to Goshen — a historically African-American community, just a few miles from UNCG, where Farrell had photographed families for the book. Through census records, city directories, and word of mouth, Filene tracked down the subjects of the photographs — several of whom were still living — as well as their descendants and other community members. He documented their experiences through approximately two-dozen oral history interviews, which trace the paths of these families from the 1930s to the present.

Through his intensive research, Filene saw the story of *Tobe* open up to reveal a broader theme: the complex history of race and representation. Drawing on *Tobe's* images, the interviews, and the community histories, Filene will explore this theme in an upcoming exhibition titled *Reading, Writing, and Race: One Children's Book and the Power of Stories*.

Filene is planning the exhibition with staff of the Levine Museum of the New South in Charlotte, with funding from the federal Institute for Museum and Library Services. The exhibition will feature original images from *Tobe*, as well as alternate images

ultimately not selected for inclusion in the book, a history of efforts to challenge the "all-white world" of Dick and Jane, a "reading nook" stocked with multicultural titles, and opportunities for visitors to create their own stories. It will also highlight contemporary questions of representation and identity, with media pieces about how black youth are depicted in contemporary media and the "Black Lives Matter" movement.

Stella Sharpe and Charles Farrell sought to present *Tobe* as a counterpoint to the pervasive stereotypical images of African Americans at the time. But Filene points out, "These images were created and presented by white people."

"We have to ask — who gets to tell the story, whose story gets told, and how does storytelling have both historical and contemporary power?"

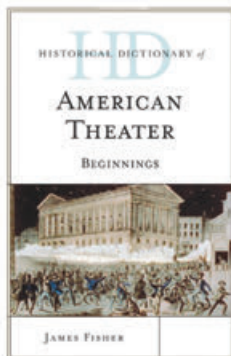
By considering these questions, exhibition visitors are invited to examine the larger proposition that representation matters. "The cultural assumptions we carry shape whom we trust, whom we protect, and whom we fear."

Filene hopes museum visitors will come away from the exhibition experience with a heightened awareness of the power of culture to shape one's understanding and attitudes. He hopes the exhibition will encourage visitors to make thoughtful, engaged decisions about culture, including the words they use, the books they read to their children, and the movies they watch. Filene observes, "Even though these are sources of fun and comfort, they're also realms that have power and where positive change can happen."

Filene staged an initial version of the exhibition at the North Carolina Collection Gallery at the University of North Carolina at Chapel Hill from October 2014 to March 2015, to celebrate the 75th anniversary of Tobe. He plans to open the expanded exhibition in Charlotte at the Levine Museum of the New South in the fall of 2018.

By Laura Gonzo • Photography from the North Carolina Collection, University of North Carolina Library at Chapel Hill • Learn more at <https://www.uncg.edu/his/faculty/filene.html>

Historical Dictionary of American Theater: Beginnings, 1538-1880



What is your next move, artistically speaking, with a three-decade-long career under your belt that includes 150 theater productions, a dozen books, numerous published essays, and the distinction of having been named "Indiana Theatre Person of the Year"? If you are Jim Fisher, the answer is simple; you go back to the beginning.

With his latest work, Fisher, professor of theatre, wraps up a colossal, multi-book roadmap of the American stage.

Historical Dictionary of American Theater:

Beginnings: 1538-1880 culminates a long-standing project that includes *The Historical Dictionary of American Theater: Modernism: 1880-1930*, published in 2007 (and co-authored with Felicia Hardison Londré), and the two-volume *The Historical Dictionary of Contemporary American Theater: 1930-2010*, published in 2011.

Beginnings, published by Rowan & Littlefield, traces the rise of the modern stage from the early colonial era to the United States of America's first century. In Fisher's previous theater references, experimental productions such as Tennessee Williams's *The Glass Menagerie* loomed large, but this time around the spotlight is on the stage's practitioners. This latest *Historical Dictionary* contains over 1000

entries on American stage pioneers such as Edwin Booth, Lewis Hallam, David Douglass, Mercy Otis Warren, Edwin Forrest, Charlotte Cushman, Joseph Jefferson, and Ida Aldridge.

"It's often said that there were no great American dramatists prior to the emergence of Eugene O'Neill around World War I," says Fisher. "This, of course, isn't really true." The American stage predates the Revolutionary War by two centuries. The late 18th and 19th centuries, in particular, gave rise to a rapidly expanding theater culture, says Fisher.

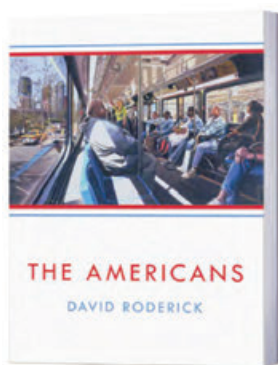
He points to playwrights such as Dion Boucicault, an Irish-American writer whose 1859 play *The Octoroon* pushed the hot-button issue of race at a time when the country was embroiled in a debate over slavery.

"[Boucicault's drama] had a potent impact on the raging debate to its time, slavery," says Fisher. "[It] established that great drama in the United States could be more than mere entertainment." Boucicault and the other playwrights featured in the reference left a grand legacy for their theater progeny, including Fisher himself, who credits those early practitioners with raising the bar high.

"I have worked on many, many great American plays," says Fisher. "And with each experience my respect for what American artists have created has only grown."

By Judy Caldwell-Midero • Learn more at <http://performingarts.uncg.edu/bios/james-fisher>

Stanzas in Suburbia



It turns out the most poetically inspiring spot around just may be a Greensboro suburb.

Or perhaps it takes the right person to see the poetic possibilities.

"I live in Sunset Hills. My poems in my recent book are meditations on the neighborhood," says UNCG English Professor David Roderick. The volume, *The Americans*, recently

won the international Julie Suk Poetry Award as best book of poetry from an Independent Press.

At the award ceremony, fellow UNCG poet Stuart Dischell explained that the Sunset Hills neighborhood has been home to a number of UNCG poets and writers since its development in the 1930s. Dischell himself once lived there.

"He and I joke about who will be the one to write a poem

titled 'The Grills of Sunset Hills,'" Roderick comments wryly.

In presenting the Julie Suk Poetry Award, editor Richard Krawiec praised Roderick's approach. "David's book stood out. No syllable was out of place. He has a book that loves suburbia, without ignoring its flaws."

The Americans traces life in Greensboro over Roderick's eight years in the city. "The poems are meditations on American life," he says.

His work explores the pace and atmosphere of Greensboro — and the tension between his current comfortable life and the strife and wars of the larger world. "It offers praise to what [suburban] life brings us," explains Roderick, "but [remains] realistic that this life does not exist in a vacuum."

Roderick's first book of poetry, *Blue Colonial*, focused on New England, where he has also lived. That volume netted him The American Poetry Review Honickman Prize in Poetry.

By Mike Harris • Learn more at <http://mfagreensboro.org/faculty/david-roderick/>

THE DATA WRANGLER

Imagine you're working on a treatment protocol to help patients overcome addiction. It's vitally important to determine whether or not the treatment is effective, so you conduct a clinical trial. This seems like a straightforward solution, but how useful is your data when the participants, for a variety of reasons, do not always fully adhere to the treatment protocol? How do you know if — or how well — the treatment works?

"I'm by no means the first person to think about this problem, but my impression is that it is often not accounted for, because it is hard to deal with statistically," says UNCG Assistant Professor of Economics Martijn van Hasselt. Through a grant from the National Institute on Alcohol Abuse and Alcoholism, Van Hasselt is developing a set of statistical models and methods to provide researchers with an elegant solution.

As an issue affecting clinical trial data, non-compliance behavior presents a number of methodological and statistical challenges. To help organize all of this unruly data, Van Hasselt has chosen a statistical tool wielded by few economists — Bayesian modeling.

Economists, according to Van Hasselt, usually don't work with Bayesian models, which are commonly used in fields like medicine and biostatistics. Van Hasselt has more experience in those areas than the typical economist — before joining the Bryan School of Business and Economics in 2014, he spent four years as a research economist for RTI International, evaluating government-funded health care projects.

In Van Hasselt's work, a Bayesian model quantifies prior uncertainties about important unknowns — compliance behavior and treatment effectiveness for example — as a range of possible values with probabilities assigned to them, with a mechanism that relates those unknowns to patient outcomes. Outcome data from the

clinical trial are then fed into the model. Depending on how the data fit, researchers begin to resolve prior uncertainties, making statistical inferences, for example, about the level of compliance and the effectiveness of treatment.

An advantage of Bayesian modeling is that you can leverage information from multiple sources. Existing evidence taken from earlier studies about the effectiveness of various treatments, such as for alcohol abuse or addiction, can be used together with the data gleaned from a new clinical trial, to better inform an understanding of the impact of the treatments.

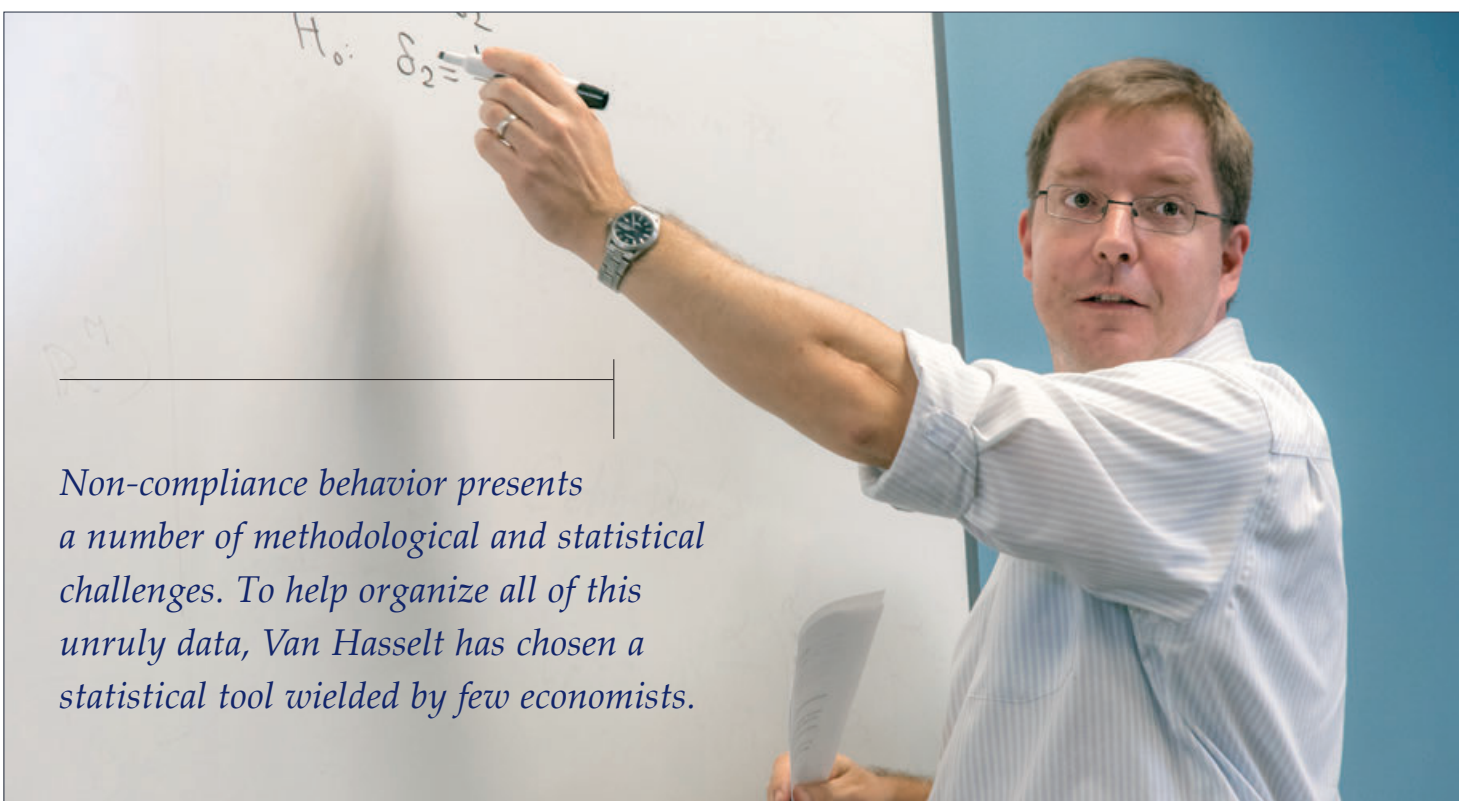
Van Hasselt is applying his model to data produced by a large clinical trial study on alcohol abuse and alcoholism, which was completed some years ago.

"The anticipated impact is that we'll be providing researchers in the field with a set of tools that are intuitive, that can be easily implemented, and that adjust inference about the effectiveness of interventions to account for non-compliance."

But the findings from this study are not limited to treatments for addiction or even to medical protocols. "What I really want to do," states Van Hasselt, "because I am ultimately a social scientist and an economist, is take some of the results from this research and apply them to the evaluation of social programs, or economic programs, or economic incentives."

As a first step to that end, Van Hasselt hopes to make his methodology available via software that will allow people to work with the models and modify them for their own purposes.

By Laura Gonzo • Photography by Martin Kane • Learn more at <http://bae.uncg.edu>



Non-compliance behavior presents a number of methodological and statistical challenges. To help organize all of this unruly data, Van Hasselt has chosen a statistical tool wielded by few economists.



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ON SEPTEMBER 8, 2015 Franklin D. Gilliam Jr. became the 11th chancellor of UNCG. "From the local to the global, in student life and in the laboratory," Gilliam says, "our world-class scholarship, innovation, and engagement demonstrate UNCG's commitment to the health and vitality of our local, regional, and global communities."

