

Big Payoffs from College Students' Research

The research that Diana C. Hargreaves performed while still an undergraduate at Haverford College has taken her a long way, literally and figuratively. She was invited to travel from her college in southeastern Pennsylvania to a national gathering of immunologists at Asilomar near Monterey, California, to present her work. While there, she landed a job at an HHMI investigator's lab at the University of California, San Francisco (UCSF), and she hopes her research experience will help open doors to graduate school and an immunology career.

Hargreaves is one of a growing number of undergraduates who not only conduct research, but have the opportunity to make formal presentations about it alongside full-fledged scientists. Over the past five years, more than 5,700 undergraduates have received HHMI support to participate in this way at scientific meetings.

Hargreaves took her first step on the research ladder as part of an interdisciplinary program supported by an HHMI grant. The chemistry major's project was to help Haverford biology professor Judy Owen design a more efficient system for isolating certain regulatory regions of genes that are expressed after B-cell activation. Because Owen believes that students who have made major contributions to the work of her lab should be invited to accompany her to scientific meetings, Hargreaves found herself, at the age of 21, presenting a poster at the 2000 Mid-Winter Conference of Immunologists at Asilomar.

"I was pretty scared," she recalls. "I was the youngest person there by a long shot. But it was really good to be part of that scientific community, to get feedback on a national level and to be exposed to what was going on in the field of immunology as a whole."

The Federation of American Societies for Experimental Biology (FASEB) 2001 meeting in Orlando, Florida, made a similar impression on Hesham Attaya. Now a junior majoring in biochemistry at Texas Tech University, he presented a poster on his research into human metastatic pancreatic cancer-cell

expression of a particular enzyme, plas-malemmal vacuolar type proton ATPase. "It was amazing to me how principal investigators, postdocs and graduate and undergraduate students from around the world come together to talk about science," he says. He was impressed with the lack of condescension. "Many people came to see my poster and talked to me as a peer, not a student."

"My laboratory encourages undergraduates to present their work at national and international meetings," says Raul Martínez-Zaguilán, a professor of physiology and Attaya's mentor. "Hesham's poster won one of the top 10 undergraduate research awards in a competition organized by the Society of Biochemistry and Molecular Biology at the FASEB meeting in Orlando, and that is a major accomplishment." Attaya says his par-

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ticipation in the meeting inspired him to pursue an M.D.-Ph.D. and a research career.

Texas Tech sends several undergraduates on similar adventures every year. Larry Blanton, biology professor and director of Texas Tech's HHMI-supported undergraduate program, calls presenting at scientific meetings "one of the most meaningful parts of an undergraduate's research experience. Participating in these meetings makes them realize that they are active participants in the creation of knowledge rather than passive recipients of delivered facts."

Such presentations also help students clarify their thoughts about research, notes Washington University in St. Louis biology professor Sarah Elgin, director of a similar program there. "They must understand and explain their choice of research problem and experimental approach, and report on the outcomes," she says.

Scheduling trips to scientific conferences can pose problems for undergraduates, but

they aren't insurmountable. Elgin recalls a student who would have to miss a mid-term exam in one of her classes in order to present his research at a national meeting. Instead, she faxed the exam to the student's mentor, who served as proctor while the student took the exam during the meeting, hundreds of miles from St. Louis. The mentor returned it to Elgin by fax in time for grading with the rest of the class. "The faculty shares a strong commitment to undergraduate research, so we are happy to work with students to make meeting participation possible," Elgin explains.

At the University of Delaware, where a dozen or more undergraduates present research at professional meetings each year, biochemistry professor and HHMI program director Hal White explains, "Our objective is to provide an undergraduate track to a research career." Delaware senior Mike Usher is speeding along that track. Presenting his research into the biochemical mechanisms underlying targeted gene repair at the 2001 FASEB meeting, he won a Pfizer summer research fellowship. The meeting,

he says, gave him a taste of the way scientists from different disciplines can nurture each other's work. "I look at things from a biochemical viewpoint, and there I was talking to a molecular biologist about bacterial genetics," Usher recalls. "We both took home some new ideas." Usher wants to earn an M.D.-Ph.D. and do clinical research.

Remember Hargreaves at Asilomar? One of the scientists who visited her poster was HHMI investigator Jason G. Cyster of UCSF. He was looking for a research assistant, and Hargreaves was looking for a job after she graduated in May 2000. "I was impressed by the enthusiasm Diana showed as she took me through her poster and by the good understanding she demonstrated of the work she had been doing," Cyster recalls. Hargreaves has worked with Cyster ever since. She was first author on a paper published in the *Journal of Experimental Medicine* in 2001, and she is now applying to graduate school.

—JENNIFER BOETH DONOVAN