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Ethics: An Interdisciplinary Path

BY ALAN FLURRY

In the race to cure diseases, harness new technologies and capitalize on new material discoveries, science and engineering continually strive to maintain a balance between their myriad responsibilities to mankind. Whether the cotton gin, the Manhattan Project or harvesting stem cells, a cascade of innovations and discoveries over the last two hundred years has led to a certain belief in the power of science. A reliance on modern science and engineering to manage and provide continued innovations has come to fruition in much of the world. On the wings of major breakthroughs, often seen as commonplace, we have been able to enjoy more comfort and convenience throughout a longer, more productive life. However, this belief has always been accompanied by a distrust in the ability of scientific rigor to provide a moral compass when its technical prowess periodically bumps up against long-held religious, political or sociological tenets. We call these dilemmas ethical questions, and they present a daunting, growing chasm for the trusting citizen who relies only on their intuition to decide whether something is right or wrong.

Therefore the modern research university finds itself with fundamental responsibilities to train not just its scientists but all of its graduates in navigating the issues that advances in science and engineering place on society. Asking the questions that illustrate the complexity of the ethical considerations and ascertaining how scientists are conditioned to evaluate their work are the first steps to gaining a sense of footing on this subject. By doing this, we can presage the questions our citizenry must be ready and able to put to its scientists.

Widening the Scope of Inquiry

Researchers in the basic sciences perhaps rarely have to confront ethical issues related directly to their experiments and results; it is when these results are incorporated to develop and support new technology that larger questions come into play. Yet the basic sciences, biology, physics and organic chemistry, are the primary interface many students have with scientific inquiry and thus a good place to start in determining whether and how ethical issues are raised.

"I was never given particular training in how to think about that aspect of my research," says Steven Lewis, UGA Assistant professor of physics and member of the Faculty of Engineering. "[Ethics] is something that's passed down from mentors and from observation of the discipline." While Dr. Lewis, whose work focuses on condensed matter, doesn't identify a formal mechanism by which young researchers are charged with confronting ethical issues, he does evince a comfort with the subject he says comes out of a cultural mindset established in the avenue of academic integrity. "Because science, just like any other discipline, takes place in the context of civilization and human affairs," he points out.

And yet, like much human endeavor, the real problems lay in unforeseen consequences. Scientists and engineers are forced to manage many different resources as they undertake a program of research: funding parameters, colleague and graduate student input, and instruction responsibilities to name but a few; should they also spend time thinking about what the consequences of that work will be? It's difficult to say, because time is also a limited resource. This is not to alleviate the burden on researchers but to offer the question of whether ethics should be introduced in a classroom with higher undergraduate and graduate students. Because it is an evolving process, the question becomes how and to what extent the subject is introduced to students, or whether instructors and mentors rely on a student's previous exposure to and experience with such nuanced subject matter.

"That's why I value the notion of a liberal arts education, because we can't target education to cover every specific thing that comes along," Lewis says.

Problems of Science – Problems of Society

Michael Covington of the Artificial Intelligence Center at UGA and Faculty of Engineering member subscribes to what he calls Popper's Law (formulated by Sir Karl Popper, 1902-1994, influential Austrian theorist and philosopher): In a complex system, nothing ever comes off as intended. In our reach for innovation, we inevitably interfere with our own goals.

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"All too often, ethical awareness means preoccupation with one evil while totally ignoring others or misunderstanding the overall context," Covington says.

It is this misunderstood or missing context that indeed is often the culprit when thinking about how ethics can be part of a formal program of instruction; if an experiment's results are to some degree unpredictable, then assessing their moral implications beforehand is a bit of a moving target and a wider array of factors must be taken into consideration. When we think about how science is learned in relation to what we expect university-level graduates to grasp of other general subjects like economics, history and literature, an incongruity becomes obvious. An understanding of the latter subjects is predicated on an underlying assumption of their overlapping, intermingling influence on each other.

Meanwhile, the notion has been ingrained over time that science is specific to scientists and somehow separate from the general body of knowledge we otherwise require of citizens. And yet, in the current climate of provocative discoveries, medical urgency and vast possibility on both a global and nano scale, questions are regularly put before the public in which a knowledge of basic science is at least helpful in deciding how to approach what is often framed as a moral question. Whether it is philosophical or technical, teaching Darwinism or releasing genetically modified organisms into the environment, a widening of the scope of inquiry to bring the larger context into focus is the bridge to reaching a reasoned conclusion. "It's not about the right answer; different people reach different conclusions through sound and reasonable means," Steven Lewis says. "What's important is that there's a conscientiousness and awareness of the breadth of an issue."

As difficult as it seems to even broach this interdisciplinary complexity, forward-thinking ideas to re-invigorate higher education, like the efforts at UGA to offer engineering in a liberal arts environment, offer the brightest opportunities to break down traditional barriers and learn about our interwoven world as it is.

In 1959, the physicist C. P. Snow wrote a book called The Two Cultures[1] and gave a lecture, later also published, in which he talked about the humanities, arts and social sciences in contrast to the harder sciences and the differences in the two cultures. This divide between the scientist and non-scientist is not exclusive to our times yet it does bring into stark relief one of the problems we as a society face. "I think the non-scientist is far behind in terms of examining ethical issues," says eminent professor of physics and Faculty of Engineering member David Landau. "They are suddenly confronted with technology which has the potential for great good — or for evil – and they've not even begun to look at these issues." The majority of students who come through his classrooms will not go on to be professional physicists. However, many may well go on to play important roles in society where they will be making significant decisions about the use of physics and hence probably have a greater impact than the men and women who are making the discoveries. For these students, "I try and at least raise questions about the multi-faceted nature of science," Landau says. In the past, scientists may have been content to be viewed as 'crazy guys in white lab coats; leave them alone and they'll do good things.' While this notion may have been convenient for some, it in fact has not served us well, "because much of society is so ignorant of science," he says.

As Dr. Landau and others attest, mankind is very inventive, and it is difficult to imagine all of the possible uses of scientific discoveries. Yet this is why we face the greater problem as a society in balancing these different features. Issues of stem cell research, cloning and genomics have evolved alongside a codified protocol of bioethics; the National Institutes of Health now mandate universities to require course-hours in bioethics through training grants and many of these programs, including those at the University of Georgia, are well established. But the disconnect between the cultures remains and this lapse in education, though it has many sources, has as much to do with what is expected of graduates, raised and educated in an age of specialization, as it does with that to which they are exposed. The questions become particularly acute with the mission to reconcile teaching basic knowledge with developing the well-roundedness needed to understand its implications and therefore take an active role in society. But addressing this mission is exactly the challenge facing the modern research university.

Wyatt Anderson, Dean of UGA's Franklin College of Arts & Sciences and himself a biologist, recognizes the importance of the obligation to bridge this context gap by turning attention to it and harnessing the larger university community to institutions like the Faculty of Engineering to foment a cross-training of sorts between disciplines and colleges. "It would make sense to have a course in engineering principles for non-engineers. Engineers think differently, they're keyed into specific problems using scientific principles, which they apply, which is technology. Everybody needs that in their life," he says. The necessity of training students to make reasoned judgments may be one missing piece of the ethics puzzle. Analytical thinking and a healthy skepticism empowers the student who has learned about this way of thinking to apply it to contexts where they haven't seen extant knowledge. In many ways, this is the key: to affect a confidence in students to take on complex issues. An interdisciplinary approach avails itself to teaching science as a viewpoint and an analytical tool; not just teaching knowledge but also a more expansive understanding of the scientific mindset, philosophy and process that created that knowledge.

Dean Anderson poses this scenario: "General ethical principles usually end up in conflict – if you do all the good you can, you may do some harm – so in the process of making a decision you may not have a choice. Then how do you decide?"

(Footnotes)

1 Charles Percy Snow. The Two Cultures. Canto edition. Cambridge University Press, 1993.

Faculty of Engineering Hosts Tunisian Delegation

As the second stage in a partnership between UGA and the University System of Tunisia, the Faculty of Engineering joined with other university units to host a delegation of high level officials representing Tunisian higher education for the week of June 7 -15. The partnership is the result of a U.S. State Department grant designed to harness UGA expertise in higher education

Lunch with V.P. for Reseach Gordhan Patel and Associate Provost Mark Lusk.

management and distance learning pedagogy for training Tunisian national leaders in these areas. The project director is UGA Engineering professor Takoi Hamrita.

"This is an opportunity for us to get to know each other better and establish a framework for the training sessions,"

The delegation meeting with Public Service & Outreach Director Glen Ames and staff

Hamrita says, "but it's also been a great way to meet other, like-minded UGA faculty." The delegation met with University officials from a variety of campus entities including the Institute of Higher Education, the Office of Instructional Support and Development and the Georgia BioBusiness Center. Luncheons and information sessions were hosted by the Associate Provost for International Affairs, the Vice President for Research and Associate Provost, the Director of Public Service and Outreach, the Dean of the College of Agricultural and Environmental Sciences, the Office of International Agriculture and the Director of the Faculty of Engineering. The visit provided a rare opportunity for exploring further interdisciplinary collaboration in Tunisia.

Educators from Tunisia will begin arriving in the fall for training, then go back to share this training with colleagues. UGA faculty will share their experience with

The delegation tours the Student Learning Center with O.I.S.D. Director Bill Jackson.

everything from effectively designing courses geared toward digital learning to developing university management information systems. An explosion in needed capacity has led the Education Ministry in Tunisia to mandate 20% of courses be offered online by 2006.

"The project has continued to evolve during this visit," said Lilia Gaaloul, advisor to the Tunisian Minister of Higher Education, Scientific Research and Technology. "We want to learn how to integrate many of the resources you have in place here with our vision for the future of post-secondary learning in Tunisia."

Engineering Professor Takes Work, Students to Uganda

Of Uganda's 2001 total estimated milk production of 900 million liters, only 10% was processed into liquid milk and milk products. This inefficiency, devastating both to Uganda's small farmers and the national economy, is a direct result of a lack of cost-effective energy sources to maintain the "cold chain" for milk production in the vast areas without grid electricity. UGA Engineering professor William Kisaalita, working with his senior design students for the last two years to identify the appropriate renewable energy alternatives, spent part of June securing partners in Uganda to pave the way for the potential solutions to succeed.

"We wanted a renewable energy resource, and we think solar energy is the best," Kisaalita says. To this end, technology based on evacuated tube collectors will be utilized to capture solar energy and drive refrigeration systems of small milk cooling plants in Southwestern Uganda. This problem in Uganda was developed as a senior design project in spring 2003 in the

Milk cooling station in Uganda

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international section of ENGR 4920, a unique blend of real-life, international problem solving, web-based interaction and a spring break trip to present solutions to the customer. The multidisciplinary design team environment, globalization backdrop and imperative for intercultural communication presented students with an added array of challenges to the design problem itself.

"And for any solution, partners are critical," Kisaalita explains in pointing out that his two weeks in Uganda were focused primarily on discussions with his private sector partners and the Ministry of Energy and Minerals, precursors to a large scale pilot project proposal for this solution Kisaalita is formulating for the U.S. Agency for International Development. That such high impact problem solving can emanate from an engineering design course is evidence of a high level of engagement from both professors and students. "This is a real solution with practical benefits, and the students learn," he says. Initially, the idea was to go to China this summer to identify a new problem for Spring 2004, but serendipitously, the SARS epidemic intervened and the trip was cancelled. Instead, Kisaalita discovered, in returning to his native Uganda, the benefits of spending two or three years in the same place.

For more information on Dr. Kisaalita's work with design students on this pressing problem in Uganda, please visit www.engr.uga.edu/people/faculty/kisaalita/ .

Faculty News

The workshop, **Building Bridges to Engineering Education**, took place at UGA in early June and was a great opportunity for high school students and teachers from Oconee County, South Gwinnett and Westminster Christian Academy to learn about engineering and careers in engineering... Look for UGA Engineering at student **orientation sessions** throughout the summer at the Tate Center... UGA Engineering Professor David Gattie is the **Guest Editor** for an upcoming issue of Ecological Engineering, the Journal of Ecotechnology.

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THE FACULTY OF ENGINEERING
DRIFTMIER ENGINEERING CENTER
THE UNIVERSITY OF GEORGIA
ATHENS, GA 30602-4435
PHONE (866) ENGR.UGA / FAX (706) 542.8806
WWW.ENGINEERING.UGA.EDU