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The Soul of MIT

Undergraduate Research Opportunities Program marks 40th year.

By Eileen McCluskey

Developing patented medical devices, seeking cures for intractable diseases, making alternative fuels--it's all in a day's work for students who participate in MIT's Undergraduate Research Opportunities Program (UROP). Launched in 1969, UROP cultivates and supports research partnerships between undergraduates and faculty, in the spirit of the Institute's commitment to hands-on learning.

"When UROP began 40 years ago, the notion of undergraduates working in the lab on faculty-mentored research was novel," says Michael Bergren, associate dean of academic and research initiatives with MIT's Office of Undergraduate Advising and Academic Programming (UAAP). "Today, 85 percent of students participate in UROPs across all disciplines at MIT."

Revolutionaries in Training

Edward Boyden '99, MEng '99, an assistant professor in the Program in Media Arts and Sciences, was once a UROP student and now brings dozens of students into his lab, where they essentially learn to teach themselves what they need to know. "I ask questions and guide students toward answering their own questions," he says. "They find this exciting. They want to be pioneers."

In his Media Lab UROP, Boyden created software that decoded changes in electrical fields to plot the location of a hand passing by an antenna. Today, e-field sensing and imaging tools are widely used in air-bag controllers and other products. "UROP allowed me to resynthesize classroom learning in applied, practical ways," he says. "I learned through UROP how to confront failure and find information."

Senior Stephanie Chan experienced a similar transformation when she did UROP work in Boyden's lab from 2007 to 2009. "The trust and faith of professors in undergraduates to be creative and take responsibility is very encouraging," she says.

In her project, Chan worked with a revolutionary technique that Boyden previously developed for turning the brain's neurons on and off using light. The light sensitivity is induced through a gene engineered into benign viruses that are injected into the brain.

Used by neurologists worldwide, this gene therapy silences targeted areas of the brain to halt such afflictions as epileptic seizures. Chan developed a device allowing precise, simultaneous injections of the therapy into multiple locations in the brain. Her novel instrument, which makes treatment much faster, is likely to win her a patent.

"I wouldn't have considered myself a scientist if not for UROPing," Chan says.

Considering the Uncertain

Kristala Jones Prather '94, the Joseph R. Mares Career Development Assistant Professor of Chemical Engineering, participated in UROP during her senior year, when she developed new strategies for measuring output in reaction vessels used to process microbial biomass.

"Until I did a UROP, I had this sense, as I think many students do, that classroom learning wouldn't really have meaning in my life," Prather says. "UROP proved that the professors weren't just making me learn abstractions without legs. And it was the first project I'd ever done where it wasn't clear what the outcome was supposed to be."

Prather started bringing undergraduates into her own lab soon after she began teaching at MIT in 2004. One of these students, Gihan Amarasiriwardena '11, is developing next-generation biofuels. In this project, metabolically engineered bacteria function as tiny factories inside a bioreactor to produce butanol. Amarasiriwardena feeds glucose to the bacteria, which they convert into the biofuel. Because butanol is toxic to the cells that produce it, Amarasiriwardena is experimenting with solid-phase polymers, in the form of resin beads, which bind to the butanol as it is created. By soaking up the butanol, the polymers remove the fuel from the water in which the bacteria circulate. This allows the bacteria to produce more fuel.

"This UROP is one of the best experiences MIT offers," he says. "The postdoc who's mentoring me, Dr. David Nielsen, let me take control of the project and figure things out on my own."

Gaining Focus

UROPs not only introduce students to authentic research challenges but can also help clarify their academic choices. Amarasiriwardena, for example, found a new discipline. "When I came to MIT, I thought I'd go into biological or materials engineering," he says. "Now I can see that chemical engineering has a little bit of everything in it, and I got to put it all together through UROP."

Faculty, especially the 45 former UROP students now mentoring today's undergraduates, find that participating in the program adds a satisfying dimension to their teaching. "UROP is not just an experience," says Boyden. "It's a way to have

immediate impact on the lives of millions of people. I see UROP as the soul of MIT."

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Upcoming Events

[Lab to Market Workshop \(http://www.technologyreview.com/emtech/09/workshop.aspx\)](http://www.technologyreview.com/emtech/09/workshop.aspx)

Cambridge, MA

Tuesday, September 22, 2009

<http://www.technologyreview.com/emtech/09/workshop.aspx>

(<http://www.technologyreview.com/emtech/09/workshop.aspx>)

[EmTech 09 \(http://www.technologyreview.com/emtech\)](http://www.technologyreview.com/emtech)

Cambridge, MA

Tuesday, September 22, 2009 - Thursday, September 24, 2009

<http://www.technologyreview.com/emtech> ([http://www.technologyreview.com](http://www.technologyreview.com/emtech)

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[Nanotech Europe 2009 \(http://www.nanotech.net\)](http://www.nanotech.net)

Berlin, Germany

Monday, September 28, 2009 - Wednesday, September 30, 2009

<http://www.nanotech.net> (<http://www.nanotech.net>)

[2009 Medical Innovation Summit \(http://www.ClevelandClinic.org/innovations/summit\)](http://www.ClevelandClinic.org/innovations/summit)

Cleveland, OH

Monday, October 05, 2009 - Wednesday, October 07, 2009

<http://www.ClevelandClinic.org/innovations/summit> ([http://www.ClevelandClinic.org](http://www.ClevelandClinic.org/innovations/summit)

[/innovations/summit](http://www.ClevelandClinic.org/innovations/summit))

[Optimizing Innovation 2009 \(http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6\)](http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6)

New York, NY

Wednesday, October 21, 2009 - Thursday, October 22, 2009

<http://www.connecting-group.com/Web/EventOverview.aspx?Identificador=6>

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