Q & A *with* Don Giddens

Dean of the Georgia Tech College of Engineering

Don Giddens, one of the nation's pioneers in biomedical engineering, became dean of the College of Engineering at the Georgia Institute of Technology on July 1, 2002. The college consistently ranks among the elite top five engineering schools in national rankings.

Giddens, who has been associated with Georgia Tech for more than 30 years, worked with Atlanta-based Emory University to develop a joint biomedical engineering department, and he enhanced Tech's research, commercialization, and faculty and student recruitment efforts. Under Giddens' direction, the biomedical engineering program continued its rise in national stature. Last year, it was ranked sixth in the nation by *U.S. News and World Report.*

1. What are the most critical challenges ahead for engineering?

For one thing, there is this "pipeline" issue. In a number of engineering fields, you have a relatively older age distribution. For example, in the defense industry, a lot of people will be retiring in the next few years, and there aren't enough students going into science and engineering to replace them.

So how do we get young people excited about engineering? Engineering education is a challenge. It is becoming more interdisciplinary, and knowledge is growing so fast. How do we handle that in our curricula? Education is not synonymous with training, though. Things change too rapidly to "train" students effectively. We have to deal with fundamentals that will be useful to students for a long time, while at the same time their education must be interesting to keep them motivated and to attract students into the field. So we need to provide a good basis for lifelong learning. This is becoming more and more of a challenge as things get more complex.

The public perception of engineering is another challenge. A lot of young people think of engineers as nerdy and not very social. This is not really true, but the image is somewhat problematic. How can we convey the excitement and creativity, and the professional and financial potential, of engineering to them? How can we ensure that our students have a liberal education that enables them to be effective in their careers?

2. In a world that has changed significantly in the past year, how do you expect the engineering disciplines to contribute to hopes for a brighter future?

From the economic side, engineering can contribute by continuing to improve productivity, a factor that contributes to a robust economy. Whether it's in manufacturing, development of new technologies, computing improvements, nanotechnology, etc., engineering can create more productivity per worker.

Engineers play a vital role in national defense. A topic on everyone's mind today is bioterrorism. Attempts to thwart it depend on engineering technologies, at least in part. For example, issues of detection depend on engineered devices such as sensors.

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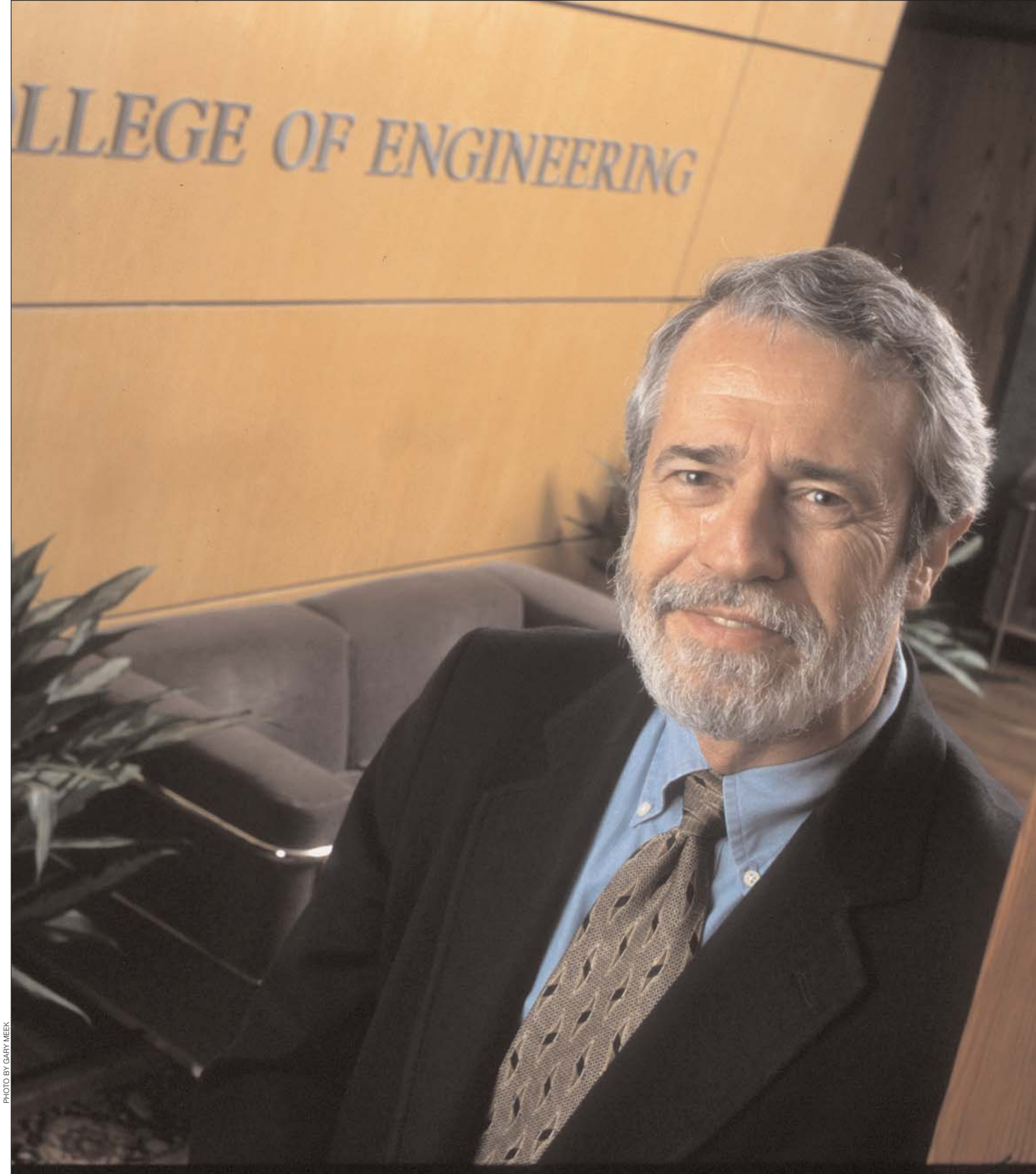

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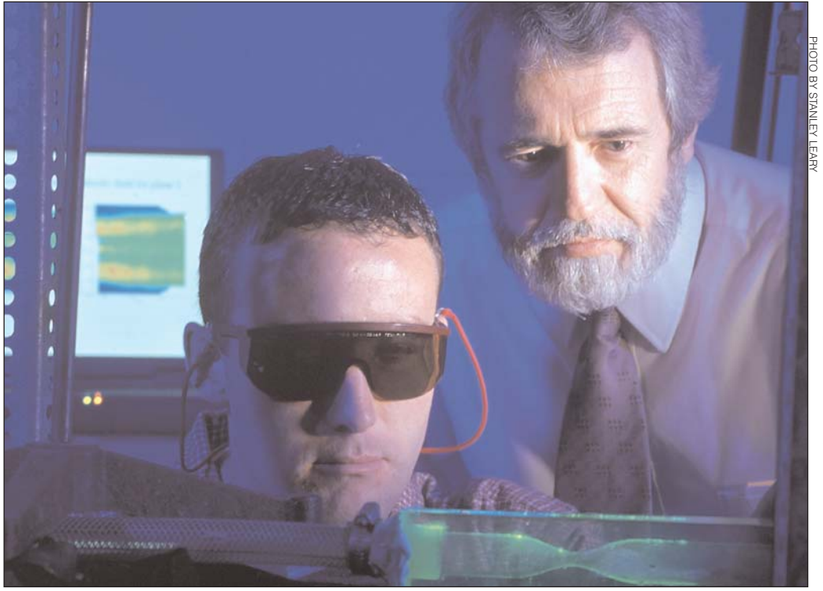

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Don Giddens is a biomedical engineer and still conducts research in the Coulter Department of Biomedical Engineering at Georgia Tech and Emory University. He helped found the joint department between the two institutions.

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Another example…..if you look at contributions from industrial and systems engineering, we might be able to do a better job of handling the logistics of confining a contaminant more efficiently.

Sustainable energy is another area in which engineering has a large role to play. There are political and economic aspects, of course, but technology has to be one of the important elements in determining how we live on this planet without making it a lot worse. We need to develop alternative energy sources and recycling capabilities much more than we have done to date, and we must understand the economic impact of "life cycle costs" of products: …..what may be cheap to produce may cost a fortune to remediate. While much of this issue is driven by economics and politics, a lot is science- and technology-based.

In health, there are a host of things that involve engineering. There are devices, prosthetics, continuing research and development into how we see, how we touch, hear, breathe, how we protect ourselves from injury, how we distribute health care, how we can perform surgery better or even remotely.

Then at the molecular level, the genomics explosion involves numerous engineering issues, such as techniques for molecular imaging, reliable testing with small samples, how to analyze a huge amount of data from molecular biology. The data are overwhelming for us to analyze in traditional "bench-science" ways.

Tissue engineering holds promise, both in hybrids and engineered tissues, such as artificial skin or a tissue-engineered liver. The tissue engineering center here at Georgia Tech is very involved in those matters.

I also have to mention the importance of engineering in our civil infrastructure. We take a great deal for granted, but what would our lives be like without modern water treatment, transportation and communication systems, and construction techniques? Someone once said that some of the greatest technological impacts are from things we don't think about when we use them.

So there are many opportunities in engineering to help toward a brighter future. We just need to communicate this excitement better.

3. As a pioneer in the field of bioengineering, describe what it takes to make an important contribution to science and technology.

For one thing, it takes a bit of luck to pick an important problem or area to work on. I urge my students to focus on identifying important problems and not just work on things that are incremental. It's easy for researchers to slip into this trap: Add a little bit of knowledge, get some publications and give some presentations. After 10 years, maybe you look back and what you've done has not had a big impact at all. It's just a little more of the same. I see a lot of this in presentations at meetings and, very often, in publications.

So, you have to be willing to bite off an important piece of a significant problem and then see it through. It's persistence. If you can do this successfully, you will have an impact.

You also have to be willing to take risks. I was in aerospace engineering, and it was a big change to move into bioengineering. At the time, I did not think of the risk. I just did it.

4. If experience is one of the best teachers, what has it taught you that you pass on to others in your charge?

Experience has taught me to be open to continual learning. I don't assume that because I have a lot of experience, because I have a Ph.D., or because I'm a professor, that I know everything. You'd be surprised how many people just close their minds. They think they have nothing to learn from someone else….and so they stop learning.

We should value people and the different insights they bring. They might think of something you never thought about. This includes valuing student insight into educational issues. We can learn a lot from students – how they learn and what's important to them.

So for me, being open to learning new things is very important. I advise my students to do this. It has ethical dimensions, as well, such as having respect for others and their views.

Another thing that experience has taught me is that you really have to like what you're doing. If you do, you will work hard at it and spend time and be successful.

PHOTO BY STANLEY LEARY

The Tech Tower is a symbol of Georgia Tech.

5. Given your experience with interdisciplinary research and inter-university collaboration, what are the long-term benefits of those interactions? How do you keep those professional relationships strong?

One way to gain new knowledge is through the various disciplines. Assimilating this knowledge is a characteristic of engineering. Engineers integrate things into creating or understanding a system, whether it is manufacturing an airplane, an automobile or a medical device. By nature, when you practice engineering, it must be multi-disciplinary to get to the solution. You interact with people in mechanics, chemistry, whatever. It's necessary to do that to solve the systems problem.

A great benefit of interdisciplinary research is learning from other people. There's a lot of cross-fertilization that occurs. You gain knowledge and perspective from interdisciplinary experiences. You get a lot of energy from interacting with other people. In kinetic theory, there's a little experiment. You have a box with a partition dividing it. On one side, there's a vacuum with no energy, and on the other a gas under pressure and a lot of energy. If you punch a hole in the partition, the energy goes over and invigorates the other side. Some of this happens in interdisciplinary research. The disciplines can excite and invigorate each other.

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A new bioengineering building is nearing completion at Georgia Tech. It will house state-of-the-art laboratories and classrooms.

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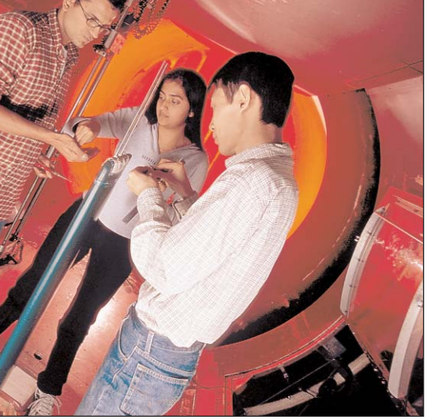

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Bala Ganeshand, left, Priya Gopalakrijhnan, center, both graduate students from India, and Takashi Saijo, a graduate student who is in the Japanese Air Force, test an airfoil in the School of Aerospace Engineering Wind Tunnel.

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And another benefit is the leverage you can get from doing interdisciplinary research. For example, in the School of Biomedical Engineering, we have taken advantage of the strengths of Georgia Tech's engineering school and Emory University's medical school. We can often tackle bigger and more important problems by using an interdisciplinary approach.

Nurturing interdisciplinary relationships takes a good bit of effort, however. Respect for the views of others, valuing their knowledge and being willing to be a team player are all important. If you look for the "win-win" opportunities, this is the best strategy.

6. What are your expectations for change in the College of Engineering for the next five years or so?

There are two types of change – change in what we can actually see around campus and change in what we don't actually see, or change in more abstract ways. In what we can see, what is visible to the campus visitor, I want to continue to push the need for space and infrastructure. We've done well with this, but we can't let up. Technology moves so quickly. We need more space, labs and equipment for faculty and for students.

Another thing we can see as we walk about the campus is the diversity of students and faculty here. Georgia Tech has done well by comparison, but I'd like to see the makeup of the student body change even more in the next five years to increase diversity. The field of engineering has done so poorly in recruiting women and minorities. By comparison, medicine has increased the number of women MDs entering the field to about 50 percent. In engineering, the level is in the 20 percent range, and it's not changed much in the past several years. Why is that? A lot of universities are interested in addressing that issue, and Georgia Tech should help lead the way.

An area that is not so "visible" is Tech's entrepreneurial spirit. We need to take even more advantage of it in the College of Engineering than we have to date – and we are already pretty good at this. I want to see more horizontal interactions among schools and vertical interactions within disciplines in the schools. How can we get synergy out of the elements in the engineering college to do more than we could do as individual schools or as individual faculty members? And we need to extend that interaction to include other colleges at Georgia Tech. Deans can help set the environment to make such interactions natural and more frequent for faculty and students. As the largest college at Georgia Tech, the College of Engineering has a responsibility for making this kind of qualitative change. I think we would be better served as a college if we look outwardly more than we presently do.

Another area of change is in engineering education. We have made many improvements, but I'd like to see us, as a faculty, thinking more about learning issues as opposed to teaching issues. Students today are accustomed to interactions. Lectures can be appealing, but they are not the only way students learn. We can borrow from our learning science friends who study how people learn from each other, and how they learn in self-motivated ways.

7. What measures of success will you use to evaluate the College of Engineering's accomplishments?

Engineers like to quantify things, so we often present data to measure whether we're meeting a goal. You can count diversity – the number of women students, the number of African-American students – for example. You can quantify things like the number of research dollars per faculty member. A softer, but perhaps better measure is publications or, more importantly, citations. Citations are a method to measure whether your publication has had an impact. Then there are honors and awards, such as society fellows, national academy membership and so on. Each of these measures, as well as others not mentioned, can tell us if we are continuing to make progress.

We also need to look at the student/faculty ratio. It has quantitative and qualitative implications. If you have too many students per faculty member, you are not likely to do as good a job because you can be overwhelmed by the workload. If we can manage it, I want to get a ratio closer to those of some of our competitors. We have close to a 20:1 ratio in the College of Engineering. We would be more productive if we had a ratio approaching 15:1.

But one measure to know when we're really successful is when we stop feeling compelled to compare ourselves to others. It's like the old TV commercials for Avis. They said, "We're number two and we're trying harder." Immediately, you thought of Hertz! It was an amusing thing.

8. What are you most proud of from your tenure at Georgia Tech? And what do you most want to accomplish as dean of the College of Engineering?

One thing I am proud of is my role in helping to start the joint Coulter Department of Biomedical Engineering between Georgia Tech and Emory. This was a bold move by the two institutions, and I was lucky to be a part of it. Another thing high on my list would be the postdocs and graduate students who came through my lab. I have a sense of pride in their success and in the success of their students.

As dean of the College of Engineering, I have some things in mind that, if we can do them, would give me a sense of satisfaction. Georgia Tech could and should be a stronger player in the "bio-X" arena. And I'm not just talking about biomedical engineering. We also have a role in the bio-environmental area and in sustainable energy, to give just a couple of examples. Integration of engineering and the life sciences is so important to our future. We've only touched the tip of the iceberg in this area. As dean, I hope I can push this issue forward. I would look back and feel good about helping do this.

At the educational level, I want us to give more attention to learning versus teaching. I want us to get at how students learn and how to convey needed fundamentals so this issue of taking four prerequisites before being able to take a certain course becomes less significant, and it opens flexibility in education. I question the bean-counting approach to the curriculum. It all gets back to the issue of training versus educating. So we need more emphasis on learning issues and on multidisciplinary education.

Also, I want to continue to encourage the entrepreneurial character of Georgia Tech. It is incredibly valuable. … I hope to open up more degrees of freedom for this activity to take place than currently exists.

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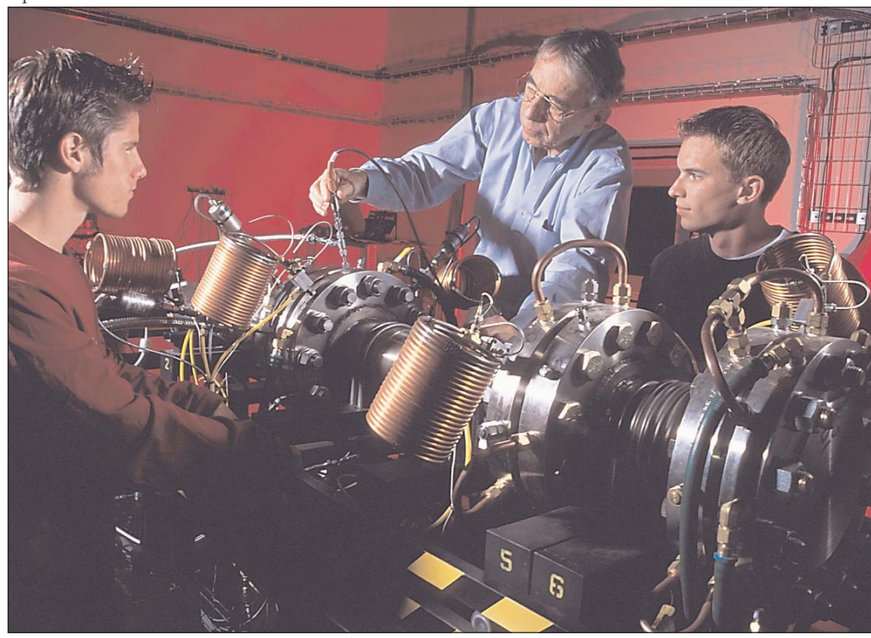

Researchers Danny Puckett, Professor Ben Zinn and Matt Christopher conduct studies in the Aerospace Combustion Lab at Georgia Tech.

■ For the text of the complete interview, see **gtresearchnews.gatech.edu/reshor/rh-f02/faculty-profile.html**. For additional information, you may contact Don Giddens, College of Engineering, Georgia Tech, Atlanta, GA 30332-0360. (Telephone: 404-385-0125) (E-mail: don.giddens@coe.gatech.edu)

The interview with Don Giddens was conducted by Jane M. Sanders, editor of Research Horizons *magazine.*