ENGINEERING IN THE LIFE SCIENCES: FROM POST-GENOMICS TO COMMERCIALIZATION

National Academy of Engineering Regional Symposium

The National Academy of Engineering (NAE) has begun to host regional symposiums around the country in order to bring more visibility to its work and to highlight areas of promise within engineering. On June 3, 2004, Cornell University and the Cornell College of Engineering hosted the Northeast Regional Meeting of NAE. In his opening remarks, NAE President William Wulf emphasized NAE's mission, "to promote the technological welfare of the nation by marshaling the knowledge and insights of eminent members of the engineering profession."

Chaired by NAE member Norman R. Scott, Biological and Environmental Engineering, the half-day symposium involved participants from around the region in lively discussions on the role of engineering in the life sciences. The program began with a focus on fundamental research and culminated with prospects for commercialization. An underlying theme of the symposium was cross-disciplinary collaborations across the spectrum of science and technology.

Norman Scott, Biological and Environmental Engineering, chaired the National Academy of Engineering regional symposium at Cornell.

Robert Barker/CU

Norman Scott

The New Life Sciences initiative at Cornell in genomics represents a movement away from a species-centric view of biology, medicine, and agriculture as highlighted by Cornell's Senior Vice Provost for Research and the 1996 Nobel Laureate, Robert C. Richardson, Physics, in his address on "Fundamental Research in Life Sciences."

How should the engineering disciplines embrace the revolution in biology? Michael L. Shuler, Biomedical Engineering and NAE member, posed this fundamental question in his discussion of "Systems Biology at the Cellular Level." A cell is a complex system, but it obeys all laws of chemistry and physics. A cell is "rational" and can be "understood" using engineering concepts. Engineering analysis is a path to understanding "What is life?" He put forth grand challenges such as:

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Michael Shuler

Michael L. Shuler, Biomedical Engineering, pointed out that a cell is "rational" and can be "understood" using engineering concepts. Engineering analysis is a path to understanding "What is life?"

- Can we replace and regenerate organs and tissues to treat arthritis, heart disease, and spinal cord injuries?
- How do we design and deliver drugs to treat Alzheimer's, cancer, and liver failure?
- Can we develop advanced diagnostic tools to detect vascular disease, infectious agents, and osteoporosis?

Barbara A. Baird, director of Cornell's Nanobiotechnology Center, described a central quest of nanobiotechnology: How do biological systems operate on subcellular and molecular levels? Baird defined technological approaches:

- Conduct high-speed and high-sensitivity analysis of biomolecules
- Investigate molecular motion and mechanical properties
- Investigate nanoscale cellular activities
- Analyze cell structure and function in engineered devices
- Investigate response and control of cells on structured interfaces
- Engineer materials at nanoscale for novel properties that can be used to manipulate biological components


Charles Harrington/CU

Barbara Baird

Barbara Baird, director of Cornell's Nanobiotechology Center, defined technological approaches to a central quest in nanobiotechnology: How do biological systems operate on subcellular and molecular levels?

Stemming from his long-term research in the use of nanofabricated devices for biological applications, Harold G. Craighead, Applied and Engineering Physics, focused on the prospects of single molecular devices. Craighead described studies and presented the development of new methods for nanostructure formation, integrated fluidic/optical devices, nanoelectromechnical systems, and single molecule analysis. He also addressed the potential commercialization of the technology.

"Industrial Biotechnology" was the topic addressed by Larry P. Walker, Biological and Environmental Engineering. Walker presented his combined interests in agricultural and bioprocess engineering, industrial ecology, and nanobiotechnology.

Bruce Ganem, Chemistry and Chemical Biology, chaired an illuminating panel discussion on "Engineering a Life Science Startup from University Research." Panelists David Putnam, Chemical Engineering; Jack Henion, President and CEO, Advion Biosciences, Inc., of Ithaca; and Karen Kerr, ARCH Ventures of Chicago, discussed startup issues from the perspectives of a senior academic (Ganem), a young academic (Putnam), a small business startup (Henion), and a venture capitalist (Kerr).

The panelists raised a number of issues:

- General characteristics necessary for successful transfer from laboratory to startup
- The need for flexibility in nurturing the process from laboratory to startup
- The importance or lack of importance of location
- The importance of name recognition
- The challenge to transcend the chasm from university to startup
- Freedom to permit venture capitalists to "walk the halls" of the university
- Importance of the role of alumni in the commercialization process
- The impact of faculty startup ventures on the educational process

Larry P. Walker, Biological and Environmental Engineering, presented his combined interests in agricultural and bioprocess engineering, industrial ecology, and nanobiotechnology.


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Larry Walker

A lively debate developed from the question of whether faculty should actively engage in startup companies. This discussion concluded the symposium.

Norman R. Scott
Biological and Environmental Engineering

Bruce Ganem, Chemistry and Chemical Biology, chaired a panel discussion on startup companies in the life sciences, which raised issues such as freedom to permit venture capitalists to "walk the halls" of the university.


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Bruce Ganem