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The Academic Exchange
A Place for Scholarly Conversation at Emory

Science in the Seams

Computational and Life Sciences Initiative redefines disciplinary lines

"SIMPLIFY, SIMPLIFY." Henry David Thoreau surely would have been surprised at having predicted the course of scientific inquiry for the next 125 years or so. For much of their histories, the keystone sciences of chemistry, biology, and physics distilled and dismantled the universe, then examined the fragments for clues about how it all worked. Biologists peered into the cell, the nucleus, and ultimately our biological destiny coiled up in DNA. The atom revealed its dense nucleus, which, with some energetic prodding, blew apart into fleeting particles with amusing names like lepton and quark. Chemists charted every known element and condensed the information in the periodic table.

"Over the last century, science has spent a lot of time breaking things down into parts to understand them," says David Lynn, professor of biomolecular chemistry and chair of the chemistry department. "We've reached a point where we have enough foundational information to try to put it all back together again, to figure out how systems operate."

VOICES IN THIS ISSUE

Visionary scientists began to reconsider—or just ignore—disciplinary boundaries; branches of science once regarded as distinct and largely dissimilar converged, and no more so than in life sciences. "Natural science, social science, chemistry, and even psychology now start to have problems that hit between rather than within those disciplines," Lynn adds. "The idea of interdisciplinary science has become preeminent in the way we think now, much more so than we did in the past. Science is interdisciplinary because problems are interdisciplinary."

BREAKING DOWN BARRIERS

But while individuals can deftly hopscotch among fields of study, their institutions are not so nimble. "To some extent we've gotten compartmentalized by the traditional structures of the university," says Dennis Liotta, professor of chemistry. "We have departments, we have schools, and those have been functional units that served important administrative purposes. But as science has evolved we find them to be somewhat artificial barriers. They're very useful for teaching undergraduates and to some extent graduate students. But if I want to collaborate on work with someone in the medical school, all of a sudden that intrinsic infrastructure is gone, and I have to work much harder on those kinds of projects."

Emory needed a crucible in which its various and varied biological sciences and potent computer-based analytical tools could blend, re-form, and emerge with new and, it is hoped, even greater capabilities. What materialized, as envisioned and defined by a steering committee of Emory faculty and administrators, was the Computational and Life Sciences Initiative (CLS), a notion important enough to warrant an entire section in the Strategic Plan. To say that hopes are high is an under-

EMORY INDICATORS

High-performance computing at Emory

Emory supports three high-performance computing centers: the Biomolecular Computing Resource, the Emerson Center, and the Emory High Performance Compute Cluster. To assess research computing needs, importance, and usage, the Office of Institutional Research conducted a survey Emory faculty on several issues.

Among the findings (based on 414 responses):

- **79 percent said research computing is very important in their area of research; 17 percent said it was somewhat important.**
- **18 percent said that they used high-performance computing, and 63 percent said they are interested in using it.**
- **37 percent said the role and quality of research computing at Emory is inferior to other leading research universities, 26 percent said it is about the same, and about 7 percent said it was superior.**
- **94 percent agreed that research computing at Emory will become increasingly important over the next five years.**
- **88 percent said Emory should consider it an area of substantial investment.**
- **17 percent said research computing was important in their decision to come to Emory.**

Faculty members also indicated the need to more clearly define the term "research computing." The following is a typical comment: "It's not clear what you mean by 'research computing' . . . these things need explanation if you want clear feedback." Faculty whose focus is medical and scientific research and those in computational and statistical fields all noted that research computing is essential to their work. For example, a medical faculty stated that "high-level computing" is essential for understanding diseases at the molecular level and for drug design. A few faculty members in the humanities also pointed to a need for research computing. One respondent said that for Emory to be considered among the "elite group of universities nationally and worldwide" means "our departments need to have research computing in place to personalize, optimize and advance our practices to cutting-edge."

statement. From the Strategic Plan:

> [The CLS] will optimize enterprise-wide technologies and unleash potential that may quickly move Emory to the next level of rank and reputation. . . . It is no exaggeration to say that this is the cutting edge of science early in the 21st Century. It is one of the areas where Emory can stake a claim to global leadership. . . . It will be this yin and yang of scientific discovery—the opportunity to create interplay between the fundamental and applied dimensions of new knowledge—that allows Emory to emerge as a destination university in the sciences.

Initial funding for the CLS comes from a portion of the sale of royalty rights to the anti-AIDS drug Emtriva, which Liotta developed in collaboration with a colleague from the medical school. That breakthrough arose from precisely the type of cross-fertilization of two university units envisioned by the CLS. Pursued independently and in isolation, the discovery might never have materialized.

The CLS will eventually occupy the equivalent of two floors of the new chemistry addition going up on Oxford Road, and the CLS executive committee is actively hunting for talent (applicant screening began May 1). Their five-year goal is to hire eight to ten new faculty and several postdoctoral candidates. A new Ph.D. program in computational science and informatics welcomes its first incoming class this fall. The faculty positions aren't specified but will be determined by each appointee's qualification and interests. Most of the newcomers will likely inhabit more than one department. Parallel initiatives in predictive health and neuroscience are in the works.

"We have a lot of strengths in the life sciences, but we also have certain gaps," Liotta says. "This could be an opportunity for us to hire some high-quality individuals who can fill in those gaps and give us an opportunity to ask and answer some of the very big questions that address modern science."

Emory is, of course, not alone in attacking interdisciplinary challenges, but the approaches differ. Harvard, for example, chose to take people from existing departments and to construct a new Department of Systems Biology. "In our assessment, such an approach may create the same type of limiting infrastructure as before," says Lynn. "Emory chose to aggregate rather than isolate. We don't know if we're right or not, but we think the approach is more powerful." The University of Chicago, Lynn adds, stands out as a school that creates centers to mix disciplines, such as social sciences, business, and economics. "They've been very successful at fashioning bridging structures that have succeeded. The CLS is modeled more on that type of bridging structure than on new departmental entities.

Computational science gives the CLS "oomph," though its prominence in the mix might seem unusual at first. The field is typically associated with mathematically intensive domains such as high-energy physics, fluid mechanics, and molecular modeling, but the sheer volume of data that cascades from life sciences research nowadays overwhelms human analytic capacity. "There's been a revolution in the amount of information we can acquire about biological systems and the human genome, gene sequences, and proteins," says Lanny Liebeskind, Samuel Candler Dobbs Professor of Chemistry and Director of University Scientific Strategies. "There's so much information that it's impossible for a human to interpret, analyze, and understand it, or to draw conclusions and look for patterns. It's physically impossible without help from computers." Really powerful computers. Think processing speeds of a trillion operations per second (a terraflop) and storage capacity in petabytes (one billion megabytes).

"There is an increasing convergence of life sciences and computational science, which is becoming more and more important for things like analysis of genes, simulations of blood flow in vessels, and identifying tumors in X-rays," adds Vaidy Sunderam, Samuel Candler Dobbs Professor of Computer Science and co-chair, along with Lynn, of the CLS. "Computational science is going to become the underpinning of how life sciences is done. The experimental aspect—where you hypothesize something, perform a physical action and observe the result—will remain, but it's increasingly complemented by theoretical things: you predict or you know something about how a system or organism is supposed to look and you model it mathematically, then translate that into a computer and actually simulate it to get some insight into how it works. It's going to increase the pace and quality at which new discoveries are made." At the same time, the fusion will inevitably produce advancements in the underlying fields of mathematics and computational techniques.

STEPPING STONES

Much of the work conducted under the CLS umbrella will be basic science—stepping stones toward more tangible advances that lead to practical, "real-world" applications—that defies understanding by the untrained. (Consider a paper coauthored by Lynn in the *Journal of Bacteriology* in 2005: "Environmental pH Sensing: Resolving the VirA/VirG Two-component System Inputs for Agrobacterium Pathogenesis.") Given Emory's enviable track record and reputation in life sciences and medical research, the potential is tremendous: fabricate living tissues and organs; engineer photosynthesis and capture light for alternative energy sources; build biocomputers that are part

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Rather than "deconstructing" nature into its simplest parts . . . , the twenty-first century will likely be spent trying to understand, scientifically, the nature of complex interacting systems by "reconstructing" complexity.

—LANNY LIEBESKIND, SAMUEL CANDLER DOBBS PROFESSOR OF CHEMISTRY AND DIRECTOR, UNIVERSITY SCIENCE STRATEGIES

Academic Exchange: *Can you frame the CLS in the context of science and Emory's goals?*
Lanny Liebeskind: A revolution is taking place in computers, which can store and process more information faster than ever, and in computational science and techniques for managing and manipulating that information. At the same time, we are witnessing a revolution in the amounts of information that scientists can acquire about biological systems, such as the vast quantities of information contained in the genomes of living systems. There's so much information that it's impossible for a human to analyze it, to find patterns, to interpret, and to draw conclusions without help from computers. At Emory, one of the core themes of the strategic plan is to advance new frontiers in science and technology. The Computational and Life Sciences Initiative (CLS), which is part of that theme, represents Emory's strategic focus on the basic sciences and includes efforts to help position the institution for the future by being attentive to the marriage of computer hardware and software with analysis and understanding of the incredible amount of information that is being produced in the life sciences.
AE: *How has the approach to scientific research changed over the years?*
LL: In past decades natural science was tightly categorized into traditional disciplines such as physics, chemistry, and biology. The discovery of the genetic code in the 1950s led to a blossoming of the life sciences, and nowadays many scientists believe that the leading edge of discovery is at the intersection of the life sciences

Everybody understands or recognizes the combination of computational and life sciences as very promising. . . . Few people have been working in this combination of fields long enough to have established a leadership presence.

— VAIDY SUNDERAM, SAMUEL CANDLER DOBBS PROFESSOR OF COMPUTER SCIENCE

Academic Exchange: *Why is the CLS Initiative so important to Emory?*
Vaidy Sunderam: The CLS has tremendous potential to advance science, and it is very close to what we do very well already. Obviously we have a very strong life sciences capabilities; we have a strong computational presence. By marrying them we can build on our existing strengths and create new strengths. We didn't invent this, but everybody understands or recognizes the combination of computational and life sciences as very promising. Genomics is a classic example; X-ray imaging is a classic example. It's all of tremendous importance. Many people are aware of this fact, but the field is still very new and progressing; therefore Emory can become a pioneer because few people have been working in this combination of fields long enough to have established a leadership presence.
AE: *Computational science doesn't immediately come to mind when Emory is mentioned. Are there "hidden" capabilities here?*
VS: Yes, but at the same time there aren't a whole lot of other places that come to mind when you think of computational science. Computational science is a unique discipline. When you say "computer science" a lot of people think of Stanford, Berkeley, MIT, Carnegie Mellon. If you say "mathematics" people say Princeton, MIT, Harvard, Berkeley, Michigan. But when you say computational science, it's more of a set of niches. In circles like medical imaging, high-performance computing, computational chemistry, or genetic analysis, Emory is very well known.
AE: *What's the difference between computer science and computational science?*
VS: Computer science is the science of making computers what they are, making them faster, interconnecting them in networks, making user interfaces that are easy to use, incorporating multimedia, accessing databases, and techniques to

with the physical sciences and mathematics. Rather than "deconstructing" nature into its simplest parts, as scientists did for most of the nineteenth and twentieth centuries, the twenty-first century will likely be spent trying to understand, scientifically, the nature of complex interacting systems by "reconstructing" complexity from its component parts. In pursuit of that goal, scientists are trying to figure out how complex interacting systems work (for example, the interacting chemistry, biology, and physics of living systems). The tremendous progress in computer hardware and computational techniques and the ability to store, organize, and manipulate vast amounts of information allows scientists now to model and to carry out experiments on complex interacting systems.

AE: *Could you give an example of computational science applied to a complex system?*

LL: The human genome is like a book with an alphabet, words, sentences, grammar, paragraphs, and chapters. Suddenly we have deduced the whole structure of the human genome (DNA), a very, very big book, but we only know the alphabet, and some of the grammatical rules, and we have found some of the sentences. We might know how to recognize the alphabet and read individual words of the story, but we don't know how to put the complete story together. How do we take the immense amount of information encoded in the human genome, which can't be interpreted simply by looking at it, and figure out where the sentences and paragraphs are positioned, where the chapters begin and end, and then try to fully understand the encoded "messages" of those chapters? It's to solve complex problems like these that the power of computers and computational science is a critical necessity.

AE: *How will the CLS affect your work?*

LL: My own research is focused in the fundamental synthetic sciences. My coworkers and I try to invent new chemical reactions that become the tools that other scientists use to build and transform molecular structure. For example, if you're going to invent a new pharmaceutical drug to treat disease (as my colleague Dennis Liotta does), you need chemical "tools" to be able to modify the structure of a molecule, to selectively make bonds between separate molecules, to add atoms here and move them there, and thus change the properties of the end product. We invent the new chemical "tools" that people use to do that.

With regard to the CLS, I'm not a computational scientist, but I'm interested in science broadly, and have worked to see that it is supported and encouraged across the institution. I helped to give "birth" to the CLS and will continue to work to see that it represents a strong and visible home for basic science within the strategic plan. ae

prevent viruses—everything that has to do with the computer itself. Computational science is the use of computers in physics, chemistry, medicine, etc., that brings together and applies the underlying mathematics using computational techniques. Any modeling and simulation system has to be founded on a mathematical model. If you have an X-ray image, how can you apply a computational algorithm to detect if that image shows a tumor or just a calcium deposit? You have to start with the basics of the underlying mathematics—how is each pixel is going to be represented, what is the characteristic of each pixel, what is the relationship between them? Then you develop equations and translate them into computer programs. The collection of those things—the application to science, the underlying mathematics, and the computer algorithm—those are the three components that make a project or a discipline called computational science.

AE: *What could come out of the CLS?*

VS: The CLS has three pillars. Computational science and informatics is the one that I know most about. CS & I is going to produce new knowledge in terms of new mathematical methods, new computer algorithms, and more precise and faster computer models of physical and biological phenomena. Synthetic sciences is another pillar of the CLS. Some of the developments that will come out of that can be described with the term "molecular machines"—ways to make molecules, proteins, and agglomerates of proteins behave in ways you want them to behave, and thereby go and do certain things. For example, if you could engineer a molecule that could eat cancer cells without destroying other cells in neighborhood, that's an example of a molecular machine. The whole field is called synthetic science, because you're synthesizing biological systems. Somewhere in the middle is the third pillar, systems biology, which is the science of understanding living systems across scales, from the molecular scale to the cellular level, to the organism level, to the system level, to the population level. Most people right now study a biological or living entity at one level, horizontally, but if you actually see the implications across the levels you get a great deal more insight into how a living system works.

AE: *You're talking about new drugs and vaccines, for instance?*

VS: Absolutely. Drug discovery is a very likely and very specific outcome of new research in these areas. So is environmental science, though more from the standpoint of molecular machines than from the standpoint of population ecology. Bio-remediation is an example, such as engineering molecules that would eat up pollution in the air or ocean. There are some limited successes in those areas, but if we could do it in general, for instance develop something that could detect pathogens in the air, such as anthrax spores, and engineer something locally to destroy all those things, it becomes a new type of environmental science. ae

Staging Science
Teaching, and learning from, the interdisciplinary class

AMY COOK, MELLON FELLOW IN THEATER STUDIES

For as long as I am able to teach, I will probably feel like a beginner. Like sex, there are few opportunities to study it, people rarely talk about it, no one wants to admit they aren't good at it, and the evaluations at the end are rarely helpful. All of which helps to explain why writing this essay has made me feel so naked.

Yet I want to talk about the interdisciplinary courses that I have taught because they have been exciting, inspiring, and great learning experiences. It might not always look the way I imagine, but I believe in border crossing in the classroom. I want students to see connections where others haven't; to re-evaluate categories, borders, and assumptions; and to increase their literacy in both science and literature so that they can see and question "drama/performance" and "science." I have found two models for structuring interdisciplinary courses: one that is explicitly interdisciplinary and another that is project-based and ultimately interdisciplinary. If talking about them makes me uncomfortable, well . . . so be it.

In her book *Geographies of Learning: Theory and Practice, Activism and Performance* (Wesleyan UP 2001), on integrating performance into education, Jill Dolan notes, "Performance offers us a practice that lets us rehearse new social arrangements, in ways that require visceral investments of bodies, of time, of personal and cultural history." Despite my own personal aversion to "warm ups" and my love of the lectern, I believe we think with our whole bodies. From my experience as a director, I know that just as some actors respond to talking, analyzing, and research, some students respond to lecture, discussion, and reading. Some actors and some students, however, find the character or the theory or the play only when they are on their feet. Incorporating performance into a class can be as simple as asking students to read a passage in front of the class or be as involved as a large group project. When discussing a play, it is almost impossible to unearth the nuances without putting voices in bodies; you may not notice who is not talking in a scene, for example, until you stage it. Days of discussion and investigation rarely yield as much clarity as when I ask students to prepare a performance in which they show the class "time" in the play. Even for classes in other disciplines, "staging" an idea can often do a lot to bring it to life. This is, in many ways, what lab work achieves in the sciences.

DRAMA IN SCIENCE AND SCIENCE IN DRAMA

At the University of California, San Diego, I designed and taught a seminar that examined how scientific epistemology and artistic methodology reflect and influence one another. The class read scientific theories of the last hundred years against the acting theories of the same period, together with plays of the last five years. This approach allowed students to see how certain prevailing models or metaphors can shape a conception of "truth" within a given period.

Reading Antonio Damasio with David Mamet and chaos theory with Sanford Meisner's acting theory of repetition, we used the science to enrich the possibilities of performance. This class put pressure on assumptions about acting, looked for new ways of thinking about character and performance, and explored the shifting ways science has made sense of the self, language, and the world. We read plays through different scientific lenses, finding new readings with each new perspective.

The diversity of perspectives gave students many different ways to approach the plays, and class discussions were always lively. The students performed scenes from the plays at the end of the term, directing them to highlight the scientific relevance. (While the class was successful overall, I ultimately felt that it would have been better with less material and more time for integration.)

For the theater and science course I am teaching this fall at Emory, I have assigned reading from scholars who are integrating a scientific perspective into their study of drama—work that was only just beginning to be done when I taught the course the first time—rather than having the students read the science to come up with their own integration. It will also be more historically contained: we will read *Hamlet* and *Satisfying Skepticism*, Ellen Spolsky's book about epistemology in the arts and sciences of the Renaissance, and then *Membranes: Metaphors of Invasion in Nineteenth-Century Literature, Science, and Politics* by Emory Professor of English Laura Otis alongside Henrik Ibsen's *A Doll's House*. Otis's book explores a concern with borders and containment that continues through the Cold War, as we will see in Bruce McConachie's book *American Theatre in the Culture of the Cold War*. In the final weeks we will read current research on memory, mirror neurons, and phantom limbs and ask how this might inform our reading of two important plays from the last few years. I am also shifting the performance focus this time, so that students will work on monologues from the plays over the course of the semester, exploring how the readings might enrich their presentation without requiring that they "present" the science through the monologue. They will then prepare a brief lecture on the scientific theory that they found most illuminating in working on their monologue. I cannot wait to learn what works and what doesn't this time around.

I want students to see connections where others haven't; to re-evaluate categories, borders, and assumptions; and to increase their literacy in both science and literature, so that they can see and question "drama/performance" and "science."

THE PLAY'S THE THING

If you want passionate discussions from undergraduates, cast them in a play. The pedagogical theory of Erasmus recommended that Renaissance students write orations from the perspective of different historical and fictional characters, and it encouraged imagination and comprehension. The first week of rehearsals for a play is often spent doing "table work"—thinking about the play without the body. When I was asked to direct the undergraduate production at UCSD I required that the cast take a class with me prior to the start of rehearsals. The play I selected was a comedy about Shakespeare and the disputed authorship of his plays, *The Beard of Avon* by Amy Freed, and I wanted the cast to read the referenced works by Shakespeare, *The Queen Majesty's Passage*, *Novum Organum*, historical documents on social hierarchy, selections from various biographies of William Shakespeare, and arguments for and against Shakespeare's authorship. Each week, students would present research on their character, so that we all knew more about, for example, Sir Francis Walsingham than I could ever have imagined. Moreover, discussions about *Venus and Adonis* or the Dark Lady Sonnets took on fiery importance once the cast became more familiar with the perspective of their characters.

Once we began working on the text, it became clear that we needed a method of unpacking the dense Shakespearean language. I had the students read *Metaphors We Live By*, a small introductory book on conceptual metaphor theory by George Lakoff and Mark Johnson and a chapter on the cognitive linguistics of jokes from Seana Coulson's *Frame Shifting*. This opened up the language and comedy in a whole new way and exposed the students to a method of digging in language for meaning and comedy. We began tracking the use of the word "nothing" in the play, as a bawdy reference to female genitalia and as a counterfactual space defined by something. Students began breathing life into "dead" metaphors and catching, as one character puts it in the play, "the dread contagion of poetry."

Despite the social superpowers bestowed on those graduates capable of tossing words like

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Thinking Outside the Pipeline
The impact of the unexpected in work-life issues

ROSEMARY MAGEE, VICE PRESIDENT AND SECRETARY OF UNIVERSITY, AND JULIE SEAMAN, ASSOCIATE PROFESSOR OF LAW

We don't see things as they are.
We see things as we are.
– Anais Nin.

By now, most of us at Emory are probably aware that work-life issues have become a hot topic in the workplace and, in particular, higher education. Emory has joined other top universities in addressing policies and investing resources in order to foster a campus culture that supports a wide range of personal and professional commitments. In February 2006, President Wagner charged Emory's Work-Life Initiative Task Force to address issues relating to work, health and well being, and family life of faculty, staff, and students as a part of the university's cross-cutting strategic theme "Creating Community-Engaging Society."

These issues are vitally important to all faculty—young and old, male and female, partnered and single, with and without children—especially with major demographic shifts occurring in society and academia. For example, as noted in the last issue of the *Academic Exchange* (May 2007), there is a growing trend among faculty to postpone retirement for reasons that include financial need and a desire for continued social engagement. Numerous studies confirm the significance of the baby boomer age group to the overall economy: in the next five years, the number of workers aged 55 to 64 will rise by 48 percent, while the group aged 20 to 24 will grow barely 1 percent.

Younger faculty, too, seek out universities that value and support their attempts at work-life integration. Research has shown that faculty members in their thirties and forties have radically different ideas about the way that higher education should work than their older colleagues. According to the Harvard Collaborative on Academic Careers in Higher Education (COACHE), these younger faculty members often seek institutions that provide "a good fit" regarding benefits and programs as much as money or prestige.

While the Work-Life Task Force has grappled with many specific issues affecting faculty, staff and students (our report will be available later this fall), we also believe it is important to pause and reflect upon the larger picture of academic culture. How can we become the university we want to be? An important first step is to recognize that most of us perceive the university—its strengths, weaknesses, challenges, and joys—through the prism of our own lived experiences. To paraphrase Anais Nin, we tend to see things not as they are, but as *we* are. There has been much talk these last few years about the need to build bridges and to foster the spirit of a university rather than a multiversity. In gathering data, both quantitative and qualitative, for the work-life project, we have been struck by the experiential and perceptual divergences among people in our community, for example, between those with responsibilities to children and those providing care to elderly parents. Such multifaceted differences create challenges insofar as work-life issues (or non-issues) depend upon who is framing the questions. And it seems daunting to try to offer answers to questions that shift and reshape as they travel over the landscape of the university.

The rewards and responsibilities of family life should be recognized as part of the fabric of our academic community. Moreover, bringing together the full range of diverse talents on our campus can lead to greater productivity, creativity, and excellence.

THE POWER OF METAPHOR

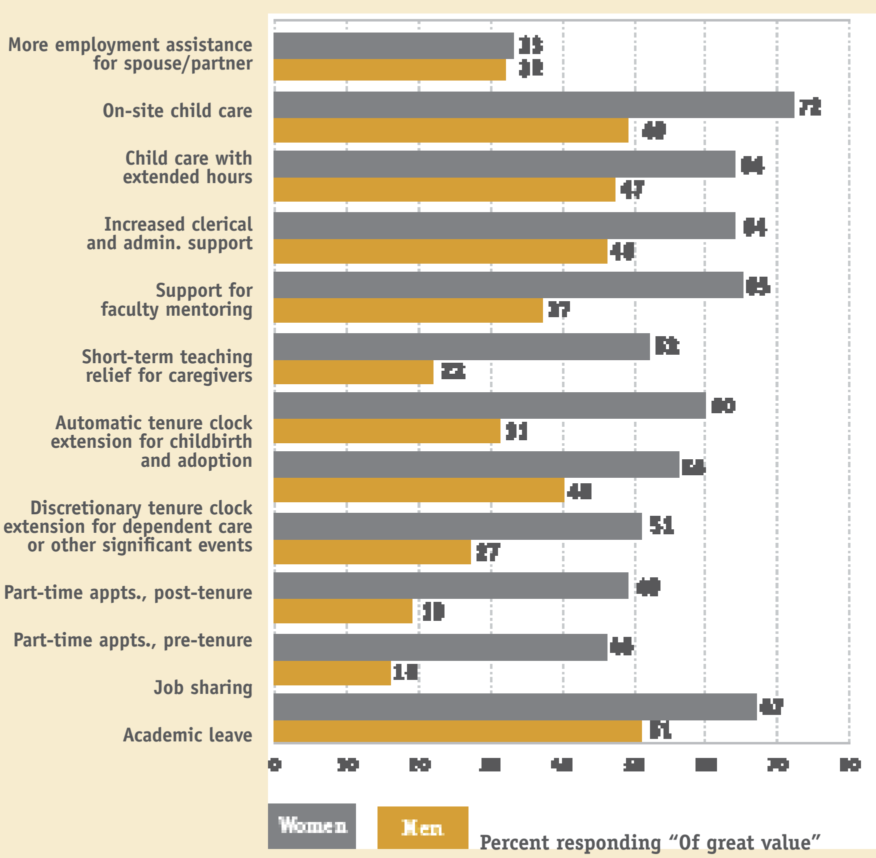
A striking example of this framing process involves the pipeline metaphor, which has dominated discourse in academia for some forty years. In the early 1970s, with the acknowledgement of gender imbalance in the faculty ranks, it became customary to talk about the problem in terms of a pipeline that, over time, had proportionate numbers of men and women entering academia at the front end, but far fewer women emerging from the other end as full professors. The solution, it seemed, would be to fix the holes that allowed so many women to leak out along the way to professional success.

Trying to find ways to plug these leakages has been a large part of the drive for gender equity in academia for at least the past decade. Flooding the pipeline with diverse populations of undergraduates, graduate students, and post-doctoral fellows, it was once believed, would in due course result in similarly diverse populations among the professoriate and academic leadership. As that expectation failed to fully materialize, despite gender parity among undergraduate and graduate students and the removal of many institutional barriers, work-life scholars have suggested that the pipeline is not just leaky but is actually blocked in significant ways for women who enter academia at a time in their lives when they may also bear significant family responsibilities. The tenure clock and the biological clock frequently come into conflict.

The metaphor of the pipeline has served us well in that it focused attention on an important imbalance. But by reducing such a complex issue to a mechanical problem, it overlooks that many life experiences, affecting both men and women, do not simply fit into a predetermined path. Indeed, some of the more meaningful experiences and deepest insights can emerge in nonlinear ways and in unexpected moments and places. Perhaps it is time to fix the pipeline metaphor itself? As the linguist George Lakoff and the philosopher Mark Johnson note in *Metaphors We Live By*, "We define our reality in terms of metaphors and then proceed to act on the basis of metaphors. We draw inferences, set goals, make commitments, and execute plans, all on the basis of how we in part structure our experience, consciously and unconsciously, by means of metaphor."

2007 Survey of Faculty on Work-Life Issues

Selected Results



Conducted online spring 2007 by the Office of Institutional Research. 597 tenured, tenure-track, and non-tenure track faculty responded.

PRELIMINARY FINDINGS FROM EMORY'S FACULTY SURVEY

A RECENT FACULTY survey on work-life issues provided the task force with useful data about faculty views on a wide range of work-life issues. All tenured, tenure track, and non-tenure track faculty at Emory were invited to participate. While there was a lot of convergence among a wide range of respondents, a more nuanced picture emerged when the survey data were broken down by gender. To begin with, women faculty replied to the survey in greater numbers than their male colleagues—women are only 36 percent of the survey population but accounted for 52 percent of respondents, perhaps because work-life issues frequently impact them more as caregivers.

Other differences are also worth noting. Whereas some 17 percent of faculty said that they had at some point considered requesting a tenure clock extension, that overall figure masked a gender disparity of more than three to one. Women consistently responded in much greater proportions than men when asked whether a range of work-life policies and

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Creative Minds and the "Greatness Game"
A response

MICHAEL KUHAR, CHARLES HOWARD CANDLER PROFESSOR AND GEORGIA RESEARCH ALLIANCE EMINENT SCHOLAR IN NEUROPHARMACOLOGY; CHIEF OF THE NEUROSCIENCE DIVISION, THE YERKES NATIONAL PRIMATE RESEARCH CENTER

The last issue (May 2007) of the *Academic Exchange* was very interesting in that it touched on many critical issues facing both Emory and academia in general. I want to comment on "The Greatness Game," that issue's lead article, which addressed strengthening faculty distinction at Emory. This is certainly a worthwhile topic, since most would agree that faculty distinction is at the heart of the quality of an institution. It's not only the work of a distinguished faculty but also what and who that faculty attracts that is valuable. Where is Emory in this game of greatness?

Some of the individuals interviewed in that article I think accurately describe Emory as often being concerned about collegial decorum, civility, congeniality, and politeness. A question raised in the article was whether these attitudes and values *prevent* Emory from reaching its potential in the "Greatness Game"—a game in which international superstars are sought after and make major contributions. I can think of one way that emphasis on decorum can interfere with "greatness," and, paradoxically, it has to do with creativity which is highly sought after and valued in academia. Allow me to take a somewhat extreme position to make the point.

Creativity has been studied for many years. Frank Barron explored it as early as the 1950s and '60s in *Creative Person and Creative Process* (Holt, Reinhart and Winston, 1969). In her recent book on creativity *(The Creating Brain,* Dana Press, New York, 2005), Nancy Andreasen, a prominent psychiatrist, describes the creative person: "Creative people tend to approach the world in a fresh and original way that is not shaped by preconceptions. The obvious order and rules that are so evident to less creative people, and which give a comfortable situation to life, are often not perceived. . . . [A]dventuresomeness and rebelliousness are often coupled with playfulness. . . . [They] may push the limits of social conventions. . . . [They are] driven by their own set of rules derived from within."

Hence, Andreasen suggests creative people can seem different at least and perhaps even rebellious. Moreover, their (annoying) "openness to experience often permits creative people to observe things that others cannot." They also have "a tolerance for ambiguity . . . [and] are quite comfortable with shades of gray," which some might interpret as a weakness or even a lack of principles. They can tolerate varying degrees of intellectual chaos, and "associative links run wild," often with new ideas. They "enjoy adventure . . . , like to explore . . . , tend to be intensely curious . . . , [and have a] "basic simplicity . . . and dedication to their work. . . . Creative people have traits that make them durable and persistent," which is one of the reasons why they survive.

Andreasen astutely points out how many of these characteristics can make the creative person *vulnerable* to social discord and loneliness. They can *appear odd* and may not fit in. While few recognize it, they pay a price for their talents. A question for Emory is, Can a faculty who values decorum also accept, respect, and even nurture such individuals?

When such faculty are recruited, they sometimes receive mixed signals from some of Emory's faculty and administrators. On the one hand, a message is, Please come to a well-off university that has nice weather and wants to be great! On the other hand, a message is, Fit in or else! Maybe you should go to LA or New York! This mixed message engenders frustration, discomfort, and the desire to look elsewhere for a job. The last issue of the *Exchange* described the French department's past struggles with such tensions. I think this is a key issue for Emory and perhaps a difficult one because each side (that is, those wanting decorum and congeniality versus those wanting the highly creative) can feel frustrated of even threatened by the other. Different visions coexist; some like the Harvard or the Hopkins models, which stress excellence and creativity, while others feel strongly that there are "other models." Perhaps one solution lies in dialogue and discussion of the issues with an attempt for sincere mutual support from and for both sides. This effort will be a challenge because the feelings seem strong on both sides. But realizing that there are healthy aspects to these tensions and discussions is helpful.

Fortunately, many creative people can maintain decorum and congeniality and also embody many of these characteristics Andreasen describes. All of us know many of these individuals. Therefore, depending on the individual, this issue may not always be a serious one. I realize that I have taken a somewhat biased view in the previous paragraphs, but it does make the point clearly. Creativity does have its costs, and we need to be aware of them, even if the price varies with the individual or circumstance.

This university really has the choice of seeking "greatness" because of its current success and its substantial resources. Some at Emory have decided to—and tried to—put Emory on that path, and the attitudes of everyone here will have an impact on what Emory will be in the future. ae

Science in the Seams

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microorganism, part circuitry; new vaccines and drugs; molecular "machines" that work from within cells to detect and repair damage; reveal the origins of living systems—how life began.

"There have been times in human history," says Lynn, "when technology has shaken the foundation of our social structure—how we exist and function. There are many examples: The domestication of plants and animals, discovery of fossil fuels and nuclear energy, Darwinian evolution. You can argue we're in the midst of another of those challenges, where we can define individuals by a sequence of base pairs, identify stem cells, and clone mammals to generate armies of identical individuals. The impact of humankind on the sustainability of the planet collides with social structure norms; upheavals emerge between religion and science. Imagine the CLS as a tree with roots that reach out to different departments to bring resources back to the center to attack problems. The bridging structure will attempt to combine theory and experiment in unique ways to address a series of problems that are preeminent in the world today."—S.F.

Staging Science

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"pluripotent," "fMRI," and "heteronormative hegemony" into a conversation, this really is not the goal of an undergraduate education. I would like to think of my areas of study as the "medium" through which I teach undergraduate students the same thing everyone else across the campus is trying to teach them: to write, to think, to question, to argue, to solve. I often think about Einstein's experience with theater: his "discovery" of relativity occurred not just because he asked what would happen if he traveled the speed of light but also because he attempted to stage it. While other daydreaming kids have thought such things, Einstein thought through the ramifications of such a fantasy and realized that science needed to expand its physics to make way for his play. Theater belongs at the crossroads of the academy because it necessitates an embodiment and imagination to learning. ae

Pipeline

Continued from page 9

practices would be "of great value" in improving the overall quality of faculty work at Emory. To take just a few specific examples, automatic tenure clock extension for childbirth or adoption was considered of great value to almost 60 percent of women responding to the survey, but only to 31 percent of men. The possibility of pretenure part-time appointments, similarly, was greatly valued by almost half of women, and by less than one-fifth of men (see graph page 9). These findings are consistent with a recently released survey conducted by COACHE.

FROM PIPELINES TO PRISM

One lesson that emerges from the faculty survey, as well as work-life research and discussions with faculty at Emory and at peer universities, is that we are both alike and different. We may be parents as well as mothers and fathers; children as well as sons and daughters; spouses, partners, and colleagues. Men are affected by these changing roles and expectations as much as women. Significant numbers of male faculty believe that support for family-friendly policies should be an important priority for the university; for many women faculty, the need is even more acute. The rewards and responsibilities of personal and family life should be recognized as part of the fabric of our academic community. Moreover, bringing together the full range of diverse talents on our campus can lead to greater productivity, creativity, and excellence.

It is time to repair and unblock the pipeline, to be sure, but also time to be open to new ways of imagining an academic life not constrained by the linear, narrow pipeline metaphor. For Emory to be a university, rather than a multiversity, we are called upon to acknowledge the various facets of the prisms of our lives. Without such commitment to mutual understanding we will remain more separate than together no matter what programs and policies we have in place. Thus it may also be time, perhaps, to turn to a colleague with a hand outstretched, to balance his or her prism in our open palm, to hold it up to the light, and to try as best we can for a moment to see a multi-faceted world refracted in an unfamiliar way. This change in imagining might presage a transformation in academic culture and community life, truly making Emory a destination university for the twenty-first century. ae

The British Colonial search for an Indian architecture

There has never been a definitive Indian [architectural] style. But the search for one occupied the British for their entire stay in India. In the early years buildings were fundamentally commercial and were usually erected by amateur architects or engineers using available patented models to build the prototypes. However, in the late eighteenth century it was acknowledged by the British that historically in India power was judged by outward expression, and that the greatness of a civilization was expressed in its architecture. . . . Although indifferently educated, [Edward Lutyens] became the best-known British architect of the twentieth century. Lutyens's career lasted fifty years. Though his career spanned the birth and flowering of the modern movement, he was not overly influenced by it. He was dubbed the last traditionalist. . . . He lamented that he had not been better educated, yet he told his children that he owed his success to never having been to school or university. That last remark is really not meant for consumption by Emory University or by one of my children.

—Sunita Kohli, prominent Indian interior designer and leader in historical restoration, from her talk "Lutyens and the Creation of a Planned City: New Delhi," April 25, 2007, sponsored by the Halle Institute

Combining genetics and genealogy

In the year 2000, a black man, a scientist, Dr. Rick Kittles, who runs AfricanAncestry.com, contacted me at Cambridge and told me he was approaching certain African Americans and asking to do their DNA, their tribal ancestry. At the time, you had to extract blood to do it. Now you don't have to do that, you just have to swab your cheek. He came up to my house and took a bottle of blood, and about two months later he sent me a printout of my DNA and his estimation of what tribe I was descended from. And he said I was a Nubian. . . . We started in the present and worked back through the great migration, and back to the nineteenth century. Eighteen seventy is like the sound barrier of genealogy, because that's when slaves first appeared in the Federal census with a legal name—with two names. There are six counties, curiously enough, in 1850 and 1860, where slaves are listed with two names. It's a miracle, and one of them is Hampshire County, Virginia—West Virginia now—which is where my family is from. . . . It's a curious anomaly that there was an overeager census taker who wrote down the names the slaves called themselves. But that is an exception.

—Henry Louis Gates, W.E.B. Du Bois Professor of the Humanities and director of the W.E.B. Du Bois Institute for African American Research, Harvard University, from his talk "Finding Oprah's Roots, Finding Your Own," March 23, 2006, sponsored by African American studies

The Academic Exchange

A Place for Scholarly Conversation at Emory

The Academic Exchange

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