FALL 2010

UNIVERSITY OF ARKANSAS

BAEG LIFE LINE

UNIVERSITY OF ARKANSAS
DALE BUMPERS COLLEGE
OF AGRICULTURAL, FOOD & LIFE SCIENCES

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UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE

UNIVERSITY OF ARKANSAS
COLLEGE OF ENGINEERING

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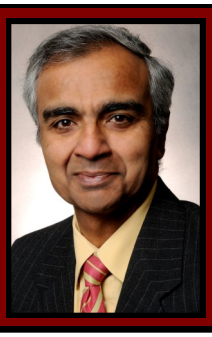

From the **Department Head**
Dr. Lalit R. Verma

It is wonderful to be back in the department after being in the role of Interim Dean of the Dale Bumpers College of Agricultural, Food and Life Sciences for the past two years. We have a very healthy group of students with our highest enrolments in some of our undergraduate and graduate classes. We have 100 undergraduates spread among sophomore to senior standings. There are 53 undergraduates enrolled this Fall in our Sophomore "Design Studio" class taught by Dr. Tom Costello, and 40 in the junior level "Properties" course of Dr. Julie Carrier. Our Department of Biological and Agricultural Engineering is truly unique as it resides in the UA Division of Agriculture and UA Colleges of Engineering and Dale Bumpers College of Agricultural, Food and Life Sciences. Research and teaching faculty are on campus while our extension colleagues are in the State Office of the UA Division of Agriculture's Cooperative Extension Service. We have experienced steady growth both in the quality and numbers of our students, and scholarly productivity of our dedicated faculty. Two of our senior student design teams were recognized nationally in June at the ASABE Annual Meeting in Pittsburgh.

Our research and extension programs address problems relevant to our stakeholders, not only dealing with food and agriculture, but also in sustaining ecological prosperity for a healthy planet. The ABET accredited undergraduate degree of *Biological Engineering* prepares students to design engineering solutions for real-world problems in Biological (living) Systems. Engineers trained to apply their expertise to various biological systems have exciting career paths and job opportunities in areas such as ecological stewardship, sustainability, food and agriculture, biotechnology, healthcare, bio-energy and bio-security.
Please let us know how you can help us and do not hesitate to call (479-575-2351), e-mail (lverma@uark.edu) or if you are in the area, drop in for a visit. I would be delighted to meet with you.

UNIVERSITY OF ARKANSAS

Biological Engineering

Engineering For Life

DR. D. JULIE CARRIER

Professor Carrier, Biological and Agricultural Engineering.

Dr. Carrier is involved in several research projects focused on extracting valuable chemicals that include materials with pharmaceutical properties from plant materials.

She is also a key player in research into bio-fuels.

Dr. Carrier mentored numerous students working on Honors Theses.

In addition, she advised many graduate students working on research projects.

Dr. Carrier's Recent News:

In June 2009, Dr. Carrier became a co-director of the Bioenergy Consortium. As co-director, she helps to provide oversight of 26 bioenergy research projects at the University of Arkansas; four projects at Arkansas State University; and two projects at the University of Georgia.

Among the active research projects in which she is engaged at UA is "Characterization and Quantification of Monomers, Oligomers and By–Products from Hemicellulose during Pretreatment," a project sponsored by NSF-CBET. This project is related to her overarching interest in extracting valuable chemicals from biomass before conversion into bioenergy.

Two PhD graduate students and two undergraduate students have worked with Dr. Carrier on this project.

BLUEINGREEN FUNDING FOR OIL SPILL CLEAN UP

BlueInGreen SDOX, a high efficiency dissolved oxygen delivery technology, is ideally suited to support bioremediation and restore oyster beds and other wildlife habitats in the Gulf. The Rapid Response Program at the National Science Foundation provided funding to deploy SDOX technology in bays and estuaries that were contaminated from the Horizon Oil Spill.

BlueInGreen is in the third year of a project funded by the National Science Foundation entitled, "A Portable Dissolved Oxygen Delivery System for Rapid Treatment of Organic Spills." SDOX has the unique ability to deliver high concentrations of dissolved oxygen to both shallow and deep bodies. SDOX is most cost effective at maintaining dissolved oxygen concentrations from the 3mg/L to saturation. It can maintain these concentrations in waters with a very high biological oxygen demand, such as those that would occur following an oil spill, excessive use of fertilizers, or other contaminating events.

The use of SDOX for remediation of water bodies polluted with organics has the following key benefits:

- Delivery of dissolved oxygen to targeted water layers (from the bottom to the surface and any point in between).
- Efficient addition of dissolved oxygen to shallow areas and estuaries along with a shoreline.
- Maintenance of aerobic conditions for rapid microbial digestion of excess organics (oil, algae, animal waste or litter, detritus, etc.)
- Formation of oxygen refugia for aquatic life threated by low dissolved oxygen caused by a spill of organics
- Portable SDOX units allow for targeted dissolved oxygen delivery to a specific location along the shore or deployment from a boat or barge that can travel with a plume of organics as it moves with the current.
- Lack of formation of oxygen bubbles that rise through the water column. The dissolved oxygen stays in the layer of water to which it is delivered.
- Injection of the dissolved oxygen at the same temperature as water being treated. No buoyancy currents are formed and the dissolved oxygen plume remains at the injection site.

Dr. Scott Osborn

ENGINEERING PROFESSOR RECEIVES NATIONAL CANCER INSTITUTE AWARD

FAYETTEVILLE, Ark. – Biomedical engineering professor David Zaharoff has been awarded a Transition Career Development Award by the National Cancer Institute to further his research on Interleukin-12, a powerful cytokine that shows great promise for therapeutic treatment of numerous types of cancer.

The award, which totals $511,368 over three years, is given to fewer than 15 investigators nationwide each year. It is the first time the National Cancer Institute has given this type of award in Arkansas, and it is the only Transition Career Development Award from any of the National Institutes of Health to be given to a researcher at the University of Arkansas.

The primary objective of the Transition Career Development Award is to help stabilize career tracks of promising investigators while establishing their first independent, cancer-related research programs. The award provides three years of salary – up to $100,000 per year – and up to $50,000 in direct costs per year for research and development expenses.

Interleukin-12 is a potent protein that allows communication between cells and helps regulate immunity – with significant clinical toxicities. To reduce clinical toxicities while maintaining or improving the antitumor efficacy of Interleukin-12, researchers in Zaharoff's lab developed a novel biomaterials-based delivery system for targeted application. They demonstrated that combining Interleukin-12 with chitosan, a viscous biopolymer, can retain Interleukin-12 in the tumor microenvironment; eradicate established colorectal, bladder and pancreatic tumors; and generate durable protection from tumor recurrence. These effects could not be reproduced by either chitosan or Interleukin-12 alone.

In 2009, Zaharoff published findings from studies of chitosan/Interleukin-12 on bladder tumors in mice. **In these studies, 88 to 100 percent of mice with bladder tumors were cured after four treatments within the bladder.** The researchers found that anti-tumor responses following chitosan/Interleukin-12 treatments were durable and provided complete protection from bladder tumor recurrence. Results were published in the August 2009 issue of Cancer Research, which may be found at http://cancerres.aacrjournals.org/.

Zaharoff received extensive training in drug delivery applications at Duke University and tumor immunology at the National Cancer Institute. At the University of Arkansas, he is part of the biomedical engineering program, a rapidly expanding program committed to achieving national recognition.

Dr. David Zaharoff Assistant Professor, 21st Century Professorship Biomedical Engineering

"The biomedical research community at the University of Arkansas is a vibrant, highly collaborative group that provides great opportunity for intellectual stimulation, collaborative interaction and equipment sharing," Zaharoff said. "This award will help us establish an academic laboratory that will focus on the development of novel delivery systems for vaccines and cancer immunotherapies."

Zaharoff is holder of the Twenty-First Century Professorship in Biomedical Engineering. He is director of the Laboratory of Vaccine and Immunotherapy Delivery and a member of the Winthrop P. Rockefeller Cancer Institute at the University of Arkansas for Medical Sciences.

2010 ACADEMY INDUCTEES

INDUCTEES—Carl Peters of Jacksonville, Ark., and Kevin Henry of New York, N.Y., were inducted into the Arkansas Academy of Biological and Agricultural Engineering during a ceremony April 17, 2009, in Fayetteville.

Peters, BS '59, MS '62, worked with reservoir flood routing and hydraulic systems and supervised construction of dams. Later, he was a project engineer responsible for organizing, training, and directing engineering survey crews that were gathering topographic data for the design layout and construction of 19 flood control dams and river channel improvements.

Henry, BS '99, is director of Global Business Planning for Estee Lauder Companies. He designed the global business planning consensus demand plan documents for all of the Estee Lauder Companies, as well as for L'Oreal USA.

Randy Childress, left, and H. B. Austin, right, were inducted into the Academy of Biological and Agricultural Engineering in April 2010.

Carl Peters, left, and Kevin Henry, right, were inducted into the Academy of Biological and Agricultural Engineering on April 17, 2009.

NEW FACULTY & STAFF

Dr. David Zaharoff, assistant professor of Biomedical Engineering, new faculty, 575-2005

Steve Green, new staff

Program Associate

Jeffie Thomas, new staff

Fiscal Manager, 575-2353

Amy Walker, new staff

Fiscal Support Specialist, 575-2106

STUDENTS QUANTIFY OIL SPILL IMPACT ON ECO-SYSTEM SERVICES

Students working with Dr. Marty Matlock of Bio and Ag Engineering and Dr. Jennie Popp of AgEcon and AgriBusiness estimated the economic value of loss of ecosystem services in the Gulf of Mexico from the Deepwater Horizon oil spill.

These students, Emily Matlock, Biosystems Engineering, Oklahoma State University; Whitney Sawney, International Studies, University of Arkansas; and Stephen Thoma, Fayetteville High School participated in the NSF Research Experience for Undergraduate Students Program through the summer, directed by Matlock and Dr. Michelle Evans-White (Biology).

Monetary values were placed on five different ecosystem services: pollution control, flood control, tourism, recreation, and fisheries. Minimum, mean, and maximum values for these services were compiled using data collected from a series of journal articles and then averages of the minimum, mean and maximum values were calculated.

Using NOAA Environmental Sensitivity Index (ESI) maps, the ecosystems and their areas located directly on the coasts of Louisiana, Mississippi, Alabama, and Florida, were found. The oil impact was determined by using data from the Emergency Response Management Application (ERMA) assessment on the oil spill as of June 29, 2010.

Using Palisade risk analysis and simulation software, *@Risk*, it was determined with 90 percent confidence that the overall ecosystem value was between $42.9 billion and $72 billion 2010 USD, averaging to $56.9 billion per year. After the oil spill, the remaining value of ecosystems was $8.2 billion, with a total ecosystem loss of $48.7 billion for the first year.

Over a 10 year period the loss would amount to $12.2 billion.

SENIOR DESIGN TEAMS PLACE NATIONALLY

FAYETTEVILLE, Ark.— June 2, 2010 Two University of Arkansas biological engineering senior design teams have placed in the top three in the ASABE Gunlogson National Student Design Competition. This is the third time in the last five years that UA teams have taken two of the top three spots in this national competition.

One of the winning teams was "Design of a Den Heating System of an Exotic Cat Rescue Shelter," with student members Taylor Christian, Michael May, and Helen Wick. They were accompanied by advisors, Tom Costello and Steve Green. The second team was "Design of an Algal Growth Bed to Remove Phosphours from Wastewater," with student members Damon Assem, Eric Boles, Amber Brown, Jeffrey Hickle, Ryan "Zak" Johnston and C. Nathan Jones. The advisors for this event were Marty Matlock, Tom Costello, and Steve Green.

This accomplishment reflects skills and hard work on the individual student teams. It also reflects the cumulative effort of all the biological engineering faculty and staff. The high level of preparation by the Arkansas teams is continuing evidence of the quality of the biological engineering programs.

The biological engineering program is a part of the biological and agricultural engineering program, an interdisciplinary field of study between the College of Engineering and the Dale Bumpers College of Agricultural, Food and Life Sciences.

BAEG LIMB DRIVE FOR HAITI

FAYETTEVILLE, Ark. – Doctors and aid workers fear that the Haitian earthquake created a generation of amputees. Many of these survivors are children. Roughly half of the 9.8 million people in Haiti are younger than 21.

To address this emerging crisis, students in the biological and agricultural engineering department at the University of Arkansas helped organize the Northwest Arkansas Limb Drive for Haiti. The event was 10 a.m. to 4 p.m. Saturday, March 6, at the Pauline Whitaker Arena on Garland Avenue.

Physicians for Peace, an international medical mission based in Virginia, Hanger Orthopedic Group, UA students and Dr. Costello collected used prostheses, or artificial limbs. Similar events, some of which also collect crutches, canes, walkers and wheelchairs, were organized in communities across the United States.

Costello and his biological-engineering students have worked with Physicians for Peace since 2006.

Several student teams in his senior design course designed low-cost prosthetics that can be manufactured in developing countries. To get feedback on their designs, students have twice visited a prosthetic clinic in the Dominican Republic, which shares the island of Hispaniola with Haiti.

In 2008, students developed a simple, low -cost prosthetic knee. A current team is developing an innovative artificial foot. Such devices have even greater value and motivate students even more, Costello said, now that a new, large group of Haitians will need replacement prostheses for decades to come.

Several recent news reports from Haiti

> *"Some survivors suffered devastating injuries when buildings collapsed. Others lost limbs in the process of being freed from wreckage."*

mentioned that small hospitals and makeshift medical clinics performed numerous amputations every day following the earthquake. Some survivors suffered devastating injuries when buildings collapsed. Others lost limbs in the process of being freed from wreckage. Still other survivors are now losing limbs due to serious infections, wounds that will not heal or gangrene. Often, doctors must amputate a limb to save a patient's life.

"It is difficult to measure the full extent of this tragedy, but some aid workers have estimated that between 2,000 and 4,000 people have lost an arm or leg in the aftermath of the earthquake," Costello said. "Those who have lost a leg will be completely immobile until they receive crutches or a wheel chair. Eventually, patients who are fitted with an artificial limb will be taught to walk and maybe even run again."

A new prosthesis in the United States costs between $5,000 and $10,000. Amputees are often fitted with a new prosthesis every one to three years. Many components of the used limbs are still functional but cannot be legally re-used in this country. Discarded prostheses can be donated for use in developing countries. Medical teams used components salvaged from used limbs to fit patients in Haiti. Use of simple, locally made devices, such as those designed by the Arkansas students, is another way for these medical needs to be met, Costello said.