

# CONNECTING

# with CORNELL

NEWS from the Office of the Vice Provost for Research

## Medical Research Is Fused with Technology and the Basic Sciences on Cornell's Upstate New York Campuses

**"Research aimed at animal health can often lead to cures for similar human diseases."**

Charles Harrington/CU



Gustavo Aguirre, James A. Baker Institute for Animal Health

Whenever someone speaks about medical research at Cornell, one is apt to think of the medical campus in New York City. Increasingly, however, one must also think about the Ithaca and Geneva campuses. Medical research is not confined to the field called human medicine, but represents a much broader range of studies. Thus, a researcher does not have to be at a medical school or even have an on-campus medical facility in order to conduct medical research.

Although it has long been the case that medical research depends on progress in the basic sciences—chemistry, physics, and biology—the links between fundamental work in these areas and medical research today are more direct than ever before. And, with the sequencing of the human genome and the realization that humans share a large fraction of genes with other mammals and organisms, these links will inevitably become even tighter.

Research aimed at animal health can often lead to cures for similar human diseases. Consider the research conducted by scientists at the James A. Baker Institute for Animal Health, a unit of the College of Veterinary Medicine. These researchers announced

Charles Harrington/CU



James A. Baker Institute for Animal Health

G. Acland



Lancelot, one of the Briard-mix dogs who was blind from birth until his sight was restored in a gene-therapy experiment.

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“The existence on one campus of such a broad range of expertise and research facilities makes medical research more feasible and the results more rapid.”

Bruce Wang/CU



Cornell Theory Center

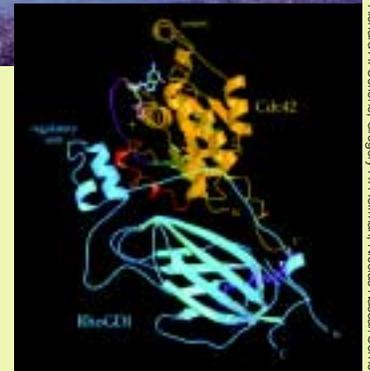
Modeling and simulation of the protein, PPT1, took place at the Cornell Theory Center. PPT1 is a protein involved with genetic brain diseases.

X-ray crystallography at CHESS was used to determine the three-dimensional structure of Cdc42. The Cdc42/GDI complex has implications for tumor-blocking drugs.



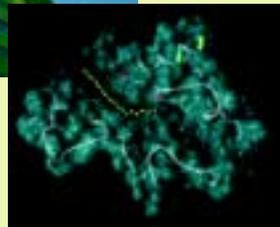
Charles Harrington/CU

CHESS



Richard A. Carbone, Gregory R. Hoffman, Nicolas Nassar/Cornell

Diagram of the Cdc42/GDI complex



John Bellizzi and Richard Gillilan

The crystal structure of palmitoyl protein thioesterase 1 (PPT1)

recently the first successful gene therapy for blindness in a large animal. One breed of dogs is prone to having a retinal degenerative disease caused by a defective gene that results in near-total blindness. However, when the normal form of this gene is injected into an animal's retina, the eyes begin producing the normal proteins and, within three months, vision is restored. This congenital disease of dogs is very similar to a human disease of childhood and the Cornell research, therefore, may lead to a cure for the human form of the disease by identifying a path for clinical studies.

Scientists in Chemistry and Chemical Biology conduct studies to determine the basic molecular structure of receptor proteins built into cell membranes and how these initiate and regulate intracellular signals. The Cornell studies show that one of these receptors binds to an antibody, immunoglobulin, which functions in the allergic immune response caused by allergens from pollen or dust mites. The binding, in turn, initiates a cascade of biochemical events

Charles Harrington/CU

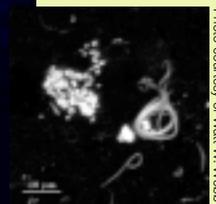
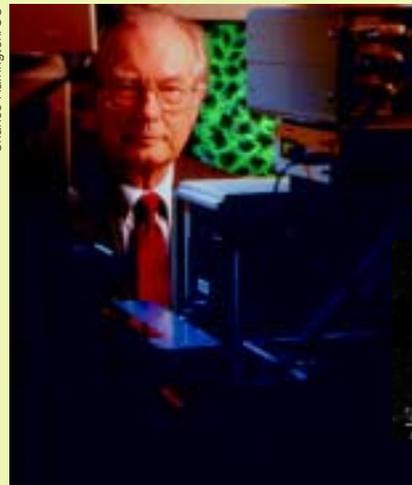


Photo courtesy of Watt W. Webb

Intrinsic fluorescence

Watt Webb, Applied and Engineering Physics, develops instrumentation and techniques for seeing (digital images) biological processes at the molecular level.



Barbara Baird, Chemistry and Chemical Biology, studies the allergic immune response system at the molecular level.

leading to allergic symptoms which, in the extreme, can be life threatening. The information learned from this research has important biomedical applications in drug design and clinical therapies.

Another interdisciplinary team of Ithaca scientists conducts a very different line of research with medical implications. Fundamental to this work is their discovery of a complex of two signaling proteins that controls a biochemical pathway leading to normal or cancerous cell growth. In order to control the pathway through drug therapy, a researcher must know the structure of these proteins. The Ithaca campus is especially well suited to perform the next steps in the research: the crystallization of the proteins for x-ray diffraction studies at CHESS, the calculation of 3-D models of the protein from x-ray studies, and the manipulation of the molecules' structure at the Cornell Theory Center to determine a best-fit drug to inhibit the transformation of cells into a malignant form. The existence on one campus of such a broad range of expertise and research facilities makes the work more feasible and the results more rapid.

Technological advances at Cornell have also had significant consequences for medical research. The "gene gun" was developed by a plant biologist on Cornell's Geneva campus and an engineer at the Cornell Nanofabrication Facility. This device is capable of inserting foreign DNA into host cells by using DNA-coated tungsten particles that are then shot at high velocity. Some of the foreign DNA can then be incorporated into the host cell and be expressed.

Cornell scientists in Applied and Engineering Physics invented a new method—multiphoton laser scanning fluorescence microscopy—to provide images, even of single molecules, within living tissues and animals in vitro. Such methods will have numerous potential applications in human medicine, for example, in recognizing the onset and progress of Alzheimer's disease. The illustration, on the previous page, of intrinsic fluorescence shows the tangled neuron (right) and adjacent granules that are characteristic of the brains of Alzheimer's patients.

This issue of *Connecting with Cornell* focuses on these kinds of research.

*Kraig Adler*  
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