



Electrical and Computer Engineering

ENG CORNELL ENGINEERING

Degree Programs and Research Areas

We offer the BS in Electrical and Computer Engineering, the MEng in Electrical Engineering, and the MS/PhD in Electrical Engineering.

Our Research Areas

- Computer Systems: computer architecture for high performance and low power consumption, novel architectures, and hardware security.
- Communication and signal processing: sensor, wireless and ad hoc networks and the Internet, information theory, and image processing and compression.
- Electromagnetic phenomena: plasma and ionospheric physics, GPS, high energy density plasmas, and space weather.
- Solid State electronics and photonics: novel mixed-signal and ultra-high frequency RF systems, photonic and electronics devices, microwave materials and systems, laser development., and MEMS.
- Bio-electrical engineering: computer-aided imaging, neural circuits, and programmable protein synthesis.

Trends

The *field* of Electrical and Computer Engineering is arguably more pervasive than ever before, with powerful microchips enabling unprecedented performance in complex systems such as communication networks, transportation, and medicine. But undergraduate enrollment in all 20 ECE programs, including ours, has declined for the last 7 years, and projections suggest this trend will not reverse soon.

Nonetheless we have experienced a significant increase in the size of our PhD enrollment and production, graduating approximately 1 PhD/year/faculty. Including outside majors working with ECE faculty we now support over 185 PhD students, one of the largest programs at Cornell. Domestic PhD student enrollment has increased significantly, from 32% to 44%.

Bio-electrical engineering is growing as a new sub-discipline in the field, and we have made good hires in this area. The tools of electrical and computer engineering are ideally suited to address some of the complex system issues in cells and in the brain.

Achievements

Hiring

We "raised the bar" on hiring and promotion, becoming much more selective in making offers and promotions with tenure. Our recent hires are truly outstanding, having been strongly recruited by other leading schools, and are establishing innovative research programs that will form a strong foundation for our future. We simultaneously have gone through several tenure denials, but this has helped focus our mission on high quality in teaching and high impact in research.

Facilities

We were able to locate five of our faculty into labs in Duffield, and each of their programs has since benefited. We historically have an unsatisfied need for good lab space, and within the last five years we did see some progress in that direction.

Fellowships

In Fall 2007, the first class of Jacobs Scholars was admitted to our PhD program. Alumni Irwin and Joan Jacobs have endowed a \$15M gift to support graduate student fellowships in ECE. In the first two years of the program, 24 Jacobs Scholars have been admitted and are currently in their 1st or 2nd year of graduate study in the school.



Irwin Jacobs, BEE '54, M.L.T. MS '74, ScD '59 with Jacob scholars and Director Clifford Pollock in the background.

Faculty Distinctions

Many senior faculty have been recognized for outstanding contributions, such as: Toby Berger for the 2005 National Academy of Engineering and the 2006 IEEE Leon K. Kirchmeyer Graduate Teaching Award. Jim Thorp received the 2008 Franklin Medal, Tom Parks the 2004 IEEE Kilby Medal, Lester Eastman the 2003 IEEE MTT Distinguished Educator Award, Robert Thomas received the 2005 IEEE PES Outstanding Power Engineering Education Award and Sandip Tiwari received the 2007 IEEE Cleo Brunetti Medal.

Priority Goals

The top priority is to retain and nurture our star faculty members, and increase their number with future selective hiring. 40% of our faculty have been hired in the last 8 years; we have made a huge investment in outstanding new talent. These faculty are changing our culture toward more collaboration and interaction, and are providing key leadership in hiring and graduate recruiting. Keeping these new faculty here at Cornell, and attracting more of similar talent is the top priority.

A second priority is the curriculum. We have accepted the challenge of delivering a curriculum that provides the foundation for creative adaptation to rapid changes in technology and that teaches critical thinking responsive to the problems society will face.

Our third priority is to address our space and infrastructure challenges. We are spread across four buildings, with infrastructure varying from excellent (Duffield Hall) to poor (60 year old Phillips Hall). We have no space for MEng students; we struggle to find office and lab space for new hires. We are adding a 4th floor of the south wing of Phillips to provide 7000 sq. ft. space of new office and lab space that will support our new bio-Electrical Engineering thrust. Duffield Hall lab space has significantly helped the five ECE faculty who were given labs there; creating quality space for our remaining 35 faculty is going to be critical to our future.



Duffield Hall named for Cornell Engineering alumnus David Duffield '62 EE, is one of the country's most sophisticated research and teaching facilities for nanoscale science and engineering.

Challenges

- Retention of outstanding faculty at all ranks is critical. This requires that Cornell provide good services, we continue to attract top students, and we provide adequate facilities to keep their careers on the fast track.
- Lack of space is a potential show-stopper, especially as we try to grow into new areas such as bio-EE that need wet labs, and we try to find office, lab, and server space for new hires. We will add a floor to one wing of Phillips to provide some immediate high-quality space.
- We have made no progress in diversity hiring for 6 years, and are no longer well represented as a diverse faculty. We will seriously focus on targeted hiring and effective nurturing of new hires.
- The downward undergraduate and MEng enrollment trends need to be stopped, and hopefully reversed. We will increase our efforts at curriculum enhancement, and increase marketing of the field.

Opportunities

We see opportunities in energy and health care that address global problems. We expect to grow research into energy conservation (low power electronics and lighting), smart grids, and efficient control of consumption. We have invited leading figures to talk to us, and will hopefully hire new faculty in the energy area. Our emerging bio-EE program should impact health care through instrumentation, imaging, and systems understanding. For example, we already have several faculty members working on the logic, networks, feedback, information theory, and electrical signals that make the brain function. ECE brings a unique system expertise to many biology problems.