

# DECIPHER



Stressed  
Salamanders  
Environmental  
stressors can  
impact *Plethodon*  
populations  
Pg. 17



## Decipher (verb)

To succeed in understanding, interpreting, or identifying

Robbie Fitzwater

# About DECIPHER

Above: Clemson University's campus is as unique and awe-inspiring as are the achievements of its student research.

Decipher magazine is produced by a team of Clemson University's undergraduate students to highlight the accomplishments of their peers in Creative Inquiry, Clemson's unique brand of undergraduate research. Creative Inquiry is Clemson's way of engaging students in research topics they find interesting, in their own or other cross-disciplinary fields of study.

Each year, more than 3,500 Creative Inquiry students investigate topics ranging from medical technology for developing countries to how stress affects astronauts in space. Their Creative Inquiry projects provide them with the tools they need to explore diverse problems and issues in our community and beyond and to come up with possible solutions. Students value these opportunities to exercise the skills they learned in the classroom and apply them to the real world.

From the more than 370 current Creative Inquiry projects, we selected 29 projects to feature in this magazine. Our Decipher team interviewed the faculty mentors and students in each of these projects in order to write these articles and produce graphics. Decipher is printed and distributed to students, faculty, alumni and friends of Clemson so they are aware of the many accomplishments of students in the Creative Inquiry program. For example, Creative Inquiry students and faculty have given more than 633 presentations at major conferences, produced 315 professional publications and won more than 47 awards.

Decipher, Creative Inquiry's Magazine, is also an app, available for free in the Apple iTunes store.

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# Contents

05	Stress In Space <i>Research being done to help NASA keep astronauts engaged while in space</i>	06	Overcoming Data Overload <i>Eye-tracking research impacts future dissemination of information</i>	07	Bringing Other Clemsons to Light <i>Making a better future by connecting Clemson to its past</i>	09	Extreme Orange <i>Research, innovation and entrepreneurialism combined offer student opportunities to work with IBM®</i>
10	Go With Your Gut <i>Making links between gastrointestinal microbiota and diabetes</i>	11	Apps R Us <i>Undergraduate teams create apps to assist in education and research</i>	12	Engaged Aging <i>Keeping Alzheimer's patients and their caregivers in a healthy state of mind</i>	13	Human Powered Vehicles <i>Watch out Fred Flintstone, Clemson Creative Inquiry students are passing you</i>
15	Sustainable Farming: From Garden to Table <i>History, culinary curiosity and gardening offer a new way to connect South Carolinians to their heritage</i>	17	Stress After Dark <i>Using salamander populations to study the impact of climate change</i>	18	Cutting Edge <i>Clemson students are pushing the boundaries in print and digital media platforms</i>	19	Out of This World <i>Studying the evolution of planet formation</i>
21	Innovative Tissue Engineering <i>Developing tissue platforms to advance medical research</i>	23	Health in Media <i>Research on health issues in foreign films offers a new perspective into foreign cultures</i>	24	Silky Structures <i>Turning to spiders to lay the framework for cell farming</i>	25	Strategic Planning <i>Cross-disciplinary teams advance marketing and fundraising strategies to benefit non-profits, starting with Relay for Life</i>
27	Fishing for Answers <i>Tagging fish to study ecosystem health</i>	29	Health & Performance <i>Psychology research to better human health and decision-making</i>	30	Tools for the Future <i>Scaling down complex technology for accessibility in a learning atmosphere</i>	31	Designing Medical Technology <i>Working with Tanzanians to develop cost-effective medical devices</i>
33	Reinventing an Ancient Art <i>Using origami structures to make petroleum alternatives for the future</i>	35	Mentoring Healthy Lifestyles <i>Building relationships and healthy habits for ClemsonLIFE students</i>	37	Thinking Outside the Box <i>There is more to catching an animal than setting up a trap</i>	39	Smart & Savvy <i>Students evaluate popular information venues, use critical thinking skills and broadcast the truth through social media and interactions</i>
40	How Fit is Fitbit®? <i>Evaluate the accuracy of your calorie counters before you eat</i>	41	Corridor of Hope <i>Education majors impact communities and gain hand-on, real world teaching experience</i>	42	CU CHEFS™ <i>Students are creating new dishes that are both appealing and nutritious for upstate families</i>	43	Material That Make Sense <i>Research in packaging sciences yields trendy new furniture</i>
45	Aspiring to Be Well <i>Evaluating student facilitated health programs on Clemson's campus</i>	***	This is only a small sampling of the interesting and exciting work being done by Creative Inquiry students. To see more projects and find out more about the program visit <a href="http://ci.clemson.edu/blog">ci.clemson.edu/blog</a> . If you prefer digital, hand this magazine to the next person you meet and download the Decipher Magazine iPad App in the Apple App Store.				



“it  
reminds  
me I’m  
at a great  
university”



# Welcome

to the Watt Family Innovation Center, Clemson University's newest and most versatile academic building. The Watt offers a setting and resources that promote cross-disciplinary interactions and collaborations among faculty, students and industry. The 70,000-square-foot building harbors 191 high-definition touch computer screens, 3D video walls, table and window whiteboards and more than 73 collaboration spaces.

Software allows users to share screens and to communicate anywhere in the world via virtual connectivity. The Watt is Clemson's epicenter for innovation and cross-disciplinary engagement, thus it is a natural home for Creative Inquiry.

The Watt is the vision of Clemson alumnus and founding director Dr. Charles Watt '59. His experience in education, government

and industry molded his conviction that students should experience cross-disciplinary, collaborative environments, in addition to gaining depth of knowledge in their majors to better prepare themselves for careers after graduation. He recognized that students need breadth of understanding, an entrepreneurial outlook, communication skills, critical thinking and the ability to work in diverse teams.

Thus the Watt is a building and a mission – to help students develop the skills they need by facilitating cross-disciplinary engagement opportunities and collaborations among industry partners, faculty and students. The Watt brings disciplines together in a collaborative environment, to spark research and innovation.

In the Watt's first semester of operation (Spring 2016), it hosted more than 3,100 students enrolled in 60 classes from 29 different departments, representing all of Clemson's colleges.

Creative Inquiry projects in the Watt are diverse. In this inaugural semester, the Watt hosted 19 teams that enrolled 292 students representing 64 majors in all of Clemson's colleges. For example, students used Lego® bricks to catalyze creative design, analyzed the mechanics of a tennis swing and participated in an international collaboration to implement public health practices for an impoverished community in the Dominican Republic. Each project engaged students in varied majors and stages of their education.

The Creative Inquiry offices are now housed in the Watt, emphasizing our commitment to interactive and cross-disciplinary student research. All Creative Inquiry projects – and all Clemson's students – are encouraged to consider how they can use the Watt's unique technology to advance their projects. Students said it best, the Watt is an "overall awesome facility [that] encourages higher learning, innovation and collaboration."

# STRESS IN SPACE

*Helping NASA to prepare astronauts for future space explorations*

WITH COLLABORATORS RANGING FROM NASA TO THE DEPARTMENT of Defense, the Social and Organizational Psychology Creative Inquiry has a history of working with some of the nation's largest organizations. Led by Dr. Thomas Britt, professor in the Department of Psychology, the team specializes in stress management, motivation and the relationships between an individual and a group. While the team is small in numbers, their advances in the realm of social and organizational psychology have large impacts in various fields. During the past four years, the team was involved in a large project funded by the Department of Defense which involved the development of unit training to support soldiers in need of mental health treatment. The training the Creative Inquiry team developed resulted in an increase in supportive behaviors toward fellow unit members experiencing mental health problems.

One of their most recent projects, in collaboration with NASA, dealt with the concept of meaningful work during long duration space exploration missions. As NASA looks to prepare astronauts for future missions to Mars, a major concern is keeping the astronauts occupied and interested in their work. Britt and his Creative Inquiry team investigated how astronauts perceive their work and what factors lead to stress reduction in space.

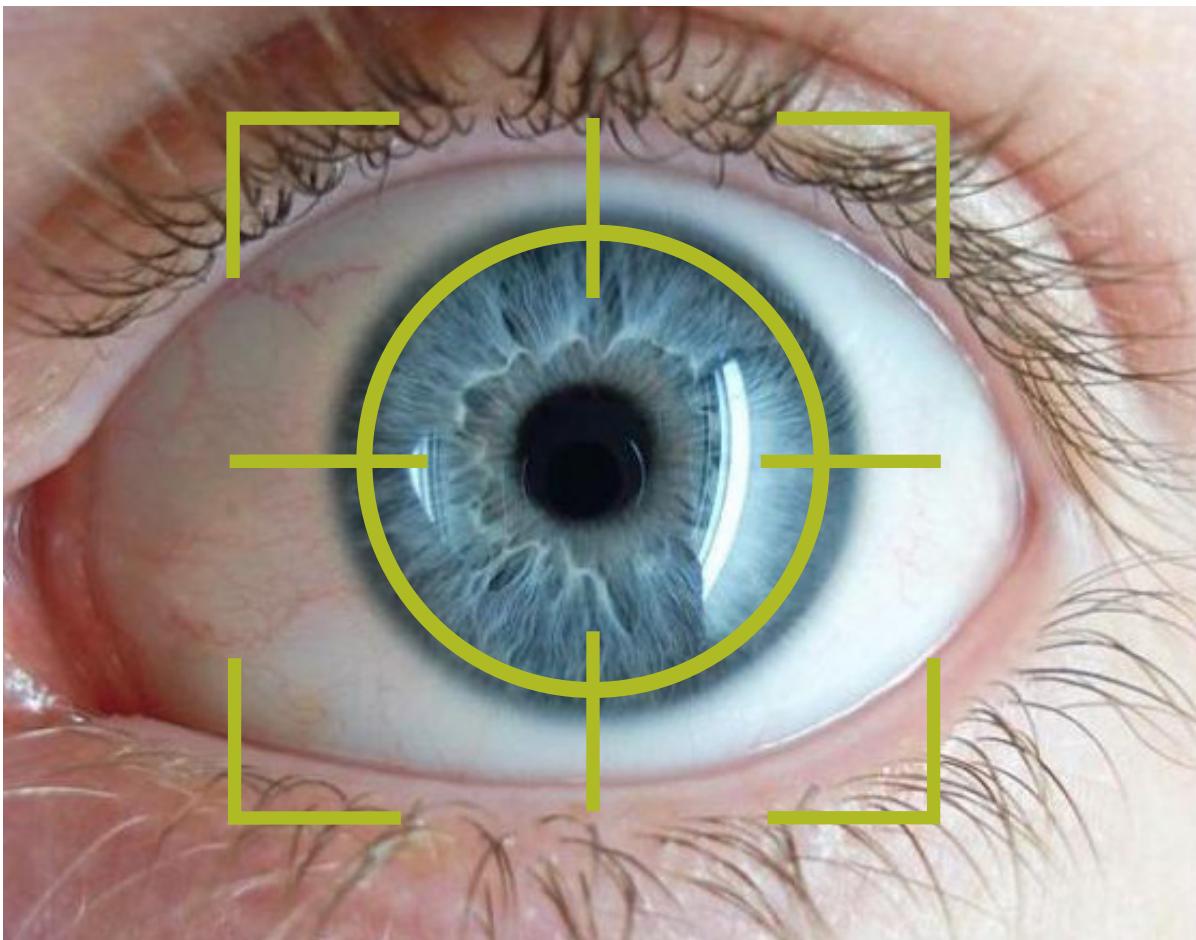
"My biggest takeaway from this team is the amount of relevant, hands-on experience I have gotten in the field. I have had the opportunity to work on several big projects, all of which have been very beneficial to me as I prepare for a career in a research-oriented field," Stephanie Jeffirs, senior psychology major, explained.

Comprised of a nearly equal ratio of graduate students to undergraduates, this project also provides a mentoring aspect that enhances student studies. As graduate students provide undergraduates with the resources and experience to succeed, the undergraduates provide the graduate students with fresh ideas and assistance on projects. Kristen Jennings, Ph.D. candidate in psychology, described, "Seeing undergraduates getting involved in research is one of the best aspects of this Creative Inquiry. The collaborations we have between graduate and undergraduate students have been beneficial and rewarding to everyone and very rewarding." Britt also feels a major advantage of this Creative Inquiry is the real-world research experience. "One of the most rewarding parts of being a professor is seeing undergraduate students get excited about research and using their experiences to get in the graduate school of their choice or to land the job they desire," Britt said.

In a world full of anxiety, motivation and social interactions, Britt's Creative Inquiry team works continuously to shine light on various issues at the intersection of social, clinical and organizational psychology. Collaborating with large organizations allows the team to translate research directly to the workplace. Understanding how humans react to different situations and the factors that influence behavior will continue to be the foundation for the research done by this team. In the future, the team hopes to be involved in the tailoring of stress management interventions for astronauts participating in long duration missions.

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**JOE WORTKOETTER**  
Staff Writer



Eye tracking measures where the eye is focused or the motion of the eye while a person views a target (e.g., a display or webpage)

Eye tracking requires special software to generate data on pupil focus and movement.

# Overcoming Data Overload

IN THE COMPLEX ENVIRONMENT OF TODAY'S WORKPLACES, workers must be able to successfully complete multiple tasks and manage multiple responsibilities at the same time. The amount of stimuli and displays can often be overwhelming. Students from the Crossmodal Links Between Vision and Audition Creative Inquiry work to improve the connection between humans and technology. The Creative Inquiry, led by Dr. Sara Riggs, assistant professor in the Department of Industrial Engineering, utilizes cognitive engineering, algorithms and various sensory channels to address and mitigate data overload.

Currently, the team is investigating how to utilize senses other than sight for displays. "Multimodal display, or presenting information through various sensory channels, has been shown to be a promising means of addressing the idea of data overload," Riggs commented. For example, if a visual sign or stimulation can be converted into a vibration or tactile stimulation, this could offload from the often overburdened visual channel.

In addition, the team is pursuing the concept of adaptive displays. Led by senior industrial engineer, Shannon Devlin, this project focuses on creating displays that can be altered based on the cognitive state of the user at that specific time. To better understand how people respond to different tasks, Devlin recently completed a study involving eye-tracking of a subject in a simulation regarding Unmanned Aerial Vehicles (UAV). "Eye-tracking of the subjects during the experiment

allows us to see how humans transition between tasks and to determine whether or not there is a mathematical modeling method we can create to predict this behavior," Devlin elaborated. While the experiment was based on UAV and military application, creating a mathematical model for how humans react to multiple stimuli can be expanded to many tasks.

Knowing and predicting how someone will react in a given situation and how to reduce sensory overload has numerous implications in nearly every field. Telemedicine, the expanding field of using telecommunications to provide healthcare, could benefit from adaptive displays to ensure patients and doctors receive the correct information at the proper time. Specialized and variable manufacturing processes, like those used in the mass production of customizable cars, require complete attention from workers to assemble components and parts properly. Better understanding of how humans receive and perceive information and instructions can help reduce manufacturing errors that are seen in high-option, high-content manufacturing. As the field of cognitive engineering progresses forward, applications of research done by the team continue to be relevant and aid in overcoming data overload.

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**JOE WORTKOETTER**  
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# BRINGING B

## OTHER

### CLEMSONS

#### TO LIGHT



*Bricks made from clay obtained from the Clemson University campus and surrounding areas in upstate South Carolina.*

EGINNING IN 2014 , CLEMSON University instituted a yearlong series of events, lectures, performance and exhibitions called “Race and the University: A Campus Conversation.” The

Clemson Brickmaking Event was part of this conversation. The event was a tribute to the predominately African American convict crew that made the bricks for the original campus buildings. The clay for the bricks came from areas around Clemson’s grounds, thus providing a hands-on approach to connecting students to Clemson’s land and history.

Bringing Other Clemsons to Light, a Creative Inquiry led by Dr. Lance Howard, is in charge of the event. The Creative Inquiry team worked together to study the history behind the convict laborers who built the original Clemson campus, to ensure the event honored their tradition and to work towards reconciling race divides. “...Through the brickmaking event everyone could participate in the healing needed to right the wrongs of the past,” Howard explained.

Molding bricks is a science and an art that allows for students to connect on a deeper level to Clemson’s past. In 2015, the weeklong event ran from September 21st to September 26th, engaging more than 400 participants. Eventually the Creative Inquiry team would like to use the bricks to memorialize Clemson’s past. The goal of the Creative Inquiry is to bring to light the conditions and the people involved in building the campus. The students were asked what they thought would be the best way to pay tribute to those who had worked to build the campus and those who have been treated unjustly throughout the years due to their race, and the decision led to brickmaking. Because it was a way to honor the convict story but also give back to the campus, the event felt intuitively right. Fall 2015 was the third semester the event has taken place and each year it brings together more and more people on the campus and in the greater Clemson community.

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**HAILEY GREEN**

*Staff Writer*



All photos / Wales Toney

Howard and members of the Creative Inquiry team, Bringing Other Clemsons to Light, organized the fall brickmaking event.

# EXTREME ORANGE

*Students applying knowledge and skills to address real world issues in industry*

**W**HAT DO YOU get when you combine a group of students from business and computing with experts from a major corporation? The answer is Extreme Orange, an incubator for computer programming projects with entrepreneurial potential. This multidisciplinary Creative Inquiry team led by Dr. Jim Martin and Dr. Sekou Remy in the School of Computing, assisted by Josh Doran, a graduate student in the MBA program, and Jianwei Liu, graduate student in computer science. IBM is the corporate partner. In addition to guidance by the Clemson faculty, the students benefit from technical and business advice provided by IBM mentors.

The project was named "Extreme Orange" to reflect its similarity to IBM's "Extreme Blue" internships in which students work as a team to develop business ideas that address real-world problems. "IBM sees the Extreme Orange program within Creative Inquiry as a critical vehicle for IBM and Clemson to

collaborate on next generation solutions. The emphasis of the Extreme Orange program is to ensure that students gain access to industry experts within IBM for joint collaboration on solving real-world problems," Mr. Mac Devine, Vice President and CTO of Emerging Technology and Advanced Innovation, IBM Cloud Division stated.

IBM supports the Creative Inquiry project and provides a set of problems that are suitable for undergraduate students with programming skills. The project pairs computing students with business students who contribute to project management, marketing and commercial development. Extreme Orange thus gives undergraduate students opportunities to extend and apply their knowledge and skills in an environment that cultivates research, innovation and entrepreneurship. "It is important to learn about the business technicalities of an idea and its implementation because there is not as much of a risk in the classroom as there is in the real world," Doran explained.

This year, the team had three projects. Project Sol worked on developing an application to

record the level of sunlight over long periods of time, with the goal to be able to predict the solar power capacity of a specific location. In Project Queue Warning, students explored the prediction of traffic queue formation. Their goal was to provide warning alerts to approaching vehicles in near real-time. Project Kite is developing a modeling tool for emerging connected vehicle technology systems. All three projects are continuing beyond this year and will be incorporated into ongoing Clemson research efforts.

The relationship benefits the sponsor as well as the Clemson students. "The IBM mentors working with the Extreme Orange students also get an opportunity to validate new technologies under development and determine their viability from both a technical and business perspective," Devine said. He and others at IBM look forward to continuing this mutually beneficial Creative Inquiry project with a new group of students in the coming year.

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**HAILEY GREEN**  
Staff Writer



# Type 1 Diabetes

1

...is an autoimmune disease.

2

...stops the pancreas from producing insulin.

3

...attacks both children and adults, leaving them dependent on insulin pumps or injections permanently.

4

...is diagnosed in 40,000 people in the U.S. annually.

5

...affects 1.25M Americans, 200,000 of which are under 20 years old.

6

...research is supported by the Junior Diabetes Research Foundation (JDRF).

Information from [jdrf.org](http://jdrf.org)

## Go With Your Gut

THE HUMAN GASTROINTESTINAL TRACT MAY NOT BE a frequent topic of everyday conversation, but it sure is a conversation worth having as it is home to symbiotic bacteria that assist in digestion. Besides digestion, bacteria in the gastrointestinal tract affect numerous processes in the body. Bacteria have the ability to affect treatment of diseases like diabetes. Dr. Kristi Whitehead from the Department of Biological Sciences described, "Sometimes we know there are genetic or host factors that play a role, but there are some unknown factors also, and people are really interested in research regarding that."

Treatment of children with type 1 diabetes involves diet manipulation and limited exposure to harmful catalysts. Not only is it difficult to ensure adherence to dietary and lifestyle changes but also hard to pinpoint areas that require change. Type 1 diabetes can also be affected by a person's genetic family history, something children have no control over. With these and other difficulties in mind, students began to explore the questions of understanding and potentially treating type 1 diabetes. Their investigations started with the microbiota in the gut. Bacteria of the genus *Bacteroides* are present in the human gastrointestinal tract and can affect positive change in patients with type 1 diabetes.

The team focused on developing a therapeutic molecule that could change the microbiota in the gut without being harmful to the individual. That is not an easy task. Dr. Daniel Whitehead from the Department of Chemistry explained, "The gastrointestinal tract in terms of an ecosystem is pretty competitive. The bacteria that live in your gut, they sort of have to fight each other

for nutrients." The team worked hard to discover molecules that selectively inhibit the *Bacteroides* without affecting other important microbes in the gut.

This Creative Inquiry has been active for more than three years. Based on their preliminary data, they received funding from the Juvenile Diabetes Research Foundation. There is still much to be discovered in this project that has been conducted primarily by Clemson undergraduates. Students from a wide variety of majors are involved in this Creative Inquiry project. For some, this project spurred them to considering pursuing medical or graduate degrees.

Undergraduates in research encounter limitations as well as opportunities for discoveries. One difficulty the team experiences is getting new students acclimated to their research environment and methods. Bacteria found in the intestine are extremely finicky and must be handled with extreme care and attention to detail. Even a short exposure to our oxygen-filled atmosphere would kill the bacteria. There are also many opportunities for growth. The team is preparing to test their molecules in mice with type I diabetes, a venture never attempted on Clemson's campus.

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**NICHOLE MARTINSON**

Staff Writer

OFFERING STUDENTS THE CHANCE TO DEVELOP apps for needs around Clemson's campus, Dr. Roy Pargas, associate professor in the School of Computing, invites students to the Apps R Us Creative Inquiry team. At the beginning of each semester, faculty, administrators and students pitch ideas to the team and vie for being adopted as one of the projects for the students in this Creative Inquiry.

As with the rapid advances in mobile technology, app development is constantly evolving. For Pargas, however, the development process began long before the introduction of mobile devices. In fact, the beginnings of this Creative Inquiry can be traced to tablet PCs, a technology that is now a rarity. Noting the origin of the Creative Inquiry Pargas said, "[Tablet PCs] preceded mobile phones and we developed many pieces of software for these tablet PCs. But tablet PCs never really caught on, and then mobile devices came along, the iPhone, Android phones, iPads, Android tablets came along and completely overwhelmed the tablet PCs." While the technology has changed, the Creative Inquiry's goal remains steadfast: developing software and apps for the betterment of Clemson University.

Forming two Creative Inquiry projects nearly four years ago, Pargas aimed to create a collaborative environment focused on producing an app ready to enter the marketplace. With a strong emphasis on teamwork, Pargas encourages sharing of computer code, techniques and ideas in order to better increase the knowledge of everyone on the team. The Creative Inquiry projects allow students with variable experience to find the team right for them and gain experience developing for both iOS and Android devices. The Apps 'R Us Creative Inquiry is geared towards those with little development experience. During the first two semesters, students learn the basics of Android development and learn many of the techniques necessary for app development. The second Creative Inquiry under Pargas's leadership is a more intensive app development Creative Inquiry, Enhancing Campus Activities with Mobile Devices, that allows students with development experience to dive into both iOS and Android systems. In the first semester, students are exposed to Android development and work towards developing an app at the end of the semester. The following semester, students explore iOS development and aim to produce another app suitable for further development.

At the end of each semester, student app projects are featured in a showcase. Several of the apps end up in the iOS App Store and Android Marketplace. For students in the Creative Inquiry, the mark of success is the ability to see the app development process from beginning to end. For Pargas, the success comes in giving students the tools and mindset to continue developing and look forward in the technology revolution.

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**JOE WORTKOETTER**

*Staff Writer*

# ENGAGED AGING

## Caring for Others, Caring for Self

D

r. CHERYL DYE, PROFESSOR IN PUBLIC HEALTH sciences and Director of Clemson University's Institute for Engaged Aging, has mentored Creative Inquiry teams for nine years. She began mentoring a Creative Inquiry as co-mentor with previous Provost Dori Helm in 2005. After her work with Helms, Dye led teams in exploring ways to improve quality of life for older adults in

the project,

Nature Experiences for Older Adults. Her current project, Effects of Thoughts and Sensory Experiences on Heart Rate Variability of Older Adults, addresses the needs of family caregivers of those with Alzheimer's disease and their care recipients. This project was created in response to the overwhelming number of people with Alzheimer's disease in South Carolina. While there is no cure for this disease, steps can be taken to educate caregivers on best practices to care for their loved ones while maintaining their own health. "[Our goals are to] reduce the stress and burden experienced by family caregivers of those with dementia and to increase cognitive and social engagement of their care recipient with early to mid-stage dementia," Dye explained.

Since the spring of 2014, when this Creative Inquiry began, 37 students have participated on the team from different majors and class standings with the majority of students from health sciences. By participating in this Creative Inquiry team, students become certified in human subject protection and research protocols and gain experience in collecting data on how heart rate variability can be enhanced through various stress management strategies. Students also gain valuable knowledge they can take with them beyond their years in college.

"Dr. Dye is very enthusiastic about the health of the elderly (specifically dementia patients and their caregivers), and it was inspiring to be able to see that from a professor. It changed my views on geriatrics," wrote a student on an anonymous evaluation. Another said, "Dr. Dye has an unmatched ability to not only educate students but those in the community as well. Through CI, she provided me with many opportunities to grow as a student and future healthcare provider." There is no doubt that the Creative Inquiry team members are passionate about the work and are led by an even more dedicated and compassionate professor.

The team has served family caregivers and care recipients with Alzheimer's disease in the Anderson, Oconee and Pickens county area but has now found a permanent home for their program, Caring for Others, Caring for Self, at the Episcopal Church of the Ascension in Seneca, SC. Dye and a local community group are currently raising funds to sustain the program in the community, which means that many families facing the formidable challenges of Alzheimer's disease in Anderson, Oconee and Pickens counties will continue to benefit from the work of her Creative Inquiry teams for years to come.



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**NICHOLE MARTINSON**

Staff Writer



# HUMAN POWERED VEHICLES

**F**OR MEMBERS OF THE HUMAN-POWERED VEHICLE CREATIVE Inquiry team, September means scouring the recently published American Society of Mechanical Engineers (ASME) competition guidelines and the beginning of a two-semester, high-intensity vehicle build project. Each spring, ASME hosts a nationwide competition for engineering programs to develop a vehicle entirely powered by a human. While the thoughts of a human-powered vehicle may invoke images of a Fred Flintstone-esque rudimentary car for some, do not make this mistake. Over twenty members strong, this Creative Inquiry combines some of the best mechanical engineering students Clemson University has to offer to produce a cutting edge, innovative design capable of ranging from carrying groceries to endurance racing.

While bicycles and other human-powered vehicles have existed for ages, developing a human-powered vehicle capable of performing alongside modern vehicles presents some obvious challenges, especially when taking

into consideration the human body can only produce fractions of a horsepower. The design of the vehicle is critical and is one of the most rewarding aspects of the Creative Inquiry for many team members. Senior mechanical engineering major, Alex Whitman, explained, “The design aspect of creating a system has been very beneficial. This [Creative Inquiry] offers the chance to apply the analysis techniques we learn in class, add them to a design and make them come to fruition.” Everything from the ergonomics, to the weight, to the cargo space of the vehicle must be taken into account to be successful in competition.

**Panthera Tigris Tigris-  
the teams 2015 model  
HPV, shown without the  
exterior windbreaker**



*Photo courtesy of Corbin Kolenmainen*

At the heart of every successful project is a dedicated team working to propel the project forward. This Creative Inquiry allows students to pick a specific aspect of the design they are interested in and dedicate their time to that system of the vehicle. In doing so, students are able to work in small design teams on their respective systems, specialize in their field and collaborate with other system groups. While this system interface may be one of the more challenging aspects of the build, the teamwork and communication required for the build help prepare the students for both success in college and in their future careers. For advisor Dr. Gregory Mocko, associate professor in the Department of Mechanical

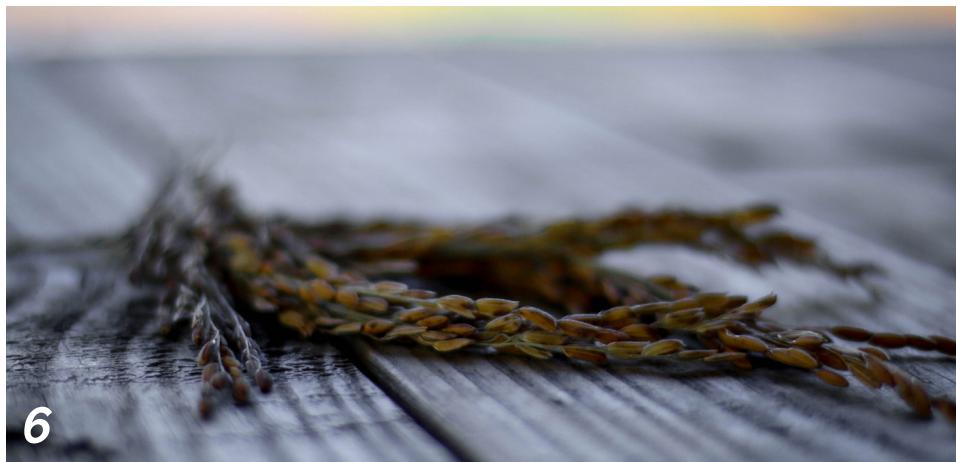
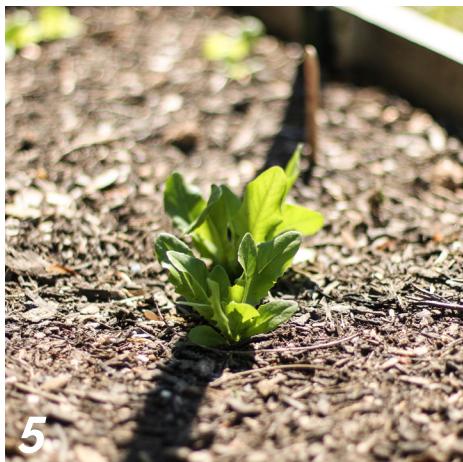
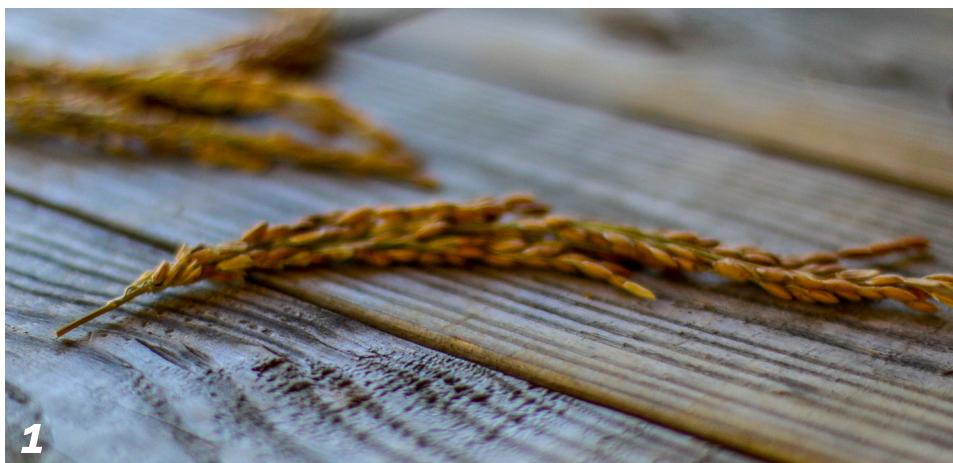
Engineering, this Creative Inquiry provides the perfect blend of creativity with practicality, as well as incorporating the thrill of competition. "The design, fabrication and testing of the HPVC is 100% student-driven. They have the free reign to explore wild ideas and technologies but are often tamed by practical manufacturing. The HPVC Creative Inquiry provides students with the opportunity to challenge and expand their engineering knowledge, get their hands dirty with hands-on design activities and have fun," Mocko said.

With global interests in lowering dependence on fossil fuels and unlocking new energy sources, the Human-Powered Vehicle

Creative Inquiry team brings us back to the original power plant, the human body. By utilizing engineering prowess and technical savvy, members of the team accept the challenge of human-powered vehicles and stretch the limits of vehicle design. With the right combination of innovation, design and teamwork, this team is sure to find success in not only competition, but also in developing skills and understanding in the field.

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**JOE WORTKOETTER**  
Staff Writer



# S

## ustainable Farming: From Garden to Table

*Using native plants to design a garden of the future*

NESTLED BESIDE THE BART GARRISON AGRICULTURAL Museum of South Carolina, located in Pendleton and amongst clucking chickens, is a garden containing crops native to South Carolina. It is here that students from the Designing a Kitchen Garden of the Future Based on the Past Creative Inquiry team meet on a weekly basis to maintain and develop the garden. The group is led by an interdisciplinary team: professor of food science and nutrition, Dr. Beth Kunkel; assistant professor of landscape architecture, Paul Russel; and Director of Healthy Campus, Jennifer Goree. The goal of the project is not only to design and maintain the garden, but also to practice sustainable food production and create a learning environment for community groups and local students.

Established in the spring of 2013, the Creative Inquiry originally sprouted from the Sustainability Café initiative at Clemson University. This initiative aimed towards discussing sustainability and conservation on campus while bringing together diverse people with different specialities and ideas. Students and professors from landscape architecture designed the original layout of the garden and worked to reduce the overgrown space into a workable garden area. As the land was cleared, planters and garden beds were built and the process of determining what plants to grow in the garden began. Noting the sustainable emphasis of the project, students on the team decided to fill the garden with native plants that are often uncommon today. Visiting the garden, which is just a few minutes off campus, you will find crops such as Carolina Gold rice, Benne seeds and Bradford

watermelons. Now in its third year, the Creative Inquiry team still maintains the strong emphasis on sustainability by educating groups on how to farm native food. Rachel Motro, senior food science major, explained, "The Creative Inquiry not only provides the opportunity to work in the garden, but also the ability to see where the food comes from and experience the entire farm-to-table process."

***The goal of the project is...  
to practice  
sustainable food production and create a learning environment***

In addition to planning and maintaining the garden, students in the Creative Inquiry experience harvesting and preparing crops for consumption. On Friday afternoons, you can hear students threshing the harvested rice or shelling the Sea Island Red Peas. To provide education to visitors and local schools, these crops are often made into long-forgotten

recipes that originated from the southeastern United States. This cross-disciplinary Creative Inquiry, now called Partnerships for a Sustainable Food System, combines native crops and classic recipes to provide the local community and students with a glimpse into the past. As this Creative Inquiry grows, students, professors and visitors alike will continue to harvest crops and to gain the knowledge and skill set that comes with sustainable agriculture.

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**JOE WORTKOETTER**  
Staff Writer

## In the dirt

A few details about what's growing on page 15.

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1

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Portion of a seed head of Carolina Gold rice grown in a raised bed at the Bart Garrison Agricultural Museum of SC. Carolina Gold was the basis of the Georgia and South Carolina economy during the colonial and antebellum years.

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2

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Mustard greens in flower. Mustard greens are thought to have originated in the Himalayan region of India but have become a staple in southern cooking. They are an excellent source of vitamins A, C and K.

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4

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Sea Island Red Peas grown in the Slow Food Ark of Taste garden at the Bart Garrison Agricultural Museum of SC. The traditional dish cooked from these peas, Reezy Peezy, is made almost exclusively in the Sea Islands of South Carolina.

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Another seed head of Carolina Gold rice. As loved as Carolina Gold rice was in the south, it had a major flaw, the grains cracked in the field. In compensation, locals would often keep the broken grains for themselves. They held more flavor when cooked, and today they are known as rice grits.

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Little Marvel green peas emerging in early spring in the garden at the Bart Garrison Agricultural Museum of SC. Little Marvel peas are an heirloom crop, boasting heavy yields of delicate good-flavored peas.



# Stress After Dark

## Protecting the world's biodiversity one salamander at a time

THERE IS A GREATER ABUNDANCE OF LUNGLESS salamanders, also known as *Plethodon*, than any other vertebrate group in the southeastern United States. Thus this group has a major impact on the ecosystem. Because salamanders are nocturnal, they are seldom seen, but these ecologically important creatures are being threatened due to stressors in their environments. The Creative Inquiry project, Stress After Dark, led by a biological sciences graduate student, Evan Apanovitch, investigates *Plethodon* and their ability to survive conditions that are threatening their abundance. "Initially I became interested in working with salamanders because they are an excellent ecological indicator and by understanding the health of their populations, and how they react to stressors is informative to the overall health of the ecosystem," Apanovitch explained. This Creative Inquiry project is focusing on how multiple stressors interact to influence physiological responses and how these responses are predictive of future range dynamics.

Stressors affecting the abundance of salamanders include increased temperature and decreased moisture levels in the air. For a salamander, moisture levels are extremely critical. Because they are lungless, they rely on moist skin in order to breathe. If moisture levels are too low, salamander activity will decrease. The Creative Inquiry team is researching the effects of warming and drying climate changes to determine whether or not salamanders can adapt to the new environments. Temperature change is a detrimental stressor because it could lead to possible extinction of the lungless salamander. Temperature, habitat loss, pollution and disease have caused the amphibian population to decrease by 40%.

*Plethodon* salamanders are a model organism for studying the impact of climate change at the organismal level. All photos/

Wales Toney

The teams research has shown that stress varies with environmental gradients, so there are different stress levels seen in different parts of their ranges. The research also suggests that an increase in stress leads to a decrease in energy available for the salamanders for activities such as reproduction and foraging. This may result in decreased survival in areas where the salamanders experience chronic stress. Stress variables have allowed for predictable and testable mechanistic responses to climate change. "With an increase in stress, salamanders are less able to be active and survive. We hope to determine the adaptability of salamanders and the range of suitable environments for them to survive in," Molly Nielsen, a junior biological sciences major, explained.

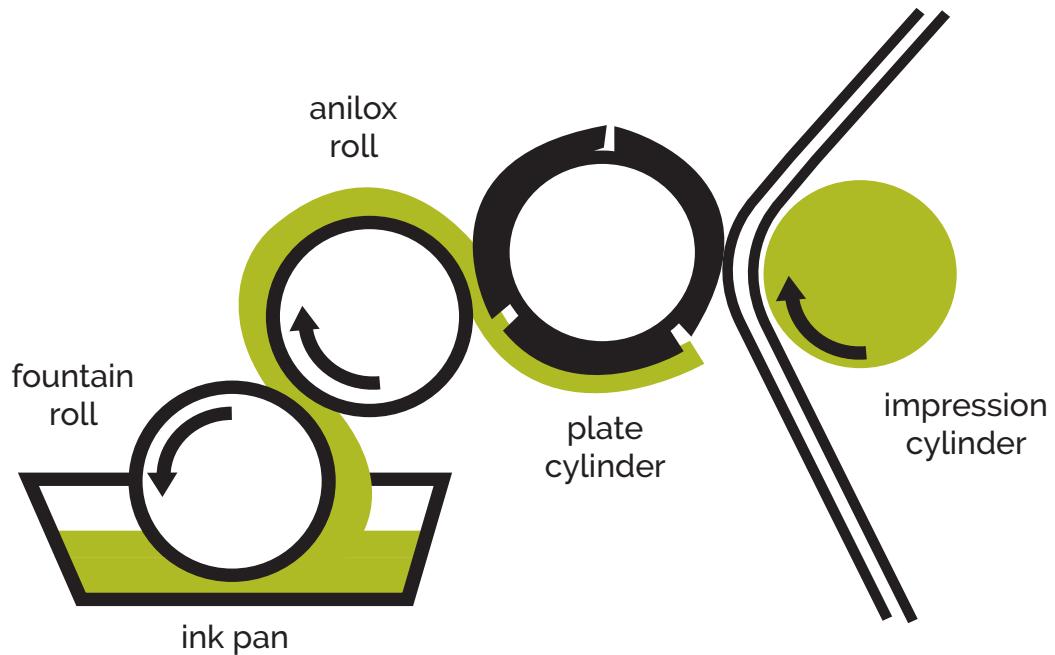
This Creative Inquiry project has nurtured the students' abilities to research an important subject. Apanovitch wants to conserve salamander populations, but he is also committed to providing the students with a skill set that will be valuable throughout their lives. These students are taking active roles in their education and gaining skills that cannot be taught inside a classroom. Apanovitch and his Creative Inquiry team plan to publish their findings to bring awareness to the growing threats to the *Plethodon* populations. The Creative Inquiry team's research contributes to protecting the world's biodiversity. These Clemson students are getting a chance to work on a project that will have a long-term impact in ecology.

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**HAILEY GREEN**  
Staff Writer

## The flexographic printing process

uses a system of rollers, liquid ink and a flexible plate to create an image. Beginning at the fountain roller which picks up ink carrying it to the anilox roller which is engraved with millions of different cells. A flexible image plate is mounted to the plate cylinder where the ink and image impress onto the substrate. Flexographic printing is often used on paper-board, film, corrugated boards and foils.



# Cutting Edge

*Student competitions push student design in digital and print graphic design to the limits*

N MARCH 2016, SCHOOLS FROM across the United States traveled to Memphis, Tennessee to attend the annual Technical Association for the Graphic Arts (TAGA) conference and to compete in the student journal competition. The conference brings leading researchers in the global print industry together to present their work. In addition, the student chapters have the opportunity to produce a technical journal designed to show off cutting-edge technology that students across the nation are learning in their graphic communication programs.

There is an Attendee's Choice Award as well as a competition where journals are judged by the TAGA Board of Directors. The articles produced in the journal are based on student research in the technical field of printing and graphic communications. Thus, they require a strong understanding of the graphics world. The goal of the competition is to encourage students to expand their printing capabilities and present their research to the most

scientific minds in the graphic communications industry.

Clemson University has been involved in the student competitions since they began 30 years ago, and has been a leader in changing the course of the conference regarding design. However, it was not until a few years ago that TAGA became a Creative Inquiry option. The Creative Inquiry TAGA Journal led by Dr. Liam O'Hara, associate professor of graphic communications, competes in the conference each year by producing a journal that showcases the students' designing and printing capabilities as well as pushes the envelope on their technical proficiency. The journal is judged on design, production, technical content and overall quality. As the team puts together the project from start to finish, they are encouraged to embrace print and digital media. Not only do they conduct the research for the content in the journal, but they contact vendors, order substrates and ink, make the printing plates, run the presses and create large-scale products that push the boundaries of the printing processes. "It exposed me to

the printing process more than what I would learn in a classroom setting and that was beneficial to my education," Melissa Thompson, sophomore graphic communications major, stated.

The objective for this Creative Inquiry during the fall 2015 semester was to focus on the design and technical content for the journal, while the spring 2016 semester was to concentrate on the printing of the journal. O'Hara wants the students to showcase their own work and the different skills they have learned throughout their years at Clemson, and the Creative Inquiry project gives them an opportunity to explore different print technologies. "My goal for the students is to take risks and push the boundaries. I want them to use diverse printing technologies and explore things that have never been done before. And of course, I want to win," O'Hara explained.

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**HAILEY GREEN**  
Staff Writer

# OUT OF THIS WORLD

*Have you ever wondered how the world was formed?*

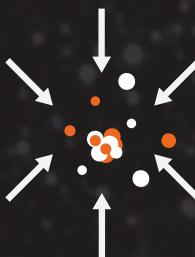
HOW THE EARTH, PLANETS AND THE BILLIONS of stars that light up the night sky were molded? Dr. Sean Brittain, assistant professor of physics and astronomy, is head of the Creative Inquiry Characterization of Planet Formation and he and his team are working to answer these very questions. Brittain's team is working together to collect information from already available resources and to create their own models to figure out how the earth and other planets were developed. Brittain explained his goal for the group, "I want them to learn how science works. When you are doing real research, there is not a pre-determined answer. It's a real challenge to solve open-ended questions with no definite answers."

The group has studied many images of stars at different stages of their evolution. By observing this information from an international archive, the students have found patterns of black space among the billions of stars. This space is where a solar system and planets are formed. Although invisible to the human eye, this empty space is composed of gas and dust, which continue to accumulate. As dust and gas build, the space begins to collapse, forming the disks around a centralized star. But, how do you go from a disk to a solar system with many planets? Currently, the Creative Inquiry team is focusing on how to answer this question using rotational-vibration spectroscopy. They believe if they focus on the carbon monoxide emissions

## Timeline of planetary formation

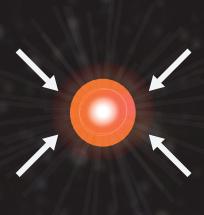
### 1. Accretion

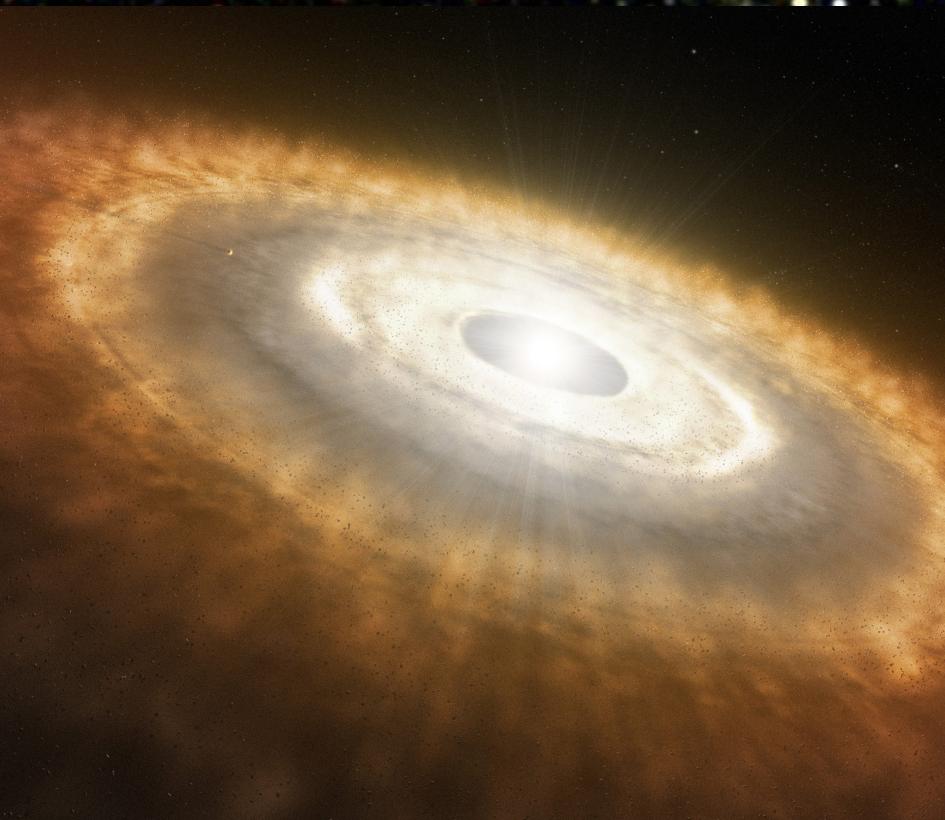
is the accumulation of matter under the influence of gravitation which form large bodies of matter.



### 2. Heating and melting

occur as accretion produces heat, causing substances to melt and condense.





Rotating disks of gas and debris, known as protoplanetary disks, can orbit objects like stars and accrete into planets.

from the disks and observe the levels of carbon monoxide present, the temperature and how it is disturbed, it will allow them to measure the movement of mass around a centralized star. The vibrational levels reflect ultraviolet light, while the rotational levels reflect thermal output. By studying the changes of these levels, the group can observe the evolution of planet formation. The emissions correspond to changes in density in a certain area, which is representative of planet formation.

This Creative Inquiry used measurements recorded over 12 years and created models that represent the changes over this period. The group is broken up into two teams. One team analyzes the raw data received from Interactive Data Language®, a

programming language used to analyze large sets of data. These students assist in breaking down the data in the rotational-vibration spectroscopy study. The other team takes the raw data and creates models using C programming language. Once the data has been modeled, it is organized using Palmetto cluster, a supercomputer at Clemson University. The software used in this Creative Inquiry encourages students to learn to analyze raw data and create organized models that others can use. “I hope my students take away a more realistic picture of how science works as far as research practices and development,” Brittain clarified.

The students have presented their research at several conferences which not only

*When you are doing real research, there is not a predetermined answer*

provides the opportunity for students to present their work but also to network with peers, graduate schools and potential future colleagues. “This Creative Inquiry project provided a strong basis for me to build a strong portfolio of undergraduate research that has earned me acceptance in some of the best physics graduate schools in the world,” John Farmer, a senior physics major, explained. As this Creative Inquiry continues to collect and analyze data there will be more opportunities to showcase their findings and continue to work towards discovering exactly where planets come from.

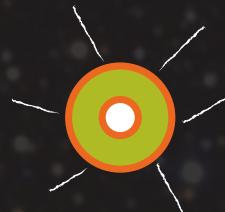
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## HAILEY GREEN

Staff Writer

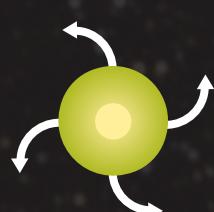
### 3. Core formation

takes place as heating of the planet causes heavier materials to sink and lighter materials to rise.



### 4. Cooling and crust formation

produces a solid in terrestrial planets, but remains a gas for gaseous planets.



### 5. Geological activity

is different for each planet yielding in different atmospheres and terrain.



# INNOVATIVE TISSUE ENGINEERING

*Research projects could lead to huge advancements in the medical field*

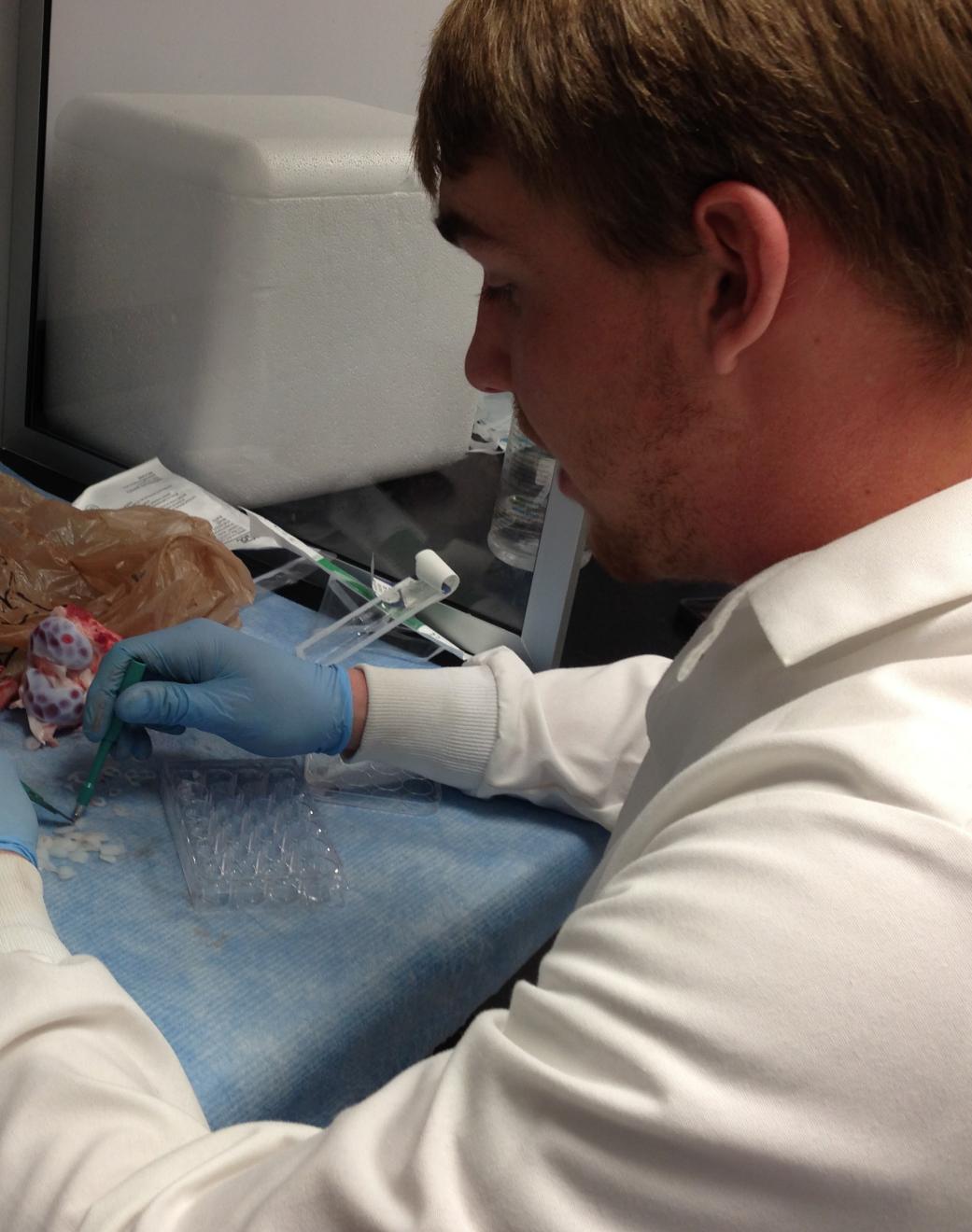
MAGINE BEING ABLE TO CREATE FULLY FUNCTIONAL biological tissues from scratch with the potential to renew an athlete's cartilage out of his own cells, or be able to culture stem cells for longer periods of time. Imagine being able to take biopsied tumor samples from a cancer patient and grow microtumors to find the most successful treatment for your patient. Tissue engineering is the practice of combining cells, scaffolds and other biological materials to create and build fully functional tissues.

The Hands-on Tissue Engineering Creative Inquiry, led by Dr. Jorge Rodriguez, research assistant professor in bioengineering, focuses on the exciting and novel field of tissue engineering. This Creative Inquiry is organized into three teams to study various aspects of tissue engineering. The first team is focused on developing an efficient method for cell culturing. Current detachment processes in cell culturing involve enzymes that compromise the cell membrane, impairing cell



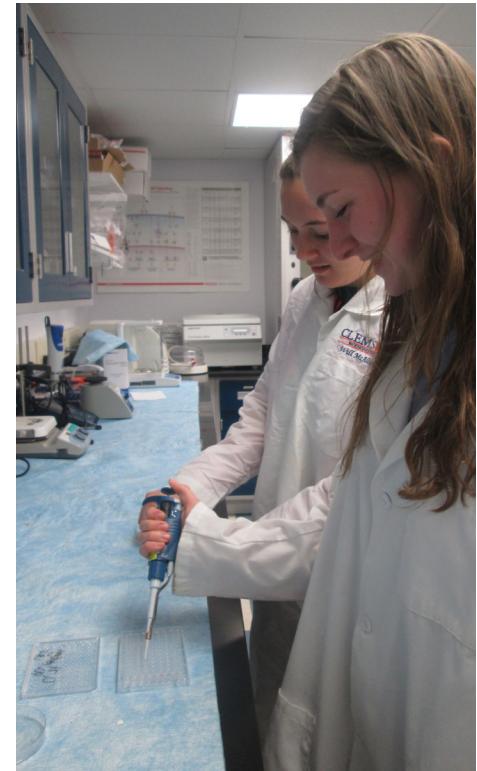
function. "We are trying to engineer a new surface for cell culture that doesn't damage the cells when removing them," Caitlyn Jones, senior bioengineering major, explained. "By growing cells on a photovoltaic surface, we hope to detach them by striking the surface with a light. The light switches the charge of the surface, repelling the cells away." This research was presented at the Biomedical Engineering Society National Conference 2014 in San Antonio, Texas.

The second team researches cartilage regeneration and implantation. Due to the prevalence of arthritis, this field is gaining large amounts of attention. The goal of this research is to improve the mechanical properties of cartilage cells constructed in three-dimensional models. The students are creating spherical microtissues. When



Left: Senior Joe Wortkoetter harvests cartilage from pig joints for cartilage regeneration research.

Below: Senior Caitlyn Jones performs an assay on cells using a pipette.



Photos by Kalli Garzon

cultured with growth factors, the microtissues have mechanical properties to native articular cartilage. To obtain the cells for research, they have learned to isolate and harvest cartilage cells from pig joints that are donated from Snow Creek Meat Processing located in Seneca, South Carolina.

Students involved in the third team are studying the formation of microtumors for drug screening. Often, preliminary drug screenings for cancer are tested on a single layer of cells, which poorly represent the structure of an actual tumor in the body. However, by growing cancerous cells as three-dimensional structures, they can mimic properties of a tumor. This model is more effective in testing drug treatments. The students are specifically researching the effect of a cytotoxic drug, doxorubicin, on breast cancer

microtumors. Students presented their research on this project at the Southeast Biomedical Engineering Career Conference in Atlanta, GA.

While each member dedicates his or her time to study his or her own project, the diversity of the entire Creative Inquiry team allows them to learn from the other research projects as well. This Creative Inquiry has given students the independence to take control over their own projects yet collaborate with one another to generate innovative ideas.

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**KALLI GARZON & JOE WORTKOETTER**  
CI Team Writer & Staff Writer

**Teams  
collaborate**

**to generate  
innovative ideas**



Students analyze the themes in foreign films in Tissera's Creative Inquiries in context to human sexuality, domestic violence etc., to understand the culture of the countries in which the films are portrayed.



Photo courtesy of Graciela Tissera

## Health in Media

*Hidden sides of Spanish culture are revealed through the analysis and discussion of foreign films*

NDERSTANDING ANOTHER LANGUAGE IS HARD ENOUGH, BUT students in the Health and Business Topics in Film and Media Creative Inquiry have reached far beyond comprehension of the Spanish language. Led by Dr. Graciela Tissera, associate professor of Spanish in the Department of Languages, this Creative Inquiry team takes foreign, primarily Spanish, films and analyzes their themes, focusing on the way health and business topics are portrayed. Pertinent topics like human sexuality, alternate realities, domestic violence and feminist symbols are just a few of the topics that Tissera and her team research and analyze through the viewing of these films.

Rebecca McConnell, senior language and international health major reflected, "We're opening up our minds and learning about a world beyond just learning the Spanish language." She is a member of the Creative Inquiry team which recently presented at the National Southeast Coastal Conference on Languages and Literatures. The students feel through media and film, they are able to get a peek into lives that are sometimes carried on behind closed doors. What is depicted on-screen offers unique insight into situations and attitudes not readily observable to the public or to researchers in learning what specific cultures value. Students follow an analysis guide while they watch the films, which helps them to identify main themes, impact of time and space, techniques, symbols, etc. This invites the students to think critically about what the directors of the films are highlighting and the interpretations that can be inferred from the production. Tissera began one Creative Inquiry project with a handful of students

in 2007. The original project evolved into four projects and 30 students. Many of the students in the Creative Inquiry are language and international health majors who then go on to pursue medical school after graduation. However, there are students from several disciplines and career trajectories on the teams.

When students are not analyzing and discussing films, they are traveling to various conferences throughout the semester. Several Clemson University undergraduate students have been recognized for their research and many are asked to speak at the conferences. Team members submit proposals to these conferences which permits them to have their work recognized on national and international levels. Offering up a different view of foreign cultures, any student interested in foreign languages or international travel should pursue one of Tissera's Creative Inquiry projects.

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**NICHOLE MARTINSON**  
Staff Writer

# Silky Structures

## Turning to spider silk to advance cell farming in the future

SPIDER SILK IS FIVE TIMES AS STRONG AS THE same weight of steel. Silk fibers are made from natural proteins, which are strong and stable and can be used as framework for growing cells. Dr. Delphine Dean, associate professor of bioengineering, and Dr. Marian Kennedy, associate professor of materials science and engineering, co-mentor the Creative Inquiry, Mapping Amino Acids on Protein Surfaces, which studies the properties of spider silk by mapping the surface of the structure and the potential applications of silk structures to cell growth. First, the Creative Inquiry team mapped the surface of the structure with an Atomic Force Microscope to determine if cells could be grown on silk. The team is composed of students from several different majors, including bioengineering, biology and materials science. As the team mapped the surface of the structure, they identified the different properties that spider silk offers.

The entire project is student-driven. The students worked together to learn about fields in which they were previously unaware. They have learned to communicate across disciplinary boundaries, have learned new vocabularies and now are equipped with the knowledge to work with other disciplines. "The things we have learned in this CI are not taught in a classroom. I would never have been able to understand some of the biology involved in our research without it. We don't have the same terms and vocabularies in our different majors, so learning a new vocabulary teaches us to communicate with other disciplines," Leif Kays, senior materials science major, said. When the Creative Inquiry has collected

enough data, Dean's goal is for the students to write and submit a scientific publication to a journal. "The students are participating in rigorous scientific work, and I want them to be able to present it," Dean explained.

During the 2015-2016 school year, the team examined the properties of silk. They worked with several species of orb-weaver spiders (e.g., golden orb-weavers and writing spiders). The students studied the different compositions and mechanical properties of the spiders in order to determine how quickly silk comes out of the spider, how silk responds to different stressors and how cells respond to changes the silk undergoes in response to stressors. The team grew dental pulp stem cells, which are similar to bone marrow cells. These cells are fibroblasts, which are found in most tissue cells and produce a tissue matrix. The goal was to see how the fibroblasts responded as they grew on silk under different conditions. "It tells us that cells really do change on the protein and that means the long-term usability has lots of potential," Dean stated. The most exciting discovery the team made is spider silk responds to humidity by becoming stronger, which is the opposite of how most structures respond. The next step for this Creative Inquiry is to grow cardiac cells on the silk in hopes of making a cardiac patch for heart surgeries. Although this is a long-term goal, it could potentially benefit hundreds of cardiac patients.

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**HAILEY GREEN**

Staff Writer



Analyzing  
marketing strategies  
to improve  
participation and  
success of non-profit  
fundraisers.



# STRATEGIC PLANNING



IN 2011 CLEMSON UNIVERSITY ALUMNUS, Audrey Turchick, came up with a plan to improve the marketing strategies used to recruit and advertise the American Cancer Society's Relay for Life fundraising event. Relay for Life is an overnight event where teams work together to fundraise and remember those that are battling or have lost their battle with cancer. Turchick's plan initiated the Creative Inquiry, Relay for Life and Strategic Event Planning. Since then, the Creative Inquiry has flourished from eight students to 136 students. Because of the large number of students, Clemson University genetics and biochemistry alumnus and former Relay for Life President, Brittany Avin, and associate professor of genetics and biochemistry, Dr. Michael Sehorn, decided to run the project as a corporation. Avin supervised the group, while Sehorn served as CEO. The students were divided into small groups and assigned three projects, including a combination of fundraising events and logistics. Sehorn's goal for the students was to understand the logistics of running a non-profit organization. If students proposed an unrealistic idea, Sehorn allowed them to attempt the project until they realized it was not feasible. Sehorn explained, "I want students to go from beginning to end and see how all their work creates a finely-tuned product. My goal is to get them to be creative and work through logistics, becoming aware of every detail that goes into creating an event for a nonprofit organization." This learning experience forced the students to consider every factor from finances, locations, policies and regulations that must be followed.

Through this Creative Inquiry, students have learned how to take an active role in creating fundraising events and organizing major events, such as the American Cancer Society Relay for Life. Each week, the small groups presented their brainstorming ideas from the previous week. The presentations include successful ideas as well as highlights of those that were not, allowing the students to examine every detail going into planning an event. In 2014 and 2015, the students focused on increasing attendance at the

events. The event must have high attendance to be successful. At the end of the year, each group makes a final presentation summarizing all of their accomplishments and errors. This allows for the students to analyze their work and determine what does and does not work, which leads to improvements for the future.

Fundraising events like Rent-a-Puppy, late-night grilled cheese sandwiches in downtown, restaurant nights, t-shirt sales and luminaries were coordinated by this Creative Inquiry. The group put on an event before a basketball game between Clemson and University of Louisville, where the students set up a raffle for a Yeti Cooler. The raffle was advertised through social media and the team coordinated with the Athletic Department to follow their policies for holding events. Faculty and administration were involved in fundraising with a toilet seat event. A bright purple and orange toilet seat was placed on the door of a faculty member, in order to remove it they paid \$10 and placed it on the door of another faculty member.

All the fundraisers culminated in the biggest event the Creative Inquiry orchestrates, Relay for Life. The event begins with a lap of cancer survivors, followed by laps of caregivers, family and finally teams composed of Greek life, clubs and organizations. There are many activities during the event including zumba, jousting, arts and crafts and paint balloon darts, that make this event fun and entertaining for all ages.

"The best experience for me has been seeing my fellow students come up with these ideas to help increase cancer awareness and involvement. Their excitement from the inception to the follow through has been contagious. As a leader and as a cancer survivor, nothing makes me happier than to see growth in this field," Avin commented.

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## HAILEY GREEN

Staff Writer

# Fishing for Answers

*Understanding fish ecology could predict the overall health of the environment*

CLAD IN WADERS AND CARRYING NETS, STUDENTS from the Stream Fish Ecology Creative Inquiry formed a line and waded through the waters of the Clemson Experimental Forest. It is here, knee-high in streams, where the team studies and conducts research on the small, indigenous fish species in the Clemson area. Led by Dr. Yoichiro Kanno, assistant professor in the Department of Forestry and Environmental Conservation, the team uses electrofishing techniques to capture fish, tag them individually and track population dynamics. Studying how the fish population changes can indicate changes in the environment. “Understanding fish ecology is important for predicting the overall health of the ecosystem,” Kanno said.

To ensure fish safety, the team used a technique called electrofishing. For Daniel Dixon, a senior wildlife and fisheries biology major, this meant supplying over 500 volts to the stream while carrying a specialized backpack. The electricity temporarily stuns the fish and causes them to swim sideways. A trained eye and swift hand are then able to spot the disoriented fish and scoop them into a bucket. The electrofishing method is common for fish collection and provides students with experience that can transfer into their careers. “One of the best parts of this Creative Inquiry is being exposed to techniques and methods that professionals use in the field” Dixon said.

Having captured the fish, students worked quickly and diligently on the bank to collect data. The target species were Striped Jumprock, Bluehead Chub, Creek Chub and Mottled Sculpin, all of which are typically less than six inches in length. In

order to track the fish, passive integrated transponder (PIT) tags were inserted into the fish. These 8-mm tags, similar to the technology found in security clearance cards and pet identification chips, allow for each fish to be given a specific identification number. If a fish is recaptured, a scanner can determine the identification number of the fish and tracking can ensue. Fish that were not previously captured are weighed and measured before insertion of a PIT tag. Clove oil is used as an anesthetic for the fish to minimize pain. Then, with steady hands obtained from weeks of practice, students made a small incision on the ventral side of the fish and inserted the PIT tag. Fish were given several minutes to recover and come out from anesthesia in a bucket before being released back into the stream.

Using this technique, Kanno’s team captured and tagged over 1,500 fish in fall of 2015. And, while Kanno sees this as a



All photos / Wales Toney

*Senior Jessica Holbrook demonstrates the fish-tagging process.*

perfect opportunity to obtain long-term data about fish behavior and population dynamics, he also notes that one of the most rewarding aspects of the Creative Inquiry is working with the students. "Creative Inquiry has been great from my perspective. It allows me to teach students how to conduct long-term field research that they wouldn't normally be exposed to" Kanno said. During the spring 2016 semester, a team of students including Morgan Reed, Jessica Holbrook, Josh Cary and Thomas Austin attended two

conferences of the American Fisheries Society and presented a poster based on a study of PIT tag retention and survival, which they designed and conducted on their own. Real-world experience, combined with meaningful field research, ensures the streams in the Clemson area will have many student visitors for semesters to come.

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### JOE WORTKOETTER

Staff Writer

*One of the best parts ...  
is being exposed to  
techniques and  
methods that  
professionals use in  
the field*



# HEALTH & PERFORMANCE

*“Improving human health while facilitating healthy behaviors and decision-making”*

ENVIRONMENTAL CUES, HEALTH ISSUES AND individual differences can have a dramatic impact on task performance. Psychology professor Dr. Eric Muth and his Creative Inquiry team, Human Stress and Motion Science Laboratory, focus on human performance and health. The goal of their research is to improve human performance and facilitate healthy behaviors and decision-making. The students in this Creative Inquiry participate in data collection, propose research topics and set up experiments.

“The students help on a variety of levels, all the way from intellectual contributions to the grunt work, and a lot of what we do, we couldn’t do without them,” Muth explained. Sometimes the grunt work is very hands-on and exciting, but other times it is just logging data, so the students experience a range of aspects of research in experimental psychology.

Muth’s lab is currently focused on several different studies. As a result, students involved with his Creative Inquiry are exposed to multiple projects from a wide range of topics. The team includes students from different majors, which provides a diverse perspectives on different ideas. “The CI group has given me countless opportunities to get hands-on learning experience that you simply cannot get in the classroom. Not only do you gain knowledge, but you

also get to work in a research setting that will help prepare you for school and work beyond undergrad,” Jenna Darrah, senior psychology major, commented.

*...countless  
opportunities  
to get hands-on learn-  
ing experience that  
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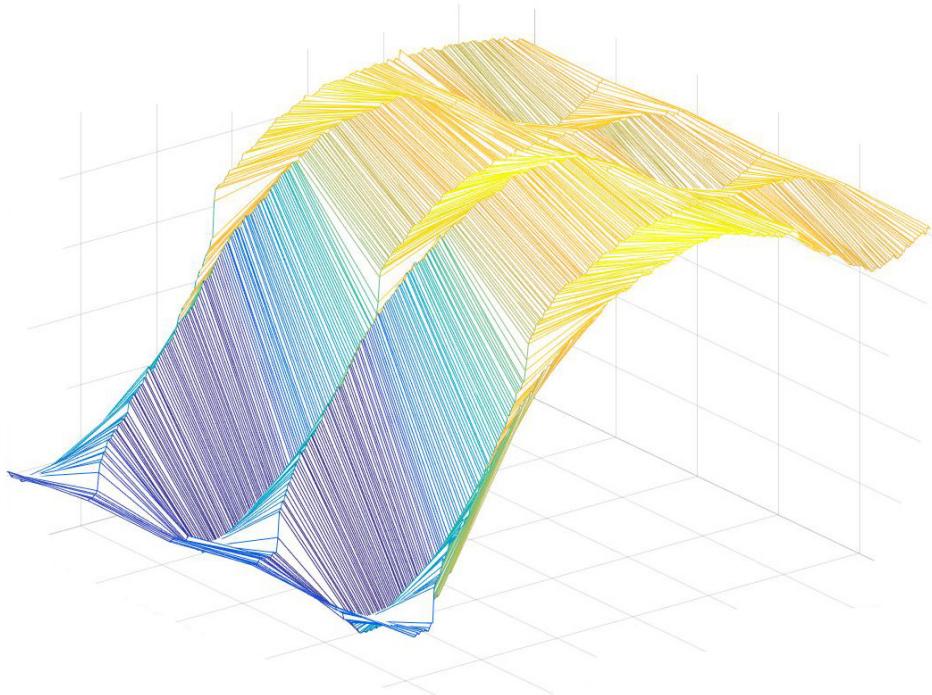
Three studies commenced in the fall of 2015. One study focused on tracking wrist activity and monitored when people ate. The purpose of this study was to create an algorithm to allow for the automated detection of eating activities for use in a wearable intake monitor. It was an observational study in which 500 subjects wore an electronic wrist monitor for a day and marked the beginning and end of their meals. The second study focused on improving a

calorie per bite algorithm to be used in a wearable intake monitor. Participants wore an intake monitor on their wrist while using a smartphone to document the foods they ate for two weeks. That information was paired with data from the wrist monitor to compare calorie and bite information collected from both devices. A third study focused on how expectations affect pain perception.

The opportunity for students to learn and garner research experience outside of the classroom is invaluable. It allows undergraduates to participate in research projects they are interested in and learn everything from setting up an experiment to analyzing the data collected. “I encourage them to ask questions because that’s how they’re going to learn, and their questions, we may never have thought of before or thought about how they asked the question,” Muth explained. The students bring in a fresh set of ideas that stem from their curiosities and through this they become better scientists and researchers.

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**HAILEY GREEN**  
Staff Writer



*This rendering shows the 3D surface of two markers plotted from a working atomic force microscope prototype built by Creative Inquiry students.*

# Tools of the Future

FOR MOST STUDENTS, THE TECHNOLOGY USED in a bioengineering laboratory seems to be from the future. For students in the Macro Atomic Force Microscopy Creative Inquiry led by Dr. Vladimir Reukov, research assistant professor of bioengineering, the understanding and development of complex technologies in a learning environment is an important part of their education at Clemson University. Atomic Force Microscopy is an imaging modality which allows the contours and surface topography of an object to be visualized. Bioengineers often use an Atomic Force Microscope (AFM) to obtain images and collect other data from different samples at very high resolution, down to nanometers. It is a way to examine the surface of new materials, nanoparticles, biological structures and other objects. The AFM maps out the topography of a sample by scanning it with a very sharp probe attached to a flexible cantilever, and it uses a laser to track deflection of the cantilever. “The regular AFM is quite complex and hard to visualize, and we have to teach the students how to understand the basic principles, so the idea for the model AFM was born,” explained Reukov, “One day I hope to see this in a classroom.” The

model promises to be a crucial learning tool to help future students in the classroom.

The goal of the Creative Inquiry project is to create a macroscopic, large-scale, model of the microscope to make AFM more accessible to students and to teach students how AFM really works. The group began with a Lego model and then designed and built a stage model they will continue working with during the upcoming school year. The students working on the project are focusing on combining the computer (which runs the moving parts) with the software (which renders the surface). Students wrote the program (using MATLAB) to run the machine, and in spring 2016, they refined the software to control the X-Y stage, and to get the surface rendering to update in real time.

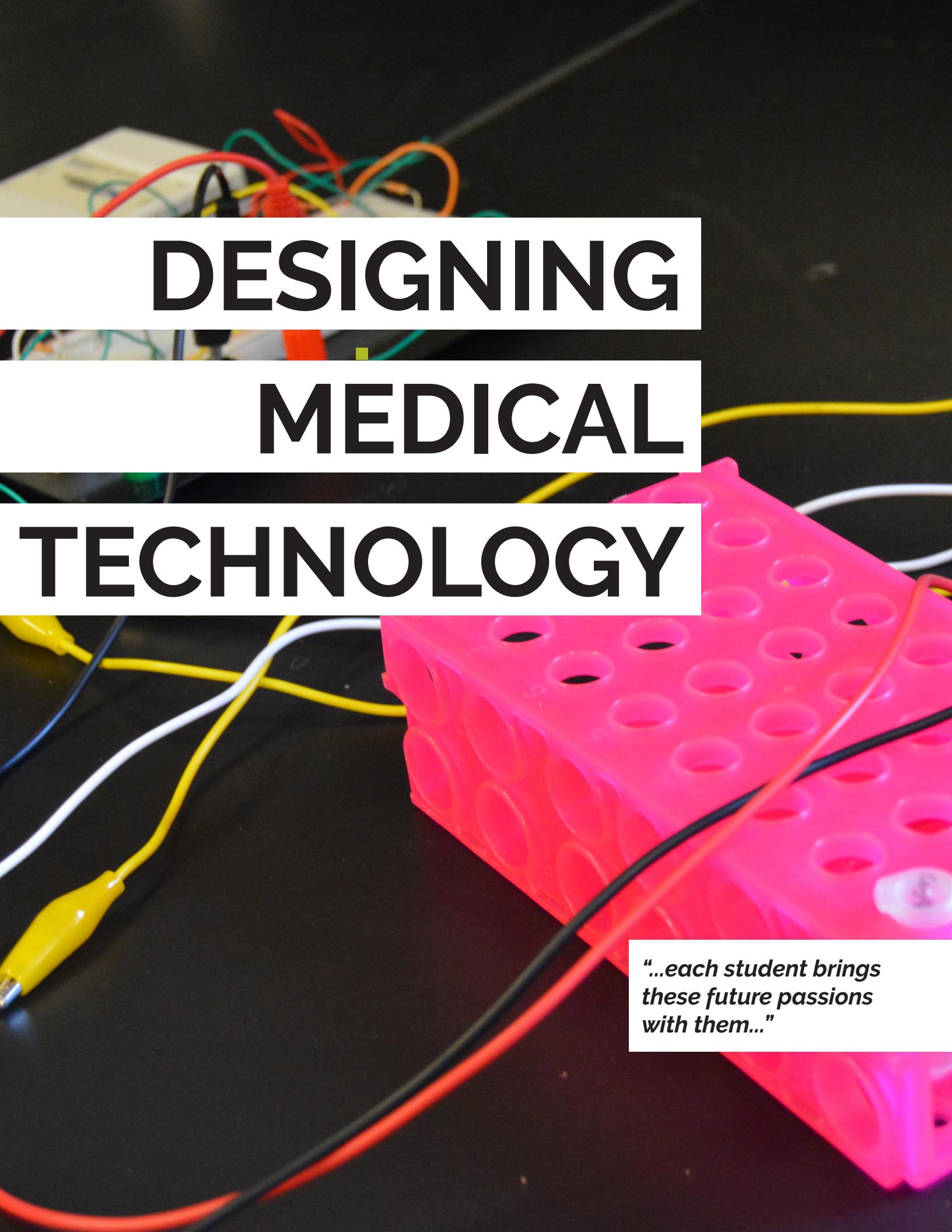
The Creative Inquiry is important for students as well as professional bioengineers. Having a working model will allow all bioengineering students to better understand a conceptually difficult to grasp machine that is used in their field and how AFM really works. “Dr. Reukov wants this CI to create a Macro AFM for educational purposes. It is much easier to visualize how this type of

microscopy works when there is a large, fully functioning model to observe. Through the CI, we have learned how to approach real world problems. This wasn’t a textbook problem that required us to plug some numbers into an equation. We had to be creative and put together all of our knowledge, and even study completely new topics, to bring life to this project,” explained Nolan Bagnal and Jacob Tilles, senior bioengineering majors. Other team members, Thomas Warner Roberts and Bryan Canas, recently joined the project and made significant contributions to software development and image recognition.

The AFM model is also a good outreach tool for encouraging highschool students to pursue bioengineering careers. The team used the model for Clemson’s bioengineering summer camp, Building a Better You. This summer camp allows prospective students to see what bioengineering students do while they are at Clemson University.

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**HAILEY GREEN**  
Staff Writer



# DESIGNING MEDICAL TECHNOLOGY

*“...each student brings  
these future passions  
with them...”*



## Clemson students develop cheap, easy to maintain medical devices for Tanzanians

IMAGINE LIVING IN A PLACE WHERE THE TREATMENT YOU NEED is unavailable or too far away for you to walk and you don't have transportation. These are examples of challenges patients in Tanzania face every day. The Designing Medical Technology for the Developing World Creative Inquiry, led by bioengineering associate professors Dr. John DesJardins and Dr. Delphine Dean, is working hard to make it easier for Tanzanians to receive the treatment they desperately need by designing devices made with relatively inexpensive materials which can be maintained in Tanzania. Current devices include a glucose meter for diabetics devised to use strips printed from an ink jet printer, a microbe sensor to test water and blood for bacteria and an automated system for delivering oxygen to infants without the need to constantly hand pump. These are just a few of the devices the Creative Inquiry has designed since its origin five years ago.

Beginning with three students, this Creative Inquiry has come a long way, accumulating many more members and completing numerous projects. Students in the Creative Inquiry do not have to be bioengineering majors, and the group prides themselves in having students from a variety of different majors. "Many students are attracted to a specific CI because of what they might want to do in their future careers; whether it is medical device design, materials analysis, international mission work, or medical school, each student brings these future passions with them into the project," DesJardins said.

Students have the opportunity to travel to Tanzania over the summer to present their designs to hospital officials. While in Tanzania, the students also assist with repairing medical equipment. Not only do they get first-hand experience in the environment where their devices are used, but also they have the chance to immerse themselves in a rich culture that is completely different from their own. The group has experienced Tanzania through safaris and traveling to the beautiful island of Zanzibar.

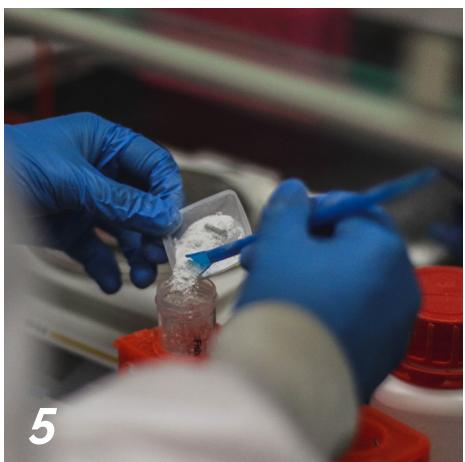
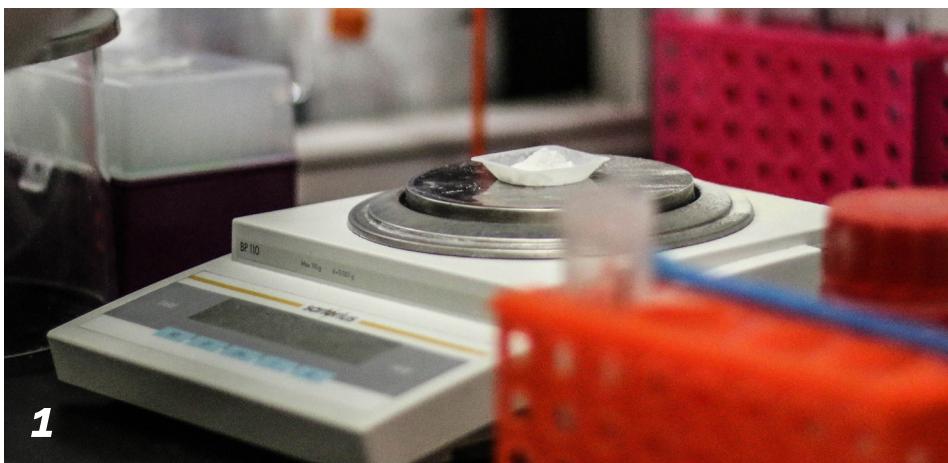
"Through this Creative Inquiry I have been given the once in a lifetime chance to travel to Tanzania to fix medical equipment and see the need for our designs first hand. The first-hand experience has inspired me to become a doctor." Sarah Stafford, junior bioengineering major, said.

One of the dire problems in Tanzania is the lack of working medical devices. Countries like the United States donate equipment to Tanzania, but after some time they run out of supplies or the equipment breaks down. Often the staff are unable to order more supplies or are not familiar enough with the equipment to fix it, so the device just sits in the corner unused. Since many Tanzanians have limited budgets, they must recreate their own versions of medical devices from the materials that are available to them. The team works with Tanzanian collaborators to create a design that is affordable and can be made in-country. This is a triple advantage for Tanzanians because they get the medical devices they need, they can produce them and they keep the profits in the community.

Medical devices for Tanzania: a microbe sensor which tests for bacteria (adjacent page); a cervical collar made by the indigenous woman held next to the model (top left); CI team maintenance equipment in-country.

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**JACQUELINE VELIZ &  
HAILEY GREEN**  
CI Team Writer & Staff Writer



# R

## einventing an Ancient Art: Applying origami to material science manufacturing

THE ANCIENT ART OF PAPER-FOLDING, OR origami, utilizes simple techniques to transform a two-dimensional piece of paper into a complex, intricate, three-dimensional structure. Though traditionally used for ornamental artwork, students in the Origami-Inspired Manufacturing of Composite Parts Creative Inquiry took a more functional approach with origami. This Creative Inquiry team utilized origami in the manufacturing of metal carbide devices. Besides offering a creative manufacturing process, the team aims to replace the non-renewable, petroleum-based carbon used in the synthesis of carbides with carbon obtained from a renewable resource, paper. The team, led by Dr. Rodrigo Martinez-Duarte, assistant professor in the Department of Mechanical Engineering, expects to reduce the cost of this process and reduce the dependence on petrochemicals.

Knowing that a number of bio-polymers combined with metal nanoparticles can be heated to form metal carbides, the team focused on using cellulosic paper as the carbon source. The team decided to use origami-inspired techniques to shape the paper in order to manufacture these devices. Although many different kinds of paper exist, the team uses filter papers, which are 100% cellulose and commonly used in the lab. They then use origami techniques to fabricate a number of shapes. After infiltrating these shapes with metal nanoparticles, the composite is heated to high temperatures to form a metal carbide

**It's rewarding  
to see it all come  
together and get  
confirmation that it  
works**

structure. According to Martinez-Duarte, "As you start heating the mixture, around 900° C, the paper will carbonize. As you keep increasing the temperature, you can induce the metal nanoparticles to react with the carbonized paper such that you can get metal carbides." While this synthesis method has proven to be successful, viable manufacturing methods have to be produced; hence the introduction of origami. Think of an origami crane: instead of machining metal carbides into complex shapes, the team is in the process of determining the exact parameters that will enable this novel fabrication process for the fabrication of carbide shapes featuring thin and complex cross sections. For Josh Flach, junior mechanical engineer,

the preliminary tests done by the team have proven the process to be successful and worthy of further investigation. "This project was really the combination of several ideas and projects so it's rewarding to see it all come together and get confirmation that it works," Flach said.

With metal carbides playing such an important role in many manufacturing processes, research into cheaper production methods could prove extremely beneficial. Reducing dependence on petrochemicals in the process would prove to be not only more environmentally friendly, but also cost efficient. While the task of finding alternate production methods may seem never-ending, this Creative Inquiry teams plans to tackle it head-on, one step at a time.

**JOE WORTKOETTER**

Staff Writer

## Carbides

A few details on making carbides from pg. 33

**1**

Weighing the components of the composite.

**2**

Experimenting with different origami-inspired shapes to make carbon structures.

**3**

A carbon crane—Originally folded in cellulose paper and later carbonized at 900°C in an inert atmosphere.

**4**

Samantha Covington, senior mechanical engineering major, displaying her carbon creation.

**5**

Preparing the precursor mixture to infiltrate the origami shapes.

**6**

Paulo Figueiredo de Lima, freshman international exchange student, showing a prepared ink used to infiltrate the origami shapes.

# MENTORING HEALTHY LIFESTYLES

*Pairing Creative  
Inquiry mentors with  
ClemsonLIFE students*

**T**HE CLEMSONLIFE (LEARNING IS FOR EVERYONE) program at Clemson University is one of few programs in the nation whose goal is to ensure that individuals with intellectual disabilities have a chance to pursue higher education. There are several groups at Clemson associated with the ClemsonLIFE program. One of those programs is the Creative Inquiry team, ClemsonLIFE: Nutrition and Healthy Cooking, which focuses on helping the LIFE students become more nutritionally independent and learn how to cook a variety of healthy meals for themselves.

Assistant professor of food, nutrition and packaging sciences, Dr. Elliot D. Jesch, became the head of this Creative Inquiry in the fall of 2015. There are 20 health science and nutrition majors. At the beginning of each semester Jesch leads an orientation session in which Creative Inquiry students receive mentor training and

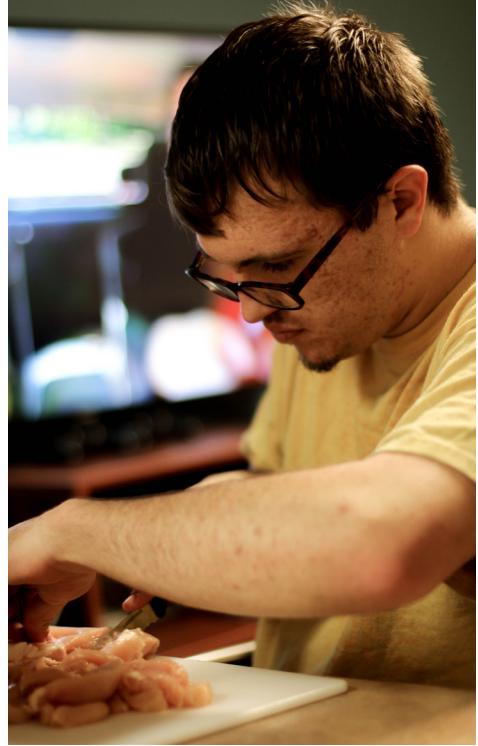


guidelines for the semester. After this meeting, a pair of student mentors is assigned to each ClemsonLIFE student apartment. Each week, the students meet with their ClemsonLIFE mentees. Together they create a different meal each week in the mentee's apartment.

After cooking and eating dinner together, the students enjoy spending time with their mentees. By cooking and eating together, the mentors model healthy nutrition practices such as proper portions and healthy eating habits for the ClemsonLIFE students. However, this Creative Inquiry also helps build friendships. At the end of the each semester, the ClemsonLIFE students cook for the mentors using a recipe they learned during the semester. Then, all the recipes from the semester of



ClemsonLIFE students Markus Wooten (left) and DJ Lancaster (below) develop healthy eating habits, including learning how to prepare and cook independently. This Creative Inquiry project worked to provide mentorship, skills and resources for them.



All photos / Wales Toney

cooking are compiled in a recipe book for the ClemsonLIFE students to keep and use in the years to come.

This Creative Inquiry team has an exciting development in the works. The team is working closely with a digital application (app) development Creative Inquiry (see Apps R Us on pg.11) to create a ClemsonLIFE cooking app. With the app, students will be able to locate a library of recipes as well as an easy-to-use interface that informs them of the ingredients they need to make each recipe. According to Jesch, "The app would be very helpful for them (the ClemsonLIFE students), but I could probably also use it myself searching through my pantry as well." The team's goal is to make it an app that is fun, straightforward and

practical enough for anyone to use. Overall, this Creative Inquiry is an exciting program which equips ClemsonLIFE students with not only a cookbook full of recipes they have learned how to make throughout the semester, but also with a better knowledge of nutrition as well as portion control. Through the help of this team, ClemsonLIFE students can be more confident about cooking for themselves and others, giving them one more stepping stone toward a more independent lifestyle.

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### NICHOLE MARTINSON

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Staff Writer

***Through the help of this team, ClemsonLIFE students can be more confident about cooking for themselves and others***

# THINKING OUTSIDE THE BOX

*Theory is put into practice for real-world applications*

**W**HAT IS YOUR FIRST REACTION WHEN you see a mouse in your kitchen? Do you scream? Do you run away? What do you do once the initial shock of seeing a mouse in your house wears off? The average response is to set a mousetrap because you do not want this nuisance animal running around your house. Trapping is the most humane way to get rid of unwanted animals in certain environments, and Dr. Webb Smathers, professor emeritus of agriculture and environmental sciences, believes that teaching students the art of trapping is a great skill because it makes them think outside of the box (or the trap).

For students in Smathers' Creative Inquiry, The Economic, Ethical, and Practical Aspects of Trapping, a normal meeting consists of wandering around the woods tracking hog trails or building fish traps. Every day is different, and students never know what to expect because one day they can be setting fish traps and the next they



can be frying fish. Students learn the theory and methods behind trapping as well as the implementation of these theories out in the field. The purpose of the Creative Inquiry is to teach students the benefits of trapping because it is the most effective way to deal with nuisance animals, which can cause issues for ecosystems. Nuisance creatures must be dealt with, or they will displace other organisms critical for maintaining a healthy environment.

Smathers' group focused primarily on hog trapping; he and his students worked to track a nuisance hog using trail cameras and setting corn feed on the trail. A trail camera is placed on a trail of an animal and used to capture pictures when it senses movement. Students checked the cameras every day for pictures of the hog, and once the hog was sighted or detected, the students set a trap. Emsley



This Creative Inquiry team applied the knowledge they learned to devise a plan and trap an invasive hog. They also learned how to design and make fish traps.



Photos courtesy of Webb Smathers

Caldwell, junior management major, really enjoyed the experiences she had through the Creative Inquiry. "We learned valuable trapping techniques that can be used in the future to do our share in keeping the animal population under control. I learned so many new things about different nuisance animals such as hogs, beavers, opossums and many other creatures. We learned about their eating, living, and daily habits, which allowed us to out smart them with our traps," Caldwell commented. The group trapped a hog that weighed in at approximately 230 pounds and then took it to be processed for the meat. Although the group focused on hog trapping, they also worked with homemade fish traps and beaver traps. The group caught two beavers, which were processed for their pelts.

The Creative Inquiry project allows students to venture outside of the classroom and put

what they are learning to the test. "That's one of the best things about Creative Inquiry, that deeper learning that occurs when small groups of students have the opportunity to learn the theory and method but actually do the practices. Empirical applications are very important. That learning will stick with the students and I for years. They teach me as well," Smathers stated. The empirical lessons learned apply not only to trapping but also to life. Although trapping may not be a skill that the students will continue to use after school, the problem solving and critical thinking skills that the students learned from the experience will allow them to be successful in their endeavors post-graduation.

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**HAILEY GREEN**  
Staff Writer

*...one of the  
best things  
about Creative  
Inquiry, that  
deeper learning that  
occurs...*



when she said, "Students, in fact most humans, are unaware of how their brain impacts their choices and their lives. We want to share information with college and high school students that can help them make better choices, choices that can have a long-term, positive effect on their lives."

The goal of Smart and Savvy Students is not only to increase the team's knowledge, but also to share this information with other students in Clemson and nationwide. This is achieved through posting on social media sites, such as Twitter, Facebook and Instagram, which allows the information to disseminate through platforms which receive a lot of student traffic. Additionally, the posts on Twitter and Instagram contain various hashtags about the articles, which allows the information to reach the greatest audience possible. Each social media site has a specific page dedicated to the team's posts, which are a "snapshot" of the scientific article and include an eye-catching photo. These posts are no more than a paragraph long, but they include links to the popular press and scientific articles if readers desire to learn more.

Creative Inquiry team member

# SMART & SAVVY

# S

TUDY. EAT. SLEEP. REPEAT. FOR MANY COLLEGE students this is an all too common cycle marked by too few hours in the day and a constant desire to escape all the pressure. What if you were told that there were ways to escape the vicious cycle? More so, that there were ways to make this cycle more efficient and rewarding. Professor of psychology Dr. June Pilcher and her Creative Inquiry team, Brain Tips (a.k.a. Smart and Savvy Students), worked to make this a reality.

Members of this team are responsible for identifying articles in popular press on a broad assortment of topics, ranging from mental health, technology, exercise and study habits. Many of the selections contain information about the human brain and how it affects human functioning. After reading the popular press articles in magazines or on websites, students are challenged to find more scholarly, scientific journals that either supports or refutes the claims made in popular press. Not only does this challenge students to learn more about their health and ability to function, but it also encourages them to think critically about everything they read. By doing so, students learn far more about their own health, while further developing research skills and understanding what types of sources should be trusted and which types should not.

*Members of the Smart and Savvy Students (a.k.a. Brain Tips) Creative Inquiry team are sharing brain tips attached to water bottles.*

Pilcher emphasizes the importance for students to be better informed about the topics covered by this Creative Inquiry project

Although the team was created recently, the results and feedback from students have been astonishing. Dale Palmer, senior psychology major, explained, "My entire life has changed for the better. Brain Tips inspired me to be the best person, the healthiest person, the most efficient student, the best friend, and the best researcher I can be," Dale Palmer, a senior psychology major, said.

As this team continues to grow, the scope of the topics discussed will continue to expand and the audience will build. Brain Tips will be able to make the most impact possible by helping students break the ongoing cycle of study-eat-sleep-repeat by being better informed and making better choices.

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**KIMREY M. HOLMES,  
ROSARIA C. BRYANT,  
KATHLEEN E. CLANCY,  
DALE E. PALMER,  
CORINE P. TYLER**  
*Guest Writers*



# How Fit is Fitbit™?

*Measuring accuracy and precision of fitness levels represented by technology*

FOR SOME PEOPLE, the dependency on their wearable fitness technology is everything. Some people live by the little screen on their Fitbit™, but is the technology really as accurate as people think? Some people base their diet off of how many calories they burn according to the Fitbit™. Fitbit™ is an activity tracker that measures a person's level of activity, heart rate, number of steps and calories. Dr. Elliot Jesch, associate professor in the Department of Food, Nutrition and Packaging Sciences and his Creative Inquiry, Human Energy Metabolism, are investigating the accuracy of the devices and whether or not they provide an accurate picture of activity levels. The project started with Jesch looking at the ability of fitness apps to measure energy burned while people exercise.

The team is designing and implemented a protocol to research the accuracy of fitness applications. The original plan was to

include many different fitness applications, but the team decided to focus specifically on Fitbit™ in order to measure how people are using energy (human energy metabolism). The students familiarized themselves with a metabolic chart to measure the intake of oxygen during exercise to infer the amount of energy used. Then, they compared these inferences to the amount of energy the Fitbit™ reported. They have found some discrepancies in the data. "I want people to know that their devices are not perfect, and they may not want to base all of their health decisions off of the device," Jesch explained.

The students on this team gained exposure to real-world, hand-on research they would not receive if they were sitting in a lecture. All students in the Department of Food and Nutrition are required to participate in a Creative Inquiry, and all have the opportunity to work with a Creative Inquiry they find interesting and to focus on what they want to learn. No matter the direction the Creative Inquiry takes in the future, Jesch believes that if the students are researching things current

and relevant to them, then he is doing great work with the students. "I've done things that I never would have done without the CI program, and something that is really great is that we get to work with professors on a more personal level. Most of our references for graduate school programs and jobs come from the CI program because of the relationships we build," Josh Jefferies, senior food and nutrition major, commented. The Creative Inquiry program provides students opportunities to explore what interests them so that they can benefit others, and Jesch's Creative Inquiry team is proof of that.

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**HAILEY GREEN**  
Staff Writer

**You will not  
only be  
a teacher,  
but an agent  
of change**



Photo courtesy of Angela Rogers

## CORRIDOR OF HOPE

Photo by: **Angela Rogers**

Photo by: **Angela Rogers**

WHILE CLEMSON UNIVERSITY'S EUGENE T. MOORE SCHOOL OF Education consistently ranks as one of the best education programs in the state, education majors have even more of an advantage because of a unique program that is only offered at this university. Students in the Moore Scholars Creative Inquiry, under the leadership of Dr. Angela Rogers, professor in the Department of Education, get hands-on experience as to what it really is like to be thrown into a teaching situation that is uncommon for many. "Students get really meaningful experiences. We visit a place that has been dubbed the "Corridor of Shame" because of a lack of adequate funding for schools there, but we like to view it as a corridor of hope and opportunity," reflects Rogers.

Each semester, education majors in the Moore Scholars program meet once a week to plan for summer projects as well as to debate, read books together and lead (practice teaching skills) with one another. The main project students plan for and execute is the Bamberg Project where students spend one week of the summer visiting a critical needs area in South Carolina. While there, Clemson sophomores teach a poetry class and, once the program is completed, host a poetry slam for the high school students they spent the week teaching. Later in the summer, freshmen welcome students from diverse backgrounds to the Clemson campus as they host a multimedia arts camp.

The program has been successful and has grown since Rogers took over the program a few years ago. Perhaps what is most exciting about

Moore Scholars work with students in the area of Bamberg, SC.

the Moore Scholars program though is where things are headed next. A program in the works, STEAM, will bring local critical needs high school students, to Clemson's campus to participate in transdisciplinary, project-based learning while mentoring them and introducing them to college life.

The Creative Inquiry team wants to broaden the program by including middle and elementary school students in need beyond the Bamberg area. Students who went to Bamberg last summer will be returning this year. Only this time, the juniors will be closely observing and mentoring the sophomores who are teaching the poetry lessons, to determine what the effective methods are and how self-efficacy has been affected through their programs. This unique opportunity will surely provide valuable insight and perspective as these Clemson students conduct their research.

The area this Creative Inquiry wishes to expand most is in the area of publishing their research. Since the program is fairly new, a lot of effort has been made to start a solid relationship with the school in Bamberg. Now, with that relationship solidified, the team can focus more on developing the Saturday STEAM program and publishing results in order to help the communities outside of this program. The unofficial motto of this Creative Inquiry perfectly encapsulates the idea behind everything they will continue to do, "You will not only be a teacher but an agent of change." What an honor to have some of Clemson University's best and brightest affecting such positive change in communities in South Carolina. Surely, the impact will continue to bring hope to generations to come.

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**NICHOLE MARTINSON**  
Staff Writer

# CU CHEFS™

*Research in culinary nutrition to improve family choices and kitchen skills*

CU CHEFS™ (CLEMSON UNIVERSITY HEALTHY Eating and Food Specialists) work as a team to provide culinary nutrition to the public. Culinary nutrition is the application of nutrition principles combined with food science knowledge displayed through a mastery of culinary skills. Once a month Dr. Marge Condrasky, professor in the Department of Food, Nutrition, and Packaging Sciences, takes students from her Culinary Nutrition Creative Inquiry team to the Greenville Health System in order to educate families on healthy meals for their children. The New Impact Weight Management program allows the Creative Inquiry team to create healthy recipes, run a cooking class and work with a professional to deliver a program to the public.

The Creative Inquiry project is multifaceted. First, the students get together to plan a menu. They take the ingredient list and decide which ingredients may have healthier substitutions. The trick is altering the recipes in ways which allow them to still be delicious and kid-friendly,

while ensuring they are healthy. Then, students then conduct recipe research and complete a nutritional analysis to determine how healthy they can make the recipes. Next, the students prepare meals following the recipes; often, they prepare the same dishes over and over again until they believe they have perfected the recipe. Once a month, several of the students travel to Greenville, SC to present the recipes and prepare the meals for the public. They set up a kitchen, prepare for the guests and go over the ingredients and substitutions. “The whole thing is basically our cooking show. We run it,” Condrasky said.

The goal is not only to provide culinary nutrition advice but to improve the cooking skills of the individuals attending the cooking show, including the kids. The students apply what they know to explain how to make the recipes to others. In addition, they make the experience fun for the kids by creating ways to get involved in the cooking class as well as the cooking at home. For the students, the best part is getting to see their hard work pay off when they see families benefit from what they are doing. “I love getting to introduce new products and alternatives to people who are just so into it. I love when it all comes together,” Lashaveria Benson, senior nutrition major, explained.



All photos / Wales Toney

*Adding color to recipes and your plate, like the red peppers in the background picture, are nutritional and fun for kids. (Right) Abel Wilson prepares a shrimp dinner for a cooking class at Greenville Health System.*

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**HAILEY GREEN**  
Staff Writer



# MATERIAL THAT MAKES SENSE

*Corrugated board furniture may be the furniture of the future.*



## Packaging science students make furniture from nontraditional materials

MAGINE SITTING ON A GREAT PIECE OF furniture. What is it made of? Wood? Leather? I bet you did not imagine that the piece of furniture you are sitting on was made of corrugated medium, which is most often recognized as cardboard. Dr. Andrew Hurley, assistant professor of packaging science and his team of Creative Inquiry students work together to create unique furniture by using corrugated medium. Corrugated medium is strong when the pieces are put together, so the team works with multiple pieces, layering them, to build furniture. “We have created a corrugated piano, chairs, tables, a tiger paw and lots of decorations that have been placed around the Harris A. Smith Building,” Mengmeg Zhao, senior packaging science major, stated.

Designing corrugated furniture requires a plan as to how to divide the whole furniture into a variety of components. For example, to design a table, the team first divides the table into a top and legs; they then design the layers for each part using Adobe Illustrator and cut each layer using the Kongsberg (a high-powered milling spindle often used to cut signs). The last step is to glue the layers together and assemble the parts as whole furniture. This Creative Inquiry encourages creativity and sustainability. The team can create unique pieces by using corrugated medium, which means less wood consumption and an increased environmental benefit. Due to the unique features of corrugated

board, the furniture can be crazy shapes, not just tradition pieces.

The process is different from making wooden furniture. Each part of this furniture is built with multiple layers of corrugated board; thus, the team must carefully and purposefully decide on the size for each layer. If they need a straight line on the final piece of furniture, they must build each layer to the same size specifications and put them together. In contrast, if they need a curve on the furniture, they must make a small change on each layer of corrugated board in order to get a curve after all layers are assembled. This is difficult to plan in advance, so some of the process is by trial and error. Also, the team must consider how many layers will be needed in order to support the weight of a person.

For the team, the most exciting part of this project is to assemble the small pieces of corrugated board to create whole pieces of furniture. This is when the team learns if their designs work or need to be changed. Brainstorming with the team is an enjoyable part of the Creative Inquiry because students can devise truly unique ideas. Everyone builds on each others ideas which will finally form a brilliant plan. The final result is useful, trendy and environmentally-friendly furniture for the future.

*Left: Erin Hongsermeier, senior packaging science major, uses a chair made out of layers of corrugated board.*

*Right: Students use the Esko Kongsberg MultiCut-HP machine to cut the materials.*

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**HAILEY GREEN**  
Staff Writer



# ASPIRING

# TO BE WELL

*Students in the Aspire Creative Inquiry project. Photo provided by the Creative Inquiry team.*

N RECENT YEARS, COLLEGE CAMPUSES ACROSS THE NATION HAVE TURNED THEIR attention to health awareness and programs that encourage student health on campus. Clemson University is no different. For several years Clemson has placed an emphasis on health and wellness programs involving alcohol misuse prevention, but it wasn't until recently that it expanded its scope to include educating students about the effects of interpersonal violence including mental health and suicide prevention. This addition catalyzed formation of the Aspire to be Well program which is facilitated by student leaders and implemented in a dialogue-style format across the campus.

The program is more than the fall semester sessions in which all Clemson students are required to participate. The Aspire program consists of a

team of student facilitators from various majors who are passionate about health and wellness. During the spring semester, student facilitators work with Chloe Greene, the Associate Director of Healthy Campus, for weekly discussions on the topics they will address in the fall. The students hear guest speakers from different departments (e.g., Gantt Multicultural Center, Counseling and Psychological Services) cover a wide range of topics.

In the fall, student facilitators work closely with Hannah Allison, Assistant Director of Healthy Campus, who is in charge of Aspire curriculum and assessment. During these months, student facilitators hold weekly sessions for their peers to discuss health topics (e.g., sexual violence, substance abuse and suicide prevention). Allison remarks, "Seeing the reactions of the student facilitators knowing they have made an impact on the student population is one of the most rewarding parts." Student facilitators are encouraged to be a health and wellness resource to their peers even after the session by stimulating further conversation and allowing them to ask any questions they may have. Jennifer Goree, Director of Healthy Campus Initiatives, explains, "We want to challenge students to rise to the occasion as we help educate them about important health topics."

Beyond the student dialogue, the Aspire : Developing Peer Delivered Initiatives to Foster the Promotion of a Healthy Campus Creative Inquiry team is making big leaps in undergraduate research by collecting data to assess the program and its impact. The Creative Inquiry team works closely with Dr. Martie Thompson, research professor in the Department of Youth, Family and

Community Studies, and Dr. Heidi Zinzow, associate professor in the Department of Psychology. After each Aspire session, student participants are sent a survey to complete, and several months later, another long-term survey is sent out for the same student participants to complete.

The data collected are valuable for assessment of and revisions for the program as well as for future publications. The preliminary data also assisted in obtaining a national Substance Abuse and Mental Health Services Administration grant to implement a comprehensive suicide prevention approach on campus.

Still, the greatest accomplishment of this Creative Inquiry is the impact it has on Clemson students and student facilitators alike. Mary Catherine Harbin, an intern in her second year with Aspire, reflects, "I would work with this program for ten more years if I could. It has given me so much confidence as I am able to communicate with my peers about important health issues and how they can make a difference." That is a testament to the heart behind Aspire. Educated students are confident students, and confidence is the key to making healthy decisions.



**NICHOLE MARTINSON**  
Staff Writer

# Survey

*Sample questions and results from the Aspire to be Well survey. These questions showed sustained positive increases from pre-survey to 4 month follow-up survey.*

**1**

Please indicate how confident you are in your ability to ask a stranger who looks very upset downtown or at a party if they are okay or need help.

Percent response of "Extremely confident" & "Very Confident"

Pre-survey

**54%**

**68%**

Post-survey

**2**

I think I can do something about sexual violence.

Percent response of "Strongly Agree" & "Agree"

Pre-survey

**67%**

**80%**

Post-survey

**3**

If a friend or I were sexually assaulted, I would know where to get help.

Percent response of "Strongly Agree" & "Agree"

Pre-survey

**76%**

**96%**

Post-survey

# Meet the **DECIPHER** staff



## BETSY BOGGS | CHIEF EDITOR

Betsy Boggs, a senior english major with an emphasis in writing and publication studies and a minor in education, is the Chief Editor of *Decipher* magazine. As this is Betsy's second year working with *Decipher*, she has very much enjoyed continuing to learn with and from the *Decipher* team about how to communicate most effectively to a wide variety of audiences. When she is not working with the *Decipher* team or reading and writing papers for her classes, Betsy can be found on the lake with her roommates, spending time with her favorite professors or baking cakes for her friends' birthdays.

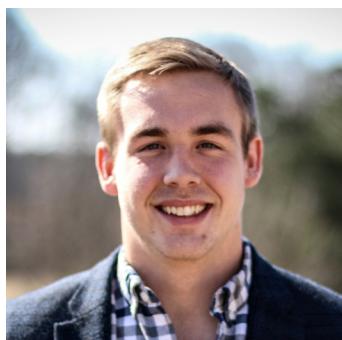
## HAILEY GREEN | SENIOR WRITER

Hailey Green is a senior english major with an emphasis in literature and a minor in technical and business writing. This is her second year working for *Decipher* as a writer. During her time with *Decipher*, Hailey has enjoyed learning about the different aspects of undergraduate research at Clemson, showcasing the Creative Inquiry program through her articles and spending time with students and professors from just about every major and department Clemson has to offer. When not working for *Decipher* or writing for english classes, Hailey can be found traveling the world, drinking copious amounts of coffee and taking pictures of flowers.



## JOE WORTKOETTER | WRITER

Joe Wortkoetter, a senior bioengineering major, joins the *Decipher* team this year as a writer. Joe's passion for research was sparked after joining a Creative Inquiry focused on developing tissue engineering techniques. As his involvement with the project grew, so did his curiosity in other research areas across Clemson's campus. He now utilizes his science background to communicate the details of the various projects and relate the significance of the projects to the broader perspective. Outside of class and writing for the magazine, he enjoys hiking, fishing, intramural sports and pretending to know how to play guitar.



## NICHOLE MARTINSON | WRITER

Nichole Martinson, a junior communication studies major with a minor in entrepreneurship, joins *Decipher* as a writer. She is from Greenville, SC and has always been a Tiger fan. Nichole's favorite part about being a member of the *Decipher* team is being able to work with such a diverse group of people on campus as she gets to meet faculty members and students from many different Creative Inquiry projects. When Nichole is not at work or in class, she loves to be involved on campus as a member of many different organizations such as Tri-County YoungLife and South Carolina Student Legislature and also enjoys managing her own photography business.





## RACHAEL NUZUM | CREATIVE DIRECTOR

Rachael Nuzum is a sophomore graphic communications major with a minor in art. She has previously designed for *The Tiger* newspaper and *The Clemson Pendulum*, but this is her first year with *Decipher*. As Creative Director, Rachael puts together the visual identity of the magazine as she chooses colors and structures, employs different typographic elements and designs layouts that align with her vision for the magazine. In addition to her work with *Decipher*, she is currently a participant in the Disney College Program and is an intern with Mama's Sauce printers in Orlando, Florida.

## DEVAUN WALKER | SENIOR DESIGN ADVISOR

Devaun Walker, a senior packaging science major, is returning for his second year with *Decipher* magazine. As the Senior Design Advisor, he is able to utilize his creative expertise and visually-oriented mind in order to provide vision and direction for the layout and graphic designs in the magazine. Participating in numerous Creative Inquiries during his time at Clemson, Devaun has an insider's perspective and appreciation for the time and effort dedicated to research. Aside from working with the magazine and completing assignments for class, Devaun enjoys naps, peanut butter fudge, Cookout milkshakes and Clemson victories over the University of South Carolina in any sport.



## HALEY BLAIR JONES | GRAPHIC ARTIST

Haley Blair Jones is the Graphic Artist for *Decipher* magazine, and this is her first year with the publication. Haley is a junior graphic communications major born and raised in Greenville, South Carolina. Formerly, Haley was a member of the Technical Association for the Graphic Arts (TAGA) Creative Inquiry team during the spring 2016 semester, which helped her gain more hands-on experience with printing presses and designing for print. In Haley's spare time, you can find her watching Parks and Recreation reruns, eating Chick-fil-A, listening to music, drawing and spending time with her friends.

## WALES TONEY | PHOTOGRAPHER

Wales Toney, a senior business management major, comes to *Decipher* in hopes of joining his creativity with his interest in learning new things. As Photographer for *Decipher* magazine, Wales plays a special role as he captures moments, people and events that could not otherwise be explained with words. When he is not snapping photos or pitching from the mound, he also enjoys hiking, hunting and fishing. Wales has benefitted tremendously from working with the *Decipher* team, and believes the teamwork and communication skills he learned will be most beneficial for him in the future.



## ANNIE MITCHELL | GRADUATE ASSISTANT

Annie Mitchell, a graduate student in the School Counseling Program at Clemson University, is serving in her second year as an assistant mentor for the *Decipher* team. During her time as an undergraduate, Annie spent two years working with two different Creative Inquiries in the Department of Psychology. Her favorite part about being a mentor for the *Decipher* team is being able to continue working with and learning from the Creative Inquiry program. When Annie is not working with the magazine team or learning from local public school counselors, she enjoys running and spending time with her friends and family.

# RELATIONSHIPS =



## The Phil and Mary Bradley Award

In addition to making the first major gift to Creative Inquiry, Phil and Mary Bradley established an annual award to recognize a faculty member for outstanding work with undergraduate students. The Phil and Mary Bradley Award for Mentoring in Creative Inquiry consists of a plaque and a salary supplement. Creative Inquiry students nominate their faculty mentors for this award.

## Bradley Award Recipients

- 2016 Dr. Michael Sehorn, Genetics and Biochemistry
- 2015 Dr. Michael Childress, Biological Sciences
- 2014 Dr. Heather Dunn, Animal and Veterinary Sciences
- 2013 Dr. Marian Kennedy, Materials Science and Engineering
- 2012 Dr. John DesJardins, Bioengineering
- 2011 Dr. Delphine Dean, Bioengineering
- 2010 Dr. June Pilcher, Psychology
- 2009 Dr. Karen Kemper, Public Health Services
- 2008 Dr. Susanna Ashton, English
- 2007 Dr. Mark Charney, Performing Arts

## The Chalmers Carr III and Lori Anne Carr Endowment for Creative Inquiry

Chalmers Carr III and Lori Anne Carr established an endowment to support Creative Inquiry teams that research rural economic development, community/business development or fruit and vegetable crop production.



## Support a Creative Inquiry Project

Does your company want to donate equipment, money or professional support to a Creative Inquiry project? Our faculty and students love the opportunity to translate their work into real-world applications.

## Carr Endowment Recipients

- 2015-2016  
Dr. Feng Chen  
Characterization of aromas and health benefiting chemicals of SC peaches
- 2014-2015  
Dr. John McGregor  
Shelf-life extension of fresh peach slices by surface crust freezing

## Current Projects Supported by Industry Partners

Extreme Orange - See page 9 for more info on this incubator for computer programming projects with entrepreneurial potential.



# RESULTS

2015-2016

With over 1,000 projects since the initiative's inception ten years ago, Clemson University's Creative Inquiry has blossomed into a model program for facilitating undergraduate research projects across the entire campus. Creative Inquiry teams average approximately eight undergraduates per project, but the size of the teams vary considerably based on the individual project goals and objectives. Most projects are designed to be long term spanning across two, four or more semesters. Students can enroll in new projects or are able to join ongoing projects that are recruiting additional members. Project proposals arise from student-based initiatives or as faculty proposals; however each project has at least one faculty (or graduate student) mentor if not a cross-disciplinary team of mentors.



421  
PROJECTS

38  
US STATES

5654  
STUDENT EXPERIENCES

17  
COUNTRIES

Our  
partnerships  
allow CI  
projects to  
make both a  
national and  
global impact.

4  
PATENTS

315  
PUBLICATIONS

633  
PRESENTATIONS

## Donate

Make your tax-deductible gift to Creative Inquiry today. Call 864-656-5896, give online at [cualumni.clemson.edu/give/ci](http://cualumni.clemson.edu/give/ci) or send checks payable to Clemson Fund to: Clemson Fund, PO Box 1889, Clemson, SC 29633. Note the check is for the Creative Inquiry Operating Fund.



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