
Charles Harrington/CU

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Cornell Pushes Ahead in the "New Life Sciences" and Medical Research on Its Upstate Campuses

The life sciences have begun a new revolution. This revolution is equally as dramatic as the one in the 1950s when James Watson and Francis Crick deciphered the nucleotide structure of genetic material. In 1995, researchers determined the entire nucleotide sequence of the genome of an organism—a bacterium. Only six years later, in February of this year, scientists announced the complete sequence for the human species. In the meantime, researchers revealed the genomes of several other organisms—yeast, a plant, and many bacteria. From this small sample of species, it is clear that organisms share a far larger proportion of genetic material than scientists previously believed. More profoundly, humans, too, share many genes with other organisms: 99.5 percent with chimpanzees, our closest living relatives; 90 percent with mice; and a significant number even with plants and yeast.

The practical use of this wealth of genetic information—the field of genomics—is a common language by which information gleaned from one species can flow to others. Discoveries in model systems (yeast, fruit flies, mice, dogs, and plants) will uncover information that is directly applicable for human medicine. Given the great difficulty—methodologically and ethically—in performing experiments with humans, studies in these model systems can greatly speed the pace of discovery for human medicine.

One of Cornell's traditional strengths in biology is the enormous range of organisms that the faculty and students study. Often, it is by comparing some function in different species—the field of comparative genomics—that scientists can identify a particular gene of practical, and sometimes medical, importance.

Another Cornell strength is the ease with which interdisciplinary studies can be undertaken, in part, due to the flexibility of Cornell's graduate field system and the existence of many multidisciplinary research centers. Unlike traditional medicine, which was focused largely on the detection and eradication of infectious diseases, modern medical science is far broader. It includes the development of biomedical apparatus, such as artificial valves, vessels, and even whole hearts, designed primarily by biomedical engineers. It was a Cornell-trained engineer, David Lederman '66, Ph.D. '73, who created the first self-contained heart, a device made of titanium and plastic, which was successfully implanted in a patient last July in Louisville, Kentucky.

Cornell faculty and students have developed many such devices, but today their work extends to finer levels of miniaturization with the establishment of several centers of nanotechnology on campus. Cornell has more centers of nanotechnologies than any other university. Nanofabrication technology, for example, generates new techniques and instruments for studying the ways in which cells attach or grow on other surfaces and for producing tiny robotic devices for insertion into blood vessels or into the brain, which can monitor or manipulate cellular, organ, or bodily functions.

These and other exciting research activities provide numerous opportunities for training students, both undergraduate and graduate, in biomedical studies. Cornell is the largest producer of baccalaureate graduates in the life sciences who continue for Ph.D. degrees, according to a recent survey by the National Science Foundation. Many of these students work in the laboratories of faculty who conduct medical research. With the establishment, this year, of a new undergraduate program in biomedical engineering, an increasing number of baccalaureate degree students will be given opportunities to do biomedical research.

At the graduate level, the Tri-Institutional Research Program—a consortium announced in June 2000 that involves both Cornell's Ithaca and New York City campuses, Rockefeller University, and Memorial Sloan-Kettering Cancer Center—has begun to train a new kind of medical research scholar. The first class of students has just arrived in Ithaca, where they will receive intensive training in Cornell's Department of Chemistry and Chemical Biology. Later, they will move to biomedical research projects under the supervision of faculty in the consortium, mostly in New York City, but they will continue to be mentored by both a chemist and a biologist. Inevitably, this program will forge new and stronger links between the two Cornell campuses, promoting dynamic medical and medical-related research on the Ithaca campus.

With programs like these and the university's increasing integration of the engineering, physical, computational, and life sciences, Cornell is sure to have an even greater impact on future advances in human medicine. We look forward to that future with great anticipation.

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