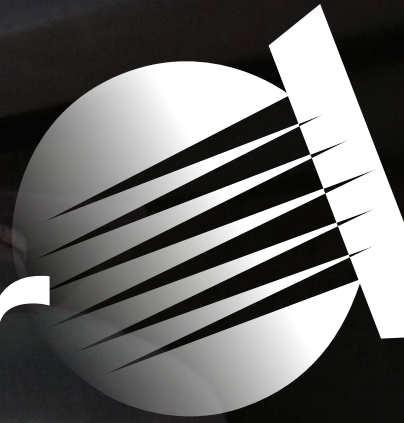


# Decipher



A CREATIVE INQUIRY MAGAZINE

Volume 7 | 2018

MEMORIAL CARILLON

1987

This Creative Inquiry team is putting the control of the Carillon bells into your hands. Find out how on page 19





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**Decipher (verb)**  
to succeed in understanding,  
interpreting or identifying

# ABOUT DECIPHER

*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 4,000 Creative Inquiry students investigate topics ranging from the impact of climate change on lizard behavior to analyzing marketing strategies at music festivals. 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 learn in the classroom and apply them to the real world.

From the 414 current Creative Inquiry projects, we selected 17 projects to feature in this magazine. Our team interviewed the faculty, graduate students as well as undergraduate students involved with each of these projects in order to write these articles and produce photographs and illustrations. *Decipher* is printed and distributed to students, faculty, alumni and friends of Clemson so that they are aware of the many accomplishments of students in the Creative Inquiry program. For example, Creative Inquiry students and faculty have made more than 1,376 presentations at professional conferences, authored more than 400 professional publications and received more than 433 awards.

*Decipher* is also available digitally, as an interactive blog on the Creative Inquiry website ([clemson.edu/ci](http://clemson.edu/ci)). Visit our blog for more information and interactive project highlights.

## ACKNOWLEDGMENTS

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A Special thanks to **Clinton Colmenares** for his time, guidance and expert advice.





# LETTER FROM THE DIRECTOR

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**Barbara J. Speziale, PhD**  
Director, Creative Inquiry  
Associate Director, Watt Family Innovation Center

---

I'm often asked, what is Creative Inquiry? The answer is complicated and impressive.

Creative Inquiry has become a cornerstone of the undergraduate experience at Clemson — and an opportunity for undergraduates that distinguishes Clemson University from other institutions.

Why? In part, it is our scope and flexibility. Creative Inquiry students come from every college, just about every academic discipline, at all stages of their time at Clemson. It is about innovation — projects spring from students' own curiosity, a professors' challenge or from the pressing needs of the world around them.

Industry leaders have taken note. They see that Creative Inquiry prepares students for workplace success and recognize the opportunity to get to know potential future employees. Creative Inquiry projects are increasingly supported by corporations, to explore real-world challenges in the workplace. The Creative Inquiry project addressing knowledge continuity in the workplace (on pg. 35) is one that is getting a lot of national attention. Clemson students are examining how to transfer knowledge from soon-to-be retired workers to newly hired employees, who may have very different communications styles. Siemens Corporation is

supporting the three-year study, but the issue affects many industries.

Creative Inquiry is not just doing research — it's also telling the stories of project accomplishments. Thus, our students present research results in many venues and in innovative, digital formats. Creative Inquiry students published more than 368 articles in professional journals and made more than 1,376 presentations at professional conferences, in 38 states and 18 countries. What better way can an undergraduate student gain professional credibility than by sharing the stage with seasoned professionals?

Perhaps the best answer to 'what is Creative Inquiry' is that it is an opportunity for undergraduates to have a graduate research experience — enhanced by developing skills in leadership, teamwork, communications and multidisciplinary thinking. Overall, a nice complement to a Clemson degree.



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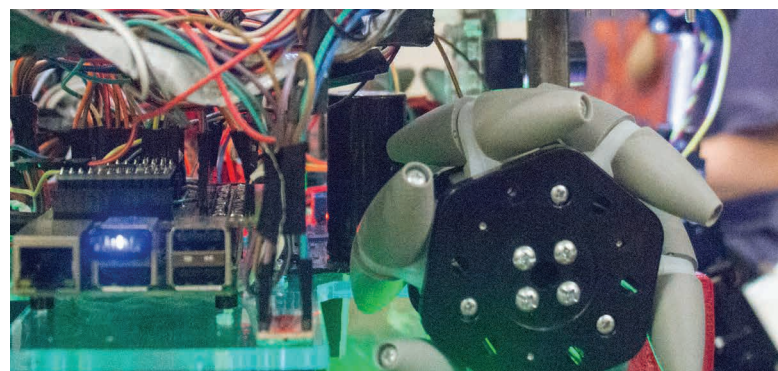
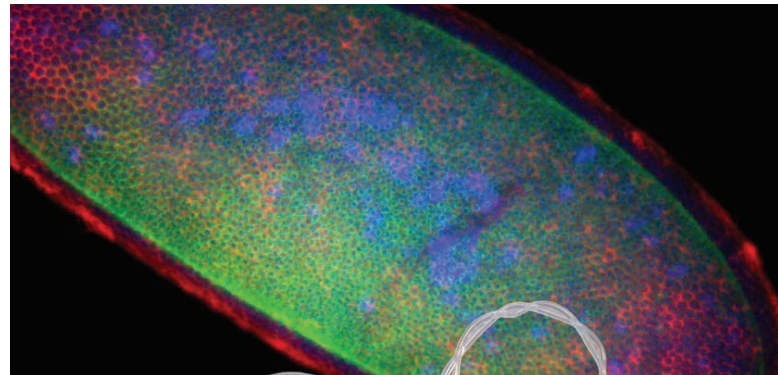
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# AN INTERACTIVE LANDSCAPE

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The creation of a campus food forest

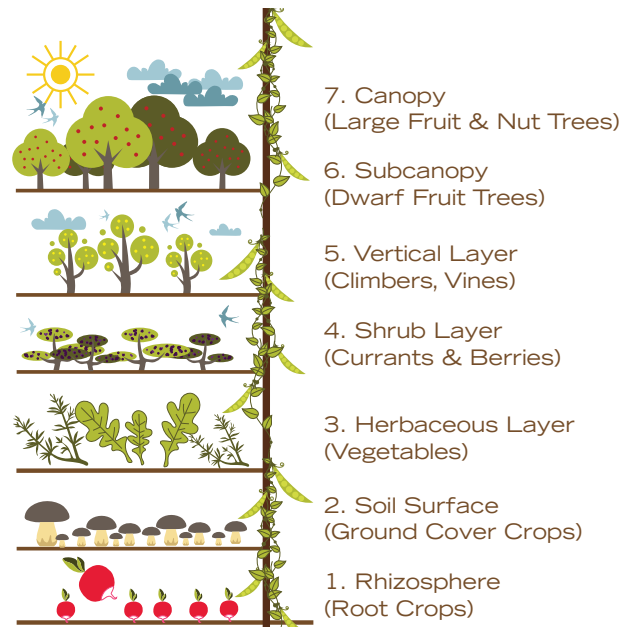
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by Michala Stewart





The team sets up beds on campus to cultivate mushrooms.



A diagram of the layers of a food forest.

The Clemson University (CU) Food Forest is a Creative Inquiry project that wants to change the way students experience the campus landscape. The team wants Clemson's landscape to not only be beautiful but also edible. Imagine walking into your local grocery store and wandering through the produce section. There are ripe fruits and berries, fresh peas and mushrooms and peppermint leaves you can add to your morning tea. Replace the grocery store with your campus landscape, remove the price tags and you have a food forest.

The convenience of grocery stores has allowed us to forget where our food comes from, but food forests turn a simple snack into a chance to learn about how food is grown. Similar to a forest, food forests are planted in layers with each layer containing different plants that function together to flourish. A forest exists and functions on its own, without human assistance. A food forest takes this same design but modifies it so that all of the plants are edible. Each plant is selected for its edible, medicinal and aesthetic qualities. Anyone can pick from these forests and the goal is to nourish, educate and inspire.

Dr. Julia Kerrigan, a mycologist from the Department of Plant and Environmental Sciences, is the mentor of the project. Kerrigan said the goal is that everyone who passes a food forest on campus can stop and enjoy it, but also learn from it. We all eat mushrooms or blueberries from stores, but there is something different about picking your own and seeing where they grow. Kerrigan believes it is this aspect that will educate others and help them to interact and connect with the landscape around them.

The project started with creating a mushroom garden outside of the Poole Agricultural Center on campus. The team harvested logs and inoculated them with mycelium, or mushroom spawn, and then arranged these logs around plant beds to serve as walls. Both the logs and the plant beds they surround will grow a variety of mushrooms such as Shiitake, King Stropharia, Oyster and Black Poplar. Senior biological science major, Brian Hurley, helped install the mushroom garden and said that this garden has a wider variety of mushrooms than he can get at most grocery stores. Hurley hopes the garden will demonstrate to other students how mushrooms are cultivated.

"I think something like what we're doing here in this food forest, growing different types of mushrooms and showing people that you can actually do it in your backyard and you can do it yourself, is great," Hurley said.

Since food forests are sustainable, they have a positive impact on the environment. The team's goal is to install food forests throughout campus so students less familiar with agriculture can see how their food is grown. They recently installed raised plant beds near the Redfern Health Center on campus. More and more people are starting to understand the importance of sustainable, natural and healthy resources and how, in the long run, they are better for us and the environment. Establishing food forests on campus is a great way to take a step towards being more environmentally friendly as a University. By turning Clemson's landscape into something functional, sustainable and interactive with tangible benefits for all, the CU Food Forest Creative Inquiry project is helping Clemson's campus nourish not only its students but also the Earth.



# THE Evolution of Mail

## New trends in the mail industry

by Kiersten Borden



Bianca Epps working on her team's submission for the competition.

Some may argue that mail is a dead form of communication due to text message, email or social media. However, according to Dr. John Leininger from the Department of Graphic Communications, you are wrong to believe such claims. In fact, Leininger said mail use has increased in the past five years and the United States Postal Service (USPS) processes up to 500 million pieces of mail every day. Mail is not dead, just evolving. Leininger leads the Graphic Communications with Variable Data Creative Inquiry project. In 2005, he recognized that mailing would be big so he received his certification as a Mail Design Professional. Through his years as a graphic communications professor he decided that he wanted to teach students what they were not learning in their classes.

In this Creative Inquiry project, students become affluent in the USPS and the new technologies they employ in variable data mailing. Variable data printing is a form of digital printing that edits text, graphics and images from one printed piece to the next without slowing down the printing process. Students partner with companies, such as XMPie Inc., to prepare and mail variable data pieces using Intelligent mail barcode for small businesses (IMsb™). Working with the XMPie users group also allows the students to gain additional experience and networking opportunities

by attending the annual XMPie conference.

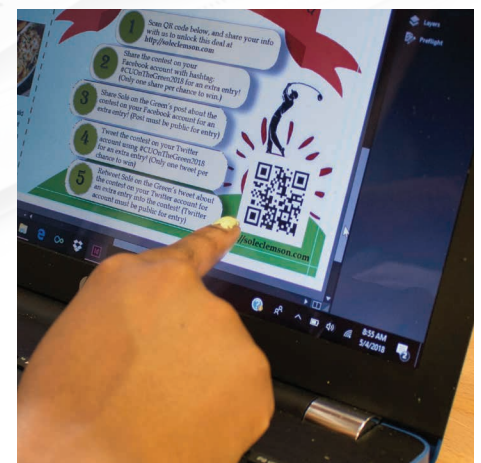
Students in this Creative Inquiry project also have the opportunity to work with startup companies. One startup company the team is working with develops Radio-Frequency Identification (RFID) tags which are a form of Near Frequency Communication (NFC). An example of RFID is the chip in your debit card. The Creative Inquiry team is working with the company to create a state of the art campaign using NFC (RFID tags).

Students enjoy the opportunity to work alongside professional in these companies. The experience allows them to further develop their skills while creating something real. Bianca Epps, a junior graphic communications student said, "The real life aspect of how the workforce is... creating a project, planning and making sure things get done on time for a client can be a beneficial challenge."

Currently, the team is working with the USPS and the Integrated Media Resource Center to develop the Integrated Marketing Campaign Student Competition. The goal of the competition is to create a marketing campaign for local businesses. The campaign includes a mailing piece, a mobile webpage with multiple pages

as well as social media tracking and analysis of the social media data. The Creative Inquiry team won the inaugural competition and the students received free registration to the National Postal Forum as well as free training as a Mail Design Professional.

Leininger wants his students to learn via real-life problem solving. "The key to me for this Creative Inquiry project, is that it is real. No one is just making something pretty. To me these are all line items on a resume." The ability to work with businesses and industry professionals motivates the students, and the industry partners acknowledge their accomplishments. Even if these students do not pursue mail as a career, their work with companies and industry professionals will give them an advantage over other applicants when seeking a career.



Making mail interactive by incorporating QR codes.

# Promoting Positive Behavior via Film

Transforming behavior in schools

by Polly Goss

From elementary schoolers singing about bathroom etiquette to high school teachers recognizing students who inspire them, Positive Behavioral Interventions and Supports (PBIS) videos are changing the way students learn and behave in school. Positive Behavioral Interventions and Supports is a proactive and respectful approach to supporting and including all students in a school or community. Videos explaining PBIS concepts in an entertaining and instructional format are increasingly popular in K-12 schools. The Developing an Online Platform for Positive Behavior Supports Creative Inquiry project, led by Dr. Shanna Hirsch from the Department of Education and Human Development, is interested in studying and promoting this video trend. Through their involvement with the PBIS Film Festival, Creative Inquiry students hope to learn more about these videos and to make them more accessible to schools.

The PBIS Film Festival, which takes place at the annual Association for Positive Behavior Support Conference, features PBIS videos made by schools or school districts.

These videos encourage positive behaviors, often in engaging ways meant to captivate student interest. Hirsch, in collaboration with faculty from the University of Florida and the University of Alabama at Birmingham, organize the film festival. However, they hope to shift the leadership responsibilities to the Creative Inquiry team. “We hope to make it student-sustained in the future, with the students in the Creative Inquiry as the leaders of the transition,” Hirsch said.

The first phase of the Creative Inquiry project included conducting a qualitative research study, to better understand the film production and dissemination process. The team interviewed 16 film producers to gain insight into the development of creating and using films. After learning more about the films and their creators, the students took on an important role in the PBIS Film Festival – collecting and curating video submissions for the festival. The students worked with a national panel of experts to screen and code each film in preparation for the event. They are assembling a catalog of videos from the past four years on a website in order

to make them more accessible to the public. No such database exists for PBIS videos.

Films are submitted from all over the world and often require a great deal of time to produce. Because of the time and resources needed to create an effective PBIS film, schools may struggle to produce multiple films. The resource website will help schools share their videos as well as scripts for films. Through collaboration with different majors and disciplines, the team hopes to bring the positive messages in PBIS videos to more students and educators around the world.

Students gather to prepare for the PBIS film festival.







# Metal Nanoparticles

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Zooming in to solve big problems

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by Tessa Schwarze

When you walk into Dr. Thompson Mefford's laboratory, you receive a pair of safety goggles. Goggles to let you see out, while keeping hazards from coming in. Framed in red and gold glitter, they are particularly festive in comparison to the various scientific instruments scattered about the laboratory. Despite their outward appearance, the most intriguing element in the lab is what you continuously observe through the lenses, but do not see at all: nanoparticles.

Nanoparticles are small, not only are they invisible to the naked eye, but they are also invisible when looking through a light microscope. The ones in Mefford's laboratory are 20–26 atoms wide. But despite their microscopic appearance, the end goal of nanoparticle manipulation is anything but small. The objective of the Synthesis and Modification of Metal and Metal Oxide Nanoparticles

Creative Inquiry project is to use these nanoparticles to work like, or instead of, medications to fight disease.

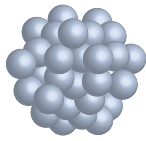
Carol Stegura, sophomore general engineering major, said currently the team is trying to create a polymer that can connect to nanoparticles and transport a specific and effective treatment to an infected site within the body. "Right now, we're making polymers with different organic structures that can attach to nanoparticles," Stegura said. "We want to make them biocompatible: that way they can go into a body for something like, well, radiation."

Cancer and antibacterial infections are the target illnesses for this kind of treatment. The ideal polymer, Mefford noted, will have several features. A structure with the ability to effectively transport nanoparticles, but the ability to balance efficiency with the amount of toxicity it introduces into the body.

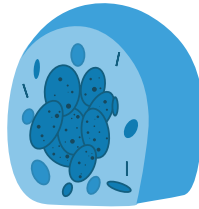
"Chemotherapy is a classic example." Mefford said, "Basically, you're poisoning the entire body to kill a small group of cells, which definitely isn't great. Or you can look at radiation, and basically, you're shooting a radiated pole through someone. That's not too great either." Currently, cancer treatment is like plowing an entire field of crops just to eliminate the diseased ones. Sometimes more damage is done in the process and every part of the patient suffers. However, the modification of these polymers would enable site-specific, injection-free treatment: meaning that it would only target cells that were cancerous, and ignore those that were healthy.

The team is using an alternating magnetic field to target cells in the body. This process eliminates the toxicity delivered to the rest of the body, and potentially changes the damage done by present treatments.

Metal Nanoparticle



Cancer Cell



Tennis Ball



10

$10^4$

$10^8$

Nanometers

Mefford explained that although their overall goal is improving cancer treatments, this system could be applied to any sort of ailment.

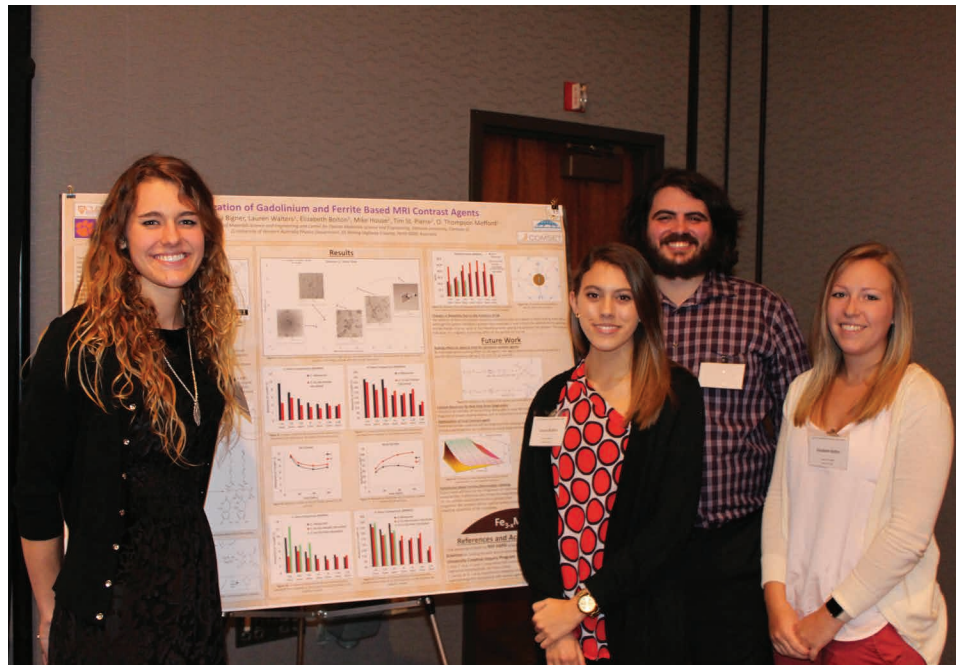
“There’s a lot of bad things we want to get rid of in the body. So, we could work on finding the treatment of other diseases — you could go from the life-threatening issues to the more non-life-threatening,” Mefford said. “We could get rid of zits this way too.”

Stegura and Mefford are both clear that the stages of the study are extremely fundamental. “I feel like we’re making progress, but it’s slow,” Stegura said, “we’re doing the nuts and bolts right now, just figuring out how the atoms need to be arranged for the best result.” But these nuts and bolts are setting the stage for building something much bigger. Andrew Patterson, sophomore general engineering major, is not letting the current focus of the research out shadow the long-term goal. “We want to cure cancer,” Patterson said, “We want to cure all disease.”

The ability to modify material at such an intricate scale has led to vast improvements in fields such as electric technology, energy preservation and even fashion. This team feels that, like the bedazzled goggles, it is time to bedazzle health care with innovative cancer and disease treatments.

### Zooming Out

For comparison, the size of nanoparticles expressed comparatively at exponential intervals to a tennis ball.



Creative Inquiry students presenting their research.



## Meet the Decipher Team

### Kiersten Borden | Head Designer

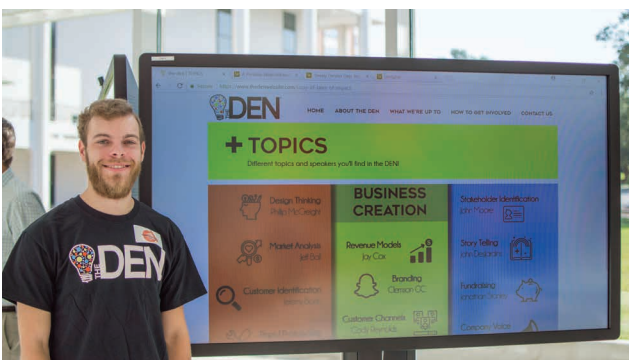
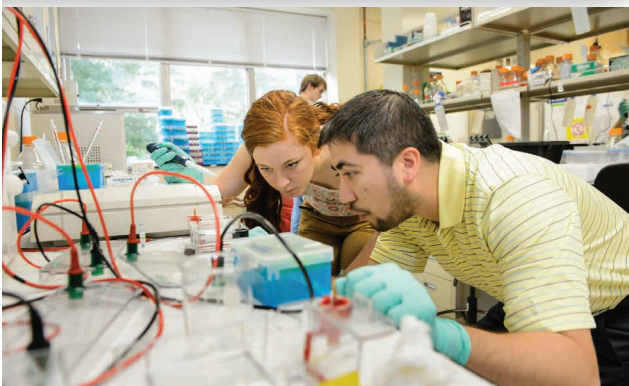
Kiersten is a senior graphic communications major from Greenville, South Carolina. She spends her free time volunteering with the ClemsonLife program and taking classes to become scuba certified. She looks forward to starting her career in the graphics industry.



# LET'S TALK

BY THE NUMBERS

SINCE  
2005

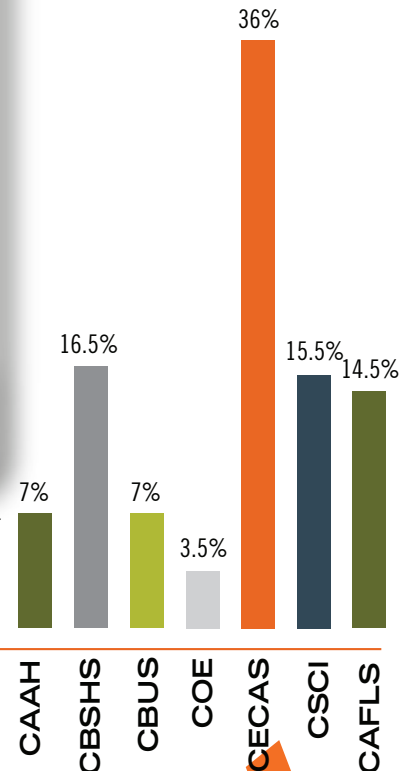


over  
47,773

STUDENT  
EXPERIENCES

IN EVERY  
SCHOOL

BY SCHOOL IN 2018

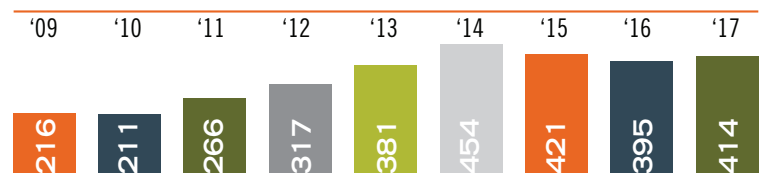


BY CLASS, 2018

1235  
PARTICIPATING  
PROFESSORS

over  
1,200

FACULTY-LED  
RESEARCH  
PROJECTS



SINCE 2009, PROJECTS BY YEAR

# ABOUT

# Creative Inquiry



## ACCOMPLISHMENTS



## WHERE WE'VE BEEN









# The Intersection of Data and Football

Turning digits into championships

by Tessa Schwarze

Every coach strives to find an undiscovered edge, something innovative to bring their team above the standard. Dr. Gregory Batt from the Department of Food, Nutrition and Packaging Sciences said this edge cannot be found in the quality of a player's game alone. The numbers, the quantitative data are the future of sports.

The Football Player Field Analysis Creative Inquiry project evolved one day at the park while Batt was watching his son play with the son of a Clemson football coach. During a casual conversation with the coach, the subject of performance data arose. "He started talking about these Catapult devices that they just purchased and how the players were wearing these devices for every practice and every game," Batt said, "They accumulated all this data, and they didn't know what to do with it."

After the day at the park, Batt coordinated with student Alex Bina. At the time, Bina was an undergraduate bioengineering major and he is now a graduate student in bioengineering. The two formulated a plan to analyze the data accumulated by these devices.

The Catapult, a device that collects

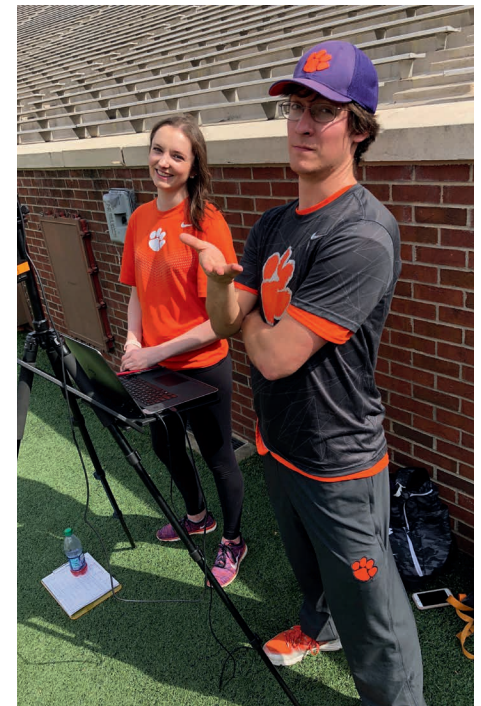
performance data, is similar to a cropped tank top. Players wear it over their shoulders with sensors laying between their shoulder blades. "There's a couple of different sensors in there that measure movements on the field in the XYZ direction, and it can accurately measure how fast you're moving, how far you move and acceleration," Batt said, "it can use that to determine how much work players are actually getting done."

The equipment was designed by an Australian company to measure performance in rugby and soccer players. Florida State University was the first collegiate football team to use the device. Their results were astounding. "They reduced their soft tissue injuries by 20%, they won the national championship," Bina said, "from that point forward everyone started paying attention."

Clemson brought Catapult to the team in 2014, but they did not have the ability to analyze and interpret the data. The information sat collecting dust until the Creative Inquiry team formed and got their hands on it.

Because of the appeal of working with the Clemson football team, Batt had a lot of students interested in

participating in the Creative Inquiry project. "We made flyers, and we put them around campus," Batt said, "and because it was Clemson Football, we had thirty people request to join with only four open slots." After a selection and interview process, five students from five different majors were selected. For the next two and a half years, these students turned sweat into digits.



Creative Inquiry students monitor performance data during practice.



The goal of the Creative Inquiry project was two-fold: help the football team and produce research results. “We felt like we had two arms – we had a research arm and a football team service arm,” Batt said.

The students compared data from games and practices to determine which players improved their performance and which players did not in comparison to past practices, games and seasons. The Creative Inquiry team used the data to evaluate player recovery time as well as to analyze performance before and after injuries, including ACL tears and concussions. They quantified player workload, which provided the coaches with the information they needed to make decisions regarding when to push players and when to ease up.

Soon, there was a live data feed at every practice and game. Now players receive reports detailing their performance, comparing it to last practice, last game, as well as last year around the same time. The data opened up new doors for the coaching staff.

“We can point out...okay this player’s performance has dipped and his recovery’s dipped, maybe there’s something off the field that we should check into,” Bina said, “It opens up the conversation. It’s a new line of communication.”

With the football team’s reliance on the Creative Inquiry team’s data, the student research team’s excitement grew, as well as the time they spent on the project. “They were interested in it, they were excited about it and they started developing tools, just grabbing data and pulling it together. I’ve been working with CI teams for six-seven years now,” Batt said, “and this group was by far the best group of CI students I’ve had so far.”

The work of the students spoke for itself. On top of multiple presentations to the coaches and attention at the MIT Sloan Sports Analytics Conference in Boston, MA, Coach Dabo Swinney mentioned the Creative Inquiry team’s contribution in a TV interview, praising his data analytics team.

The collaboration of the Creative Inquiry team with the football team was the beginning of a new relationship – one that was long overdue. “At Clemson, there’s a wall between [athletics and academics] – they don’t work together. Sports analytics is the perfect way to link them,” Batt said, “If we can bring athletes and science together, we can benefit everyone – the research and the athletic communities.”

Although the Creative Inquiry project ended in the fall of 2017, the football team intends to extend the analysis of their performance data into a full time position. As for the five students, they all plan to graduate from Clemson with careers on the horizon. Jewell Smolenski, senior bioengineering major, is accepting a position working for the National Football League. Prior to joining this Creative Inquiry project, Smolenski did not have experience with data analytics although she was proficient in data interpretation and communication.

“This Creative Inquiry has honestly been the most valuable experience I’ve had at Clemson. It’s gotten me internships, it got my foot in the door to where I’m going to be working full-time, it’s definitely one of the most incredible experiences,” Smolenski said, “and I’ll have it for the rest of my life.”



# Investigating Experiential Marketing



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A glimpse into real-world  
qualitative marketing strategies

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by Polly Goss

The Lollapalooza music festival in Chicago, IL usually represents four days of music, art and fun. However, for students in the Qualitative Marketing Creative Inquiry project, it also represents an opportunity to study the chaotic assemblage of marketing practices and consumption rituals.

The Creative Inquiry team, led by Dr. Anastasia Thyroff from the Department of Marketing, is investigating the marketing techniques that help brands such as Toyota, Pepsi and Red Bull promote themselves through extraordinary consumer experiences such as music festivals. In order to do so, the students document what the consumer journey looks like before, during and after the music festival. They also study how brands insert themselves into an extraordinary customer journey to be effective and cut through the chaotic clutter of the festival scene.

The students in this project spend an entire semester learning and becoming experts in the best qualitative research methods. Then armed with their newly acquired skills, the students attend the Lollapalooza Music Festival in downtown Chicago which attracts approximately 400,000 people each year. While there, the students conduct interviews with festival attendees, asking about their festival journey and experience. Their relationship with material objects and brands are also observed and questioned. Together the six students collect over 30 interviews, all of which are 20 to 70 minutes in length.

The team's findings include the discovery that the customer journey at Lollapalooza consists of three stages, all with an appeal to different parts of the consumer identity. Brands can evolve during the consumer experience to reach consumers throughout

their journey, even in a chaotic environment. The team is working on finishing a manuscript for submission to an academic marketing conference.

The Creative Inquiry project also gives the students opportunities to see different marketing strategies in action. "It has been an awesome group to be a part of and a really cool way to gain marketing experience," Erin Andrews, a senior marketing major, said.



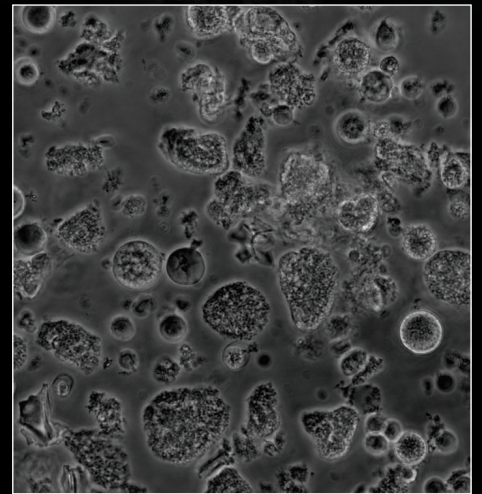
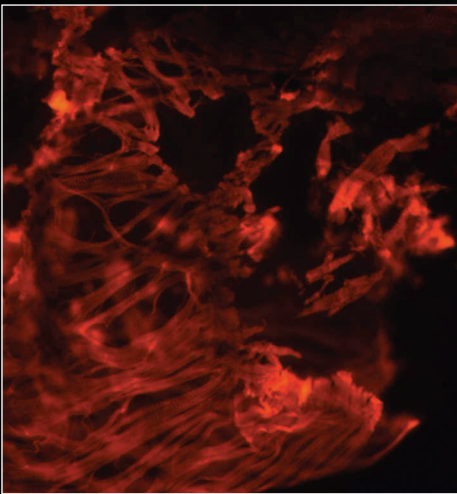
The Qualitative Marketing  
Creative Inquiry team.



# STORIES FROM INSIDE AN INSECT'S GUT

A small organism with a big impact

by Polly Goss





A thin brown caterpillar crawls across the sidewalk. It squirms on the hot concrete as a shoe descends on the insect, forcing its guts out of its body. Although the students in the Insect Viruses, Molecular Biology and Biotechnology Creative Inquiry do not crush caterpillars with their shoes, they are interested in how insect guts can explain processes in their bodies, as well as ours.

Mentored by Dr. Matthew Turnbull from the Department of Biological Sciences, the Creative Inquiry team is studying various aspects of caterpillar development and physiology. The Creative Inquiry project consists of several different student-driven projects, but each piece of the research addresses the theme of the laboratory — studying life at the smallest level, in this case insect physiology and molecular biology, and translating it to the rest of the world.

“It’s about approaching broader topics from a different perspective,” Richard Melton, a senior biological sciences major, said. Melton brought his interest in ecology and evolution to the lab, studying insects as environmental indicators before moving on to caterpillar guts.

In order to better understand caterpillar development, stem cell regeneration and immune systems, Melton began studying the part of the insect that most people do not think about unless it ends up on the bottom of their shoe. Melton’s research investigates the regulators that affect the stem cells of *Heliothis virescens*, or tobacco budworms, as they regenerate. Melton and his fellow researchers dissect budworms and examine their digestive systems, finding patterns in the bioelectric phenomena that occurs as the insects break down their food. Melton’s work not only helps him understand the way stem cells regenerate in budworm guts, but also how to manipulate bioelectricity in

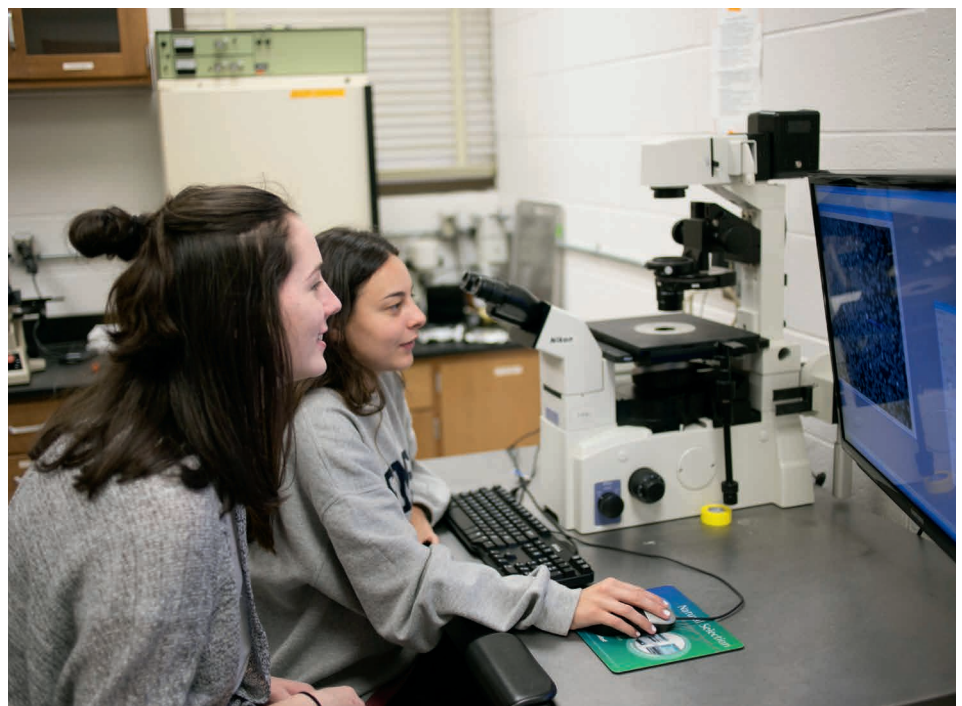
the guts. However, their research has implications that reach far beyond insect physiology.

“They are using insects to ask fundamental questions about life,” Turnbull said. While they study these fundamental processes, they also begin to understand the broader impacts of their work. As the team draws conclusions, they realize their work sometimes finds ways to end insect lives or to potentially save human lives.

As a pest that attacks many agricultural crops as well as ornamental flowers around the house, the budworm is also known for its resistance to most insecticides. The wide range of plants affected by the budworm makes the students’ work with the insect

applicable to both home gardens as well as agribusiness. It could change the way farmers approach the use of pesticides, attacking caterpillars through their guts by limiting their ability to establish alkalinity and to absorb amino acids.

Their conclusions could also shed light on human gastrointestinal cancers by helping medical researchers and professionals to better understand gut biology. Whether they are destroying tobacco budworms or helping to identify the effect of cancer on the human gastrointestinal system, the team is dedicated to discovering how to stop pests and how those pests can help to explain processes in our bodies.



Student analyzing images.



## Meet the Decipher Team

### Sarah Stewart | Photographer

Sarah is a junior wildlife and fisheries biology major from Charleston, SC. This is her second year working with the Decipher team. She is pursuing a career in wildlife biology and hopes to help preserve populations of threatened and endangered species in the near future.





# CODING FOR CARILLON

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Using your phone to *change the tune*  
of Clemson's Carillon bells

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by Polly Goss

The Carillon bells at the top of Tillman Hall have a history of talking to the students. When the first bell was installed in 1892, its clanging informed the cadets of military changes. As the school expanded from its military roots, several classes donated bells until the University's Carillon became a collection of 50 bells. As the Carillon grew, it became a musical instrument rather than an acknowledgment of time. While the bells still chime every fifteen minutes, they also broadcast Disney soundtrack snippets, Harry Potter themes, pop music hits and other instantly recognizable songs across campus.

The Coding for the Carillon Creative Inquiry team, led by Dr. Brian Dean from the School of Computing and Dr. Linda Dzuris from the department of performing arts, is well aware of the conversation that the Carillon has with students as they hear video game theme songs or Taylor Swift tunes while walking from class to class. However, only twenty students each semester have the ability to communicate with and through the bells. These students sign up for a coveted class or pay for private lessons. By combining computer science with music, the Coding for the Carillon Creative Inquiry project is giving all students a way to join the conversation.

The team is developing a phone application (app) that will allow students to vote on songs for the Carillon to play. Voting will take place throughout the day each day, with the ten top-voted songs playing at a specific time of day. While the first songs on the app will be those that the Creative Inquiry team programs into the system, students will soon be able to compose songs using Musical Instrument Digital Interface (MIDI) format.

"We want to make the Carillon more interactive, to open it up to all students and everyone on campus," Joey Bonitati, a senior computer science major, said. In fall 2017, the team received a grant from the Information Technology Student Advisory Board for a new electronic system that plays songs on the bells automatically. The \$50,000 system represented a marked improvement from the previous version, which only operated half of the bells.

The team divided the project's tasks based on their interests and skills. Four students focused on the song library, making arrangements of dozens of songs specifically designed to sound good on the bells (e.g., an arrangement with many low notes at once sounds good on a piano but "muddy" on the Carillon bells). Other students handled the more technical aspects of the project, building the app and ensuring

smooth communication among the different devices involved in managing and playing songs. The system, which is located in the same room as the bells, plays each song selected using the app by moving the levers of the Carillon accordingly.

“ We want to make the Carillon more interactive, to open it up to all students and everyone on campus.” ”

The team is determined to show how computer science and art can work together. In 2017 and 2018, the team displayed their work at Artisphere in Greenville, SC as part of Clemson’s STEAM (Science, Technology, Engineering, Arts and Math) initiative. The Coding for the Carillon booth allowed visitors to play a keyboard that was connected to Clemson’s Carillon thirty miles away. Although their end product will only allow those on campus to interact with the bells, the students’ experience at Artisphere showed them the power of collaboration when technical disciplines work with the arts.

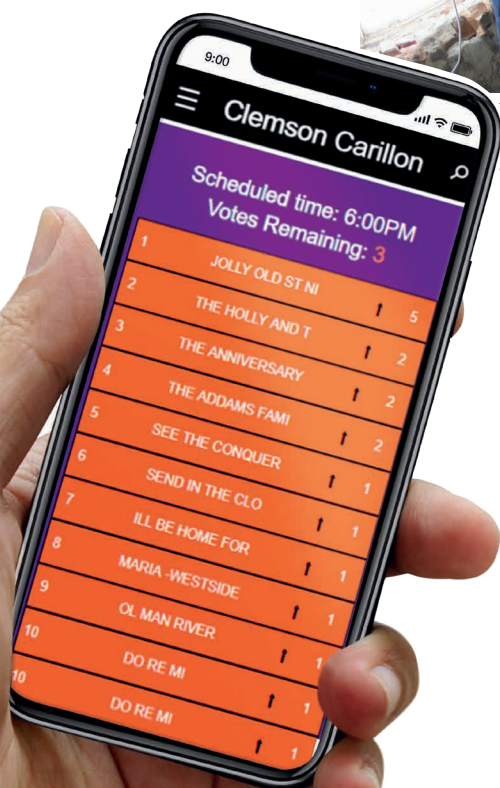
Once the team is finished designing the app, the students will give the project reins to faculty members in order to integrate the finished product into the Clemson experience. The students connecting the bells to computers and phones hope that the app will be available during campus tours, game days, holidays and regular class days. They believe that everyone on campus should be able to interact with the Carillon as well as hear other students’ voices through the songs of the bells.



Students use software to create various tunes for the Carillon bells.



The Coding for the Carillon Creative Inquiry team.



### Cast Your Vote!

Visit the Clemson Carillon Song Voting App at [carillon.clemson.edu](http://carillon.clemson.edu). At certain times of the day, you can vote for your favorite songs from the app library, and the song which has the most votes at a given time will play automatically on the bells!



# WHERE ARE THEY NOW?

A visit with previously featured Creative Inquiry projects

## Developing a Sustainable Business Model for a Clemson Makerspace



What once was the Developing a Sustainable Business Model for a Clemson Makerspace Creative Inquiry project is now a booming hub for students. With 3D printers mapping out complex plastic shapes and laser cutters humming, the Makerspace offers students access to high-end tools in a collaborative fabrication environment. The space allows any Clemson student the ability to create, requiring only that they have a valid Clemson TigerOne card and complete training courses before operating its machines. The Makerspace has evolved since its creation.

Initially, the team was focused on developing a business model for the Makerspace. Now, several different Creative Inquiry projects are involved with this space. One team is making the Makerspace more user-friendly, creating tutorials for each machine. Some students created training videos or modules, while others wrote out step-by-step instructions. The team hopes that these programs will encourage students from all majors to use the Makerspace. “A successful Makerspace would be mechanical engineering students, nursing students, electrical engineering students and all different majors working at the same table and sharing ideas,” Nolan Hoolachan, a senior mechanical engineering major, said. The team is creating a new website for the Makerspace that will feature the training courses. Using entrepreneurship skills and principles, the Creative Inquiry team hopes to give students more access to all that the Makerspace offers.

## CI Collaboration: Architecture and Ecology

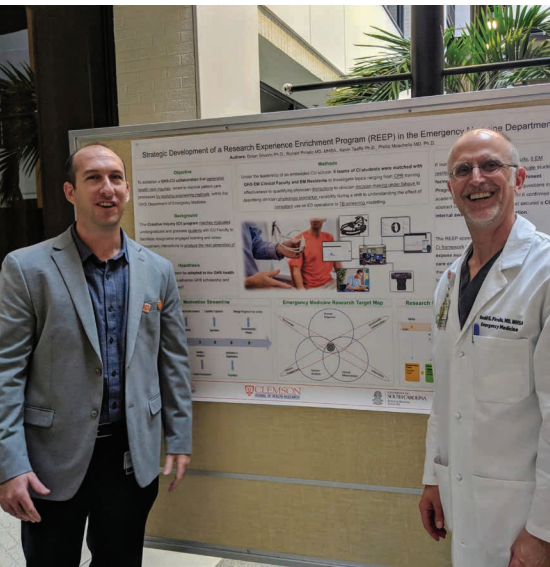


Generally speaking, Creative Inquiry projects naturally foster collaborations. However, those collaborations are usually within similar disciplines or research interests. Two long running Creative Inquiry projects, Ecology and Biology of *Bellamya japonica*, a New Invasive Freshwater Snail led by Dr. John Hains from the Department of Biological Sciences and Biomimicry and Biomimetics led by Dr. Carlos Barrios from the School of Architecture, are bringing students from these very different departments together. A casual introduction in the hallway of the Watt Family Innovation Center, Clemson’s hub for innovation and collaboration, turned into a great partnership.

Both Creative Inquiry teams were at a standstill before they met. The vertical distribution of snails within the surrounding lakes includes deep water and Hains’ team did not have the ability to access deep water. Barrios was looking for some natural inspiration for his team to study underwater. Members of the Biomimicry and Biomimetics team are scuba divers and able to access regions of the lake inaccessible to most. Working together the team were able to access the deep regions of the lake to observe and collect snails for the snail team and to help the Biomimicry team understand the biology and ecology behind the structures they observed in the snail.

# WATT FAMILY INNOVATION CENTER

## Human Performance Engineering in Health Care



A collaboration with Greenville Health Systems (GHS) seeks to improve patient care by applying engineering methods within the GHS Department of Emergency Medicine. This new collaboration, Research Experience Enrichment Program (REEP), arose from the partnership Dr. Kevin Taaffe and Dr. Dotan Shvorin, both from the Department of Industrial Engineering, developed with GHS while mentoring the Human Performance Engineering in Health Care Creative Inquiry project. REEP aims to recruit Creative Inquiry undergraduate students to participate in summer internships at GHS to shape and enhance their professional experience. During the academic year, the team conducts cutting edge research that incorporates virtual reality, robotics and the integration of pioneered sensory data collection technology (iMotions) into emergency medicine patient treatment.



## Culinary Nutrition



As part of the Culinary Nutrition Creative Inquiry project, led by Margaret Condrasky from the Department of Food, Nutrition and Packaging Sciences, students review and collaborate to design of the curriculum for the South Carolina 4-H Melting Pot program. Funded by the Walmart Foundation, this program offers a summer culinary camp designed for youth. The Clemson students use their nutrition science knowledge to modify recipes originally from a program at Pennsylvania State University by chef Anne Quinn Corr.

"This is the third year we have held this type of culinary nutrition camp," Pamela Ardern, South Carolina 4-H program leader, said. "We are so excited about the program this year. We have a new curriculum based on skills learned in the Basic Cooking Like a Chef Module from the past two summers. Our agents requested additional recipes and the Melting Pot concept emerged."

Focusing on the cultures of Asia, Africa, Native Americans, Latinos/Hispanics and the Mediterranean, the cooking lessons encourage acceptance of the diverse cultures in America and provide a table filled with healthy and affordable food that the young campers will prepare and sample this summer. Cooking camps will be held in Beaufort, Berkeley, Charleston, Dorchester, Fairfield, Jasper, Marion, Richland, Saluda and Sumter counties this summer.



# Engineering for Efficiency

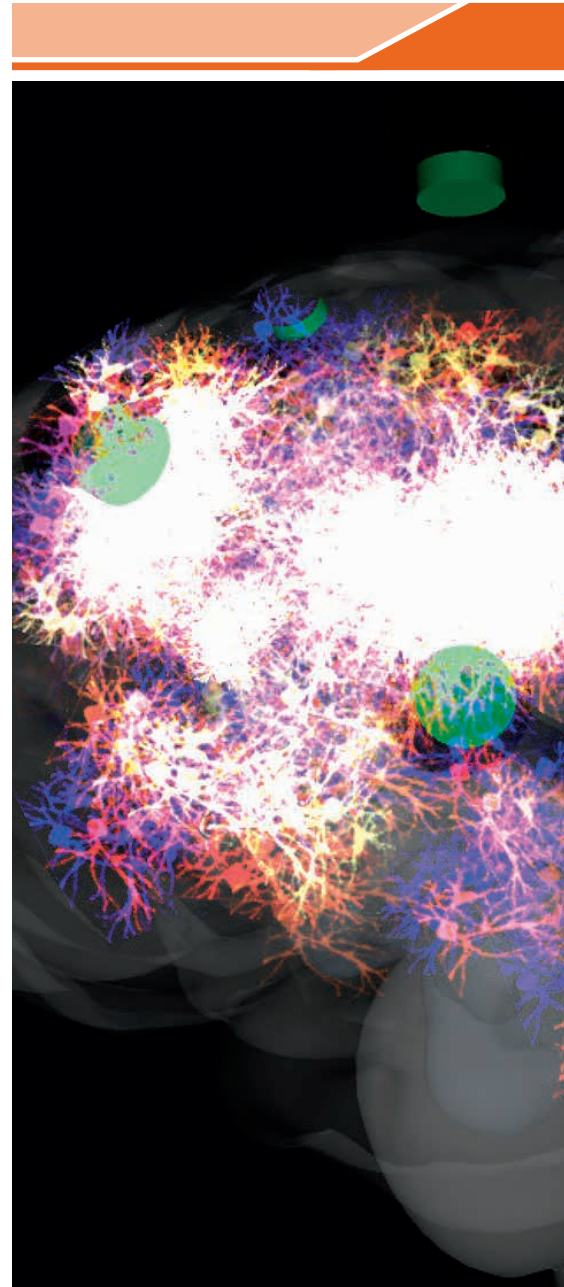
Using industrial engineering to inform processes

by Jason Erno

Led by Dr. Kevin Taaffe and former professional tennis player Dr. Dotan Shvorin, both from the Department of Industrial Engineering, the Human Performance Engineering Creative Inquiry team looks to use new industrial tools to inform and improve human performance.

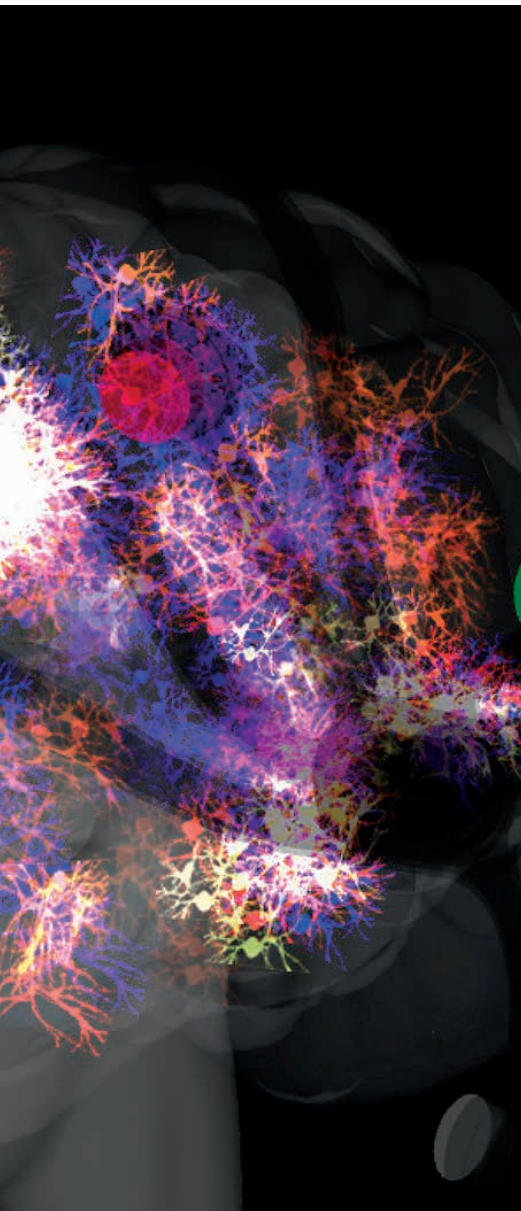
Tools like an electroencephalogram (a device that detects electrical activity in the brain) give researchers access to sensory information that can be used to identify the active areas of the brain, their intensity and their activation sequence during a specific activity. Creative Inquiry undergraduate researchers can now tap into brain waves and analyze them the same way an electrical engineer attaches a voltmeter to measure voltage. "There's no class we take to cover this kind of cutting-edge technology. It's so outside the box of traditional industrial engineering," Kathryn Watson, a senior industrial engineering major, said.

This Creative Inquiry project focuses on two types of human performance: decision making and academic success. The Creative Inquiry's collaboration with the Clemson Club Tennis team puts athletic decision making to the





Data recorded is studied via brain visualizer software.



“There’s no class we take to cover this kind of cutting-edge technology. It’s so outside the box of traditional industrial engineering.”

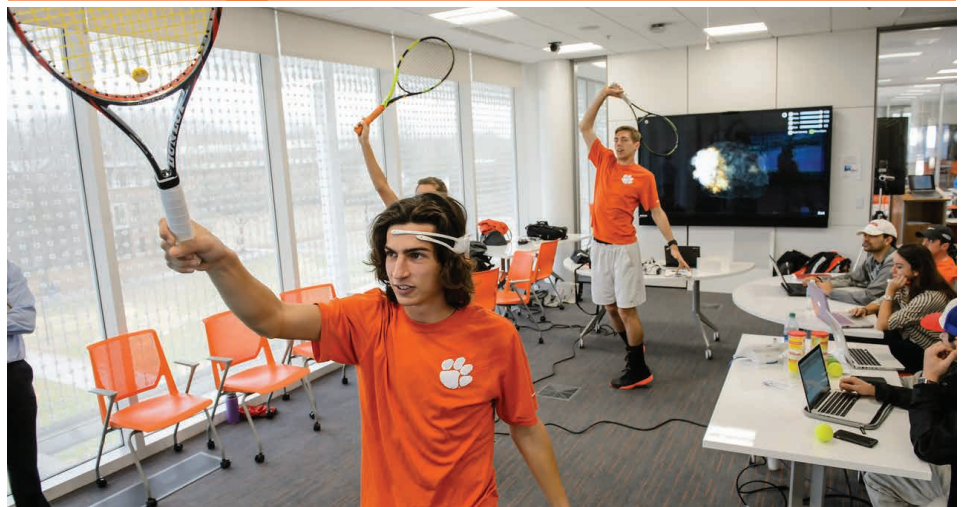
test. Tennis players are asked to hit the ball to a target. Then the Creative Inquiry team analyzes the player’s thought process in order to identify risk taking, decision making patterns, learning curves and zoning.

Another goal of the research team is to improve the academic success of students diagnosed with ADHD. The team collaborates with Student

Accessibility Services at Clemson to better understand the brain activity of students with ADHD. Then, they use BrainHQ, a software developed by neuroscientists to increase the capability of certain brain areas, to evaluate brain function using ADHD diagnostic tools.

While the team works to improve human performance, they also work to improve their own knowledge, including Shvorin’s. “The students actually lead me to be a better researcher by asking intellectual questions,” Shvorin said. The Creative Inquiry project’s work will have a serious impact on training programs and health initiatives in the future.

Students play virtual tennis wearing sensors that digitally measure performance.





# Making

# History

## Digital

Retelling history in  
new and innovative ways

by Tessa Schwarze

The word “history” often evokes images of leather-bound books, weathered statues and crumbling buildings. Using online platforms, databases and social media, the Digital History and Introduction to Cyberinfrastructure in Humanities, Arts and Social Sciences Creative Inquiry project is showing people that history is a living, ever-changing story that is as present on a MacBook as it is in a textbook.

The project, led by Dr. Vernon Burton from the Department of History, approaches an old topic from a new perspective. The team of students compile databases and websites that bring historical trends, topics and records to online platforms. Some of these platforms, such as the database of Confederate soldiers’ records, will be useful to scholars as they study the soldiers’ experiences during the Civil War. The students use Microsoft Excel to record data on soldier events such as when men joined and came out of the Confederate army. Additional soldier records of events that occurred while enlisted and after the war are also included. These variables can potentially reveal how the war affected people, such as whether those who fought or those who stayed home benefited more economically. The students learn how to build a database and link it to other databases. Building and connecting these databases makes

the records more accessible and searchable than paper sources.

Students investigate a wide range of topics in attempts to bring the same technology to the historical records. For example, Corinne Foster, a senior history major, studied the history of Cherokee people living in the Clemson area. Her work included processing documents and using technology to select common words to create word clouds. Foster tracked the movement of Cherokee people across the area as settlers moved into the region, creating maps that show migration patterns. Although she works with different subject matter, her goal is the same: bringing history to an online platform to make it accessible worldwide.

While many students in the Creative Inquiry are trying to put historical records online, Collin Eichhorn, a history major who graduated in 2015, found a way to let other online platforms, such as Twitter, inform the way history is told. Eichhorn used the Clemson Social Media Listening Center

to discern attitudes about the Civil War. The Social Media Listening Center provided Eichhorn and Burton with a large dataset to analyze. They were interested in the thoughts, opinions and attitudes of the general population. While the data showed the researchers how people on the internet think about events like the Civil War, Eichhorn thinks that their research will open doors to a larger conversation on how we educate the public about the nature of history.

“The success of our research is highlighted by the concept that history is not written in stone,” Eichhorn said. Instead, through websites, databases and social media research, the digital history students are trying to show that history is fluid and that it is still being written.

Students transforming the way  
we experience history.





# Clemson

Renowned author, Paul Beatty, speaks to Clemson

# Literary Festival

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A festival in celebration of literature

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by Polly Goss

For a few days in April, poets and authors read their work in lecture halls, conference rooms and even in bars and restaurants in downtown Clemson. The Student Directors of the Annual Clemson Literary Festival Creative Inquiry team, led by John Pursley from the Department of English, intentionally mixes downtown hangouts with academic venues in order to bring the entire community into contact with literature. It is an exercise not only in “town-gown relations,” but also in literary discussion. Students, faculty, community members and writers mingle in classrooms and over food and drinks at free events downtown.

The students on the team divide up the various tasks involved in planning and running the festival. Students designed the posters, others handled t-shirts, E-vites, budgeting, vendors and finding a sound system. On top of individual event-planning tasks, each student serves as the personal contact for a writer invited to speak at the festival. The student helps the

writer make travel arrangements and other accommodations. While faculty in the English department chose the headliner of the festival, the Creative Inquiry students are able to select the other nine guests. The team spends the first semester of the project reading selections from different authors, carefully discussing and narrowing the list. At the end of the semester, they vote on which writers to invite to the festival. In order to keep the pool of authors diverse, the students do not have any specific rules regarding the types of authors they choose to invite.

This year, the headlining author is multidisciplinary writer Paul Beatty. However, the festival includes more local authors than usual in order to promote the festival’s goal of becoming an established event in the Clemson community and region beyond. As they look for new ways to brand and market the festival, the students reach out to the greater upstate area in order to promote their event across the upstate. Advertisements were sent to four different counties which cultivated

a diverse lineup of poets, editors and authors of fiction and nonfiction for the festival. Through marketing and choosing a wide range of venues for the festival, the Creative Inquiry team wants to increase community members attendance by bringing literature to locations within the community. “Our goal is to promote accessible literature and to invite anyone who is interested in or curious about literature,” Glenn Bertram, a senior history major, said.

In order to be successful, the team divides up the various event-planning tasks according to each student’s talents. The students’ majors range from English and philosophy to mechanical engineering and economics. This diversity of talents allows them to use their interests to work on festival planning while also learning new skills. As the Creative Inquiry continues, the students hope the festival will grow in popularity while cultivating and exhibiting Clemson’s literary community.



# FIGHTING CANCER ONE BITE AT A TIME

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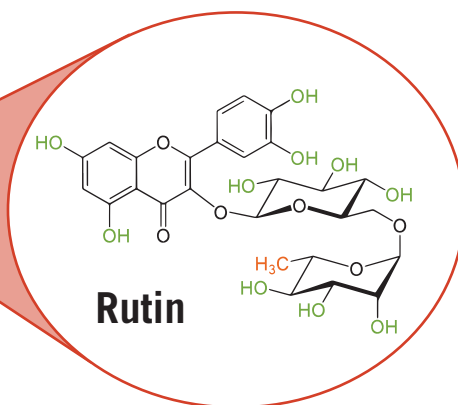
The benefits of peaches

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by Polly Goss

The solvents in these bottles are the HPLC mobile phase which separates bioactive natural products in peaches to identify phenolic compounds.





### Phenolic Compounds

Phenolic compounds are a large class of plant secondary metabolites, which consist of one or more **hydroxyl groups** directly bonded to an aromatic **hydrocarbon group**.

They act as antioxidants which allow them to scavenge free radicals. This is important because they help us rid impurities in the body.

With help from the Nutraceutical and Functional Foods Research and Product Development Creative Inquiry project, South Carolina peach farmers can boast that consuming their peaches has health benefits. Led by Dr. Feng Chen from the Department of Food, Nutrition and Packaging Sciences, the team studied the chemicals in South Carolina peaches to determine how one of the state's major agricultural products benefits its consumers. The team, which is supported by the Carr Family Endowment (see pg. 46), is continuing to expand its research to explore the chemical properties that give local foods, such as Clemson's blue cheese, their flavors and healthy properties.

Most people know that peaches are fruits which have positive effects on the human body. However, the Creative Inquiry team investigated the specific

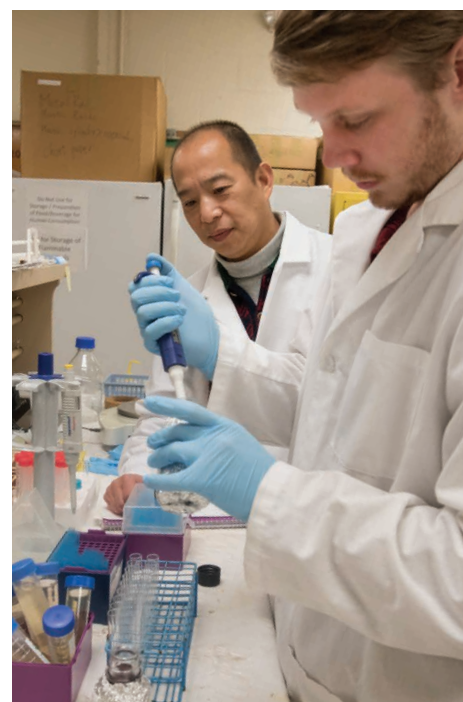
positive effects. The students chose to study the phenolic compounds found in peaches because these compounds help to eliminate impurities in the body and thus have potential anti-cancer properties. This single property of peaches' nutritional value could change the way peach farmers advertise their products. It could also change how consumers see peaches, elevating the fruit from a refreshing treat to a tool in cancer prevention.

Because of the project's ground-breaking work, the team was invited to compete in the American Chemical Society National Meeting's student paper competition in San Francisco, California. The team competed with students from Cornell University and from as far away as Germany. Although they did not win the competition, Chen is proud of their accomplishments. Their work could impact South Carolina's economy by bolstering the reputation of one of the most popular fruits at produce stands and farmers markets across the state. The students' findings could help local farmers to educate the public on the chemistry of their peaches as they advertise their produce.

After wrapping up their successful study of peaches, the Functional Foods Research and Product Development Creative Inquiry project is exploring Clemson blue cheese flavors. For more than 75 years, Clemson blue cheese has been closely tied to the

University's history. Now, the students are looking for the scientific basis behind its popularity. "No one has studied the flavors and the chemistry of the Clemson blue cheese. We want to reveal the chemical makeup of these flavors," Chen said. Like the team's research on peaches, their findings on Clemson blue cheese could affect the way local businesses market and sell the product.

As the Creative Inquiry continues, the team members hope to uncover the chemical backgrounds of the flavors and health benefits that people experience from their food every day.



A student isolates phenolic compounds in the laboratory.







# Using Data to Promote Inclusion & Success

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Forming cycles of support among students of color

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by Polly Goss

Transitioning from high school to college life at Clemson can be difficult for any student, but those who belong to underrepresented groups on campus can face additional challenges. The Effects of Peer Mentoring on the Student of Color Experience Creative Inquiry project focuses on the impact of mentoring on student retention as well as the overall experience in the CONNECTIONS program.

The CONNECTIONS program fosters relationships and networks of support among students of color and first-generation college students. The program offers a Living-Learning Community, mentorship program

and direct engagement with faculty and staff. Each student in the Creative Inquiry project mentors two or three incoming students, meeting with their mentees several times per month to support, encourage and guide them as they adjust to Clemson classes and campus life.

In addition to mentoring, the Creative Inquiry team conducts research in order to create a cycle of support efficiently and effectively among students of color and first-generation students. Many of the Creative Inquiry students entered CONNECTIONS as mentees now taking on mentees of their own as senior members of the

group. The team is looking for ways in which the CONNECTIONS program, as well as the university, can better recruit, retain and support students of color.

“We are supporting mentors to become change agents as they move on in life,” Sarah Dumas, CONNECTIONS Coordinator, said.

In order to improve student experiences in CONNECTIONS and at Clemson, each Creative Inquiry student conducts research on a target population (e.g., student athletes, first-generation students). The primary focus of the research is

to determine mentorship patterns in this population. Megah Carter, a junior psychology major, focuses her research on male athletes of color. Carter's preliminary research reveals that this group, specifically football and basketball players, brings in large profits for the university and mostly focuses their energy on their sports. However, Carter postulates that these students do not always feel connected with other students of color on campus. Her research indicates that athletes need to receive more encouragement to pursue back up plans so their athletic performance does not determine their future. In addition, she hopes to bridge the gap between being an athlete and being a student of color at Clemson in order to make student athletes feel included in other groups on campus.

“ We are supporting mentors to become change agents as they move on in life. ”

Carter attributes the CONNECTIONS program to be an essential part of her transition to college and wants to ensure that others have similar experiences. “I want to impart what I gained to someone else. I learned time management and about different populations dealing with different factors that can affect students of color at Clemson,” Carter said.

The Creative Inquiry team's research involves interviewing students who identify with their target populations at Clemson and conducting research on their populations across the United States. While the research gives them a big-picture view, the on-campus interviews are crucial to the students' work. The students learn not to make generalizations from the qualitative data they gather in interviews, as personal experiences shape different

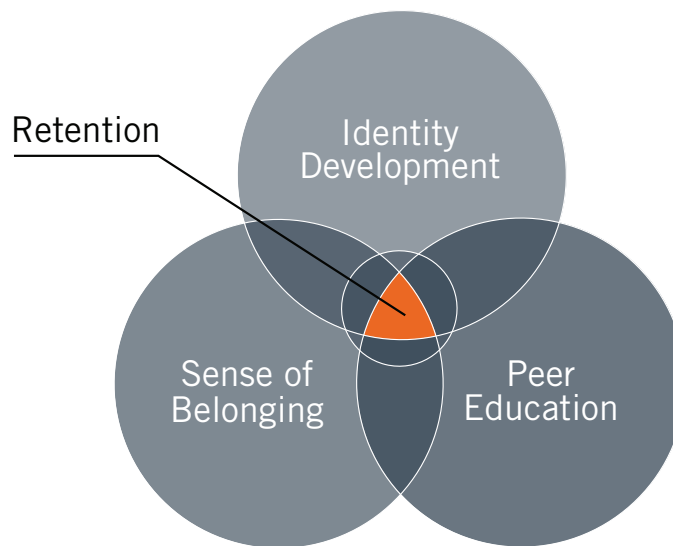
groups' points of view. “It's easy to look up the statistics online, but this gives a more personal perspective,” Rashad Tate, sophomore recreation therapy major, said.

The team will present their research in papers and poster sessions. However, the Creative Inquiry team is also determined to be a force for change on campus, using their findings to inform the movement. Students are sharing their discoveries in order to help future students have a better experiences in CONNECTIONS as well as at Clemson. The students make suggestions to the university for ways in which both can recruit, retain and support students of color and first-generation students.



### Factors leading to a Higher Retention Rate

The peer mentoring team's research brings together different aspect of campus life that encourage students of color to stay at Clemson. Identity development, peer education and a sense of belonging are key factors that lead to higher retention rates for underrepresented groups on campus.



## Meet the Decipher Team

### Michala Stewart | Designer

Michala is a senior visual arts major emphasizing in photography from Columbia, South Carolina. After graduation, she hopes to continue making art while working as a graphic designer. She has a passion for painting, traveling, embroidery and all things creative.



# UP AND COMING

A glimpse at new Creative Inquiry projects that  
*Decipher* will feature in the future

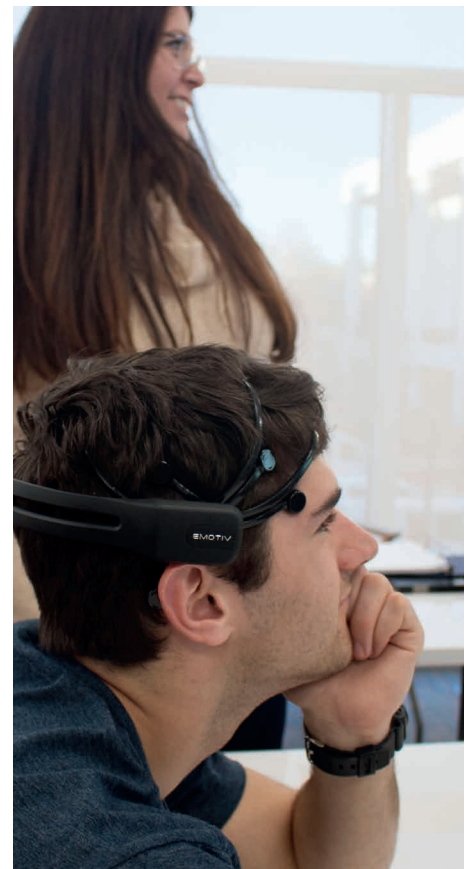
## Emotion and it's Expression

When you are so happy you cry, that is what Dr. Oriana Aragón from the Department of Marketing refers to as a dimorphous expression – a facial appearance provoked by intense emotions that generates an expected positive reaction, but also an unexpected negative reaction. The Emotions and Expressions Creative Inquiry project investigates dimorphous expressions and uncovers how they impact the marketing industry and society. The team evaluates expressions and the connection of expression with marketing. Currently, the students are evaluating design ideas and testing the association between particular expressions with particular emotions. For example, why tears are strictly associated with sadness, when in reality they can represent a range of emotions from anger to happiness.

This project operates with the students in multiple teams. There is a design team, a model team and there is even an EEG team. They all work together to create videos that display expressions and to analyze the expressions and reactions of viewers with an EEG.

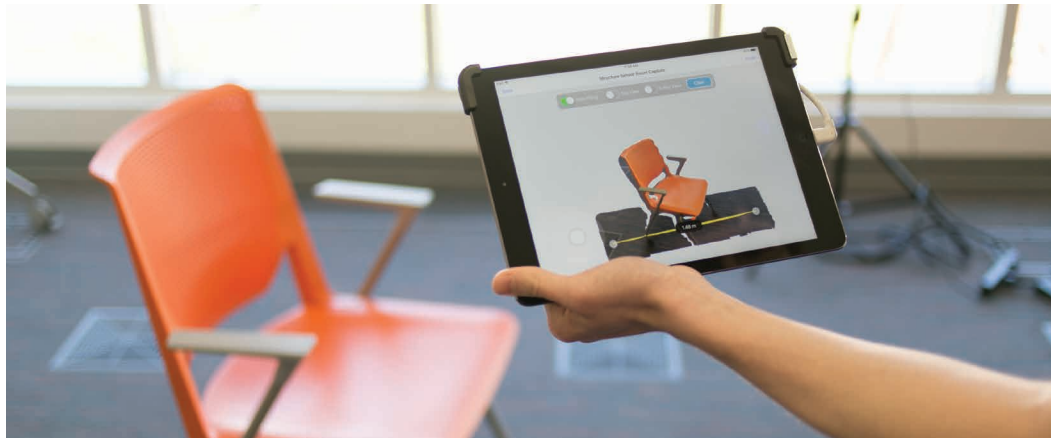
Although this project and research

is relatively new, Aragón is excited about the teams findings and their application to areas beyond insurance and car commercials. “Emotions are important. They apply to a vast amount of contexts....” Aragón said, “We’re just beginning to skim the surface of possibilities.”



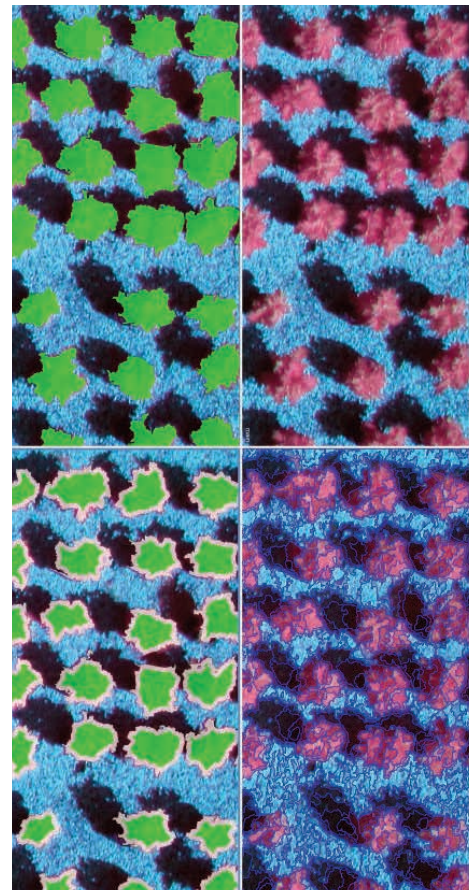
## Virtual Reality

Several new Creative Inquiry projects are emerging that investigate virtual reality (VR) and VR technology. The Immersive Space, a new VR space in The Watt Family Innovation Center, specifically designed for VR research and student VR initiatives, provides headsets and software for such projects. One of the projects, The Design of New Virtual Reality Headset team, is researching optics and the ways in which light moves through different mediums. Students involved in this project will work with various types of lenses and develop preliminary designs for VR headsets. “I’ve enjoyed being part of these teams from the beginning and seeing them take off,” Tom Birdsong, a senior computer engineering major, said. The teams welcome students from various majors including engineering, architecture and computer science. (3D scanners allow objects, like a rock (pictured above) or a chair (pictured below) to be brought from the real world to virtual environments.)



## IBM Watson in the Watt

Researchers at Clemson generate and study huge amounts of data in an attempt to better understand our world. This data covers topics from agriculture to politics and comes in many forms such as audio, video and text. There is a growing need for more intelligent ways to learn from the vast and varied data available to us. The Watson in the Watt Creative Inquiry team partners with Clemson researchers to apply IBM Watson Artificial Intelligence technology to their research problems. The team successfully designed and built a Watson application that analyzes drone imagery to determine crop health. In the future, the growing team plans to apply this technology to learn from thousands of video interviews of US veterans, to understand the relationship between weather patterns and the spread of bacteria and to assist clinicians in diagnosing and treating cancer.





# GOING SOLAR

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Changing campus culture one cart at a time

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by Tessa Schwarze







The Solarcart team taking their cart for a spin.



Creative Inquiry students with their faculty and graduate student mentors.

When you look around a college campus, you might observe many vehicles. One vehicle that is growing in popularity for facilities and for recreation is the golf cart. The Novel Applications of Photovoltaics Creative Inquiry project wants to use these carts as a model for going solar on Clemson's campus. They view the carts as the grounds for research, a platform of insight into energy conservation and the means to reduce our carbon emissions.

The United States Environmental Protection Agency lists the two leading contributors of human generated carbon emissions as transportation and electrical production. The Creative Inquiry team aims to confront both of these agents by utilizing an alternative form of energy for transportation on campus. To do so, their first creation is a solar powered golf cart.

Dr. Rajendra Singh from the Department of Electrical and Computer Engineering is the mentor of this Creative Inquiry team. Singh said in the past eight years, the solar energy mindset has been growing, but has not been recognized to its full potential. "One hour of solar power can power the entire world for one year," Singh stated, "but the

question is, what is the cheapest way to implement solar power?"

The Creative Inquiry team thinks the answer lies with a golf cart and \$664.92 in electrical additions. The vehicle itself is relatively average looking until a closer look: the roof is completely flat, surrounded by a metal frame and if one were to look down upon it from above, they would see a blue panel at work, absorbing the sun.

What the cart lacks in glamour, it makes up for in savings. The team collected data on the golf cart's efficiency and found an increase in drive time by 39.42% and in distance traveled by 74.11% in comparison to a standard, gas powered cart. The maintenance of the solar cart is also less than a gas powered cart, approximately \$130 a year. If implemented on campus, a reduction in carbon dioxide emissions of

approximately 1,100 lbs a year is expected. In addition, the university would save on gas money and improve air quality for the campus community and visitors.

Libby Zanin, a senior biosystems engineering major, said that even though the cart's potential savings are extensive, there is still room for more improvement. "We used a poor quality panel, and still saw an increase in efficiency," Zanin said, "If we used a 400-500 watt panel, the cart could run for the entire day." When asked about where they want their invention implemented, Zanin has a request for the university. "I want to see all Clemson carts solar. If charging stations are available, Clemson can easily cut down on emissions and save money."





# Communication

## — between — Generations

Making the workplace newcomer friendly

by Polly Goss

While college students worry about finding their place in the business world, many corporations are just as concerned with incorporating recent graduates into their workforces. In order to learn the best way to integrate young professionals into the workplace, Siemens Corporation, an electronics and electrical engineering company, is asking Clemson University students to help. Siemens is looking to Clemson students to develop strategies for transferring knowledge from the retiring generation to newly employed millennials. The Siemens Qualitative Marketing Creative Inquiry project, led by Dr. Jennifer Siemens and Dr. Anastasia Thyroff, both from the Department of Marketing, is using student perspectives on their workplace experiences to draw conclusions about the best methods of knowledge transfer between generations. In particular technical training and tips transfer more easily from one generation of employees to the next. Over the course of a summer, the students involved in the project completed internships that allowed them to experience

generational knowledge transfer. By immersing themselves into the work environment of different companies, the students gained work experience at the company as well as experienced the practices of knowledge transfer at the company.

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“ Knowledge transfer takes initiative. Millennials as well as older employees have to make the effort. ”

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Each student's internship provided unique experiences. Two of the students interned with the Siemens Corporation, while others worked with L'Oreal, Tanger Outlets and ASM Sports. Over the course of the summer, the students conducted interviews with employees and formed relationships with mentors in order to better understand how young employees interact with older employees in the workplace.

Despite the differences in their work environments, the students found similarities in the intergenerational relationships they formed and observed in their workplaces. For example, Devin Ostermann, a senior marketing major, found that the mentor her supervisors assigned to her was in a different department and only a few years older than Ostermann herself. Realizing that this relationship would not provide the insight and direction that she hoped to gain from a mentor, Ostermann cultivated relationships with three other employees. Finding several mentors in her field who were at various stages in their careers allowed Ostermann to enhance her knowledge of marketing as a profession. From her experience, Ostermann learned to value organic mentorships more than prearranged work relationships.

Some of the students encountered obstacles in their attempts to relate to potential mentors during their internship. During senior marketing major Vinny DeVenoge's internship,

he observed a strict hierarchy among employees. According to DeVenoge, this arrangement did not foster communication between veteran and novice employees. Unlike his fellow team members' experiences, DeVenoge found the company did not actively seek out intern ideas or encourage fellowship between generations of workers.

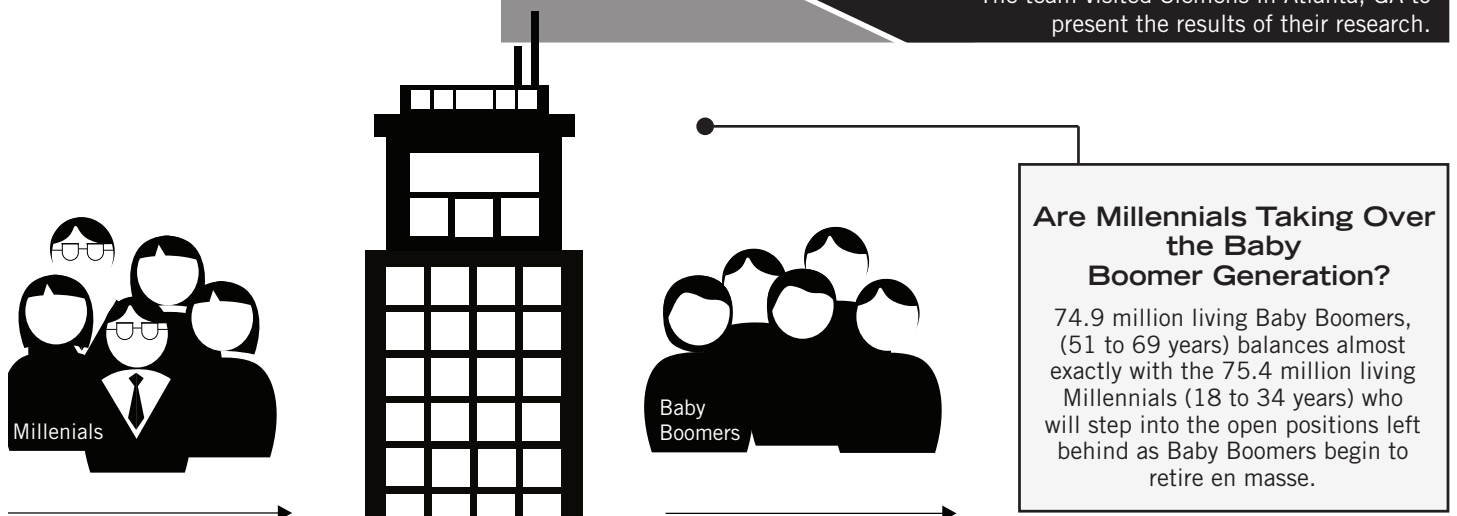
Tanner Parsons, interned with Siemens during the summer. Parsons stressed the importance of communication between different generations and encouraged mentors to reach out to their younger coworkers. "Knowledge transfer takes initiative. Recent graduates as well as older employees have to make the effort," Parsons said.

In order to figure out how to initiate this knowledge transfer, the team analyzed data they gathered over the past two semesters. This data included two focus groups and more than 30 interviews, totaling to 20 recorded hours. Then the students traveled to Siemens in Atlanta to meet with the executives and to share their conclusions.

After studying methods, conducting research during their internships, analyzing data and presenting their findings, the Creative Inquiry team is now facing the problem that it studied. Because every member of the team is a senior, the Siemens Qualitative Marketing Research project will soon be full of younger students who do not have the same knowledge of research methods or internship experiences that the current students have cultivated. Before they graduate, the veteran team members will use their findings to transfer their own knowledge of their project to new members of the Creative Inquiry team in order to sustain the project across generations of students.



The team visited Siemens in Atlanta, GA to present the results of their research.





# Creating a New Climate for Change

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Realizing your impact on the environment

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by Tessa Schwarze

People living in Kutubdia, Bangladesh, are losing land and homes to a rising and warming sea. This is the reality of climate change: there are people in 2018 feeling the effects of man-made pressures (e.g., carbon emissions, use of plastic materials) on the environment in their everyday lives. However, many people who live in places not affected as dramatically as Kutubdia still consider climate change a political issue, a future event or an exaggerated phenomenon. On the campus of Clemson University, far from rising sea levels, the Engaging the Public on Issues of Climate Change Creative Inquiry team is working to show that climate change is a human issue, that it is happening now and it is damaging lives as well as the environment.

The Creative Inquiry team wants to help anyone who visits their exhibit to understand how everyday routines can help or hurt the environment. Led by Michael Carlo, from the Department of Biological Sciences, the team is designing an exhibit that will greet visitors with pictures, text and interactive materials explaining climate change and suggesting ways that everyone can do their part in slowing it down.

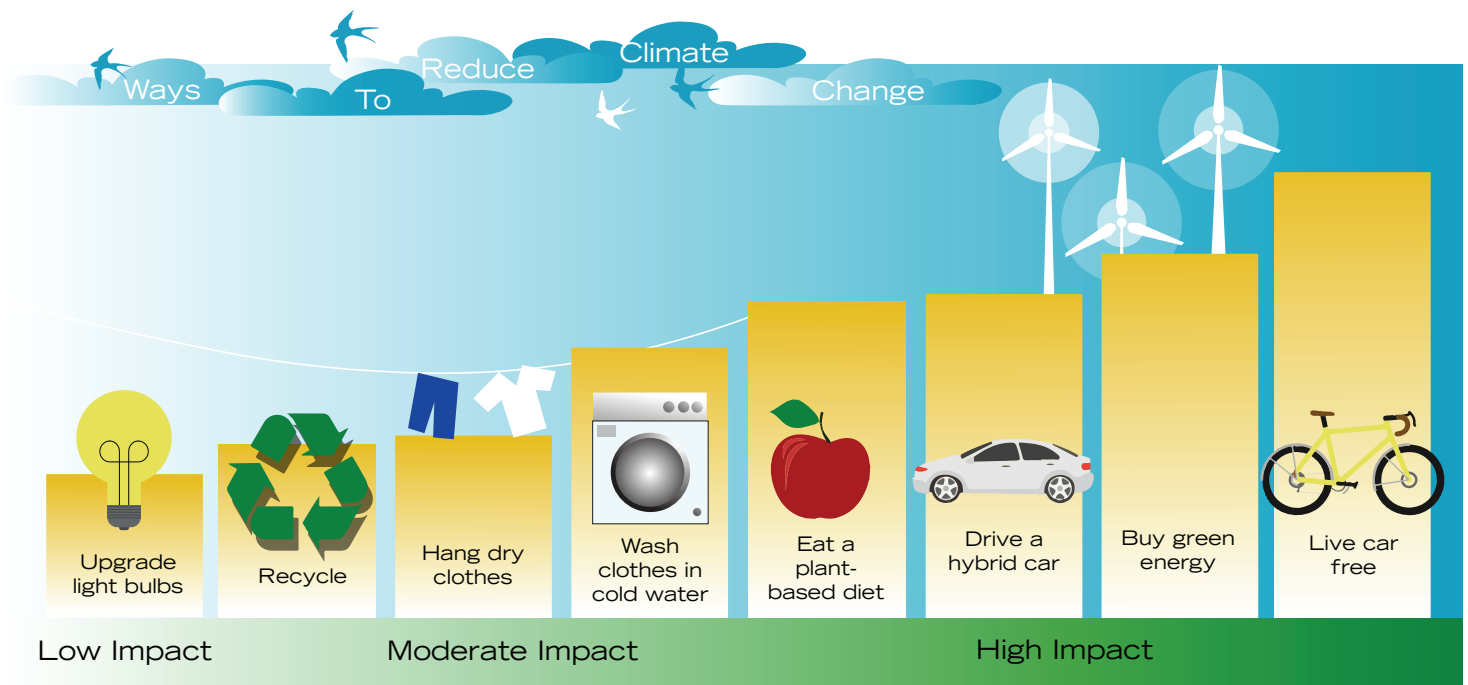
Previous outreach efforts include handing out biodegradable and naturally antimicrobial toothbrushes to help students realize the impact of using and discarding plastic toothbrushes. They also gave out reusable shopping bags in order to demonstrate that neither paper nor plastic bags are a good choice at the store. These items accomplish more than simply promoting the Creative Inquiry project. Ultimately, they promote changing lifestyles and new thought processes around climate and the environment.

The group hopes that their exhibit will help change the public's perception of climate change. They believe if people think about the effects of their actions on plants, animals and other people it will become a relevant topic for them. "The goal is to make a person care about the issue before you try to change their

mind or change the way they see the issue," Carlo said. The exhibit covers topics such as transportation, energy, products, diet, human health and the economic value of natural resources. It also features information on screens and panels with interactive displays that visitors can touch and hold.

In order to assess the impact of their outreach efforts, the students are conducting surveys of exhibit participants and using the survey data to write, and hopefully publish, a manuscript. The team's research will explore different methods of engaging people in the issue of climate change. They will also explore how people talk and think about climate change before and after visiting their exhibit.

The team wants to encourage people to think about the effects of their everyday actions on the environment. However, they do not want to give people the impression that there is a perfect way to live in order to prevent climate change. Instead, they want to encourage people to think critically about their role in the



## Lifestyle Choices That Impact Climate Change

world and to know that they are part of the environment. If people think of themselves as participants in the environment instead of as an outside force acting on it, they will better understand their part in preventing damage to the world around them. “It’s happening right here in South Carolina and right now,” Lydia Stroupe, senior environmental and natural resources major, said. “It’s something we have to address before it gets worse. Climate change affects everyone.”

“ It’s something we have to address before it gets worse. Climate change affects everyone. ”



The Climate Change exhibit in the Cooper Library at Clemson University.

## Meet the Decipher Team

### Tessa Schwarze | Writer

Tessa is a junior psychology major from Atlanta, Georgia. This is her first year with Decipher. She hopes to one day work in the public health research field as a neuroepidemiologist. In her free time, Tessa acts as Vice President of Clemson’s Neuroscience Club, enjoys reading, writing and traveling abroad.



# SPOTLIGHTS AND AWARDS

## Awards



Creative Inquiry student **Meredith Bailey**, senior chemical engineering major, won 2nd place in the student poster session at the 2018 SC EPSCoR/IDeA Conference .

Congratulations to Nolan Hoolachan, Haley McKee, and Isabella Gebhard for winning the Best Overall Student Poster at the 2018 American Society for Engineering Educators Conference.



**Christopher Mayerl**, Biological Sciences, received the 2018 Phil and Mary Bradley Graduate Student Mentor Award.



**Drew M. Morris**, Psychology, received the 2018 Phil and Mary Bradley Graduate Student Mentor Award.

Creative Inquiry mentor **Dr. Arelis Moore de Peralta** was the recipient of the 2018 Phil and Mary Bradley Faculty Award for Mentoring. Peralta has a joint appointment in Languages and Youth, Family and Community Studies.





## Spotlights



This year, Dr. Hugo Sanabria from the Department of Physics and Astronomy is receiving the prestigious National Science Foundation (NSF) CAREER Award. Sanabria mentors three Creative Inquiry projects, one of which is in collaboration with Tecnológico de Monterrey in Mexico. He mentors more than 26 undergraduate Creative Inquiry students each year.

The focus of his NSF CAREER relies on understanding how cells communicate by generating, transmitting and receiving chemical signals. In particular, the current program studies the protein Calmodulin, which is present in all higher organisms and senses calcium levels in the cell regulating vital functions such as heart beating, muscle contraction, learning and memory.

**Dr. Hugo Sanabria**



Eva Diaz, a senior psychology major, began her journey in Dr. June Pilcher's Creative Inquiry project as a sophomore. Through the semesters in the project, Diaz developed her research skills as well as her leadership skills. As a senior, she is now a peer-mentor for the Creative Inquiry team.

Her newly acquired leadership skills will come in handy as Diaz pursues a career in law. She hopes to specialize in family or immigration law. But, her first stop is the University of South Carolina's School of Law.

**Eva Diaz '18**



Dr. Joshua Bostwick from the Department of Mechanical Engineering, is receiving a \$500,000 CAREER award from the National Science Foundation. The funding pays for Bostwick to do research and to develop an educational program based on his research. Bostwick mentors more than 18 undergraduates in three Creative Inquiry projects each year.

The reward will fund his research on elastocapillary fluid dynamics which deals with the motion of liquid on soft materials, such as organs and other human tissue. When the materials come into contact with liquid, they deform, creating their own speed bumps. That affects the fluid motion. He will incorporate his Creative Inquiry students into this research.

**Dr. Joshua Bostwick**



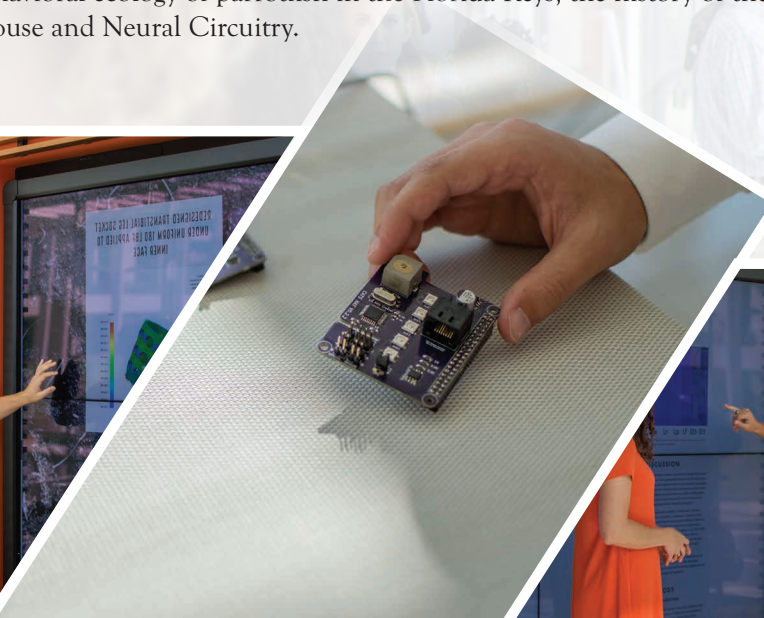
# HIGHLIGHTS AND EVENTS

## CI Showcase

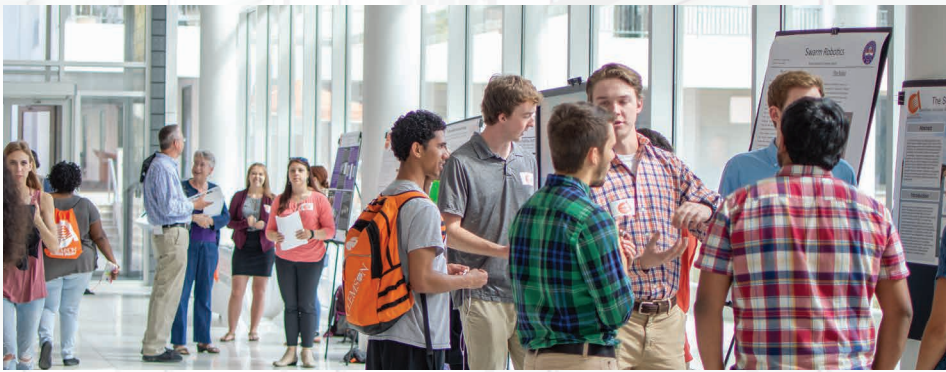
In fall 2017, Creative Inquiry hosted Clemson University's first all digital poster session at the Watt Family Innovation Center. This event was the culmination of 40 Creative Inquiry students who had the opportunity to extend their Creative Inquiry research experiences into the summer. Creative Inquiry offers limited awards for summer research, known as Summer CI. As part of the Summer CI award, participants created a digital, interactive research poster. A collaboration with Adobe allows all students and faculty to access creative software used to create these posters. The large ultra-high-definition touchscreens in the Watt allow the presentations to be dynamic as viewers can touch the screens to activate videos or other digital simulations within the presentation. Presentations included behavioral ecology of parrotfish in the Florida Keys, the history of the Clemson House and Neural Circuitry.



2017 **summer**  
showcase







## Focus on Creative Inquiry

Creative Inquiry's annual poster symposium, Focus on Creative Inquiry (FoCI) gives all Creative Inquiry students the opportunity to present their projects' research via paper or digital poster presentations. Each year more than 130 projects participate with more than 370 undergraduate student participants.

This year's two-day event hosted the research of 808 student coauthors. Each poster was evaluated for the best poster and best popular vote poster awards. Winners include Characterization and Application of Quantum Dots for Drug Delivery and Cancer Cell Tracking mentored by Dr. Vladimir Reukov and The Effect of Depressive Symptoms on Risky-Decision-Making mentored by Dr. Kaileigh Byrne.

In addition to student presentations, FoCI culminates with a Plenary speaker and awards ceremony. The Plenary presentation is given by the previous year's recipient of the Bradley Award for Mentoring in Creative Inquiry.





The background of the cover features a close-up of a robotic arm with grey joints and black sensors, positioned in the lower right. To the left, a person's arm is visible, wearing an orange t-shirt with a white paw print graphic. The scene is set in a laboratory or workshop, with various electronic components and wires visible. A semi-transparent white rectangular box is centered over the image, containing the title and subtitle.

# ROBOTIC SYSTEMS

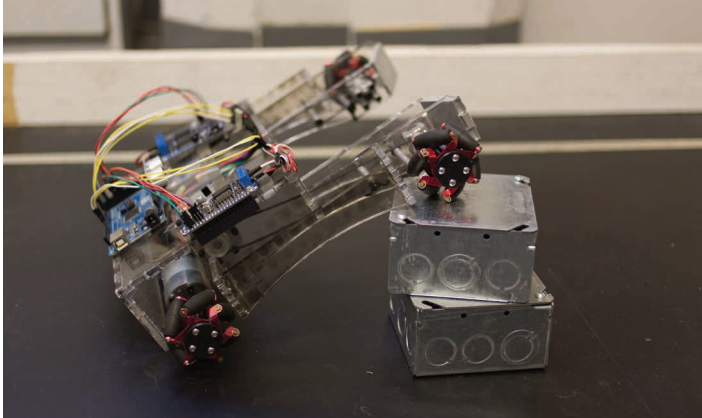
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Using passion to build a team

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by Tessa Schwarze





Specially designed wheels allow this base to move through sand and gravel.



The Clemson Robotics team displaying their robot.

Cameron Keats, senior electrical engineering major, always enjoyed working on cars, but it was not until high school that he found his love for robotics. “When I was in high school, I found out about this robotics team at my school,” Keats said, “and because I really wanted to get some experience, I joined...and I wanted to continue to grow that experience.” He brought his passion for robotics to Clemson University’s robotics team.

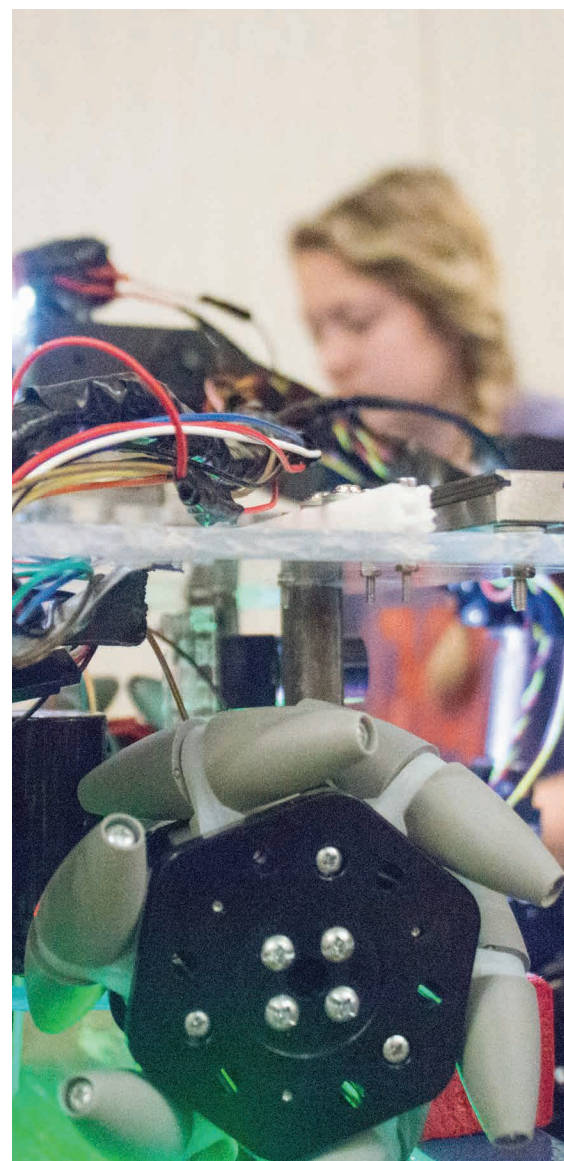
At Clemson, Keats joined the Robotic Systems Research Creative Inquiry project. Now as a senior, Keats has participated in the project for four years, each year competing in the annual Institute of Electrical and Electronics Engineers (IEEE) SoutheastCon hardware competition. Competing in this competition is the Creative Inquiry project’s goal each year which make the project somewhat unique as most Creative Inquiry projects do not compete in competitions.

Surya Sharma, graduate student in computer engineering and the team’s mentor, said the Creative Inquiry project started ten years ago. When Sharma arrived at Clemson, the team did not compete well in the competitions. “There wasn’t much happening with robotic systems at Clemson at the time but I wanted to get involved. So I asked them [my department] what I could do and they told me about this robotics team that comes in last place every year,” Sharma said, “and we need to do something

about it.” With Sharma’s leadership and the passion of students like Keats, the team climbed from placing 30th to placing within the top ten.

While a perfect robot is the goal Sharma and Keats said that the Creative Inquiry project is set up for other reasons. “I would say the biggest success we have is not in the robot but in the success of developing the abilities of the students we work with,” Keats said. This year the team included four freshmen with the hopes that they continue in the project and offer their experience, skills and mentorship to the future teams. “This year, our robot is the most successful because we built these freshman so they have more experience for the competition next year,” Keats said.

When Keats graduates, he does not plan to work in the robotics field, but he wants to use his passion for robotics to show younger kids what they can do with technology. “I’m hoping that whenever I start working, I can go around to different high schools and start growing robotics programs there,” Keats said, “And sort of help get kids interested in engineering.”



## Meet the Decipher Team



### Polly Goss Writer | Editor

Polly Goss is a senior history major with an English minor from Fort Mill, South Carolina. In her free time, Polly enjoys reading, running and playing with her dog, Pearl.



# SUPPORT US

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

### What Do Your Dollars Do?

Gifts to Creative Inquiry directly support student research. You can support students in multiple ways including, but not limited to: student travel to national and international conferences to present research and supplies for student research activities.

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## The Bradley Award for Mentoring

Phil and Mary Bradley made the first major gift to Creative Inquiry and 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

- 2018** Dr. Arelis Moore de Peralta, Languages; Youth, Family and Community Studies
- 2017** Dr. Vladimir Reukov, Bioengineering
- 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 Carr Family Endowment

Chalmers Carr III and Lori Anne Carr established an endowment to support Creative Inquiry teams working in fruit and vegetable crop production, rural economic development or community and business development. The project recipients of this award receive a financial supplement to further enhance their project activities.

### Carr Family Endowed CI Recipients

- 2018**, Dr. Doug Bielenberg  
Breaking bud: environmental control of bloom time in peaches
- 2016 & 2017**, Dr. Feng Chen  
Characterization of aromas and health benefiting chemicals of SC peaches
- 2015**, Dr. John McGregor  
Shelf-life extension of fresh peach slices by surface crust freezing



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