ARKANSAS INGENUITY

FROM THE COLLEGE OF ENGINEERING AT THE UNIVERSITY OF ARKANSAS • SUMMER 08

The Future of Energy

UNIVERSITY of ARKANSAS 1871

IMAGINATION • INNOVATION • INSPIRATION

Exciting things are happening for the College of Engineering at the University of Arkansas. During this academic year, we have added a new building, new department heads and faculty members, increased research funding and have proudly supported faculty and students who have received recognition for extraordinary achievements. There is no doubt that this academic year has been a success.

This May, we awarded 46 diplomas to honors graduates in the College of Engineering. In the Biological and Agricultural Engineering Department, seven out of 20 graduates were recognized with honors. In addition, an electrical engineering senior was recently awarded the prestigious Barry M. Goldwater Scholarship. These outstanding achievements speak well of our students, as well as our faculty.

In addition to quality teaching, our faculty members also pride themselves on conducting cutting-edge research. From nearly 100 faculty members, our current research expenditures now top $21 million as they investigate critical areas of healthcare logistics, renewable energy and nanotechnology. These areas of research hold the potential to save industries and citizens countless dollars in decreased healthcare and energy costs.

Our Freshman Engineering program just finished its first year with a Decision Day celebration. On this day, students chose the engineering field that they will pursue. This is a very important time in the students' lives as they make this decision which will impact their futures in such a significant way. Decision Day pictures and results can be seen on page 21.

This issue of Ingenuity is filled with these and other notable stories and achievements about our faculty and students. As you read through these pages, I hope that you will share in the feeling of accomplishment that comes from your association with the dedicated and innovative students and faculty that comprise the College of Engineering.

At the University of Arkansas we are engineering the future—today.

Ashok Saxena

Dean of Engineering
Irma F. and Raymond F. Giffels Endowed Chair in Engineering

College of Engineering

Innovation in medical processes increases efficiency in hospitals, physicians' offices, labs and long-term care facilities. This increase in efficiency results in saving money, and potentially lives. See story on page 4.

Arkansas Ingenuity is published twice a year by the College of Engineering at the University of Arkansas. Questions or comments should be sent to Editor, 4180 Bell Engineering Center, University of Arkansas, Fayetteville, AR, 72701 or sent by e-mail to llannutt@uark.edu.

Dean of the College of Engineering
Ashok Saxena

Editor
Leslie Lannutti

Writers
Leslie Lannutti
Matt McGowan

Editorial Consultant
Charlie Alison

Graphic Designer
Leigh Caruthers Prassel

Photographers
April Brown
Russell Cothren
Rick Green
Beth Hall
Peter Main

New Directors Appointed to College of Engineering Program and Center

The Master of Science in Operations Management program and the Mack-Blackwell Rural Transportation Center have named new directors.

Heather Nachtmann has been appointed as the new director for the Mack-Blackwell Rural Transportation Center. Nachtmann is an associate professor in the department of industrial engineering at the University of Arkansas.


Heather Nachtmann


Edward A. Pohl

Nachtmann has established a research program in economic decision analysis and uncertainty modeling. Her current research focuses on improving decision making through proper handling of uncertainty data elements with applications to transportation, logistics and manufacturing systems.

The center was recently selected to participate as a member of the National Transportation Security Center of Excellence. Institutions that make up the NTSCE are funded by the federal government to conduct research that will improve the security of America's transportation systems.

Edward A. Pohl, associate professor of industrial engineering at the University of Arkansas, has been appointed director and chair of studies for the Master of Science in Operations Management program.

Pohl came to the university in 2004, after serving on the faculty of the U.S. Military Academy at West Point, where he doubled as deputy director of the Operations Research Center. He also served as a research analyst for the U.S. Defense Department in areas of cost, scheduling and performance. Pohl has been teaching in the University of Arkansas operations management program since last year.

The program, offered through the department of industrial engineering, is the university's largest graduate program with over 300 students from business, industry, the military and other sectors enrolled nationwide.

The master's in operations management is an accelerated degree program for managers and professionals who require extensive knowledge and a high level of skill in managing work processes and people. Students can take distance-learning classes that allow them to study from any Internet-accessible location around the globe.

Civil Engineering Professor Receives University of Arkansas' Top Teaching Honor

Norm Dennis, professor of civil engineering, was named winner of the Charles and Nadine Baum Faculty Teaching Award for 2008 at the General Commencement Ceremony on May 10. This is the university's most prestigious teaching award.


Norm Dennis

Dennis is a native of Macon, Mo. He received his bachelor's and master's degrees in civil engineering from the University of Missouri-Rolla, a master's degree in business administration from Boston University, and his doctorate from the University of Texas-Austin. He joined the University of Arkansas in 1996. Dennis is a registered professional engineer in Colorado and Arkansas. His specialty area is geotechnical engineering, but his passion is teaching, both undergraduate and graduate students, and mentoring junior faculty.

In addition to the Baum Faculty Teaching Award, Dennis has also received the Chi Epsilon National Award (James M. Robbins Award) for Outstanding Teaching in Civil Engineering in 2008; was named a Fellow of the University of Arkansas Teaching Academy in 2006; and received the Excellence in Civil Engineering Education Leadership Award from the American Society of Civil Engineers in 2006.

"He is a remarkable teacher; he is an accomplished education scholar; and he is tireless in his service to the educational mission of his profession, his university and his department," said Kevin Hall, head of the civil engineering department. "We are very proud of Norm's extraordinary dedication to providing the best education possible for our students."

Civil's Concrete Canoe and Steel Bridge Teams Have Best Showing Ever

The Civil Engineering department hosted the 2008 Mid-Continent Conference Concrete Canoe Race and Steel Bridge Competition from Thursday, April 17 to Saturday, April 19. Approximately 300 civil engineering students from 11 regional universities competed in the events.

Our Civil Engineering Teams had their best showing ever in these events. The UA Steel Bridge team placed 4th overall. The UA Concrete Canoe team placed 6th overall.

Results in the Steel Bridge Competition:

1.University of Missouri- Kansas City
2.Kansas State University
4.University of Arkansas

Results in the Concrete Canoe Competetion:

1. University of Oklahoma
2. Southern Illinois University- Edwardsville
3. Kansas State University
4. University of Nebraska- Lincoln
5. University of Kansas
6. University of Arkansas

Conference Coordinators for the Concrete Canoe and Steel Bridge competitions were Adam White, Andrew Moore, Meagan Berlau, Trent Ellis and Hayley Moore.

Process Dynamics Inc. Partners with DuPont Chemical Solutions to Offer New Technology

Michael Ackerson, a University of Arkansas associate professor of chemical engineering, has announced the sale of the intellectual property rights of his IsoTherming technology to DuPont, a world-leader in science-based products and services. The IsoTherming rights are a part of Ackerson's company, Process Dynamics, Inc.

The trademarked IsoTherming technology will now be offered as a clean fuel technology application within DuPont Clean Technologies, a division of DuPont Chemical Solutions Enterprise. This new approach to hydrotreating allows refiners to produce cleaner fuels with significantly lower construction and operating costs.

"This partnership with DuPont places Process Dynamics in a position to meet the needs of refineries all around the world as clean fuel requirements are implemented," said Ackerson.

Process Dynamics is a 2003 graduate of the University of Arkansas' Genesis Technology Incubator. Genesis provides technology-based companies with research and development support. This support assisted the company as it grew from a fledgling start-up to a successful independent operation. Process Dynamics has since fostered relationships with several major engineering companies and oil companies, in addition to DuPont.

"This is a wonderful example of how the Genesis Technology Incubator and our engineering faculty are partnering to address the technological challenges that our society faces today," said Ashok Saxena, dean of the College of Engineering at the University of Arkansas and holder of the 21st Century Graduate Research Chair in Materials Science and Engineering. "It will be exciting to see the environmental and economic benefits that IsoTherming technology will offer to Arkansas and to the world."

The first commercial IsoTherming hydrotreater was completed in 2003 at Giant Industries' refinery in Ciniza, N.M. It was one of the first refineries in the nation to begin production of EPA-mandated ultra-low sulfur diesel.

Process Dynamics has now licensed a total of nine IsoTherming technology packages to U.S. refiners.

DuPont operates in more than 70 countries around the world and offers a wide range of innovative products and services for markets including agriculture and food, building and construction, communications and transportation.

Tracking Down Good Health Care

By Matt McGowan

Nurses become nurses to care for people - help ease their pain and make them healthy. Yet health-care industry analysts estimate that nurses spend more than half of their working hours entering data on a computer or searching for needed materials. This reality, says Ron Rardin, epitomizes the shortfalls of health-care delivery in the United States.

"The reason the delivery system works at all is because of the dedication of doctors, nurses and other professionals," says Rardin, Distinguished Professor and the John and Mary Lib White Systems Integration Chair in Industrial Engineering. "If they didn't make the effort, the system would often fail. But we need to free up these highly trained professionals to care for people and perform the tasks they're trained to do. As important, we need to assure the right materials are in the hands of doctors and nurses where and when they are needed."

Center for Innovation in Health Care Logistics researchers and students observed health-care logistics and operations at Washington Regional Medical Center in Fayetteville. Greater investment in logistics technology can ensure patient safety.

The health-care delivery system Rardin describes is too frequently a world in which medical records and life-saving drugs are lost, identical patient information is requested and documented numerous times - sometimes by inappropriate or overqualified personnel - and materials and equipment are unavailable, overstocked or duplicated because clinics do not have an adequate system to manage inventory. These kinds of failures have compromised quality of care and patient safety and led to significant waste, all of which have contributed to rising health-care costs.

"It's a huge problem," says Rardin, who accepted the White Chair - he and Chancellor John A. White have been friends for many years - in January but has focused on healthcare engineering for the past 10 years while at Purdue University and the National Science Foundation. "We're all so impressed with advancements in medicine - pharmaceuticals, imaging, implantable devices and things

Bar codes, RFID tags and other visibility solutions can improve the flow of drugs and lab results within and between medical facilities.

like that - that people don't appreciate how deeply flawed the health-care-delivery system sometimes is. And that is where you actually bring all of this wonderful technology to the patient."

As director of the new Center for Innovation in Healthcare Logistics, Rardin will lead an interdisciplinary team of researchers who will investigate the supply-chain network and information and logistics systems within the broad spectrum of U.S. health care, from acute-care hospitals, physicians' clinics and pharmacies to long-term care facilities, laboratories and distance-medicine facilities. Throughout their research, the overriding question will be: How can information and logistics technology make these systems and processes more efficient and improve health-care quality and safety while saving money?

Rardin and other industry experts already know that technology - or lack of it - is a big part of the problem. With arthroscopy, ultrasound and wonder drugs, consumers find it difficult to believe that U.S. health care suffers because of inadequate investment in technology. But that's the truth, not so much with medical technology such as pharmaceuticals, surgical tools and diagnostic and monitoring equipment, but with software and other information technology that, as Rardin says, "deliver" the benefits of medical technology to patients. For example, 75 to 80 percent of all patient records exist in paper format. In contrast, Rardin says, the banking industry spends, on average, four times as much on information technology to deliver its products to consumers.

One thing information technology can provide - but too often doesn't in the health-care industry, Rardin says - is the ability to follow material around and know not only what it is but where it is supposed to go and exactly how much of it is needed. By whatever method, tracking and product visibility are critical components of any service organization, regardless of whether it's a private company trying to turn a profit or a government office delivering postcards from Hawaii. With a sophisticated understanding of the supply-chain network, corporations like Wal-Mart Stores Inc. and Federal Express have mastered logistics. Technology - tracking software, barcodes and radio frequency identification - are among the tools that have made this possible.

The College of Engineering and the Sam M. Walton College of Business have a core of researchers specializing in supply chain, logistics and RFID technology. For the most part, their research has not been connected to the health-care industry. One of the primary goals of the center is to harness this expertise. For example, as an initial investigation target, the center will work with researchers in the Walton College's RFID Research Center to discover whether RFID tags, barcodes and other visibility solutions can improve the flow of materials within and between hospitals, outpatient clinics, pharmacies and other facilities.

"We want to understand the supply chain from end to end, manufacturer to patient," he says. "It's so important to see the flow of clinical supplies, medical devices, pharmaceuticals and diagnostic materials. All these things are possible if you have some kind of computer-readable capability. In many cases, we do not have that today, so human beings follow paperwork and re-enter data in computers to do tracking. Errors are bound to be introduced."

In addition to adapting logistics and supply-chain solutions from other industries, the center's researchers will identify and replicate proven applications within health care. For example, Rardin's team will investigate a hospital group that has begun to practice what researchers call "postponement" with surgical packs, or pre-packaged sets of surgical tools and equipment.

Most surgical units or operating rooms use generic packs, one-size-fits-all packages for all surgeons performing a procedure. The problem is each surgeon may perform the same surgery differently than others, which means that different tools and equipment are necessary. With surgeons using a generic pack, many of the contents are wasted and have to be thrown away or donated to medical facilities in developing countries. To address this problem, at least one hospital group created a variation of the generic pack by including a smaller set of essential tools, such as scalpels and clamps. This group postpones the delivery of more advanced tools and adds them later as customized packs, the contents of which depend on the surgeon's specific approach.

"It may not seem like a big deal," Rardin says, "but these packs are complex and expensive. In the end, these modest modifications can have a big impact.

"We know there are many smart applications out there. We just need to find them, replicate them and demonstrate their superiority and efficiency to other groups. We want to add targeted research to overcome gaps and roadblocks. If this can be done, patients, providers, and the nation as a whole will see major benefits."

Lessons from Katrina

It is difficult, if not insensitive, to find something good in human and natural disasters. Perhaps it is better to say that Hurricane Katrina taught many lessons. For Wal-Mart Stores Inc., and thousands of the storm's victims, Katrina presented a heuristic experiment and demonstrated the tremendous social value of a well-oiled logistics network. Aided by sophisticated weather-monitoring technology, the company delivered a surplus of critical supplies to select Gulf Coast stores before the storm hit. The effort probably saved numerous lives.

"Many companies - not just Wal-Mart - discovered that logistics networks have great value in emergencies," says Ron Rardin, Distinguished Professor and the John and Mary Lib White Systems Integration Chair in Industrial Engineering.

Buoyed by this experience, the world's largest retailer pledged $1 million over five years to help found the University of Arkansas Center for Innovation in Healthcare Logistics. Rardin, whose research for the past decade has focused on healthcare engineering, serves as the center's director. Arkansas BlueCross BlueShield is the center's other founding strategic partner.

Rardin is in the process of establishing collaborative projects with many established University of Arkansas research centers, such as the College of Engineering's Center for Engineering Logistics and Distribution and the Sam M. Walton College of Business' RFID Research Center, Supply Chain Management Center and Information Technology Research Institute.

Rardin plans to include faculty associates and students from professional programs in nursing, medicine and pharmacy. The center will interact with health-care providers and networks that will help shape research projects and provide living laboratories to collect data and conduct pilot projects.

The Future of Energy

College of Engineering researchers tackle energy challenges

There is no doubt that increasing energy demand and spiraling costs are grabbing the attention of people around the world. These increased costs do not discriminate. Everyone will be touched by this situation—whether you are filling your gas tank, buying groceries at the store or turning on your air-conditioner.

As countries such as China and India flex their economic muscles, they are increasing their use of fuels. Oil producing countries are not increasing production to keep pace with this growth in demand. The law of supply and demand tells us that the increased demand for fuel will lead to an increased cost of the existing supply. How can we lessen the blow?

Research, education and honest discussions will need to take place as our country tackles these serious energy issues. The College of Engineering is very involved in renewable energy and energy efficiency research. There is also a focus on educating business leaders and citizens to help ease the financial squeeze that many people feel.

We are proud to be part of the future of energy.

Researchers Look to Convert Fat and Oil into Biodiesel

By Matt McGowan

Chemical engineering researchers at the University of Arkansas have investigated supercritical methanol as a method of converting chicken fat into biodiesel fuel. The new study also successfully converted tall oil fatty acid, a major by-product of the wood-pulping process, into biodiesel at a yield of greater than 90 percent, significantly advancing efforts to develop commercially viable fuel out of plentiful, accessible and low-cost feedstocks and other agricultural by-products.

"Major oil companies are already examining biodiesel as an alternative to petroleum," said R.E. "Buddy" Babcock, professor of chemical engineering. "With the current price of petroleum diesel and the results of this project and others, I think energy producers will think even more seriously about combining petroleum-based diesel with a biodiesel product made out of crude and inexpensive feedstocks."

Under Babcock's guidance, Brent Schulte, a chemical-engineering graduate student in the university's College of Engineering, subjected low-grade chicken fat, donated by Tyson Foods, and tall oil fatty acids, provided by Georgia Pacific, to a chemical process known as supercritical methanol treatment. Supercritical methanol treatment dissolves and causes a reaction between components of a product – in this case, chicken fat and tall oil – by subjecting the product to high temperature and pressure. Substances become "supercritical" when they are heated and pressurized to a critical point, the highest temperature and pressure at which the substance can exist in equilibrium as a vapor and liquid. The simple, one-step process does not require a catalyst.

A jar shows the type of tall oil fatty acids that graduate student Brent Schulte worked with to create biodiesel.

Schulte treated chicken fat and tall oil with supercritical methanol and produced biodiesel yields in excess of 89 and 94 percent, respectively. With chicken fat, Schulte reached maximum yield at 325 degrees Celsius and a 40-to-1 molar ratio, which refers to the amount of methanol applied. The process also produced a respectable yield of 80 percent at 300 degrees Celsius and the same amount of methanol. At 275 degrees Celsius and the same amount of methanol, the process was ineffective. Ideal results using tall oil fatty acid were achieved at 325 degrees Celsius and a 10-to-1 molar ratio. At 300 degrees Celsius and the same amount of methanol, the conversion produced a yield of almost 80 percent. Again, at 275 degrees Celsius, the process was ineffective.

Previous efforts, including a study two years ago by another one of Babcock's graduate students, to make biodiesel out of low-cost feedstocks – as opposed to refined oils – have used one of two conventional methods, base-catalyzed or acid-catalyzed esterification. Although successful at producing biodiesel, these conventional methods struggle to be economically feasible due to long reaction times, excessive amounts of methanol required and/or undesired production of soaps during processing.

"The supercritical method hit the free fatty-acid problem head on," Babcock said. "Because it dissolves the feed material and eliminates the need for the base catalyst, we now do not have the problems with soap formation and loss of yield. The supercritical method actually prefers free fatty acid feedstocks."

Biodiesel is a nonpetroleum-based alternative diesel fuel that consists of alkyl esters derived from renewable feedstocks such as plant oils or animal fats. The fuel is made by converting these oils and fats into what are known as fatty acid alkyl esters. The conventional processes require the oils or fats be heated and mixed with a combination of methanol and sodium hydroxide as a catalyst. The conversion process is called transesterification.

Most biodiesel is produced from refined vegetable oils, such as soybean and rapeseed oil, which are expensive; they generally account for 60 to 80 percent of the total cost of biodiesel. Due to these high feedstock prices, biodiesel production struggles to be economically feasible. Currently, as Babcock alluded, biodiesel cannot compete with petroleum diesel unless the per-gallon price of diesel remains higher than $3. For these reasons, researchers recently have focused efforts on less refined and less-expensive feedstocks as a more viable competitor to conventional diesel.

Biodiesel has many benefits. In addition to reducing U.S. dependence on foreign oil, it is better for the environment than purely petroleum-based products. As a renewable, biodegradable and thus carbon-neutral material, biodiesel does not contribute to greenhouse gases. In fact, it decreases sulfur and particulate-matter emissions. It also provides lubrication for better-functioning mechanical parts and has excellent detergent properties.

"Biodiesel provides an effective, sustainable-use fuel with many desirable properties," Schulte said. "In addition to being a renewable, biodegradable and carbon-neutral fuel source, it can be formed in a matter of months from feedstocks produced locally, which promotes a more sustainable energy infrastructure. It also decreases dependence on foreign oil and creates new labor and market opportunities for domestic crops."

Schulte worked with Ed Clausen, professor of chemical engineering and holder of the Ray C. Adam Chair of Chemical Engineering, and Michael Popp, professor of agricultural economics, in addition to Babcock. Schulte's study, which led to his master's thesis and is available upon request, was supported by the University of Arkansas Mack-Blackwell Rural Transportation Center. His work was awarded first place at the inaugural Admiral Jack Buffington Poster Paper Contest sponsored by the transportation center at its annual advisory board meeting.

The federal government recently designated the Mack-Blackwell Rural Transportation Center as a National Transportation Security Center of Excellence. For more stories related to rural transportation issues, please visit http://www.mackblackwell.org/.

A Look at the Future of Energy

Energy consumption across the globe is growing at a record pace. Energy costs are soaring. People and businesses are feeling the pinch. It seems as though the cost of everything is increasing. With these inflationary pressures, business leaders and ordinary citizens alike are trying to find answers to their concerns about energy costs, energy availability and viable options for renewable energy.

Clearly, it is time for serious education and discussion about what business leaders and average citizens can do to save energy and money.

The College of Engineering supports research and education in the field of energy efficiency and renewable energy. This spring, the college hosted two events that encouraged open discussion of energy issues.

Mike Morris, the CEO of American Electric Power, invited students to make their voices heard at the AEP "Future of Energy" Listening Tour. During this event, Morris led an open discussion on topics such as global warming, renewable energy, energy efficiency and the cost of energy. The 90-minute event drew a crowd of over 225 students, faculty and staff.

When asked about plug-in hybrid vehicles, Morris replied that consumption of gasoline could be reduced by 20% with the use of these vehicles. This decrease in gasoline usage would result in decreased energy needed to refine and transport that gasoline to the market. The electricity needed to recharge these vehicles would not require any new power generation. The savings could be substantial.

Morris met with graduate students and faculty that morning as he toured the new National Center for Reliable Electric Power Transmission facility in the Arkansas Research and Technology Park. NCREPT, established in 2005, focuses on the design, packaging and testing of advanced power electronics. The center conducts research and develops prototypes of advanced power electronics systems for applications in the power grid including both solid-state protection devices and energy storage. In addition, the center develops advanced packaging solutions for high current, high voltage power semiconductor devices and applications. The center co-sponsored the tour event with AEP and the College of Engineering.

In April, the college hosted the Conference for Renewable Energy and Energy Efficiency in cooperation with U.S. Rep. John Boozman, congressman for the 3rd district. This event gave local business leaders and citizens a chance to learn what they can do to decrease energy costs and increase energy efficiency in their homes, autos and companies.

The lecture series featured Robert Noun, executive director of external affairs at the National Renewable Energy Laboratory; Robert Ames, director of development at Tyson Foods; Chris Benson, director of the Arkansas Energy Office; Charles Zimmerman, vice president of prototype and new format development at Wal-Mart; and Tom Vander Ark, president of the X-Prize Foundation. This series gave participants the opportunity to hear from leaders in the field of energy efficiency.

In addition to the lecture series, the conference also featured an expo that highlighted energy conservation and renewable energy tips. One popular feature of the expo was the display of alternative fuel automobiles. A semi-truck that runs off of used cooking oil was also on display. With gas prices hovering around $3.50 a gallon, these vehicles drew a lot of attention.

By partnering researchers with business leaders in the field of renewable energy and energy efficiency, the College of Engineering stands prepared to create a brighter future of energy for everyone.

Above, Mike Morris, CEO of American Electric Power, discusses energy decisions that will need to be made in the coming years. Below, Valerie Morris, former business anchor for CNN, fields questions from students at the "Future of Energy" Listening Tour at Willard Walker Hall Auditorium.

Researcher to Receive Grant to Study Vascular Complications

By Matt McGowan

Mahendra Kavdia will help medical researchers better understand the molecular mechanisms for endothelial cell dysfunction and will guide the development of new therapies for diabetes-related vascular problems.

A biomedical engineering researcher at the University of Arkansas will receive a $1.3 million grant from the National Institutes of Health to study the causes of endothelial cell dysfunction, which significantly contributes to many diabetes-related vascular complications and cardiovascular disorders. The research will help medical researchers better understand the molecular mechanisms for endothelial cell dysfunction and will guide the development of new therapies for diabetes-related vascular problems.

"Scientists know that endothelial cell dysfunction is a common pathogenic framework of many vascular complications," said Mahendra Kavdia, an assistant professor in the College of Engineering. "For example, we know that oxidative stress is a key event in endothelial cell dysfunction. But the underlying molecular mechanisms of this process remain poorly understood. Our investigation will improve this understanding."

Endothelium is a single layer of thin cells that line blood vessels. In this case, the focus is on the function of endothelial cells for regulation of blood flow. Scientists have determined that in diabetes patients these cells do not function properly or fail, which results in a reduced availability of endothelial-cell-released nitric oxide, a key signaling molecule for the regulation of blood flow. So far, this is the primary marker for endothelial cell dysfunction.

Kavdia's research team hypothesizes that this biochemical chain of events includes interaction between nitric oxide and reactive oxygen species that are influenced by many factors such as enzymes and antioxidants, and the release of nitric oxide and superoxide. To test this hypothesis, the researchers have been developing computational models to predict levels of nitric oxide, superoxide and peroxynitrite, a toxic biochemical produced by the interaction between nitric oxide and superoxide. With the aid of endothelial cells from human umbilical cords, the research team also has performed in vitro experiments to expose endothelial cells with oxidative stress. The grant from the National Heart, Lung and Blood Institute will allow the researchers to continue this integrated computational and experimental approach.

Specifically, researchers will determine the release of nitric oxide and superoxide from endothelial cells and the nature of cell damage in hyperglycemic conditions. They will also develop computational biotransport models to simulate experiments and predict levels of nitric oxide, superoxide and peroxynitrite. Finally, Kavdia's team will develop multiscale computational models to explain underlying processes of oxidative stress in the microcirculation.

The grant will also help to

Continued on next page

Student Awarded Goldwater Scholarship for Breast Cancer Research

Jordan Greenlee, a senior Electrical Engineering honors student, received prestigious recognition in April when he was awarded a Barry M. Goldwater Scholarship for his undergraduate research on breast cancer detection.

Jordan's journey began in the Fall of 2006 when he was selected by Magda El-Shenawee, associate professor in electrical engineering, to use her National Science Foundation travel abroad grant to study for one semester in Scotland at the University of Dundee. El-Shenawee selected Jordan from a pool of 17 applicants and served as his faculty advisor for this trip as he studied mathematical biology.

Magda El-Shenawee and Jordan Greenlee work together to improve breast cancer detection.

Mathematical biology allows researchers to use math to create biological models. Through the use of computer code, Greenlee creates models that take into account the differences in breasts of women of different ages and breast density. To ensure the realistic qualities of the models, El-Shenawee and Greenlee have collaborated with the University of Dundee in Scotland. The University of Dundee is known for pioneering the use of mathematical biology as it relates to cancer. Seth Shumate, El-Shenawee's graduate student, will travel to Dundee this summer with funding from a second NSF grant. Shumate will work with the same research group led by Mark Chaplain, mathematics professor at the University of Dundee.

El-Shenawee and Greenlee have combined her study in the use of microwave detection of breast cancer with his use of computer code to create a true-to-life model of a breast that includes the ducts, vessels and lobes. Shumate and Ahmed Hassan, both graduate students in electrical engineering, have designed models of tumors that can be merged with Jordan's models. The result is an amazing depiction of breast tissue that can be manipulated through computer simulations to depict various stages of cancer.

These models help to advance El-Shenawee's work to understand how cancerous cells in the ducts, for example, can invade surrounding tissue. The goal of her research is to improve breast cancer detection through the use of microwaves. Her work could lead to techniques that, when used with mammography, would help to decrease the number of biopsies, false alarms and false negatives.

Jordan presented a paper, A Computational Biology Approach to Full Breast Mathematical Modeling, on April 12 at the Arkansas Academy of Science Conference. He will present additional information in June at the Ohio Collaborative Conference on Bioinformatics.

In the two past years, Jordan has received financial support from the Student Undergraduate Research Fellowship (SURF) by the Arkansas Department of Higher Education, International Research and Education in Engineering funding by the National Science Foundation, and the Barry M. Goldwater Scholarship.

Jordan plans to pursue a doctoral degree in applied mathematics.

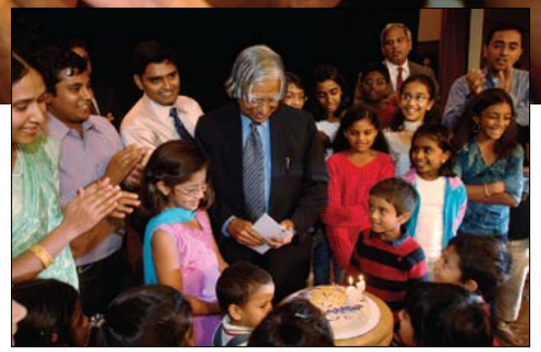
"We are very proud of Jordan's accomplishment," said Samir El-Ghazaly, head of the electrical engineering department. "The fact that one of our students won an award as prestigious as the Goldwater is indicative of the quality of engineering students that we work with at the University of Arkansas."

Continued from previous page

significantly augment biomedical engineering research opportunities at the university.

Kavdia, the first biomedical engineering faculty member hired by the university, also has research projects supported by the American Heart Association. He recently received the Arthur C. Guyton Award for Excellence in Integrative Physiology and Medicine.

For background or more information about Kavdia's research, please visit http://comp.uark.edu/~mkavdia/.



Above, A standing-room-only crowd greets Dr. A.P.J. Abdul-Kalam, the former president of India (2002-2007), at an evening reception in the Arkansas Union Alltel Ballroom. Below, Children sing their birthday greetings to Dr. Kalam to celebrate his 76th birthday.

Former President of India Visits University of Arkansas

A.P.J. Abdul-Kalam, D. Sc., president of India from 2002-07, swept through the University of Arkansas-Fayetteville on Oct. 19, 2007 with the energy and enthusiasm of a young man. Kalam, who celebrated his 76th birthday just days before, was met with a rock star's reception as hundreds of people crowded into the Reynolds Center Auditorium and the Arkansas Union Ballroom to hear Kalam speak. Some people in the standing-room-only crowds had traveled from as far away as Little Rock, Oklahoma City and Columbia, Mo. for a chance to meet Kalam.

During Kalam's visit, he presented a public lecture titled "Dynamics of Peace and Prosperity" as part of the Chancellor's Distinguished Lecture Series. During his lecture, Kalam stressed the importance of educating and cultivating the minds of today's young people. Kalam's speaking style engaged members of his audience as he encouraged them to join him in reciting phrases that stressed peace and education as keys to the prosperity of the world.

Kalam has taken a personal interest in developing large research programs between research laboratories and universities in India and the University of Arkansas in the field of nanotechnology as applied to medicine. His research collaboration with Vijay Varadan, distinguished professor of electrical and biomedical engineering, dates back to the 1970s when Kalam, himself, was an eminent scientist in the Indian Space Research Organization, which parallels NASA in the United States.

Currently, there are an estimated $6 million in active research programs in Varadan's research group that have grown out of this relationship. These research programs are being conducted in Varadan's newly constructed world-class research facilities for fabricating nanomaterials, devices and systems for biomedical applications. These research facilities are located in the Engineering Research Center. Kalam toured the facilities with Varadan to gain

Continued on next page

Team Receives Award for Creating Diversity Program

Thomas Carter, III and Bryan Hill were awarded the Staff Senate's Outstanding Staff Team Award.

Two College of Engineering staff members received the university-wide, Staff Senate's Outstanding Staff Team Award. Thomas Carter III, assistant dean for student affairs, and Bryan Hill, associate director of recruitment, retention and diversity, were honored with the award at the February Staff Senate meeting in recognition of their work with the Engineering Career Awareness Program.

Carter and Hill developed and implemented the program to support the recruitment and retention of underrepresented engineering students. The program began in 2007 with 21 freshmen holding an average composite ACT score of 27.8 and an average high school GPA of 3.87. Students recruited into the program are eligible for scholarships that remove financial barriers to an engineering degree.

"It's clear that commitment, passion and work excellence have been expended by Bryan Hill and Thomas Carter," said Carol Gattis, director of recruitment, retention, honors and diversity for the College of Engineering. "They collaborate extremely well with each other, other units on campus, alumni, school leaders and teachers, and prospective and current students," said Gattis.

The program has led to an underrepresented engineering freshman enrollment increase of 17 percent over the previous year. The number of African American freshmen increased by 93 percent. The number of Hispanic American freshmen increased by 83 percent.

Two peer-reviewed articles outlining the program and its successes have been accepted for publication. The details will be presented at the American Society for Engineering Education national conference in June 2008.

Continued from previous page

first-hand knowledge of the university's capabilities in this new and emerging field with tremendous potential to influence the quality of human lives.

Kalam made a great number of significant achievements in promoting India's development. He is known for his expertise as a rocket propulsion scientist, as a leader in India's quest to become fully developed by 2020, and for his dedication to the students who will help him achieve his vision for India's future.

Kalam served as the project director for the program that developed India's first indigenous Satellite Launch Vehicle. This project resulted in a successful launch of the Rohini satellite in July 1980. The launch allowed India to join the ranks as a member of the space club. His work as the scientific adviser to the defense minister and secretary through the Indian Department of Defense Research and Development from 1992 until 1999 led to the development of highly advanced strategic missile systems.

In addition, Kalam's Technology Vision 2020 plan is leading his country toward a robust knowledge-based economy. This plan serves as the road map that India will follow in its quest to move from developing status to that of a developed nation.

The recipient of 30 honorary doctorates, Kalam has been recognized by many universities and other institutions for contributions to his field and for his dedication to excellence in education.

In Memoriam

Dr. Deepak Bhat
Giffels Professor of Mechanical Engineering
September 20, 1944 to November 7, 2007

2008 Engineering Alumni Awards Banquet

The College of Engineering recently hosted the 2008 Engineering Alumni Awards Banquet. The event brought together alumni from across the country to celebrate the achievements of our 2008 Hall of Fame awardee, our five Distinguished Alumni awardees and our two Young Alumni awardees.

The banquet opened with welcoming remarks by Dean Ashok Saxena. Chancellor John White and Chancellor-elect Dave Gearhart were recognized for their support of the College of Engineering. Dean Saxena honored Chancellor White with a plaque that featured a slide rule from 1957 that had been donated by William Keltner (BSIE '59), who is a dear friend of the chancellor.

The 2008 Hall of Fame award was presented to John Walter Keller Jr. (BSEE '46), the originator and systems/electronic designer of a pacemaking program that resulted in the world's first implantable, remotely programmable digital pacemaker. This award was presented by George Combs (BSChE '59, PhD '64), himself a Hall of Fame member and a lifetime member of the Dean's Advisory Council.

The 2008 Distinguished Alumni Award was presented to John D. Selig (BSIE '58), Sam L. Chaffin (BSChE '59, MSIE '60), Karl D. Schubert (BSChE '75, PhD '83), Neil B. Ingels (BSEE '59) and Troy Alley (BSEE '69). These awards were presented by Dave Foust (BSIE '64), who has been previously recognized as a distinguished almnus, and currently serves as a member of the Engineering Advisory Council.

The 2008 Young Alumni Award was presented to Dawn K. Wheeler (BSBAE '99) and Kevin C. Henry (BSBAE '99) by Alex Lostetter (PhD '03), the Chief Operating Officer for Arkansas Power Electronics International and previous Young Alumni Award recipient.

The College of Engineering Alumni Awards Banquet is held each year in April in Northwest Arkansas.

Above, 2008 Engineering hall of Fame Award Recipient: John Walter Keller Jr. (BSEE '46), originator and systems/electronic designer of a pacemaking program that resulted in the world's first implantable, remotely programmable digital pacemaker. Below, Wife of Distinguished Alumnus Sam Chaffin, Charlie Cole Chaffin and Lee Lane.

Troy Alley (BSEE '69) receives the Distinguished Alumni Award from Dean Ashok Saxena.

Chancellor-Elect, Dave Gearhart, with his wife Jane and Aruna and Lalit Verma.

Dean Ashok Saxena and Distinguished Alumnus, Neil Ingels (BSEE '59)

Dean Ashok Saxena presents a gift from the College of Engineering to outgoing Chancellor John White (BSIE '61).

Distinguished Alumni Award winner, John Selig (BSIE '58), is joined by his wife, Helen and son John.

2008 Hall of Fame award recipient, Walter Keller (BSEE '46), is congratulated by past Hall of Fame awardees.

Distinguished Alumni, Karl Schubert (BSChE '75, PhD '83) flanked by Young Alumni Award winners, Kevin Henry (BSBAE '99) and Dawn Wheeler (BSBAE '99)

Sam Chaffin (BSChE '59, MSIE '60), George Combs (BSChE'59, PhD '64), Walter Keller (BSEE'46) and Dean Ashok Saxena

Kavdia and McCann Honored with Imhoff Awards

Mahendra Kavdia, assistant professor of biomedical engineering, received the College of Engineering's 2008 Imhoff Outstanding Researcher Award. Kavdia has enthusiastically supported the college's efforts to develop and launch the master of science program in biomedical engineering. He has established a state-of-the-art computational biology and biomedical engineering lab and actively collaborates with several colleges on the Fayetteville campus, as well as colleagues at the University of Arkansas for Medical Sciences and the University of Alabama.

Kavdia's research is gaining national attention. He was recently awarded an NIH grant of $1.3 million for research involving vascular complications from diabetes and other cardiovascular disorders. In 2007, Kavdia was published in six refereed journal articles.

Roy McCann, associate professor of electrical engineering and director of Control Systems Laboratory, received the College of Engineering's 2008 Imhoff Outstanding Teacher Award. Since his arrival in 2003, McCann has made many contributions towards integrating engineering theory and practice for undergraduate students within the classroom and through design-oriented activities with practical applications.

Dean Ashok Saxena congratulates assistant professor Mahendra Kavdia, the recipient of the 2008 Imhoff Outstanding Researcher Award.

Dean Ashok Saxena congratulates associate professor Roy McCann, the recipient of the 2008 Imhoff Outstanding Teacher Award.

McCann serves as a faculty advisor for the University of Arkansas SolarSplash boat team. His interaction with students grooms them for their future roles as leaders in project management and electrical design. To date, McCann has mentored and coached over 30 electrical engineering students through the SolarSplash competitions.

McCann is dedicated to expanding the horizon for students. He has developed new courses to strengthen the technical electives that are available to seniors. In addition, he has worked diligently to recruit students from historically black colleges and universities to pursue graduate degrees with the support of the university's George Washington Carver Project.

His dedication to excellence in teaching will benefit his students for years to come.

Spring 2008
Decision Day Survey Results

On Decision Day, Freshman Engineering students were asked to complete a brief survey associated with the major selection process. This report summarizes the responses to that survey.

Part I: Changing Their Mind

In addition to selecting their engineering major, students were asked to identify the major that they would have selected at Summer Orientation. A total of 225 students responded to this question. Of these 225 students, 12 indicated a major outside of the College of Engineering.

Of the 213 students who indicated that they would have selected a specific College of Engineering major at Summer Orientation, 52 (24.4%) selected a different College of Engineering major on Decision Day.

The table to the right is intended to provide additional detail on these results for individual departments.

Major	Number of Students Identifying This Major as Their Choice at Summer Orientation	Number of Students Selecting This Major on Decision Day	Number of Students Selecting This Major on Both Occasions
Biological Engineering	26	23	18
Chemical Engineering	7	8	2
Computer Engineering	26	24	18
Computer Science	17	16	12
Civil Engineering	30	33	24
Electrical Engineering	29	28	21
Industrial Engineering	17	42	16
Mechanical Engineering	61	64	51

Selected Major	Before Orientation	During Orientation	During Fall Semester	During Spring Semester	This Week	Today
Biological Engineering	13	3	2	2	0	0
Chemical Engineering	2	1	0	5	0	0
Computer Engineering	16	0	3	4	0	1
Computer Science	10	0	1	3	1	1
Civil Engineering	18	1	6	3	0	1
Electrical Engineering	17	1	2	2	2	2
Industrial Engineering	13	3	8	3	7	6
Mechanical Engineering	43	1	7	2	3	3
Total	132	10	29	24	13	14

Part II: Timing of the Final Selection

Students were also asked to identify when they settled on their final major selection. A total of 222 students responded to this question. The results are summarized in the table to the left.

Face to Face with the College of Engineering: Samir El-Ghazaly, Ph.D.

Hometown: Born in Luxor, Egypt; Grew up in Luxor and attended university in Cairo.

Degrees:

B.Sc. Electronics and Telecommunications Engineering, Cairo University

M.Sc. Electronics and Telecommunications Engineering, Cairo University

Research for the master's degree was done at Universite de Lille, France.

Ph.D. Electrical Engineering, University of Texas at Austin

What are your areas of research interest?

My areas of interest include microwave devices and circuits; electromagnetics; and high-frequency and high speed semiconductor devices.

How and why did you select engineering?

As a child, I liked to learn how electrical and mechanical devices and equipment worked. As I grew up, I was fascinated with modern electronic devices, from the radio and TV to computers. I enjoyed reading about these devices.

The Apollo space program and the man landing on the moon also became major factors in my decision to be an engineer.

What do you like about teaching?

I like working with others and helping young people to understand electrical engineering. It is wonderful to see the joy on students' faces after they understand something they perceived to be difficult.

What do you like best about being the department head for electrical engineering?

I enjoy working with the faculty to accomplish common goals. I also enjoy seeing our students excel in their studies and careers. We have top students in our department. We try to position them to achieve their best and accomplish their goals.

As a new department head from an out-of-state university, I found the Arkansas Academy of Electrical Engineering to be a fabulous concept. The members are a great support and resource for our department.

What do you think of Arkansas?

I think the people of Arkansas are kind and open. I also find them to be honest and sincere.

The state is beautiful. The weather is mild and the state has many hidden treasures. To appreciate it, one needs to explore its mountains, trails, rivers and canyons. I like observing the green nature, and numerous lakes and mountains. This is a wonderful area for outdoor activities.

UNIVERSITY of ARKANSAS
1871

4180 Bell Engineering Center
College of Engineering
Fayetteville, Arkansas
72701

Nonprofit Org.
U.S. POSTAGE PAID
Permit No. 278
FAYETTEVILLE, AR