FALL/WINTER 2016

EXCHANGE

BENEATH THE SURFACE

Student Researcher Explores Vast Undersea World

UNC CHARLOTTE
College of Liberal Arts & Sciences

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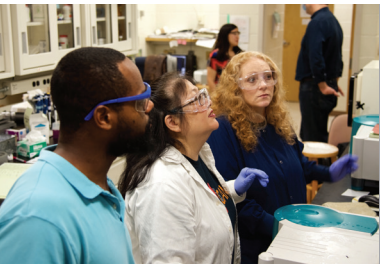

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The College of Liberal Arts & Sciences
UNC Charlotte
9201 University City Blvd.
Charlotte, N.C. 28223
clas.uncc.edu | exchange.uncc.edu
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flickr.com/photos/unc_charlotte_clas/

Editor Lynn Roberson.
Designer Angette Williams.

Send comments or story ideas to lynnroberson@uncc.edu.

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About the Cover:
The Reitzel Lab studies marine animals, including these North Carolina sea urchins, in the lab and in natural habitats. Image: Lynn Roberson.

Dear Alumni & Friends,

In the third week in September, African American Charlottean Keith Lamont Scott was killed by a police officer, and in the next week, the city of Charlotte responded with protest, sometimes violent and sometimes peaceful. The shooting occurred late in the afternoon on September 20, just a short half mile from our campus. Our students, also members of the Charlotte community, reacted to this horrific event in respectful and thoughtful ways—with non-violent demonstrations, with peaceful marches, and with individual expressions of community and grace. But our campus community is not a bubble, and we also saw unfortunate examples of hostility and hate.

The College of Liberal Arts & Sciences (CLAS) is committed to the values of community, of diversity and inclusion, and of ethical behavior. The killing of Mr. Scott has reinforced the need, more than ever, to help our students and each other learn to navigate the world with curiosity, compassion, and empathy.

Prior to these events at the end of September, CLAS had mounted a campaign to raise the visibility of this commitment, so that our students would know that racism, sexism, homophobia, and oppression of vulnerable populations would not be tolerated in our community. Such actions include identifying curricula in our programs that study these issues so that our students can more easily find them, communicating more effectively when we schedule speakers and programs on these topics, and exploring opportunities for additional relevant programming.

Now, more than ever, CLAS must be recognized as a welcoming place, where students and faculty can learn, engage in the exchange of ideas, and explore our world without fear.

In this issue, one of our stories highlights the work of Dr. Cherie Maestas, Rauch Distinguished Professor of Political Science, and Dr. Sara Levens, Assistant Professor of Psychology, who are researching the emotions of the Charlotte community, as a result of Mr. Scott's killing. This is only one response of several by college faculty and students in the aftermath of the events of late September, which include artistic, pedagogical, and research-driven actions.

Other stories demonstrate the pervasive engagement of the college and the community in trying to address issues of social justice and societal needs: Dr. Shelley Listwan's work to understand recidivism rates, the Charlotte Teachers Institute's summer programing that brought Charlotte-Mecklenburg Schools teachers to the laboratories of working scientists, and the efforts of UNC Charlotte Geography undergraduate students, Jamal Covington and Devin Martin, to provide neighborhoods a tool to solve issues such as burned-out street lights.

Inquiry into better understanding our world comes from other stories: Dr. Vasily Astratov's identification of a new field of study, microspherical photonics, that explains the physics behind such mysteries as the Whispering Gallery in St. Paul's Cathedral in London; Dr. Adam Reitzel's work with marine invertebrates in the study of circadian clocks; and Dr. Akin Ogundiran's archaeological explorations in Nigeria that produce a different narrative about how west African became a global economic player. While it may appear that the research of Dr. John Reeves, Blumenthal Professor of Judaic Studies, in the religion of late antiquity and the early medieval period, has little to do with the early part of the 21st century, certainly the objects of his study, religious zealotry and apocalyptic fervor, resonate with our own experience of our complex and interwoven global community.

In my letter in the previous issue of *Exchange*, I celebrated the role of the Africana Studies Department in the founding and the accomplishments of the National Council for Black Studies. In this letter, I note that the college's mission of education and research to "leverage discovery for the public benefit," remains constant. I invite you into these pages and welcome hearing from you. &

Nancy A. Gutierrez

DEAN NANCY A. GUTIERREZ
COLLEGE OF LIBERAL ARTS & SCIENCES

News Briefs

Provost Joan Lorden (l) presents award to Ryan Kilmer.

1 Psychology Receives Provost's Teaching Excellence Award

Psychology Department celebrates teaching award.

The Department of Psychology has received The Provost's Award for Excellence in Teaching for 2016, in recognition of the department's efforts to improve students' learning and outcomes, through the collective responsibility of faculty members for maintaining high-quality teaching.

Provost and Vice Chancellor for Academic Affairs Joan Lorden presented the honor at a reception on Oct. 5, 2016. The Department of Psychology's goal is to educate students who have a strong knowledge base in the concepts and methods of the discipline, who can think critically about issues of human behavior and human thinking, and who can apply psychological concepts to a variety of real-world problems and situations.

The department has implemented a number of initiatives, such as developing online learning through its work with the Center for Teaching and Learning; a review and revision of the undergraduate curriculum; and support for two learning communities for entering first-year students and new transfer students. Community-based research and short-term international experiences have become critical elements of the department's focus.

2 Psychology's Kilmer Lauded for Community Engagement

Dr. Ryan Kilmer, Professor in the Department of Psychology, has received the 2016 Provost's Faculty Award for Community Engagement. Throughout his over 15 years of conducting community-based research at UNC Charlotte, Kilmer has focused on factors influencing the development of children at-risk for emotional, behavioral, and/or academic difficulties, particularly children's resilience and adjustment to trauma; and the use of evaluative research to guide system change, program refinement, service delivery, and policy.

Kilmer has been a key partner in UNC Charlotte's relationships with both Mecklenburg and Cleveland counties' systems of care, working with schools and family advocacy programs to support children with mental health problems and their families. The most recent focus of Kilmer's community engaged scholarship is on early childhood development in Charlotte-Mecklenburg Schools. Under the threat of funding cuts, Kilmer was part of an advocacy effort to address the importance of quality pre-K programs. He played a significant role in the most comprehensive evaluation of the program in its history.

3 Team Finds Rare Roman Gold Coin at Mount Zion Dig Site

The UNC Charlotte team that is conducting archaeological excavations on Mount Zion in Jerusalem has discovered a rare gold coin bearing the image of the Roman Emperor Nero.

"The coin is exceptional, because this is the first time that a coin of this kind has turned up in Jerusalem in a scientific dig," said Shimon Gibson, co-director of the excavation and a visiting professor at UNC Charlotte. "Coins of this type are usually only found in private collections, where we don't have clear evidence as to place of origin."

The image of Nero is significant in that it shows the presence of the Roman occupation and provides a clear, late date for the occupation of the residences. There is no historical evidence that Nero ever visited Jerusalem.

James Tabor, co-director of the excavation and Professor of Ancient Judaism and Early Christianity in the Department of Religious Studies, pointed out that the coin is dated "to the same year of St. Paul's last visit to Jerusalem, which resulted in his arrest (on the charge of taking Gentiles into the Temple) and incarceration in Caesarea."

4 Faculty Members Receive College Teaching Excellence Awards

In recognition of their exceptional teaching, Allison Hutchcraft, Susan Hodge and Joseph Kuhns received the College of Liberal Arts & Sciences' Excellence in Teaching Awards for 2016.

Hutchcraft, a faculty member in the Department of English, received the Award for Outstanding Teaching by a Part-Time Faculty Member. Hodge, a faculty member in the Department of Criminal Justice and Criminology, received the Award for Outstanding Teaching by a Full-Time Lecturer. Kuhns, a faculty member in the Department of Criminal Justice and Criminology, received the Integration of Undergraduate Teaching and Research Award.

Hutchcraft has been an adjunct lecturer in the English Department at UNC Charlotte since fall of 2013. She teaches creative writing courses in poetry and fiction, supporting students in becoming active, engaged and empathetic citizens of the world. Hodge teaches criminal justice courses and is the department advising coordinator, working to insure students are on the correct path toward graduation and fulfilling careers. Kuhns teaches courses in policing, community policing, drugs and crime, and research methods. His research includes a focus on the impact of community policing and problem-oriented policing, and use of force.

Dean Nancy Gutierrez (left) with Kuhns, Hodge and Hutchcraft.

5 Faculty Member Earns Award for International Work

For his international work in advancing public sector performance, UNC Charlotte researcher James Douglas has received the Senator Peter B. Boorsma Award. The Southeastern Conference for Public Administration presented him the award in October.

The Boorsma Award honors a practitioner or academician who facilitates over many years the international exchange of knowledge and administrative practices that foster better performance in the public sector.

Douglas is a professor in the Department of Political Science & Public Administration in the College of Liberal Arts & Sciences. He was a Fulbright Scholar in Estonia at Tallinn University of Technology in 2014 and an advisory board member for the Center of Governance and Public Management at the Lahore University of Management Sciences from 2013 to 2015. He has consulted with and taught public officials in Japan, China, Pakistan and Estonia, focusing on public policy best practices.

"Receiving the award affirms in my mind that the work I have been doing abroad is meaningful and is hopefully making a difference in the world," Douglas said.

Pragmatic Pursu

Scholar Recaptures Biology, Philosophy Conversation

Trevor Pearce

In the contemporary world, natural sciences and philosophy may seem to be worlds apart. Yet, these disciplines are not always estranged.

"I think now, when we think about biology and philosophy, it's more about reducing philosophical theories to biology or thinking that we could talk about ethics in strictly biological terms," says Trevor Pearce, a UNC Charlotte philosophy assistant professor.

"But I think the early pragmatists offer us a different way of engaging with biology, where we're not reducing culture to biology or reducing ethics to biology," Pearce says. "Rather, we're using this kind of biological paradigm to think in a new way about things like ethics or knowledge. Thinking of ourselves in a biological way doesn't have to mean that we're just reduced to our biology."

Pearce currently is researching the historical connections between philosophy and biology. He has published book chapters and papers on the topic, including in *Journal of the History of Ideas*, and the *Journal of the History of Philosophy.*

His National Science Foundation-funded book project, *Pragmatism's Evolution: Organism and Environment in American Philosophy,* is exploring how developments in the life sciences at the end of the 19th century shaped the ideas of American philosophers such as William James, John Dewey, Jane Addams, and W. E. B. Du Bois.

"They're one of the first groups of philosophers to be directly influenced by the ideas of Darwin and other evolutionary thinkers," Pearce says. "They were there at just the right time for that to happen. The book is about how biological ideas affected the ideas of these particular philosophers. So, my work tries to recapture this conversation between biology and philosophy happening around 1900."

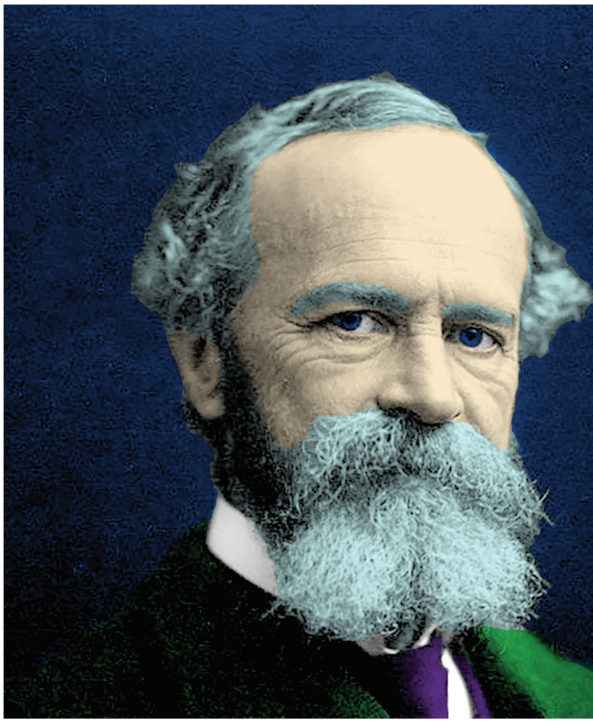
These philosophers focused largely on the practical implications of philosophy, viewed through the lens of experimentation. They believed philosophical theories should be judged by their practical results, thus, the name pragmatism.

"Pragmatists try to put theories into practice and see what happens," he says, "They are experimenting in philosophy in the same way that people experiment in science."

For those curious about the advent of pragmatism and its relevance to modern research, the book may broaden their notions of what falls under the name of pragmatism. "It may appeal to those already interested in the question of how evolution changed our way of thinking, and what it means to be human," Pearce says.

Pearce looks specifically to biological debates and science of the 19th century, an important period for academic discourse.

"All the debates at this time were really about how evolution works," he says. "Everyone kind of accepted that evolution



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"Pragmatists try to put theories into practice and see what happens. They are experimenting in philosophy in the same way that people experiment in science."

— Trevor Pearce

happens, but they were still debating about how it worked." This wider acceptance of evolution as reality provided an intellectual climate for philosophers to participate in more practical thinking.

"Looking back, we don't usually realize that philosophers are following along with these scientific debates," he says. "But, if you look at the footnotes, there's just clue after clue that those connections were there."

He first found these hints while completing his dissertation. "I got interested in the interaction between organisms and their environments and discovered that these philosophers working at the end of the 19th century were also really focused on this question about organism environment interaction," he says.

During his research, Pearce recognized a pattern in the language used. "I noticed a striking use of biological vocabulary that we don't see as much in philosophy now," he says. "So, just following up citations to various biologists at the time is what really led to the project." He continued to systematically look at other philosophers of the time, tracing the "biological roots" of their thinking.

He is sifting through published and archival sources, such as library records of universities attended by prominent pragmatists. He parses lecture notes from their classes and letters of correspondence among philosophers and biologists to find these connections.

"W. E. B. Du Bois, this famous thinker about race, took a class with William James at Harvard in 1889," he says. "It was a class on theistic ethics, sort of religion inspired ethics, the last class where you'd expect a discussion of evolution to happen. But, we actually have Du Bois' notes from that class and there's a whole section where James talks about different views of evolution and how it works. Because it turns out, the religious ethics that he's talking about in that class is opposed to evolution and so evolution comes up a lot."

Pearce has incorporated into his classroom selected results of his research. The innovative method of thought utilized by pragmatists, he believes, can prove relevant to contemporary education.

"One of them, John Dewey, says pragmatism is really an experimental attitude," he says. "I happen to think that the approach that they take, especially this experimental attitude, is still a useful attitude to have today." &

Words: **Alexandra Celender** | Illustration: **Robyne Pomroy** | Images: **commons.wikimedia: Du Bois** (clockwise, from top)**, Addams, Dewey, James**

Sculptures in the Grove honor Osun.

Ogundiran excavates pegmatite (glass-sand).

The team has discovered glass-making tools.

the GROVE

Sacred Grove Reveals New View of Africa's Past

Surrounded by the sprawl of a modern city, the dense forest grove of Osun-Osogbo in southwestern Nigeria has long stood as a silent sentry guarding the mysteries of the ancient past. Those secrets are now revealed by UNC Charlotte researcher Akin Ogundiran, whose work has upended long-held views of how west Africa became a global economic player.

Ogundiran, chair of the Africana Studies Department and professor of Africana studies, anthropology and history at UNC Charlotte, has spent years sifting through the soil of Osun-Osogbo.

His research is proving that Africa – long thought to be a mere supplier of raw materials and labor to a world considered more civilized – was actually a significant manufacturing pioneer with finished goods eagerly sought by European traders.

"Many scholars of the previous generation already made up their mind that it was not possible for African cultures to develop iron production on

their own, to build cities on their own," Ogundiran says. "Africa was coming out of colonialism in the 1960s, so the kind of historical view that was created at that time tended to denigrate past achievement."

As a young boy growing up in Nigeria, Ogundiran had heard the narrative that was long accepted. As the widely held story goes, African communities knew how to trade, but had not created technologies and products on their own.

A critical focus for his research was how the Yoruba people of west Africa became part of the global economy.

"It's a big question," he says. "Societies that were autonomous, with their own traditions, own economic systems and own way of life – when and how did they become part of wider economic networks?"

Researchers had probed the question before, but mostly focused on the Atlantic coast and the contact the Yoruba had with Europeans. "I'm saying, 'No, no – the coast was actually just a point of exchange," he says. "The goods were coming from the mainland. That was the center of the action."

To unearth clues to Nigeria's precolonial economy, Ogundiran needed a piece of ground that had escaped the rapid development of much of his home country, land that had somehow been sealed off from development for more than a thousand years. That search led him to Osun-Osogbo.

Local people had for centuries set aside the sacred grove for the worship of the Yoruba goddess, Osun. A UNESCO World Heritage site, the grove has been preserved for its religious and cultural importance. Long before the 75-acre forest was a place of worship, it was the site of a thriving village, and residents left behind fragments of their economic life.

Permission secured to do his work, Ogundiran and his team began digging. They unearthed pottery, terracotta figures, brass jewelry, and cowrie shells once used as currency. As Ogundiran peeled back years through layers of soil, he found artifacts dating from the busy trading years of 1575 to 1720. He found pipes modeled after prototypes from Florida, which were used to smoke tobacco imported from Brazil.

While all these finds proved significant, the most exciting finds were broken pieces of glass.

"These were not just glass beads," Ogundiran says. "We also found glass waste products and raw materials, indicating there must have been some glassmaking industry around that area. We began to see glass-making crucibles."

Historians had long considered African glass-making a kind of recycling. The common thinking was that Africans imported glass from the Mediterranean and melted it to make beads. That type of glass was typically fragile, crumbling to dust if not preserved. Ogundiran's glass was rock-hard.

"It shows that as early as about 1100 AD, they were making glass products," he says. "When the Portuguese and Dutch arrived on the coast of west Africa, they did not have sufficient products of their own that people desired."

What people wanted was Yoruba-made glass. Tinted into lush blues and greens with the addition of cobalt and magnesium, the glass was a desired commodity, moving from manufacturing sites in the heartland to the European traders' hands on the Atlantic coast. Europeans plied these beads to different African nations along the coast.

Ogundiran's research at Osun-Osogbo revealed the early peoples of his homeland were much more than middlemen. He and a colleague published their findings in the *Journal of Black Studies.*

"Glass-making is one of the tests of a really great civilization," Ogundiran says. "This is changing the narrative of Africa as a continent just supplying raw materials." The complexities of turning a composition of different minerals into highly specialized, very hard and brightly ornamental glass signal the existence of protected intellectual property, he says.

Ogundiran has received support from the Social Science Research Council, Wenner-Gren Foundation for Anthropological Research, National Endowment for the Humanities, Dumbarton Oaks, The Carnegie Foundation, and the National Humanities Center, among others, to further his research.

He is widening his focus to other parts of the Yoruba region, studying how people managed to thrive in places where the environment is highly challenging.

"I'm now asking questions regarding the environment and social resilience, how societies built cities as a way of creating resilient adaptations," he says.

Ogundiran plans a book that will describe the history of the Grove from 1575 to present, with a focus on how to protect what is special about the place even as the city surrounding it grows.

Protecting the land is crucial, he says, for its biodiversity and also for its archaeological secrets that only now are being revealed. &

Words: **Amber Veverka** | Images: **Courtesy of Akin Ogundiran and Lynn Roberson**

RESEARCH REALITY

Teachers Study With Researchers In CTI Initiative

Teachers lay the foundation for students to understand and embrace science. This significant role holds true whether the students aspire to scientific careers or simply need as citizens to understand how scientific research can help their everyday lives.

Despite their critical role, teachers often find themselves limited in their exposure to the settings where scientific research occurs.

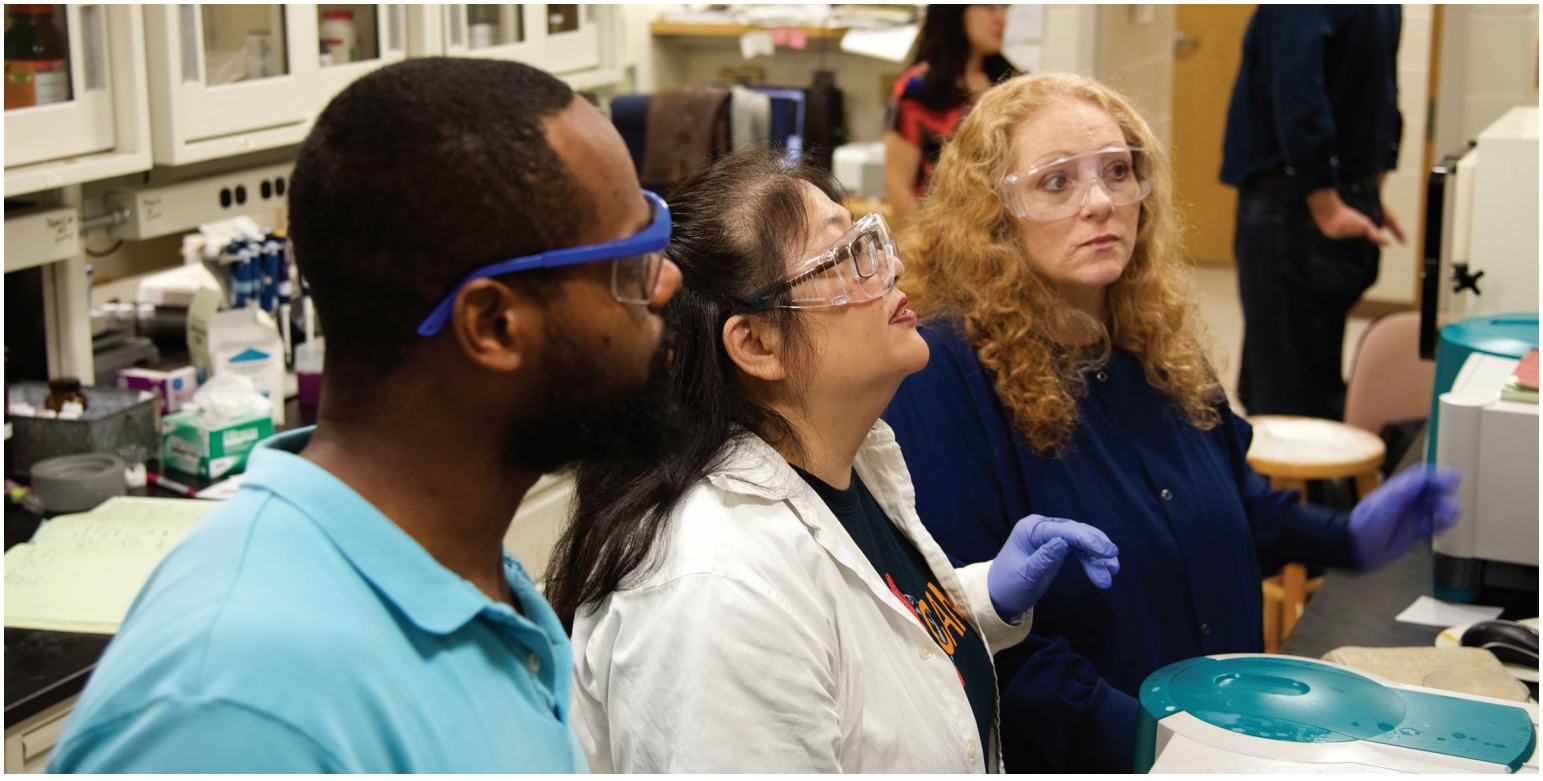
This summer, Charlotte Teachers Institute worked with UNC Charlotte professors Susan Trammell and Marcus Jones to address that gap. Through a pilot program called the Summer Research Experience for Teachers, Charlotte-Mecklenburg Schools teachers collaborated with professors and graduate students in UNC Charlotte lab settings.

"I wanted to give teachers a first-hand look at what it is like to be a scientist," Trammell says. "The teachers that I worked with come from many different grade levels and will prepare the scientists of the future. However, most of them have never been in a research lab and do not really know what it is like to 'do science' as a career. This is information that they need, to help inspire and guide their students."

This summer's initiative was a first for CTI, which is an educational partnership among Charlotte-Mecklenburg Schools, UNC Charlotte and Davidson College that works to improve teaching in Charlotte-Mecklenburg public schools.

"CTI is all about bringing together university and college professors to collaborate and co-create with classroom teachers," says CTI Executive Director Scott Gartlan. "This program is no different. This experience for teachers cultivated their curiosity, creativity and knowledge of cutting-edge scientific techniques."

The initiative came together because of converging interests, Gartlan says."Marcus Jones initially reached out to CTI to support his proposal for an NSF CAREER award," he says. "Dr. Jones and I decided to include stipends for teachers to participate in a summer research



Doctoral student Andrew Tobias (left), with teachers Joanne Rowe and Joyce Patton.

experience in his university laboratory working alongside his graduate students."

Meanwhile, Trammell, a three-time CTI seminar leader and CTI University Advisory Council member, also wanted to broaden her research agenda to include more science teacher education, a passion of hers for years.

In each lab, Trammell and Jones provided guidance for the partnership. Graduate students educated teachers on laboratory protocols and scientific principles, as well as helping them develop curricula for later use in their classrooms. The teachers expressed surprise – and gratitude – for the important role that graduate students played in the labs and in their collaboration.

"As a graduate student, my duties included overseeing safety procedures and daily lab maintenance," says Drew Tobias, a Nanoscale Science doctoral student in Jones' lab who worked with the teachers, along with fellow student Kathleen Dipple.

"But my role ultimately became one of a mentor," Tobias says. "We were able to keep the teachers engaged and productive, and they were excited to be here. I think they gained insight into actual experimentation and can better relate what we are doing to general life."

Jones' efforts with the teachers drew from his current CTI long-term seminar, called "It's a Small World!" which draws upon themes from his NSF-funded research. "Nanomaterials could provide a pathway to cheap and abundant renewable electricity," Jones says. "In that context, we discussed the need for sustainable energy and the economic and environmental factors that are driving the search for alternative sources."

Coulwood Middle science teacher Joyce Patton describes the experience and its lingering impact as amazing.

"The summer experience in Dr. Jones' lab was inquiry learning done right," Patton says. "Engaging, inspiring and by far the best educational experience I have ever had. It was so inspiring I was able to work with a local scientific equipment company, CEM Corp., to donate a single-mode focused microwave unit. This will allow my students to safely synthesize nanoparticles, right in the classroom."

UNC Charlotte's Trammell also turned to her CTI seminar, which is titled "How Science is Done," providing a behind the scenes look at university research and the scientific method. Doctoral candidates Joseph Peller and Madison Young joined her in coaching teachers in the lab.

Trammell's research concentrates on biomedical applications of optical techniques, imaging and spectroscopy in particular. Projects in her lab include building a new camera that can be used for cancer detection and developing a method to preserve proteins that are used in diagnostic tests.

"It was great experience for the teachers as they learned lab work is not as formulaic as standard teaching labs would imply," Peller says. "They encountered problem after problem, yet continued to work rigorously until they resulted in success."

Professor Susan Trammell (second from right), doctoral student Madison Young (left) and teachers Miesha Gadsden, Tabitha Miller, Connie Wood.

Two undergraduate students who were conducting research through the Charlotte Community Scholars program joined the team, working with CTI as interns. Political science and economics student Anthony Ellis and psychology student Kenia Rios were part of a 9-week research experience that provides students with an immersive engaged scholarship experience to address community needs.

"Over the summer I worked directly with CTI to analyze six years' worth of data to see if the program has caused any impact," Ellis says. "I've gained tons of experience working with abstract quantitative data, and now have an idea on how we can use it to improve future programs."

Since its inception in 2009, CTI has conducted 60 long-term seminars led by 46 Davidson College and UNC Charlotte professors for more than 400 CMS teachers, totaling over 17,000 hours of professional development. The summer experience provided another avenue for exposing teachers to intense professional development.

"The teachers developed a deeper understanding of university-level scientific research, methodology, and laboratory equipment and practices," Gartlan says. "In turn, they will develop curricula that motivates and excites their students to see the essence of scientific inquiry more as a process of discovery than as a set of rules to follow." &

Words: **Tyler Harris and Kendra Sharpe** | Images: **Lynn Roberson**

College Deepens Data Science Collaboration

Navigating the world's oceans of data can prove daunting. It is not enough to simply amass and access vast quantities of data; researchers have learned the importance of understanding and using data in purposeful ways.

"Data is, from a data science perspective, seen as a way to understand better the way the world is at a time when there is an increasing amount of technology that collects all kinds of data," says researcher Jean-Claude Thill. "Much of the modern world is about data. This presents significant challenges, including the need to protect people's data. But, it also presents opportunities."

To make the most of these opportunities, the College of Liberal Arts & Sciences earlier this year joined the UNC Charlotte Data Science Initiative. This university initiative creates education, training and research programs in data science and analytics, integrated with business and industry expertise.

Thill, who is Director of the Project Mosaic social sciences research initiative, was named DSI Director for the College of Liberal Arts & Sciences. With this agreement, Project Mosaic will deepen its collaboration with the DSI, enhancing the ability of the DSI to leverage existing strengths in computational social science research. The agreement will also facilitate partnership with the humanities, natural sciences and mathematics disciplines that are part of the college.

The rapid growth of data sets in size, scope, and number brings almost unlimited potential that demands greater insight and collaboration, Thill says.

"We need special approaches of data analytics, data visualization and processing of the data to make sense of what the data is telling us," he says. "Interpretation of the data is something that researchers in the College of Liberal Arts & Sciences can contribute significantly to the Data Science Initiative."

In one critical aspect of the DSI, the Partnership for Social Good analyzes historical and real-time data points and uses predictive modeling to identify the factors and issues plaguing communities and to unlock potential solutions to complex social problems.

"There are many social scientists in this college who can bring their domain expertise to data analytics," Thill says. "They can help by not just collecting the data, but collecting the data for a purpose. The purpose may be to improve and enhance quality of life in a community, or to help with the understanding of job creation, for example."

In a project Thill is leading, researchers seek to understand the factors contributing to Charlotte's high ranking among cities struggling with human trafficking.

"The project is focused on getting a better handle on the magnitude of the problem in Charlotte, and looking to see how social media is often used for recruitment in sex trafficking," he says. "The goal is finding out how do individuals use technology to create a coercive environment to these vulnerable populations."

With other efforts, scholars will consider non-numerical data.

"Consider archived historical documents or pictures," Thill says. "Pictures have a lot of information and researchers can use data analytics for facial recognition, to track individuals or figure out the shape of buildings and understand the materials that were used. Data analytics could reconstitute the Charlotte of the 19th century or create three-dimensional models of that era based on pictures that exist in the museums or even people's drawings."

The college's collaboration with the other academic and industry partners in the DSI – including Belk College of Business, the College of Health and Human Services and the College of Computing and Informatics – will enrich opportunities for all involved, Thill says.

"The data science perspective is bringing a different view by taking the world as it is," he says. "Instead of studying from sets and assumptions on how the world is supposed to be, data science looks at how the world is not normal. Data science picks up where statistics leaves off, and the best way to train students in how to observe the flow of information is exposure." &

Words: **Alexandra Celender** | Illustration: **Angette Williams**

SOCIAL GOOD

Students Create Tool to Address Economic Mobility

When streetlights burn out in the Enderly Park neighborhood, the darkness closes in, causing residents to worry about safety.

Neighborhood advocates may soon have a new tool to help them push back the dark. UNC Charlotte geography undergraduate students Jamal Covington and Devin Martin have created a way for residents to use mobile devices to easily report issues such as burned-out lights.

Their design tied for first place in the Partnership for Social Good's Hackathon this summer. As a key element of UNC Charlotte's Data Science Initiative, the partnership harnesses the university's collective expertise and resources to collaborate with the community on potential solutions to complex social problems.

The hackathon challenged students to create an app or game for a mobile device to address the issue of economic mobility, defined by people's ability to change their economic status. In a nationwide analysis of economic mobility, Charlotte ranked last among 50 major metropolitan areas studied.

"We tried to address this issue by creating a mobile mapping application powered by Geographic Information System technology that would plot out different physical issues, problems, and assets that could be recorded within the application," Covington says.

The students focused specifically on the Enderly Park neighborhood in west Charlotte, a longtime partner with the Charlotte Action Research Project (CHARP), which is based at UNC Charlotte. The students began their project through the university's Community Scholars Program, a summer research initiative focused on engaged scholarship.

"The timeline of our See My Voice project started in mid-June, and we finished it at the beginning of August," Martin says. "During this time we developed and tested the app and made revisions and technical tweaks as to how it would work, how data would be recorded, and what data exactly we would be looking to record."

The application works through the plotting of components found in the neighborhood.

"An example of this would be inadequate lighting at a bus stop," Covington says. "This poses a safety risk for people using the buses to commute because of low visibility in these dark environments. The person using the app could record this issue by taking a photo using a mobile phone. A component point is then placed on the map to represent faulty lighting. The final step in the process could involve a company taking this data and finding a way to implement solar lighting infrastructure at the bus stop."

Plans are to continue to fine-tune the app and make it available for use in the real world.

"We understand that the world is transforming and changing constantly," Martin says. "These constant changes mean that the types of data that will be gathered and used will ultimately change. CHARP will have access to edit and revise the app to alter and manipulate how data is collected within the application."

The students worked on the project with Department of Geography and Earth Sciences faculty members Laurie Garo and Janni Sorensen. "Our mentors are what we would like to call our unsung heroes," Martin says. "Absolutely none of this could have been possible without them. They were constantly challenging us and pushing our minds daily to create something extraordinary that could be used to change and transform communities forever."

The students' studies in geography also played a significant role in their entrepreneurial work.

"Studying geography enabled us to observe how different components of our environment are connected," Covington says. "Understanding connectivity between things that we all use and interact with on a daily basis allowed us to really put our creative thinking skills to work. We hope that this idea can be used as an instrument to create change in the world." &

Words and Image of Covington and Martin: **Garland Beamer**

Paper Trails

The collection includes 3,000 photographs.

Author Traces Journey Through Time

The soldier's face has faded in the World War II photograph, falling victim to the ravages of time. Yet, even as the picture has turned cloudy, the image of her father has grown sharper in Barbara Presnell's mind.

Presnell, an award-winning documentary poet and essayist, has captured the story of her father William G. Presnell in her *Blue Star* collection, published earlier this year by Press 53 in Winston-Salem.

The poems trace over a century in the life of her family, with a focus on their connection to wars from the Civil War forward. She has discovered the stories in family memories, military records, census reports, letters, journals, maps, medals, and over 3,000 photographs she found in dusty boxes in the attic.

"I don't think this is a pro-war book. I don't think this is an anti-war book. I think it's a factual book about war being part of our lives," says Presnell, a senior lecturer with the University Writing Program.

At its root, *Blue Star* is more about family than war. It documents one family's journey through time and tragedy, offering a backdrop that lends a raw and intimate grace to the moments of tenderness throughout.

When her father enlisted in the National Guard in 1940, he was 24 years old. Four years later, he was called to active duty in Europe as a member of the 120th regiment of the 30th Infantry Division. Following his discharge, he returned to his North Carolina hometown to raise a family and make his living in textiles.

The recipient of two Purple Hearts and survivor of the Normandy Invasion and the Battle of the Bulge, he died following routine surgery at age 52. Presnell was just 14 years old.

She and her siblings were left with little understanding of his earlier life, including his time during the war and its impact on him. As children, they had paid scant attention to his stories. Following his death, their mother discouraged lingering in the past.

"I now wanted to try to understand who my father was," she says. "I searched for answers to my most important questions. I wanted to know who was my father as a boy? How did his childhood shape him into the young man who went off to war? How did war shape him into the father I knew?"

Presnell began writing the poems in 2012, in an effort to answer her lingering questions through her inquiry-driven poetry. She pieced together the factual foundation over time.

One interesting find came when a cousin was cleaning out her house and found books with Presnell's father's name scrawled in them.

"There's this one book, an eighth grade French textbook," Presnell says. "He was just as bored as he could be, and he had actually carved the title out of this book and rewritten it as *How to Cuss in French*. Well, how ironic that he ends up in France able to speak the language. Looking back, here is a kid in eighth grade without any foresight, without any thought that he's going to be in France in ten years, with his life on the line."

During her exploration, Presnell turned to her father's dusty boxes of memorabilia. The cartons had traveled to Presnell's house from the family homeplace following her mother's death. There, the boxes waited, tucked away until the day Presnell opened the first box and sifted through its contents.

It became clear that Presnell's father, in his role as first sergeant,

William G. Presnell's Bronze Star Medal.

must have served as an official record-keeper for his regiment. The few photographs of him show his trusty camera slung around his neck.

He, on the other hand, wrote thousands of journal entries and took thousands of photographs, an unusually large number in the days of film. He meticulously documented the activities of his fellow soldiers and townspeople. The images show work details and slices of life – soldiers with their arms around young women, rolling cigarettes, lining up for chow or the latrines.

He also took ground and aerial views of the terrain, bridges, roads and towns. Orchards, livestock, and bombed out buildings appear in other photographs.

"He was charged with keeping records of all the men and what happened to them," Presnell says. "We have a journal of their movement through Europe. We have 3,000 photographs, two scrapbooks, and lots and lots of stuff that documents their travels. My brother and sister and I decided that we would follow that trail, and along the way, try to find people we could talk to about it."

In 2014, Presnell, her husband, her siblings and her sister's husband acted on that decision, setting out to trace the journey through France, Belgium, The Netherlands, and Germany. They plotted their trip using her father's map, marked by his hand with a path from Omaha Beach in Normandy to the Battle of the Bulge to the end of the war in the European Theater in late April 1945.

Photographs pasted into scrapbooks with legends aided their journey, as did phone calls and emails to find contacts in the area.

During their 21-day trek, they found many of the spots her father had documented in his journal, including the 12th century Rolduc Abbey in the Netherlands, where the troops rested between battles. The abbey, now a convention center, offered them a place of respite as well.

The mayor of Mortain, France hosted a reception for the family, as he does for all returning veterans and their families. They met historians and people who were liberated as children during the war and who expressed gratitude to Presnell's family, as Americans.

"We don't even understand how much the soldiers did," she says. "My appreciation for that has greatly increased since I was over there and studied closely what they did, walked through their trail. But for the most part, we just don't think about that. And it's cliché, but it's so true, we're here because they were there."

They stood on the very spot on the banks of the Elbe River in Magdeburg, Germany where a rare photograph of her father shows him standing between two Russian soldiers. In the picture, he drapes his arms loosely over the Russians' shoulders, the stub of a cigar gripped between two fingers and smiles on the three faces. It is April 25, 1945, the day Soviet and American troops met at the Elbe River, marking an important step toward the end of the war.

This precious image came to her from Frank Towers, a veteran she found who remembered her father and wrote, "I think I have a picture of your father with some Russian soldiers."

In "The Dance," Presnell speaks of finding her father's spirit in this place where "you are a boy my son's age."

Poems in the collection also talk of the connections between mothers and sons, including Presnell's with her own son. She details Quaker

Continued page 14.

The treasure trove included photographs and maps.

Presnell (center) with two Russians.

Presnell's Purple Heart Medal.

Presnell found her father's uniform from World War II.

roots and Native American heritage, as well as World War I connections.

While she worked on *Blue Star*, Presnell found that the work of her students in her classrooms became richer and more authentic as a result of working alongside one another and sharing in common journeys. "We had our exciting finds and frustrating dead ends," she says.

"My students have recovered lost Civil War ancestors, traced immigration journeys, uncovered Holocaust stories, and confirmed and refuted long-told family legends of all kinds," she says.

"One young man investigated his grandmother's death in a helicopter crash during the Vietnam War, while another dug into newspaper accounts from the 1970s to learn about his uncle's involvement in gay rights in New York City," she says. "A young woman explored her grandfather's association with the Italian mafia. There are so many more examples, each one its own fascinating tale."

Through her own family-based inquiry project, Presnell has helped her students understand that research and writing are about seeking answers to questions that grow and change along the way.

For her, the *Blue Star* journey has brought greater understanding of her family and of herself. By "putting the family story into a shape that's going to be passed down to the next generation," as she describes it, Presnell has perhaps become a reflection of her father, the record-keeper. &

Words: **Brittany Stone** | Images: **Lynn Roberson**

What Flutters

Heat rising. Tick of afternoon sun.
The screen door, banging. A telegram.
When it comes, Hannah is in the kitchen making dinner.
She slips her greased finger beneath the flap,
hands trembling so she can hardly read.
Company almost wiped out. Stop. Our boys
fought bravely to the end. Stop.
It's the *almost* she clings to as day splinters
into days, then a week.

Wings tipping. Grass that pillows.
Loose fabric. A place called France – she's seen it on a map
and Slim sent a postcard back in July.
Words. Picture of a cow in the field like theirs.
Bone jur scribbled above the cow's ear.
Seems like a fine place on the back side. And,
Everybody says hi. I sure miss
your cold ice tea, Mama.

Flotilla of red leaves. Fine hairs
of a sweet potato. Screen door
banging. Her husband Josiah holds the letter.
He's alive. Our boy. Then names those gone:
the Dixon's youngest, Jimmy Gatlin,
Big John Pugh. More.
His gray chin on her shoulder.
Dusk stirring in.

From *Blue Star,* 2016. Reprinted with permission.

EXPONENTIAL

The Campaign for UNC Charlotte

At the College of Liberal Arts & Sciences, our disciplines are as diverse as our students. Our many departments, applied research centers and interdisciplinary programs unite behind the shared goal of educating critical and imaginative thinkers through inquiry and engagement.

"Our college is a place of exploration and discovery, where we seek out and encourage an entrepreneurial spirit and an expansive habit of mind that cross fields of inquiry," says Dean Nancy A. Gutierrez. "Our faculty and students cultivate connections and collaborations with local, regional, national and global communities to support our shared goals and to address societal issues."

Through Exponential: The Campaign for UNC Charlotte, the College of Liberal Arts & Sciences will sustain and strengthen its research community and develop creative, pragmatic solutions to societal problems. The focus is in six specific areas.

Opportunity For Discovery

The Mount Zion project is an archaeological excavation in the ancient city of Jerusalem. UNC Charlotte is the only American university currently licensed to carry out such excavations in Jerusalem. At the heart of the undertaking is a two-week summer study-abroad program consisting of fieldwork, lectures and guided tours. The future of Mount Zion depends on expanding our excavations, publishing scientific study of discovered objects, transforming the dig site into an archaeological park, and developing the Armenian Museum to use as an operational headquarters.

Leading in Research

Endowed professorships directly impact the college's effectiveness in attracting and retaining exceptional faculty. With the prestige and additional resources that endowed professorships offer, the college can compete more effectively for high-caliber students, additional grant funding and collaborative partnerships. Endowed professorships in the natural sciences and mathematics are especially critical to UNC Charlotte's leadership role in many research areas, such as data science, disease, energy, the sustainability of the world's natural resources, next-generation optics and other critical areas.

Green Heart of The University

For 50 years, the UNC Charlotte Botanical Gardens has been a living classroom for students and a horticultural and botanical asset for the community. To sustain the future of the gardens, including its educational curriculum, and ongoing research, a new welcome center is needed. This sustainable facility will draw students, faculty, staff and the public to an open and inviting teaching facility, working greenhouse and surrounding plaza.

Attracting Top Candidates

The college competes with other research universities that offer full funding to attract outstanding, intellectually curious graduate students. Unfortunately, the college is severely constrained by a lack of resources when competing for top talent. The Buchenau-Pharr Graduate Research Award is an example of a fellowship that helps graduate students fulfill their research obligations by funding domestic and international research travel.

Beyond Borders

The transformational opportunities that occur when studying abroad are invaluable for all students. However, students from underrepresented populations make up only a small percentage of all study abroad program participants. One way the college will address this gap is through the Harper-Thomas Legacy Endowment for Study Abroad, a perpetual merit-based award to support international educational experiences, with preference given to first-generation college students from underrepresented populations.

Real-World Resources

Society needs liberal arts and sciences graduates who can think holistically and act pragmatically. The college is addressing this need through the LEADS initiative (Leadership-Entrepreneurship-Applied-Development-Skills). Funding is needed to help students gain leadership skills through internships, integrative learning, and education abroad and other international experiences.

Learn more: exponential.uncc.edu/clas

BUILDING RESILIENCY

Research Looks At How Communities Manage Conflict

Protests erupted across Charlotte in the days following the September 20, 2016 police shooting of African American Charlottean Keith Lamont Scott. At UNC Charlotte, faculty, students and staff have gathered peacefully to express their concerns and their grief in the aftermath of the shooting.

The campus also saw research- and scholarship-driven responses by faculty, alumni and students at UNC Charlotte, including gathering of protest images for archival and research purposes, talks on campus grounded in the history of the Charlotte community, and an artistic protest.

The college has continued to raise visibility of its commitment to the values of community, of diversity and inclusion, and of ethical behavior. Such actions include identifying curricula that study these issues so students can more easily find the classes, and scheduling and communicating the schedule of speakers and programs on related topics.

Among the responses, UNC Charlotte researchers Cherie Maestas and Sara Levens were moved to research how the emotions of members of the community translated to action following news of the shooting.

Maestas, Marshall A. Rauch Distinguished Professor of Political Science, and Levens, assistant professor in the Department of Psychology, developed an anonymous random-sample research survey of UNC Charlotte students and an anonymous respondent-driven survey of residents of the Charlotte area to ask about their reactions – and actions – following the events. Here are their responses to questions about their research.

What motivated you to do this survey?

The shooting death of Keith Scott and subsequent protests and conflict in the city released a storm of emotional responses that affected all of us very deeply. What happened here, while unique and painful, is also part of a larger backdrop of tensions faced by many cities and campuses. The recent unrest in Charlotte raises difficult but important questions about how communities manage in times of conflict. In these critical moments, it is essential to understand the individual emotional experiences of those affected in order to understand how to build greater emotional resiliency in communities. We were motivated to make a difference. We sought to connect to larger conversations around racial bias, responsibility and equity and to provide a safe outlet for people's strong emotions.

What are the anticipated outcomes from the surveys?

In terms of specific research papers and related projects, we are interested in understanding two key things from the survey responses. First, how do students and members of the community cope with difficult, emotion-laden situations; what strategies are effective, and what can we learn from them? Second, how can we create more effective survey tools to give individuals a voice to their concerns in a safe but impactful way during critical moments in a community?

Answering the first question is key to understanding the health of a community and its ability to recover and build following a crisis. In

our preliminary analysis, we saw little evidence of information avoidance – even though information about the shooting and protests was upsetting, most people sought out news to stay informed. This is a healthy response. Not surprisingly, emotions ran high, but how those emotions connected to actions varied quite a lot across individuals, with some motivated to discuss with friends and family, or post on social media while others turned to more active behavior such as protesting. We hope to untangle the complex factors that gave rise to different perspectives and actions within UNC Charlotte and the broader community. The resulting analyses will serve the interests of the University both through practical understanding and through a series of academic papers based on rigorous empirical tests of theoretical models of emotion expression, crisis attitudes and behavior.

Answering the second question is key to understanding how people express their feelings and attitudes during times of crises in their own words – a necessary condition of truly understanding the essential meaning from all perspectives during crisis events. Natural language processing and advances in text coding technology make using open-ended survey questions a viable and important option in times of crisis. Moreover, understanding how individuals express themselves in this manner is becoming increasingly important, as blogs, social media posts and reactions become more and more common. What is often expressed on social media is emotion, and psychology studies show that individuals who are given a chance to express themselves are better able to regulate their emotions. In this vein, one resulting line of research is exploring whether surveys deployed during crises can serve both the aims of researchers while providing an outlet for much needed self-reflection and expression of meaning.

Why is this kind of work important?

Emotions are often thought of principally as internal constructs that exist within an individual to affect their attitudes, preferences and mental and physical well-being. Yet more and more it is becoming clear that emotions have unique interpersonal properties that can affect well-being at the community and societal levels as well. Anxiety, distress, anger and fear are communicable. Just as a great deal of research has investigated the effect of negative emotions on an individual's health, this research is important because it is trying to understand how emotions are communicated and spread to affect the health and well-being of communities and groups of people.

How does this fit into your broader work?

This research project fits into each of our scopes of work, yet in unique ways. Dr. Maestas studies public response to crisis with an eye towards understanding what stimulates strong emotions, and how specific emotions like anxiety, fear, and anger, give rise to different responses to unfolding events. She is also interested in developing more nuanced survey designs to improve researchers' ability to measure and understand individual and group-based emotions. Dr. Levens, on the other hand, studies how people process and regulate their emotions in a range of contexts and experimental conditions. Specifically, she examines the cognitive processes that are involved in the control and expression of emotions as well as the effect that emotions and emotion regulation have on mental and physical health.

How does the work that the two of you do intersect?

Our research principally intersects in the domain of emotion. While we both study emotion, it is from different disciplines, Dr. Maestas in the field of Political Science and Public Policy, and Dr. Levens in the fields of Psychology and Cognitive Neuroscience. While our experiences and expertise differ, the way that we investigate the impact of emotion on attitudes and behavior is quite complimentary, and a strength of our interdisciplinary collaboration. Our research partnership was solidified through the 2016-2017 Project Mosaic Research Mentoring Program, and we are thankful for that collaboration catalyst. Interdisciplinary research within the social sciences is critical for advancing our understanding of behavior in complex interpersonal and community contexts. &

Words: **Alexandra Celender** | Images: **Lynn Roberson**

CIRCADIAN CLOCK CLUES

Sea Anemones Respond to Changing Environment

A sea anemone, with its columnar, jelly-like body and bouquet of tentacles that protrude from its head like a Medusa curlicue mass, looks every bit a weird sea creature. For UNC Charlotte's Adam Reitzel, this curiosity of a marine invertebrate also holds fascinating clues on how changes in the environment may influence molecular mechanisms such as circadian clocks.

The sea anemone, Nematostella vectensis, is in the phylum Cnidaria ("nye-dare-e-uh") and is found along the Eastern seaboard from Maine down to Florida. Many of the anemones in Reitzel's biological sciences lab come from the North Carolina coast.

Considered a model organism – as the sequencing of its genome has provided a map to gene evolution – sea anemones offer an ideal biological system for use in a wide range of comparative studies, including Reitzel's investigation into circadian clocks.

"The circadian clock is responsible for how we function," Reitzel says. "Why do we wake up when we do? Why do we get hungry when we do, and why is this very predictable? The circadian clock is why we experience jet lag or tend not to be ourselves after we pull an all-nighter."

Reitzel's lab uses sea anemones to learn more about how organisms may entrain their clocks when faced with disruptions. More broadly, his research considers the evolution and mechanisms of stress response and the genetic variation and adaptation of coastal invertebrates, including the purpose of the circadian clock.

Adam Reitzel and graduate student Whitney Leach work in the lab.

"We are asking two fundamental questions," he says. "One is from an evolutionary perspective. How does a sea anemone, in this case, have a circadian clock and how similar is it to the human clock? And two, how does that clock work? If we interrupt a sea anemone's circadian clock, what does that do to that anemone? What does it do to its physiology?"

A key question is determining whether a sea anemone takes in environmental cues such as changes in light and, as a result, entrains its circadian clock to anticipate and adapt to environmental changes.

"There's plenty of literature to suggest disruptions in the circadian clock can result in increased susceptibility to diseases," he says. "We want to know, and this relates back to the non-human model, if we interrupt a sea anemone's circadian clock, what does that do to that anemone?"

In a locked room near Reitzel's lab, a video recorder captures the movement of sea anemones in a dish as they are exposed to light. A computer remotely controls the

intensity of the light and when it is turned off and on. Whitney Leach, a graduate student in Reitzel's lab, uses light because it is the most predictable environmental cue.

At the conclusion of the controlled manipulations of the environment, the lab team will study the tissue of the anenomes, specifically looking at the genes and proteins to assess what may have changed as a result of the environmental differences.

Reitzel's most recent funding is the prestigious Young Investigators' Grant from the Human Frontier Science Program, one of only seven awarded worldwide earlier this year. Reitzel and colleagues from Germany and Australia are looking at how bacteria and other microbes influence the biology of sea anemones, particularly in the context of climate change.

"We are looking at how organisms live naturally," he says. "If they can respond and adapt by changing gene expression or how they associate with particular types of bacteria, it tells you how organisms are projected to survive in a changing environment."

Reitzel also has two National Science Foundation grants for marine species adaptation research, a National Institutes of Health AREA grant for the circadian clock research and a Binational Science Foundation Young Investigator Grant that pairs him with a colleague in Israel. Also as part of his collaborative work, he is working with Mitchell Community College biology instructor Parks Collins in Statesville and hopes this work can provide a model for others.

Scientific exploration first came into focus for Reitzel when he spent a summer as an undergraduate researcher on the West Coast with Brian Bingham of Western Washington University, as part of a Research Experience for Undergraduates program.

Coming from the cornfields of Illinois, Reitzel saw the ocean for the first time during that trip. He also learned a lesson about collaboration and hands-on research that continues to shape his approach.

"I remember those times others took a chance on me and gave me the opportunity to conduct a research project, with mentoring, but allowing me to be very independent," he says. "I got to come up with my own ideas and dedicate myself, and the work became mine as something I was really invested in. That had a huge impact on me to get into the field and to do this for a long time." &

"I remember those times others took a chance on me and gave me the opportunity to conduct a research project, with mentoring, but allowing me to be very independent."

—Adam Reitzel

Words: **Leah Chester-Davis** | Image: **Lynn Roberson**

BENEATH THE SURFACE

Student Researcher Explores Vast Undersea World

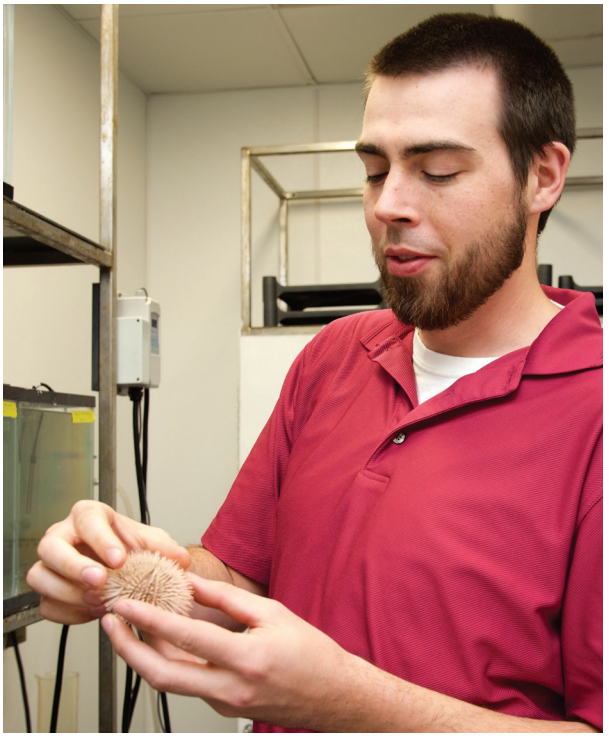
Beneath the surface of the sea exists a vast world that UNC Charlotte student researcher Tyler Carrier seeks to explore through research at the intersection of evolutionary ecology, oceanography, and microbiology.

"The questions I am attempting to answer are deeply rooted in fundamental evolutionary and ecological processes, and are also vastly unexplored, which leaves a lot of room to expand our understanding of how and why microbes are essential for life," says Carrier, who is pursuing his doctoral degree in biology. "From talking with various people in the field of larval biology as well as animal-microbial symbiosis, there is some excitement as to what we can find out."

He is investigating how larvae endure starvation from a microbial perspective and how that response may change depending on the geographical location of the parental habitat. This investigation will begin to unravel whether microbes help animals cope with environmental stressors and provide a landscape for adaptation. Carrier believes the implications of this may apply more broadly to many other animals as well as plants.

Carrier's work resulted in his selection for a National Science Foundation Graduate Research Fellowship. The NSF Graduate Research Fellowship Program recognizes and supports outstanding graduate students in NSF-supported science, technology,

Continued page 20.



Tyler Carrier studies sea urchins.

These two varieties of sea urchins come from the North Carolina coast.

engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees.

He travels to field stations throughout the world to conduct experiments in the field, where his animals are found. Last summer, he conducted experiments at Friday Harbor Laboratories in Friday Harbor, Washington and at the Duke Marine Lab in Beaufort, North Carolina, and plans to conduct future experiments at the Sydney Institute of Marine Sciences, part of the University of Sydney, Australia.

"Those who visit the world's oceans find invertebrates at the seaside, and what they often don't see is that those animals have water column-dwelling embryos and larvae," Carrier says. "As a result of this tactic they use, larvae can be swept vast distances from the parental site. Many of these larvae have to find their own food in the form of single cell phytoplankton. At the surface, this doesn't seem to be an issue, but where phytoplankton reside and their abundance varies greatly in the ocean with respect to both space and time. This could lead larvae to endure extensive periods of starvation."

By conducting hands-on research by the sea, Carrier is able to study how larvae respond naturally to situations in the environment. "This is one of the first times that we are looking at the microbiome – or microbial communities – of marine invertebrate larvae, especially in their natural environment," he says.

Carrier works closely at UNC Charlotte with his mentor Adam Reitzel, a biological sciences assistant professor, in The Reitzel Lab.

"The past few years have seen a dramatic increase in the appreciation for the roles bacteria play in animals, from development to longevity," Reitzel says. "While much of the focus has been on mammals, for example humans, the complex and intricate functions of bacteria in the biology of marine invertebrates remains little studied."

Carrier's research is important in helping to address the paucity of knowledge in this area, Reitzel says, by considering how bacterial communities form and change their association with sea urchin larvae based on shifting environmental conditions.

"Tyler's work has the possibility to tell the scientific community something quite novel and to help expand our appreciation for animal-bacteria interactions in the natural environment," he says.

While a member of Reitzel's research lab, Carrier has received highly competitive grants and published academic papers – including one in *Symbiosis* and another in *Aquaculture International*. His selection as one of 2,000 NSF Graduate Research Fellows chosen from 17,000 applicants has allowed Carrier to focus his energy on research and classes rather than worrying so much about financial burdens and other obligations that graduate students face.

"Upon hearing I was awarded the fellowship, I was in complete shock and disbelief because this is one of the most sought-after fellowships in the nation," Carrier says. "There are also special Fellows-only programs that allow me to go to various laboratories around the world to conduct experiments and continue to enhance my training and network with the world's best minds." &

Words: **Brittany Algiere** | Images: **Lynn Roberson**

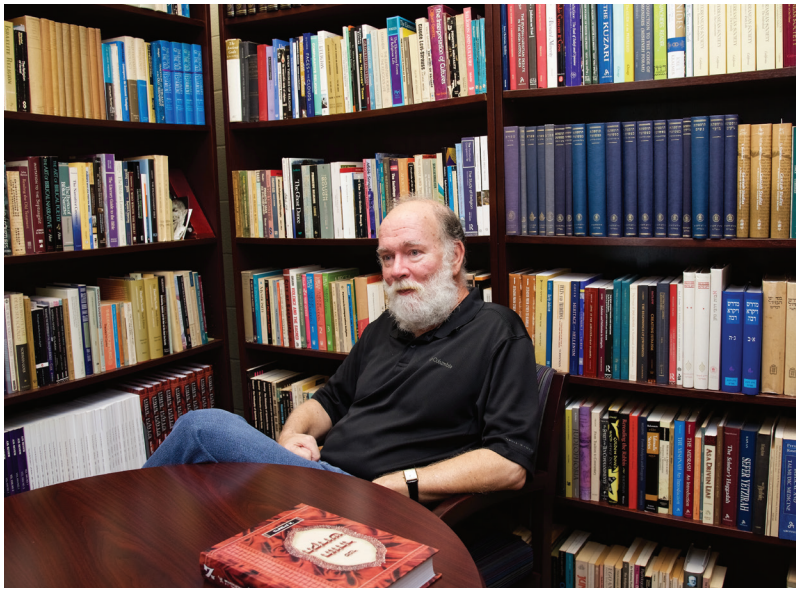
Crossing Boundaries

SCHOLAR FINDS CONNECTIONS BETWEEN RELIGIONS, BELIEFS

The ancient texts that tell their secrets to UNC Charlotte researcher John C. Reeves inhabit the twilight realms of cosmic arcana, apocalyptic fervor, and religious dualism of Late Antiquity and the Medieval Era.

"It's really the thrill of solving mysteries that keeps me going," says Reeves, UNC Charlotte Blumenthal Professor of Judaic Studies and Professor of Religious Studies.

Reeves' research agenda is broadly construed, focused on the study of the religions practiced in the Mediterranean world, the Near East, and Iran from roughly 600 BCE through the Middle Ages. Much of his work takes place at the margins of conventionally conceived categories, exploring the overlaps and commonalities discernible among a host of Near Eastern fringe groups.



John Reeves is surrounded by his books in many languages about broad topics.

"One of the main focuses that I've been doing over the course of my career is to try to cross boundaries into different religions and not leave them in hermetically sealed containers from one another," Reeves says. "That is because they all interacted with each other in much more intimate ways than we are normally accustomed to thinking about."

In 2015-16, Reeves received a prestigious American Council of Learned Societies Fellowship for a project concentrating upon the history of the transmission of ancient Jewish literary texts and non-canonical lore among a variety of Near Eastern religious communities and movements during late antiquity and the early medieval period.

In a recent paper that is in press, "Moses at the Margins of Space and Time," Reeves considers figures such as Moses and aspects of his death, along with Jewish, Christian, and Muslim scriptures and legends, to show how they have interacted with one another in their respective realms of beliefs.

"One of the things I've been fascinated with is the literary development of religious characters, like a Moses or a David or an Adam and Eve, and how they look, are interpreted, and have developed in these different traditions," Reeves says. "Sometimes there is a version of a biblical story like we have in the book of Genesis that carries almost the opposite message from how the Jewish Bible or the Christian Bible or the Quran tells the story."

Reeves now is pursuing three separate monograph projects. The first is a new annotated translation of the Syriac *Cave of Treasures*, along with closely affiliated literature in Syriac, Arabic, and Ethiopic. Reeves contends that the *Cave of Treasures* is more influential than the Bible in terms of understanding how what ancient history was presented in the Eastern Christian and Islamic worlds.

"The impact that the *Cave of Treasures* has had is far-reaching," Reeves says. "Though produced in Syriac, it's been picked up by various groups, including Muslim and Christian writers in Arabic, as well as the Armenians and Georgians, the Coptic church in Egypt, and the Ethiopic orthodox church in Ethiopia. A lot of this information has never been translated into English, and I decided that it needed to happen."

The second project is a synthetic study entitled "Shades of Light and Darkness: Chaldean Dualism, Gnosis, and the Islamicate Milieu." More of a continuation of the kind of work he has been doing over the course of his career, this study focuses on how "gnostic" forms of religiosity in the East have influenced certain currents in Judaism, Christianity and Islamic sources.

The third project is a compilation and analysis he is completing with Annette Yoshiko Reed of the University of Pennsylvania on a massive library of literature associated with the biblical character Enoch, which he has gleaned from Greek, Latin, Hebrew, Aramaic, Syriac, and Arabic language sources.

"The Enoch project is one that I've been working on for the last 25 years," Reeves says. "It consists of a collection of literature that's either attributed to Enoch, or in some cases, just literature about Enoch that I've extracted from Jewish, Christian, Muslim, and gnostic sources from the Dead Sea Scrolls up to about the time of Christopher Columbus."

Reeves emphasizes the importance of exploring the connections between different religions in the past, and the implications for today.

"With Enoch especially, a lot of the literature is along the lines of astronomical, astrological, and medical content that stands at the threshold of the beginning of scientific investigation in the West," Reeves says. "So to be able to trace how Enochic literature has passed between religious traditions or between thinkers across these religious divides is not only significant to our history, but it shows us that there is no reason the interactions between religions shouldn't continue in today's world." &

Words: **Tyler Harris** | Image: **Lynn Roberson**

breaking THE CHAINS

Research Examines Impact of Strain on Recidivism

Common sense suggests that dangerous prison conditions will deter released prisoners from committing more crimes and returning to prison. However, studies by UNC Charlotte researcher Shelley Listwan have found that harsh prison conditions may actually push prisoners in the opposite direction.

The United States is home to just under 5% of the world's population, yet holds more than 20% of the world's prison population, with the highest incarceration rate of any country at 716 prisoners per 100,000 people, according to the World Prison Population List.

Legislative changes since the 1970s have led to tougher sentencing and longer mandatory sentences, which dramatically contributed to escalating numbers of prisoners, researchers say.

Prisoners' inability to break the chains of behavior also worsens the recidivism rate, says Listwan, an associate professor and graduate coordinator with the Department of Criminal Justice and Criminology at UNC Charlotte. Listwan's research focuses on correctional rehabilitation, criminology theory, and victimization in prison.

"Reentry into society is closely related to these huge increases in incarceration rates, and there is a very high failure rate among people who have spent time in prison and reintegrate into the community," she says. "Almost two-thirds of people who have been incarcerated are arrested within three years after their release."

Listwan's targeted work on the topic began in earnest in 2003, with passage of the federal Prison Rape Elimination Act. She and a colleague applied for research funding through the National Institute of Justice and began a study in which they interviewed 1,600 former prisoners in Ohio. They amassed a massive dataset.

"We asked these people, who were then living in halfway houses, about their experiences in prison, taking into consideration all that could occur in such a hostile environment," Listwan says. "We then followed them in the community over a period of time to assess whether or not they were re-arrested or re-incarcerated. Many of them were, and we were able to understand that victimization in prison often contributed above and beyond other factors known to be related to recidivism, such as substance use, unemployment, and lack of social support."

This dataset laid the groundwork for three recent peer-reviewed journal publications, "The Pains of Imprisonment Revisited: The Impact of Strain on Inmate Recidivism" (2013), "Poly-Victimization Risk in Prison: The Influence of Individual and Institutional Factors" (2014), and "Vicarious Victimization In Prison: Examining the Effects of Witnessing Victimization While Incarcerated on Offender Reentry" (2016).

The first paper examined the salience of strain theory in examining reentry outcomes. Listwan identified three strains in prison environments: direct victimization, the perception of a threatening prison environment, and hostile relationships with correctional officers. She found that the three strains were significantly related to arrest and, with the exception of negative relations with officers, to re-incarceration.

"Those who perceived the prison environment as more hostile are more likely to be arrested in the

community," the first study concluded. "Low social support [also] increases likelihood of arrest, [and] reported negative relations with other inmates as measured by experience of direct victimization suggested 32% greater odds of being recommitted to prison."

Her most recent paper, published with colleagues at Georgia State University, echoed the earlier findings.

The research focused on the impact on prisoners who vicariously experienced victimization of others. Specifically, "witnessing theft significantly increased the odds of a respondent having any of the negative criminal justice outcomes" and "of all the types of victimization, witnessing sexual victimization appears to be most related to post-release outcomes," the study indicates.

"The general public thinks we shouldn't incentivize prisoners – through offering amenities or education," Listwan says. "People think we should make the prison environment harsh so they'll never want to come back. But that is not the way that we change behavior. Punishing behavior without changing the circumstances surrounding why someone committed crime in the first place will not lead to positive outcomes."

Listwan points out that psychological research on changing behavior emphasizes therapeutic-like rehabilitation styles, not punishment. "Yet for some reason in criminal justice, there's a disconnect from this idea. Harsh conditions simply don't fix the root causes of crime."

Listwan earned her bachelor's degree in psychology in the mid-1990s, around the same time incarceration rates were spiraling and the criminal justice academic field was growing popular. The idea of treatment for offenders piqued her interest, pushing her to pursue master's and doctoral degrees in criminal justice.

Today, Listwan works with multiple agencies in Mecklenburg County and nationally, both presenting research and consulting around best practices in corrections for changing offender behavior. Her dataset has also been a resource used by researchers around the country. Currently, one of her master's degree students is using it to examine whether prisoners' coping styles can impact them following release.

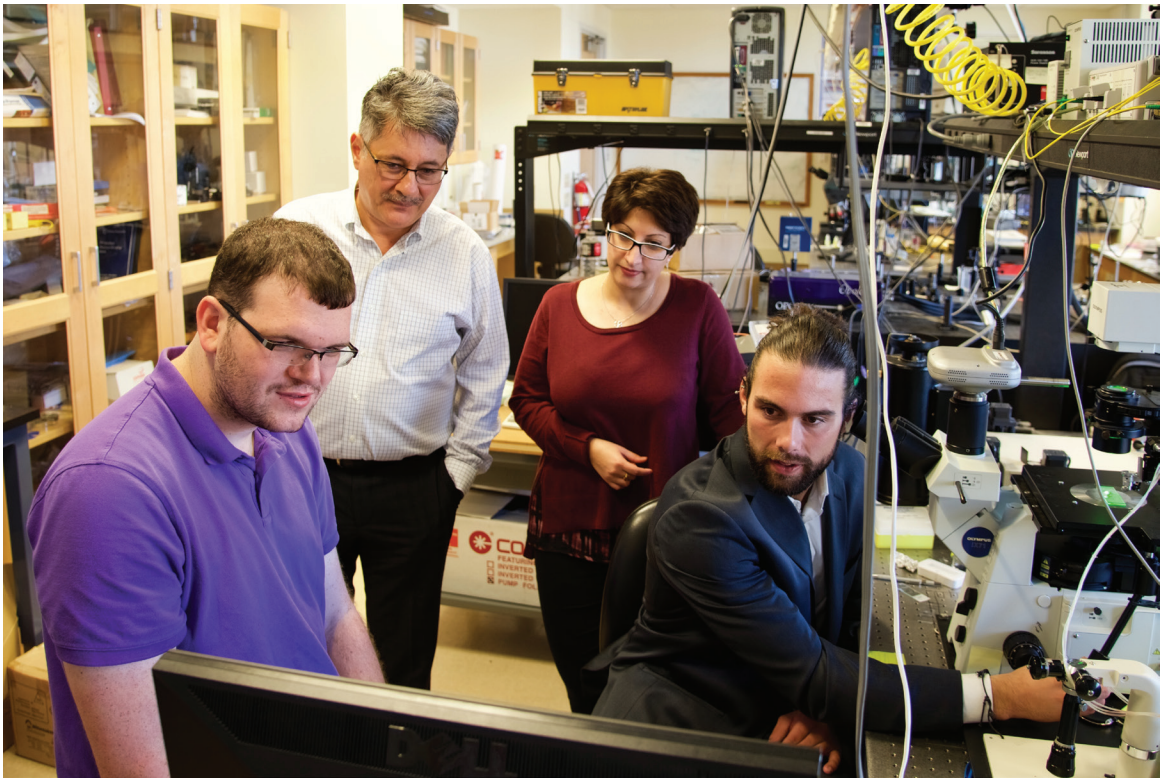
In addition to her work on correctional rehabilitation and victimization in prison, Listwan has been the principal investigator on the Mecklenburg County Frequent User Service Enhancement (FUSE) Pilot Evaluation since 2013. She has received funding to study and evaluate the effectiveness of the FUSE program, an interagency effort providing supportive housing to individuals who cycle between the criminal justice and homeless shelter systems.

She and two other colleagues have just received funding from the Office of Juvenile Justice and Delinquency Prevention (OJJDP). "The research will examine whether traumatic experiences among juveniles have an influence on their trajectories, and whether or not providing them trauma-informed care services can reduce the chance that they'll go on to be adult offenders," Listwan says. "So the research in offender rehabilitation has definitely flourished into many different areas, and it is exciting to see where we will go next." &

Words: **Tyler Harris** | Images: **Lynn Roberson**

From Planets to M

New Optical Devices Target Real-World Problems



Aaron Brettin (from left) Professor Vasily Astratov, Farzaneh Abolmaali and Kylen Blanchette work in the lab.

When Vasily Astratov explains complex principles of physics, specifically in the world of optics, he turns to St Paul's Cathedral in London and its Whispering Gallery. Whisper on one side of the iconic dome, and someone standing a hundred feet away on the other side can hear the whispered words.

"The dome or spherical shape helps trap the sound inside the cavity and transmits it around the inside surface," says Astratov, a professor in the Department of Physics and Optical Science. "The same principle is at work in optics."

Optics involves the study of light. Instead of a large cathedral dome, think of a microscopic sphere. "A different form of wave – electromagnetic – traps visible light in much the same way acoustic waves trap sound," he says. "Just as the cathedral can trap sound, a microsphere can trap visible light."

However, there is one important difference with the acoustic waves. The light trapped in microspheres has an evanescent component – a kind of "cloud" extending from the microsphere, very much like an atmosphere on a planet. When the light wave resonates inside the sphere, this cloud becomes thicker and it extends longer. This electromagnetic cloud is extraordinarily sensitive to variations in the microsphere environment. More than a decade ago, researchers Stephen Arnold and Frank Vollmer suggested using such evanescent clouds for sensing of individual protein and viruses.

It has become apparent that the applications of this phenomenon are unlimited, Astratov says. "One of the lines of thinking in the modern optics community is that this evanescent field can also help us see extraordinary small details of the objects in the atmosphere of the microspheres, which are not ordinarily seen in standard optical microscopes," he says.

Knowledge of this phenomenon and its implications for scientific research have propelled Astratov to submit patents on optical components that use microspheres to provide super resolution capabilities - one with his former student in 2012 and another with his Air Force Research Lab collaborators in 2015. Astratov, a native of St. Petersburg, Russia, received his doctoral degree at the Ioffe Institute, one of Russia's largest institutions for research in physics and technology, part of the Russian Academy of Sciences and a home institution for several Nobel laureates.

It was there in the mid-1990s that he pioneered studies of synthetic opals as novel three-dimensional photonic crystals for visible light.

A leader in his field of study, Astratov has named a new field of study, microspherical photonics, to describe the research directions of his group. In microspherical photonics, individual spheres are focusing and trapping light, and they "whisper to each other" due to an overlap of their evanescent electromagnetic clouds.

"There are many applications where you need extreme accuracy, such as precise laser surgery to attach a retina or remove a fibrotic membrane, for example," he says. "We want to explore the many applications."

Since joining UNC Charlotte in 2002, his work in the field has yielded several technologies – the new optical device and laser scalpels to focus laser beams, for example – with four patents and two more pending.

The new optical devices take the study of light to a new level, moving into the realm of photonics which, simply defined, is a combination

icrospheres

of optical science and engineering. The optical devices based on microspherical photonics promise to deliver a cost-effective solution to physicians, scientists, lab technologists and others who want to improve the performance of their microscopes and their diagnostic capabilities.

"Optical microscopes are fundamentally limited in their resolution due to diffraction of light," Astratov says. "The outer edges of an object remain blurred when viewed through a microscope. Use of these evanescent electromagnetic fields and our new optical component helps overcome that limitation."

In Astratov's lab, doctoral student Aaron Brettin leans over a microscope, carefully placing a sample under its objective lens. The optical component, made from elastomeric transparent material with embedded barium-titanate glass spheres, looks like razor thin sheets or microscope coverslips. By placing them over the sample, the microspheres are as close as possible to the objects to be viewed, catching their evanescent electromagnetic fields and allowing greater resolution capabilities, an enhancement for imaging biological structures.

According to Astratov, these new coverslips with embedded spheres help scientists view not just the cellular level but also to resolve the subcellular structures, a critical component in biomedical research. While numerous industries such as pharmaceutical, semiconductor, optoelectronics, computer chip and, especially, microscope manufacturing companies, may benefit from the work in Astratov's lab, the biomedical area is what draws him the most.

> ***"The application I find most exciting and practical is the potential use by pathologists and histologists."***
>
> ***—Vasily Astratov***

"The application I find most exciting and practical is the potential use by pathologists and histologists," he says. Physics, in this case microspherical photonics, gives insights into diseases by helping pathologists more readily see the subcellular level of human tissues, proteins, bacteria and viruses.

In initial research with pathologists at a nearby hospital, Astratov and his team received valuable feedback to take back to the lab to improve their process. "By gaining insights into the methodology entailed with their diagnostic processes, I was able to extrapolate new ways to improve our own product fabrication," says Kylen Blanchette, a senior physics and mathematics major.

While higher resolution is available with scanning and transmission electron microscopes, Astratov says that they have their drawbacks. "They are expensive, they require a high level of training, and they also destroy cells," he says.

Even though the standard optical microscopes have less than optimal resolution due to the diffraction limit, doctors prefer them. This is why the new optical components hold great promise for the industry. Astratov is working with the Charlotte Research Institute and the Office of Technology Transfer to form SupriView, a company that will manufacture and sell microsphere-embedded slabs.

He also plans to expand the technologies related to microspherical photonics, including further development of ultra-precise laser scalpel technologies for tissue surgery and new ways for sorting dielectric microspheres by using their resonant whispering gallery properties.

The latter technology is based on breakthrough research in his lab devoted to observation and study of the giant resonant light forces in microspherical photonics, highlighted in *Optics & Photonics News* as one of best achievements in 2013.

His innovative laser scalpel technology received a prize in 2013 in the Charlotte Venture Challenge, a competition for early-stage high growth companies. Through the National Science Foundation Industry/University Cooperative Research Center on Metamaterials, his team receives funding from the Air Force Research Lab, part of the U.S. Department of Defense.

Astratov's team relies on the fabrication facility at AFRL to develop the nanoplasmonic arrays or objects that are used in super-resolution studies. They also work together to publish results of their research, and AFRL has for many years provided summer student internships.

Astratov and doctoral student Farzaneh Abolmaali will present designs of their optical devices in early 2017. Astratov is a program committee member of a subconference on Nanoscale Imaging, Sensing and Actuation for Biomedical Applications and an invited speaker at Photonics West, the world's largest event focusing on photonics technologies, including medical technologies and smart manufacturing.

Abolmaali selected physics, specifically optics, "where the fundamental knowledge of light can be connected with engineering and technology and then becomes practical." The new optical devices, Abolmaali says, "are an example of how optics bridges science and engineering."

For Astratov and his collaborators, the devices serve as inspiration for his continuing research into how microspherical photonics can help solve real-world problems. &

Words: **Leah Chester-Davis** | Image: **Lynn Roberson**

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UNC CHARLOTTE

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GUZMANIA BROMELIAD

Guzmania is a genus of bromeliad, coming from the humid, shady forests of Central America. As an epiphyte, it collects water in its overlapping leaves. The topmost of those leaves are brightly colored, attracting hummingbirds, which will search to find the true flowers hidden among the vibrant leaves. This plant is part of the UNC Charlotte Botanical Gardens collection. For 50 years, the Botanical Gardens has been a botanical and cultural asset for the community. Learn more: **gardens.uncc.edu.**

Image: **Lynn Roberson**