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Mad Scientists? IWU Faculty Writing Revolutionary New Chemistry Curriculum

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BLOOMINGTON, Ill.--"Mad scientists" at Illinois Wesleyan University? Some might think so, after discovering the amazing new product being concocted by the chemistry department.

Chemistry faculty and students at IWU are continuing work on their unique creation, a revolutionary new two-year curriculum devised under a $140,000 three-year grant from the National Science Foundation (NSF).

Under the NSF grant, four IWU professors are writing new chemistry textbooks and lab manuals, merging general and organic chemistry concepts typically segregated in the first two years of college chemistry.

The "Lab" Schedule

According to Tim Rettich, chairperson of IWU's chemistry department and project head, the new chemistry curriculum is proceeding as scheduled. Sixteen chapters of the first textbook are completed, and this spring Rettich will edit the rough draft while on leave from teaching.

This first book must be completed by summer to introduce the new curriculum next fall. According to David Bailey, director of IWU's natural sciences division and editor of the second textbook, three-fourths of the second textbook has been written. Bailey hopes to edit and complete the manual by summer of '98.

Joining Rettich and Bailey on the project are IWU's Forrest Frank, associate professor of chemistry, and Jeff Frick, assistant professor of chemistry.

Initially, the IWU faculty will publish the new chemistry texts and lab manuals. However, after the new chemistry curriculum has undergone a trial run and revisions, a commercial publisher will be sought, perhaps next year.

"Once we actually teach the new material, we'll have to adjust the texts

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as needed," Rettich explained.

A Fizzling Formula

Traditionally, college freshman are exposed to one year of general chemistry, a highly quantitative and physical course, and a second year of organic chemistry, the study of carbon-containing compounds.

However, the strictly separated courses pose difficulties for college chemistry students. Because first-year general chemistry is more mathematically oriented, Bailey believes that it leaves many freshman fizzling.

"Not all students are yet comfortable," he explains, "because math is a struggle for many freshman."

Rettich says another problem in teaching college chemistry is creation of artificial barriers between general and inorganic chemistry.

"The walls are frustrating for students, they can't make the connections between inorganic and organic," Rettich explains. "We're sending them mixed messages that there's no unifying quality to chemistry."

Frick credits some of this lack of continuity in chemistry education to over specialization, tradition, and a mentality that says, "it's always been done this way."

The New-and-Improved Formula

Under the new curriculum, chemistry no longer will be divided into general and inorganic, but will combine both areas throughout the two-year curriculum. This format also will allow more difficult mathematical concepts to be postponed until the second year.

"We took the information from the first two years, put it into a blender, and poured it into a new mold," Bailey explains.

Frank believes this new mold will produce a "kinder and gentler subject, which is important since chemistry can be an intimidating subject."

Laboratory methods also will be altered to match the new teaching practices. According to Rettich, students will be involved in more group

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work extending into multi-week projects. Students also will analyze their lab experiments earlier than traditional lab manuals have allowed.

"Instead of hiding all the nice toys until organic, they'll actually see some of those in practice in (first-year) labs," Rettich laughs.

Faculty benefits also will emerge from the new curriculum equation. Frick explains, "It will give them a new outlook on how to teach chemistry and maybe on chemistry itself. It also will help breakdown barriers separating disciplines and perhaps increase interaction among colleagues."

Reshaping the Elements

Redefining chemistry education has its challenges. In addition to finding the time to work on the project while teaching, the professors confess to difficulties in finding a fresh viewpoint.

"It's a personal challenge to start with a new perspective between what students need to know and what has been traditionally taught," explains Rettich.

"When you've been doing general chemistry for 16 years, there is a challenge to find something new," adds Bailey.

Joining them in facing the challenges of crafting a new chemistry curriculum is a five-member advisory committee organized to supervise project implementation and evaluation. Committee members are:

- William Bordeaux, Jr. of Huntington University in Huntington, Ind.
- Mauri Ditzler, dean of Millikin University in Decatur, Ill., and a renowned expert in chemical education.
- Pat Holt of Bellermine University in Louisville, Ky.
- Doris Kolb, assistant editor of The Journal of Chemical Education.
- John Moore of the University of Wisconsin-Madison in Madison, Wis.

The Eager Assistants

The NSF grant requires IWU to broadly disseminate the new chemistry curriculum. A portion of grant funds is earmarked to support alternative test sites, where faculty at other campuses also can become "mad scientists" and test the program in their classrooms and laboratories.

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Joining IWU as alternative test sites are Bellermine University in Louisville, Ky., Huntington College in Huntington, Ind., and Illinois College in Jacksonville, Ill.

Testing the Formula

The IWU chemistry team formally introduced the new curriculum in October '95 at a meeting of the Midwestern Association of Chemistry Teachers in Liberal Arts Colleges meeting.

In May of '96, the group presented their ideas at a regional meeting of the American Chemical Society (ACS), where they were invited to the national ACS meeting to discuss a blended organic/inorganic form of chemistry education.

In April, they will present the curriculum at the national ACS meeting in San Francisco, Calif., and the 8th National Conference on College Teaching and Learning in Jacksonville, Fla.

According to the group, feedback from the professional societies has been extremely positive.

"Every meeting we come from, we're pumped up further towards the project," Bailey exclaimed. "They're giving us feedback that this is a wonderful method, the way chemistry should be taught."

Although student evaluations are pending, IWU students involved in the project praise its value.

"The program has lots of benefits, especially since general chemistry texts leave out a lot of aspects of the chemistry field," commented Davis.

Once the new curriculum has been implemented, students will be queried about the program. They also will be tested using final exams developed by ACS. The ACS program, according to Bailey, has been in place for 50-60 years, providing a long term national database to compare student performance in the traditional and the new IWU chemistry courses.

"One way we'll know if we have reached our goal," Frank said, "is if more people are taking chemistry and if student retention increases. I'd like to see more students give chemistry a chance. I want them to give it an honest shot--and not just become discouraged."

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The National Science Foundation

The grant is from NSF's Undergraduate Course and Curriculum Development program. IWU's award is one of about 100 new grants made by NSF's Division of Undergraduate Education (DUE) in response to almost 500 proposals submitted. Under terms of the grant, IWU will contribute $9,520 to the project.

DUE, Rettich points out, also read chemistry education literature and saw problems with the way general chemistry traditionally has been taught. In 1995, seed money was provided to get people to rethink the chemistry curriculum from the ground up.

Bailey believes IWU was selected by NSF because of its strong track record. "IWU has an excellent record," he said. "We turn out good students."

"I hope NSF picked IWU for this job," Frick said, "because they saw a dedicated group of faculty who work well together."

Frank believes the NSF grant represents a "big chance for a little school."

The "Mad Scientists"

Members of IWU's chemistry faculty participating as "mad scientists" in the new chemistry curriculum project are:

Tim Rettich

Rettich earned a bachelor of science degree in chemistry at the University of Dayton and a doctorate in physical chemistry from Case Western Reserve University.

Rettich, who joined the IWU faculty in 1981, also has served on the faculty at Wright State University and his research has been funded by the National Institutes of Health (NIH).

David Bailey

Bailey earned a bachelor of science degree from Juniata College in Huntingdon, Pa., and a doctorate from the Massachusetts Institute of Technology. Before joining the IWU faculty, he taught at Gustavus

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Adolphus College in St. Peter, Minn., and Lebanon Valley College in Annville, Pa.

In the mid-1980s, Bailey devised a reliable and cost-effective test, in cooperation with State Farm, to determine whether life insurance policy applicants have smoked in the past 24 to 36 hours.

Forrest Frank

Frank earned a bachelor of arts degree from Grinnell College in Iowa and a doctorate from Purdue University in West Lafayette, Ind.

Frank began teaching an innovative course, "Chemistry and Crime," in 1985. It provides non-science majors an introduction to basic chemistry principles and techniques by studying scientific aspects of evidence. A 1989 sabbatical took Frank to London, where he worked at Scotland Yard, focusing on new fingerprint detection and reproduction methods.

Prior to joining the IWU faculty in 1965, Frank was employed as a research chemist at Rayonier, Inc., of Whippany, N.J.

Jeff Frick

Frick earned a bachelor of arts degree in chemistry from Augustana College in Rock Island, Ill., and a doctorate in chemistry from Loyola University of Chicago. He was a postdoctoral research associate at the University of California-Berkeley before joining the IWU faculty in 1992. His research interest is the synthesis and activity of biologically important compounds.

Chemistry at IWU

IWU has 61 chemistry majors, and according to Rettich, about 130-160 students take general chemistry annually.

"The bulk of IWU's chemistry majors--perhaps two-thirds to three-quarters--go on to advanced degrees such as doctorates in chemistry or medical degrees," Rettich said. "A number of our chemistry majors are going into law and working in areas like environmental and patent law. Some go into high school teaching and we would like to encourage more of them to do

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that."

IWU, founded in 1850, enrolls about 1,900 students in a College of Liberal Arts, College of Fine Arts, and a four-year professional School of Nursing. A $15 million athletics and recreation center opened in the fall of 1994; and a $25 million science building opened in the fall of 1995. The $4.6 million Center for Liberal Arts--a facility housing 60 faculty offices, six classrooms, and other facilities for social science, humanities business and economics, and interdisciplinary studies' faculty--is slated to open next August, as well as a new $6.5 million residence hall. The Carnegie Commission for the Advancement of Teaching promoted Illinois Wesleyan to a "Baccalaureate I" institution in 1994, a classification that places it among 161 highly selective National Liberal Arts Colleges in the annual *U.S. News & World Report* rankings. *Barron's Profiles of American Colleges*, another respected college guide, rated IWU "highly competitive (+)" in its latest edition.

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