Decipher 2015
Fall 2015

Barbara J. Speziale
Creative Inquiry Director and Associate Dean

James P. Clements
President

Robert H. Jones
Provost

Janice W. Murdoch
Dean of Undergraduate Studies

Joseph Whitt
Creative Director

Devaun Walker
Assistant Creative Director

Bridada Bethea
Photographer

Writers
Victoria Cespedes
Amanda Pridmore
Hailey Green

CI Staff
Tullen Burns
Jon Harp
Julie Dubose
James Ward

Acknowledgments

Special Thanks to...

Robbie Fitzwater
Jan Lay
Eric Rodgers
Bobby Hollandsworth
Peter Kent
Wesley Smith

© 2015 Clemson University
Cover Image by Will Hinkley
Cover article on Pages 38–41
Decipher Magazine is produced by a team of Clemson undergraduate students to highlight the accomplishments of their peers in Creative Inquiry—Clemson’s unique brand of Undergraduate Research. Creative Inquiry is Clemson’s unique way of giving students opportunities to research topics that they find interesting, in their own or other fields of study.

Each year, more than 4,000 Creative Inquiry students investigate topics ranging from medical technology for developing countries to the history of the Cooperative Extension Service. 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 have been taught in the classroom and apply them to the real world.

From the more than 700 current Creative Inquiry teams, we selected 32 projects to feature in this magazine. Our Decipher team interviewed the faculty mentors and students in each of these projects in order to write these articles and produce illustrations.

Decipher (verb)
To succeed in understanding, interpreting, or identifying

There is an entire world to discover, explore, and decipher—Creative Inquiry students are doing just that!

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 produced more than 370 presentations at major conferences, 116 professional publications and have won more than 26 awards.

Beginning in 2015, Decipher Creative Inquiry Magazine is also an app – available for free through the Apple iTunes store.
Creative Inquiry is one of the most exciting and interesting academic endeavors at Clemson. The fact that our undergraduates have the opportunity to take part in research alongside graduate students and faculty members is something that truly sets Clemson apart from its peers.

This is a banner year for Creative Inquiry — the program will celebrate its 10th anniversary this year. Over the past decade, more than 1,000 projects have provided more than 22,000 students with invaluable, hands-on experience solving real-world problems.

Students from all disciplines of study have participated in the program, often in multi-disciplinary groups that take them outside their major, and sometimes, on the road. More than 587 students have presented at national and international professional conferences. Clemson student projects are currently making a difference in 13 countries.

Creative Inquiry has truly transformed the undergraduate experience at Clemson, making undergraduate research the norm, rather than the exception. I hope you enjoy reading about some of the latest achievements of our students in Creative Inquiry in this issue of Decipher.

Go Tigers!

Jim Clements
President
To some people, research conjures only images of white lab coats, yet the concept refers to a broad range of creative and discovery-oriented activities that advance the boundaries of knowledge. The name/term ‘creative inquiry’ signals just that—by emphasizing that discovery is not limited to a laboratory. Clemson University offers many ways for undergraduate students to delve deeply into research projects, providing them with opportunities for active engagement in inquiry and discovery, guided by renowned experts. Students can do this in any discipline, whether in the laboratory, the library or through performance.

This graduate student type research experience allows undergraduate students to be in charge of their own learning. They may bring an idea to full circle from start to finish or they may hand their research off to incoming students. In the process, they learn stewardship, how to cultivate ideas and how to work with others. Creative Inquiry also connects students to faculty members who provide mentorship, help the students set rigorous goals, and assess the quality of student learning.

Today’s real world problems are very complicated and very large. Solving them will require two key skill sets – teamwork and multi-disciplinary approaches – that form the core of every Creative Inquiry experience.

As Provost, I am proud to support Creative Inquiry. And I welcome and encourage additional support of businesses and alumni – to achieve the goal of giving every student the opportunity to engage in research.

Please enjoy this issue of Decipher and plan to experience firsthand the Creative Inquiry way.

All the best,

Bob Jones
Provost
Adobe Scholars
First: Lean on Me
Mythbuster: Party Edition
The Mechanics of Tasting
Excite: Lights, Cameras, Action!
Behind the Façade
Through the Lens of Diversity:
The Appalachian Culture
The Impact of College Athletics
Taking Fresh to a New Level
Together We’ll Go Far
From Farm to Table: A Detailed Analysis
From Paper to Pixels
Why Salamanders?
Going Batty: Techniques in Bat Conservation
Bones and Stones
The Final Frontier
36. Solving Tomorrow’s Issues Today
38. Solar Decathlon
40. Coast to Coast Construction
42. Buying Local with Clemson Community Supported Art
44. Is Our Mascot Part of the Clemson Family?
46. Fluorescence Quenching / Enhancement Gold and Silver Nanoparticles
48. The Art of Engineering Bio-Inspired Adaptable Structures
50. New Theory
52. Think Smarter, Not Faster
54. Hope: An Ever-Lasting Flame
56. Clemson Digital Media + Learning
58. Sexless In the City
60. Biofilm Interactions
62. Have a Cow!
64. Tigers in Marketing
Creative Inquiry students are leading the way in transforming how research is communicated. Through a partnership with Adobe®, all Clemson students, faculty and staff have free access to Creative Cloud applications, thus enabling them to produce high-quality, innovative digital publications. “We are moving beyond the powerpoint and word generation so students can represent their work however they want. They have the ability now to do a documentary, build an app, build a website,” Keith Spencer, Adobe senior account executive, stated.

In summer 2014, a select group of Creative Inquiry (CI) students, the CI Adobe Scholars, began this quest. They volunteered to learn to use the Adobe applications—Illustrator, Photoshop, InDesign, and Premiere Pro—and then to produce print and digital articles for this issue of Decipher. Some had prior experience with the applications—for others this was an entirely new experience.

“The Adobe programs are so dynamic that learning tricks first-hand from others is really invaluable. Also I was inspired by other students to challenge myself personally to learn new programs. It was great to have students from multiple disciplines learning from each other and improving one another’s design,” Joey Whitt, a senior Architecture major, explained.

The training program was a collaborative effort, with instructors from the CI office, Jan Lay from Clemson Computing and Information Technology (CCIT), Bobby Hollandsworth and Wesley Smith from the Cooper Library, and Eric Rodgers from Clemson Broadcast Productions. Special guest lecturers included Clemson PSA News Editor, Peter Kent, and Adobe Vice-President, Jim Guerrard.

At the end of the summer, the Scholars presented their work to an audience that included their instructors and Adobe executives, Jim Guerrard, Keith Spencer and Patrick Koster. In September, the Scholars were honored by the opportunity to describe their projects and their learning experiences at a luncheon announcing the Adobe gift, sharing the stage with Adobe Vice-President, Monte Wilson, and Clemson President Jim Clements.

The CI Adobe Scholars training program is continuing. Ideally, each CI will eventually have at least one student proficient in these digital communications tools.

“Creative Inquiry is a cool program that gives students a lot of different experiences. We want to enhance those experiences. I can see these training sessions as something we continue until Adobe becomes an integrated part of the culture,” Lay commented.
What comes to mind when you think of college? Some thoughts may align with Hollywood’s portrayal of wild parties and socializing, while others with intense academic courses, all-nighters, and ramen noodles diets. Yet another view is often overlooked. Students who are the first in their families to attend college (first generation college students) view it as an opportunity to permanently change their families’ futures. First generation students must figure out how to apply, work with financial aid, and succeed in college, often on their own, without guidance from parents who had college experiences. The FIRST Program, led by Sherry Dorris in Undergraduate Studies, trains successful upperclassmen to mentor incoming first-generation students and, through two Creative Inquiry projects, engages them in research on the first-generation experience.

The Creative Inquiry projects have reviewed the literature on first generation students, conducted focus groups, and produced videotapes to document their own experiences. Future plans include qualitative data analyses.

Robert Locke, senior Civil Engineering major and FIRST mentor, helps his mentees to succeed in their majors and enjoy their time at Clemson by hosting tutoring sessions and social events. Locke said, “The most common problem I see among my mentees is that when they struggle to grasp concepts for a class, they either do not know where they can go for help, or they are too afraid to ask for help. This causes them to become discouraged and want to give up on the class, or worse on their career paths.” Locke lets his mentees know that he is available whenever they need assistance, whether it’s an academic or personal problem.

With mentors like Locke and ongoing research, first generation students have the support they need to succeed in and out of the classroom. Dorris’ goal is to “give top notch support to our first-generation students, while creating a model program that other universities reproduce.”
We’ve all been to parties where we have seen people drop food on the floor and, then, immediately pick it up and eat it. Have you ever wondered whether or not food is actually safe to eat within five seconds of dropping it on the ground? How about double dipping—is it really that bad? Do germs actually spread by blowing out birthday candles? Dr. Paul Dawson, Professor of Food Science in the Department of Food, Nutrition, and Packaging Science at Clemson University, and his Creative Inquiry team, Antimicrobials and Surfaces Affecting Transfer and/or Survival of Bacteria, have made it their job to scientifically prove and disprove common food myths.

They began with simple questions and over the course of a semester they put their research plan into practice by setting up experiments, collecting data, and drawing conclusions based on the data. Dawson explained, “While the topics may seem trivial, they are designed to teach students about food science, which includes food safety, tasteness and freshness, while also learning how to conduct research, and how it affects our daily lives, even if it’s about dropping food on the floor.”

One of the teams took the popular notion of the five-second rule, which says that food that touches the ground is still safe to eat as long as it is picked up within five seconds of it being dropped. To test this myth, they had to figure out how long germs live on the floor. They found that the bacterium Salmonella typhimurium could survive for up to four weeks and still be transferred onto food. Next, they experimented with bologna and bread to see how fast and how many bacteria clung to them once they were dropped. They tested them on three different surfaces: wood, tile, and carpet. As soon as the food was dropped, the bacteria transferred immediately. 68.8% of the bacteria on the tile flooring were transferred to the bologna while 48.7% of the bacteria were transferred to the bread.

At the same party where you see that guy eat that cookie that he dropped on the ground, someone else across the room is probably eating chips and salsa, double dipping without even thinking about it. Double dipping disgusts most people, but is it a complete and total party foul? Not necessarily, but Dawson and his team found that it definitely is not the most sanitary practice. They discovered that sauces that had been dipped in but not double dipped in had less than 10 bacteria per milliliter of salsa (bac/mL), whereas sauces like salsa that had been double dipped in, averaged 1000 bac/mL.

Now that you’ve watched people eat food off of the ground and double dip, it’s time to sing “Happy Birthday” to the birthday girl and then watch her blow out her birthday candles. Does blowing out birthday candles also spread germs? This Creative Inquiry team found that the icing on birthday cakes after the candles are blown out has a significant increase in the number of bacteria: cakes with candles still lit had averaged 183 bacteria per milliliter and cakes with candles blown out had more than 15 times as much bacteria per milliliter.
Dawson’s current Creative Inquiry students have been able to think outside of the box when developing each of their different research projects and questions. Because of this, they have also learned how to collect data effectively and conduct research on topics that matter to them. Molly MacNaughton, a senior Food Science Technology student working with Dawson’s Creative Inquiry explains, “The most important thing I’ve learned is that mastering the methods for data collection is key, especially when you are trying to coordinate eight people on two different days every week. The methods are important to discovering any useful results and without everyone on the same page all of our hard work is useless.”

This year, Dawson’s Creative Inquiry is researching the transfer of bacteria from hands to popcorn and then hands to mouths as people eat popcorn and then share it with others. Stay tuned for the results, but in the meantime, just to be on the safe side, think twice before agreeing to share a tub of popcorn with your whole row of friends at the movies. Is sharing really caring?
For a brief moment, think about your favorite food. Immediately, its taste overwhelms you. This intense nostalgia is all thanks to your tongue. Despite its rather odd and fuzzy appearance, the human tongue is the reason we can enjoy our favorite foods, detect when a substance is not fit for consumption, and distinguish between complex levels of flavor interactions.

Through the delicate perceptions of your tongue’s taste buds, located on the papillae on the upper side of your tongue, you are able to accurately distinguish between different chemical triggers that translate into flavors such as salty, sweet, sour, and bitter. The Creative Inquiry, The Electronic Tongue, has created a bioelectronic equivalent of the human tongue for the measurement of taste that spans far beyond our body’s capabilities. By combining advanced research methods, a team of highly talented students has engineered a robot called the Electronic Tongue that can “taste.”

“We have gained a lot of experience in running experiments and recording our data. Research and lab experience is a big part of our major as Engineers. We are able to learn the correct laboratory procedures to use for future projects.”

The Mechanics of Tasting
By Amanda Pridmore
The Electronic Tongue robot is made up of extremely sensitive, impedimetric receptors that respond with specific changes in electrical impedance both during and after exposure to various types of chemicals. The electronic tongue itself, which looks similar to the tongue of a pit-viper snake, is a biosensor chip or biochip made up of a pair of interlocking comb electrodes that are capable of sensing the electrical properties of the fluid to which the electrodes are exposed. The electronic tongue can then be hooked up to devices, such as a flying drone, emulating a moth or a hummingbird in order to obtain its results. Using digital signal processing and data collected during test conditions, the sensor is able to gather information about the “taste,” or the chemical makeup, of a solution.

Similar to the human tongue, the Electronic Tongue uses prior experiences to sort new ‘tastes’ into categories. Dr. Guiseppi-Elie, professor of Chemical and Biomolecular Engineering engaged a team of students in both the creation and testing of the electronic tongue.

The students—who call themselves “the Vipers” due to the Electronic Tongue’s similarity in appearance to that of a viper’s tongue—run controlled experiments to gain the data set needed to compare future unknown results. Many of these tests include recording the results of the Electronic Tongue’s findings for different chemical media. So far, these include orange juice, cranberry juice, Pepsi®, Coke®, and a wealth of hand-made buffer solutions. By comparing the changes in the electrical impedance for each of these fluids, the students are able to chart the exact “taste” of each of these materials and develop classified protocols.

Haley Leslie, a sophomore Biomedical Engineering major, sees the Electronic Tongue Creative Inquiry as a way to give students a background in research techniques and laboratory procedures. “We have gained a lot of experience in running experiments and recording our data. Research and lab experience is a big part of our major as engineers. We are able to learn the correct laboratory procedures to use for future projects,” Leslie explains. Made up exclusively of chemical and bimolecular engineering majors, this Creative Inquiry provides the tools in both lab procedures and research necessary to make each of these young Clemson engineers successful in the future.

The application of the work these Creative Inquiry students are doing goes far beyond the fun of tasting different juices and sodas. Guiseppi-Elie states, “By detecting taste, the electronic tongue has a wide range of applications.” Using its ability to detect the presence and amount of specific chemical solutions, the Electronic Tongue has the potential to be used in a life-saving capacity. Further, by detecting the presence of contaminants or potentially deadly allergens within food, the Electronic Tongue’s tasting ability could mean a safer food industry.

The results of this Creative Inquiry will help lead the way in electronic “tasting.” While gaining skills in research, laboratory methods, and professional communications, the students in The Electronic Tongue project are exploring new territory in biochemical engineering. These Creative Inquiry students are developing a novel technological application to create life-saving taste sensors that will aid in a safer chemical future.
These days at Clemson, innovation in undergraduate research has become the norm for Creative Inquiry students. Students in the ExCite Creative Inquiry project led by Eric Rodgers, director of Clemson’s Broadcast Productions, capture videos of the accomplishments of students in other Creative Inquiry teams.

With hundreds of active Creative Inquiry teams, documenting the research process and accomplishments is essential. Although the students within the Creative Inquiry may take pictures and videos, they may not have the skillset or time to put together a video production that showcases their work effectively and in its entirety.

Although most students in ExCite were familiar with video production, they were excited to acquire new skills to become more effective videographers, and to learn about other Creative Inquiry projects.

Before production, Rodgers exposed his students to advanced video editing skills that would help them achieve optimal footage that would capture the essence of each Creative Inquiry. Each student had to accomplish specific pre-production tasks before contacting other Creative Inquiry teams. Rodgers explained, “I wanted to take the skillset that I have learned and use it to work with students in a very direct hands on type of way, by helping them to learn and increase their skills in capturing and producing video content.”

Taylor Shilling, a sophomore Sports Communication major, commented, “After learning both practical and technical skills from Mr. Rodgers that would benefit us when filming and editing, we also had access to several video cameras and microphones, as well as computers to do our editing with Adobe® Premiere.”

After weeks of pre-production, the students filmed several projects on topics ranging from exploring environmental toxicology in aquaculture fisheries to helping disabled students through therapeutic recreation, such as soccer games. After reviewing countless recordings, the students carefully edited the raw film footage.

The footage was then assembled into videos with each planned to be an episode in a series. Rodgers believes that having the ability to focus on methods and content, rather than having to adhere to a strict course curriculum, allows the team to produce content similar to Creative Inquiry’s magazine, Decipher.

As each video was completed, the team used social media as the first outlet to display their final product. The team began sharing their videos through this method because it allows ExCite to publicize the Creative Inquiry world at Clemson University.

Shilling noted, “We are trying to make sure students know how many options they have to choose from, and that this program that is unique to Clemson is well represented.” Social media websites, such as Facebook and Twitter, have given ExCite the audience they were hoping to achieve in addition to a reputable presence among other Creative Inquiry groups.
Meet the *Decipher* Team Leaders

Joseph Whitt, a senior Architecture major with a minor in Business Administration, enjoys designing, particularly in the built environment and graphics. As the Creative Director for Creative Inquiry and the *Decipher* magazine, Joseph uses his creativity to help orchestrate the production of the magazine as well as producing graphics for the Office of Undergraduate Studies. He believes the responsibilities that stem from the production of a large publication, such as *Decipher*, equates to the duties of a project manager, which will help him become a better leader in his chosen career path. Joseph is also the Advocacy Chair for AIAS, a Freedom by Design project manager, and is constantly looking for ways to support growth and health in our community.

Ackelia Vassell, a senior Communication Studies and Marketing double major with a minor in Business Administration, is the Editor-in-Chief for *Decipher* magazine. *Decipher* has been a wonderful experience. She believes that being in a pivotal leadership role with the magazine provided her with many opportunities that will contribute to her future in the communication field and helped her to become a better communicator, leader, and critical thinker. She noted that there are more than 700 Creative Inquiry projects and *Decipher* magazine is an outlet to showcase the groundbreaking discoveries that all are making. Her favorite part of the editor position was learning about what each Creative Inquiry was doing to make a difference in the world. She was delighted to be a part of it all.

Annie Mitchell, a graduate student in the School Counseling Program at Clemson University, works with *Decipher* as an assistant mentor. She received her Bachelor of Arts degree in Psychology with a minor in Spanish from Clemson. Annie spent two years on two separate Creative Inquiry teams in the Psychology Department during her undergraduate years. She believes her experience with Creative Inquiry has been invaluable to her graduate career. Working with *Decipher* as a graduate assistant mentor has allowed Annie to expand her knowledge about the extensive Creative Inquiry program, and hone her management skills. Aside from her position with *Decipher*, Annie enjoys running, watching Clemson football, and spending time with friends and family.
Concerning these various deductions, the mortgage deductions, the charitable deductions, the child tax credit and also the education credits, which are important to me, because I have children in college. What would be your position on those things, which are important to the middle class?” This was a question from a 2012 presidential debate between Mitt Romney and Barack Obama. The answers to these questions from both candidates came across as diplomatic and vague. The candidates aim to please their supporters and the viewers, so how does the viewer know truth from rhetoric? Dr. Jennifer Bisson, a professor in the Psychology Department, started a Creative Inquiry project, Micro-Expressions in Political Speeches, to answer that question. Through the study of recordings of political debates from 1984 to 2012, Bisson is working on creating a tool that will help decipher these diplomatic answers and get to the true opinions of the candidates.

Bisson and her team of undergraduate students are exploring the types of micro-expressions, witnessed during political speeches, that indicate deceit. Bisson explained, “I decided to open this Creative Inquiry course because my students wanted to learn something I could teach, micro-expressions. With the highly motivated group members on the team, we plan to learn something new and share our findings through a published empirical article.” A micro-expression is an involuntary facial expression that occurs in less than five seconds. A candidate can practice keeping his tone, posture, and seriousness, but these facial expressions are reflexes that stem from the autonomous part of the brain. Bisson and her students are using these automatic expressions to reveal where the candidates truly lie on important matters such as taxes, healthcare, and unemployment solutions.

The Creative Inquiry team decided to focus on political debates because that is when candidates could be caught off guard. Videos enable the team to go back and further analyze the micro-expressions by examining the footage in slow motion or comparing the questions and answers per candidate. Once an untrue statement is found, the team explores the micro-expressions surrounding this lie utilizing the Facial Action Coding System (FACS) manual by Paul Ekman that categorizes human facial movements based on their appearance. FACS gives the team a way to define the micro-expressions found and furthers their ability to read exactly how the candidate may feel on a particular issue.
Parker Rhoden, senior Psychology major, has specific behavior that he looks for when analyzing a video. He is particularly aware of candidates’ body language as they are placed in particular situations. He feels it is important for the public to be aware of who has their genuine interest at heart. If a certain candidate is elected based on his political views, then that candidate should be true to those previously held opinions and views found in his political campaign. Rhoden continues to work with Bisson to further understand the true opinions of candidates and help the public make informed decisions the next time they vote for a future leader. He remarked, “Working on this Creative Inquiry with Dr. Bisson has been awesome. We have had such a great experience researching and working to understand psychology through politics. Our team is really interested in the topic and I’ve learned so much more than I ever thought possible.”

This Creative Inquiry project has made a lot of progress, but creation of this tool is becoming more difficult. Bisson noted that, since political debates first started being recorded, politicians have become better at controlling every aspect of their behavior and body movement. However, even with this increased difficulty, she feels that micro-expressions are the key to understanding the true opinions of political candidates, from those running for Senate to those running for Presidency. This may be the answer average citizens require, a way to read through the political façade and get to the core of the problem. With a rise in economic uncertainty and world issues, American citizens need to be aware of what their future leaders truly believe in. Bisson and her students are working towards creating a tool that will allow the public to see through politicians’ words by examining their actions to recognize true opinions.

“Working on this Creative Inquiry with Dr. Bisson has been awesome. We have had such a great experience researching and working to understand psychology through politics. Our team is really interested in the topic and I’ve learned so much more than I ever thought possible.”
Clemson University, at its core, is a service-minded institution. With its rich heritage of sacrifice and service, the Clemson community continues to reach out to aid in expanding the cultural boundaries of its neighbors. Within the near range of Clemson lie the remnants of Appalachian America. However, little information remains about the true racial and cultural identities of the Appalachians near the Clemson community. In line with Clemson’s service mentality, the Creative Inquiry, Black Appalachia, identified the intertwining of race within the region and applied film to tell the story.

The goal of the students within the Black Appalachia Creative Inquiry was to bring to light the presence of a historically black community in upper Pickens County, guided by faculty advisors Dr. Meredith McCarroll, a lecturer in the English department, and Dr. John M. Coggeshall, professor of Anthropology in the Anthropology and Sociology department. McCarroll came up with the idea for the Creative Inquiry. She noted, “The truth is that the region has been influenced by a strong African-American presence.” Under her direction, the students set out to accomplish two goals: to embrace Appalachia’s racial diversity and to capture the culture of Black Appalachia on film.

To gain access to the rich cultural heritage of the African-American community within the Appalachians, this Creative Inquiry focused on the Liberia community in northern Pickens County. This community, originally created by a group of freed slaves in the late 1860s, is currently made up of fifth generation descendants centered on the local church. Today, the community stands as a living testament to the strength of the original Black Appalachian settlers and their offspring.

Coggeshall used his connections within the Liberia community to give the Creative Inquiry students a first-hand look into this Appalachian community. For the students, working within a Black Appalachian community brought new insights of history within the near range of Clemson. Through the lens of the Liberia...
community, Coggeshall taught the students about the origins of the Liberia community, history of racial discrimination within the region, and the importance of cultural traditions to the African-American community in this area.

In the Liberia community, the heart of cultural life and communication revolves around the monthly fish-fry. Every third Saturday of the month, the community puts on a fish-fry in which bountiful amounts of food are served to visitors from the larger area to fundraise for the local Soapstone Baptist church and community center. As a part of the Black Appalachia project the students studied the significance of the fish-fry as a cultural tradition.

Spencer Riehl, a junior Sociology and Economics major, spoke extensively on the importance of the fish-fry. “The fish-fry was amazing. I really enjoyed going, and everyone that you talked to was really accommodating, and happy to get to know you. The experience definitely challenged my expectations.”

Focusing on the fish-fry as a cultural heritage for the community, the students created short films depicting the event and the life in Liberia. Under the direction of both McCarroll and Nathan Hansen, an award-winning filmmaker who spent a week in-residence with the Black Appalachia project, the students directed and filmed 5-minute videos on the fish-fry and its role in the Liberia community.

While each of the student films had a different take on the Liberia community tradition, each worked towards the same goal—to raise awareness for the Liberia community. The films serve as a medium for educating future visitors and community members about the extensive cultural heritage of Black Appalachia.

“The goal of the student films, beyond allowing the students to gain knowledge of the Appalachian community and documentaries as a medium, ultimately was to bring attention to the Liberia Community,” McCarroll stated. And this, the students agree, was their greatest success. Through the application of filmmaking techniques, the students were able to produce a tangible product that gave a testament to the progress and transformation of race within Appalachia. At Clemson University, the students make up a larger family—and as the students show in the Black Appalachia Creative Inquiry, this family comes with a rich tradition of diversity.
oes success on the football field generate interest for that sport, other sports, or the universities? Can success in athletics transfer from the field to the classroom? These are the questions that Dr. Scott Baier, associate professor of Economics, Dr. Scott Swain, assistant professor of Marketing, Clemson University’s Athletic Department, and a team of undergraduate students are seeking to answer. This Creative Inquiry team, The Impact of College Athletics on University Performance, originated when the Athletic Council at Clemson contacted faculty like Baier and Swain from the College of Business and Behavioral Science and asked if they would be interested in researching the correlation between university athletic performance and university academic performance.

During Fall 2014, the Creative Inquiry team began this two-to-three-year process by collecting data during football season. The group studied 114 college football teams between 2005 and 2014 to calculate an average attendance at football games. After they calculated the average attendance, the team focused on what factors mattered for attendance at football games by studying each game. Did it matter whether the school was a public or private institution? Did it matter what day and time the football game was held? What was the average attendance of Thursday night games compared to the average attendance of Saturday games at noon?

Thursday night games cause a headache for many universities as professors are sometimes forced to cancel classes. In this way, are Thursday night games a form of advertising? Did the weather affect the attendance? Did attendance increase when a university’s football team was featured in ESPN’s College Game Day? Because the locations of Game Day are not randomly assigned, the quality of the teams competing, the location of the schools, the stadium atmosphere, and the historical cache are each important factors to study. “If we want to understand whether or not success in football attracts people to games or to Clemson, we have to understand outside effects,” Baier explained.

After studying and researching individual games of over one hundred teams, the group has concluded that the average attendance at college football games goes up by 2 to 3 percent for each win above six or seven wins for an individual team in a given season. They also found that the attendance at games goes up when the win goes in one of the teams’ favor by 10-15 points. By researching the factors that affect attendance at football games, the group was also able to measure whether or not there is an increase in demand for certain “name-brand” college football teams like Florida State and Auburn to come in and compete from other conferences. With this specific example of “name-brand” schools like Auburn coming from the Southeastern Conference (SEC) to compete in the
Atlantic Coast Conference (ACC), the Creative Inquiry team found that the demand for both of the schools is about the same.

The impact of College Athletics on University Performance is a data-intensive project where students and faculty learn to use data to understand a customer base. Mandy Nerone, a senior Marketing major, described, “The biggest lesson I have taken away from the CI is the due-diligence required in the beginning steps of the research process. In order for us to get to the ultimate goal, we had to take the time to solidify the research upon which we wanted to build. The process required patience, but it was well worth it for the next steps in our research.” By measuring qualitative and quantitative economics in marketing, this group is learning to think linearly, which gives them a better understanding and ability to work with lots of data and synthesize it quickly.

“\textit{In order for us to get to the ultimate goal, we had to take the time to solidify the research upon which we wanted to build. The process required patience, but it was well worth it for the next steps in our research.}”

Meet the \textit{Decipher} Team

Bridada Bethea, a senior Visual Arts major with a minor in Architecture, has a passion for capturing people and beautiful landscapes. As Photographer for \textit{Decipher} magazine, Bridada takes this passion and applies it by engaging herself with the Creative Inquiry teams and the projects that they are developing. Studying Visual Arts and Architecture, Bridada has the opportunity to think dynamically when producing photographs to depict the Creative Inquiry projects. Bridada believes that \textit{Decipher} magazine helps magnify the distinct love students at Clemson have for learning and researching about subjects that interest them as individuals. In addition to photographing for \textit{Decipher}, Bridada enjoys producing artwork for exhibitions, dancing, and hunting for opportunities to become a successful individual.

Amanda Pridmore, a senior Political Science and Philosophy major, comes to \textit{Decipher} due to her love of writing and her Creative Inquiry experience. Amanda brings an analytical eye to her writing for \textit{Decipher}, which she gained through years of extensive research writing with a number of political internships. Having herself participated in more than 7 semesters of Creative Inquiry at Clemson University, Amanda finds \textit{Decipher} magazine as an excellent highlight of all the hard work Clemson students can accomplish. Outside of writing for \textit{Decipher}, Amanda enjoys studying existential philosophy, exploring the local trails with her dog Boo Radley, and cooking vegetarian dishes for her friends and family.
Today’s society is committed to focusing on fresh products and understanding why consumers choose certain foods to eat. Aquaponics is one of the most reliable methods for getting fresh food and as a result is becoming an up-and-coming player in today’s food markets. The Creative Inquiry team, Aquaponics: Maximizing Use of a Biological System for Unique Production of an Aquatic and Plant-Based Crop, led by Dr. Lance Beecher, Aquaculture and Fisheries Specialist, is studying Aquaponics as they pertain to plant systems and fisheries.

Aquaponics is a branch of aquaculture combined with hydroponics that allows farmed fish and vegetables to be grown on small acreage. Because the acreage is small, it allows for tight regulation of the environments of the plants and fish, which keeps the products fresh. Daniel Weekes, a senior Mechanical Engineering major, explained, “The great benefit of this technique isn’t only that you get two outputs, but also that the plants clean the water for the fish and the fish provide fertilizer for the plants. It’s basically a win-win-win between us, the fish, and the plants.” The students on the team grow fish in tanks with vegetable plants. By using this system, the students have grown lettuce, kale, mustard greens, collard greens, herbs, basil, mint, parsley, and cilantro. Currently the team is focusing on how to make the system so precise that the only fresh water lost in the environment will be to evaporation. This Integrated Multi-Trophic Aquaculture system helps conserve water and keep it clean throughout the system. Aquaponics is taking fresh to a whole new level.

Each day the students assess the quality of the water in order to maintain a healthy environment for the plants and fish. They use those results to determine how much feed to place in the system and to calculate water flow and aeration requirements. After the plants complete a growing cycle, the students harvest them. The Creative Inquiry provides a hands-on experience that students cannot receive in a regular classroom. “It has given me a wonderful opportunity to test my own ideas. As a student pursuing a horticulture minor, it has allowed me to gain hands-on experience in plant production,” said Ashley Clayton, a senior Biological Sciences major.

Beecher hopes that the community members will

“The Creative Inquiry is focused on a hands-on experience that students cannot receive in a classroom.”

By Hailey Green
want to install a similar system in their own homes. There is a strong market for fish and produce now. Aquaponics is driven by marketability and this Creative Inquiry is focused on how that will affect the future of aquaponics. With the world’s population expected to reach nine billion by the year 2050, fresh fish will be a very vital food source. Even today, the many people who wake up early on Saturday mornings to support farmers at their local farmer’s markets are willing to pay a little more to buy fresh food. The beauty of aquaponics is that it requires very little space for high production—an acre of land, greenhouses, warehouses in rural or urban areas, or even rooftop gardens. “With foods being grown on less land than ever before, it is extremely special that we aren’t trying to find new land to put these operations up,” Beecher said. This makes aquaponics appealing in the market and a likely contributor to the success of America’s food system.

Meet the Decipher Team

Devaun Walker, a junior Packaging Science major with an emphasis in Food & Healthcare Packaging, joined Decipher this year as the Assistant Graphic Designer. Having a design-related major certainly proved advantageous as he worked closely with the Creative Director to design both visually appealing and interactive layouts for this year's Decipher. He is a huge fan of matte black design, clean lines, contrast design, and the use of negative space. Outside of Clemson and Decipher, Devaun loves to play the piano and is an active member in his church where he serves as the lead pianist for the modern service, The Vine. He also enjoys a good Groucho’s STP dipper, napping, Bible study, and new ways to do old things.
Say you’re walking down the grocery store aisle and spot a nice, see-through package that reads “ORGANIC.” Just like that, you’re hooked. Do you actually know what organic foods are, or are you convinced because of the nature of the package? This mystery is what packaging and food scientists alike work every day to figure out. What drives a consumer to purchase a product? Is it the taste? Is it because it is healthy?

Here at Clemson University, Food, Nutrition, and Packaging Sciences are three separate degree programs that are housed within the College of Agriculture, Forestry, and Life Sciences. Students in these majors take classes in one of the three fields and rarely cross; however, in the food industry, they may be as close as sharing an office wall. To bring them together, associate professor Dr. Marge Condrasky; senior lecturer, Dr. Aubrey Coffee; and associate professor, Dr. Duncan Darby, advised this Creative Inquiry project, with assistance from graduate student Alexandra Weeks. The goal was for students to gain a well-rounded view of all steps used in the product development process.

The team started the research project with an introduction to each field aiming to learn the basics of product development. This particular product development project was focused on creating healthy foods that would be attractive to children and marketable to their parents.

Students began the first semester with lectures that covered each of the majors and what they specifically study. From there, they took an in-depth look at how industry professionals operate when developing a new product and completed ideation activities that started putting informative knowledge into practice. These ideation (thought) activities gradually increased in complexity and made each student—no matter their education background—think like another, forcing them to ask each other questions that they may not have otherwise thought to consider.

Throughout the projects, students were exposed to a number of experiences that both enhanced current
study efforts and promoted long-term professional development. Students learned how to process more than 300 ideas to find the best ideas that could be used for a product launch. They were also taught how a few perfected ideas are transformed from an ideation through each of the stages of product development.

A trip to Popeyes Louisiana Kitchen solidified concepts taught in previous lectures about how industry professionals approach situations. While visiting their Atlanta, Georgia facility, students were also able to attend a networking event with members of the Research Chefs Association, who could potentially be future employers. At the Denny’s headquarters in Spartanburg, South Carolina, students were introduced to a different style of product development.

After learning how to formulate ideas, perfect them, and develop them from an industry professional’s perspective, students put their skills to the test. Members of the Creative Inquiry project split into groups and each developed products that could be used as healthy alternatives to nutritionally-poor foods favored by elementary school children. The products ranged from healthy versions of waffles to healthy cookies. Each group focused on either packaging components or food development, while striving to make each snack as nutritious as possible.

Members of the Creative Inquiry team then partnered with a local school, Chastain Road Elementary, to run a sensory panel to test their new food. After a first failed attempt, students went back to the drawing board to perfect their designs and prepare them for a presentation with invited Clemson media, faculty members, and industry professionals.

Students in this Creative Inquiry learned critical thinking as well as discipline-specific skills, conditioning them to work as industry professionals in a team. This unique opportunity for professional development expanded their classroom to encompass the world. Students gained skills that not only benefited their college studies but that are also attractive to future employers.

So the next time you see that same see-through organic package, let your mind wonder about what makes it or the product unique, and think of the dedicated individuals that worked hard to test and perfect something so delicious and healthy.
Have you ever wondered how much work actually goes into preparing that bacon cheeseburger that you order from your favorite restaurant? Think about everything you like on that burger: cheese, tomato, lettuce, ketchup, mustard, mayonnaise, onion, and bacon all topped on a juicy hamburger patty enclosed in a fluffy bun. Now, think about how much time and effort it takes to produce all of those burger toppings and condiments. Ms. Christi Leard, a student services program coordinator in the College of Agriculture, Forestry, and Life Sciences, and a team of undergraduate and graduate students formed a Creative Inquiry project called “Bacon Cheeseburger: From Farm to Table—A Detailed Analysis” to better understand and to help others better understand how much work goes into making the food, specifically the bacon cheeseburgers. Leard explained, “By analyzing the bacon cheeseburger we are able to break down each component and show how many different aspects of agriculture went in to creating each part and attempt to determine the cost all the way back to the farmer.”

Leard’s team is made up of Agribusiness, Agricultural Education, Agricultural Mechanization and Business, Animal and Veterinary Science, and Food Science students. Nick Rogers, graduate student in Agricultural Mechanization and Business, explained, “You think from your own experience and background, so it is necessary and important to have students from a variety of majors working on this project.” When they began this project, the goal was to discover and learn about everything involved—from farm to table—in making a bacon cheeseburger. As the project progressed, the team quickly realized that thoroughly exploring every step that goes into making this burger is a huge process because every step can always be taken a step further. Now, the team’s goals are to be able to explain through agriculture where each product comes from and calculate the average cost of a bacon cheeseburger. This will allow the average person to understand agriculture better and how it relates through a real world example.

The team takes one component of the burger at a time and analyzes the cost of raising, producing, and developing that component. For example, for the bacon, the team starts with hogs. They have to calculate the cost for the hogs. Someone has to purchase the hogs and/or raise the hogs, and the hogs have to eat, so the cost of the feed also has to be accounted for. In order to get the feed, a farmer has to grow a mixture of barley, corn, and soybeans. This could involve multiple farms, and it usually takes months for these crops to grow. The crops then have to be harvested and sent to the companies who mix feed. As the hogs grow up, they begin to eat more food, and once they reach a certain weight, they are ready to be processed. When the hog is processed, only a certain percentage from the mid-section is made into bacon. Then, the hog
has to be sliced, cured, packaged, and sent out. All of these things must be factored into the cost. On top of all of that, the price at which the bacon is sold will be affected by the cost of gas to ship the bacon from the factories to the stores, whether or not a drought was occurring during the time that the hog feed was grown, whether or not the hogs had any diseases, water waste, water prices, chemical prices, and medical bills from the hogs. All of these costs and work are just for the bacon. Leard’s team is doing this kind of analysis for every component of the bacon cheeseburger by researching, interviewing experts, and visiting farms and grocery stores to do cost analyses. Aside from cost, the team is aiming for the project to highlight the various sciences and disciplines required at each of these steps.

“**You think from your own experience and background, so it is necessary and important to have students from a variety of majors working on this project.**”

The team’s work emphasizes the importance of horticultural knowledge to grow grains and feed, the integration of animal sciences into food production, and technical or engineering in agricultural mechanics or agribusiness for marketing. Though the team’s focus is on economic impact at each level, these numbers not only signify the impact on a consumer’s pocketbook, but also they represent hundreds of jobs and critical levels of growth and development for the American economy. Once they finish their research and compile all of the data, the team’s goal is to come up with a binder that describes each ingredient to make a bacon cheeseburger to use as an educational tool for the average person.
Thanks to the constant growth in technology, people now have a variety of platforms to publicize just about anything. The Internet has become a major source for information, making digital technology the Holy Grail for media while print is slowly becoming obsolete.

At Clemson University, where there are countless education and recreational media outlets for students and faculty, there is always a need for technologically savvy individuals to keep up with the demands of new digital technology. One important need is for individuals who can utilize available software, provided by Clemson University, to monitor and update various media outlets.

The Atelier InSite Creative Inquiry, led by Art Department faculty, Dave Detrich, Joey Manson, and Denise Woodward-Detrich, assembled a team to select public art for Clemson’s campus. Within that Creative Inquiry, a group of students focus on producing online publicity for the project. The web team dedicates its time and efforts to raising awareness for art and upcoming art events on the Clemson website, and to attracting artists and their artwork to be displayed on campus.

Manson said, “everything needs to be current, this is one motivation for changes. Second would be to update with the goal of keeping our media platforms looking good in comparison to other programs. Also, anything that would facilitate out-reach or better public interaction with art on campus would
be a motivator for media changes.”

Graduate doctoral student, Nathan Newsome, works with the undergraduates, using his experience in various Adobe® programs, art, and computer science to help Manson and the media team develop a website that is more creative and user-friendly. For example, the team is developing a map for the Atelier site that depicts recognizable campus art silhouette icons, allowing visitors to locate specific pieces around campus.

When it comes to designing effective publicity, students turn to the Adobe Creative Suite, particularly Photoshop and Illustrator. They use this software to give students and faculty news about the creative actions being taken to connect the campus with art. It is also used to produce products such as logos, edited photos, and advertisement posters. A major goal of the web team is to get Clemson students more involved with the art program—to see what goes on behind the scenes and to attract a diverse group of students to become interested in art and to join the Creative Inquiry team.

The web team constantly searches the Internet for artists that meet Atelier InSite’s qualifications and who might be interested in the opportunity to be featured on Clemson’s campus. The web team is eagerly working to publicize opportunities in new, innovative ways so that artists can find it without having to search Clemson’s website. A Clemson Visual Arts student and web team partner, Ashley Wright stated, “Art encourages the audience to think critically in addition to seeing the world through a different lens. I think it is time for a change here on campus and I believe art will help to facilitate that change.”

Creative Inquiry students are developing an app for both iPhone and Android users, to help them to locate and learn about public art on Clemson’s campus. Atelier InSite has partnered with Dr. Roy Pargas, associate professor in Human-Centered Computing, to help with developing these smart phone apps. The launch of these apps will be the final showcase of the web team’s time and efforts.

Art, just like the Atelier InSite team’s goal, is meant to take diverse views and see what comes from them when focused upon one subject ... art. What makes art so beautiful is the fact that it causes almost a stop in time as people take their eyes away from their daily lives and look at something crafted from human hands. The Atelier InSite web team is committed to designing effective media to contribute to art, science, and the growing giant called technology so that art won’t go unnoticed.

This clay figure is the product of a claymation short, and is now the main character of the Atelier Web Team article and video. He is the guide throughout the video, and will help the visitor understand the team’s purpose, duties, and how it all works behind the scenes.
Whether you know it or not, you are sitting next to the global hotspot for salamander diversity,” explained Eric Riddell, a doctoral student of Biological Sciences in Dr. Michael Sears’ lab. The Appalachian Mountains have more salamanders and species of salamanders than anywhere else in the world. These slippery amphibians are important for nutrient cycling, trophic interactions, and energy flow through the ecosystem. Riddell leads the Creative Inquiry, Physiological Ecology with Salamanders, to study the way that salamanders respond to environmental conditions in hopes of answering the bigger question: how do all organisms respond to changes in the environment? The team of six Biology students is focusing on salamanders because they are a biological indicator, which means that they present a window to assess the susceptibility of other organisms to environmental change, such as global climate change.

Along mountains in South Carolina, there is a gradient of environmental conditions which support a variety of salamander species. In the lab, Riddell has collected Southern gray-cheeked salamanders (Plethodon metcalfi) and placed them in a flow-through system to study their water loss rates. The system monitors the vapor in the air and the vapor that evaporates from the creatures. The amount of water they lose is important because the level of activity in salamanders is directly influenced by hydration state. A salamander that can reduce water loss rates has more time to roam the forest floor looking for bugs to eat and potential mates. With this project, the team has discovered that salamanders change their physiology according to their environmental conditions, potentially to increase the duration of activity. Riddell’s research has also identified a potential limit on how much the salamanders can control their response to changing conditions.
environmental conditions. These responses might help salamanders remain active longer, but if they lose the water too quickly, they have to replenish it by retreating to moist microhabitats, such as under logs.

To test the limits of salamander physiology, the team performed a reciprocal transplant study. In this study, salamanders were moved from the top of the mountain to lower elevations of the mountain and vice versa. Riddell measured the salamanders throughout the summer and found that all of the salamanders remained watertight. These responses were likely due to the exceptionally dry conditions in that summer, which reinforced the point that salamanders are tied to their environment. However, Riddell wants to dive further into their physiology by performing a differential expression study. This would be a study centered on the genetics behind the mechanism that controls the salamanders’ responses. The team plans to look at the genes that the salamanders turn on and off in order to understand how they control their water loss rates and respond to changes in the environment. Hopefully, this next step will improve predictions of the effects of climate change on the distribution and abundance of salamanders.

Spring 2015 holds many opportunities for Riddell’s students, as they present research in three different symposia to discuss their projects. “My goal is for my students to be able to talk to anyone about their research and explain it in an interesting and engaging way,” Riddell said. His goal for the project is to help develop scientists that can design an experiment, explain the process, and find discoveries that answer big questions in the field of biology. Students in the Creative Inquiry are enthusiastic about the opportunities to present their data. Meghan Matlack, senior Biology major, said, “My partner and I are presenting at three different conferences, and I am excited to see if our data is actually significant. If it is, it would be a great opportunity to help co-author an article and get it published, especially as an undergraduate.” The experience that his students will gain from the project will provide them with a unique skill set developed by opportunities for individual growth. The students are not only becoming professional researchers, they are seeing science in a different way and getting excited about it.

Meet the Decipher Team

Hailey Green, a junior English major with an emphasis in Literature and a minor in Business Writing, Communications and Technology, is a writer for Decipher magazine. Her love for Clemson University and language led Hailey to join the Decipher team in showcasing the Creative Inquiry Program, which is unique to Clemson. She believes her position with the magazine will also help her pursue a career in writing. Outside of Decipher, Hailey is a member of Alpha Phi Sorority, Incorporated and a FCA leader. In her spare time, Hailey travels the world with her family. One of her most memorable trips was when she taught English to students in Hungary. When asked what she enjoys the most, Hailey loves a good cup of coffee, running half marathons, and watching Netflix.
I went into the CI not sure about what I was getting myself into, but I came out with a **passion** to protect bats and other threatened species.

Creatures of the night, the winged-death, bloodsucker—there is no other animal that carries with it a myth such as the bat. With its nocturnal habits and presence in vampire folklore, the bat is often seen as both a mysterious and dubious creature. The Creative Inquiry team, Techniques in Bat Conservation, seeks to show that bats are an important part of a healthy ecosystem. This Creative Inquiry exposes the true nature of America’s bats and the need for conservation.

This team exclusively studies bats within the Clemson area, including those within the Clemson Forest and in Memorial Stadium. Bats contribute greatly to the local ecosystem by controlling insects and by aiding in the pollination of many vital plants. Students in this Creative Inquiry learn about the beneficial nature of these local bats as they develop research projects.

Leading this investigation is Dr. Susan Loeb, a Research Ecologist for the USDA Forest Service Southern Research Station. “Bats within the Clemson area face major threats in the forms of development and disease,” Loeb noted. A growth in industry within the area has destroyed much of the bats’ habitats and has introduced more windmills and chemicals, which have led to an increase in bat mortality. The prevalence of the fungal disease White-Nose Syndrome has also decimated the bat population in the surrounding areas.

“One of the main learning objectives for the students is to develop their own research on bat conservation, this includes writing research proposals, reading literature, creating hypotheses and objectives, and conducting research in the field.” Loeb stated. Using the bat population within a 30-mile radius, each Creative Inquiry
student has developed a research project and used tools donated by the Clemson Wildlife and Fisheries Department and the USDA Forestry Service to collect quantitative data. These projects have included the analysis of bat environments, pinewood versus hardwood habitats, light and bat activity, feeding behavior, and bat vitality within Memorial Stadium.

Brittany Sumner, a senior in the College of Agriculture, Forestry and Life Science, spent two years developing research in a little-studied area of bat life. Sumner dedicated the last two winters to studying the bat population and gaining quantitative insights into their population size and habits. As one of the few researchers focused on bat activity in the winter, Sumner has made significant contributions to the international study of bat conservation.

Sumner explains, “I went into the CI not sure about what I was getting myself into, but I came out with a passion to protect bats and other threatened species. Bats are a misunderstood species that people need to learn about and I am very happy that the Bat CI has given me an opportunity to share my knowledge of bats with other people.” As a testament to this Creative Inquiry’s hard work and emphasis on research, Sumner and two other students presented in the 44th Annual Symposium on Bat Research in Albany, New York. The opportunity not only allowed the students to share their research with the academic community but also gave them access to the leading experts in bat conservation.

Through their in-depth approach to bat study, the students are finding that the bat population within the Clemson community plays a vital role in maintaining a healthy ecosystem. The bat is not a creature of fear and mystery, but rather an important pillar within the environment of the Clemson community.

Going Batty

Techniques in Bat Conservation

By Amanda Pridmore
Clemson students are solving mysteries in ancient Peruvian culture. The Archaeological Research for Project El Purgatorio Creative Inquiry Group is interested in discovering the secrets of the ancient Peruvian city of El Purgatorio, in the Casma Valley on the north coast of Peru. Dr. Melissa Vogel, associate professor of Anthropology at Clemson, along with Peruvian archaeologist Percy Vilcherrez, have been working at the site since 2004. The role of the Creative Inquiry team is to assist with data analysis and publication. There are currently six projects going on within the team. Dr. Vogel stated, “As a large city that had received very little scientific attention, our study of El Purgatorio is extremely important for understanding the late prehistoric period on the coast of Peru and the role of the Casma state.”

One project undertaken by student Kristin Buhrow was the analysis of spindle whorls found at the site. A spindle whorl is a weight placed on a spindle to control the speed of the spin. The presence of spindle whorls on an archaeological site indicates textile production. At least 74 spindle whorls of various shapes and sizes were found at the site. Kristin examined the data collected by Dr. Vogel and her colleagues in order to compare the weights and stylistic differences.

Sarah Dunn looked at the burial data from El Purgatorio dating from the Middle Horizon (AD600-1000) through most of the Late Intermediate Period (AD1000-1350). She pulled information from the project database to facilitate analysis of Casma mortuary practices.

Angela Garren did a detailed analysis of the fauna and flora of the site examining the quantities and distribution of different species and how urban residents utilized them in the past. She contributed to an article with Dr. Vogel and her colleagues that was submitted for publication.

One of the biggest projects that the group is working on is the spatial analysis of the site using Global Information Systems (GIS) technology, allowing other researchers as well as students to view and analyze the spatial distribution of artifacts from the site. This is a time-consuming and expensive aspect of the project that is crucial to being able to integrate the findings.

Jeremy Fowler is working with Portable X-Ray Fluorescence (PXRF) technology readings that were gathered from artifacts at El Purgatorio, Peru. The technology...
measures the fluorescence of different elements and
determines which elements compose each artifact. Fowler
noted, “This software and technology for Portable
X-Ray Florescence tells each element in an artifact and,
as archaeology and archaeometry progress, the science
behind the crafting of tools and other objects of ancient
and prehistoric people becomes illuminated.” The great
thing about this process is that it is non-destructive and
extremely accurate, plus it allows for better conserva-
tion and preservation of artifacts. Fowler runs the data
through Artax software to determine the photon count
of each element in the artifact. Upon analysis, several of
the metal spindle whorls, a pendant, two metal scraps,
and a tiny silver ball, were found to contain lead. This
metal is not very well documented in prehistoric Peru
and, as such, this is ground-breaking work. He is also
assisting Kristin in documenting the composition of the
metal spindle whorls found in El Purgatorio.

Team member Kayla DiMarco is using software called
Blender, which can recreate buildings in a realistic
3D model. The site is a large complex but can only be
excavated in small segments. The site has to be rebur-
ried at the end of the field season to protect it from
the elements. The only evidence that Dr. Vogel gets to
bring home of her work is pictures of small portions of
buildings and maps of the layout of the site. Kayla uses
these images to recreate those buildings on a 3D level.
The goal of her work is to make these ancient sites nav-
gible. Dr. Vogel has gathered so much data and visual-
izing it will translate that into something more relatable
to people outside her project. “I’m hoping that she can
show my work to experts or just an average person and
they will all be able to learn about ancient Peru.”

Dr. Vogel and her team are in the process of writing
and publishing scientific articles about the discoveries
made at the site.
Having previously worked with NASA, Dr. Marissa Shuffler, assistant professor of Industrial and Organizational Psychology, began the Creative Inquiry project, The Final Frontier, to guide her students in seeking answers to some of NASA’s biggest questions. In Fall 2014, Shuffler and Billy Kramer, a graduate student in Industrial and Organizational Psychology, first posed NASA’s questions and predicaments to the team of undergraduate Psychology, Business, and Engineering students, “How is a team of astronauts going to prepare for a three-year journey to Mars? How will they live in space for three years? How will the astronauts balance different roles? What can be sent with the team to make their voyage easier? How is putting the team in a tiny space for three years going to affect the team dynamics?” As NASA is beginning to prepare a team to embark on a three-year journey to Mars in 2030, Shuffler and her
team are studying and researching effective leadership techniques that can be implemented by the astronauts once they are in space.

Because this mission to Mars is unique in the sense that it will last 36 months and it is the longest distance mission ever embarked upon by NASA, this Creative Inquiry is working to understand the science of how this team going to Mars should function. Every other NASA space team up until this point has maintained continuous communication with a ground control team. Whenever the astronaut team has questions of any kind, the ground control crew is there to help them think through a solution. This expedition to Mars will be different because the communication delays will force the astronaut team to move from relying on ground control to becoming more autonomous by making their own decisions.

The Final Frontier is trying to explore any and every situation—but especially mentally and physically high-stress situations that astronauts may be faced with on this expedition. Shuffler explained, “Because this team is looking at leadership and teamwork issues as we look towards exploring space, the final place left for humans to explore, I decided to name the CI, The Final Frontier.” Shuffler and her team began by looking at case studies of historical events, like sailboat races and arctic explorations, to see who typically leads, how they lead, and whether or not the people and their techniques were effective. Kramer explained, “This is the Age of Exploration again, but with technology ... it’s pretty amazing.” They are taking their findings and presenting them at NASA workshops. The next step for this group is launching a lab study where they take the factors that they think will be challenging to astronauts and then place them in a computer simulation setting.
Today’s industries are fast-paced, complex, and, like most things, expensive. As markets grow and economies surge forward, companies and industries of the twenty-first century must be a step ahead of the curve. The Creative Inquiry, Lean Principles and Lean Accounting in Practice, led by Dr. Frances Kennedy, professor and director of the School of Accountancy and Finance, works on solving major issues that many companies and industries face today.

Kennedy and her students work directly with companies, such as Sonoco and Boeing, to identify and seek solutions to problems. The team first characterizes problems based on the Eight Wastes of Lean: transport, inventory, motion, waiting, overproduction, over-processing, defects, and skills. These wastes cost companies time and money and result in lower quality products. The students split into teams, each working with a company representative who explains the problem. The students then analyze the problem to seek a workable solution. Each team presents their research and a possible solution to the company. This method of collaborative, group problem-solving that improves the performance of a company or industry is known as Lean Six Sigma.

Sterling Lecy, a senior Finance major and member of the team working with Boeing, explained the most beneficial part of this project, “It was interesting to look at the industry from a higher viewpoint and create a central platform for people from multiple departments to be able to communicate on. They all work together to create this one product, but the communication between departments needed some adjustment.” Lecy’s project involved correcting issues concerning transportation and waiting. Boeing products must be completed to a specified percentage before being shipped to the next department. For example, a satellite has to go through mechanics, electrical technicians, and computer engineers. However, the electrical technicians and computer engineers can’t work until the mechanics are done. Lecy’s team found a solution to this problem and created a presentation to describe that process. Today, Boeing uses the solutions that the Creative Inquiry students found to increase production by improving communication between departments.
Lean Six Sigma is quickly becoming mainstream in the business world. The experience that business and accounting students gain in this CI will allow them rapid advancement in the workplace. Lean Six Sigma tools aid in narrowing problems into separate categories to be analyzed and solved. This simple way of viewing a company’s dynamics allows students to work on improving companies’ output by increasing productivity and eliminating unnecessary expenditures. Kennedy and her students work every semester on applying Lean Six Sigma tools to create lasting solutions to problems faced in companies and industries. With the progress these teams have already made in the business world, the possibilities are endless.

Meet the Decipher Team

Victoria Cespedes, a junior Genetics major with a minor in Psychology, likes to look at life through a quizzical eye. She enjoys discovering new places and cultures, whether it’s hiking a nearby mountain or traveling to experience a new place. Victoria plans to become a genetics counselor to help families and children with complicated medical histories. Decipher has allowed her to explore new fields and share this knowledge with other students. With her love for learning new things and writing about her discoveries, Victoria has found her niche at Decipher. Victoria has dedicated her life to humanitarian work. She has participated in Meals on Wheels, Greenville Hospice, and construction projects in her hometown to provide living communities for the homeless. Loving and adventurous, Victoria wishes to one day join the Peace Corps, which will allow her to travel and help people.
Did you know that Clemson, South Carolina is in a climate zone that covers 40% of the entire world? Did you also know that no other single climate zone is as big as this one? Because of these factors, designing and constructing a home that is environmentally friendly and affordable in this climate zone creates home solutions for 40% of the rest of the globe. Clemson University’s Creative Inquiry, Solar Decathlon, has embarked on a journey to design and construct an affordable, three bedroom, 1000 square foot solar house for a family that has low environmental impact and uses net-zero energy.

In December 2013, an interdisciplinary team from Clemson University, led by Dr. Vincent Blouin, associate professor in the School of Architecture and the School of Materials Science and Engineering, and Dan Harding, associate professor of Architecture and Community Design+Build, submitted a proposal to enter the Solar Decathlon competition hosted by the Department of Energy and the National Renewable Energy Laboratory (NREL). Colleges and universities from all across the United States submitted proposals to enter into this competition, but only twenty were chosen to compete in the Solar Decathlon. In January 2014, Clemson’s team was chosen to compete. Since then, the Creative Inquiry has brought together over 100 students, faculty, and supporters from Architecture, Engineering, and the Social Sciences in order to accept the challenge of designing, building, and operating a solar-powered house that is cost-effective, energy efficient, and attractive. Corey Ferguson, junior Architecture major, described the benefits of this Creative Inquiry when he said, “One of the best experiences I got out of working on the Solar Decathlon team was the inter-disciplinary aspect of our team. We had such a wide variety of majors and year-levels that the collaboration and teamwork between us was my favorite part.”

In October 2015, Clemson will join the other selected colleges and universities in building its solar house in Irvine, California. Once the team arrives in California, they will pick up the materials from a plywood company, and then, using mainly manpower and hand tools, they will have seven days to construct the house in an energy-efficient manner. Assistant Professor and Associate Chair of Architecture Ulrike Heine, who also helped to lead this project, explained, “Everyone feels like solar-powered energy-efficiency is expensive. We are trying to prove that wrong.” The completed homes will compete in 10 categories: Architecture, Market Appeal, Engineering, Communications, Affordability, Comfort Zone, Appliances, Home Life, Commuting, and Energy Balance.

The Creative Inquiry team decided to name their solar home Indigo Pine. “Indigo” because of the traditional indigo dyes that originated in the Low Country of South Carolina and “Pine” because of the pine trees found in abundance all over the state. It is designed to be constructed using materials that are found locally.
in order to reduce the amount of energy used in the building of the home. Indigo Pine will be made mainly out of wood because solar power is an innate quality of wood, which makes it a renewable, natural resource that has the lowest embedded energy of any structural material, particularly when it is indigenous to the area and sustainably harvested.

In previous years, teams competing in the Solar Decathlon have transported construction materials and parts of their solar homes to California using transportation methods that substantially increased their carbon footprint. After Clemson entered this competition in sustainability, there was no way they could transport their solar home across the United States because that would defeat the purpose of trying to create an energy-efficient, solar powered home. Was there a way to deliver the house to California without shipping it?

Clemson’s team spent lots of time planning and designing their solar home, and finally, they decided to transport the home to California through a completely carbon-neutral system using e-mail. By emailing their design files to a plywood manufacturer in California, this allowed them to ship nothing from South Carolina to California, eliminating transportation energy and cutting costs significantly.

With the money that this Creative Inquiry team saved by virtually transporting its home, they partnered with the Botanical Gardens in Clemson and constructed a prototype of the solar house during the spring of 2015. They constructed the home just as they will in California using stopwatches to time themselves, minimizing time, waste, and costs. With the building of the prototype, Clemson has something to do research on and also something to showcase before the competition in the fall. While it would be a huge accomplishment to win the Solar Decathlon, Harding explained, “The second the competition is over, we will still be working on research. The Solar Decathlon is not the destination, but something that we’re moving through ... Infrastructure will be something that we won’t be able to put away.”

“We had such a wide variety of majors and year-levels that the collaboration and teamwork between us was my favorite part.”
Coast to Coast construction

By Hailey Green

Only twenty schools were selected to compete in the U.S. Department of Energy’s 2015 Solar Decathlon, and Clemson University was one. A Creative Inquiry project, The Transportation of the Indigo Pine Solar House for SC, is in charge of the transportation of the house to Irvine, California. A team of four Packaging Science students, led by Dr. Gregory Batt, is working on the best way to transport the house across the country from Clemson, South Carolina, using a route that leaves the smallest carbon footprint. The 2,900-mile route, consisting of trucks and trains, has been reduced to a 50-mile route, thanks to e-mail.

“You start with one plan and then all of a sudden we are e-mailing the house.”
The plan is that the students will draw up designs and a process to piece the house together, and then they will e-mail these designs to a manufacturing shop in California. This shop will then produce the pieces and the team will transport them to the building site, a much shorter, 50-mile trip. With this change in planning, the Creative Inquiry team faces new trials, and flexibility is crucial. “With this challenge, you have to be flexible. You start with one plan and then all of a sudden we are e-mailing the house. Okay then, let’s retool and figure out what is most important,” Batt stated.

In Spring 2015, the team worked on a Microsoft Excel-based code called a Critical Path Sequence. This code takes the number of tasks and the amount of time each task should take, plugs it into a formula and it adjusts the plan based on the path. To create the code, the students reached out to Dr. Scott Mason, endowed chair in Supply Chain and Optimization Logistics in Industrial Engineering. This code will be especially important during the decathlon because the team will only have 157 hours spread over five days to complete the house. “The point of the critical path is to optimize the correct order of operations that need to happen to get this house build in the least amount of time,” Batt explained. The first version of the code has been completed, and the team built a mock-up house in the Botanical Gardens during spring semester in hopes of working out the kinks in the critical path, and finalizing the e-mail design.

The Indigo Pine House is essentially puzzle pieces that have to be put together, and the next challenge that the team faces is packaging the pieces so they survive the transport from the manufacturing shop to the construction site. They have to make sure the fragile parts survive the 50-mile transport, and the truck is loaded in accordance to the critical path sequence in order to assemble the house most efficiently.

This project has taken several different directions and, according to Scott Grooms, senior Packaging Science major, the focus of the project could change several more times. “You have so many people and ideas and I think that is why it changes so much and that’s a challenge in itself. It’s experimental and it teaches you a lot and gives you experience,” Grooms said. The goal of a project like this is to teach students things that they cannot learn in a classroom and to challenge them to think outside the box. By e-mailing the house, the team hopes to accomplish a design that can be manufactured and built anywhere in the country, which brings a new meaning to “You’ve got mail.”
Community Supported Art (CSArt) is a nationwide movement modeled after Community Supported Agriculture (CSA), where one purchases a share from a local farm and in return, receives a portion of fresh, seasonal crops. In over forty communities in the United States, CSArt programs are selling shares of local, handmade artwork from a selection of artists within the community, and in return, shareholders receive crates filled with unique, limited-edition pieces. With a “buy local” frame of mind, the goal of the CSArt movement is to provide a platform to connect and engage the community with its emerging artists and to offer the opportunity for art lovers to invest in original, local artwork.

A group of undergraduate and graduate students studying ceramics within the Art Department, along with their professor, Valerie Zimany, caught on to the growing CSArt movement and seized the opportunity that Creative Inquiry provided to establish Clemson Community Supported Art (CSArt), with its first share offering in Fall 2014. To make the inaugural season possible, the Clemson CSArt Creative Inquiry team researched programs across the country, and held Skype meetings with Springboard for the Arts, the organization that founded the CSArt movement.

“This initiative provides students with an entrepreneurial learning opportunity – many of our graduates work for institutions, non-profits, galleries and more, and the real-world marketing and administration skills they acquire through participating in the program gives a tangible experience to enhance their studio-based portfolio upon graduation,” Zimany said. Proceeds from the shares and Creative Inquiry support will allow these students to continue research and to present Clemson’s CSArt initiative at national conferences. Hallie Shafer, a senior Art major, shared, “I was able to learn about and implement how to market my team and myself. I gained experience with web design which is crucial as an artist, and it was an insight into how I would potentially be able to sustain myself in the art world.”

Clemson CSArt is uniquely set apart from other CSArt ventures in that the shares include student artwork, which is carefully selected through a jurying process to ensure that each piece is of high quality.
The first offering of shares included hand-made ceramic cups and bowls from the six chosen student artists, juried by Harriet Green, the Visual Arts Director of the South Carolina State Arts Commission. Each share included six original, limited-edition ceramic pieces for a total of $120, along with a one-time bonus coupon towards Clemson’s popular Annual Bowl Sale, hosted by the Clemson Ceramics Association. Brittany Wilund, senior Art major, explained, “It not only made our community aware of what is going on in the ceramic studios, it created personal connections between student artists and local art patrons.”

From building the website to designing crates, the students within the Clemson CSArt Creative Inquiry team have been involved in and responsible for every aspect of what it takes to establish a CSArt initiative. Although the inaugural shares focused on ceramic pieces, it is the goal of Clemson CSArt to reach out to different disciplines within the Art Department, and possibly recent alumni, to create shares that include artwork in various media. “For those students who create the limited edition ceramic works for the share, the commission is a vote of confidence in the developing quality of their artwork, and a challenge to meet our enthusiastic shareholders’ expectations at our seasonal pickup event,” Zimany stated.

With a firm belief in the value of art in our community, it is the goal of the Clemson CSArt team to establish a strong presence not only within the university, but to deliver fresh, Clemson student art to communities throughout the Upstate.
The Clemson University mascot is the tiger, but how much do we really know about tigers? Where do wild tigers live? Are they an endangered species? How many wild tigers are left in the world? What if I told you that in 25 years, there would be no more wild tigers? Dr. Betty Baldwin, associate professor of Parks and Conservation Area Management in the Parks, Recreation, and Tourism Management department, first began to think about these questions when she was at a conference where the Global Tiger Initiative (GTI) posed these exact questions. Baldwin wanted to get others involved in helping her answer the question of “how much do we (at Clemson) really know about tigers?” so she began the Creative Inquiry, CU Save the Tiger.

In 2008, the National Zoo and the Smithsonian partnered with the World Bank to develop The Global Tiger Initiative (GTI). This is an alliance of governments, international organizations, civil society, and members from the scientific and conservation community committed to working together to save wild tigers from extinction. Their main goal is to double the world’s wild tiger population by 2022. After attending a presentation from the Global Tiger Initiative, Baldwin knew that the perfect place to start asking these questions would be Clemson’s campus. In April of 2012, Clemson University became a partner with the Global Tiger Initiative, its leaders from the World Bank, and the Smithsonian.

In Baldwin’s Creative Inquiry, the students began by learning about where wild tigers live and the threats that wild tigers face. The team then developed a survey about wild tigers that asked the Clemson community about their general knowledge of tigers and was also used to raise awareness. Baldwin explained their goal when she said, “[The goal] was just to find out the information, but it translated into sharing the information and engaging the community in conversation.” Creative Inquiry students on Library Bridge asked people to fill out paper surveys, and also posted the survey to Survey Monkey, Facebook, and Twitter. The survey asked five multiple-choice questions: 1) what is your gender?, 2) what is your age?, 3) what social media outlet do you believe is the most useful in aiding tiger conservation?, 4) approximately
how many tigers are left in the world?, and 5) how many tiger range countries are there?

Baldwin and her students concluded that about 20% of people on Clemson’s campus have general knowledge about wild tigers. Let’s get the facts straight: There are 13 tiger range countries (native countries where tigers currently live): Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Russia, Thailand, and Vietnam. There are only 3,200 tigers left in the wild today. Yes, in the last 100 years, we’ve lost more than 97% of all tigers. After all of the research completed by Baldwin and her team, she explains, “We entered into a world that we didn’t know existed.”

In addition to Clemson’s partnership with the Global Tiger Initiative, other events and Creative Inquiry projects have focused on tiger awareness, conservation, and preservation. In September 2014, Clemson University held its first annual Tiger Conservation Week, “Tigers Always.” During this week, representatives from the thirteen tiger range countries, the Global Tiger Forum, the India National Tiger Conservation Authority, and the World Bank’s Global Tiger Initiative came to Clemson to inform, support, and partner together in global tiger conservation.

Clemson has another active Creative Inquiry project called Tigers for Tigers working to protect wild tigers through education since 1997. Clemson also hosted the first National Tigers for Tigers meeting in 2013 that was described in the 2013 Decipher magazine.

More than 52 colleges and universities have the tiger as a mascot. So far, the National Tigers for Tigers Coalition has united tiger conservation efforts at 14 colleges and universities across the United States, and it is aiming to eventually unite all 52 schools.

Students are encouraged to join together, expand the family and protect our own, because the tiger is not just an animal or Clemson’s mascot, it is a part of the Clemson family.

“... In the last 100 years, we’ve lost more than 97% of all tigers.”
Every day different ideas are constantly being explored and tested to see if they can have benefit in the modern world. The search to find new and better ways to deliver medicine to the human body is one of these areas. A possible solution to this cause could be to use something so small, that it can only be seen when millions of them are together at one time. These tiny objects are called nanoparticles.

Nanoparticles are a part of everyday life—most people just don’t realize it because they can’t see them. This Creative Inquiry, Design and Synthesis of Advanced Nanomaterials to Address the Global Challenges of the 21st Century, is led by Dr. Christopher Kitchens, associate professor in the Chemical and Biomolecular Engineering Department. Kitchens’ vision is to use nanoparticles to choose the specific time that medicine is released inside of the body.

Dr. Kitchens is working with his Creative Inquiry team, as well as graduate students, to see if nanoparticles can be used to coat lipid vesicles that are filled with some sort of medicine, then have those lipid vesicles sent to a problem area inside of the body. From there, they would use the nanoparticles to rupture the vesicle on command, thereby releasing the medicine inside. This concept may seem complicated, but it is quite simple. When asked to describe a lipid vesicle so that a 10-year-old could understand, Matthew Stonaker, a Chemical Engineering undergraduate student, explained, “A lipid vesicle is like a water balloon, and the water inside the balloon, in this case, would be the medicine.”

The students in Dr. Kitchens’ Creative Inquiry are working to make this goal a reality. They are very proficient in synthesizing several different types of nanoparticle solutions, with both gold and silver nanoparticles. The process of synthesizing nanoparticles can be as simple as mixing together water with one or two chemicals, or as complicated as having to mix multiple chemicals while boiling the solution then letting it sit for a few days. Synthesizing the nanoparticles, though, is just the tip of the iceberg in this research.

After each solution of nanoparticles is made, they have to be characterized. Characterizing the nanoparticles is crucial because it lets the students know all of the properties of the individual nanoparticle. There are many ways to characterize the nanoparticles. One option is Dynamic Light Scattering (DLS), which measures the diameter and other size qualities of the nanoparticle. Another option is ultra-violet visual...
spectroscopy (UV-Vis), which uses the light absorbency of the solution to determine the type of particles in the solution. Characterization is important because two different solutions could look identical, but have different sizes of nanoparticles and have different effects on the lipid vesicles.

The Creative Inquiry team is also conducting leakage studies for each different type of nanoparticle. These leakage studies are used to see how whatever is inside of the lipid vesicles will be released when in contact with the nanoparticles. Fluorescein dye is used for this purpose because, when a light is shined through the dye, it emits light at a different wavelength and color than the light that was absorbed. This is called fluorescence. The dye is tested to see how it will react with each separate type of nanoparticle—whether or not the nanoparticle will quench or enhance the emission of the dye. This testing can take up to two hours per each unique nanoparticle solution, and has to be replicated three times for each solution. After the dye is tested to see how it will react with just the nanoparticle, it will be encapsulated in the vesicles to see how they will react with the different types of nanoparticles.

Nanoparticle research is a vast frontier waiting to be fully explored and understood. People are fascinated by the mysteries of objects that can’t be seen with the human eye. This Creative Inquiry team is exploring this vast unknown and may someday see their work applied to progress in medical or other fields.
What if the solutions to a lot of our problems could be found in nature? With the invention of the airplane, the problem of how to transport people quickly over long distances and over large bodies of water without using boats was solved by mimicking a vehicle after a bird. In much the same way, if buildings and other infrastructure were modeled after structures found in nature, wouldn’t they be more resilient, sustainable, and adaptable? This is exactly what assistant professor in Civil Engineering, Dr. Brandon Ross, his graduate student, Diana Chen, and their Creative Inquiry, Bio-inspired Adaptable Structures, are studying and researching through artistic case studies.

In 2008, The National Academy of Engineering released what it calls “The Grand Challenges for Engineering,” which includes challenges such as providing access to clean water, reverse-engineering the brain, and restoring and improving urban infrastructure. They call these “The Grand Challenges” because they believe that these are some of the biggest issues that engineers face today. Ross and Chen have chosen to work towards finding solutions to the grand challenge of restoring and improving urban infrastructure by pairing civil engineering and biomimicry with art.

According to Dr. Ross, “infrastructure includes all of the physical structures that make modern life possible. Every time you get a drink of water, you are relying on infrastructure to clean the water and to deliver it to you ... Infrastructure is all around us, and, yet, we don’t often realize how critical it is to almost
every aspect of modern life.” In 2013, the American Society of Civil Engineers issued a report card grading various categories of U.S. infrastructure. The average grade was a D+. The report card graded America’s infrastructure so harshly because it is aging and failing, and so is the funding that supports infrastructure, particularly in urban areas which support millions of people. This grand challenge is calling for sustainable solutions, paying specific attention to environmental and energy-use considerations (though cities take up just a small percentage of the Earth’s surface, they disproportionately exhaust resources and generate pollution). The Creative Inquiry students are working towards answers and solutions to this grand challenge.

Ross and Chen began this Creative Inquiry in an attempt to guide and lead students in the exploration of sustainable construction techniques through art, bridge the gaps between different academic disciplines, and come up with potential solutions to the grand challenge. Ross, Chen, and their team have also joined forces with Dr. Lisa Benson, associate professor in Engineering and Science Education, to spearhead an event called “Science as Art.” It’s an outreach festival targeted towards non-scientists and secondary school students as a means of celebrating and bringing awareness to Science, Technology, Engineering, and Math (STEM) fields through artwork. Visual representations of scientific discoveries and concepts provide a valuable connection between scientists, artists, and the general public. Ross explains, “We’re trying to couple these ideas of brute engineering and creativity.” Because art is a universal language that we use to communicate with others, we can all relate to it in one form or another, and we’re all capable of creating it.

Students in this Creative Inquiry began by learning about biomimicry—a design concept that involved studying nature’s models and using these designs and processes to solve human problems. After learning about biomimicry and other sustainable construction techniques, the students studied and chose a biological organism that portrayed a structural form found in nature. The students then took this example of structural form and applied it to civil engineering through art by designing and building a piece of bio-inspired (bio-mimicked) artwork.

The biomimetic aspect the team chose to use was the honeycomb. The students constructed a structure that is shaped like an individual cell in a honeycomb. This structural decision represents the maximization of internal space and the minimization of resources used. When it comes to building a prototype such as the honeycomb, the students take into consideration its capability of having multiple shapes and functions. As Ross, Chen, and their students continue to make groundbreaking prototypes, they keep in mind that most things, much like their prototypes, mimic something that came before them.

Meet the Decipher Team

Betsy Boggs, a junior English major, loves communicating with written words. As assistant editor of Decipher magazine, Betsy expresses her love for the English language by writing articles and meticulously editing and revising other magazine articles. Beginning as a Food Science major and then transitioning to an English major with minors in both Education and Spanish Language, Betsy appreciates the opportunity to learn about the wide variety of Creative Inquiry projects at Clemson University. Betsy believes the production of the Decipher Magazine helps bring unity to the interdisciplinary studies at Clemson. In addition to writing for Decipher, Betsy enjoys baking cakes, being a WyldLife Leader at R.C. Edwards Middle School, exploring new places, and searching for opportunities to serve.
Have you ever wondered how Spiderman, the Hulk, and the Fantastic Four all got their powers? By radiation, of course! Unfortunately, radioactive spiders aren’t wandering around every day to help mutate hapless bystanders into superheroes. The Characterization of Radiation for Biomedical Applications Creative Inquiry team hopes to use its research to design new radiation-based therapies to improve human health and, perhaps, inspire the science fiction lover in all of us. Though electron beam ion traps, liquid helium cooled chambers, and genetic modification may sound like they come from science fiction, these are just some of the real equipment and techniques used by this Creative Inquiry team to figure out how radiation can affect living tissues.

The goal of this Creative Inquiry team, led by Dr. Endre Takacs in Physics, Dr. Delphine Dean in Bioengineering, and graduate student, Matt Rusin, is to study the effect of radiation on cells. The effect of radiation on biology is something that has been studied for a very long time. Radiation has been used to treat cancer for more than 100 years. However, little is still known about how radiation can affect cells. Could we better tune radiation treatments to protect surrounding healthy tissues while still killing tumors? Could radiation be used for other therapeutic strategies? These are just some of the questions this team hopes to tackle. “The emphasis for this project is on students driving it forward. This would be the overarching goal for the Creative Inquiry,” Rusin stated.

The team’s research takes a cross-disciplinary approach to investigating the effects of monochromatic X-ray radiation on cells, so as to lead to advances in health care in the areas of cancer treatment and other genetic disorders. The team is broken into an experimental group and a theoretical group. The experimental group deals with the laboratory research, such as growing cells, and creating parts and apparatuses for the radiation source. The theoretical group is creating a computer with predictive powers to aid in understanding and discovering the various phenomena the experimental team is measuring.

For Katelyn Truong, a freshman Bioengineering major, the most challenging part of the project has been understanding aspects of the research that do not specifically pertain to her major. “I was exposed to a lot of physics that I had not learned before. Additionally, I had to learn about freezing, growing, and passaging cells,” Truong said.
The characterization of radiation includes learning the properties of the radiation that exits the machine, such as its frequency range and polarity. The frequency range gives information on the energy of the radiation. Radiation at different energies will interact differently with the molecules that make up cells, such as DNA, proteins, and phospholipids. The polarity provides information on how the radiation interact with biological materials.

Currently, the team has focused its attention on generating monochromatic radiation. By using an electron beam ion trap (EBIT), they are able to create X-ray radiation in a very narrow frequency band, i.e. monochromatic or “one colored.” This EBIT machine is currently one of only two in the U.S. However, it is not currently set up to operate with cell cultures. Much of the team’s current work entails learning as much as possible about the EBIT and designing the special parts and accessories necessary to carry out the cell-based research. Meanwhile, the students are culturing a variety of cells including cardiovascular, bone, and cancer cell types. They are optimizing culture conditions to ensure that the culture substrate doesn’t interfere with the radiation from the EBIT.

This Creative Inquiry team is dedicated to thinking of creative ways to learn about the effects of radiation on biological materials in order to yield more in-depth knowledge. “I joined this project because I believe it has the potential to make a huge difference in people’s lives. If we discover a safer, more effective treatment method for cancer, it will save lives. That’s the bottom line,” explained Joey Wilson, a sophomore Bioengineering and Political Science major. While superpowers from radiation may be not be possible, this team hopes that by understanding the basic science of how radiation interacts with our cells, it might eventually be able to create novel therapies and treatments to help improve many patients’ health and quality of life.
In the current Age of Information, technology has become more important and advanced than ever before by transforming the way we live and the ways that we can be connected. iPhones, computers, and tablets are ruling our lives, but what can they do that we as humans can’t? We can type notes on them, but we could also write notes using a pen and paper. We can Google our questions, but we could also research those same questions using books, journals, and encyclopedias. We can send five words in the form of a text message, but we could also walk across the room and speak to that same person. In today’s world, these devices seem so necessary because speed and simplicity are becoming more important, but are they really all that necessary? David Lee, assistant professor of Architecture, and his Creative Inquiry, Computational Design Group, are applying these same kinds of questions to architecture.

What can computers offer to architecture? Lee explained, “... much of what we have seen in the digital computers’ short history has been an expected emulation of what we can already do with a pencil and paper and have done for centuries.” So why bother learning how to do the same things with a computer? You may get faster, but you won’t get smarter. The focus of this Creative Inquiry is computational thinking, which doesn’t require the use of a computer or other digital device. Computational thinking is about understanding how computers work, about systems and logic, and using that as a methodology to develop architectural designs.

Over the course of a year, Lee and his students develop anywhere between one and six projects. Lee begins with an interesting and relevant theme, and then his students design their own projects in hopes of answering design questions about the specific theme. However, the students’ answers are focused on applying computational thinking and design. For example, one of his themes was “material intelligence,” where his students were asked to focus on embedding intelligence into project designs. With this theme, the students first researched and studied the behaviors of solids, like steel and plastic, and, then, they explored the kinetic abilities and structural capacities of the solid materials.

As the students sought out ways to apply this new knowledge to architectural design, they developed a structure with hinges made of a nickel titanium alloy. Most hinges are made of metal, which cannot change shapes. However, as the students applied the systems and logic used to previously study kinetic abilities and structural capacities of these materials, they were able to come up with a computational design. The students decided to develop the nickel titanium hinges because this particular alloy changes shape when it is coiled. They were interested in a hinge that changed shapes because they were exploring opportunities where people might need to have a deploying structure that
changes shape after it has been deployed. These types of structures are particularly important when it comes to disaster relief.

Most people who are not familiar with architecture view architecture as designing and making buildings. Designing and making a building is a part of architecture, but a building is not just architecture because it’s a building. It’s possible to construct a building and it not be architecture. Architects think about how to place buildings in the environment so that the buildings can be a part of the environment while best serving the needs of the community.

Thinking about the design process and architecture today, that is computational design. Developing models using hinges that change shape for the purpose of making disaster relief easier and more efficient, that is computational design.

“... much of what we have seen in the digital computer’s short history has been an expected emulation of what we can already do with a pencil and paper and have done for centuries.”
Growing up, we are told that the sky is the limit and that we can be anything we want to be in life. Our society provides everything we need from food to entertainment to opportunities. The chances are endless and the resources are unlimited. Unfortunately, this is not the case for many people, especially those in less affluent countries.

The Creative Inquiry project, Tigers in Tanzania, led by Dr. Skye Arthur-Banning, associate professor in Parks, Recreation, and Tourism Management, helps orphanages, schools, and villages in Tanzania, a country located on the east coast of Africa. Arthur-Banning and his students work with orphanages and middle schools in Dar Es Salaam and Koshi, a small village at the base of Mt. Kilimanjaro. Dr. Mori, a professor at the University of Dar Es Salaam, Arthur-Banning, and his team work to improve the lives of the children in these territories by bringing health and recreational equipment.

The Tigers in Tanzania project has three main purposes: to help orphanages and schools; share cultural knowledge with students at the University of Dar Es Salaam; and visit the small town of Uru East near Moshi. Each year, Clemson students visit Tanzania for two weeks to interact with children, villagers, and other students to grow cultural awareness to worlds outside of their own. Junior, Kelly Alexander, had this to say about her experience, “It was a lot of work to travel around to the schools and orphanages, but the kids were so excited when you got there, that you just forgot about how tired you were and the fact that you had already worked since seven that morning.”

Although it is exciting, a trip to Tanzania requires a lot of preparation throughout the school year. The team met weekly to research the cultural norms and other information about Tanzania to aid in planning the trip. The students prepared presentations about education, monetary expenses, and health laws. By doing this, the
students gained an understanding of what the people of Tanzania encounter on a daily basis.

Arthur-Banning and his team also work on expanding cultural awareness in South Carolina. For example, Clemson students taught middle schools in Charleston, S.C. about the lifestyle and history of Tanzania. The students interacted through booths that showcased Tanzanian activities, arts, and crafts. With this fair, the students were able to learn how children their own age in Tanzania live. One of the games involved racing with a bucket full of water, which is something the children in Tanzania do on a daily basis to bring water back to their family.

This Creative Inquiry also raises money to purchase first aid kits, soccer balls, and other recreational equipment to take to Tanzania. Arthur-Banning gets coffee from Tanzania that is then roasted in Charleston and sold, with all of the money sent back to the farms in Tanzania. The Creative Inquiry group also sells jewelry, with 50% of the profit going to coffee farmers and jewelry makers and 50% going to buy recreational and health equipment for the orphanage.

This Creative Inquiry has a lasting impact on Clemson students as well as the people of Tanzania. In the summer of 2013, students brought chickens to the village of Koshi and gave one to each child. The eggs from these chickens pay for their education. The team also raised $2500 to send to an orphanage, which was used to buy a plot of land for more living facilities.

Students in this continuing CI team plan to return to Tanzania each summer to continue their service to these communities.
August 2013: the doors to the new Digital Media+Learning Lab (DML Lab) opened for students and teachers at Clemson University. This room 213 in Tillman Hall was entirely remodeled and restructured for a different kind of learning. Dr. Matthew Boyer, assistant professor of Digital Media and Learning, describes the DML lab as a change in how we think about education. Boyer explained, “The philosophy behind the Digital Media+Learning Lab is to shift from a focus on technology used simply for instruction by teachers to more of a participatory, interdisciplinary, interest-driven space where students and teachers can all come in and use the spaces to pursue their own personal interests, use the different tools in an integrated fashion, and create digital media projects.”

The DML Lab Creative Inquiry, like the lab itself, is focused on empowering students and giving them the tools they need to create great things. Students in the Creative Inquiry guide other students to develop tutorials using the lab equipment. Through surveys and testing, the tutorials are refined and changed based on the feedback and put in the lab. For example, “Making your first song with FL Studio 11,” was tested and subsequently updated on the audio lab computers based on the feedback received from the testers.

Students are using the DML lab to create exciting projects. For example, Computer Science undergraduate, Peter Barnett, and a team of Clemson students have banded together to create a new company and their first product: the Coconut Pine. The Pine is a salt and pepper shaker that uses a slider to let the

M-AUDIO
user control flow rates of each spice. Before they began using the DML lab, in order to test their prototypes they had to work with external companies that took weeks to ship their printed designs and made mistakes, which cost them more time and money. Barnett noted, “We were able to come to the 3D printing lab and take it from paper to an actual product that you can hold in your hand and it has been going great.” The team launched a Kickstarter campaign, however, they are currently looking at other options to make the Pine a reality.

While the DML is different from most labs, Boyer emphasized that the space supplants, rather than replaces, Clemson’s more traditional, lecture-style classes. Boyer revealed, “This has been a great start for us to see if we have an audio room or if we have a 3D printer, what are the things that people can do with them and how can we support that kind of learning ... Being able to extend and not replace what is happening in the classroom is a key piece to what we’re doing here.”
Many people who have walked around Clemson’s campus have had an awkward standoff with a squirrel. The Clemson squirrels are “city” squirrels, which means they are used to human interaction. This desensitization makes them seem sassy and somewhat rebellious. When a student walks by and the squirrel is on the sidewalk, it shows no inclination to move out of the way. These squirrels are causing more issues than just awkward moments. They eat away at plant life and chomp on the power cables throughout campus, causing expensive damage. Clemson has been searching for a solution to this continuing problem.

Dr. Greg Yarrow, chair of the department of Forestry and Environmental Conservation, and his graduate student, Kristina Dunn, have been testing a possible solution to this problem. In the Squirrel Contraceptive Project Creative Inquiry, Kristina and a team of undergraduate students are working on limiting the squirrel population on Clemson’s campus using an oral contraceptive. The fieldwork utilized five sites around Clemson’s campus, four treatment and one control. L-shaped stainless steel hoppers with oral bait along with trap cameras were placed in all five sites. The students both ear and PIT-tagged captured squirrels to properly track them and to avoid any redundancies in analysis.

The contraceptive used is DiazaCon™, a cholesterol mimic known to inhibit the production of sexual hormones. So how can anyone know that the contraceptive is working? The oral bait is a combination of sunflower kernels, DiazaCon™ powder, rhodamine-B dye, corn oil, and alcolec S, which keep the bait together in a beautiful, sticky mess. The rhodamine-B dye is pink so it turned the bait pink. Some squirrels presented with pink on their fur. The dye acts systematically, so three whiskers were pulled from each captured squirrel and were analyzed under a fluorescent microscope for the presence of fluorescent bands. When the squirrels were trapped, the animals were taken to the lab to be weighed, sexed and have blood drawn. During the last trap session, female squirrels had ultrasounds done and their blood was analyzed for hormone levels.

This Creative Inquiry, other than stopping the growing population of squirrels, encourages students to develop individual projects. The students develop hypotheses, conduct field work, analyze data, and draw conclusions. Many of the students presented their results at conferences, including the annual Wildlife Society Conference in both Pittsburgh and Milwaukee. Kristina Dunn says that, “Not only do the students get involved in the fieldwork, but they get an understanding as to the intricacies involved with a graduate project.” From the classroom, to the field, to the real world, these Clemson students get to share their knowledge and expand their problem-solving skills.
For example, student Mark McAlister noticed that non-targets, like birds and chipmunks, were going into the L-shaped hoppers and taking the bait. Mark decided to test different bait types to determine whether the bait type influenced non-target activity. He wanted to limit the amount of non-target activity at the hoppers so he created mock bait of corn, unsalted peanuts, and sunflower seeds. Mark commented, “I designed my study to test if changing the bait to whole kernel corns or peanuts would result in a reduction in non-target species usage.” He found that non-target activity did vary with bait type.

The students in this Creative Inquiry were given a problem, and through a series of tests and observations found a solution. This project taught students how to collect raw data, analyze it, and draw conclusions. The project was a success, limiting the squirrel population, at least for some period of time. But the contraceptive is not permanent, like the birth control pill, the squirrels must continue to take the bait during mating season every year. If persistent, Clemson could save itself from the expensive problems caused by the squirrels.
Legionella! Legionella! Legionella! What is it? Why do the Centers for Disease Control and Prevention care about it? And why has the McNealy Lab decided to investigate it? Legionella is a bacterium that causes a type of pneumonia and can be found almost anywhere there is fresh water. It is the number one cause of waterborne disease outbreaks in the U.S. and is estimated to hospitalize 8,000 – 18,000 people a year here in the U.S. One reason that Legionella causes so many outbreaks is by its ability to persist in a biofilm. A biofilm is a group of bacteria and other organisms that live together to better protect themselves from the environment. Although some research has been done, little is known about Legionella biofilms.

The Creative Inquiry, Biofilm Interactions, studies such biofilms in hopes of achieving a better understanding of how biofilms interact with the environment, ultimately to help prevent future outbreaks of Legionella. Dr. Tamara McNealy, associate professor of Microbiology, leads this Creative Inquiry team in building and designing personal and group projects to help better understand biofilms.

One of the ongoing projects in the lab is to understand the life cycle of the biofilm and to determine how biofilms respond to the various environmental stressors to which they are normally exposed. The group also investigates how genes are expressed. Much of the investigation uses confocal microscopy, which generates multi-color, 3D images of the biofilms. This technique was a relatively new way of looking at gene expression in biofilms. The lab worked closely with the Clemson Light Imaging Facility (CLIF) to perfect the protocols. Once trained, undergraduate students work independently in the facility to acquire and analyze their images.

This Creative Inquiry also explores the composition of a Legionella biofilm. Bacteria in a biofilm secrete products, primarily proteins, polysaccharides and extracellular DNA, to build a matrix that supports and protects the organisms within. Each matrix is specific to the bacteria in the biofilm. Components of the matrix are targets for biofilm disinfection and eradication strategies. Understanding the
components of a biofilm matrix could help predict how biofilms will respond to the environment and help develop novel eradication techniques such as the use of nanoparticles.

Nanoparticles are particles ranging from 1 to 100 nanometers and can be composed of many different materials. In addition to the possible use in biofilm eradication efforts in man-made environments, nanoparticles are also found in many products we use, such as cosmetics or sunscreen. As a result, nanoparticles are released into our environment, and can eventually settle onto microbial biofilms. The long-term impact of nanoparticles on native biofilm composition and function is unknown. With the growing use of nanoparticles and the limited understanding of their ecological impact, the work that this Creative Inquiry is doing provides an excellent opportunity to generate data that can affect environmental health and safety concerns and policy.

McNealy stated, “The work conducted by the undergraduates on the team has provided essential data from which the project continues to grow. Experiments that give you interesting data that enable you to then ask more questions is how science progresses. This happens in this group.” The McNealy Lab is a dynamic place with three graduate students and up to ten undergraduates participating in any given semester. Each undergraduate receives mentoring from Dr. McNealy and the graduate students. There is always someone to talk to and ask questions. Bethan Fanning, a senior Microbiology major, shared, “In this lab, we are each given our own unique projects, allowing us to learn how to plan an experiment, think critically through any problems we encounter, and interpret data. Through my experience, I have gained a greater understanding of scientific research and microbiology, far beyond what I could have learned in classes alone.”

Students also engage other scientists, peers and the public through presentation of their research at professional conferences. Recent presentations were made at conferences in Charleston, Boston, and Australia, including meetings of the national and regional American Society of Microbiology. The lab also presents at events sponsored by Clemson, including the Focus on Creative Inquiry Forum (FoCI) and the Clemson Biological Sciences Annual Student Symposium (CBASS).

The research activities of the Biofilm Interactions Creative Inquiry provide invaluable experiences for the students and advance the study of microbiology and biofilms.

A description of the lab’s work and its publications can be found at www.microbesadapt.com.
Lower back pain associated with degeneration of invertebral discs affects tens of thousands of people in the United States, but the team, Engineering the Intervertebral Disc, led by Dr. Jeremy Mercuri and Dr. Dan Simionescu, in Bioengineering, is attempting to change that. This five-person team has been working for three semesters on developing a tissue-engineered total intervertebral disc (IVD) replacement. An IVD is the layer of cartilage that acts as a shock absorber between vertebral bodies (back bones) in the spine. The idea is to create tissue-engineered IVD using discs from the tails of cows as a starting scaffold material. After studying literature to find the best surrogate to the human IVD, students found that a bovine (cow) IVD had the most similar size, structure and biochemical makeup.

The team is working towards removing the cow cells while still maintaining the native architecture and biochemistry of the IVD. Ultimately, the team will subsequently replace the cow cells that they removed with human stem cells. In order to remove the cow cells, detergents and agitation are used to ‘wash off’ the cells. The CI students are trying different methods to see which one works best, and if they are successful, they hope to apply for a patent. To date, the team has tried four or five different de-cellurization procedures and are now attempting to develop their own repeatable method. “The ideas essentially came from students reading literature and identifying different techniques and detergents that others have used in their own unrelated technologies,” Mercuri said.
The process has been challenging, but it is a hands-on experience that allows students to develop their research and critical thinking skills as bioengineers. The team meets every semester to go over what works and what doesn’t. “It has definitely been challenging to try and find a good process. It’s been a great learning experience. I feel like I learned a lot by just being here,” Clayton Compton, a junior Bioengineering major said. The team will continue working towards completing the process of creating the tissue-engineered IVD and completing their research. The students are careful about what they release to the public so they do not limit development of intellectual property, but they presented a poster at the 2015 Focus on Creative Inquiry Poster Forum.

Disc degeneration will affect most people at some point in their lives. The problems associated with degeneration of an IVD can decrease mobility, pinch nerves and cause pain. Multi-factorial degeneration is a especially problematic because it is caused by several different factors such as genetics, mechanics, and IVD nutrition. If the cells are malnourished, they are more likely to malfunction and break down themselves. There is no blood supply directly in an IVD, which creates a harsh environment, and can contribute to structural breakdown. This eventually results in the need for a replacement.

The overall goal for the Creative Inquiry team is to take human cells and place them in vitro on the structure of the decellularized cow disc and observe whether or not they can regenerate the entire tissue. Their hope is to get as close as possible to a healthy disc. The key difference between implanting a disc and currently available metal hardware is that the engineered disc will be able to grow and regenerate over time. The development of this technology may significantly change the way IVD replacements are developed in the future because the tissue engineered replacements will closely resemble the normal construction of natural IVDs, and will provide another option for those suffering from disc degeneration.
In each of the past five years, Dr. James Gaubert, senior lecturer in Marketing, and the marketing students in his Creative Inquiry Advertising Campaign Development and Execution have developed an advertising campaign from start-up to presentation. This Creative Inquiry teaches students how to collaborate, devise a strategy, and execute an advertising campaign which they then present at the national competition held by the American Advertising Federation in April each year. Teams have been very successful placing first in the nation with a General Motors campaign, fourth in the regional district with a State Farm campaign, and third in the nation with a Taziki campaign.

“This Creative Inquiry has helped me learn more about different companies and the strategies that they use. “By learning in a group setting, we are able to collaborate with each other and expand our ideas,” commented Carolina Blackwell, a junior Marketing major. The skills that the group developed carry over into the business world, and will contribute to their future career success. During the 2015 spring semester, the group worked with Pizza Hut to further develop their smart phone app and increase their orders through mobile application to 72%. They also examined the various ordering options, such as phone, computer, and mobile app, in order to compare people’s preferred methods of ordering.” Based on this research, the team will devise a strategy design to make the app more “user-friendly,” in order to increase Pizza Hut’s sales from customers using the mobile app.

The Creative Inquiry is broken up into four groups: strategy, research, creative, and media. These teams continually collaborate to ensure fluidity in the final project. As each project unfolds and the research is completed, the teams recombine to produce a presentation. The Creative Inquiry runs like an agency, with positions that help organize, express creativity, and meet deadlines. For senior Marketing major and president of the Creative Inquiry, Madison Clark, the most difficult challenge was getting individual groups to meet deadlines and getting the work completed in a timely and efficient manner so that the teams could combine to focus on the end product. The culmination of the 2015 project was a 16-page book that contained raw data and explanations of the campaign that the students designed.
Phil and Mary Bradley are dedicated Clemson supporters. In addition to making the first major gift to Creative Inquiry, they established an annual award to recognize 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 the award.

**Bradley Award Recipients**

- 2015 Dr. Michael J. Childress, Associate Professor, Biological Sciences
- 2014 Dr. Heather Walker Dunn, Research Assistant Professor, Animal and Veterinary Sciences
- 2013 Dr. Marian (Molly) Kennedy, Associate Professor, Materials Science and Engineering
- 2012 Dr. John DesJardins, Assistant Professor, Bioengineering
- 2011 Dr. Delphine Dean, Assistant Professor, Bioengineering
- 2010 Dr. June Pilcher, Alumni Distinguished Professor, Psychology
- 2009 Dr. Karen Kemper, Associate Professor, Public Health Sciences
- 2008 Dr. Susanna Ashton, Professor, English
- 2007 Dr. Mark Charney, Professor, Performing Arts

**Dr. Doris R. “Dori” Helms Creative Inquiry and Innovation Endowment**

She’s been called a teacher, a mentor, an idea machine, and an inspiration. Dr. Dori Helms is all of that and more. Having served Clemson for 40 years, the last 13 as provost, the recently retired Helms had a profound impact on the university, by challenging students, earning the respect of her colleagues and working to transform Clemson into a nationally ranked research university.

To continue her legacy, Clemson has established the Doris R. Helms Endowment for Creative Inquiry and Innovation. The endowment will benefit student and faculty teams generating ideas and solving problems through Creative Inquiry and will support Clemson centers for innovation, such as the Watt Family Innovation Center.

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