Ithaca KnowLedges. 5(1): 4-5. Spring 2004.

The New Face of Science

As a senior faculty member, biology professor Vicki Cameron knows first-hand the recent changes in sciences at Ithaca. She is surrounded by new faces, exciting new research, and a growing awareness that her school is on the forefront of undergraduate science education.

At the heart of the program is a belief that science is a hands-on experience, that the 190 science majors are not just science students: they are student scientists. Seventeen new faculty members have been hired in the sciences over the past three years to fill positions left open due to retirements, creating an intellectual hotbed of ideas and enthusiasm.

> *"The lights are on in all the labs, the doors are open, and things are happening."*

"This is an exciting time to be here," Cameron said. "Our faculty are really research active, and the research we do is about teaching. It's all about getting students involved, creating opportunities for hands-on research—experience that's going to benefit them down the road."

Cameron needn't look far for examples. A $281,000 grant from the National Science Foundation (NSF) directly benefits student scientists in the biology program.

Cameron and her students are studying the genetic and biochemical function of Cytochrome c Oxidase, or CcO. CcO is one of several proteins essential to the synthesis of adenosine triphosphate, the chemical "fuel" of cellular organisms.

"Defects in CcO can limit an organism's ability to store and utilize energy, thereby limiting growth and ultimately causing cells or entire organisms to fail. In humans, CcO activity declines with age, particularly among individuals with Alzheimer's disease. Understanding this protein's function on a genetic level could one day translate into major advances in human health," Cameron said.

"It's a multidisciplinary study," said Cameron. "Students learn about DNA, genetics, biochemistry, biology—and they do so while engaged in real science. They're expanding the frontiers of knowledge as they learn."

The four-year NSF grant allows Cameron to supply her lab, and more importantly, allows students the opportunity to do the hands-on lab work.

"It provides us stipends for four students to do research in the lab every summer for 10 weeks," she said. "Hands-on learning—this is what it's all about for us."

This hands-on philosophy is also at the core of the Department of Chemistry. "It's our only philosophy," said department chair Vincent DeTuri. "We believe that the best way to teach chemistry is to do chemistry. The best education is to treat students as chemists. All the research we do is oriented for undergraduate involvement, and it's all competitive on an international level."

Indeed faculty and students are engaged in a wide array of research, from modeling the fundamentals of proton transfer, to exploring the emerging science of silylene-metal complexes. In biochemistry one team is examining the biochemical function of LuxS, an enzyme critical to the biosynthesis of certain autoinducers in bacteria. Autoinducers are the signaling molecules that allow bacteria to "communicate." This ability is a key factor underlying the virulent behavior of many human pathogens. The development of LuxS inhibitors holds significant promise in human health.

Freshman Sweta Shah, *left*, and assistant professor Beth Clark Joseph at the NASA Infrared Telescope Facility in Hawaii

Such research is attracting national attention. As proof of this, Ithaca sent five chemistry students to the annual meeting of the prestigious American Chemical Society last year to present papers on their research and meet fellow scientists on the cutting edge of the field.

"It's a new, bustling department," DeTuri said. "The lights are on in all the labs, the doors are open, and things are happening. It's a tribute to the strong foundation laid by the previous faculty and the outstanding reputation they built for the department."

Research being conducted in Ithaca's environmental studies program is yielding tangible results, both for students and for people living in the research area. Assistant professor Susan Allen-Gil and her students are studying the spread of pollutants to arctic fish, a question of major importance to the health of native people in coastal Alaska who survive primarily on subsistence fishing.

Her five-year, $325,000 research grant from the NSF came with additional funding for logistics—money that covers her

costs and those of the student scientists who travel with her to Alaska's north coast. Thus far 10 Ithaca students have made the trip, collecting samples, analyzing them in the lab, and—this summer—reporting the findings back to the affected population. "Early results indicate that unlike migratory salmon, which are widely studied elsewhere, the resident fish utilized for food in the region have relatively low levels of contamination—good news for the people eating them," Allen-Gil said.

"Each time I go I bring one or two students," she said. "It's a huge part of what we're doing, showing students the value and the application of science to people in the areas we go."

The faculty and students in the Department of Physics are likewise engaged in hands-on science. Freshman Sweta Shah recently traveled to Hawaii with assistant professor Beth Clark Joseph to make asteroid observations at the NASA Infrared Telescope Facility atop Mauna Kea. The two were using infrared spectroscopy to study the surface structure of X-type asteroids, celestial objects of unknown composition. Their research, underwritten by a two-year, $28,000 grant from the Research Corporation, suggested the presence of an unexpected silicate chemistry—perhaps a new type of mineral in asteroidal science—and offered tantalizing clues that the asteroids may contain water. Clark Joseph and her students hope to expand their study in the coming years.

In more earthbound observations, student Kevin Faehndrich is working with assistant physics professor Michael Rogers and biology professor John Confer in an interdisciplinary effort to establish bird population survey points in southern New York's Sterling Forest State Park. These survey points will form the backbone of an online database allowing multiple scientific teams to accurately compare populations of different animals in the area. The work is funded by a $31,000 grant from the New York State Department of Environmental Conservation. In addition, Faehndrich and fellow physics student Greg Shear will travel with Rogers to New Mexico this summer and conduct magnetic surveys of a one-thousand-year-old Mimbres Mogollon culture village site.

"We're committed to creating the next generation of great scientists."

While it seems that Ithaca's commitment to young scientists may be extraordinary, the effort is hardly one sided. Two graduates have recently returned to the School of Humanities and Sciences to join faculty in the sciences. Other graduates return on a regular basis as guest lecturers.

"This spring, one of my former students returned to present a seminar describing research conducted while he was a graduate student at Harvard," Cameron said. Tom Torello '97, who graduated from IC with a degree in biochemistry, received his Ph.D. from Harvard in spring 2003. "He told us his research experience at Ithaca was what made him competitive for admission to Harvard. We have a great track record of acceptance in Ph.D. programs: Harvard, Yale, Cal Tech. We have Ph.D. students at leading universities nationwide."

The performance of Ithaca's science graduates is perhaps the program's ultimate badge of success, as last year's chemistry and biochemistry majors demonstrated. Of the program's 12 graduates, 10 were accepted into prestigious Ph.D. programs. Two others launched their careers, one at a major pharmaceutical firm and the other at Sandia National Labs. Credit goes to the students themselves, to the faculty, and to a program built on student-centered research.

"Undergraduate research is the name of the game around here," said Clark Joseph. "We're not just doing research in a vacuum; we're committed to creating the next generation of great scientists. This is a vibrant place." HS

Assistant professor Susan Allen-Gil with student scientists working in Alaska