

# CHEMICAL

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## Industrial Strength

### DuPont-MIT partnership gives students a preview of real-world research and life after school

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Unlike many research deals between corporations and universities, the management of the DuPont-Massachusetts Institute of Technology Alliance (DMA) has made education an integral component of the program from its outset. The alliance funds a number of fellowships for incoming graduate students and provides opportunities for collaborative research.



PHOTO  
BY CATHY GREENE

**CONSULTATION** Grad student Moore and his adviser, Griffith, enjoy academic freedom within the DuPont-MIT Alliance.

“It’s often assumed that when big money flows into a university, it is somehow not in the students’ interest,” says [Robert E. Cohen](#), a chemical engineering professor at MIT and an associate director of DMA. “We’ve had some very positive impact on the graduate enterprise at MIT.”

DMA was launched in 2000 to develop new biobased materials and enabling technologies

directly related to the strategic direction of DuPont's research and development. The original \$7 million annual budget included \$1 million earmarked for education. Unable to spend all of that money in its first five years, DuPont and MIT announced in May that their alliance would continue for another five years at a reduced funding level of \$5 million per year, with the amount for education also proportionately scaled back.

At first, program officials imagined that the educational activities would take the form of workshops, seminars, and short courses for DuPont executives, managers, and scientists, but officials quickly realized they just couldn't spend that much money on such activities.

"We realized that there was a much better use of those funds," Cohen says. Although the programs for DuPont employees continue, most of the education money is now allocated for fellowships for incoming graduate students. At first called DuPont Fellows, these students are now known as DuPont Presidential Fellows following integration into a larger MIT program.

The nine-month fellowships for first-year graduate students come with no strings. The students are free to concentrate on their courses and qualifying exams without teaching or research responsibilities. They are under no obligation to join a DMA research project later.

"A goal at MIT has been to uncouple the first year of graduate experience from the need to get involved in a pay-for-service research enterprise," Cohen says. "Students can select a thesis adviser from a position of strength and interest rather than need."

Cohen divvies up 14 to 18 fellowships per year among MIT departments that participate in DMA, which range from physics to the Sloan School of Management. The "center of gravity" has been in the engineering departments, Cohen says. The number of fellowships a department receives is only "loosely coupled" to the level of faculty participation.

"The participation of the chemistry department in DMA has been relatively small," Cohen adds. He thinks this is simply a reflection of the research interests of the chemistry faculty. Nevertheless, the chemistry department has received two fellowships each year. "I decided that you want to have chemistry students supported by this enterprise. We're always vigilant and hopeful that more participation [on the research side] will come from chemistry faculty."

The fellowships are only one way that DMA impacts graduate education at MIT. A larger, though perhaps less direct, effect is through DMA research projects.

DMA projects are funded through an application process open to the entire university. Professors submit two- to three-page white papers about their proposed research, which are independently reviewed at MIT and DuPont. That's the biggest hurdle. Only about 25% of the white papers are asked to be fleshed out as full proposals, though the success rate for that subset is generally around 90%.

Cohen convinced people at DuPont and MIT not to impose research areas from the top down and instead to see what faculty proposed on their own. "Could DuPont find in these white papers a portfolio of research that is perhaps even better than the one that they might have tried to invent for us?" he asks. "DuPont has been very good about taking topics that on the face of it are not exactly aligned with their interests."

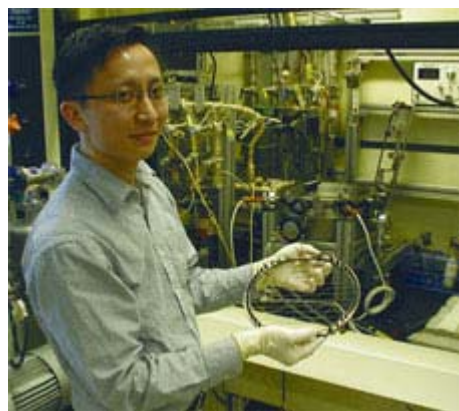
Each funded project has a liaison at DuPont, with whom the faculty and students regularly interact through video and phone conferences or face-to-face meetings.

For the students, one of the face-to-face opportunities is a research symposium held each September. The students and postdocs are the main attraction as they update DuPont executives and scientists on their progress. At the symposium, the students “have a chance to be a featured piece of the enterprise,” Cohen says. “The competitive juices are flowing among the graduate students. It's really quite a show.”

MIT chemical engineering professor [Gregory N. Stephanopoulos](#) is the principal investigator for a DMA project focused on three applications of metabolic engineering. His students get a chance to interact with DuPont scientists through bimonthly videoconferences and visits by the DuPont scientists.

One of Stephanopoulos' projects got started in 2001 when he, biology professor Anthony J. Sinskey, and grad student Maciek Antoniewicz gave a two-day summer course at DuPont. They described their work determining the flux of metabolites in microorganisms, something that DuPont was also interested in.

“We started talking about starting a collaborative project where most of the data analysis would be done at MIT but the experimental work would be done at DuPont,” Antoniewicz says. “That was a win-win situation for me because I was personally more interested in the theory.”



Kate  
Megquier/DMA photo

**IN THE LAB** Kenneth Lau, a postdoc and coprincipal investigator on a DMA project, with an array of filaments used in the chemical vapor deposition process.

Antoniewicz has developed general algorithms and software for analyzing metabolic systems and designing experiments to get the most information out of the system. “The DuPont project gave me another application to show the versatility of the tools I'm applying. It gives me an opportunity to showcase my work in a setting that is relevant for the industry.” He has appreciated the focus of the collaboration. “It forced me to develop tools I might not otherwise

have developed.”

Antoniewicz has known from the start that his career goals lie in the direction of academia. His positive interaction with DuPont hasn't changed that. And he anticipates more interactions after he leaves MIT. “Once I go into academia, I don't believe the interaction will stop, especially with one person whom I work closely with at DuPont,” he says. “I can see us developing a collaborative project, even if I become a faculty member somewhere.”

Some students get to do more than just meet DuPont researchers. [Yet-Ming Chiang](#), a professor in the department of materials science and engineering, has sent students to DuPont for extended visits. The grad students are the “glue” that holds the collaborations together, he says. “We have graduate students spend time at DuPont, especially in the summer when they don't have classroom responsibilities,” Chiang says. One student has spent two summers at DuPont, and another student made a couple of trips there this summer

Through these longer visits, the students “get a close look at how a team of highly accomplished professional researchers in an industrial environment operates,” Chiang says. “This is a good chance for them to see what life after MIT could be like.”

The DMA projects give students a chance to do research that will have life beyond the ivory tower. “It's so much fun for them to imagine and to realize that what they're doing has the potential for impact out in the real world,” Cohen says. “There is the possibility that their work will be a piece of a product or process at a well-known, high-end company. That has a certain attraction.”

Stephanopoulos credits the collaboration with providing focus for his group's research. By changing the particular metabolic pathway they were studying, Stephanopoulos and his students were able to concentrate “on an area that we knew at least one industrial sponsor was interested in,” he says.

Linda G. Griffith, a professor of biological and mechanical engineering, sees the industrial collaboration as an important part of her students' education. “Engineering students view interactions with industry as a very important part of their professional development,” she says. “Some of them are very focused on going into industry research positions when they graduate.”

One of Griffith's students-not officially working on a DMA project-parlayed the DuPont connection into a job. Griffith's lab is divided into two areas, one working on a “liver chip” to mimic liver metabolism and the other on biomaterials. Although DMA helps fund the liver chip Griffith was invited to present a tutorial at DuPont on biomaterials, which forged a connection with another group at DuPont. As a result, one of her students made contacts that led to a position at DuPont.

Another of Griffith's students, Corey J. Moore, learned about Griffith's research on the liver chip while an intern at DuPont. He already knew he was going to MIT, and he thought the project sounded interesting. “One thing led to another, and eventually I joined her lab,” he says.

Moore finds input from DuPont researchers valuable. "It's nice to touch base with people who have a lot of knowledge about the field so that we can make sure we're on the right track."

Simultaneously, the DuPont researchers with whom Moore interacts give him breathing room. "Some people might think that it might not be beneficial because it sounds like the company is trying to push you in a certain direction. That's not the case I have here," he says. "I feel like I have a lot of scientific freedom while at the same time having plenty of research direction."

DuPont gains from the interaction with grad students and postdocs as well. "There are aspects of the collaboration that young students and postdocs bring that are very important to DuPont: their perspective, their energy, their enthusiasm," says Vikram Prabhu, new ventures manager at DuPont. "These are brilliant people on their way to leading fabulous research. For us, it's of tremendous value to interact with these up-and-coming scientists."

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