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From the Dean

This edition of IDEaS offers features that have a service thread running through them. Some are perfect examples of how research often results in applications that benefit society at large. Others underscore the importance of individual commitment.

On a personal note, I’ve recently had the honor of being elected vice chairman of the National Science Board (NSB). This vote of confidence by the NSB membership presents a unique opportunity – one for which I am extremely grateful. My work with the NSB is a reflection of Clemson’s commitment to public service and my own personal philosophy of involvement. Early in my academic career, I made a conscious decision to accept service assignments that provide valuable experiences. As dean, I emphasize the importance of translating discoveries into useful products and services for society.

One of our features tells the story of Engineers for Developing Countries – an organization that provides ways for our engineering students to use their skills for a better world. This group came together more than two years ago with a desire to develop a project or series of projects for which they could take ownership and sustain student involvement for an extended period of time. This story of dedication, commitment and accomplishment is an inspiration. These students are making a real difference in the lives of people in Cange, Haiti, particularly after the devastating earthquake that occurred in January.

There is also a story about Juan Gilbert and Damon Woodard, professors in the Clemson University School of Computing. Gilbert is the chair of the new human-centered computing division that applies computer solutions to real-world problems. He has translated his research to successful tools for electronic voting and college admissions. In 2008, Woodard established the Center of Advanced Studies in the Identification Sciences. He applies his skills in facial and periocular region-based biometric recognition to national security concerns.

Another feature in this issue describes a public service commitment of a different kind – one undertaken by a corporate partner. Earlier this decade, Eastman Chemical Company donated a portfolio of innovative fiber technology to Clemson comprised of more than 100 U.S. and international patents and other intellectual assets. As promising as the CSM technology was, Eastman felt it didn’t fit into its core business. The company set out to find a research university that could develop the technology to its full potential and eventually license it for commercial use. Clemson was deemed eminently qualified. While this gift may benefit the University at some point, the ultimate recipient of Eastman’s good will is the general public.

Our “Clemson Family” feature tells the story of Terry Tritt — a Clemson alumnus whose commitment to the institution has put the University on the international stage in thermo-electric research. His avocation also carries him to a different sort of stage, where he’s making notable contributions to the arts. His story is enlightening and entertaining.

All of us — particularly engineers and scientists who make time for public service and imagine useful applications of our discoveries — have unprecedented opportunities to contribute to the betterment of mankind. I’m proud to be a part of these efforts.

Sincerely,

Esin Gulari, Dean
College of Engineering and Science
Clemson University
Earlier this decade, Eastman Chemical Co. donated a portfolio of innovative fiber technology comprised of more than 100 U.S. and international patents and other intellectual assets. The technology is known by several names, but it is commonly referred to as capillary surface materials, or CSM. Its ability to handle fluids is what makes it unique.

CSM fibers have an extraordinary capacity for the wicking of fluids — even viscous fluids such as oil — along the fibers’ specially designed surfaces.

As promising as the CSM technology was, Eastman felt it didn’t fit into its core business; the company set out to find a research university that could develop the technology to its full potential and eventually license it for commercial use. Clemson was deemed eminently qualified.

“I like to think one reason the Eastman gift came to Clemson is the atmosphere of collaboration that one finds in the College of Engineering and Science,” observes Philip Brown, an associate professor of materials science who joined the faculty in 2002. “It’s certainly what brought me here.”

During his interview visit, Brown was invited to a faculty home for an old-fashioned Southern barbecue. He was joined by a group of professors from the college.

“Here were physicists, chemists, bioengineers, mathematicians and materials scientists — all talking about these research projects they were currently working on together,” says Brown. That sort of collegiality and cooperation were things he had not experienced prior to that point. “I decided right there that if Clemson made me an offer, I was going to accept,” he adds.

Shortly after his arrival in Clemson, Procter and Gamble (P&G) donated additional fiber technology that complemented the Eastman gift. The company’s capillary channel film and fiber technology was similar to CSM in that it dealt with synthetic fibers that had grooves or channels that allowed the fibers to readily wick fluids. Like Eastman Chemical, P&G was looking for a laboratory or company needs to analyze a mixture to determine what components are present, and if they’re present in the correct amounts, it relies on a process known as HPLC to separate those components. The pharmaceutical industry, for example, uses HPLC daily for quality control purposes.

A critical part that resides within the HPLC instrument — where the separations actually take place — is the column. This pencil-sized tube is generally filled with microscopic particles of silica through which the analyte (fluid to be analyzed) is pumped. If production schedules so dictate, a user can speed up the analysis by increasing the flow rate through the column by increasing the pressure. The flow rate, therefore, is limited by how much pressure the instrument can withstand, and that’s where Invenca saw an opportunity.

Having obtained a license — based on patents secured by chemistry professor Ken Marcus — to use Clemson University’s CSM technology, Invenca replaced the silica particles in the separation column with Clemson’s fibers. This revolutionary change allows the instrument to be operated not only at higher flow rates, but at much lower pressure — and at a lower cost. With Invenca’s innovative product, upgrading to expensive ultra HPLC instruments will no longer be necessary. Moreover, the company’s CSM-filled column is the same size as a standard separation column and can therefore be easily installed in existing HPLC instruments.

Fiber technology threads the needle of economic development.
Above: Phil Brown discusses the research with a graduate student.

Right: Chemistry professor Ken Marcus conducts polymer fiber research with a startup company that has licensed technology through CURF. 

Facing page: Bioengineering research with a startup company that has licensed technology through CURF.

One of the device applications involves the analytical chemistry of proteins and other biological compounds. The work of chemistry professor Ken Marcus involves the separation of proteins in matrices that are present in the post-processing of protein therapeutics. Basically, proteins are processed in a variety of solutions (blood to buffers) that are not compatible with many analytical instruments. Marcus has developed an approach that allows him to separate proteins from these solutions and then elute them into instrument-friendly solvents. He is a principal researcher along with materials science and engineering research associate Kate Stevens in a startup company called Specialty and Custom Fibers LLC, which has licensed technology through CURF. In another device application, Chris Cox, professor of mathematical sciences, is working with Brown on a project using shaped fibers from the Eastman Chemical technology in the design of high-efficiency particulate air filters. The large surface area of the shaped fibers (in comparison to round) have interesting effects on airflow, which influence the particulate capture efficiency of filters. Ken Webb, associate professor in Bioengineering, is investigating the application of CSM fibers as scaffolds for tissue engineering. The value of these materials relative to existing alternatives is that parallel channels provide a mechanism for topographic guidance—a biological phenomenon in which living cells orient themselves parallel to physical features of the surface on which they are growing. This is particularly beneficial in designing materials for use in highly organized tissues such as the nervous system, tendons and ligaments, and muscle.

The Clemson Apparel research Center, under the direction of professor Chris Cole, is investigating fabric applications of the technology for apparel applications. This body of work takes advantage of the ability to design the width and depth of the channels in the fibers to hold active particles. The particles are held without the use of added adhesives. Adhesives would “blind” the activity of the particles by covering a substantial portion of their surface.

Clearly, the use of shaped fibers can be quite varied. CSM fibers hold great promise in oil spill remediation, chemical/biological decontamination, sound insulation and aesthetic ligaments among other applications. One license, for example—a license LLC—is using CSM in a process called high-performance liquid chromatography. Building upon the donated technology, Clemson University researchers are spinning a web of new applications and new markets.

**Patent Applications to Date**

<table>
<thead>
<tr>
<th>Inventor(s)</th>
<th>Title</th>
<th>U.S. Patent Filing Date</th>
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<tr>
<td>Ken Marcus</td>
<td>Capillary-channeled Polymer Fibers as Stationary Phase Extraction Media</td>
<td>3/13/06</td>
</tr>
<tr>
<td>Ken Marcus</td>
<td>Capillary-channeled Polymer Fibers as Stationary Phase Media for Spectroscopic Analysis</td>
<td>Patent issued 12/14/06 (provisional)</td>
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<tr>
<td>Ken Marcus, Kenneth Christensen</td>
<td>Capillary-channeled Polymer Fibers and Films for the Coating, Spinning, and Modification of Colloidal Matter</td>
<td>2/7/07 (provisional)</td>
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<tr>
<td>Chris Cole, Deborah Lackie, Kate Stevens and Philip J. Brown</td>
<td>Activated Protective Fabrics</td>
<td>6/1/10</td>
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CES STUDENTS ARE APPLYING THEIR SKILLS TO MAKE A DIFFERENCE IN OTHER PARTS OF THE WORLD.

September 2008, a group of students in the College of Engineering and Science came together in search of a way to offer their skills for a better world. The group, led by civil engineering graduate student Jeff Plumblee, envisioned a project or series of projects for which they could take ownership and sustain student involvement for an extended period of time. A few months later, a registered professional engineer with volunteer experience in Haiti addressed an undergraduate civil engineering class about the need for clean, accessible water in Cange, Haiti. It was evident that the challenges in Cange were well-suited for the group’s project goals and areas of expertise.

By the next summer, the students were in Haiti, conducting research on the situation and collecting data to begin system design once they returned to Clemson. This was the beginning of a Creative Inquiry (CI) project with Engineers for Developing Countries (EDC) that has drawn on the expertise of the community, alumni, faculty and the students themselves.

Laura Simpkins was part of the initial 2009 visit to Haiti. She and other group members collected data to rebuild a water system that will revolutionize how the townspeople approach the daily task of acquiring clean drinking water. The group was searching for ways to eliminate a two-mile walk with an 800-foot vertical climb to the nearest water source.

Simpkins joined the group as an undergraduate chemistry student and has continued participating as she pursues her graduate degree in environmental engineering. “The group started as a way for students to apply the skills they have learned to real-world needs,” she says. “We’ve split up into groups to tackle each aspect of the project. Some raise funds while others design water pumps—but no matter what you do, the experience is life-changing and rewarding.”

But the benefits do not stop there. Employers are watching. According to Lance Bell, a civil engineering professor and the group’s adviser, this CI project helps the students differentiate themselves from other job applicants by adding community service and...
real-world experience to their résumés. “The project is entirely student-driven,” he says. “Faculty are available to assist as needed, but it’s primarily run by the students. In some cases, employers value this type of experience with teamwork, initiative and networking more than a GPA.”

This CI group has relied greatly on the help of the Clemson Family to make their project successful. Group members who have graduated have served as liaisons to experienced consultants from companies like Duke Energy. The Episcopal Diocese of Upper South Carolina has also responded to the need by helping to raise funds for supplies and service trips.

The students have completed the design of a water filtration system and are currently renovating a water distribution system. Recent challenges include building a barge that is able to carry 2,000 pounds of pumps and pipes across a lake. The ingenious team designed one out of 55-gallon plastic drums.

Future projects include redesigning dilapidated community water distribution stations, implementing a biodigester for waste treatment and investigating the use of modified shipping containers as homes. Twenty-five students, consisting of both undergraduate and graduate students, have signed up to carry on the work of the group during fall semester.

Clemson’s EDC group leader, Jeff Plemline, was able to collect essential background information and equipment requirements/constraints before visiting Cange. It was determined that traditional surveying equipment such as a total station, tripod and prism pole could be held in customs for some time or even confiscated. As a result, the students had to use some ingenuity in completing their surveys. They decided that a hand level and a dimensioned length of PVC pipe could be used to calculate elevations and approximate distances. Plemline also acquired surveys previously completed in the area that the students could use as a reference.

“In some cases, employers value this type of experience with teamwork, initiative and networking more than a GPA.”
— Lance Bell, civil engineering professor and EDC adviser

Human-Centered Computing Gets a New Face

Professor Juan Gilbert is chair of the new human-centered computing division within the School of Computing. He says the director’s concept is a relatively new idea in that it applies computer solutions to real-world problems.

“I’ve been doing this kind of work for years,” says Gilbert. “It’s finally getting the recognition it deserves as a cutting-edge discipline. Students have flocked to this area because they see the connection between what they are doing in the lab and how it will impact the public. They get it immediately.”

Gilbert says students are drawn by the desire to see how technology helps the community, just as he was drawn to Clemson because of the University’s willingness to transfer research to the private sector.

“Clemson is very conductive toward startup companies and technology transfer,” says Gilbert. “My research is applied — with real-world applications — so it will ultimately transfer. That’s what I was looking for when I came to Clemson.”

Two of Gilbert’s pet research projects have made the successful transfer to business. The first is his research
Clemson University’s College of Engineering and Science

in electronic voting spawned by the hanging-chad controversy in the 2000 presidential election. The result is a first-of-its-kind, accessible voting system called Prime III. Gilbert explains it is a multimodal system where votes are privately and securely taken by touch, voice or both. The technology, known as universal design, allows everyone within a precinct to vote on the same machine, reducing the training required of poll workers and the opportunity for error or security breaches. Gilbert has testified to the U.S. Senate’s Rules and Administration Committee and the U.S. Election Assistance Commission Board of Advisors.

The second project is a data mining and software analysis tool that allows education admissions officers to address diversity and capacity in admissions while maintaining academic standards and adhering to the law—all done in a shorter period of time than traditional methods. A company called Applications Quest™ of Fairfax, Va., was created as a result of this research.

Gilbert credits students as being the workhorse of research. “They’re vital at every level, undergraduate and graduate,” says Gilbert. “It’s important to get our freshmen involved at the earliest possible time. The type of research we do is a tremendous recruiting factor. Students love, once, that they play a significant role, and two, that they can jump in early. They’re also attracted to the collaborative nature of the research. We work with disciplines across campus to accomplish a common goal.”

The editors of Speech Technology recently named Gilbert one of four Speech luminaries for his influence in shaping the speech technology industry, and he was just selected to the 10th Annual 50 Most Important African-Americans in Technology by eAccess Corp. He is also an associate of the National Research Council of the National Academies and a distinguished speaker for the Association for Computing Machinery.

Gilbert is a believer in communicating science to the broader community in an effort to educate the public. “My research is applied — with real-world applications — so it will ultimately transfer. This is what I was looking for in coming to Clemson.”

—Juan Gilbert

He has been invited to give more than 150 speeches across the country in areas that include motivational talks, career development, technology policy and scientific research. Most recently, he has been selected to serve a two-year term on the National Science Foundation (NSF) Computer and Information Science and Engineering Advising Committee. Made up of members from universities and industry, this committee counsels staff in the NSF’s Computer and Information Science and Engineering Directorate. The directorate funds more than 80 percent of all federally sponsored academic computer-science research in the United States.

School of Computing assistant professor Damon Woodard, right, became acquainted with Juan Gilbert through the Future Faculty and Research Scientist Mentoring (FFRSM) program. The FFRSM is part of Gilbert’s experience with his NSF Broadening Participation in Computing: African-American Researchers in Computing Sciences grant. Through the FFRSM, Gilbert mentors soon-to-be computer science Ph.D. students through the academic and research scientist job search process. The FFRSM led Woodard to Clemson, and ultimately, he wound up bringing his mentor as well.

Curiously, Woodard is the director of the Center of Advanced Studies in the Identification Sciences (CASSIS), located within the School of Computing. The lab is working with a $2 million grant from the Office of the Director of National Intelligence and has joined with other universities to create CASSIS. The aim of the center is to strengthen biometric identification, which is the measurement of physical characteristics to verify a person’s identity.

Woodard has led the way in developing periocular and iris recognition techniques, which can achieve high performance when using less-than-ideal-quality data. “Historically we’ve looked at the iris for identification, but what if the iris is obstructed when the subject blinks? We then can look at eye region features such as skin folds and wrinkles for more accurate identification, along with the iris,” says Woodard.

Woodard believes the techniques he has developed could open up additional possibilities for applications—such as airport, border and home security procedures.

Under the five-year, $8.9 million grant, Clemson is working with researchers from Carnegie Mellon University, North Carolina A&T State University and the University of North Carolina at Wilmington.
Perfect Harmony

By Charreau Bell

Although he is known worldwide for his research in the field of thermoelectric materials, Terry Tritt is also known locally — and at least as far as Denver — as the lead vocalist and guitarist for the bluegrass band The Grass Room Revue. The band’s humble beginnings are found in Highlands, N.C., Tritt’s hometown, where he grew up loving music.

After graduating from high school, Tritt spent the next three years playing in a band and working. “My dream was to go to Nashville and be a musician,” he says. “But my destiny was down a different path.” Tritt’s first step on that path was inspired by his fiancée, Penny, who indicated she wasn’t terribly excited about the prospects offered by a budding musician. Instead of pursuing his musical career, Tritt committed himself to earning his bachelor’s and doctoral degrees in physics at Clemson University. He then moved to Washington, D.C., on a prestigious fellowship at the Naval Research Labs. “There’s never been a doubt in my mind,” he observes. “Going after my education was the right thing to do.”

Eleven years after graduating, he returned to his alma mater to interview for a faculty position in the physics department. After joining the faculty in 1996, Tritt began building a world-renowned thermoelectric materials program. Along the way, he rediscovered his love for music. He recalls, “When I came back here, we were working something like 70 hours a week getting the lab going — the first couple years were really intense. Then, I ran into some of the old guys I used to play music with. We started getting together and playing, and it became this tremendous release that I really needed.”

Now Tritt is making beautiful music, both in the lab and the recording studio. He currently serves as the director of the Complex and Advanced Materials Lab at Clemson, which is one of the premier facilities in the world for thermoelectric research. The current focus is on the development of...
Clemson announces three-part clean-energy plan

Sensing and attracting "green" jobs, preparing people to fill them and generating innovations to propel the state and nation into energy leadership positions are the goals of Clemson University's clean-energy strategy, outlined in a recently released white paper.

The white paper entitled "Clemson University's Clean Energy Strategy Plan" draws from the proceedings of two emergendy convened summits Clemson hosted in late 2008. The events drew hundreds of academics, industry and government leaders and included round discussions and keynote addresses by U.S. Secretary of Energy Steven Chu, General Electric Electric chairman and chief executive officer Jeffrey R. Immelt and U.S. Sen. Lindsey Graham.

Five CES researchers net NSF CAREER awards

The Faculty Early Career Development (CAREER) Program, the National Science Foundation's (NSF) most prestigious awards in support of early-career development of teacher-scholar achievements, announced grants to five CES faculty this spring.

Zahra Hazari, an assistant professor of engineering and science education, received her NSF CAREER grant to study ways to improve physics and biology learning for high school students, hoping to help more students — particularly young women — develop a passion for science that will enable them to perform better in science classes. Using classroom case studies, Hazari will study what she calls "reversal learning experiences" that high school students have reported in physics. She will then develop a pedagogical plan including 15 sample lesson plans with detailed activities that connect physics to everyday contexts, counter the misconception young people have about physics and help students see themselves as capable of performing well in the subject. She will also seek to grasp the long-term impact of these experiences as students progress from high school to college.

Assistant professor of engineering and science education Julie Teonor will research the social interactions that influence underrepresented students' decisions to enter and continue in the study of engineering. She will be the first researcher to apply the theoretical framework of social capital to explain the academic and career choice that are available to engineering students. Building on the results of researches in other fields, Teonor's study will bring fresh perspectives and new tools to the study of engineering student persistence. Her project seeks to increase the number of students who complete engineering degrees and subsequently fill engineering jobs or start new high-tech businesses.

Guang Li, an assistant professor of mechanical engineering, seeks to develop a theory and methodology for analysis of nanometeric materials and structures. Because accurate and efficient computational tools are not currently available for analysis of thermomechanical interaction in ultra-small structures, it will address the gap that exists between current models and continuum and atomistic theories. His project will allow him to develop a multipurpose computational approach, combining the thermomechanical models. In addition, he will explore a concept of mechanical design of thermal transport in materials. Li also will develop a simulation-based learning and discovery Web site to engage K-12, undergraduate and graduate students in the study of nanomaterials.

Brian Donnelly's project will take him inside the minds of molecules. The assistant professor of chemistry will use Clemson's "condominium cluster" computer — ranked by the American Computingepisode for supercomputing in America — to calculate how molecules, especially the proteins that are the biochemical workhorses of the human body, will adapt and change when they meet new partners, such as medicines. By analyzing experimental data on the movement of proteins molecules over time and under different circumstances, Donnelly hopes to shed light on how proteins evolve. In addition to identifying the physical and chemical laws that dictate these changes, the research could help medical scientists develop therapies for pathogens that have become resistant to current therapies.

Assistant professor of mechanical engineering Laine Meece will research model-based control methods for machining processes, where material is removed by high-shear-rate cutting. His project will involve real-time modeling and the exchange of information among processes in a machining system to maximize efficiency. Meece will focus on model uncertainty and adaptation in a manufacturing system's complexity grows. Improved modeling and control methods would yield in a more profitable manufacturing and more competitive manufacturing of high-quality parts for automotive, aerospace and consumer products industries, among other manufacturers. Meece also will develop an educational component with the Clemson to Technology, a nationally recognized middle school program for improving the instruction and experience of S.C. students and encouraging future researchers to pursue an education in manufacturing.

Clemson professors elected Fellows

Anand K. Gramopadhye, professor and chairman of industrial engineering at Clemson University, has been elected an Institute of Industrial Engineers Fellow, the highest recognition conferred by the professional society. The honor recognizes Gramopadhye's career in industrial engineering research, which focuses on solving design problems in human/machine systems and modeling human performance in technology-intensive environments. His work has shaped medical care, aviation and manufacturing.

Kathleen Richardson, a professor in the School of Materials Science and Engineering, also was elected to the rank of Fellow at the October 2009 Board of Directors meeting of the Optical Society of America (OSA). Richardson joined one of 61 U.S. members elected to this prestigious rank and was acknowledged for her "contributions to the advancement of glass science in optics through teaching and research across institutions and international boundaries.

Jean-Marc Dubois, a senior lecturer in mechanical engineering, was elected to the College of Fellows for the American Society of Mechanical Engineers. Dubois's research involves nanocomposites, whose superior physical properties enable more efficient conversion of heat into electric energy. Under his guidance, the lab has obtained more than $11 million of external funding, including grants from the Department of Energy and the Department of Defense. He has been a featured speaker and panel expert at thermoelectric conferences all over the world, including Japan, China and Germany. Tritt has published more than 200 scientific papers, and his research group has published more than 30 refereed articles in the last year alone. For his long history of excellence in research, he was awarded the 2008 S.C. Governor's Award for Excellence in Scientific Research, the Clemson Alumni Award for Research as well as the Clemson College of Engineering and Science Award for Achievement in the Sciences.

Tritt, however, measures his success in terms of the accomplishments of his graduate and undergraduate students. "They come first," he says. "I want to see them succeed — I've had numerous students who've won fellowships and scholarships over the years. They're on go and done well. That's how I measure my success. I tell my students to remember to play hard and work hard, and good things will happen."

The group has released five CDs. The band enjoys a bluegrass CD — Carolina Star — in the same year," Tritt beams. The band enjoys.

For his long history of excellence in research, Tritt was awarded the 2008 S.C. Governor's Award for Excellence in Scientific Research.

For his long history of excellence in research, Tritt was awarded the 2008 S.C. Governor's Award for Excellence in Scientific Research.
has covered a wide area in two-phase flow and heat transfer including analytical formulation, modeling and measuring techniques. His latest research activities mainly concern forced convective subcooled boiling; single-phase, forced convection in narrow rectangular channels; and gas-lift systems for reprocessing plants.

National Science Education Leadership Association recognizes Clemson center coordinator

Thomas T. Peters, executive director of the S.C. Coalition for Mathematics and Science and coordinator for the Clemson University-based Anderson-Oconee-Pickens-Greenville Regional S'MART Center, is the National Science Education Leadership Association’s 2010 Outstanding Leader in Science Education.

Peters received the honor, which includes a one-year association membership, a plaque and a $1,000 check from Pearson Publishing Co.

The S'MART Center was created in 1994 by an NSF-funded Statewide Systemic Initiative grant. The center, along with a statewide network of regional centers and business, education and public/policy partners, has been instrumental in leading schools through changes associated with the creation of mathematics and science curriculum standards and the implementation of South Carolina’s student achievement testing program.

Clemson students earn prestigious Goldwater Scholarships

Four Clemson University students have received the prestigious Barry M. Goldwater Scholarship. The scholarship honoring the late senator is intended to foster and encourage outstanding students to pursue careers in mathematics, engineering and the natural sciences.

The University may nominate up to four students a year for the scholarship. This year’s recipients are:

Benjamin Cousins, a sophomore in mathematical sciences and computer science;

Kemper Talley, a junior physics major;

Chelsea Woodworth, a sophomore biology major; and

Ann Guggisberg, a junior majoring in genetics.

Clemson University named to President’s Higher Education Community Service Honor Roll

For the third year in a row, Clemson University has been named to the President’s Higher Education Community Service Honor Roll, the highest federal recognition a college or university can receive for its commitment to volunteering, service-learning and civic engagement. Honorees are chosen based on a series of selection factors, including the scope and innovation of service projects, the percentage of student participation in service activities, incentives for service and the extent to which the school offers academic service-learning courses.

Last year, more than 10,500 Clemson students engaged in some form of service-learning activity or community service, spending a total of more than 126,300 hours volunteering.

Clemson to offer new environmental engineering undergraduate degree

Clemson University will offer a new B.S. degree in environmental engineering this fall, the first of its kind in South Carolina. Tanju Karanfil, environmental engineering professor and department chairman, says the new program fills a niche within the state.

“The new degree should help keep the best and brightest students here in South Carolina to pursue their education,” he said. “We’re facing serious environmental issues in the future, such as contaminated water supplies, hazardous wastes, increasing populations and limited resources. We need a highly trained work force ready to tackle environmental issues. This technical and challenging program is led by world-class faculty dedicated to providing the best possible educational experience.”

Clemson professor recognized for dedication to manufacturing industry

Two prestigious manufacturing organizations have recognized Clemson University professor Thomas Kurfess for his outstanding contributions to the profession.

The Society for Manufacturing Engineers gave Kurfess the 2010 Education Award for promoting manufacturing-related curricula and training methods as well as inspiring students to enter the manufacturing profession.

Kurfess also is one of two new members on the board of directors elected to the National Center for Manufacturing Sciences, North America’s largest collaborative research and development organization, in addition to serving as the administrator of the Robotics Technology Consortium.

Proterra selects CU-ICAR for research, development and assembly of hybrid commercial vehicles

Proterra Inc., which develops and assembles fuel-cell hybrid-powered transit vehicles, recently announced that it will locate a facility for research and development as well as assembly of its products at the Clemson University International Center for Automotive Research in Greenville.

Proterra and its partners design, develop and assemble all-electric and battery-dominant hybrid drive solutions and complete vehicles for commercial applications, including transit, school and commercial buses; parcel delivery vehicles; and other class 4-8 trucks.

Proterra anticipates that it will invest $68 million and create 1,300 new jobs over the next seven years in Greenville County. The company will require a variety of skilled workers to support functions such as mechanical assembly, warehouse, logistics, management, engineering and quality assurance.

National Transportation Research Center Inc. recognizes two Clemson engineers

Two Clemson University researchers have been recognized by the National Transportation Research Center Inc. for being among the top in the nation.

John Limroth of Greenville, first recipient of a doctoral degree in automotive engineering from Clemson and in the United States, was named Student of the Year. Michael Arant of Williamston, a master’s student in mechanical engineering, was named Outstanding Student Researcher.
Inquiry, Discovery in Engineering and Science

College of Engineering and Science

College Contacts

College of Engineering and Science Administration
Dr. Esin Gulari
Dean
College of Engineering and Science

Dr. R. Larry Dooley
Associate Dean
Research and Graduate Studies

Dr. E.R. (Randy) Collins
Professor and Associate Dean
Undergraduate and International Studies

College of Engineering and Science
109 Riggs Hall
Box 340901
Clemson, SC 29691
www.ces.clemson.edu

Office of the Dean
109 Riggs Hall
Box 340901
Clemson, SC 29691-0901
www.clemson.edu

Contributors

EXECUTIVE EDITORS
Peri Storer
Ron Grant
Rebecca Shepherd

DESIGNERS
Dave Dryden
Christine U. Prado

PHOTOGRAPHERS
Craig Mahaffey
Patrick Wright

WRITERS
Charreau Bell
Ron Grant
Tara Polowczuk
Rebecca Shepherd

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The College of Engineering and Science is made up of 14 separate schools and departments, but the unique structure of combining engineering and science programs within one college has led to an uncommon ability to provide a team-based, integrated approach to teaching and research. Scientists and engineers working together to find more efficient solutions is the structure of Clemson University’s College of Engineering and Science.
Bioengineering

Martine Labbe, Ph.D.
Department Chair
664-356-5338 • labbe@clemson.edu
www.clemson.edu/engs/bio/home.htm

Fast Facts
Graduate, interdisciplinary, Ph.D.
Undergraduate, B.S.
Research expenditures: $12,380,000


Biosystems Engineering

Facilities
The bioengineering department recently expanded its research and education facilities with the opening of the Rhodes Arena. The 29,000-square-foot, three-story addition to Rhodes HALL—home of the department since its establishment at Clemson in the mid-1960s—is part of a development plan unveiled by President Barker in 2007 that includes campus-wide facility and technology improvement programs.

The arena features classrooms equipped with the latest distance-learning capabilities. It was designed for communication, collaboration and networking among undergraduates, graduate students and faculty. Numerous laboratories include those dedicated exclusively to research that supports the bioengineering B.S. curriculum, such as undergraduate labs for tissue engineering, biomaterials and biomechanics. Several other laboratories are designed to facilitate integration of undergraduates and graduate education.

Faculty Highlights
The American Institute for Medical and Biological Engineering elected Naren Vyavahare to its Class of 2010 College of Fellows. D.C. Vourvahis, Hunter Endowed Chair of Bioengineering, received this honor for his outstanding contributions for the treatment of abdominal aortic aneurysm and leadership in biomaterials education and training. Vourvahis was also recognized with Clemson’s Alumna Award for Outstanding Achievements in Research. In October 2009, Vourvahis assumed the role of director of the S.C. Center of Biomaterials for Tissue Regeneration. A $1.5 million B01 grant to fund the development of a heart valve device engineered from collagen scaffold and mass cells. Simionescu is a senior professor in biomaterials and bioengineering faculty member at the Regenerative Medicine, Tissue Engineering, and Biomaterials Research Laboratory, and his research group focuses on finding regenerative medicine solutions to treat cardiovascular and orthopedic diseases.

Student Achievement
Ph.D. bioengineering student Suzanne Parks was awarded an NSF Graduate Research Fellowship for her research in studying engineering approaches to cardiovascular applications. Parks graduated with a B.S. in bioengineering from Clemson in May 2009. She is currently pursuing her doctoral work in the CLU-MUSC bioengineering program in Charleston.

Department Overview
Bioengineering is a science-based engineering discipline that integrates engineering science and design with applied biological and biophysical sciences to solve biomedical and related health and environmental problems. The bioengineering program is unique among engineering disciplines because it incorporates biomaterials, structural and mechanical design.

Caye Drapcho

Koren J.L. Bung, Hunter Endowed Chair of Bioengineering and interim vice provost for Research and Innovation, has been elected to the vice president-presidential of the Society for Biomaterials (SFB). This role on the professional society that promotes advances in all phases of materials research and development by encouraging cooperative educational programs, clinical applications, and physiological design.

Caye Drapcho

Biofuels — particularly biodiesel — made from biomass are playing an important role in the development of a sustainable bioenergy economy. The BioEnergy Research Collaborative (BERC) was recently established to enable consolidated biofuel research efforts among Clemson University, Savannah River National Laboratory, Georgia Institute of Technology, and University of South Carolina.

Caye Drapcho

Many undergraduate students were accepted to summer REU or internship programs, including Natalie Bull (Savannah State Biofuels REU), Jazmine Taylor (Colorado Consortium for Biofuels and Biorefining), and Ana Grod (Biofuels Internship, Ford, and Plan B LLC).
**Chemical and Biomolecular Engineering**

**Department Overview**

Based on the sciences of chemistry, biology, physics and mathematics, the Department of Chemical and Biomolecular Engineering (CBE) at Clemson University is one of the foremost repositories of knowledge and information in the areas of energy and fuels, and "green" engineering and leads the way in medical and health-related research.

In recognition of the national need of greater diversity in areas of employment for chemical engineers, CBE implements meaningful outreach in areas of environmental, energy-related, biotechnology, materials, business management, and applied engineering, mathematics and sciences.

Approximately 55 percent of undergraduate students come to CBE at recruitment with some at both RAEF, Dow Chemical, Kellogg, Clorox, Michelin, Milliken, NASA and Rohs Carolina. In addition, study abroad opportunities abound — including a study abroad in France, summer offered in Vienna, Austria.

There are numerous opportunities for undergraduates and graduate students at CBE. Strong department research programs exist in advanced materials, biomaterials, biophysical, biotechnology, kinetics and catalysis, molecular modeling and simulation, nanomaterials, supercritical fluids, polymer science and engineering, and interfacial science and engineering.

**Faculty Highlights**

- **Charlie Gooding** received the CES 2014 Murry Stotz Award for Excellence in Teaching for his recognition of his outstanding teaching abilities, his outstanding contributions to the educational mission of the department, and his dedication to our students and their personal and professional development.

- **Scott Hanson** was elected to the board of directors of the North American Membrane Society. Hanson also received an NSF grant to work with Timmons Technologies to provide the technical knowledge needed to produce advanced membranes for CO2 separation from natural gas. Design and testing of advanced membranes for carbon dioxide removal is a critical component of the development of emerging standards and technology in bioseparation.

**Department Chair**

Stephen Creager, Ph.D.

Department Chair

864-656-3122 • scmcg@clemson.edu

cbem.clemson.edu

**Fast Facts**

- **Undergraduate**
  - 150 Students
  - 10 Faculty

- **Tenured/tenure-track faculty:**
  - 45

- **Degrees awarded (December 2009 and May 2010):**
  - Doctoral 2
  - Master's 8

- **Research expenditures:**
  - $4,328,018

- **Research thrusts:**
  - Analytical, environmental, organic, and physical; polymer and materials; solid-state, biochemical, bi-organic and medicinal; computational chemistry, chemical physics, and chemical education.

- **Chemistry**

**Department Overview**

The chemistry program is one of the largest and most active on the Clemson campus. More than 20 faculty members have been recognized in strategic planning of more than 100 graduate students with the assistance of approximately 15 postdoctoral and visiting scientists. In addition, several faculty are primarily engaged in undergraduate instruction and chemical education research. Faculty members also manage the department's Nuclear Magnetic Resonance Research Center, Molecular Structure Center and additional computing resources. The research activities of the faculty include projects in the traditional areas of analytical, inorganic, organic and physical chemistry as well as a broad range of interdisciplinary and nongovernmental areas — polymer and materials chemistry, catalytic chemistry, molecular chemistry, computational chemistry, chemical physics, and chemical education and other areas.

**Faculty Highlight**

Brian Dominy was awarded the 2009 Philip H. Award. The award recognizes the chapter's work toward enhancing the professional development of its members, fundraising and mentoring Hispanic students at elementary, middle and high schools in Clemson, Walhalla and Greer. The award also recognizes the chapters presented at the conference from four graduate students in the chemistry department.

- **Department Chair**
  - Brian Dominy
  - 864-656-0822 • bdominy@clemson.edu
  - hirtd@clemson.edu
  - Interim Department Chair

Douglas Hirt, Ph.D.

Department Chair

864-656-0822 • dhirt@clemson.edu

cbem.clemson.edu
Civil Engineering

Ronnie Chowdhury

als, geotechnical engineering, structural engineering infrastructure, applied fluid mechanics, construction resilient and sustainable

Research thrusts:

Research expenditures:

$2,100,000

Doctoral 6

Degrees awarded (Dec. 2009 and May 2010):

Doctoral 35

Master's 61

Enrollment:

Undergraduate 490

Undergraduate 150

A. Burtner Award for Excellence in Advising.

CES

IDEaS

Professors. Chowdhury also received the Frank

Ronnie Chowdhury

D. Eisenhower Fellowship for 2010-2011. Tupper is pursuing

supervision of

K.V. Harish

Graduate student

Yan (Joanne) Zhou received

Ph.D. with a transpor-

Science at the U.S. Air Force Academy.

Research highlights:

Research expenditures:

$1,298,803

Doctoral 6

Degrees awarded (Dec. 2009 and May 2010):

Doctoral 46

Master's 119

Enrollment:

Undergraduate 368

Undergraduate 308

Tenured/tenure-track faculty:

28

Research opportunities: $2,100,000

Research thrusts: resilient and sustainable infrastructure, applied fluid mechanics, construction engineering and management, construction materials, geological engineering, structural engineering and transportation systems engineering

Fast Facts

Civil Engineering

Fast Facts

Department Overview

Student Achievement

Two civil engineering students received prestigous NSFGraduate Research Fellowships. Jeff Plumblee and Jakubh

received advanced degrees under the direction of

Leisl Klitz. Graduate student Prithika Alluri received the 2010

Women in Transportation Suzanne Charlots

Chapar President's Legacy Award and the Helen M. Overly

Memorial Graduate Scholarship. Alluri is pursuing a Ph.D. under the supervision of

Jennifer Ogle.

Graduate student Yan (Joanne) Zhou received Clemson's Outstanding Graduate Research Assistant Award. She also won third prize in the 2010 ITS America Annual Essay Competition. Zhou received her Ph.D. with a transpor-

tation emphasis under the direction of Ronnie Chowdhury.

Graduate student K.V. Harich received the AAS/ RACF 

Construction Chemicals Student Fellowship for the 2010-

2011 academic year. Harich is pursuing a Ph.D. under the supervision of Prasad Rangaraju.

Graduate student Lee Tupper received the Dwight D. Eisenhower Fellowship for 2010-2011. Tupper is pursu-

ing a master's degree under the supervision of Ronnie Chowdhury.

Larry E. Hodges, Ph.D.

Director

464-373-5020 • Office@ce.clemson.edu

www.ce.clemson.edu

School of Computing

Faculty Highlights

Student Achievement

Jason Hallstrom has been named as one of the first CES

IDEaS professors. This distinction is specifically oriented toward recognition of CES faculty engaged in exemplary teaching and research activities.

Stephen Guimaraes and Jason Hallstrom have been granted tenure and promoted to associate professors. Sabarish Babu has joined the faculty as an assistant HCL professor.

Joashen Tabore has joined the faculty as a research professor in HCL. This is a joint appointment with the Department of Electrical and Computer Engineering.

Roy Purga is on sabbatical and will be spending the 2010-2011 academic year as a distinguished visiting professor in the endowed Coleman-Richardson Chair for Computer Science at the U.S. Air Force Academy.

John D. McGinigal was a guest editor for the May/June 2010 special issue of IEEE Software on software product lines.

Jim Martin and the Tiger student team completed the first official release of the TigerFlix end-user product. The system provides video-on-demand game replay and highlights as well as realtime game statistics to Clemson football fans in Death Valley.

M.S. student Jerome Doubar won first place in the poster competition at the ADMI 2010 Annual Symposium held at Jackson State University. The competition is sponsored by the Association of Computer and Information Science/Engineering Departments at Minority Institutions. The symposium highlighted undergraduate and graduate research with particular interest in socially inspired computing.

Ph.D. students Aquasha Martin, Lauren Calico, Toni Bloodworth, Xuhong Zhang, Yvon Fautea and James Gyle received grants to attend the 2010 CRA-W Graduate Colloquium Workshop in Bellowus, Wash. These workshops provide mentoring support for women in the first three years of their graduate studies in computing.

Ph.D. students Jerome McClenon, Aquasha Martin, Kinnis Goshia and Wanda Moore received fellowships to attend the 2010 Computing Human Interaction Mentoring (CHIMO) Workshop in Atlanta. The workshops provided a unique opportunity for underrepresented minority HCI researchers to interact with leaders in their field, network about the latest trends and present their work to the HCI community for constructive feedback.

Ph.D. students Toni Bloodworth received an ACM Conference on Human Factors in Computing Systems in Atlanta. CHI is the premier international conference for HCI.

Ph.D. student Yvon Fautea received an NSF Graduate Fellowship Award. The program recognizes and supports outstanding graduate-students in NSF-supported science, technology, engineering and mathematics disciplines who are pursuing research-based master's and doctorate degrees in the U.S. and abroad.

Nadine M. Katz, Ph.D.

Department Chair

664-362-3940 • katz@clemson.edu

www.clemson.edu/cc

Fast Facts

Department Overview

Through internal deliberations and team building, the civil engineering faculty have decided on a research and education focus on resilient and sustainable infrastructure. This interdisciplinary and collaborative initiative addresses some of the most pressing national priorities, resulting in new frameworks for civil infrastructure design. This compendium, multi-phenomena model will advance the understanding of interdependencies between infrastructure systems and components that may impact design decisions related to security, energy and the environment.

The civil engineering department will offer a new M.S. program in sustainable and resilient infrastructure as part of a $100,000 NSF grant. The program will involve 14 students over the next three years with the first seven beginning in August 2010. Unlike traditional civil engineering programs, the new curriculum will involve interdisciplinary coursework and internships with external partners to help students focus on broader issues involving the nation’s infrastructure problems, such as aging roads and bridges, water supply and power grids.

The NSF proposal was the result of a team effort.

Jeff Plumblee received the Dwight D. Eisenhower Fellowship for 2010-2011. Tupper is pursuing research-based master's and doctoral degrees in the technology, engineering and mathematics disciplines who are focusing their graduate studies in computing.

Ph.D. students

with particular interest on socially inspired computing.

The symposium highlighted undergraduate and graduate research with particular interest in socially inspired computing.

Ph.D. students

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Faculty Highlights

Julie Trenor was presented the Thomas C. Evans Instructional Paper Award at the American Society for Engineering Education (ASEE) 2010 Annual Conference. Trenor was recognized for her work examining teacher efficacy as a result of an NSF-funded Research Experiences for Teachers program. Trenor, along with two Clemson University colleagues, examined the effects of a new, innovative, classroom-based professional development program. The program was designed to enhance the professional skills of engineering teachers, and improve students’ understanding and appreciation of the field.

Malcom Cooper, Ph.D.
Internal Affairs Director
406-529-5013
ncareer@cemlani.clemson.edu

Fast Facts

200 Undergraduate students have been named one of the top 500 students in the nation who have earned a certificate in Engineering and Science Education.
Department Overview
Research in the School of Materials Science and Engineering (MSE) is as diverse as its faculty interests, MSE faculty conduct research on ceramics, glasses, polymers, bio-medicinal materials, bio-engineering, biomaterials, thin films and nanomaterials.

The Department is comprised of expert collaboration who work with nearly every CS department and college across the state’s support of numerous University centers and institutes demonstrate. Their ability to create stronger, lighter and more efficient materials makes MSE researcher-attractive research partners with broad design, process, characterization and manufacturing experience.

Clemson’s MSE program is one of a small group of MSE programs in the country whose faculty and students not only work but also actually make many of the materials they design and test — from optical glass and fiber to bricks, bio-polymer fiber wallboats, space fabrics and nanomaterials metal materials. While computational materials science is also employed in the design and evaluation of materials in systems, the school also provides a source foundation in the design and manufacturing of ceramics, polymers, phononics. Hand-on experience of realizing fundamental principles of research and institutes demonstrates. Their ability to create stronger, lighter and more efficient materials makes MSE researcher-attractive research partners with broad design, process, characterization and manufacturing experience.

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Mechanical Engineering

Department Overview
The department includes 32 tenure-track faculty, seven ASME Fellows, one SME Fellow, two Presidential Faculty Fellows, five NSF CAREER Awardees, and nine NSF PEACER awardees and one member of the European national/international journals. The department holds three of the largest endowed chairs in the country — each valued at $3 million.

Faculty Highlights
Assistant professor Mohammed Daqaq received the 2010 Eugene H. Bishop Award for his exceptional abilities of teaching and research. A full professor, John Wagner has been selected annually by a vote of the students and is presented at the mechanical engineering awards banquet.

Fast Facts
- 250 students enrolled
- 75 Master’s
- 9 Doctoral
- 127 Undergraduate
- 14 Graduates
- 30 Faculty
- 3,118,726 in grants and contracts

Physics and Astronomy

Department Overview
Clinical physics encompasses the fields of mechanics, heat and thermodynamics, electricity and magnetism, acoustics and optics. Modern physics is concerned with the study of atoms and molecules, atomic nuclei, elementary particles and the properties of liquids, crystals and solids. Modern physics also involves the notions of planets, stars, galaxies and the large-scale structure of the universe.

Faculty Highlights
- Dr. Leigh Herran, a Ph.D. student of Yong Huang, has recently been awarded a $3,118,726 grant from the Office of Naval Research to study the quantum mechanical tunneling of electrons.
- Dr. Peter Barnes was selected as the 2010 Outstanding Teaching Award of the Society for Manufacturing Engineers (SME).

Fast Facts
- 418 students enrolled
- 4 Undergraduate
- 11 Doctoral
- 5 Master’s
- 37 Doctoral
- 5,758,743 in grants and contracts
Department Contacts

Bioengineering
301 Rhodes Research Center
Clemson University
Clemson, SC 29634-0905
Phone: 864-656-5557
Fax: 864-656-4466
URL: www.clemson.edu/ces/bio
Dr. Martine LaBerge, Chair

Chemical and Biomolecular Engineering
127 Earle Hall
Clemson University
Clemson, SC 29634-0909
Phone: 864-656-3055
Fax: 864-656-0784
URL: www.ces.clemson.edu/chemeng
Dr. Douglas Hirt, Interim Chair

Chemistry
219 Hunter Laboratories
Clemson University
Clemson, SC 29634-0973
Phone: 864-656-3065
Toll Free: 888-539-9954
Fax: 864-656-6613
URL: chemistry.clemson.edu
Dr. Stephen Creager, Chair

Civil Engineering
Lowry Hall
Clemson University
Clemson, SC 29634-0911
Phone: 864-656-3000
Fax: 864-656-2670
URL: www.clemson.edu/ce
Dr. Nadim M. Aziz, Chair

School of Computing
100 McAdams Hall
Clemson University
Clemson, SC 29634-0974
Phone: 864-656-3444
Fax: 864-656-0145
URL: www.cs.clemson.edu
Dr. Larry F. Hodges, Director

Holcombe Department of Electrical and Computer Engineering
105 Riggs Hall
Clemson University
Clemson, SC 29634-0915
Phone: 864-656-5650
Fax: 864-656-5917
URL: www.ece.clemson.edu
Dr. Darren Dawson, Chair

Engineering and Science Education
105 Holtzendorff Hall
Clemson University
Clemson, SC 29634-0902
Phone: 864-656-2541
Fax: 864-656-1327
URL: www.clemson.edu/ese
Dr. Melanie Cooper, Interim Chair

Environmental Engineering and Earth Sciences
L.G. Rich Environmental Laboratory
342 Computer Court
Anderson, SC 29625
Phone: 864-656-3276
Fax: 864-656-0612
URL: www.ces.clemson.edu/eees
Dr. Tanju Karanfil, Chair

Industrial Engineering
110 Freeman Hall
Clemson University
Clemson, SC 29634-0920
Phone: 864-656-4716
Fax: 864-656-0795
URL: www.ces.clemson.edu/ie
Dr. Anand K. Gramopadhye, Chair

School of Materials Science and Engineering
161 Sirrine Hall
Clemson University
Clemson, SC 29634-0922
Phone: 864-656-3176
Fax: 864-656-5973
URL: www.clemson.edu/mse
Dr. Igor Luzinov, Interim Director

Mathematical Sciences
O-110 Martin Hall
Clemson University
Clemson, SC 29634-0975
Phone: 864-656-3434
Fax: 864-656-5230
URL: www.math.clemson.edu
Dr. Robert L. Taylor, Chair

Mechanical Engineering
100 Fluor Daniel EIB
Clemson University
Clemson, SC 29634-0921
Phone: 864-656-2482/5640
Fax: 864-656-4435
URL: www.clemson.edu/ces/departments/me
Dr. Georges Fadel, Interim Chair

Physics and Astronomy
118 Kinard Laboratory
Clemson University
Clemson, SC 29634-0978
Phone: 864-656-3416
Fax: 864-656-0805
URL: physicsnt.clemson.edu
Dr. Peter Barnes, Chair

Biosystems Engineering*
221A McAdams Hall
Clemson University
Clemson, SC 29634-0312
Phone: 864-656-4077
Fax: 864-656-0338
URL: www.clemson.edu/agbioeng/bio/home.htm
Dr. Young Jo Han, Interim Chair

*This degree program is jointly administered by the College of Agriculture, Forestry and Life Sciences and the College of Engineering and Science.