Dear Colleagues,

I am pleased to present you with the first issue of Convergence, a newsletter about research in the College of Engineering and Science (CES). The goal of this publication is to provide updates every six months about the research and graduate education activities in our College. Please note that we have a new web page for the office of the associate dean of research and graduate studies (www.clemson.edu/ces/research). On the site, we will continuously post more information and updates beyond those found in this newsletter. Available on the website are sample templates and proposals for some large federal agencies that may be useful in your proposal preparation. We welcome your comments as we strive to create a user-friendly environment.

We recently closed the 2013-14 fiscal year, and it was a productive year for the College. New research awards have exceeded $40 million. This number represents about half of the University’s total in new awards. The research expenditures during the same period totaled about $43 million.

Two trends in the past year have been particularly promising.

> Spotlight on Faculty

Foam Test Could Help Inspectors Find Banned Weapons

New Clemson University Technology Approaching Readiness

New technology under development at Clemson University could help inspectors determine whether nations have violated international treaties by allowing work with chemicals that are used in banned weapons.

Igor Luzinov, a materials science and engineering professor, calls the technology an "unattended off-line sensing system" and said it could be completed in two years.

An extremely thin polymer foam is attached to a silicon chip measuring about one-inch-by-one-inch. It would be placed in labs and collected about once a month, he said.

The foam would collapse at specific points if it had been exposed to chemicals that could be used in banned weapons, Luzinov said.

The foam would be chemically encrypted to make it impossible to replicate without highly specific inside intelligence, he said. Any tampering would be obvious to scientists, Luzinov said. "It’s virtually foolproof," he said.

Luzinov said his team has proven the technology works and is now perfecting it. The foam so far has been exposed to high concentrations of vapors and needs to be made more sensitive, he said.

His work has been funded with about $1.4 million from the Defense Threat Reduction Agency. He has been collaborating with Lionel Kimerling and Anu Agarwal of the Massachusetts Institute of Technology; Kathleen Richardson of the University of Central Florida; and Joel Hensley of Physical Sciences, Inc.

Tanju Karanfil, associate dean for research and graduate studies in the College of Engineering and Science, called Luzinov an im...
Continued from pg 1

First, the new awards proposed last fiscal year increased significantly after three years of decline and exceeded 2009 levels (see figure). This is important because the success rate of the College proposals has been about 15-20 percent for the past five years, which is comparable to many other institutions. Therefore, increases proposed research funding will likely increase our award revenue in coming years.

Over the last fiscal year, we also saw a significant increase in the submissions of large (over $2 million) proposals. These involved a range of programs and agencies, such as COBRE, ERC, EPSCoR, MRSEC, NNMI, and NRTs. As you will see in this newsletter, we’ve already had a few significant hits. Dr. Naren Vyavahare will serve as principal investigator on an $11-million grant from the National Institutes of Health to expand the South Carolina Bioengineering Center of Regeneration and Formation of Tissues (see pages 8-9). Dr. Brian Powell will be the principal investigator on a $5.2-million grant from U.S. Department of Energy’s Experimental Program to Stimulate Competitive Research (see pages 4-5). Several other large grants are pending. This success is a testament to the intellectual quality, creativity and hard work of our CES faculty.

We are well-positioned to seek and win many other large projects. One component of our strategy is that that we have funded 22 TIGER grants providing $400K from CES as to support the development and submission of large proposals. The new call for the 2014-2015 academic year will be announced very soon.

There is no doubt that each large initiative is unique and requires significant hard work, strong commitment and strategic planning. If you plan to pursue large-scale proposals, please contact me early in the process, as you develop your ideas and form teams. I will be happy to work with you and assist in your initiatives.

Looking at our funding sources for 2013-14, the top five sponsors of CES research were all federal agencies; 39 percent of funding was received from the National Science Foundation, followed by 13 percent from the National Institutes for Health/Department of Health and Human Services; 11 percent from the Department of Energy; 7 percent from the Army; and 6 percent from the Department of Defense. The balance of funding came from other federal agencies, industry, foundations and the state (see pie chart). Although we have a significant amount of funding coming from NSF, I would like you to consider pursuing opportunities at other agencies and from within industry.

You will also find opportunities to advance your research at our Innovation Campuses (AMRL, CU-ICAR, CURE, and CUBEInC) where the University has made significant investments in the past two decades, and there are several state-of-art research facilities. I encourage you to take maximum advantage of these resources for your research as appropriate and applicable. We are working with Dr. John Ballato, the vice president for economic development, to better link and integrate the research on campus with these locations.

On another note, we organized and hosted the first annual CES Research Symposium at the end of the spring semester and was a great success. With more than 60 presentations in two parallel sessions, our symposium was a great success. Special thanks go to Drs. Marcus, Ogale and Powell, who organized and managed this event along with Dana Simpson and Jessica Economy. We are currently planning for 2014-2015 and will publicize the dates as soon as possible so you can mark your calendars. With over 300 tenured and tenure track faculty in CES engaged in a various research, we expect and even greater level of participation in our second year. I especially wish to encourage new and junior faculty to participate and learn about the depth and diversity of research in the College.

Looking ahead to spring semester, our office will again present a series of seminars specific to various federal agencies, including NIH, NSF, DOE, and DOE. These seminars are provided by Clemson faculty who have historically been successful with these agencies, and provide junior faculty, post-doctoral scholars and others with valuable information on how to successfully negotiate the submission process for each agency.

The CES Post-doc Support office is now established and providing services including record keeping, organizing events and helping with the HR process. As a sustaining member of the National Post-doc Association, CES provides affiliate membership to all postdocs,
as well as faculty, staff and students with a “clemson.edu” email addresses. Our post-docs organized a seminar series for the summer, and each week two post-docs presented and shared their research with the campus community. I am very pleased with the involvement of our post-docs with these activities. We also organized a dinner for our post-doc and their advisors during the National Post-doc Appreciation week in September. Please encourage your post-docs to take advantage of these activities, and if you need assistance in hiring post-docs, please contact Jessica Economy in my office.

For the 2013-2014 academic year we had over 1,760 graduate students in the College, and there has been a continuous increase in both our master and doctoral student populations. Increasing the number of doctoral students is especially important to increase the research brand of the College and Clemson. It is especially helpful in placing our graduates at academic institutions and national laboratories. We are very pleased to see that six of our graduate students have received the prestigious 2014 National Science Foundation Graduate Research Fellowship (see page 13) with several other honorable mentions. Special thanks go to the Clemson team, including Lisa Benson, Julia Frugoli of the College of Agriculture, Forestry and Life Sciences, and Ricki Shine of Calhoun Honors College. Their tremendous efforts have brought great success to Clemson and CES. These are exciting times for CES Research and Graduate Education. Thank you for all your efforts, hard work and contributions.

While I am aware of needs in various areas, I see a very bright future in front of us. With strong teamwork, we are poised to make a significant impact and take the Clemson and CU research to the next level. Please do not hesitate to contact me or my office, if there is any way we can assist with your research and graduate education endeavors.

Tanju Karanfil
Associate Dean for Research and Graduate Studies

>>Faculty Awards

NSF CAREER-Award Researchers

16 current tenured and tenure-track faculty are actively conducting research that is being directly supported by their CAREER grants.

These projects range from nanomaterials to petascale computing and everything in between. The National Science Foundation Early Career Development Program, or CAREER award, is the most prestigious award in support of junior faculty who exemplify the role of teacher-scholars through research, education and the integration of the two to support the institutional mission. The College of Engineering and Science is proud to have so many of these researchers among our colleagues.

Jeffrey Anker (2013) – High Resolution Spectrochemical Imaging Through Tissue
Delphine Dean (2013) – Hierarchical Mechanical Models of Cell Constructs
Hai Ying Shen (2013) – A New Efficient and Cooperative Large-Scale Disributed Data Sharing System
Stephen Moysey (2012) – Advancing the Mechanistic Understanding of Field-Scale
Preferential Flow and Transport Processes in Soils Using Geophysics
Melissa Smith (2012) – Harnessing Hybrid computing Resources in PetaScale Computing and Beyond
Xiangchun Xuan (2012) – Electromechanical Transduction of Vibratory Energy Harvesters in Random and Non-Stationary Environments
Beshah Ayalew (2011) – Control of Processes Actuated with Mobile Radiant Sources
Lisa Benson (2011) – Student Motivation and Learning in Engineering
Mohammed Daqaq (2011) - Electromechanical Transduction of Vibratory Energy Harvesters in Random and Non-Stationary Environments
Brian Dominy (2010) – Computational
Modeling of Protein Evolvability
Li Gang (2010) – Multiscale Thermomechanical Analysis of Nanomaterials and Nanostructures
Sean Brittain (2010) – The Evolution of Gas in Disks – Setting the Stage for Planet Formation
Michael Mears (2010) – Model-Based Control of Machining Processes and Scalability for Manufacturing System Control
Brian Dean (2009) – Algorithmic Aspects of Ordinal Matching Problems
Jason Hallstrom (2008) – Supporting Patterns for Embedded Network Systems
peccable researcher whose work is on the cutting edge of materials science and engineering. “Dr. Luzinov’s exemplary work is addressing the complex challenges facing the global community,” Karanfil said. “His research into polymers is a game-changer.”

Researchers start with a silicon chip as a base. Then they graft an extremely thin polymer film onto the chip.

The film is infused with a solvent that swells it, and the foam is formed as the solvent turns from vapor to solid. It can be made so that every point on the foam has different chemical composition.

The foam’s topography is later measured with precision lab equipment, such as an ellipsometer. Researchers can also put the foam on “optical micro-resonator arrays” that have been developed at the partner institutions for precise detection, Luzinov said. “We can get a very accurate profile,” he said.

Researchers published some of their findings earlier this year in a paper published by the Royal Society of Chemistry. The paper was titled “Temperature controlled shape change of grafted nanofoams.”

Luzinov said he has been developing new ways of attaching polymers to surfaces for a decade and that the foam works because of the prior research. “When it swells, it does not dissolve and it stays in place during operation,” he said.

“Dr. Luzinov’s exemplary work is addressing the complex challenges facing the global community,”

-Dr. Tanju Karanfil

Luzinov is also using his research to make biodegradable plastics and new coatings for fibers and textiles. But he said the foam test for treaty verification is what currently excites him most. “It’s a very simple device, but it’s based on fundamental polymer science and knowing how polymer materials behave,” Luzinov said.

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Clemson University to Begin Field Experiments on Nuclear-Waste Storage

A team of more than 20 researchers from across the state will begin running field experiments at Clemson University next year to find the best ways of storing nuclear waste.

Experiments have been done on a small scale in labs, but a new outdoor site will allow researchers to test underground storage methods on an intermediate scale in real-world conditions, said Clemson associate professor Brian Powell. “If we can do that, then our confidence in these waste disposal scenarios will be much, much higher,” Powell said. “This stands to be a premiere test-site in the country.”

Experiments will be conducted in an above-ground, prefabricated container that university officials are calling a “research testbed.” Researchers are deciding between two sites, both near Clemson’s main campus, Powell said. Clemson is leading the study, and researchers from South Carolina State University and the University of South Carolina are collaborating.

The study will be funded by a $5.2 million grant from the U.S. Department of Energy’s Experimental Program to Stimulate Competitive Research and is supported by the U.S. Department of Energy, Office of Science, Basic Energy Sciences.

Clemson President James P. Clements said that an impressive team has been assembled to study an issue of vital importance to South Carolina and the nation. “About half of South Carolina’s energy comes from nuclear power,” he said. “We also have to deal with legacy waste from weapons production. It’s crucial to our health and the environment that we find the best storage methods. The study will bring together some of the state’s top minds to advance the science behind environmental monitoring, remediation and disposal of radioactive contaminants.”

South Carolina is home to seven nuclear power plants, and six more are close to the state’s borders. Two nuclear reactors are under construction in South Carolina and Georgia. South Carolina is also home to Savannah River Site.
“The state is well-positioned to make a decisive contribution to the future of nuclear energy,” said John Ballato, Clemson’s vice president for economic development. “To do so, it’s imperative that we understand the scientific and engineering needs of safely dealing with the waste.”

Nuclear waste storage takes on heightened importance in the Edisto River basin, which is surrounded by nuclear facilities and is home to S.C. State, said Zheng Chang, an associate professor of nuclear engineering at the Orangeburg university. “It’s really important to do research and find out how to deposit this nuclear waste,” Chang said. “We also need to know the behavior and characteristics if the nuclear waste is leaked into the environment.”

“This stands to be a premiere test-site in the country”

-Dr. Brian Powell

Travis Knight, the director of USC’s Nuclear Engineering program, said that nuclear power is an important part of the nation’s energy portfolio. While growth has slowed recently due to cheap fossil fuels, particularly natural gas, waste will continue to be an issue. Space exploration, oil drilling and nuclear medicine all involve radionuclides, he said. “Our study is solving a complex issue in an inter-disciplinary nature,” Knight said. “It’s an opportunity to advance the science.”

Researchers plan to study legacy waste from weapons production and the waste that comes from generating nuclear power, Powell said. Components of used nuclear fuel can be reprocessed into fresh fuel. But even with reprocessing, some leftover material is no longer usable.

“We’ll be looking at that stream of waste as well,” Powell said. “The current U.S. policy is not to recycle spent fuel. The thinking worldwide, though, is that recycling some of this material is really the way to go. We want to be ready to deal with that option. The defense related nuclear waste has already gone through this recycling process. So we already have some of this waste that we need to deal with anyway.”

A persistent concern among researchers is whether small-scale lab experiments will yield the same results when performed on a larger scale, Powell said.

Powell said he didn’t know of any other test site that can run experiments on the scale that Clemson plans to offer. The only exception would be Department of Energy sites that have been contaminated by many years of operation, he said. “The Clemson site will have the advantage of allowing researchers to control the experiments,” Powell said.

The study’s goal is to find safe, secure and cost-effective ways to isolate waste that ensure environmental and human health are protected. “To do that, we’ve got a very wide range of possibilities, the vast majority of which are focused on underground burial of some sort,” Powell said.

Larry Dooley, Clemson’s interim vice president for research, said that what stood out about the grant to him is how it encourages collaboration among several institutions to work for the common good. “We’re building a team,” he said. “We can accomplish more together than we can separately.”

The team includes expertise in nuclear engineering, radiochemistry, health physics, environmental science, hydrogeology, geophysics, plant physiology, computational modeling, sociology and civil engineering. The project includes an educational outreach component that will incorporate research findings into public presentations, including some in schools. The goal will be to inform the public about nuclear energy and the environment.

Anand Gramopadhye, dean of Clemson’s College of Engineering and Science, said that the grant will enable the university to do world-class research that helps create a sustainable environment. “The end result will be a team of engineers and scientists who have the tools and skills to deal with waste from commercial nuclear energy and legacy weapons production,” he said. “The size of the grant reflects on the quality of the leadership and the high quality of research that will be delivered.”

Powell said the test site will pose no risk to people who live and work nearby. “We will get approval from DHEC to build and run the site,” he said. “We’re operating a sister facility like this at the Savannah River Site. We know how to build it and run it well.

“The Clemson site will be secured to prevent access by non-authorized personnel and will be routinely monitored. Furthermore, though we will be monitoring below-ground processes, the experiments will be conducted in above-ground containers to prevent any possibility of releases to the environment.”

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Clemson University Professor Strives to Prevent Disease

Research and conference shine light on University’s role in personalized medicine

Emil Alexov says that in the near future, a DNA sample will be taken from every newborn and analyzed to figure out what diseases could endanger the child’s future. Doctors could recommend eating a specialized diet or taking medicine, depending on the risks the child faces.

“We don’t like to treat sick people,” Alexov says. “We like to prevent diseases.”

Alexov’s research and a conference he organized in August are shining a spotlight on Clemson University’s role in advancing personalized medicine, as well as understanding the molecular mechanisms of human diseases.

Personalized medicine is a fast-growing field that will allow doctors to use individuals’ genetic makeup to determine whether they are susceptible to disease and tailor treatment to them. It holds the promise of preventing suffering and lowering healthcare spending.

“We don’t like to treat sick people, We like to prevent disease”
-Dr. Emil Alexov

While new methods have made DNA sequencing quick and relatively inexpensive, they haven’t gone far enough to become a routine practice, Alexov says.

“Most human DNA variations are likely harmless by themselves, but some could help explain hereditary diseases and the origin of complex diseases,” he says.

Alexov’s approach to his research and the conference are the same: He is bringing together researchers from various fields to look at common problems from different angles.

Tanju Karanfil, associate dean for research and graduate studies in the College of Engineering and Science (CES), says Alexov is one of Clemson’s most esteemed researchers.

“Dr. Alexov is focused on health, one of the 21st century’s grandest challenges,” Karanfil says.

“His research in personalized medicine could have a direct effect on health in the coming years. The work he’s doing with electrostatics could have a broad impact across disciplines for decades.”

The team that Alexov has assembled for his personalized medicine research includes CES professors Weiguo Cao, Feng Ding and Brian Dominy and College of Agriculture, Forestry and Life Sciences professor Susan C. Chapman. They work in close collaboration with a team at Greenwood Genetic Center led by Dr. Charles Schwartz.

The teams’ research encompasses intellectual disabilities, developmental syndromes and neurological and metabolic disorders. They look for how human DNA variants and other factors may play a role in making diseases better or worse.

“We’re at the frontiers of modern medicine,” Alexov says. “The potential for corporate support is strong. We expect to add to the Upstate’s economic
Alexov, a professor of biophysics and bioinformatics, has been recognized as a leader in his field. He is an editor of the International Journal of Molecular Sciences and of Computational and Mathematical Methods in Medicine.

Alexov has also been named chair of the Gordon Research Conference on “Human Single Nucleotide Polymorphism and Disease.”

The conference was at Stonehill College in Easton, Massachusetts, Aug. 3-8, 2014. Researchers from as near as Harvard Medical School in Boston and from as far as Koc University in Istanbul are on the agenda to speak. Some specialize in genes, while others focus on proteins.

“We are at the frontiers of modern medicine”

-Dr. Emil Alexov

“Gordon Conferences are very prestigious,” Alexov says. “It’s a personal honor to organize one, but I’m also hoping that bringing together the best minds in a quiet, small-town setting will have an impact on research and development.”

Alexov’s is also conducting fundamental research that could also help shed light on disease causes and cures. His work with electrostatics is crucial to modeling virtually all biological processes and other phenomena in molecular biology and nanodevices, he says.

He is three years into a $2.2-million federal grant to do fundamental research to model “electrostatics” in the human body.

Alexov expects the research will provide the necessary tools and methodology for understanding the crucial role of electrostatics’ cellular machinery. The work is sponsored by the National Institute of General Medical Sciences, a part of the National Institutes of Health.

The software for his project, DelPhi, was developed specifically to handle the math of the Poisson-Boltzmann equation. It’s a differential equation that describes electrostatic potential in complex systems and serves as the basis for Alexov’s work.

Alexov served for five years as senior researcher in the lab of DelPhi’s creator, Barry Honig of Columbia University.

At Clemson, Alexov is working to improve the software’s speed and accuracy, continuously adapting the program so that scientists across the world can apply it to the rapidly changing areas of computational biophysics and bioinformatics.

More than 2,000 researchers and labs have signed the license agreement and downloaded the software.

“You couldn’t achieve everything with wet laboratory experiments,” Alexov says.

“Combining computational modeling with in vitro and in vivo experiments is the best thing to do. It saves time, money and at the end delivers better results and even more importantly, provides comprehensive explanation of the effects and phenomena being studied.”

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Money could help nurture state’s medical-technology industry

Clemson University has been awarded $11 million to expand a bioengineering center that helps mentor junior faculty members as they research how lab-grown tissue can treat some of the world’s most debilitating diseases, ranging from heart disease to spinal cord injuries.

Scientists expect the program will encourage an upward spiral that leads to more research dollars and helps boost the state’s growing medical-technology industry. Much of the center’s research will be done at a new cutting-edge campus in Greenville.

The money comes from a National Institutes of Health program that supports the nationwide Centers of Biomedical Research Excellence (COBRE). The one at Clemson is called the South Carolina Bioengineering Center of Regeneration and Formation of Tissues (SC BioCRAFT).

The grant was the largest from the NIH in university history and brings the total NIH funding for the center to $20.3 million.

The $11 million will pay for maintaining and upgrading state-of-the-art facilities. It will also provide funds for five junior faculty to begin their research, said Naren Vyavahare, the SC BioCRAFT director and Hunter Endowed Chair of bioengineering.

The goal is make the center self-sustaining, so that it can transition away from COBRE funding. Once the center is established, its researchers will be well-positioned to compete for funding from a range of federal and non-federal sources, Vyavahare said.

“This is seed money,” he said. “The whole idea behind the center is to fund and mentor junior faculty and make them successful. When they get their own major grant, we graduate them and get new people in.

“This is a unique program to help early career investigators to establish their research program quickly with the support of expert mentors and free access to world-class core facilities”

Clemson researchers will collaborate with Dr. Roger Markwald of the Medical University of South Carolina, who is a co-principal investigator on the grant. Senior investigators Drs. Thomas Borg and Mark Kindy, both of MUSC, will provide biology expertise.

Support for the COBRE centers comes in three phases, each lasting five years. The new round of funding launches Clemson’s second phase. In the first phase, the university used the $9.3 million it received to start SC BioCRAFT.

Researchers at the center work on finding new ways to engineer cells and tissue to help the body function normally when someone gets sick or hurt. The field, regenerative medicine, holds the promise of eventually allowing scientists to grow vital organs in the lab for transplants.

“We’re on the right track,” Clemson University President James P. Clements said. “The NIH has invested more than $20 million in Clemson’s program since 2009. This level of funding is a great vote of confidence in our bioengineering faculty and their research.”

The funding strengthens The Clemson-MUSC Joint Bioengineering Program.

A $60-million bioengineering building that recently opened on MUSC’s campus in Charleston houses the labs of five full-time Clemson faculty, including one involved in the grant.

“The new building and partnership underscore the growing statewide emphasis...
on bioengineering and regenerative medicine,” Markwald said. “Collaboration is key. We can accomplish more together than we can separately.”

SC BioCRAFT has been headquartered in Rhodes Engineering Research Center on the main campus. But the new round of funding will funnel more research to Clemson University Biomedical Engineering Campus (CUBEInC) at Greenville Hospital System’s Patewood Medical Campus.

CUBEInC opened nearly three years ago to serve as an economic engine that helps power the state’s medical technology industry. The campus’ 29,000 square feet includes world-class labs, a conference center and room for start-ups.

The first round of COBRE funding helped make CUBEInC possible, and the second round will take it to the next level, said John Ballato, Clemson’s vice president for economic development.

“An $11-million grant is a game-changer,” he said. “That level of funding allows us to attract and retain the kind of talent the state needs to grow its portfolio of med-tech businesses. Jobs in the field start at $60,000 to $80,000.”

Clinical mentors, including Eugene Langan, M.D. and Thomas Pace, M.D. from GHS, will help junior faculty keep their research clinically relevant.

We can help faculty stay focused on critical, real-world healthcare needs and improving patient care,” Langan said. “As physicians, we treat patients daily, allowing us a front-row view of what’s needed in the field.”

Researchers at the center are focused on a branch of study called “translational research.” The emphasis is on practical research with a high probability that it can be taken from the lab bench to the patient’s bedside.

“SC BioCRAFT researchers are improving health, one of the 21st century’s grand challenges,” said Anand Gramopadhye, dean of the College of Engineering and Science.

“The high-impact medical technology they are developing could lead to therapies and cures that help patients around the world. And having the research in Greenville means that it could help create high-paying jobs here in South Carolina.

“Securing second-phase funding from NIH reflects on the leadership and the high quality of research the team delivers.”

-Dr. Anand Gramopadhye

In its first five years, the center has helped support and mentor 13 junior faculty members who have collectively received more than $10 million in external funding and published 151 journal articles. The center also helped the university recruit three junior and two senior faculty members.

The Clemson Light Imaging Facility was installed in the main campus’ Life Sciences Facility as part of the first round of funding. The facility houses several advanced-light microscopes, cell sorting equipment, a specimen preparation laboratory and a 20-seat classroom.

“We did very well in phase one,” said Martine LaBerge, who is chair of Clemson’s bioengineering department. “We will build on our success in phase two.”

The National Institutes for Health lists nearly 100 COBRE centers nationwide, including seven in South Carolina. Each focuses on a different area of health, ranging from colon cancer to pediatric research.

Clemson’s center is the only one focused on bioengineering.

The university’s history in the field goes back more than 50 years, making it one of the world’s oldest and most experienced bioengineering departments.

“With the work our researchers have done and the phase-two funding in hand, Clemson and our partners are well-positioned to strengthen the bioengineering and regenerative medicine community in the state and nationally.”

Dr. David J. Cole, president of MUSC, said, “This NIH funding for our Clemson-MUSC collaboration in bioengineering and regenerative medicine is very exciting. Our vision is to not only continue to support the development of talented young scientists and our biotechnology industry within the state, but to provide an environment that will fundamentally change patient care of the future.”

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Clemson University Restoration Institute (CURI)

Clemson University’s Wind Turbine Drivetrain Testing Facility is a world class environment for developing the next generation of wind turbine nacelles and offers outstanding research and educational opportunities. To advance these systems without compromising safety or driving up expenses, Dr. Ryan Schkoda is constructing a real-time simulation laboratory. The simulation lab will serve as an intermediary between physical testing and purely simulation based analysis.

The laboratory will consist of a duplicate test control computer from RENK Test Systems and a real-time simulation computer from Concurrent Real-Time, an industry provide of computer systems and software solutions. Additionally, the lab will have controllers, I/O hardware, and data acquisition hardware so that engineers can replicate test-floor configurations in a laboratory setting.

Practical applications of the simulation lab include test profile development, system troubleshooting, training, and pretest communication validation. Additionally, the laboratory may be used for research by making the dynamic behavior of a complete test bench available to students and faculty remotely and without the risk associated with operating the actual test bench.

CUBEInC is a nearly 30,000-square-foot economic engine that opened just over two years ago at Greenville Health System’s Patwood Medical Campus.

The campus is playing a key role in the industry’s growth by bringing together scientists, physicians, students and businesses to find new ways of diagnosing and treating illness.

Some of the campus’ research focuses on making less-toxic chemotherapy, preventing breast cancer relapses, figuring out why some implants fail and developing orthotic insoles for diabetic patients with foot ulcers.

Michael Gara, the technology management director for CUBEInC, sees huge opportunity in the medical-technology industry because of the state’s tax incentives, Greenville’s business-friendly environment and Clemson’s half-century of bioengineering experience.

The jobs that would come with an expansion of the medical-technology industry start at about $60,000 to $80,000 a year, Gara said.

“We just need a couple successes to put us on the map,” Gara said. “Much like a BMW came in and anchored the auto industry, we need that sort of thing for the medical technology industry.”
The Office of the Associate Dean for Research and Graduate Studies–College of Engineering and Science

Innovation Campus Highlight
CU-ICAR
Making the Engines Smart: Highlight of Research in the Automotive Engineering Department Directly Impacting the Industry

The Advanced Powertrains group within the Department of Automotive Engineering has experienced significant growth recently. Their research portfolio includes a healthy mix of projects funded by major Original Equipment Manufacturers, South Carolina companies, and government agencies. Collaboration with Chrysler (now Fiat Chrysler Automobiles) has been particularly fruitful, and a string of projects started since 2013 have established Clemson as one of their primary academic partners.

A project on Physics Based Spark Timing Control highlights the philosophy of combing pure research, such as development of original physics-based models and novel algorithms, and translation into solutions for future Chrysler products. “New fuels saving technologies such as variable valve actuation and low pressure EGR open up new possibilities, but also make modern engines more complex”, says Dr. Robert Prucka, the principal investigator on the project. “The added complexity makes traditional engine control and calibration approaches burdensome”. Instead, predictive models make the engine controller smarter, enabling realization of the fuel savings potential, and decreasing time to market.

The development of physics-based control models is supported by experimental testing carried out in the state-of-the-art dynamometer cell, where solutions are ultimately demonstrated in real-time on a multi-cylinder engine. Results obtained so far were presented at the Advanced Powertrain Controls Symposium held on the CU-ICAR campus in March 2014, as well as conference and journal publications.

Advanced Materials Research Lab (AMRL)

The Urban Research Group at Clemson University, Advanced Materials Research laboratory (AMRL), is an interdisciplinary research group interested in a broad range of fundamental and applied aspects of materials chemistry in general and macromolecular science in particular.

Team members, under the guidance of Dr. Marek Urban, the J.E. Sirrince Foundation Endowed Chair and Professor in the Department of Materials Science and Engineering, use chemical imaging (infrared and raman) with a spatial resolution below one micron as a tool to design, develop and formulate clever, environmentally benign materials attractive to many branches of technologies, ranging from coatings and fibers to biomedical, composite and energy related industries. Our labs at AMRL offer the state-of-the-art instrumentation, which combined with innovative materials designs, attract federal and private section funding. This equipment is expected to provide seed materials for startup companies in South Carolina.

For more information, visit clemson.edu/ces/urbanresearch.
The National Science Foundation’s (NSF) Graduate Research Fellowship Program helps ensure the vitality of the human resource base of science and engineering in the United States and reinforces its diversity. The program recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering and mathematics disciplines who are pursuing research-based masters and doctoral degrees at accredited U.S. institutions. The NSF welcomes applications from all qualified students and strongly encourages underrepresented populations, including women, underrepresented racial and ethnic minorities and persons with disabilities to apply for this fellowship. NSF received more 14,000 applications for the 2014 competition and made 2,000 fellowship award offers. Congratulations to the awardees and honorable mentions.

Julie Renee Robinson, ChBE
Devin Gordon Alexander, MS&E
Melissa Marie Gende, CE
Kathryn Elizabeth Gasparro, CE
Scott Robert Cole, BioE
Marvin J. Andujar, CompSci

Amin Bibo, from Jordan, is a strong researcher with a strong combination of skills. Working with Dr. Mohammed Daqaq for both his MS and PhD degrees, he has conducted complex analytical work working with different researchers on energy-harvesting issues. This work has resulted in eight published journal papers and many presentations. He has become a top expert in nonlinear energy technology, specifically wind-energy harvesting. Bibo has developed mathematical models and conducted experiments for a piezoelectric wind-energy harvester that have demonstrated excellent accuracy in describing and predicting dynamic behaviors. He has demonstrated a deep understanding of nonlinear dynamics and problem solving.

Dale Hitchcock, of physics and astronomy, conducts Ph.D. research in the synthesis of novel complex materials and characterizations of their structural, mechanical, electrical, magnetic and thermal properties for fundamental research applications. His research has been conducted under Dr. Jian He as part of the Complex and Advanced Materials Lab. Since 2010, he has lead-authored and co-authored 15 peer-reviewed journal papers and one book chapter, and he has given many oral and poster presentations. He made his mark in single-crystal growth, a NRC strategic area by resolving a long-standing bottleneck problem in floating zone crystal grown, increasing the efficiency of raw material. His current thesis research is on mixed-conductor thermoelectricity, bridging two major classes of energy-related materials, ionic conductors and semi-conductors. He is working collaborating with researchers nationally and hopes to continue his research as a NRC postdoctoral fellow.

These two outstanding researchers demonstrate the qualities we want to see in Clemson graduates and we are proud to recognize their accomplishments. To learn more about the many awards received by Engineering and Science graduate students across the college, please visit the Honors and Awards portion of our website: www.clemson.edu/research.
New equipment could reduce cost of blood-sugar testing for diabetics

Creative Inquiry team targets Tanzania as students seek regulatory approval

Clemson University students have developed new medical equipment that could dramatically slash the cost of blood-sugar testing for diabetics and help prevent potentially fatal complications, especially in developing nations.

Tyler Ovington, Alex Devon and Kayla Gainey were on the team that won a Lemelson-MIT “Cure it!” prize in the undergraduate category for their GlucoSense project. The prize rewards students for working on technology-based inventions that can improve health care.

The work is part of the bioengineering department’s broader effort to improve lives in Tanzania, where students and faculty are working to introduce several low-cost medical devices, including an infant warmer and grass-woven neck braces.

The latest inventions are test strips and a glucometer that are more affordable than commercial products and can be made from readily available parts. They work much the same as conventional test strips and glucometers. Diabetics put a drop of blood on a strip and then insert it in the glucometer to check whether their blood sugar is too high or low.

A key difference in the student-designed test strips is that they can be printed for about a penny each by rigging an inkjet printer to shoot enzymes instead of ink. The potential cost-savings is huge. Commercially available test strips sell for about $1 each, and many diabetics need to use five or more a day.

Students have also made a glucometer out of widely available parts that can be found in any U.S. electronics store or bought in bulk and shipped to remote parts of the world. That’s key because when medical equipment breaks in Tanzania, it can be tough for engineers to find replacement parts. Now that students have prototypes, they are working with regulators in the United States and Tanzania to get the necessary approvals for distribution.

Human testing begins soon.

“What excites me most about this is it puts the technology in the hands of the people who are in need,” said Ovington, who is from Greenville and graduated in May. “It empowers them to provide themselves with health care and make the standard of health care that we have in the U.S. more ubiquitous across the world to give all populations a fair chance at a life.”

The GlucoSense team was mentored by Dr. Delphine Dean and Dr. John DesJardins and financially supported by Clemson’s Creative Inquiry Program.

Dean, an associate professor of bioengineering, has been working in Tanzania since she took the lead on developing infant-warming blankets. She was among a group of faculty and students who met with Tanzanian President Jakaya Kikwete in the capital, Dar es Salaam, in January 2012.

Diabetes is a big problem for the East African nation, Dean said. And donations of commercially available test strips and glucometers haven’t been much help, she said. “The meters and the test strips don’t match, and they’re completely useless,” Dean said. “So the patients have to go without testing.” Testing helps maintain blood sugar levels. When blood sugar is too high, diabetics need to take insulin. They need to eat when blood sugar is too low. Failing to maintain blood sugar levels can lead to complications, including kidney disease, high blood pressure, stroke, neuropathy, ketoacidosis and gastroparesis.

Gainey, a doctoral candidate from Sumter, said she learned about the work in Tanzania when she went to talk to Dean about graduate schools and internships about a year ago. As a Type 1 diabetic, Gainey had personal motivation to join the project. While she specializes in making the glucometer work electrically, she can also offer insight that non-diabetics can’t. “You know how the person is going to use it,” she said. “It adds to things like how it opens and closes or the shape of the strip or the way you administer the blood drop.”

Dean said that at the outset, she hoped that the glucometer would be accurate enough to meet standards but didn’t expect it to be as accurate as the meters currently on the market. “It turns out our accuracy is quite good and is on par, if not better, than some of the meters on the market,” she said.

Devon, who graduated in May and is from Greenville, said that he has been to Tanzania twice in the past six months and that what excites him most is the potential impact. “I’ve done work on the infant warmer and just seeing the progression it has had and knowing the potential for this design is really incredible,” he said.

Contact:
Delphine Dean:
finou@clemson.edu

THE OFFICE OF THE ASSOCIATE DEAN FOR RESEARCH AND GRADUATE STUDIES-COLLEGE OF ENGINEERING AND SCIENCE

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CONVERGENCE: TRANSLATING IDEAS INTO INNOVATION

**News & Updates**

**Pre & Post-Awards News**

**RESIDUAL BALANCES IN FIXED PRICE CONTRACTS POLICY (EFFECTIVE 2/24/2014)**

The procedure for transferring remaining project balances in fixed price contracts was incorporated into the policy on “Residual Balances in Fixed Price Contracts.” Remaining balances greater than 10 percent of the total original award require VPR approval prior to transfer. Full policy information can be found on the OSP website at http://media.clemson.edu/research/sponsored-programs/policies/residual_balances.pdf.

**INCENTIVE CARD POLICY (EFFECTIVE 7/01/14)**

Incentive cards may be used as a tool to meet the business purposes of the University. They can be used to support research study participants and for awards or prizes to support student activities. As cash-equivalent instruments, incentive cards are governed by internal control requirements and may be subject to tax reporting. They must be distributed in accordance with the guidelines set forth in this policy. Full policy information can be found at http://www.clemson.edu/finance/business-manual/cts04pol.html.

**EXPORT CONTROLS AND FOREIGN TRAVEL**

Clemson policy states that travel “outside the continental United States, Alaska, Hawaii, Canada or Puerto Rico meets the definition of foreign travel and requires approval prior to departure.” U.S. Export Control regulations do apply to Canada; therefore, employees who travel to Canada must complete a foreign travel request form so the export control office can approve. However, when submitting payment for Canada trips, out-of-state rates and account codes apply.

**FOREIGN NATIONAL PAYMENTS**

Payments made to a foreign national (non-resident alien) for activities occurring within the U.S. may be taxable under the IRS Revenue Code. Policy and Procedure regarding these activities are located in the Finance Division Business Manual. Questions regarding policy or payment procedures should be directed to Mack Howard, Director of International Employment, at 864-656-5589.

**REMAINING BALANCES AT PROJECT END**

Be wary of processing corrections after the project end date. This could give the appearance of “zeroing out” remaining budget balances. If corrections after the project end date are necessary, be sure to provide an adequate explanation.

The CES Post Awards office will notify the principal investigator three months prior to the project completion date.

**INFOED PROPOSAL DEVELOPMENT UPDATE**

Over the past year, the Office of Sponsored Programs has been upgrading the InfoEd database application to include Proposal Development (PD), an electronic proposal routing and submission system. The official rollout of the InfoEd PD system was July 1, 2014. Training sessions are now available for investigators and department chairs to cover the proposal initiation and approval processes. If you are planning a proposal submission, please contact Sheila Lischwe, Director of Sponsored Programs, slischw@clemson.edu, to arrange a training session well in advance of your proposal deadline. As of July 1, the paper Proposal Processing Form (PPF) will no longer be used.

**INFOED TRAINING SESSIONS SCHEDULE**

(All sessions held in Brackett 300, conference room) Tuesdays at 3 p.m.

- August 26th 27th
- September 23rd 24th
- October 28th 29th
- November 25th 26th
- December ---- ----
- January 27th 28th
- February 24th 25th
- March 24th 25th
- April 28th 29th
- May 26th 27th
- June 23rd 24th

**Contact Information:**

- **Proposal Development/Pre-Awards**
  Dianne Myers (dmmyers@clemson.edu)
  864-656-5534

- **Grant Management/Post-Awards**
  Michelle Duncan (schlock@clemson.edu)
  864-656-7264

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**New Hire**

**Welcome Brandon Smith**

We would like to welcome Brandon Smith to the Proposal Development Office. Smith is a 2012 graduate of Southern Wesleyan University with a B.S. in business administration with a concentration in accounting. Smith will be assisting with federal, state and foundation funding accounts. Please feel free to stop by 113 Riggs Hall during business hours to meet Brandon.

We are delighted to have him on our team.
# New Faculty Grants and Awards over $100K

## January - June 2014

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Funding Body</th>
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<tbody>
<tr>
<td>Atamturktur, Huriye Sezer</td>
<td>“A Combined Numerical and Experimental Study - Structural Behavior of Dry-Stacked Systems,”</td>
<td>NCMA Education &amp; Research Foundation</td>
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<td>Ballato, John M</td>
<td>“Novel High Temperature and Radiation Resistant Infrared Glasses and Optical Fibers for Sensing in Advanced Small Modular Reactor,”</td>
<td>US Dept. of Energy</td>
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<td>Blenner, Mark Alan</td>
<td>“Collaborative Research: Intracellular Localization of Biosynthetic Pathways for Conversion of Lipids to Dicarboxylic Acids in Oleaginous Yeast”</td>
<td>National Science Foundation</td>
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<td>Bordia, Rajendra Kumar</td>
<td>“Precursor Derived Nanostructured SI-C-X Materials for Nuclear Applications”</td>
<td>Battelle Energy Alliance, LLC/ US DOE</td>
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<td>Brooks, Johnell O</td>
<td>“Health &amp; Safety 2015: Sustaining Workforce Capabilities,”</td>
<td>BMW Group (US)</td>
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<td>Brumaghim, Julia</td>
<td>Preventing Ischemia - Reperfusion Injury with Multifunctional Selenium Antioxidants,”</td>
<td>American Heart Assoc.</td>
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<td>Chowdhury, Mashrur A</td>
<td>“Professional Services Contract Manager On-Demand Training and Best Practices,”</td>
<td>SC Dept. of Transportation/ US DOT</td>
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<td>Foley, Ann Catherine</td>
<td>“The role of TAK1 in Sinoatrial Node Differentiation,”</td>
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<td>Gao, Zhi</td>
<td>“Dynamic Interaction of Basement Membrane Components with Cardiomyocytes,”</td>
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<td>Grujicic, Mica</td>
<td>“Reactive-Moiety Functionalization of Polyurea for Increased Shock-Mitigation Performance,”</td>
<td>Office of Naval Research</td>
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<td>Kim, Sung-O</td>
<td>“Fully Transparent Flexible Displays Dual Powered by Dye-Sensitized Solar Cell (DSSC) and Organic Radical Battery (ORB),”</td>
<td>CURF/Samsung Advanced Institute of Technology</td>
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<td>Kolis, Joseph W</td>
<td>“Novel Optical Hosts: chemistry, Single Crystal Growth and Applications,”</td>
<td>National Science Foundation</td>
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<td>Larsen, Miguel F</td>
<td>“MIST: Mesospheric Inversion-layer Stratified Turbulence Study,”</td>
<td>NASA - Goddard Space Flight Center</td>
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<td>Larsen, Miguel F</td>
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<td>Mason, Scott Jennings</td>
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<td>Shuller-Nickles, Lindsay Carmell</td>
<td>“Coupling Experiments and Atomistic Modeling to Characterize Actinide Oxides in Support of Nuclear Forensics,”</td>
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<td>Smith, John</td>
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<td>David Harris Corporation</td>
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<td>Thies, Mark C</td>
<td>“Graphenic Materials from Ployclic Aromatic Hydrocarbon Oligomers,”</td>
<td>American Chemical Society</td>
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<td>“Deep Orange 7 - Mini Reinvented,”</td>
<td>BMW Group (US)</td>
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New Bioengineering Center awarded $11M Grant
See inside for details and additional research news