



BAE Lifeline

Winter 2005



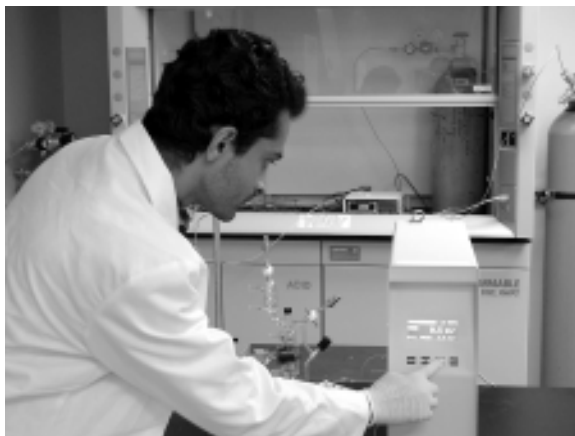
Department of Biological and Agricultural Engineering
Dale Bumpers College of Agricultural, Food and Life Sciences
and the College of Engineering



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

Biomedical Engineering

Dr. Mahendra Kavdia joined the department in October of 2003 as the first Biomedical Engineering Faculty member. Dr. Kavdia's research interests are computational systems biology and medicine; mathematical modeling of biological systems; nitric oxide; reactive oxygen and reactive nitrogen species biotransport; signal transduction; cellular engineering; endothelial cell dysfunction; blood substitutes; molecular mechanisms of diabetes; and age related vascular complications. In particular, his research focuses is on evaluation of the significance of nitric oxide (NO), reactive oxygen species (ROS) and reactive nitrogen species (RNS) in physiology and pathophysiology and provides a quantitative understanding



Prabhakar Deonikar working on Sievers NOA 280 chemiluminescence analyzer.

of NO, ROS and RNS interactions with biological targets at the molecular and cellular level. Ongoing projects in Dr. Kavdia's Laboratory are: **Nitric Oxide (NO) Biotransport:** NO plays a key role in numerous physiological functions including endothelium-derived relaxation, platelet inhibition, smooth muscle proliferation, neurotransmission and host defense. Its role as a vasodilator has been established over the last two decades. However, the fate of NO when it enters the bloodstream is still not established. The overall objective of the proposed research is to use computational modeling and in vitro experiments to improve our understanding of the interactions of NO with the red blood cell (RBC). Dr. Kavdia has designed an in vitro model system of the microcirculation. Deoxygenated and oxygenated whole blood, red blood cell solution and extracellular Hb solution are used for interaction with NO. Experimental measurements of concentrations of S-nitrosohemoglobin, nitrosylated hemoglobin, nitrite and nitrate are performed to quantify NO and RBC interactions using chemiluminescence. Detailed computational models are being developed to (a) simulate NO-RBCs interaction in an in vitro experimental system and (b) simulate NO transport in the microcirculation. By designing a new experimental model for studying biochemical interactions of nitric oxide and the red blood cell, Dr. Kavdia is advancing the knowledge of biomedical researchers on these molecular interactions and may provide therapeutic opportunities in areas as diverse as sickle cell anemia, pulmonary hypertension, septic shock, nitric oxide inhalation, and blood substitutes.

Endothelial Dysfunction: The primary

Beginning with the Summer 2005 issue, this newsletter will be emailed to you electronically. As always our newsletter will be on www.baeg.uark.edu. Please see the insert that is included in this issue for all the requested information.



A M.S. in Biomedical Engineering was approved by ADHE for implementation in Fall 2004. This new program will be the only one of its kind in the state and will have four areas of concentration.



Dr. Kaiming Ye joined the department in December 2004 as the second Biomedical Engineering Professor. Dr. Ye worked as a Research Assistant Professor at the University of Pittsburgh.



The Department is looking forward to the 2005 class of inductees of the Arkansas Academy of Biological and Agricultural Engineering. The Academy Banquet will be held on April 8, with the College of Engineering Alumni Awards Dinner on April 9.



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AWARDS AND RECOGNITION

Department head Lalit Verma has been named to the board of directors of the national Accreditation Board for Engineering and Technology for university programs in applied science, computing, engineering and technology. The board is a federation of 30 professional and technical societies. It currently accredits some 2,600 programs at more than 550 colleges and universities.

Zhihui Liu, Abani Pradhan, Xiaole Mao and Madhukar Varshney presented their posters on flow-through electrolyzing chamber, microbial risk assessment model, DNA biosensor and nanobead separation method at the Arkansas Section of ASAE 2004 Annual Meeting in Little Rock on October 1. Liu and Pradhan won the first and second prizes in the Graduate Student Poster Competition.

Yanbin Li gave a talk on immunosensors for rapid detection of foodborne pathogens, and Xiaoli Su and Madhukar Varshney presented their posters on QCM biosensors and magnetic immuno-nanoparticles at the Food Safety Consortium 2004 Annual Meeting in Ames, IA, on October 3-5. Dr. Li also gave an invited presentation at the 2004 CIGR (International Commission of Agricultural Engineering) International Conference in Beijing, China on October 11-14, titled "Microfluidics based biosensors for rapid detection of *E. coli* O157:H7." Dr. Li gave an invited presentation, titled "Brief introduction of biological engineering programs at the University of Arkansas," at the International Forum on Biosystems Engineering Programs October 16-18 in Hangzhou, China.

Sreekala Bajwa attended the 2004 ASPRS Fall meeting in Kansas City, MO, on September 13-16 and presented a paper titled "Spatial modeling of soil compaction with geographically weighted regression." Dr. Bajwa also attended the America View Annual Meeting at EROS Data Center in Sioux Falls, SD, on September 19-23.

Dennis Gardisser was awarded the state and regional award, "Aviation Safety Counselor of the Year," from the FAA this past Saturday at the annual Safety Counselor training workshop in Mountain View. This is a competitive award selected from applicants throughout Arkansas at the state level, and throughout Texas and surrounding states for the FAA regional level. Dr. Gardisser received a letter of congratulations from John Knight, Director of the Arkansas Department of Aeronautics, and Governor Mike Huckabee.

Jin-Woo Kim, Steve Tung and Russel Deaton gave an invited presentation, "Interfacing Micro-/Nano-Scale Biological and Abiological Materials for Bio/Abio Hybrid Systems," at the 206th Meeting of the Electrochemical Society (Biological Nanostructures, Materials, and Applications Session) October 3-8 in Honolulu, HI. Steve Tung and Dr. Kim also gave the invited presentation, "Flagellar Motor Based Micro Hybrid Devices," at the 26th Annual International Conference IEEE Engineering in Medicine and Biology Society (EMBS) Sept. 1-5 in San Francisco, CA, and chaired the Technical Track under Technical Theme 4 – Micro and Nano-Biotechnology – "Artificial Cells: Hybrid Devices Integrating Cell Machinery and Micro/Nano Sensors."

Graduate Assistant Subodh Kulkarni and Dan Humburg, Associate Professor at SDSU, Brookings, presented "Modeling Sugar

Beet Quality Variables from Satellite Images and Canopy Spectral Indices" at the American Society for Photogrammetry and Remote Sensing Annual Meeting in Denver, CO, on May 24-28 and at the ASAE annual conferences in Ottawa, Canada, on August 1-4. Kulkarni also wrote a paper on "Soil Compaction Modeling with GIS and Geographically Weighted Regression (GWR)" for the fall ASPRS conferences in Kansas City, MO, on September 12-16. Dr. Bajwa coauthored and presented the paper.

Yanbin Li presented papers at the 2004 World Biosensors Congress Annual Meeting, May 24-26 in Granada, Spain; at the 2004 ASAE Annual International Meeting on August 1-4 in Ottawa, Canada; and at the 2004 IAFP Annual Meeting, August 8-11 in Phoenix. Dr. Li spent one month at Zhejiang University, China, conducting research on biosensors for rapid detection of foodborne pathogens and pesticide residues in Chinese food products in collaboration with Yibin Ying in biosystem engineering, Ping Wang in biomedical engineering and Weihuan Fang in animal sciences.

Yanbin Li's graduate and postdoctoral students, X.L. Su, Z. Liu, B.L. Swem, A.K. Pradhan and M. Varshney, along with B. Kim and Dr. Li, presented a total of four papers at the Institute of Food Technologists Annual Meeting in Las Vegas, NV, on July 12-16 and three papers at the ASAE Annual Meeting in Ottawa, Canada.

Liju Yang accepted a postdoctoral research associate position in the Biomedical Engineering Department at Purdue University. She obtained her Ph.D. in biological engineering last December, and then worked as a postdoctoral associate for Dr. Yanbin Li.

Sreekala Bajwa, Ashish Mishra and Subodh Kulkarni attended the ASAE annual meeting, where Mishra and Dr. Bajwa presented a paper coauthored by Richard Norman. Dr. Bajwa also attended the International Precision Agriculture Conference in Minneapolis July 25-28, and presented a paper coauthored by Dr. Mishra and Morteza Mozaffari.

Indrajeet Chaubey and his research group, Kati White, Vijay Garg, Sumit Sen and Sudhanshu Panda, attended the annual conference of the American Society of Agricultural Engineers and presented a total of five research papers, some coauthored by Brian Haggard, Kristofor Brye, Marty Matlock and Thomas Costello. Dr. Chaubey, Kati White and Chad Cooper also organized a one-day workshop on Simulating Watershed Response with the Soil and Water Assessment Tool (SWAT) model in Little Rock on August 24. Personnel from the Arkansas Soil and Water Conservation Commission, Arkansas Department of Environmental Quality and the University of Arkansas, Division of Agriculture attended the workshop.

Carl Griffis was elected into the Teaching Academy of the University of Arkansas. Only four faculty members were elected this year, and he was nominated and elected by his peers.

The following students were inducted in the Alpha Epsilon Honor Society of Agricultural, Food, and Biological Engineering: Ashish Mishra, Eylem Mutlu, Inoka Wijesekera, Jayarani Kandaswamy, Mansour Leh, Nalini Kotagiri, Prahlad Jat, Senthil Subramaniam, Subodh Kulkarni, Vibhava, Vijay Garg, Xiaole Mao and Zhihui Liu.

Phil Tacker was awarded the M-159 Award for the Advancement of Surface Irrigation.



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AWARDS AND RECOGNITION CONT.

Dennis Gardisser was an invited speaker at the Michigan Agri-Business Association's 72nd Annual Winter Conference and Trade Show held on January 10-12, 2005 in Lansing, MI. He conducted two sessions regarding spray drift mitigation. The emphasis was on drift control and rust & aphid application efficiency and efficacy.

Lalit Verma was invited to make a keynote presentation titled, "Food and Bioprocess Engineering: A Key Element of Biological Engineering" at the International Conference "Emerging Technologies in Agricultural and Food Engineering" during December 14-17, 2004 at the Indian Institute of Technology, Kharagpur, India. Dr. Verma was invited to present and discuss Biological Engineering programs at the Amity School of Biotechnology Engineering in New Delhi, India, on January 3-4, 2005.

Indrajeet Chaubey, Deb Sahoo, Brian Haggard, Marty Matlock, Tom Costello and Kati White presented "Integrated assessment of BMPs, nutrient transport, and water quality in an agriculturally dominated stream," at the First International Conference on Environmental Science and Technology, American Academy of Sciences in New Orleans, LA.

Katie White, Indrajeet Chaubey and Brian Haggard presented, "Coupling of CE QUAL-W2 and SWAT to simulate watershed reservoir management" at the First International Conference on Environmental Science and Technology, American Academy of Sciences, in New Orleans, LA.

Andy Riester was awarded an undergraduate research grant under the direction of Dr. Julie Carrier. The project title is: "Evaluating the effect of red grape marc extracts for reduction of Low-Density Lipid (LDL) Oxidation."

Adam Jokerst was awarded a SURF Grant to research, "Fish Attraction and Oxygen Sanctuary Creation Utilizing Newly Developed Oxygenation Techniques." Adam will study under the direction of Dr. Scott Osborn.

Jennifer Rioble was also awarded a SURF Grant and will be studying under the direction of Dr. Julie Carrier. Jennifer will research, "The Effects of Milk Thistle Extract on Reduction of Low Density Lipid (LDL) Oxidation."

Indrajeet Chaubey attended the USDA-CSREES National Water Quality Conference from February 6-10, and presented a talk titled "Development of a field scale methodology to identify runoff source

areas in a pasture dominated watershed." Dr. Chaubey also presented a poster titled "Development of an integrated water quality-water management program in the Arkansas Delta."

Indrajeet Chaubey, served on the review panel of the National Science Foundation Graduate Research Fellowship program on February 11-13.

Dennis Gardisser was an invited speaker at the 2nd Annual Mississippi Agricultural Aviation Association/Southeast Aerocultural Fair Convention in Biloxi, MS. The convention was held February 3-5. Dr. Gardisser's presentation was "Spray Drift Reduction - On Target Delivery Tools" and application operating tips. While in attendance, Dr. Gardisser was presented with the Lee Abide Award. The Lee Abide Award, which is not necessarily given every year, is the highest award issued by the Mississippi Agricultural Aviation Association. The purpose of the award is to recognize and honor a person who has made outstanding contributions to agricultural aviation, over and above that normally expected and over a period of time long enough to have established himself as a leader in a field or fields directly affecting the well being and welfare of the agricultural flying industry and of the Mississippi Agricultural Aviation Association.

Mahendra Kavdia made a presentation entitled, "Model for Nitric Oxide and Superoxide Interactions in the Microcirculation," at the Biomedical Engineering Society (BMES) Annual Fall Meeting, Philadelphia, PA, in October, 2004.

Dr. Marty Matlock received a Design Award from the Arkansas Chapter of the American Institute of Architects for the Design of "Riparian Meadow, Mounds of Rooms Urban Greenway in Warren, Arkansas."

Napura Bhise was awarded an Honors Undergraduate Research Grant for the project "Designing a Micron Scale In-Vitro Experimental system for Studying and Measuring the Products of bovine Red Blood Cell's Reaction with Nitric Oxide. She will be studying under the direction of Dr. Mahendra Kavdia.

NEW PROJECTS

M. Kavdia. Biotransport and Biochemical Interactions of Nitric Oxide, Reactive Oxygen Species and Reactive Nitrogen Species.

ARTICLES PUBLISHED

Bajwa, S.G., P. Bajcsy, P. Grove and L.F. Tian. 2004. Hyperspectral Image Data Mining for Band Selection in Agricultural Applications. Transactions of the ASAE 47(3): 895-907.

Haggard, B.E., S.A. Ekka, M.D. Matlock and I. Chaubey. 2004. Phosphate Equilibrium Between Stream Sediments and Water: Potential Effects of Chemical Amendments. Transactions of the ASAE 47(4):1113-1118.

Haggard, B.E., E.H. Stanley, and D.E. Storm. 2005. Nutrient Retention in a Point-Source-Enriched Stream. Journal of the North American Benthological Society 24(1):29-47.

Harmel, R.D., H.A. Torbert, P.B. DeLaune, B.E. Haggard, and R.L. Haney. 2005. Field Evaluation of Three Phosphorus Indices on New Application Sites in Texas. Journal of Soil and Water Conservation 60(1):29-42

Harmel, R.D., H.A. Torbert, B.E. Haggard, R. Haney, and M. Dozier. 2004. Water Quality Impacts of Converting to a Poultry Litter Fertilization Strategy. Journal of Environmental Quality 33:2229-2242.

Kulkarni, S. S., and S. G. Bajwa. 2004. Spatial Modeling of Soil Compaction with Geographically Weighted Regression. In: Proc. of ASPRS Annual Fall Conference, Sept 12-16, Kansas City.

Smith, D.R., B.E. Haggard, E.A. Warnemuende, and C. Haug. 2005. Sediment Phosphorus Dynamics for Three Tile Fed Drainage Ditches in Northeast Indiana. Agricultural Water Management 71: 19-32.

Su, X.L., and Y. Li. 2004. Quantum Dot Biolabeling Coupled with Immunomagnetic Separation for Detection of *Escherichia coli* O157:H7. Analytical Chem. 76(16):4086-4810.



**Distinguished Doctoral Fellowships
and
Doctoral Academy Fellowships**

The Department of Biological and Agricultural Engineering at the University of Arkansas has two Distinguished Doctoral Fellowships and four Doctoral Academy Fellowships as well as graduate research assistantships available in several research areas in biological engineering.

FELLOWSHIPS:

Distinguished Doctoral Fellowships offer a stipend of \$30,000 per year plus tuition for up to four years.

Doctoral Academy Fellowships offer a stipend of \$23,700 per year plus tuition for up to four years.

REQUIREMENTS:

Distinguished Doctoral Fellows should have a master's GPA of 3.85 or B.S. GPA 3.65 or higher, a GRE verbal plus quantitative score at least 1300 and a GRE writing score of 5.5 or higher.

Doctoral Academy Fellows should have a master's GPA of 3.65 or B.S. GPA 3.5 or higher, a GRE verbal plus quantitative score of at least 1200 and a GRE writing score of 5.0 or higher.

TO APPLY:

Send a letter of application, a resume and transcripts of all college work and three reference letters to:

Dr. Lalit Verma, Head and Professor
Department of Biological and Agricultural Engineering
203 Engineering Hall
University of Arkansas
Fayetteville, AR 72701
Phone: 479-575-2351 Fax: 479-575-2846
E-mail: lverma@uark.edu
Website: www.baeg.uark.edu

NEW GRANTS

S. Bajwa, I. Chaubey and D. Gardisser. US EPA. Pesticide pollution risk assessment and mitigation training in Arkansas. \$41,995.

I. Chaubey and M. Matlock. (US EPA) Arkansas Soil & Water Conservation Commission. Arkansas Soil & Water Conservation update of Arkansas nonpoint source pollution management program. GIS database development and watershed modeling in Arkansas priority watersheds. SWAT modeling for the Illinois River watershed. \$190,547.

T. Costello. NASA. GSRP Heat transfer within a hypobaric plant growth chamber. \$24,000.

T. Costello, B. Haggard and I. Chaubey. US Geological Survey, Water Resources Research Institute. Development of techniques for identifying and linking physical characteristics to surface runoff source areas. \$14,838.

T. Costello. Arkansas Soil and Water Conservation Commission, Arkansas Department of Environmental Quality. Demonstration of on-farm litter combustion. \$98,812.

B. Haggard and M. Matlock. US EPA (Prime). Development of a lotic ecosystem trophic status index using periphytometers. \$4,000.

B. Haggard, I. Chaubey and M. Matlock. Parsons Engineering. Stream sampling for nutrient impairment. \$56,532.

G. Huitink and A. Bajwa. Cotton Foundation. Precision farming technology for developing subsoiling guidelines in Arkansas. \$15,000.

M. Kavdia. Nitric oxide transport in the microcirculation. SDG. American Heart Association (AHA). \$260,000.

M. Matlock. US EPA. Wadeable stream assessment in Arkansas. \$226,864.

M. Matlock, I. Chaubey and T. Costello. Arkansas Soil and Water Conservation Commission. GIS database development and watershed modeling in Arkansas priority watersheds. \$85,184.

NEW FACULTY

Dr. Kaiming Ye joined the BAE faculty in December of 2004, as an Assistant Professor of Biomedical Engineering. Dr. Ye comes to the department from the University of Pittsburgh where he worked as a Research Assistant Professor. Dr. Ye received his B.S., M.S. and Ph.D. from East China University of Science and Technology. For more information on Dr. Ye's research interests, please see page 5.



Ye

Yes! I would like to contribute to the scholarship fund!

Please accept my contribution to the following scholarship. My check for \$_____ is enclosed.

Billy Bryan Scholarship Fund _____ **Joel T. Walker** Memorial Scholarship Fund _____
Biological and Agricultural Engineering **General** Scholarship Fund _____

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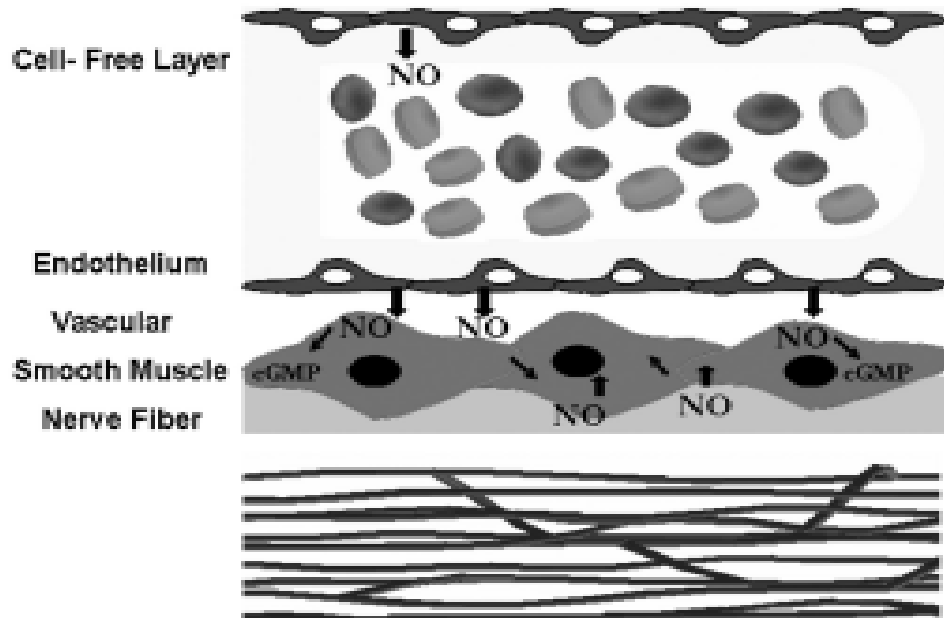
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University of Arkansas, Fayetteville, AR 72701



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marker generally used for endothelial dysfunction is reduced bioavailability of endothelial cell-released nitric oxide (NO). Numerous studies point to the overproduction of reactive oxygen species including superoxide resulting from oxidative stresses is the first and key event in endothelial dysfunction. The underlying mechanisms of oxidative stress induced endothelial cell dysfunction remain poorly understood. The factors that lead to endothelial cell dysfunction include enzyme systems, with cofactors substrate availability, antioxidants and cellular location. These reactive oxygen species can directly interact with nitric oxide or serve as signaling molecules to modulate the release of nitric oxide by endothelial cells. This can be linked to the amount of peroxynitrite generation at the endothelial cell level. Dr. Kavdia is developing computational models to predict levels of NO, superoxide & peroxynitrite at the endothelial cell level. In addition, he is using an in-vitro shear stress experimental system to expose HUVECs oxidative stresses related conditions. Knowledge of underlying mechanisms of molecular interactions in oxidative stresses will be useful in developing new treatment and in rationalizing the use of existing treatments in cardiovascular disorder, diabetes and age related vascular complications. If you would like more information on Dr. Kavdia's research, please contact him at mkavdia@uark.edu.

Computational Model of NO Transport in the Microcirculation.



Dr. Kaiming Ye's research interest focuses on stem cell engineering, tissue engineering, biosensing and biomedical imaging. Dr. Ye expertise is molecular cell biology. He has engineered a stem cell marker, named CD34GFP, that can be used to in vitro label and track stem cells. He is currently cooperating with Dr. Hubel, a clinical scientist at Magee Women's Hospital, University of Pittsburgh, and using this technique to study the role of the maternal endothelial progenitor cells in the course of development of preeclampsia in pregnant women. This NIH supported research project could lead to a new treatment of preeclampsia that is a leading cause of maternal death. He also engineered a new protein that can serve as a glucose indicator for continuous blood monitoring by a fluorescence resonance energy transfer (FRET) detection mechanism. With this new protein, Dr. Ye and his colleagues invented a micro-glucose biosensor that can provide continuous blood glucose monitoring for diabetics when it is implanted under the skin. He has also developed a new technology to simplify the purification of retroviral vectors. With this technology, the vectors can be highly purified and concentrated for use in human gene therapy clinical trials. His recent research also involves high throughput screening of breast cancer genes using siRNA library. If you would like more information on Dr. Ye's research, please contact him at kye@uark.edu.

Meet our Faculty....

Department Head and Professor

Dr. Lalit Verma
lverma@uark.edu

Professors

Dr. Dennis Gardisser
dgardisser@uaex.edu

Dr. Carl Griffis
clg@uark.edu

Dr. Yanbin Li
yanbinli@uark.edu

Dr. Otto Loewer
ojl@uark.edu

Dr. Karl VanDevender
kvan@uaex.edu

Associate Professors

Dr. Julie Carrier
carrier@uark.edu

Dr. Tom Costello
tac@engr.uark.edu

Gary Huitink
ghuitink@uaex.edu

Dr. Marty Matlock
mmatlock@uark.edu

Phil Tacker
ptacker@uaex.edu

Assistant Professors

Dr. Sreekala Bajwa
sgbajwa@uark.edu

Dr. Indrajeet Chaubey
chaubey@uark.edu

Dr. Mahendra Kavdia
mkavdia@uark.edu

Dr. Jin-Woo Kim
jwkim@uark.edu

Dr. Scott Osborn
gsosborn@uark.edu

Dr. Kaiming Ye
kye@uark.edu

Adjunct Assistant Professor

Dr. Em Ward
eward@uark.edu



Department of Biological and Agricultural Engineering
203 Engineering Hall
University of Arkansas
Fayetteville, Arkansas 72701-1201

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Educational Objectives: To produce graduates who:

1. Effectively apply engineering to biological systems and phenomena (plants, animals, humans, microbes, and the environment) with demonstrated proficiency in basic engineering skills, technical knowledge, and professional and personal skills.
2. Are well prepared for future challenges in biological engineering, life-long learning, and professional and ethical contributions to society through sustained accomplishments.

Calendar of Events

March

21-25 Spring Break
25 Good Friday
27 Easter

April

8 Academy Dinner
8-9 College of Engineering Alumni Weekend

May

6 Dead Day
7-13 Finals
14 Commencement
30 Memorial Day

July

4 Independence Day

BAE Lifeline

Department of Biological and
Agricultural Engineering
203 Engineering Hall
University of Arkansas
Fayetteville, AR 72701-1201

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Dale Bumpers College
of Agricultural, Food and Life Sciences
and
College of Engineering

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Dept. of Biological and Agricultural Engineering
479-575-2351
baeg@engr.uark.edu
www.baeg.uark.edu

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Bumpers College
479-575-2252
www.uark.edu/depts/dbcafls/

College of Engineering
479-575-6012
www.engr.uark.edu/

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