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Engineering: Impacting UGA from the 1860's into the 21st Century

University of Georgia professor of engineering David C. Barrow in 1883 with his students in the civil engineering program on a week-long field trip surveying a rail line through the countryside near Athens. (Courtesy of Susan B. Tate)

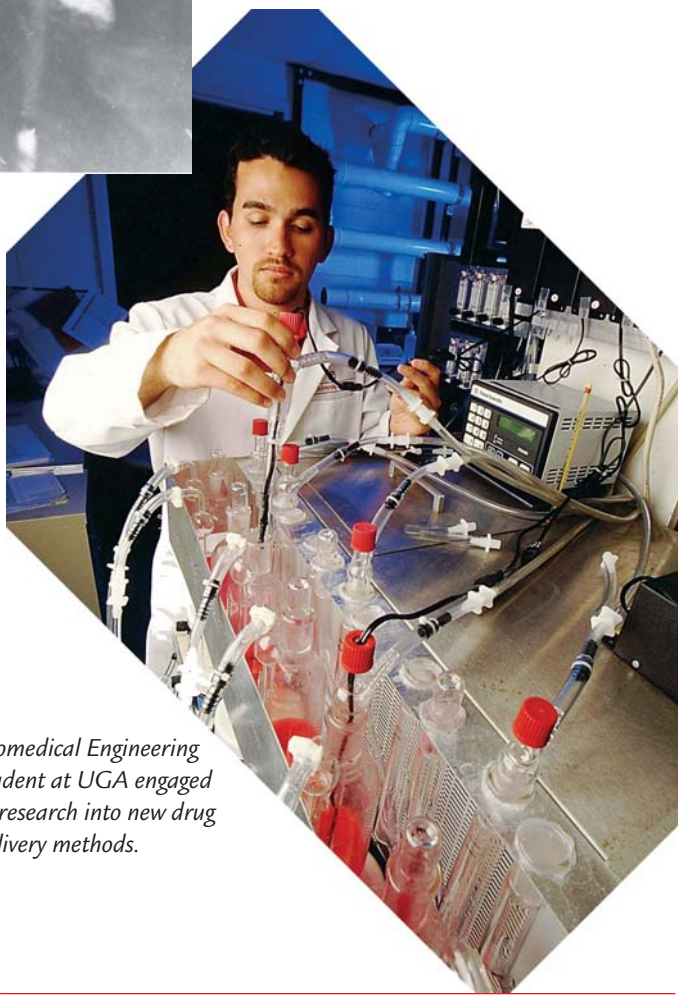
Engaged in Engineering

by Alan Flurry

The recent strides in the University of Georgia Engineering program harken to its developmental arc throughout the history of UGA. From courses in spherical trigonometry and fluxions taught by Charles McCay in the 1830's to UGA's land-grant designation in the 1860's and the physical evolution of campus and the research stations, engineering has always played a transformative role at the University.

In his 2006 State of the University address, President Adams lauded the passage of five new engineering degrees by the Board of Regents as the foundation "to engage our Faculty of Engineering more effectively." With his leadership and support, Adams updates the tradition of UGA leaders recognizing engineering as "an area ripe for expansion."

When new degrees in Biochemical, Computer Systems and Environmental engineering were proposed in 2003, faculty and administrators felt the imminence of giant steps in the offing for engineering. Establishing comprehensive engineering at UGA, a



Biomedical Engineering student at UGA engaged in research into new drug delivery methods.

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major research institution without a medical school or college of engineering, seemed an intuitive step towards correcting an anomaly that had kept many avenues of scientific research from finding their applications, much less making it to the marketplace. A new opportunity to serve the citizens of the state by expanding the availability of engineering education in Georgia has never been more important.

One need only revisit the way engineering at UGA has evolved through the approval of the new degrees to understand the unique opportunity to forge this new model in interdisciplinary research collaboration, instruction and outreach. Implementing this paradigm intact sets a definitive cornerstone in building the new learning environment and furthering crucial new research lines.

The UGA Faculty of Engineering was established in 2001 out of the crucible of resistance and innovation. Amid concerns about duplication and competition to existing nationally recognized engineering programs in Georgia, UGA faculty longed for a new approach, outside of the mold of traditional programs. "While in some ways it was forced on us, the situation was seen, even at the time, as a great opening, an opportunity," says Dale Threadgill, founding Director of the Faculty of Engineering.

With the steady support of President Adams and then-Provost Karen Holbrook, engineering faculty were granted access to the administrators to make the case for expanding engineering at the university. It was in this appeal that the crucial aspects of the present program found their form and voice.

"There was always the feeling that engineering could be so much more at the University of Georgia," Holbrook, currently President of the Ohio State University, said recently. "We knew we had something unique, something special, with engineering in the liberal arts environment," she added and indeed, recognizing the connection of individual UGA strengths to how they could affect the institution as a whole was key to advancing comprehensive engineering at UGA.

"I asked the deans a simple question: In what ways is your college/program unable to grow because of a lack of engineering?" relates UGA Engineering professor Brahm Verma. This one opportunity to frame engineering in that light provided the thoughtful responses from administrators that marked a shift away from the idea that a new initiative would take something away from their programs. At the 2001 Engineering symposium, over 100 faculty from all over the UGA campus came together to provide insight around the same question. Faculty were able to envision new ideas for collaboration, most notably providing the impetus for what became the Nanoscale Science and Engineering Center (NanoSEC)."They could see that there were many things they could not do and that engineering would add a dimension to what our researchers and scientists were trying to do," Verma says.

That dimension is taking new knowledge and bringing it to a more useful purpose, engaging work that is done at the University of Georgia in a way that attracts greater federal funding. This is engineering at a research university – a further endpoint of scientific research which allows scientists access to greater resources by interaction with those focused on their work's use and application.

A good example, and one embodied in the new degree programs by biochemical engineering, is how drugs are developed. UGA has a dynamic College of Pharmacy, engaged in many areas of fighting and preventing diseases. And yet, there is tremendous work involved after a particular new compound has been formulated, in terms of the processes that are developed for delivery, the scale-up technology and the quality control essential for any new drug to find its way through approval processes and eventually to patients. None of these post-discovery steps are possible without engineering. At the same time, scientists may be led away from certain areas by the impossibility of converting a new formulation into a product. So the use-inspired model works both ways, to provide the necessary technology and expertise for complete drug development and open up UGA pharmaceutical research to the widest possible avenues.

> UGA has a social and charter responsibility as Georgia's flagship institution to provide innovative services for the economic development of the state. Engineering is a key linchpin in this effort.
> - UGA President Michael Adams, April 18, 2002

In 1859, in an effort to change UGA's status from a small classical college to a true university, the Trustees of the University accepted a plan to expand and reorganize UGA into several schools (medical school, law school, agriculture school, engineering school) and authorized granting of Bachelor of Arts, Masters of Arts, Bachelor of Laws, Doctor of Medicine, Doctor of Philosophy, Doctor of Divinity and Doctor of Laws.

In 1866, the trustees authorized establishment of the school of engineering; the first engineering class at the University of Georgia matriculated in 1868.

In 1883, David Crenshaw Barrow was made professor of Engineering and in 1899, professor of Mathematics and Engineering. An 1883 graduate, Charles Morton Strahan, succeeded Barrow as Head of the Civil Engineering Department and held the post for 43 years. Strahan designed modern-day structures like the Academic Building and Terrell Hall (1905).

Integrating existing UGA strengths; building a greater collaborative atmosphere within the UGA community; and continuing the transformation of the UGA campus in the ongoing endeavor to fulfill the land-grant mandate are inherent goals of the university. A common element runs from Strahan and Barrow to President Adams, Provost Mace and our colleagues in the Faculty of Engineering today: a commitment to move UGA forward. This commitment requires great effort and depends entirely on the engagement of the faculty to challenge themselves and each other.

Dr. Holbrook again: "Georgia has something unique, something special, with engineering in the context of the liberal arts. We really wanted to do it and my view was, let's keep pushing."

Now more than ever, that admonition rings true. That great effort has led to an opportunity to see what this faculty can do. A roster of new degrees to offer and an array of leading-edge research - from nanotubes to holistic systems analysis - balanced by inquiry on some of its most fundamental levels puts UGA Engineering in the unique position of never standing still.

Senior Design Projects Teach Synthesis, Creative Thinking

Each spring fourth-year engineering students at UGA take part in a course challenging them to solve a design problem that is a snapshot of the challenges awaiting them as engineers. The selection of the design projects this year exemplifies the reach of UGA engineering into critical problem-solving and forces the students to bring their ideas off the paper and into reality.

Students are assigned to design groups by a faculty committee after an application process. "We look at their choice and factor in the needs of the project to line up the needed expertise with the students' priorities," says Sid Thompson, professor and chair of the selection committee.

Integrating traditional engineering challenges with new concepts and opportunities, the design projects bring into focus a holistic approach to instruction. It's the kind of cumulative course that is itself designed to exact a degree of creative thinking that reflects the sum of their training. "It also plays an important role in our accreditation as a capstone course bringing together everything they've learned," Thompson says.

The course, ENGR 4920, is a requirement for students slated for graduation in May, August or December of this year. Presentations in May are open to the public and usually attract some press coverage in addition to the industry participants invited to evaluate certain projects.

"The project mimics the first entry-level job our students usually take," says Tim Foutz, UGA engineering professor and undergraduate coordinator. "We don't teach a class on how to complete the project, so there's a great degree of self-learning involved."
The senior design projects for spring 2006 are as follows:

1. **Strengthening Moroccan Women's Argan Oil Cooperative through culturally appropriate technology**
   In a Moroccan cooperative that produces small quantities of high quality oil from Argan tree nuts, women perform much of the tedious work of cracking nuts by hand. While machines already exist which could be used to perform this same task, the activity is also a way for the women of the community to work and socialize. The focus: to develop a device to provide more production while preserving the social economic role the nut-cracking activity provides for the women and the families.
2. **Nutrient Recovery of Yellow Water**
   In many rural communities in the tropics, waste disposal is accomplished only by dilution of the materials in streams and rivers. The focus: to design and build a device which can be used to segregate the residual water stream into black water, gray water and yellow water. Yellow water has a high nutrient value and can be used as a fertilizer by farmers. Special consideration should be given to the possible effects on the soil flora and fauna of estrogen and antibiotics discarded by the human body through the urine. This project will involve travel to Costa Rica to meet with stakeholders.

William Kisaalita

Moroccan Women's Argan Oil Cooperative

3. **Design and Build a Low Energy Use Desalinization System**
   Desalinization of water is not unique but the processes used to perform this task are very energy intensive and overly expensive. The focus: to design and build a working prototype model of a desalinization system that uses small amounts of energy and is economical to operate.
4. **Design of A Prosthetic Leg for Dogs**
   This project will focus on the design and building of a prototype prosthetic leg for a dog. The prosthetic device must be economical and easy to use.
5. **Design of A Structural System to Enclose the Driftmier Courtyard Area**
   The courtyard area of the Driftmier Engineering Center is an underutilized portion of the building. Adding greater functionality and usefulness, this project will focus on enclosing this area, including all structural and mechanical aspects of the task. The design must satisfy the environmental concerns of the campus as well as address advanced energy efficiency and sustainable building design issues.
6. **Design an Engineering Learning Center for the University of Georgia**
   Reflecting the expansion of engineering degree programs on campus, additional facilities are envisioned to teach engineering lecture and laboratory classes for these programs. The focus: to design an engineering learning center of at least 28,000 square feet that satisfies the environmental concerns of the campus as well as address advanced energy efficiency and sustainable building design issues.
7. **Design of Affordable Housing Living Units**
   Affordable housing which meets the needs of contemporary lifestyles is an ongoing challenge. The focus: design prefabricated living units which can be transported easily and assembled for use as a single block unit or connecting of multiple blocks into a living unit. These living units must be able to be transported by air or sea in standard containers for commercial transportation without requiring any special vehicles.
8. **Railroad Car Management Tool**
   Errors in manually recording and translating numbers and locations of parked railcars contribute to financial loss for railroads in lost and underutilized railcars. The focus: develop a device and/or system which can track railcars. Ideally any system/device which is developed should be able to handle the data entered only once while seamlessly merging data into a scheduling program.
9. **Design and Build a Controlled Fishing Rod for Quadriplegics**
   The device must be mountable and removable from the fishing pole while not damaging the pole. The focus: design and build a device which can both cast and retrieve a conventional fishing lure and could be used by a disabled person.

Faculty Notes and Reminders

UGA Regents Professor Bernard C. Patten was honored with presentation of the Senior Researcher Award by Wessex Institute of Technology and the University of Seina in honor of the late Nobel laureate, Ilya Prigogine. The Prigogine Awards are presented annually for the best papers submitted to the International Journal of Ecodynamics on the topic of ecological systems. Each award consists of a gold medal and a cash prize. The 2006 Award Ceremony will be held in Tallinn, Estonia on July 17, 2006. As this year's first prize winner, Patten has been invited to give the keynote address at the conference... Davenport Professor of Engineering Sid Thompson was selected to receive the 2006 UGA Undergraduate Academic Advisor Award. The selection, based on his dedication to the co-op program and his accessibility to students, allows UGA to nominate him for a similar award at the national level... S. Edward Law, Brooks Distinguished Professor and Member of the National Academy of Engineering, officially retired from UGA in February. Dr. Law will now focus his attention upon electrostatics research on a part-time rehire basis... Elections will be held in March for members of the Faculty of Engineering Council. Program areas will select representatives to the council and one representative will be selected from the membership at-large...Interviews and seminars of joint appointment faculty candidates continue. Members are encouraged to check web announcements for dates and times to interact with candidates and participate in this important aspect of faculty expansion.

Faculty of Engineering
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