Above: A student prepares Clemson's entry in the ASCE/AISC National Steel Bridge Competition. This year, Clemson will host the event.

On the cover: Clemson's planetarium celebrates its second half-century by opening its newly renovated, state-of-the-art facilities.

# IDEaS

INQUIRY, DISCOVERY IN ENGINEERING AND SCIENCE

COLLEGE OF ENGINEERING AND SCIENCE SPRING 2012

*in this issue:*

2 Continuing to Build on the Future
*The Glenn Department of Civil Engineering springs from strong foundations.*

5 Putting It to The Test
*Some students apply classroom knowledge in practical work settings.*

8 Bridging the Gap
*A culture of collaboration fosters a tradition of success.*

12 Book Smart
*For five decades, one professor strove to teach the next generation in the classroom – and in his textbooks.*

15 News Around the College of Engineering and Science

CLEMSON
College of ENGINEERING AND SCIENCE

# From the Dean

Issues related to the declining state of America's infrastructure appear to be more complex and challenging every day, and they're a major concern to those of us in engineering and science education. The American Society of Civil Engineers' most recent report card rates the nation's infrastructure GPA as a "D." Most experts agree that the Rx for the country's infrastructure is investment, and I'm excited to report that — here at Clemson — we recognize the need and are actively involved in producing the young civil engineers who will be addressing the issues.

For the first time, *IDEaS* is dedicated to a single department — the recently named Glenn Department of Civil Engineering. Gerald Glenn is a 1964 Clemson alumnus who is very familiar with America's infrastructure needs. He spent more than four decades leading engineering projects around the globe, and he has now turned his attention to a new, even more demanding task: building the next generation of engineers for the greater challenges that lie ahead. In this issue, we'll share what makes the department special, and what our partnership with Gerald means for the future.

We're building the next generation of engineers for the greater challenges that lie ahead.

Even before the Glenn gift, the civil engineering department had made "sustainable and resilient infrastructure" a future research and educational focus. Last year, a three-year National Science Foundation award allowed us to establish a new degree program to support 14 master's students who are studying and conducting research on sustainability issues such as aging roads and bridges, water supplies and power grids.

Through the years, we've been committed to providing real-world experiences where students can test their knowledge and skills. Beyond practicums, co-ops and internships, Clemson also offers a unique program called Creative Inquiry (CI), which encourages undergraduate research. On page 6, you can learn more about CI and how one of these teams was recognized with the S.C. Commission on Higher Education's Service-Learning Award.

Among the features, you'll also find stories about how dedicated faculty have been striving to improve leadership and instruction within the department. One story is about a mentoring program that brings young and more established faculty together to inspire collaborative research and teaching. Another story features the efforts of Clemson Alumni Distinguished Professor Emeritus Jack McCormac to write textbooks that ease the difficulty students may experience with understanding complex engineering principles.

We hope you enjoy the features in this issue of *IDEaS*, and we welcome your comments.

Sincerely,

R. Larry Dooley, Acting Dean*
College of Engineering and Science
Clemson University

*Dean Esin Gulari is on medical leave, so acting dean, R. Larry Dooley, is writing the "From the Dean" letter for this issue.

# Continuing to Build on the Future

*By Tom Hallman*

## Gerald Glenn committed the lion's share of his life to building things.

As an executive with international engineering firms like Chicago Bridge & Iron Company B.V. and Fluor Corp., Glenn devoted his career to creating and developing new manufacturing, energy and environmental infrastructure.

With a track record of more than four decades in leading engineering projects around the globe, he has now turned his attention to a new, even more demanding task: building the next generation of engineers for the greater challenges that lie ahead.

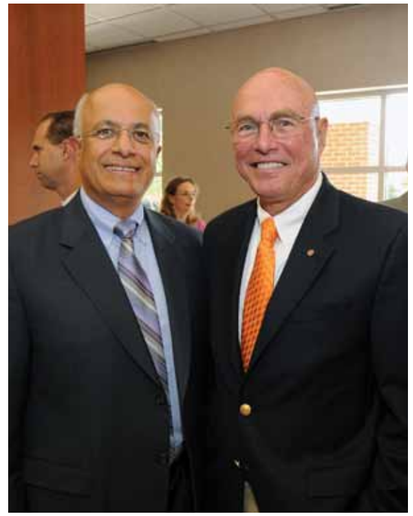
"Whatever the future may hold, it's certain the coming decades will require unparalleled talent and expertise in engineering and construction across the spectrum — from energy and transportation to housing and manufacturing," Glenn said in announcing a $5 million gift to Clemson's civil engineering department. "We're honored to be able to participate in the development of the next generation of engineers."

The unrestricted gift from Gerald and Candice W. Glenn is one of the largest gifts from an alumnus in Clemson's Will to Lead capital campaign to raise $600 million to support students and faculty with scholarships, professorships, facilities, technology and enhanced opportunities for learning and research. The gift also provides for the first named department in the campaign: the Glenn Department of Civil Engineering.

"We're proud to have the Glenn name associated with Clemson," says University President James F. Barker. "Not only professionally, but also personally, Gerald and Candi are exceptional role models for our civil engineering students."

The department from which Glenn graduated not only bears his name, but also bears his mark. "The gift will create scholarships and fellowships, support collaborative learning workspaces and seminars, attract and retain top faculty, and develop a program that will help civil engineering students gain a global perspective," says Nadim Aziz, chairman of the department.

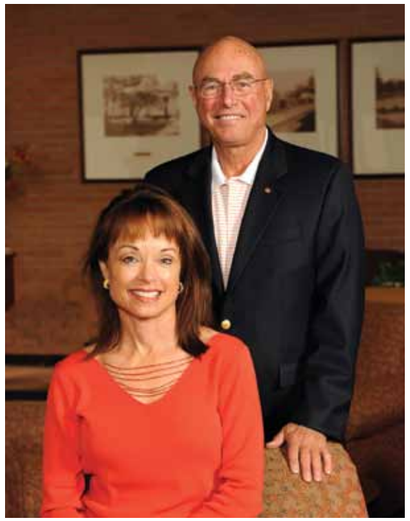
"This will help us mold the future leaders of civil engineering," Aziz says. "As we face more pressing problems with our infrastructure, our graduates will need the broad education that will make them the problem solvers of the future. This gift will help us create the environment necessary for students, faculty, government and industry partners to come together to discuss ideas for solutions to our failing infrastructure."



Nadim Aziz and Gerald Glenn

Even before the Glenn gift, the department had made "sustainable and resilient infrastructure" a research and educational focus for its future. A $700,000 NSF grant last year allowed for 14 master's students over the next three years to enter a new program involving interdisciplinary course work and internships with external partners, helping them focus on broader issues involving the nation's infrastructure problems — from aging roads and bridges to water supplies and power grids.

A 1964 Clemson alumnus, Glenn is no stranger to America's infrastructure needs. He served as chairman, president and CEO of the Chicago Bridge & Iron Company B.V. — a multinational engineering, procurement and construction company that posted more than $3.6 billion in revenue in 2010. Previously, he was a director of Fluor Corp. and a group president of Fluor Daniel Inc., its primary subsidiary. He has served as director of the Gas Technology



Gerald and Candi Glenn

Institute and a member of the Mid-America Committee, the 25-Year Club of the Petroleum Industry plus a number of other professional organizations.

From the vantage point of his own career, Glenn sees the wisdom – and the necessity – of Clemson's approach. The Glenns and the civil engineering department share a common goal: to prepare a generation of engineers who could shepherd the nation's infrastructure throughout its life – from the planning stages through design, construction, operation, maintenance and rehabilitation.

"It's critical that Clemson builds on its strengths in engineering and science to meet the needs of our economy and our nation. Our experience in sustainable and resilient infrastructure is a key," Glenn says.

"Clemson is in a unique position to prepare our engineering students for a role of leading a cooperative setting with construction, manufacturing, materials, environment and management in the coming decades," he says. "We're proud to contribute to Clemson's continuing support of civil engineering, advancing it to reach its rightful leadership position."

For the Glenns, the gift is another step in lifelong philanthropic contributions.

"Gerald and Candi are a credit to the communities they serve, including Clemson," Barker says. "Their professional achievements are outstanding, but their gifts of time and resources to so many important causes show their vision for the future and commitment to helping others."

The Glenns have been active contributors to the College of Engineering and Science Leadership Circle and other projects, including

The Glenns and the civil engineering department share a common goal: to prepare a generation of engineers who could shepherd the nation's infrastructure throughout its life — from the planning stages through design, construction, operation, maintenance and rehabilitation.

the Fluor Daniel Engineering Innovation Center. In the coming year, Gerald will serve on the President's Advisory Board at Clemson. He also serves as vice chairman of The John Cooper School and is a board member for both the Montgomery County Women's Center and St. Luke's Hospital.

Candice is an attorney and a graduate of the University of California-Irvine and Southwestern Law School. She served as chairman of the board and was instrumental in rebuilding the Cynthia Woods Mitchell Pavilion, a 16,000-seat outdoor amphitheater north of Houston, after it was severely damaged by Hurricane Ike in 2008. She was recently recognized as a "Hometown Hero" in The Woodlands.

The Glenns have chaired the Heart Ball fundraiser in both Chicago and The Woodlands, and Gerald chaired the metropolitan Chicago board of directors of the American Heart Association.

The Glenns live in The Woodlands, Texas, and they have two sons. Mike is an engineering student at Clemson, and Charlie is a sophomore at The John Cooper School. Gerald's daughter, Gina, is director of operations for *Homes & Land* magazine.

"As a father, I often think about what the future may hold for my children and for their children. What will our world be like in 20 or 30 years?" Glenn says. "Engineering will remain a vital field in that future, and a critical task for engineering and construction companies will be to ensure that we have sufficient human resources – especially engineers and skilled craftsmen – to design and build the facilities that will be required." ✻





*By Charreau Bell*

# Putting It to The Test

Clemson's goal of creating engineers and scientists ready to engage in real-world challenges has led to an educational experience peppered with learning opportunities that are, indeed, unique. In fact, beyond the usual internships and co-op experiences, civil engineering students frequently take advantage of chances to see how what they've learned in the classroom affects the rest of the world.

Immersed in a departmental culture of faculty achievement based on cross-disciplinary partnerships and mentoring, civil engineering students are extending this tradition of excellence through competition, service and academic achievement. Student organizations provide opportunities for polishing professional development.

The American Society of Civil Engineers (ASCE) Steel Bridge Team competes annually in a unique arena. "Winning this competition means designing and fabricating bridge components that are as light as possible but can also sustain a 2,500-pound load," says Scott Schiff, faculty adviser. He continues, "For some teams, that means hiring someone else to fabricate their bridges, but our students build it themselves." Among other criteria, the bridges are judged on their appearance, ability to bear loads, the speed at which they can be constructed and cost effectiveness. Clemson's Steel Bridge Team holds a national championship title, and out of 15 consecutive appearances at the National Student Steel Bridge Competition, they have achieved eight top-20 finishes. The annual competitions are held on campuses around the country, and in 2012, the National Steel Bridge Competition will be hosted at Clemson University.

The Clemson University Concrete Canoe team is also of championship caliber, having brought home a national title three times from the ASCE competition. The team has made appearances at the national level for 17 of the last 18 years, and over the last seven years, the team has won the regional championship six times. Team adviser and assistant professor of civil engineering Brad Putman says, "This competition provides firsthand experience in handling challenges that are encountered in real-world civil engineering projects." He continues, "Overcoming them requires technical skill, teamwork and creativity."

Left to right: Clemson's chapter of Engineers for Developing Countries visited Haiti; the concrete canoe team competes regionally and nationally; graduate student Jennifer Johnson won an NSF Graduate Research Fellowship to pursue her Ph.D.; students go on service projects as part of Clemson's chapter of the Institute of Transportation Engineers.

Students must design, construct and race a concrete canoe, which requires research and consultation with experts, fabrication in the civil engineering department facilities, and testing and training with the concrete canoe on Hartwell Lake. There is also a critical presentation component that can mean the difference in being a first-place team or a team that "also-ran."

The civil engineering department also houses a number of organizations with specialized topics within the framework of the discipline, including transportation and structural engineering. The student chapter of the Institute of Transportation Engineers participates in a number of transportation engineering projects and has several regional and national accolades, including five Best Student Chapter awards and five consecutive Southern District Traffic Bowl Championship titles. "This competition tests students on their knowledge of transportation engineering and planning; it's been a great testament for the quality of the program at Clemson," observes chapter faculty adviser and associate professor of civil engineering Wayne Sarasua. The competition requires students to correctly answer transportation engineering questions in a "Jeopardy"-like setting. The prize is the championship title and a $3,000 scholarship.

Clemson's civil engineering students' competitive spirit is as strong as their commitment to service activities.

Clemson Engineers for Developing Countries (CEDC) was dedicated to developing a plan for a water treatment and distribution facility for rural parts of Haiti even before the earthquake in 2009. "We had ideas for a new community fountain and created a master plan to present to decision-makers for the new water pump design," says Jeff Plumblee, a civil engineering graduate student and CEDC president. The group is actively engaged in design, logistics, training and fundraising for the project. Faculty adviser and civil engineering professor Lance Bell states, "It's a significant challenge to help the residents get something as essential as water. Their situation is urgent, so we work decisively and effectively to meet those needs." For the merit of their project as well as planning and implementing the design, the group won one of the highest state awards by the S.C. Commission on Higher Education – the Service Learning Project of the Year Award.

The Structural Engineers Association of Clemson University (SEA-CU), a division of ASCE, was founded in 2008 by a group of students and professors dedicated to structural engineering. Membership in this group carries a community service component. Michael Grayson, SEA-CU president and NSF Graduate Research Fellow, states, "The main purpose of SEA is to stimulate interest in the discipline of structural engineering. The greatest benefit comes through exposure to real-world experience through presentations from prominent and experienced professionals working in the field."

In addition to hosting these technical seminars, members also spend time introducing K-12 students to the basics of structural dynamics. SEA challenges them to construct buildings with pasta and gumdrops to determine how they fare in an "earthquake," simulated on Clemson's shake table. In addition, the group works with Habitat for Humanity to provide the roof trusses on Clemson's annual Habitat house, constructed on Bowman Field during the week of homecoming.

Civil engineering students are also distinguished for their academic achievements. Three of the eight 2011 NSF Graduate Research Fellowship recipients at Clemson University are students in civil engineering. Jennifer Johnson received one of those fellowships, and she's now pursuing her Ph.D. in civil engineering at her alma mater. She was recently named one of five laureates of Tau Beta Pi, the world's largest engineering society, and, for her dedication to increasing the number of professional women in academia, she won the Thea McCrary Student Award for Outstanding Service by the Clemson University President's Commission on the Status of Women. She is also the inaugural recipient of the college-wide Hambright Leadership award.

In total, the department has five NSF Graduate Research Fellows, three U.S. Department of Transportation Eisenhower Fellows and six privately funded graduate fellowships.

"Our purpose is to mold the future leaders of civil engineering," says department head Nadim Aziz. "The level of excellence demonstrated by these students individually and in team competitions sets the standard for achievement nationally. Our students are determined to be on the cutting edge of the profession, and their experience in the Glenn Department of Civil Engineering helps temper the steel of their knowledge and ability." *

## Building Bridges

In May, the field of dreams will hold visions of steel as Clemson University hosts the 2012 ASCE/AISC National Student Steel Bridge Competition. The conference will be held May 24 – 26 and is the second national civil engineering competition that Clemson has hosted. The event includes a number of technical presentations and workshops, business meetings, competitions, social gatherings and an awards banquet.

Sponsored by the American Society of Civil Engineers (ASCE) and the American Institute of Steel Construction (AISC), the competition tests students on their knowledge of structural engineering by requiring them to design, fabricate and construct a steel bridge.

The steel bridge competition originated in 1987 from the college relations division of AISC as a local competition to determine which student bridge design — made from balsa wood at that time — was the best. Since then, the competition has evolved, and the bridges are fabricated from structural steel by students at their home college institution or under strict student direction by a commercial fabricator.

"This event challenges students to face real-world structural design issues," explains Scott Schiff, Clemson civil engineering professor and event coordinator. "A winning design must meet a host of spatial, strength, fabrication, construction and cost criteria."

Bridges are judged based on *lightness* — the weight of the bridge, *stiffness* — the bridge's ability to resist sagging under a heavy load, *structural efficiency* — a dollar amount corresponding to the lightness and deflection qualities of the bridge, *construction speed* — the total time required for builders to erect the bridge during the competition, *construction economy* — a dollar amount reflecting the construction speed and additional materials required, and *display* — the aesthetic qualities and identifying features of the bridge. The overall winners have the lowest scores in construction economy and structural efficiency.

To compete at the national level, teams must place in the top positions of their regional competitions. The rules of the competition are varied each year, and success in the competition requires effective teamwork and time management to meet the required criteria.

# Bridging the Gap

Left page: Ronnie Chowdhury and Leidy Klotz

*By Ron Grant*

As Albert Einstein observed, "Problems cannot be solved by the same level of thinking that created them." Which leads to the question — how does one go about changing his or her level of thinking? One way to conquer seemingly insurmountable problems is through collaboration across disciplines and areas of expertise.

Nadim Aziz, chair of the newly named Glenn Department of Civil Engineering, is building a successful department through his philosophy of collaboration and cooperation. Historically, Clemson's civil engineering department was grouped into six traditional areas of civil engineering: applied fluid mechanics, construction engineering and management, construction materials, geotechnical engineering, structural engineering and transportation engineering.

Aziz realized that there would be distinct advantages in de-emphasizing compartmentalization and emphasizing collaboration. "At the time, there were very few faculty members crossing disciplinary boundaries," he observes. "I challenged them to discover ways to align the department with national priorities by forming interdisciplinary teams."

Using a mentoring strategy that pairs young faculty with productive, established professors is one step in creating a "collaborative culture."

One tool Aziz used to establish this "collaborative culture" was a mentoring strategy that pairs young faculty with productive, established professors. This approach was an extension of his own mentoring philosophy.

"As the chair of the department, I believe it's my responsibility to do all I can to provide guidance and counsel to junior faculty," states Aziz.

The actual guidance provided by senior faculty varies from one member to another and can focus on both teaching and research. Aziz has provided direction on teacher effectiveness, research proposals, journal publications, professional society leadership and time management.

Partnerships between Aziz and his young faculty attract highly competitive national research funding, and he recognizes that encouraging mentoring across the department leads to broader opportunities for success.

Two of these pairings have been particularly productive. Sez Atamturktur, a young female faculty member, was teamed with Hsein Juang, who has an international reputation in geotechnical engineering. Juang is a prodigious scholar, having published more than 120 technical articles in professional journals.

"Just after I became a mentee of professor Juang, I asked him for his curriculum vitae," explains Atamturktur. "When I made a hard copy, I thought there was something wrong with the printer, it ran so many pages! His record of scholarship truly is amazing, but what I find inspiring is his grace and approachability." Juang's example of access and affability is one she admires and tries to emulate.

Juang's work in geotechnical engineering meshes well with Atamturktur's focus on structural engineering.

"My association with Sez is more than a mentoring relationship," observes Juang. "We're colleagues, and in fact, we've jointly submitted a number of funding proposals. We both bring a different perspective to our proposals, and by incorporating both views, our joint submission is stronger than what we might have been able to accomplish as individuals."

Juang and Atamturktur have co-advised an M.S. student and a Ph.D. student — both of whom graduated last winter. They have also co-authored several journal papers with their students.

A second mentoring partnership brought together associate professor Mashrur (Ronnie) Chowdhury and junior faculty member Leidy Klotz. Chowdhury has received more than $3 million in sponsored research

## A tradition of success

Founded in 1852, the American Society of Civil Engineers (ASCE) represents more than 140,000 members of the civil engineering profession worldwide and is America's oldest national engineering society. The status of Fellow is attained by professional accomplishments. Fellows are practitioners, educators, mentors — and most of all — leaders. They have distinguished careers that have contributed significantly to the civil engineering profession. This prestigious distinction is held by less than 5 percent of ASCE members, while 18 percent of Clemson's civil engineering faculty members hold the honor.

### Lansford C. Bell, Ph.D., P.E.
### Professor of Civil Engineering

**Areas of Interest:**
Construction management
Materials management
Information technology
Contracting strategies
Construction manpower and cost forecasting
Leadership skills in construction project management

**Education:**
B.S., Civil Engineering, University of Maryland
M.S., Civil Engineering, University of Maryland
Ph.D., Civil Engineering, Vanderbilt University

**Membership:**
Fellow, ASCE

**Professional Registration:**
P.E. in S.C. and Ala.

### Abdul A. Khan, Ph.D., P.E.
### Associate Professor of Civil Engineering

**Areas of Interest:**
Computational hydrodynamics
Environmental fluid mechanics
Sediment transport
Hydraulics and hydrology

**Education:**
B.S., Civil Engineering, University of Engineering and Technology
M.S., Civil Engineering, University of Alberta
Ph.D., Civil Engineering, University of Alberta

**Membership:**
Fellow, ASCE
Member, International Association of Hydro-Environmental Research

**Professional Registration:**
P.E. in S.C.

**Professional Activities:**
Editor, *Journal of Experimental and Applied Mechanics*
Member, ASCE Computational Hydraulics Committee

### Charng Hsein Juang, Ph.D., P.E.
### Professor of Civil Engineering

**Areas of Interest:**
Uncertainty modeling and reliability design in geotechnical engineering
Liquefaction
Braced excavations
Risk assessment and management

**Education:**
B.S., Civil Engineering, National Cheng Kung University
M.S., Civil Engineering, National Cheng Kung University
Ph.D., Civil Engineering, Purdue University

**Membership:**
Fellow, ASCE

**Professional Registration:**
P.E. in S.C.

**Professional Activities:**
Associate Editor, *Journal of Geotechnical and Geoenvironmental Engineering*
Member of Editorial Boards, *Engineering Geology, Georisk and GeoEngineering*
Chairman, ASCE Geo Institute Technical Committee on Risk Assessment and Management

### Mashrur (Ronnie) Chowdhury, Ph.D., P.E.
### Associate Professor of Civil Engineering
### Eugene Douglas Mays Professor of Transportation

**Areas of Interest:**
Intelligent transportation systems
Surface transportation safety and security infrastructure
Traffic engineering
Multiobjective decision making
Fault-tree analysis

**Education:**
B.S., Civil Engineering, Bangladesh Institute of Technology, 1988
M.S., Transportation, Morgan State University, 1991
Ph.D., Civil Engineering, University of Virginia, 1995

**Membership:**
Fellow, ASCE

**Professional Registration:**
P.E. in Ohio

**Professional Activities:**
Associate Editor, *IEEE Transactions on Intelligent Transportation Systems*
Editorial Advisory Board Member, *Journal of ITS*
Editorial Advisory Board Member, *Journal of Transportation Security*



funding from the NSF, the Departments of Transportation in Ohio and South Carolina, and the U.S. Department of Transportation Centers. Chowdhury is an associate editor of the *IEEE Transaction on Intelligent Transportation Systems* (ITS) and the *Journal of ITS*.

Klotz is a recent recipient of an NSF CAREER grant. The CAREER program supports junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and their integration within the context of the mission of their organizations. In his study, Klotz plans to investigate designers' decision-making practices for net-zero energy buildings – a topic that addresses a major national push toward a sustainable energy future.

"I was so proud of Leidy when he won his NSF CAREER award," says Chowdhury. "I had the opportunity to offer a few recommendations on the proposal, so I felt very much a part of the process. When he won, I jokingly told him that now I could list an NSF CAREER award on my resume."

"Ronnie has helped make my transition to a faculty position an enjoyable one," says Klotz. "Of course, he covered the professional bases – offering advice and guidance on my teaching and research, but beyond that, I am particularly grateful for his recommendations about maintaining a work/life balance. This is an area that can cause problems for new faculty members. Ronnie is an excellent example of being an incredibly productive faculty member and an even better father and husband."

In the fall of 2009, Aziz undertook a very special mentoring project. He brought together a team of junior and senior faculty members to compete for a very prestigious NSF funding program.

Solid teamwork resulted in the proposal being funded. The grant provides resources to develop a science master's program (SMP) in sustainable and resilient infrastructure. The SMP team includes 10 faculty members: six from civil engineering and single representatives from architecture, physics, environmental engineering and earth sciences, and management. To date, 14 fellowships have been awarded to M.S. students, each including a $15,000 stipend and $10,500 for educational expenses.

Hsein Juang and Sez Atamturktur

"This program gives us the opportunity to prepare a generation of engineers who will examine the nation's infrastructure throughout its life," says Ron Andrus, professor of civil engineering and principal investigator on the project.

Obviously, it is difficult to measure the impact of this NSF project on the future of the department; however, the fact that students and faculty are engaged on a topic of national importance is a significant achievement for the Glenn Department of Civil Engineering. This project and an internal refocus on the common theme of sustainable and resilient infrastructure have resulted in several faculty members from different disciplines working with several Ph.D. students to address fundamental research in the field. This has also led to the development of new undergraduate and graduate courses.

"I'm very proud of what my colleagues have accomplished," offers Aziz. "And I'm honored to be a part of this dynamic department." ✻


# Book Smart

*By Heidi Coryell Williams*

Much has transpired in the world of engineering since Clemson Alumni Distinguished Professor Emeritus Jack McCormac penned his first textbook 50 years ago.

From the equipment engineers use to the way equations are computed, staying relevant has meant staying current. But of all the technologies, certifications and applications that have required updating through more than two dozen editions of textbooks authored by McCormac, one thing has stayed the same: the difficulty young students experience with understanding complex engineering principles. "Sometimes it's a challenge for authors to determine where civil engineering students are going to have difficulty," McCormac explains from his office on the third floor of Lowry Hall.

"When I started, I didn't know much," McCormac admits. "I struggled when I learned these things, and I figured other students had the same trouble understanding. I thought about that a lot when I was writing my textbooks."

Five decades and seven textbooks later, McCormac is one of the most notable engineers in the world — not because of an ingenious invention or some awe-inspiring building design. His claim to fame is having found a unique way to help students learn the basics.

The rest, as they say, will go down in civil engineering history. When the *Engineering News-Record* named its top 125 engineers or architects in the world, McCormac's name was listed alongside such notables as Frank Lloyd Wright, Thomas Edison, Gustave Eiffel and Henry J. Kaiser — and he was one of only two educators still living to receive the honor.

The *News-Record*, widely recognized as the definitive source of news for the construction industry worldwide, noted in its write-up about McCormac that he penned a textbook for each of the classes he taught — structural analysis, structural steel design, design of reinforced concrete and surveying. Those books, in turn, have educated and influenced untold numbers of students and civil engineers.

Now an Alumni Distinguished Professor Emeritus of Clemson University's Glenn Department of Civil Engineering, McCormac — retired since 1989 — still spends his weekday mornings at a metal desk in a modest office he shares with another professor emeritus. Reflecting on a lifetime of work, he demurs to any suggestion that his contributions to the industry have been exceptional.

"The nicest thing anyone ever said to me about my books is that they went back and referred to them," he says. "Former students are always nice about the books."

## Modest Beginnings

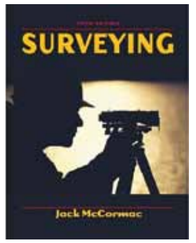
When McCormac graduated from high school at age 15 and left his hometown of Columbia to enroll at The Citadel, he never imagined that the remainder of his life would be spent almost entirely in a classroom, much less creating the texts that would usher tens of thousands of budding civil engineers through their instructive course work. His first writing gig was in college, occasionally being asked to provide "filler" content for an alumni publication. He wasn't even supposed to be writing — his official title was circulation manager, which meant he was supposed to sell the magazine, not contribute to it. "I would find historical tidbits, interesting things to write about," McCormac recalls.

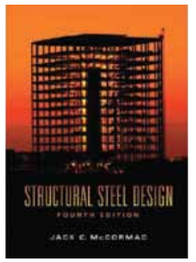
So when he started writing textbooks in 1957, during the first of two teaching stints at Clemson, he found himself returning to familiar territory. "I found ways to put interesting statements in there, historical things that would appeal to students," he says. "Like, Napoleon got his first promotion in the military because he could read a topographical map."

In a textbook about structural steel design, he offers memorable anecdotes about problems with temperature change and constructing lengthy bridges. For example, a famous bridge in Edinburgh, Scotland — being built in the dead of winter — was wrapped in naphtha-soaked cloth and set on fire so the steel would expand, enabling workers to line up the bolt holes. Conversely, workers on the St. Louis Bridge had to pack steel beams in ice when summer heat caused the members to expand, creating misalignment.

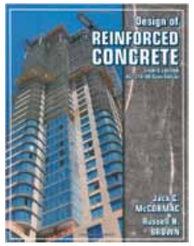
Students in his Clemson classes always got a "sneak peek" at the texts before they were published. Everything, from anecdotes to information and equations, was copied and handed out in his classes so he could test his writing on the people who would ultimately benefit from it. "The best textbooks are those that are used in class before they're published," McCormac says.

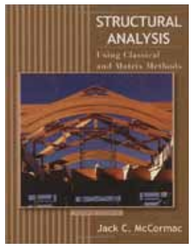
Since he proclaims himself to be an expert on exactly nothing (save staying out of his wife's way during her lengthy antique hunts), he found himself gathering information for his textbooks in unlikely ways, as well. Asked to pen a guide on surveying early in his career, he quickly realized he had little more than a textbook understanding of the skill himself. So, he went to work for an area surveyor, using a now-antiquated brass transit




McCormac's textbooks have educated untold numbers of students and civil engineers.





to gather measurements and collect evidence. "I had to describe how people actually went about surveying," he explains. "Actually doing the work seemed to be the most expedient way to do it."

The only times he was not in the classroom, as either a student or a teacher, were when he was drafted to serve in World War II, followed a few years later by a four-year stint at the E.I. DuPont Co. in Aiken. He was one of many engineers involved in the construction of the Savannah River Site.

McCormac is listed as one of the *Engineering News-Record*'s top 125 engineers or architects of the world.

"I enjoyed working in the field," McCormac recalls of his time at the nuclear facility. "But I always felt like I wasn't working hard enough. Here, I always felt like I had something to do — maybe because I was always writing books."

Colleague and Clemson professor Ben Sill says that the mere fact that McCormac has been able to write so many textbooks that are so successful is the best indicator of his reputation nationally and abroad. "I'm the co-author of a single text and just can't imagine the effort required over many years to produce the number of books Jack did," he explains.

But what many might view as extraordinary effort is, in McCormac's view, a healthy diversion. Spend a little time talking to him, and one realizes he seldom sits still. Retired for more than two decades, McCormac is a spry 84 years old, and it seems that a common theme in his life has been simply staying busy.

### Honors and Avocations

Among the more notable awards McCormac has received throughout his career include the AT&T Award for Engineering Teaching in the U.S. (1987), an Honorary Doctor of Letters degree from Clemson University (1995), induction into the Thomas Green Clemson Academy of Engineers and Scientists (2000), the Letellier Cup for an outstanding lifetime contribution to the profession of civil engineering (2001), as well as a variety of technical and professional merit and achievement awards for contributions to construction, engineering and education.

After five decades in the textbook and teaching business, he shifted into the world of fiction writing in 2009. "It's a lot easier to tell lies," he chuckles. His series of fiction books, published by Ithaca Press, is titled "The Sketching Detective." The main character, Jack MacKay, bears just a little resemblance to the author himself. MacKay is a professor of civil engineering who's witty, collects wood shaft golf clubs and bumbles through life and various unsolved murder cases — negotiating mishap after mishap — all while trying to use the sketching skills acquired in engineering mechanics to figure out "whodunit."

Though he has never undertaken police work as a distraction from the day-to-day, McCormac does collect wood shaft golf clubs, along with mystery books (think Hardy Boys), a habit he picked up while accompanying his wife on lengthy antiquing missions through the years.

When he's not penning his latest work of fiction (he's now on his fifth book in the series), he's playing 36 holes of golf a week, taking part in tennis matches, swimming laps at the local rec center, or fishing and hiking a piece of land he owns in the nearby mountains. On the seventh day, he rests. Which means he attends early church services and walks between five to 10 miles.

As busy as McCormac still manages to stay, he's started phasing out his work on the textbooks he spent so many years writing and revising. He's selected five professors to take over the revision work, which they will need to continue in earnest for the books to stay current. Four of the five co-authors are from Clemson. The fifth is at The Citadel.

For over half a century, McCormac's contributions to engineering education have forever changed the world and the way it's held together. His words will continue to enlighten and educate for years to come. *



# News and notes

### Clemson ranked eighth in graduating African-American engineers

According to a survey by the magazine *Diverse: Issues In Higher Education*, Clemson University ranks eighth among the nation's universities in graduating African-American students in engineering. Half of the top-10 institutions are historically black colleges and universities. North Carolina A&T State University led the list. Among non-historically black institutions, Clemson ranks between the University of Florida (No. 7) and the University of Michigan (No. 10). "We have an awesome group of students and alumni, and I'm thrilled to see us in the top 10," says **Sue Lasser**, director of Programs for Educational Enrichment and Retention (PEER) within CES.

Among other services, the PEER office pairs minority freshmen in the college with minority upperclassmen who serve as mentors and guides in the transition to college life. Prior to the program's establishment in 1987, Clemson's graduation rate of African-American engineering majors was near the national average. "Now, it is consistently among the highest among non-historically black colleges and universities," Lasser says. "The mentors through the years have made this program happen along with college and University support plus the involvement of government, industry and foundations," she adds. "We've been very fortunate to be a part of the Louis Stokes – S.C. Alliance for Minority Participation and receive generous support from Duke Energy and Fluor Corp."

### Professors advancing STEM education participate in White House Roundtable

Civil engineering associate professor **Jennifer Harper Ogle** has been honored by the White House as a "Champion of Change" for encouraging and educating young women in science, technology, engineering and mathematics (STEM). The Champions of Change program was created as a part of President Barack Obama's Winning the Future initiative. The program highlights the work of a variety of community leaders — ranging from educators to entrepreneurs — and brings them to the White House to share their ideas.

As a result of the honor, Ogle joined a roundtable discussion on the advancement of girls and young women in the STEM fields that involved other "champions," education leaders and delegates from White House policy offices and federal agencies. Among the leaders in the Washington roundtable will be Ogle's colleague and assistant professor of engineering and science education **Julie P. Martin**. Martin was invited to share her expertise on changing the stereotypes of girls in the sciences and technology in addition to mentoring, supporting and retaining women in the STEM workforce. Her research focuses on methods of increasing the participation of women, minorities and first-generation college students in undergraduate engineering programs.

### Federal grant to create "sustainable vehicle systems" center at CU-ICAR

The Clemson University automotive engineering program has received a $1 million award from the U.S. Department of Energy (DOE) that will create a center for research and education

in "sustainable vehicle systems." Established by the DOE's Graduate Automotive Technology Education or "GATE" division, the center, to be headquartered at the Clemson University International Center for Automotive Research in Greenville, is one of seven in the country. GATE Centers of Excellence were created to "train the highly skilled engineering workforce of the future to understand and address challenges in advanced vehicle design and development," according to the DOE. "The program is designed to help our students learn to address the fundamental issues of sustainability, such as vehicle life-cycle, energy use and emissions, reliability, manufacturing and cost of ownership," says **Imtiaz Haque**, chairman of Clemson's automotive engineering department.

### Research team to lead accessible voting technology project

A Clemson University research team has been chosen by the U.S. Election Assistance Commission to lead a national effort to make voting systems more accessible. Professor **Juan Gilbert**, chairman of the Human-Centered Computing Division in Clemson's School of Computing, will direct a three-year, $4.5 million project funded by the Election Assistance Commission to increase the accessibility of "new, existing and emerging technological solutions" in the design of voting systems. As leader of the project, Gilbert will coordinate commission research and training efforts nationally, as well as conduct research on voting technology in his Clemson lab.

Gilbert was also one of nine people who received the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring. The award recognizes the role mentors play in the academic and personal development of science and engineering students — especially those who belong to groups that are underrepresented in these fields. The award was presented at the White House.

## Patewood bioengineering lab opens at GHS

The Clemson University Biomedical Engineering Innovation Campus (CUBEInC), located on the Patewood Campus of the Greenville Hospital System, formally opened its 30,000 square feet of wet laboratories, shared facilities, surgical skills and bioimaging laboratories. Anonymous donors have invested $250,000 to fund a new lab at CUBEInC to establish the Frank H. Stelling and C. Dayton Riddle Orthopaedic Education and Research Laboratory Endowment. The research will help develop high-impact medical technology and devices for disease management to be transferred from the laboratory to bedside.

## Algae may hold promise for lithium-ion batteries

By looking to Mother Nature for solutions, researchers have identified a promising new binder material for lithium-ion battery electrodes that could not only boost energy storage, but also eliminate the use of toxic compounds now used to manufacture the components. **Igor Luzinov**, a professor in Clemson's School of Materials Science and Engineering, is teaming with Gleb Yushin, an assistant professor in Georgia Tech's School of Materials Science and Engineering, to work with alginate — material extracted from common, fast-growing brown algae. In tests so far, it has helped boost energy storage and output for both graphite-based electrodes used in existing batteries and silicon-based electrodes being developed for future generations of batteries. The results of their collaboration will appear in the journal *Science*. The project was supported by the two universities, as well as Honda and NASA.

## Figliola involved in novel heart valve research

Mechanical engineering professor **Richard Figliola** is part of a research team investigating critical pediatric heart valves. The Paris-based Leducq Foundation has awarded researchers at the Medical University of South Carolina, Clemson University and a collaboration of other institutions in the United States and Europe $6 million to establish a transatlantic network of excellence focused on developing improved support decisions for treating children born with only one functioning heart ventricle. These patients require radical and complex heart surgeries to alter blood flow in order to live.

This network will use computational fluid-flow models of a patient's own anatomy to allow physicians to perform virtual surgeries and to observe the effects of different decisions based on the individual patient's data. Figliola will coordinate the engineering efforts across the network. He and his students will develop experimental validation methods for the computer models, including lifelike replicas of specific-patient blood vessels, and will lead new research to advance the understanding of the mechanics of ventricle-artery couplings.

## IE professor named Fellow

**William G. Ferrell**, an industrial engineering professor and associate dean of the graduate school, has been elected a Fellow of the Institute of Industrial Engineers (IIE). The world's largest professional society dedicated to industrial engineering, the IIE elects Fellows from its membership "who have made significant, nationally recognized contributions to industrial engineering." Ferrell's research is focused on supply-chain management.

## Mears receives researcher award

**Laine Mears**, assistant professor of automotive engineering, has been selected to receive the 2011 Governor's Young Researcher Award for Excellence in Scientific Research. This award recognizes Mears for his research in manufacturing process control, equipment diagnostics and intelligent machining systems. His work is supported by the NSF, the National Institute of Standards and Technology and the U.S. Department of Energy.

## Engineering and Science student named laureate of engineering society

Graduate student **Jennifer A. Johnson** has been named one of five laureates of Tau Beta Pi in its annual program to recognize gifted engineering students who have excelled in areas beyond their technical majors. Johnson, who earned her bachelor's degree in civil engineering at Clemson this spring, has begun work toward her Ph.D. in the field at her alma mater.

INQUIRY, DISCOVERY IN ENGINEERING AND SCIENCE

IDEaS

SPRING 2012

IDEaS is produced biannually for the College of Engineering and Science at Clemson University by the Office of Creative Services.

On the cover: Some civil engineering majors get a start on college classes the summer before freshman year through the EUREKA! program.

Right: Students perform surveying in Haiti as part of their Creative Inquiry experience.

## Contributors

**EXECUTIVE EDITORS**
Esin Gulari
Ron Grant
Rebecca Shepherd

**DESIGNERS**
Dave Dryden
Christine U. Prado

**PHOTOGRAPHERS**
Craig Mahaffey
Patrick Wright

**WRITERS**
Charreau Bell
Ron Grant
Tom Hallman
Heidi Coryell Williams

CLEMSON
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 29634-0901
*clemson.edu/ces*

Left to right: Dr. R. Larry Dooley, Dr. Esin Gulari, Dr. E.R. (Randy) Collins

CLEMSON
College of ENGINEERING AND SCIENCE

CLEMSON
College of ENGINEERING AND SCIENCE

Office of the Dean
109 Riggs Hall
Box 340901
Clemson, SC 29634-0901

Nonprofit
Organization
U.S. Postage
PAID
Clemson, SC
Permit No. 10

# IDEaS

INQUIRY, DISCOVERY IN ENGINEERING AND SCIENCE

COLLEGE OF ENGINEERING AND SCIENCE SPRING 2012

## Highlights from our departments

# College Structure Is Key to Collaboration

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.

# Automotive Engineering

**Imtiaz Haque, Ph.D.**
Department Chair
864-283-7217
*sih@clemson.edu*
*clemson.edu/centers-institutes/cu-icar*

### Fast Facts

**Tenured/tenure-track faculty:** 10

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | - |
| | Master's | 90 |
| | Doctoral | 45 |
| **Degrees awarded:** | | |
| | Undergraduate | - |
| | Master's | 1 |
| | Doctoral | 3 |

**Research expenditures:** $2,006,105
**Research thrusts:** systems integration, vehicle manufacturing, vehicle design and development, vehicular electronics


Zoran Filipi

### Faculty Highlights

**Laine Mears** has received the top state honor for young science faculty — the 2011 S.C. Governor's Young Researcher Award for Excellence in Scientific Research.

**Zoran S. Filipi** joined the Clemson faculty as the Timken Endowed Chair in Vehicle Design and Development in January. Filipi holds one of four endowed chairs that form the academic core at the Clemson University International Center for Automotive Research (CU-ICAR) in Greenville. The chair was funded by The Timken Co., a leading global manufacturer of highly engineered bearings, alloy steels and related components.

Previously, Filipi was a specialist in automotive powertrain systems at the University of Michigan. He was deputy director of the Automotive Research Center, a seven-university consortium led by the University of Michigan, and director of the Center of Excellence in Engineering through Hybrid Technology, funded by the U.S. Environmental Protection Agency (EPA). He also led the HCCI engine thermal studies thrust area in the University of Michigan-General Motors Collaborative Research Lab on Engine Systems Research.

Filipi's research includes a wide variety of projects involving hybrid vehicle systems, sponsored by the U.S. Department of Energy (DOE), the EPA and the NSF. Corporate sponsors of his advanced powertrain research have included Bosch-Rexroth AG, Chevron Energy Technology Co., Ricardo Inc., Detroit Diesel/Daimler Trucks North America, Chrysler LLC and General Motors Corp.

### Student Achievements

**John Adcox** won the best student paper award at the Tire Society Conference last fall. The title of Adcox's paper was "Interaction of Anti-lock Braking Systems with Tire Torsional Dynamics," a study funded by Michelin.

Clemson University's automotive engineering program has received a $1.25 million competitive award from the DOE that will create a center for research and education in sustainable vehicle systems. Established by the DOE's Graduate Automotive Technology Education division, the center, to be headquartered at CU-ICAR, is one of seven in the country. The goal of the center is to overcome technology barriers in the design and development of high-energy-efficient and low-environmental-impact vehicle propulsion systems by integrating graduate education and research.

The second-generation Deep Orange prototype vehicle, designed and engineered by CU-ICAR students, was showcased at the 2011 Specialty Equipment Market Association (SEMA) show last fall. Students and faculty unveiled a breakthrough Human Machine Interface (HMI) and center-stack design, demonstrating personalized driver interaction through a configurable dashboard.

The new technology means the sleek dashboard can be personalized to interact between the driver and vehicle through virtualized onboard computers. The HMI can be configured for infotainment, climate control and personalized information for specific drivers. SEMA attracts more than 100,000 attendees and 2,000 exhibitors to the annual four-day show in Las Vegas, where more than 1,500 accessorized and customized four- and two-wheel vehicles are displayed. CU-ICAR students also demonstrated the vehicle's innovative advanced powertrain, energy storage and seating.





# Bioengineering

**Martine LaBerge, Ph.D.**
Department Chair
864-656-5556
*laberge@clemson.edu*
*clemson.edu/ces/bio*

### Fast Facts

**Tenured/tenure-track faculty:** 21

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 236 |
| | Master's | 32 |
| | Doctoral | 103 |
| **Degrees awarded:** | | |
| | Undergraduate | 56 |
| | Master's | 16 |
| | Doctoral | 15 |

**Research expenditures:** $7,256,252
**Research thrusts:** biomaterials engineering, bioelectrical engineering


Delphine Dean

### Faculty Highlights

The Clemson University Phil and Mary Bradley Award for Mentoring in Creative Inquiry was presented to **Delphine Dean**, assistant professor of bioengineering, in recognition of her outstanding work with undergraduate students.

**Dan** and **Aggie Simionescu** collaborated with Peter Zilla and Deon Bezuidenhout of the University of Cape Town, and they were awarded the NIH Fogarty International Research Collaboration Basic Biomedical Research Award for three years for their work on elastin-derived scaffolds for tissue-engineered small diameter vascular grafts.

A $1.25 million gift from Mitch and Carla Norville will be used to endow the Ernest R. Norville Endowed Chair in Biomedical Engineering. "This enlightened investment will have a lasting legacy," says Clemson President **James F. Barker**. "The Norville Endowed Chair in Biomedical Engineering will improve medical care and help generations of undergraduate and graduate students at Clemson."

**Robert A. Latour**, McQueen Quattlebaum Professor of Bioengineering, has been named a Fellow of the American Institute for Medical and Biological Engineering.

**Jiro Nagatomi**, **Dan Simionescu** and **Alexey Vertegel** received tenure and promotion to the rank of associate professor.

The Clemson University Biomedical Engineering Innovation Campus (CUBEInC), located on the Patewood Campus of the Greenville Hospital System, formally opened its 30,000 square feet of wet laboratories, shared facilities, surgical skills and bioimaging laboratories in December. Anonymous donors have invested $250,000 to fund a new lab at CUBEInC to establish the Frank H. Stelling and C. Dayton Riddle Orthopaedic Education and Research Laboratory Endowment. The research will help to develop high-impact medical technology and devices for disease management to be transferred from the laboratory to bedside.

### Student Achievement

Of the 13 National Scholars Clemson has named for 2011, two are bioengineering majors, **Medha Vyavahare** of Easley and **David Zhang** of Mount Pleasant.

**Jordan Maivelett**, a bioengineering senior, has been selected for an Intramural Research Training Award from the National Institute of Biomedical Imaging and Bioengineering.

**Erin Pardue**, a bioengineering doctoral student in the Clemson University/Medical University of South Carolina bioengineering program, was inducted into the MUSC Student Leadership Society. She was selected for her contributions to the University and her leadership qualities.

The department established a Clemson University chapter of Alpha Eta Mu Beta, the Biomedical Engineering Honor Society, in the fall of 2011.

# Chemical and Biomolecular Engineering

**Douglas Hirt, Ph.D.**
Department Chair
864-656-0822
*hirtd@clemson.edu*
*clemson.edu/ces/chbe*

### Fast Facts

**Tenured/tenure-track faculty:** 11

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 155 |
| | Master's | 1 |
| | Doctoral | 31 |
| **Degrees awarded:** | Undergraduate | 50 |
| | Master's | 0 |
| | Doctoral | 5 |

**Research expenditures:** $1,891,035

**Research thrusts:** advanced materials, kinetics and catalysis, energy, chemical and biochemical separations, molecular modeling and simulation, biosensors and biochips

Amod Ogale

### Faculty Highlights

**Rachel Getman** received an Obermann Center for Advanced Studies Interdisciplinary Research Grant from the University of Iowa for her project entitled "Creating Self-Healing Streams: Applying Industrial Catalytic Processes to Environmental Remediation." Getman will collaborate with Adam Ward from the University of Iowa.

**Charlie Gooding** has been featured in *Renderer* magazine for his work involving undergraduates in studying the feasibility of producing value-added products from rendered products, such as animal fats. The work has involved mostly senior design teams and their capstone-design projects, but some elements of the analyses have been performed by sophomore students in the material and energy balances course. The overall project has been supported by the Fats and Proteins Research Foundation.

**Anthony Guiseppi-Elie** of Clemson's Center for Bioelectronics, Biosensors and Biochips presented an invited paper in the Symposium on Hybrid Biomaterials at the 2011 AIChE Annual Meeting in Minneapolis.

**Scott Husson** received the Prince Award for Innovation in Teaching at the 2011 Victor Hurst Convocation. The Prince Award, named for Clemson President Emeritus Philip Prince and awarded by Clemson's undergraduate student government, recognizes outstanding teachers who demonstrate creative and novel teaching methods in the classroom. Husson also was named associate editor of the journal *Separation Science and Technology*.

**Amod Ogale** was awarded the Graffin Lecturership 2013 by the American Carbon Society. The lecturership is in honor of George D. Graffin, a pioneer in natural graphite, and is awarded each year to an individual who has made distinguished contributions to the field of carbon science and engineering. Ogale also presented a keynote lecture on carbon fibers derived from low-cost mesophase pitch precursors at the World Carbon Conference 2011 in Shanghai, China. Ogale was also awarded an NSF grant worth $200,000 to conduct research on extrusion of films in micropatterned dies in collaboration with Hoowaki LLC. He was also awarded a $150,000 research grant from the United Soybean Board to develop soy-based fibers that use bio-renewable precursors and offer cost-competitiveness.

**Mark Roberts** was awarded a competitive Non-Tenured Faculty Grant Award from 3M. This award is administered by 3M's research and development department in partnership with the 3M Corporate Giving Program. It recognizes outstanding new faculty for the quality and pertinence of research and is intended to help the recipient achieve tenure, maintain a teaching position and conduct research.

**Chris Kitchens** and **Thompson Mefford** (MSE) were recipients of the CES Faculty Collaboration Award. Kitchens and Mefford were cited for their interactions in the field of nanotechnology — in both the classroom and research lab. Over the past year, they were awarded a four-year, $600,000 NSF grant to study the fate of nanomaterials in the environment. The pair was also instrumental, along with **Scott Husson**, in establishing an NSF-supported REU site. Additionally, they co-taught an Honors course about nanotechnology, which was available to Honors students from all disciplines. They also led a Creative Inquiry team of undergraduate researchers.

### Student Achievements

Senior **John Howell** was selected to participate in the German Academic Exchange Service Research Internship in Science and Engineering. This past summer, Howell worked in the Department of Mechanical Process Engineering and Minerals Processing at the Technische Universität Bergakademie Freiberg, developing a process to separate lithium-rich ore from waste materials.

Each year, Eastman Chemical Co. selects top students to participate in a summer internship program at their facility in Kingsport, Tenn. This past summer, **Scott Tryggestad**, a ChBE senior, participated in the program and was the recipient of the Eastman Award for Excellence in Chemical Engineering. Funds affiliated with the program were donated to the department and will be used to fund lab renovations and programs that support our undergraduates.

Graduate students **Ashley Hart**, **Fiaz Mohammed**, **Ming He**, **Jose Orellana**, **Daniel Wandera** and undergraduate **Adam Klett** were selected to present at the AIChE annual meeting in Minneapolis.





# Chemistry

**Stephen Creager, Ph.D.**
Department Chair
864-656-4995
*screage@clemson.edu*
*chemistry.clemson.edu*

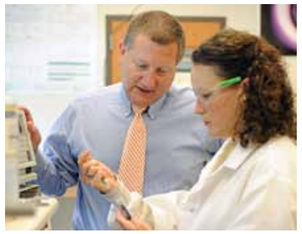
### Fast Facts

**Tenured/tenure-track faculty:** 23

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 148 |
| | Master's | 0 |
| | Doctoral | 98 |
| **Degrees awarded:** | Undergraduate | 19 |
| | Master's | 6 |
| | Doctoral | 15 |

**Research expenditures:** $3,769,037

**Research thrusts:** analytical, inorganic, organic physical chemistry, chemical education, interdisciplinary and nontraditional areas: polymer and materials chemistry, solid-state chemistry, bioanalytical chemistry, bioorganic and medicinal chemistry, computational chemistry, chemical physics



Ken Marcus

### Faculty Highlights

The Department of Chemistry welcomed four new faculty members last year. **Joe Thrasher**, specializing in fluorine chemistry, is a full professor of chemistry. He comes to Clemson after 28 years on the faculty at the University of Alabama. **Dan Whitehead**, an assistant professor of chemistry, specializes in organic chemistry. He comes to the department following his Ph.D. work at Michigan State University and postdoctoral work at North Carolina State University. **Modi Wetzler**, a research professor, specializes in organic chemistry. He recently finished his Ph.D. work at the University of California-Berkeley and his postdoctoral work at Stanford. Finally, **Tom Hickman**, a lecturer, earned his Ph.D. at Clemson in 2009 and was part of the faculty at South Georgia College before returning to Clemson.

**Ken Marcus** received an NSF grant for a project entitled "Capillary-Channeled Polymer Fiber Stationary Phases for High-Speed and Preparative Protein Separation." Marcus was also awarded 120 hours of instrumentation time on the ThermoScientific Exactive Orbitrap mass spectrometer system at the W. R. Wiley Environmental Molecular Science Laboratory, a national scientific user facility sponsored by the U.S. Department of Energy (DOE).

**George Chumanov** received a grant from the DOE for his project entitled "Asymmetric Hybrid Nanoparticles."

**Dvora Perahia** was awarded 30 days of neutron-beam time to study the structure and dynamics of polymers for clean energy, and 7 million computation hours on NSF and DOE computers to study polymers and polymer-nanoparticle complexes for functional materials.

**Steve Stuart** received a grant from High Performance Technologies Inc. for a project entitled "Using AIREBO Potentials to Optimize Properties of SiC Composites Reinforced with Carbon Nanotubes."

**Melanie Cooper** received three NSF grants for the following projects: "iRespond: iPhone/iPod Touch/iPad as Interactive Personal Response Systems," "SocraticGraphs: A Free-Form Interactive Graphical Recognition System" and "Collaborative Research: BeSocratic: A Free-form, Interactive System to Investigate the Development of Representational Competence." Cooper was also co-investigator along with **Gautam Bhattacharyya** from chemistry and **Michael Padilla** from Clemson's School of Education on an NSF grant for "Tigers Teach: Noyce Scholarship."

**Steve Creager** received a grant from the Advanced Research Projects Agency - Energy, a part of the DOE, for a project entitled "Electroalcoholgenesis: Bioelectrochemcial Reduction of $CO_2$ to Butanol." Creager is also co-investigator with **Scott Husson** from Clemson's Department of Chemical and Biomolecular Engineering on a Research Experiences for Undergraduates grant for "REU Site: Advanced Functional Membranes."

**Joe Kolis** received two NSF grants (Phase I and II SBIR Grants) through Advanced Photonic Crystals, a private company. His project is entitled "Hydrothermal Growth of Potassium Beryllium Fluoroborate (KBBF) for Deep UV Nonlinear Optical Applications." Additionally, Kolis is co-investigator on a planning grant from the NSF entitled "Collaborative Research: Planning Grant: I/UCRC for the Ceramic, Composite and Optical Materials Center," for which **Phil Brown** (MSE) is PI.

**Jason McNeill** received an NSF grant for a project entitled "Conjugated Polymer Nanoparticles for Nanoscale Chemical Microscopy."

**Jeff Anker** received a grant from the S.C. Space Grant Consortium for "Magnetic Surface-Enhanced Raman Spectroscopy Sensors." Anker is also co-investigator with **Marian Kennedy** (MSE) on an REU grant for "REU Site: Interfaces and Surfaces, Exploring and Experiencing Science."

**Ya Ping Sun** received three grants from the S.C. Space Grant Consortium for the following projects: "Palmetto Academy Site on Advanced Space Materials," "GRA: Toward a Career on Advanced Materials Research for Space Applications" and "Light-Weight Nanocomposites of Superior Thermal and Electrical Properties for Space Applications." Additionally, he received a grant from the University of Dayton for "Nanoenergetics-Fundamental Exploration and Technological Development."

**Joe Thrasher** has won two grants. The first is from the NSF for "International Collaboration in Chemistry: Preparation and Utilization of $SF_5$-Containing Building Blocks." The second is from a major fuel-cell company for "High-Temperature Membrane Development."

### Student Achievement

The chemistry department ran a Summer Undergraduate Research Program (SURP) last year. In an effort to provide opportunities to students who typically do not have such access, the program focused on students from institutions without substantive research options. Four students participated in the program — all from predominantly undergraduate institutions.

Clemson's student-member chapter of the American Chemical Society has received an honorable mention award for its activities during the 2010-11 academic year.

# Civil Engineering

**Nadim M. Aziz, Ph.D.**
Department Chair
864-656-3002
*aziz@clemson.edu*
*clemson.edu/ce*

### Fast Facts

**Tenured/tenure-track faculty:** 21

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 490 |
| | Master's | 75 |
| | Doctoral | 50 |
| **Degrees awarded:** | Undergraduate | 157 |
| | Master's | 48 |
| | Doctoral | 9 |

**Research expenditures:** $3,327,643
**Research thrusts:** sustainable and resilient infrastructure


Lee Tupper

### Faculty Highlights

*Geotechnical Risk Assessment and Management*, edited by **C. Hsein Juang**, Kok Kwang Phoon, Anand J. Puppala, Russell A. Green and Gordon A. Fenton, contains 127 peer-reviewed papers that address uncertainties in the geological environment. It covers new and continuing work on geohazard mitigation, uncertainty modeling, and risk assessment and management. Published for the proceedings of GeoRisk 2011: Geotechnical Risk Assessment and Management held last summer, the Geo-Institute-sponsored collection offers researchers and practitioners in all fields of geotechnical engineering essential information on identifying and managing risks.

*Structural Steel Design* by professor emeritus **Jack McCormac** and professor **Steve Csernak** was published last summer. The authors' major objective in preparing this new edition was to update the text to conform to both the *American Institute of Steel Construction (AISC) 2010 Specification for Structural Steel Buildings* and the 14th edition of the *AISC Steel Construction Manual* published in 2011. Also, changes were incorporated from the *ASCE 7-10 Minimum Design Loads for Buildings and Other Structures* published in 2010. McCormac continues to publish textbooks in structural engineering in addition to writing mystery novels (four so far). Csernak is the Glenn Department of Civil Engineering undergraduate program coordinator and teaches structural engineering courses and the capstone design course.

*Rainfall: State of the Science* by assistant professor of civil engineering at Clemson University **Firat Testik** and professor Mekonnen Gebremichael from the University of Connecticut addresses the critical component of the water and energy cycles — rainfall. The authors present the science of rainfall by focusing on rainfall microphysics, measurement and estimation, and statistical analysis. The book is published by the American Geophysical Union. Testik teaches and conducts research in the area of fluid mechanics.

Associate professor **Abdul A. Khan** has been elected Fellow of the ASCE. The society grants the Fellow status to fewer than 4 percent of its 125,000 members. Khan's specialty is modeling river flow and associated phenomena, including sediment transport and flows with shocks such as dam failure.

Assistant professor **Leidy Klotz** received an NSF CAREER grant to study the irrationalities of designers to support their decisions for net-zero energy buildings. The outcome will affect how energy-related decisions are made at the planning and design stages. The project will bridge engineering and behavioral sciences to advance understanding of how irrationalities influence design decisions. The project's research and education components support the civil engineering department's focus on sustainable and resilient infrastructure. Klotz is an expert on sustainability and has received research funding from the U.S. Department of Energy and the NSF. He teaches courses on sustainable construction, energy and infrastructure systems.

### Student Achievements

Ph.D. student **Lee Tupper** gave a presentation on "Clemson's Integrated Intelligent Transportation Platform" at the 18th Intelligent Transportation System (ITS) World Congress. The presentation described a collaborative proposal developed by a team of 12 Clemson graduate students from five departments: civil engineering, electrical and computer engineering, automotive engineering, the business school and the School of Computing. The proposal from Clemson's team won the People's Choice Award in the U.S. DOT Connected Vehicle Challenge, which sought innovative transportation-related uses for dedicated short-range communications The winners of the challenge presented their proposals in a featured session at the conference. Nine students from the civil engineering department attended the ITS World Congress to accept the award on the team's behalf and also presented five papers.

# School of Computing

**Larry F. Hodges, Ph.D.**
Director
864-656-7552
*lfh@clemson.edu*
*clemson.edu/ces/computing*

### Fast Facts

**Tenured/tenure-track faculty:** 27.5

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 350 |
| | Master's | 149 |
| | Doctoral | 55 |
| **Degrees awarded:** | Undergraduate | 62 |
| | Master's | 46 |
| | Doctoral | 10 |

**Research expenditures:** $2,138,370
**Research thrusts:** computer science: computing foundations, software engineering, cyberinfrastructure and networking, bioinformatics; visual computing: computer graphics and animation, eyetracking, visualization, digital arts; human-centered computing: intelligent and interactive systems, electronic health records, biometrics, virtual environments, human-computer interaction, pedagogical tools using tablet pcs and handheld devices


Juan Gilbert

### Program Highlights

The School of Computing (SoC) announces the initiation of a new Ph.D. degree in human-centered computing (HCC). The degree is the third of its kind in the nation and the first of its kind in South Carolina. It is designed so that students understand how to design, build and evaluate computational technologies as they relate to the human condition and how these technologies affect society.

SoC has a new undergraduate minor in digital production arts. It is designed so that students receive significant training across the artistic and technical disciplines that underlie computer animation, visual effects and computer games.

### Faculty Highlights

**Juan Gilbert**, IDEaS Professor and chair of human-centered computing, was honored with the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring. This award, presented by the White House to individuals and organizations, recognizes the crucial role that mentoring plays in the academic and personal development of students studying science and engineering — particularly those who belong to groups that are underrepresented in these fields. Gilbert was also awarded $4.5 million by the U.S. Election Assistance Commission to lead a national effort to make voting systems more accessible.

**Amy Apon** has joined the faculty as chair of the division of computer science. She brings a distinguished record of contributions at the University of Arkansas where she held the position of director of the Arkansas High-Performance Computing Center and professor of computer science.

Apon has been re-elected as the 2012 chair of the Coalition for Academic Scientific Computation (CASC), a national organization of academic high-performance computing centers and government laboratories. CASC is an educational nonprofit organization with more than 60 member institutions representing the nation's most forward-thinking universities and scientific computing centers. The organization advocates the use of advanced computing technology to accelerate scientific discovery for national competitiveness, global security and economic success. It also seeks to develop a diverse and prepared workforce.

**Shaundra Daily** has joined the faculty as an assistant professor of human-centered computing. Prior to joining Clemson, she co-founded and served as principal investigator of g8four, an educational technology firm. She received her doctorate from the Massachusetts Institute of Technology.

IDEaS Associate Professor **Jason Hallstrom** led a Clemson team that was awarded $3 million by the NSF to design, develop and deploy a basin-wide network of computerized sensors to monitor water quality along the entire length of the Savannah River.

**Andrew Duchowski** gave an invited talk at École Polytechnique Fédérale de Lausanne in Switzerland.

**Damon Woodard** has been promoted to senior member of the Institute of Electrical and Electronic Engineers for his contributions in the area of biometrics.

### Student Highlights

Ph.D. students **Jamie Lyle** and **Jessica Jones** both received ASEE SMART Scholarships. The Science, Mathematics and Research for Transformation (SMART) Scholarship for Service Programs was established by the U.S. Department of Defense to support undergraduate and graduate students pursuing degrees in science, technology, engineering and mathematics disciplines.

Undergraduate student **Charles Jones** received a superior rating for the presentation of his summer research project, "Palmetto Island: Developing Computer Science Awareness in Middle and High School Students," at the 2011 Sigma Xi Student Research Conference.

Ph.D. student **Liang Dong** has been awarded the AAAI/IAAI Deployed Application Award certificate from the Association for the Advancement of Artificial Intelligence and received student scholarships from both the AAAI and the International Society of Applied Intelligence.

# Electrical and Computer Engineering

**Darren Dawson, Ph.D.**
Department Chair
864-656-5924
*ddarren@clemson.edu*
*clemson.edu/ces/ece*

## Fast Facts

**Tenured/tenure-track faculty:** 32

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 425 |
| | Master's | 81 |
| | Doctoral | 87 |
| **Degrees awarded:** | Undergraduate | 101 |
| | Master's | 44 |
| | Doctoral | 12 |

**Research expenditures:** $2.8 million

**Research thrusts:** optoelectronics, cyberinfrastructure, wireless communications, computer networks, nanoelectronic materials processing, biochips, semiconductor lasers, optical systems, integrated circuit design, high-performance computing, computer security, robotics, image processing, biological modeling, situation and threat assessment, power systems

Adam Hoover with Eric Muth

## Department Overview

Clemson University has maintained a traditionally rich background in fundamental and applied engineering as the research areas have focused onto increasingly narrower topics within the subject disciplines. This heritage provides Clemson's Department of Electrical and Computer Engineering (ECE) with the breadth to offer a sound undergraduate education. At the same time, the specialization of faculty provides the stimulating environment for research.

ECE graduate studies and research programs include a spectrum of activity that reflects the interests and expertise of the faculty. Particularly noteworthy across the faculty are the breadth of education, the balance between experience and youth, the record of recent publications and the research funding obtained in recent years. More than 40 faculty members teach and perform research in a broad range of topics in electrical and computer engineering, and many are known nationally and internationally. Among them are IEEE Fellows, two endowed chairs and seven named professors.

Additionally, several young faculty members have won prestigious national and international awards and grants.

## Faculty Highlights

**Lin Zhu**, the Warren Owen Assistant Professor of Electrical and Computer Engineering, has been selected to participate in the Army Research Office Young Investigator Program. The objectives of the program are "to attract to Army research outstanding young university faculty members, to support their research, and to encourage their teaching and research careers." This award will fund Zhu's research on high-brightness, broad-area diode lasers for the next three years. The successful realization of this transformative research could have enormous long-term impacts on laser weapons, laser radar systems and other military applications.

**Lin Zhu** has also been awarded a $300,000 grant from the NSF's Division of Electrical, Communications and Cyber Systems. The objective of Zhu's research is to control optical gradient forces in light-wave circuits through wave-guide dispersion, to enhance optical-gradient forces by using plasmonic effects and to create novel resonant optomechanical devices. Zhu hopes his work will lead to the creation of novel devices for information processing and fundamental physics. The outcome of his research will have significant impacts across many disciplines, such as light-controlled biomechanical manipulation and detection, photonic information processing and strong light-matter interactions.

Associate professor **Stan Birchfield** and CES *IDEaS* Professor **Ian Walker** have been awarded a $400,000 grant from the NSF's Division of Information and Intelligent Systems to conduct research that explores the concept of interactive perception or manipulated-guided sensing. In this project, successive manipulations of objects in an environment are used to increase vision-based understanding of that environment and vice-versa. In particular, the project involves developing appropriate low-order models of highly non-rigid structures such as fabrics and textiles; constructing algorithms to perform real-time, vision-based sensing of such objects in cluttered, unstructured environments; and building prototype robotic hardware for testing the resulting models and algorithms. The research forms an integral part of programming next-generation household service robots to perform everyday tasks such as sorting and folding laundry.

Two Clemson University researchers seek to make diners mindful of mindless eating. Psychology professor **Eric Muth** and electrical and computer engineering professor **Adam Hoover** have created the Bite Counter, a measurement device that will make it easier for people to monitor how much they eat. Worn like a watch, the device tracks a pattern of wrist-roll motion to identify when the wearer has taken a bite of food. Think of it as a pedometer for eating.

The advantage of the Bite Counter is that it is automated so that user bias is removed. The device can be used anywhere, such as at restaurants or while working, where people find it difficult to manually track and remember calories.

In laboratory studies, the device has been shown to be more than 90 percent accurate in counting bites, regardless of the user, food, utensil or container. However, there is little existing data on how bite count relates to calorie count or how a bite-counting device could be used for weight loss. The device will allow for such data to be more easily collected.

With prototypes completed and manufacturing under way, the devices are being tested in 20 subjects for one month. The devices will store logs of bite-count activities, which will provide researchers baseline data for developing guidelines for completely new and innovative weight-loss studies.





# Engineering and Science Education

**Melanie Cooper, Ph.D.**
Interim Department Chair
864-656-2573
*cmelani@clemson.edu*
*clemson.edu/ese*

## Fast Facts

**Tenured/tenure-track faculty:** 7

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | n/a |
| | Master's | n/a |
| | Doctoral | 3 |
| | Certificate | 20 |
| **Degrees awarded:** | Undergraduate | n/a |
| | Master's | n/a |
| | Doctoral | n/a |
| | Certificate | 2 |

**Research expenditures:** $243,026

**Research thrusts:** epistemologies, learning mechanisms and systems, diversity and inclusiveness, assessment

ESE studies have established numerous "smart classrooms" around campus.

## Department Overview

The Department of Engineering and Science Education (ESE) offers CES graduate students the opportunity to earn a Certificate in Engineering and Science Education. This program is designed for graduate students who seek experience in preparation for an academic career, who wish to further their understanding of the education process in engineering and science, or who are interested in engineering and science education research. This certificate program specifies a range of courses (minimum of 11 credits) that may be selected to address specific research questions or interests.

## Faculty Highlights

**Melanie Cooper**, interim chair of the Department of Engineering and Science Education, has been awarded an NSF grant for "Be Socratic: A Free-form, Interactive System to Investigate the Development of Representational Competence." The grant focuses on developing a new formative assessment system that can recognize and respond to student drawings, graphs and chemical structures.

The NSF-funded TigersTeach Noyce Scholarship Initiative will provide $10,000 scholarships to 30 undergraduate or graduate students from the science, technology, engineering or math (STEM) disciplines who enroll in an undergraduate dual-degree program or enter the Master of Arts in Teaching program.

Funded by a five-year, $1.2 million NSF grant from the Robert Noyce Teacher Scholarship Program, TigersTeach is a collaboration among Clemson's colleges of Health, Education and Human Development; Engineering and Science; and Agriculture, Forestry and Life Sciences. School districts in nearby Greenville, Anderson, Oconee and Pickens counties are partners in the project.

"This program will allow us to actively recruit well-qualified students who otherwise often leave the STEM disciplines. We anticipate that our program will form the nucleus of a new cadre of teachers who are prepared for tomorrow's classrooms," says **Michael J. Padilla**, associate dean and director of Clemson's Eugene T. Moore School of Education.

TigersTeach students will learn from veteran scientists and teachers, participate in professional conferences and work with local schools and agencies.

## Student Achievement

**Randy Hutchison** completed his research in engineering education and successfully defended his dissertation, "Assessment of Knowledge Transfer in the Context of Biomechanics." He has accepted a tenure-track position at Furman University.

# Environmental Engineering and Earth Sciences

**Tanju Karanfil, Ph.D.**
Department Chair
864-656-1005
*tkaranf@clemson.edu*
*clemson.edu/ces/eees*

### Fast Facts

**Tenured/tenure-track faculty:** 20

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 145 |
| | Master's | 89 |
| | Doctoral | 42 |
| **Degrees awarded:** | Undergraduate | 19 |
| | Master's | 13 |
| | Doctoral | 5 |

**Research expenditures:** $3,379,563
**Research thrusts:** environmental chemistry, environmental fate and transport, hydrogeology, nuclear environmental engineering and science, environmental process engineering, biosystems engineering, sustainable systems, environment


Tim Devol

### Faculty Highlights

EEES welcomes the biosystems engineering undergraduate and graduate degree programs into the department. Biosystems engineering has approximately 70 undergraduates and 25 graduate students. Four new biosystems engineering faculty have joined the department – **Caye M. Drapcho**, **Charles V. Privette III, Tom O. Owino** and **Terry H. Walker**.

**Lindsay C. Shuller-Nickles** joined EEES as an assistant professor last fall. Shuller-Nickles received her Ph.D. in materials science and engineering at the University of Michigan. She also worked at the Glenn T. Seaborg Institute at Lawrence Livermore National Laboratory and in the civil engineering and geological sciences departments at the University of Notre Dame. Shuller-Nickles participates in the nuclear environmental engineering program, which is a unique program that combines radiochemistry with environmental chemistry. Her research integrates computational and experimental techniques to better understand the thermodynamic stability and kinetics that control the behavior of radionuclides in the environment.

**Brian Powell** and **Yuji Arai** (Clemson's School of Agriculture, Forestry and Environmental Sciences) were awarded a subcontract from Savannah River Nuclear Solutions to examine technetium reduction in saltstone formulations.

**Ron Falta**, together with Gerald Blount and Alvin Siddall from the Savannah River Site, has received a U.S. patent for a new method of capturing carbon dioxide during the manufacturing of cement. The patent, entitled "Carbon Dioxide Capture From a Cement Manufacturing Process," involves combining the use of a two-stage calcining unit with a low-temperature (900° C) unit and a high-temperature (1400° C) unit. The low-temperature calciner converts limestone and dolomite into calcium and magnesium oxides and produces pure carbon dioxide as a waste product. This carbon dioxide can be sold or stored in deep geologic formations.

**Brian Powell** and **Mark Schlautman** have been selected to lead a three-year, $1 million project funded by the U.S. Department of Energy (DOE) Nuclear Energy University Partnership. The project, entitled "Quantification of Cation Sorption to Engineered Barrier Materials Under Extreme Conditions," will focus on quantifying interactions of risk with driving radionuclides with engineered barrier materials used in radioactive waste repositories. Studies will be conducted under the high-temperature and high-ionic-strength conditions expected within the repositories. Linfeng Rao of Lawrence Berkeley National Laboratory and Heino Nitsche from the University of California-Berkeley will collaborate on the project.

### Student Achievements

A group of Clemson engineering students, led by EEES graduate students **Christina Anderson** and **Catherine Ruprecht,** traveled to Liberia in West Africa to implement sustainable engineering projects as part of their Creative Inquiry class. Clemson students worked with students from the University of Michigan and the University of Liberia. The five undergraduate students built a solar-powered dehydrator, a biogas-producing latrine, two basketball hoops, a playground and an electricity-generating merry-go-round.

The significant efforts and contributions of the undergraduate students helped the department inaugurate a student chapter of the American Water Works Association.

**Salmatta Ibrahim** recently received an award from the Margaret McNamara Memorial Fund, administered by the United Nations World Bank. This was a competitive application process, and she was one of only 13 people to receive the award.

**Peng Luo** received a 2010-11 Roy G. Post Foundation Graduate Student Scholarship.

**Jia Hu's** doctoral dissertation entitled "Exploring the Formation and Distribution of Halonitromethanes in Drinking Waters" was selected as one of the best doctoral dissertations by the American Water Works Association.

**Viet Duc Dang** and **Ting Shao** were selected for the graduate student awards from the Division of Environmental Chemistry of American Chemical Society.





# Industrial Engineering

**Anand K. Gramopadhye, Ph.D.**
Department Chair
864-656-4716
*agramop@clemson.edu*
*clemson.edu/ces/ie*

### Fast Facts

**Tenured/tenure-track faculty:** 12

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 215 |
| | Master's | 155 |
| | Doctoral | 40 |
| **Degrees awarded:** | Undergraduate | 45 |
| | Master's | 30 |
| | Doctoral | 7 |

**Research expenditures:** $1,280,098
**Research thrusts:** supply chain optimization and logistics, human factors and safety in health care and in technologically complex environments, education and learning systems


Anand Gramopadhye

### Department Overview

The industrial engineering program is accredited to award B.S., M.S., M.Engr. and Ph.D. degrees in industrial engineering. The department promotes excellence in scholarship, research and industrial engineering education – broadly focused in supply chain, optimization and logistics; human factors and safety in health care and technologically complex environments; and education and learning systems.

The department has several programmatic initiatives that have resulted in significant growth, garnering esteem on both national and international levels. These include the online M.Engr. in industrial engineering and the SmartState Endowed Chair in Supply Chain. In addition, the department is home to two institutes, the Clemson Institute of Supply Chain, Optimization and Logistics and the Human Factors and Ergonomics Institute. The department is also home to an NSF-sponsored Industry and University Cooperative Research program satellite center in engineering logistics and distribution as well as the Center for Excellence in Quality.

Finally, to engage undergraduate students in research, the faculty is implementing a new Creative Inquiry paradigm to enrich the undergraduate experience. Clemson has become a leader through its international research and collaboration, and the industrial engineering department has played a significant role in bringing the world's talent to our doorstep.

### Faculty Highlights

Associate professor **Joel S. Greenstein** and his Ph.D. student **Kapil Chalil Madathil** won the SIGCHI Honorable Mention Paper Award at the CHI 2011 ACM Human Factors in Computing Systems Conference in Vancouver, Canada. Their paper presented a novel approach for conducting synchronous remote usability testing utilizing virtual worlds to address usability issues.

**Scott Shappell** has received the Franklin V. Taylor Award for Outstanding Contributions in the Field of Aerospace Human Factors and the Raymond F. Longacre Award for Outstanding Accomplishments in the Psychological and Psychiatric Aspects of Aerospace Medicine from the Aerospace Medical Association.

**Sandra Garrett** was honored as an Extraordinary Educator by the Delta Alpha Pi Honor Society for inspiring her students and for her commitment to being an open and inclusive educator.

**William G. Ferrell** has been elected a Fellow of the Institute of Industrial Engineers. Ferrell established the Clemson Institute for Supply Chain Optimization and Logistics. He also founded and serves as the director of the Clemson site of the Center for Engineering Logistics and Distribution, an NSF industry/university cooperative research center.

**Anand K. Gramopadhye** will direct a statewide initiative to create a skilled workforce for South Carolina's leading aviation and automotive industries. In partnering with technical colleges and industry in three key regions, the collaboration will drive workforce development by providing technicians for the state's new manufacturing industries that most need labor with specific skills. Funded by a $2.3 million NSF grant, the program creates the Clemson University Center for Workforce Development, a center for aviation and automotive technology education that will use virtual and distance learning. The program brings education to a wide audience through virtual classrooms and personalized learning. It uses cost-effective e-learning modules with virtual reality or similar high-level visualization and simulation tools.

### Student Achievement

At the 46th annual INFORMS Southeastern Conference, **Paul L. Goethals** was awarded the Best Paper in Track and the Best Paper in Conference. Goethals also won the 2011 General Omar Bradley Fellowship in Mathematics and began his assignment as an assistant professor in the department of mathematical sciences at the U.S. Military Academy at West Point.

# School of Materials Science and Engineering


**Igor Luzinov**
Interim Director
864-656-5958
*luzinov@clemson.edu*
*clemson.edu/mse*


## Fast Facts

**Tenured/tenure-track faculty:** 15.5

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 101 |
| | Master's | 21 |
| | Doctoral | 55 |
| **Degrees awarded:** | Undergraduate | 27 |
| | Master's | 6 |
| | Doctoral | 4 |

**Research expenditures:** $5,293,209

**Research thrusts:** manufacturing, characterization and structure/property/performance relationships of ceramics, glasses, polymers, photonics/optics, fiber-based materials, thin films, metals

Thompson Mefford

## Faculty Highlights

Last fall, **Fei Peng** joined the School of Materials Science and Engineering (MSE) as an assistant professor. Peng earned his Ph.D. in materials science and engineering from the Georgia Institute of Technology. His research focuses on the fabrication and characterization of high-temperature ceramics.

MSE hosted our first NSF research experience for undergraduates (REU) program last summer. **Marian Kennedy** teamed up with **Julie Martin** (Department of Engineering and Science Education) to create a program focused on engaging undergraduate participants in cutting-edge research projects while also helping the students develop the professional skills necessary in higher education or industrial jobs.

**John Ballato** was elected a Fellow of the Optical Society of America (OSA). He was recognized "for research on optical and optoelectronic materials and fibers – both directly and through his formation and direction of the Center for Optical Materials Science and Engineering Technologies at Clemson University."

**Kostya Kornev** and **Phil Brown** organized the International Symposium on New Frontiers in Fiber Materials Science in Charleston last fall, which attracted more than 180 attendees from different countries.

**Thompson Mefford** and Thomas Crawford (Department of Physics and Astronomy at the University of South Carolina) were recently awarded an NSF grant for a new technique for rapid manufacturing of nanostructured materials. The ultimate goal of this project is to test their hypothesis that magnetic recording can be used to direct the assembly of nanomaterials into complex 2-D and 3-D structures and offers a promising route toward rapid and low-cost nanomanufacturing.

**Thompson Mefford** teamed up with **Jeffery Anker** (chemistry) to organize "Frontiers in BioMagnetic Particles," a conference focused on the biomedical applications of magnetic nanoparticles. Conference attendees were from more than 10 countries, and specific topics included biosensors and imaging, magnetic separations and biomedical applications of magnetic nanoparticles. A separate section on career development was offered for students.

The Air Force Office of Scientific Research awarded **Kostya Kornev** and **Igor Luzinov** a Defense University Research Instrumentation Program grant to create a laboratory of excellence for characterization of electromagnetic properties of nanocomposite materials. The proposed system consists of a time-domain reflectometer, alternative gradient magnetometer and spectroscopic ellipsometer.

**Igor Luzinov** was awarded a Materials World Network (NSF-German Research Foundation) grant to design and characterize a responsive thin polymer film platform comprised of functionalized mixed polymer brushes for the stimulus-triggered exposure of functional molecules to the bioengineered interfaces of mammalian cells. Besides Luzinov, the U.S.-German research team includes: Minko (Clarkson University); Revzin (University of California at Davis); Stamm, Eichhorn and Uhlmann (Dresden Technical University and Leibniz-Institute for Polymer Research in Dresden); Müller (University of Göttingen); and Hinrichs and Esser (Leibniz-Institute for Analytical Sciences in Berlin).

## Student Achievement

Undergraduate student **Chris Ostrouchov** (adviser **Kathleen Richardson**) received an NSF Undergraduate Fellowship to attend the Vanderbilt/Columbia Molecular Modeling Cybercamp sponsored by the NSF EPSCoR and the NSF Cyber-enabled Discovery and Innovation programs last spring.

As part of his undergraduate research project, **Timothy Herrin** has conducted experimental research on the degradation of the *U.S.S. Yorktown*, a decommissioned aircraft carrier currently based in Charleston. The goal of the project is to estimate the rate of corrosion in and around the ship in order to assist in the development of a long-term conservation plan for the hull.

Ph.D. student **Daria Monaenkova** (adviser **Kostya Kornev**) received the Johnson & Johnson award for the best student paper during the International Symposium on New Frontiers in Fiber Materials Science last fall.

Last summer, Ph.D. student **Benn Gleason** (adviser **Kathleen Richardson**) received an alternate sponsored fellowship from Pacific Northwest National Laboratories located in Richland, Wash., and a summer manufacturing internship from Edmund Optics in Pennsburg, Penn.





# Mathematical Sciences


**Robert L. Taylor**
Department Chair
864-656-3434
*rtaylo2@clemson.edu*
*clemson.edu/math*


## Fast Facts

**Tenured/tenure-track faculty:** 44

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 235 |
| | Master's | 67 |
| | Doctoral | 56 |
| **Degrees awarded:** | | |
| | Undergraduate | 47 |
| | Master's | 25 |
| | Doctoral | 4 |

**Research expenditures:** $827,320

**Research thrusts:** algebra and discrete mathematics, applied analysis, biomathematics, computational mathematics, experimental statistics, operations research, probability and statistics

Smart classrooms help students and faculty interact throughout the learning process.

## Department Overview

For the eighth consecutive year, the department hosted the Clemson Calculus Challenge, a calculus-exclusive competition based on the Advanced Placement Calculus AB syllabus. Recognized with continued NSF funding, the 2011 competition involved 274 of the Southeast's brightest high school math students, with most students coming from Alabama, Georgia, North Carolina and South Carolina. Teams of students worked together at the event, and prizes included $500 scholarships to Clemson University for individual students.

## Faculty Highlights

**Jim Brannan** received CES's 2011 Award for Outstanding Teaching in the Sciences.

**Robert L. Taylor** served as chair of the National Test Development Committee for Advanced Placement in Statistics.

**Xuhong Gao** presented three invited talks in China and was a major speaker at the Cryptography Workshop in Beijing, China.

Assistant professor **Jan Medlock** published "Protecting the Herd from H1N1" in *Science* and received national recognition for the optimal modeling for the distribution of limited vaccine.

Associate professor **Calvin Williams** served on the advisory board for the Centers for Ocean Science Education Excellence.

Assistant professor **Elena Dimitrova** received the department's Faculty Teaching Award in April.

Student services coordinator **Kris Hunnicutt** received a Board of Trustee Exceptional Staff Award in May.

## Student Achievements

**Abigail Bowers** contributed a research talk in the special session on "Algorithm Analysis, Design and Computation for Turbulent Flows" at the 2010 SIAM annual meeting.

**Mariah Magagnotti** contributed a poster in the student poster session at the 2010 SIAM meeting.

**Wittawat Kositwattanarerk** presented the research paper "Pseudocodewords and Tanner Graph Representation" at the 2010 IEEE International Symposium on Information Theory.

**Catherine Trentacoste** received the University's Outstanding Graduate Teaching Assistant Award for 2011.

**Erin Doolittle** has received funding to study at Telecom Bretagne in France in conjunction with her dissertation research on optimization problems.

**Dania Zantout** and **Chris Johnson** were funded for two months of research study at the Hausdorff Research Institute for Mathematics in Bonn, Germany.

**Frank Volny** presented a research talk at the 35th International Symposium on Symbolic and Algebraic Computation in Munich, Germany.

**Lori Layne** presented a research talk entitled "Stability Properties of Biologically Relevant Boolean Functions" at the Cha-Cha Days conference at the College of Charleston.

# Mechanical Engineering

**Georges M. Fadel, Ph.D.**
Interim Chair
864-656-5640
*fgeorge@clemson.edu*
*clemson.edu/ces/me*

## Fast Facts

**Tenured/tenure-track faculty:** 21

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 634 |
| | Master's | 89 |
| | Doctoral | 62 |
| **Degrees awarded:** | | |
| | Undergraduate | 130 |
| | Master's | 39 |
| | Doctoral | 12 |

**Research expenditures:** $2,749,000
**Research thrusts:** transportation, energy, design, materials, manufacturing, fluids, complexity, multi-scale modeling


Yong Huang

## Department Overview

Mechanical engineering at Clemson is the largest degree-granting department at the University and continues to grow significantly. The number of undergraduates (sophomore through senior) is at an all-time high, with more students than ever seeking a degree in a broad discipline that prepares them for a variety of careers.

## Faculty Highlights

**Joshua Summers** received a $597,392 NSF award for a project in which he is a co-PI entitled "CUESTS:IE & CUESTS:ME Clemson University Engineering Scholarships for Transfer Students in Industrial Engineering and Mechanical Engineering." Summers also received $59,398 from the Industrial Fabrics Association International for his project entitled "IFAI 2010: Testing and Performance Analysis of Tent Ballasts."

**Gregory Mocko** and **Joshua Summers** received an $86,038 award from Johnson Controls for their project entitled "Refined Displacement Seat Adjusting Concepts." They also received $110,828 from BMW for a project called "Formalization of TVG Information and Manufacturing."

**John Wagner** received a $54,400 award from the U.S. Army TACOM through the University of Michigan for a project entitled "Modeling and Evaluation of Novel Cooling Strategies using Nanofluid-enhanced Coolant and Thermoelectric Devices."

**Yong Huang** received a $15,000 NSF award for conference support for student participation at the 2012 International Symposium on Flexible Automation.

**Paul Joseph** received $14,048 from S.C. EPSCOR for his project entitled "Manufacturing Science of Improved Molded Optics."

**Ardalan Vahidi** received a $40,000 award from the U.S. Army TACOM through the University of Michigan for his project entitled "Ultracapacitor Energy Storage for Improving Fuel Economy and Extending Battery Life in Heavy Vehicles."

**Mica Grujicic** received $50,000 from the Army Research Organization for a project entitled "Concept Validation and Optimization for a Vent-based, Mine-blast Mitigation System."

**Yong Huang** was elected a Fellow of the ASME. Fellow grade is the highest elected grade of membership within the organization, and its attainment recognizes exceptional engineering achievements and contributions to the engineering profession.

**Ilenia Battiato** will join Clemson this spring as an assistant professor. Her research involves analytical and numerical modeling of (reactive) transport processes in crowded environments at a variety of scales with applications to environmental flows, nanotechnology, biological systems and granular matter.

**Huijuan (Jane) Zhao** joined the Clemson faculty at the first of the year from Oak Ridge National Laboratory. Her research focuses on understanding material properties in different length scales. This is done by using proper computational techniques, including finite element method, multi-scale simulations, molecular dynamics simulations and first-principle-theory studies.

Mechanical engineering was named a finalist in the **Innovations in Education** category for the **2011 Innovisions Awards.** The nomination came for a class project directed by **Joshua Summers** where teams of engineering students designed, built and delivered functional wind tunnels as educational platforms for fourth-graders at Anderson's Midway Elementary School.

**Giovanni Biglino**, **Richard Figliola's** London-based post-doc, received the Levitronix ASAIO Fellowship for Young Investigators for the presentation "A Patient-Specific Paediatric Mock Circulatory System: Investigating the Circulation Following the Norwood Operation," by G. Biglino, A. Giardino, S. Schievano, A. Taylor and R. Figliola.

## Student Achievement

**Beshoy Morkos**, **Prabhu Shankar**, **Sudhakar Teegavarapu**, **Ashwin Michaelraj**, **Joshua D. Summers** and **Andreas Obieglo** received the Arch T. Colwell Merit Award for their SAE paper entitled "Conceptual Development of Automotive Forward-Lighting System Using White-Light Emitting Diodes."

Clemson students won several awards at the NSF/ASME Design Essay contest:

- **Jun Hu** and **Manh Tien Nguyen** for their paper entitled "Challenges in the Design of Complex Systems"
- **James Mathieson** for his paper entitled "Integrated Industry-Based Education"
- **Vikrant Rayate** for his paper entitled "A High-Tech Global Manufacturing Enterprise — Product Development in 2030 and E-Business"





# Physics and Astronomy

**Mark Leising, Ph.D.**
Interim Department Chair
864-656-5304
*lmark@clemson.edu*
*clemson.edu/ces/physics-astro*

## Fast Facts

**Tenured/tenure-track faculty:** 21

| | | |
|---|---|---|
| **Enrollment:** | Undergraduate | 42 |
| | Master's | 6 |
| | Doctoral | 66 |
| **Degrees awarded:** | | |
| | Undergraduate | 14 |
| | Master's | 5 |
| | Doctoral | 8 |

**Research expenditures:** $2,752,641
**Research thrusts:** astronomy and astrophysics, atmospheric and space physics, materials physics, surface physics, theoretical quantum physics


Terry Tritt

## Faculty

**Peter A. Barnes,** department chair of physics and astronomy, retired in October after 10 years of loyal and faithful service.

Professors **Terry Tritt** and **Satish Vitta** (Indian Institute of Technology-Bombay) hosted the first ever Indo-US workshop on Thermoelectrics - Theory, Materials and Applications in India. Vitta is a Fulbright Scholar who worked with Tritt at Clemson last year.

The physics and astronomy department hosted its first symposium last summer on introduction to research. The full-day event consisted of research presentations by graduate students and faculty and a poster session. The intent of the conference was to introduce incoming graduate students to the various research groups and ongoing projects within the department.

The highlights of the symposium included talks and posters on astrophysics, the Earth's atmosphere and ionosphere, fundamentals of quantum mechanics, quantum computing, computational modeling of biophysical molecules, nanoscale materials and ion beam physics.

An international conference on time domain astrophysics was held last fall, attracting nearly 100 participants from Japan, Europe and South America. Professors **Dieter Hartmann** and **Mark Leising** brought together scientists who have been working with NASA's Swift satellite. The goal of the meeting was to discuss key science topics from Swift's successful past seven years, to focus attention on opportunities for further improvements in its observing program and to target opportunities for the coming years. A comprehensive analysis of the road ahead is extremely important, considering that Swift is now in its extended-life operating phase and faces stiff competition from missions such as the Hubble Space Telescope and Fermi.

When Swift was launched in 2004, its prime objective was to chase gamma-ray bursts. However, it was quickly realized that its multi-wavelength and fast-scheduling capacity make it the most versatile mission ever flown. Now it is used for an impressive variety of targets, including active galaxies, supernovae, novae, variable stars and much more. Swift has also observed nearby solar system objects (comets) and reached out to GRB 090423, one of the most distant objects in the universe. The detection of J1644+5734/GRB 110328A has shown that Swift continues to discover new object classes.

Staff from the Department of Physics and Astronomy were instrumental to the conference's success and include **Amanda Crumpton**, **Lori Rholetter** and **Janet Lee**.

**Apparao Rao,** along with other researchers from the Department of Chemistry at the Sri Sathya Sai Institute of Higher Learning in Prashanthinilayam, India, and Clemson's Center for Optical and Materials Science and Engineering Technologies, published a paper in the journal *Langmuir*. They reported a "green synthesis" method for silver and gold nanoparticles and further showed that these particles exhibit superior catalytic properties.

## Student Achievement

Last summer, **Terry M. Tritt** and graduate students **Jennifer Hubbard Graff** and **Dale Hitchcock** visited Hangzhou, China, in an interaction with Zhejiang University as part of the NSF Materials World Network. The network is led by Tritt and **Jian He** on the U.S. side and T.J. Zhu and X. Zhao on the Chinese side. Both of the students presented lectures at Zhejiang University on their research efforts at Clemson University.

**Ginger Bryngelson**, a Ph.D. candidate, was awarded nationally competitive time on the 4m telescope at the Kitt Peak observatory based on the merit of her science proposal.

# Department Contacts

### Automotive Engineering
6 Research Drive
Greenville, SC 29607
Phone: 864-283-7217
*clemson.edu/centers-institutes/cu-icar*
*sih@clemson.edu*
Dr. Imtiaz Haque, Chair

### Bioengineering
301 Rhodes Research Center
Clemson University
Clemson, SC 29634-0905
Phone: 864-656-5556
Fax: 864-656-4466
*clemson.edu/ces/bioe*
*laberge@clemson.edu*
Dr. Martine LaBerge, Chair

### Chemical and Biomolecular Engineering
127 Earle Hall
Clemson University
Clemson, SC 29634-0909
Phone: 864-656-0822
Fax: 864-656-0784
*clemson.edu/ces/chbe*
*hirtd@clemson.edu*
Dr. Douglas Hirt, Chair

### Chemistry
219 Hunter Laboratories
Clemson University
Clemson, SC 29634-0973
Phone: 864-656-4995
Toll Free: 888-539-9954
Fax: 864-656-6613
*clemson.edu/chemistry*
*screage@clemson.edu*
Dr. Stephen Creager, Chair

### Glenn Department of Civil Engineering
Lowry Hall
Clemson University
Clemson, SC 29634-0911
Phone: 864-656-3002
Fax: 864-656-2670
*clemson.edu/ce*
*aziz@clemson.edu*
Dr. Nadim M. Aziz, Chair

### School of Computing
100 McAdams Hall
Clemson University
Clemson, SC 29634-0974
Phone: 864-656-7552
Fax: 864-656-0145
*clemson.edu/ces/computing*
*lfh@clemson.edu*
Dr. Larry F. Hodges, Director

### Holcombe Department of Electrical and Computer Engineering
105 Riggs Hall
Clemson University
Clemson, SC 29634-0915
Phone: 864-656-5924
Fax: 864-656-5917
*clemson.edu/ces/ece*
*ddarren@clemson.edu*
Dr. Darren Dawson, Chair

### Engineering and Science Education
105 Holtzendorff Hall
Clemson University
Clemson, SC 29634-0902
Phone: 864-656-2573
Fax: 864-656-1327
*clemson.edu/ese*
*cmelani@clemson.edu*
Dr. Melanie Cooper, Interim Chair

### Environmental Engineering and Earth Sciences
L.G. Rich Environmental Laboratory
342 Computer Court
Anderson, SC 29625
Phone: 864-656-1005
Fax: 864-656-0672
*clemson.edu/ces/eees*
*tkaranf@clemson.edu*
Dr. Tanju Karanfil, Chair

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

### School of Materials Science and Engineering
161 Sirrine Hall
Clemson University
Clemson, SC 29634-0922
Phone: 864-656-5958
Fax: 864-656-5973
*clemson.edu/mse*
*luzinov@clemson.edu*
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
*clemson.edu/math*
*rtaylo2@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
*clemson.edu/ces/me*
*fgeorge@clemson.edu*
Dr. Georges Fadel, Interim Chair

### Physics and Astronomy
118 Kinard Laboratory
Clemson University
Clemson, SC 29634-0978
Phone: 864-656-5304
Fax: 864-656-0805
*clemson.edu/ces/physics-astro*
*lmark@clemson.edu*
Dr. Mark Leising, Interim Chair

CLEMSON
College of ENGINEERING AND SCIENCE