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Green Chemistry Might Revive Science Training

Universities find that environmentally friendly chemistry draws more student interest--and could have an outsized impact on industry

By Sara Goodman

Slowly, the chemical industry is [going green](#).

Many companies are starting to emphasize reducing or eliminating hazardous substances to save money, reduce inefficiencies and promote their brands to consumers who [favor eco-friendly products](#).

"Industry really sees the value of 'green chemistry,'" said Julie Haack, assistant head of the University of Oregon's chemistry department. "If you want to recruit the best chemists, wouldn't it make sense to promote the opportunity to work in an environment where they can align their interest in the environment with their passion, which is chemistry?"

Having employees concerned about sustainability leads to more innovative, long-term solutions, said Neil Hawkins, vice president for sustainability at [Dow Chemical Co.](#)

"It's very important to us to have a pipeline of the best and the brightest students in science and technology, but that also have a broader perspective, as well, so they can understand the tradeoffs," Hawkins said. "This means balancing environmental, social and economic decisions."

Many universities are responding by creating a green-chemistry curriculum. Their efforts require addressing what green chemistry advocates call a fundamental problem in chemistry education: a lack of toxicology training.

"Students can earn a doctoral degree in chemistry in nearly every university in the

country and not have to demonstrate a basic understanding of toxicology or ecotoxicology how to design a molecule that doesn't disrupt the endocrine in some way," said Michael Wilson, assistant research scientist at the University of California, Berkeley.

But students, faculty and industry are starting to change that by pushing for programs and courses about alternate design principles, slowly shifting chemistry education.

The University of Oregon a leader in the movement began an outreach program nine years ago that teaches professors nationwide about integrating green chemistry into a curriculum. Haack said that effort has driven up demand for green-chemistry courses nationwide and has led to changes in how students and faculty approach chemistry.

"We've seen subtle shifts," Haack said in an interview. "Instead of students questioning the mechanics of something, now they're thinking about chemistry as a tool for sustainability. They're excited about the possibility of designing out hazards."

'Breaking down walls'

Colleges and universities are eager to tap this enthusiasm to revitalize interest in science, which has been flagging for years. Oregon, for example, offers courses in other disciplines that address green chemistry, including ethics, marketing and public policy development.

The university has an online database that collects education materials focused on green chemistry and allows professors and other interested parties to share insights and questions about teaching techniques and field studies. The database currently lists 240 individuals from around the country who have expressed professional interest in green chemistry.

Some see green chemistry as a vehicle for crossing lines between academic disciplines. The University of Oregon, for example, has 11 faculty members doing green chemistry research in some capacity in various departments.

"There has been far too much fragmentation in academia," said Paul Anastas, director of the [Center for Green Chemistry and Green Engineering](#) at Yale University. "That is the tradition which things like green chemistry and sustainability are battling against by bringing together different perspectives and breaking down walls."

Dow has also been working to promote a cross-disciplinary approach to education, Hawkins said. The company in 2007 launched a collaboration with the University of California, Berkeley, to create a university-wide program to address a wide range of issues from expanding water supplies to measuring the environmental impacts of products' supply chains.

"In the area of sustainable chemistry, it's really important that we look at all of the different dimensions, because technology alone is not the answer," Hawkins said.

"Having a broad experience, not just in the technical field but looking at the business aspects as well as the social aspects, is extremely important for the executives, managers and leaders of tomorrow."

The company last year also began the Dow Sustainability Innovation Student Challenge award, which brings together six universities the University of Michigan, Northwestern University, Tufts University, the University of Cambridge, Brazil's University of São Paulo, and China's Peking University to recognize innovative student projects.

"If you look at the quality of the projects, you'll see that young people today are on fire to take their skills and know-how and make a difference in the world," Hawkins said. "As we go out and recruit, to virtually any place on the planet, these issues of sustainability are very important to students students want to know what a company does in this space."

Market forces

The far-reaching implications of green chemistry and design spreading across disciplines and applications suggest that the field has tremendous potential for growth, Yale's Anastas said. Green chemistry applications make up 1 percent of the total chemical market share, Anastas estimated.

Hawkins predicted that the drive to expand green chemistry will come from the market, not regulations.

"Back 20 years, the world was dealing with these issues more in a regulatory way," Hawkins said. "What we see today, with cap and trade or other systems, are really economic models for helping the private sector become a part of the solutions in a sustainable way. Technological and innovative business models can help fuel a more sustainable economy."

Ultimately, UC Berkeley's Wilson said, market forces rule.

"You have to get the market working properly," Wilson said. "Once you do that, demand for trained chemists who understand green chemistry and toxicology will ramp up. Universities will respond, as will research."

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