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THE NEWSLETTER OF THE UNIVERSITY OF GEORGIA FACULTY OF ENGINEERING

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The Inaugural University of Georgia Engineering Conference

The Georgia Center for Continuing Education

Masters Hall, October 28, 2004

To present recent advances and opportunities in Engineering at UGA

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Keynote address by

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President, Olin College
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Students Making the Most of Engineering Opportunities

Walking through a laboratory in Physics and Astronomy or Driftmier Engineering Center one is struck by something beyond the shiny surfaces of thermal evaporators, atomic microscopy systems and nano-fabrication clean rooms: students. Working with this equipment, devising new experiments and recording it all, many UGA undergraduate and graduate students are discovering the benefits of integrating cutting edge engineering research from all around campus.

Anu Desai, left, and Prince Odame, both second year graduate students in bioengineering, pursue different paths in the lab.

"The structures bend and we want to find out how we can prevent the bending because it may not be good for the application," says Jianguo Fan, a PhD student working on the fabrication of nanostructures in one of Dr. Yiping Zhao's labs inside the Physics building. From new research areas like nanotechnology to more well-established fields, students are integrating engineering with other disciplines on different parts of campus and beyond in ways that make their UGA experience unique.

And it's not just limited to graduate students, as undergraduates also realize the benefits of spending time in labs with professors. Layne Bradley, a 3rd year student from Athens majoring in Physics and Math, works in another Zhao nanotechnology lab on surface plasmon resonance, used in sensors and other biomedical detection devices. "We use a thin film and at a certain frequency a laser beam resonates it at the same frequency as the plasmons on the distiller surface. Right now, this is physics, but we hope to increase the sensitivity of the sensor by placing nanorods on the film," explains Bradley, who just began working in the lab this summer. Undergraduates gain

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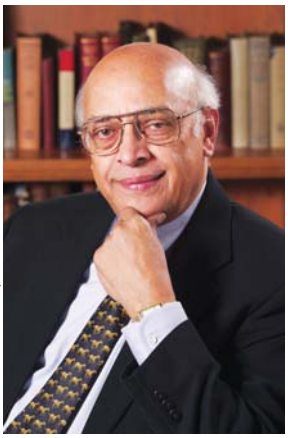
Engineering's Integral Role at UGA

By Gordhan L. Patel

As we continue to advance the breadth and quality of our research programs at UGA, it is apparent that institutions like ours will increasingly be expected to garner support from sources outside the state to achieve our highest academic goals. I see the Faculty of Engineering as an integral part of UGA's strategy to expand its opportunities for extramural funding and sustain its steady climb among America's research universities.

The university's decision thirty years ago to make strategic investments in the life sciences has been paying off for some time in terms of extramural support for basic research across campus in Arts and Sciences, Agriculture, in several interdisciplinary centers and institutes, and in other programs. More recently, our increased emphasis on biomedical research and public health has had a significant impact. Among America's top 100 research universities, UGA is fourth overall in its rate of increase in funding from the National Institutes of Health, according to a recent article in the *Chronicle of Higher Education*. We have also positioned ourselves to move forward in biotechnology and bioinformatics and have made some very significant investments to advance research in the Colleges of Veterinary Medicine and Pharmacy.

Engineering offers a very significant opportunity to amplify our research commitment and capacity. The focus of engineering on solving problems helps to identify the pragmatic value of scientific discoveries as well as triggering further innovation in the sciences. Engineering facilitates the use of new scientific discoveries to design new products, processes and systems to solve real-world problems. One of the most dramatic outcomes at UGA of this dynamic relationship has occurred in the field of nanotechnology. UGA's interdisciplinary nanotechnology initiative has its origins in a symposium held when the Faculty of Engineering was originally formed. Faculty in mathematics, physics, chemistry, engineering and other fields began developing a program to explore this new territory collaboratively. This resulted in the formation of NanoSEC, an interdisciplinary center that now involves more than thirty UGA faculty from ten different academic units. These developments, initiated mainly by engineers and physical scientists, have significant implications for the life sciences as well and will amplify activity in this traditional area of strength at UGA. Nanotechnology applications are now being explored at UGA in fields like drug development and agriculture, and UGA's capability to pursue nanobiotechnology has positioned us to be a major player in the Governor's initiative to make nanotechnology a strategic focus for university research. In terms of the impetus provided by the Faculty of Engineering, more than $5 million in extramural funding involving more than twenty projects relating to nanotechnology has been awarded to UGA since July, 2003.



Another example involves researchers in the chemistry department, biological engineering and engineering outreach partnering with private industry to develop new methods to refine fuel from biomaterials. UGA biological engineers have established expertise in biofuel production. This expertise has been significantly amplified by research in our Department of Chemistry relating to the nanoscale surface chemistry of fuel cell electrodes. The resulting knowledge could improve the prospects for developing hydrogen-based fuel cells. While this has implications for the nation in terms of the development of alternative fuels, it also could directly impact the economy of Georgia by providing an alternative use for wood products and other biomaterials available here. Extramural funding to date for this project totals about $1 million with continuing support anticipated.

One related area where UGA has recently emerged as a key player is engineering education. A Faculty of Engineering member from the College of Education was a co-principal investigator on a grant proposal to the National Science Foundation. The proposal resulted in a $10 million, multi-institutional award to improve engineering and technology education in K-12. Since its inception, the Faculty of Engineering has been an incubator for new engineering curricula with proposals to make engineering education more interdisciplinary and more integrated with the liberal arts. As the number of students who choose engineering nationally continues to decline, this kind of curricular innovation deserves increased attention.

These are only a few of the successes that confirm the decision at UGA to experiment programmatically with a greater emphasis on engineering. It is a testimony to our faculty that these successes have been achieved in a climate of economic downturn and uncertainty about how and when things will improve. The Faculty of Engineering, with active membership in programs across campus, is to be commended for continuing to innovate internally in order to raise engineering to the highest level of participation possible in the university's overall research enterprise.

"Engineering offers a significant opportunity to amplify our research commitment and capacity."

The Faculty of Engineering was formed in this context to link engineers and scientists in programs across campus, and the UGA Research Foundation agreed to fund the Interdisciplinary Engineering Grants program to support this strategy. The program provides $200,000 in total seed funding each year for competitive grants of up to $50,000 per year for up to two years for research projects that involve faculty in science departments working with engineers. The program is just entering its third round of competitive funding, but already over 70% of the first-year awardees and several other participants have submitted proposals to external funding agencies based on their initial submissions to the internal program.

Gordhan L. Patel
Vice President for Research and
Associate Provost
University of Georgia

STUDENT SPOTLIGHT

To mark the new semester, meet a few of the students taking advantage of the breadth of engineering experience available at UGA.

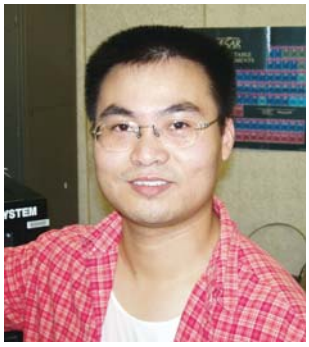
Yeswanth Rao, PhD student, bionanosensors: "We're making a biosensor using the principle of surface acoustic waves, combining technology from the communications industry with biotechnology and nanotechnology."

Venkataramani Anandan, graduate student, bioengineering: I'm working on the fabrication of nanostructures, like nanorods and nanowires, using electrodeposition technique."

Xialing Yang, PhD student, bioengineering, is new to UGA this semster and will work with Dr. Guigen Zhang in the area of nanoscale biosensors.

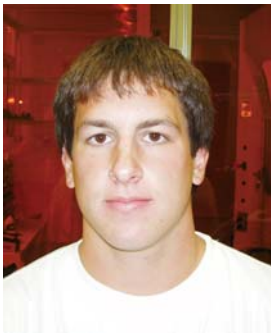
Xiaojia Tang, PhD student, physics, nanotechnology and electrochemistry of biophysics, working on a nanostructured electrode for biosensors with Dr. Yiping Zhao.

Layne Bradley, a 3rd year undergraduate from Athens majoring in physics and math, began working in Dr. Zhao's nano lab after taking a class with him.



Jianguo Fan, PhD student, physics, works on the fabrication of nanostructures: "There are so many applications for this work, from optics to detection to drug delivery."

Jackie DiRamio, graduate student in bioengineering from Marietta, began working in Dr. William Kisaalita's lab after taking classes with him as an undergraduate**: "**My work is pharmaceutical-based drug delivery with hydrogels, especially estrogen."



Dustin Dyer, a 4th year undergraduate in Agricultural Engineering: "My mentor Dr. Verma suggested that I get a taste for what it was like to do research and introduced me to Dr. Zhang in my second year."

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valuable experience and expand their credentials in this setting while establishing integral relationships with professors. Working in a lab is becoming another avenue for students to make the most of their time at UGA, and engineering opportunities are connecting labs across campus.

Prince Odame, a 2nd year graduate student in bioengineering from Ghana, is capitalizing on UGA connections with the Medical College of Georgia to further his research on cranial sutures. "It's a very big advantage for me," Odame says of working with Dr. Jack Yu of MCG and having him on his thesis committee. "I come up with an idea and then talk to him to see if it is reasonable and he says, 'Look, here's what actually happens'. I can then interpret this perspective from the engineering point of view."

The biomedical area brings together many fields that, combined with advances in UGA engineering, put students at the forefront of innovative new disciplines. Furqan Haq, a PhD student working in the new Nano-Micro Fabrication lab with Engineering professor Guigen Zhang, is able to apply floral lithography and other nanotechnology techniques to study cell growth on artificial matrices. "It's a great combination," says Haq of his collaboration with Zhang as well as faculty in Cellular Biology and Animal and Dairy Science. "In the nanotechnology lab we can create substrates and matrices and then take this work to any other biomedical department and work in their labs and culture cells," Haq explains.

In many ways, biological engineering is a nexus for a variety of budding new research fields, and hence an attraction to many young scientists. Anu Desai, a graduate student in bioengineering says her work with William Kisaalita, studying three-dimensional hydrogels, arose out of his mentoring and collaborations with other graduate students.

"We're finding out some fundamental properties underlying how biosensors can function in the body," says Desai, who worked on the sequencing of the human genome as an undergraduate at Washington University in St. Louis. "Dr. Kisaalita gives us instruction in the lab but also space to experiment ourselves and arrive at new questions."

"These are the opportunities students should be given," says Faculty of Engineering Director Dale Threadgill. "Funds from external sources such as federal grants provide us the means to equip these labs and bring students in to gain experience and stir the curiosity that often determines career directions."

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