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How They Did It: Computational Science

By Karin Fischer

Collaboration is the key ingredient in creating new programs in computational science, say academics in the field.

A handful of American colleges offer studies in the up-and-coming discipline, which uses mathematical modeling and computer simulation to solve complex problems in business, technical, and academic research. Aeronautical engineers rely on computer simulation to determine air flow and pressure on airplane wings, for example, while astronomers use models to better understand the creation of galaxies. Forensic scientists apply computational tools to recreate car crashes.

The interdisciplinary nature of computational science makes it essential to get other campus departments involved. Curricula differ from college to college but typically include advanced mathematics, high-performance computing, computer simulation and modeling, and advanced course work in particular science and engineering

fields.

The State University of New York College at Brockport has one of the earliest programs, started in 1998. The curriculum was drafted by a panel of professors; new faculty members then were hired to teach, says Osman Yasar, the program's first director. Two years after its founding, the program became a separate department.

Faculty members in other departments hoped that combining computing technology with other scientific disciplines could help reverse flagging enrollments in those departments, says Mr. Yasar, a professor of computer science. Typically about half of Brockport's computational-science majors earn a second major in another field.

Computational science also had strong advocates in the dean and the president of the college at the time, who saw the field as a way to distinguish Brockport and attract top-flight students, says Mr. Yasar.

Resistance at First

At Oregon State University, computational science ran into resistance from traditional departments.

Rubin H. Landau, a physicist who taught at the university, became interested in computing 40 years ago, as a graduate student, as a way to wrestle with scientific problems. The discipline gave him an edge in his research because few other physicists had computing

backgrounds. It wasn't until 1996, though, that he decided to offer his first class in computational physics.

Mr. Landau slowly increased computation-related course offerings and worked with colleagues from mathematics and computer science to develop course work at Oregon State. When it came time to propose a stand-alone degree program, about seven years ago, he won university and state approval for computational physics, but was unable to persuade other science departments to create similar majors. Faculty members in those departments tend to see computational work as peripheral, and as something they would not get rewarded for at promotion and tenure time, he says.

That continues to frustrate Mr. Landau, who retired this year. "The tool set," he says, "is the same in all fields."

Statewide Partners

In Ohio the path has been not just multidisciplinary but also multi-institutional. The Ralph Regula School of Computational Science, a joint venture of the state's colleges, universities, and other educational institutions, is statewide and virtual, allowing students to take computational-science courses offered by a dozen partners, including both public and private and two- and four-year institutions. If students cannot find appropriate courses on their home campuses, they can take them by distance education through another participating college.

Thus far students can earn only minors or certificates, awarded by their home institutions. But Richard G. Gass, a research associate in physics at the University of Cincinnati who is its point person on computational science, says the demand is there, but dispersed.

"The dean wouldn't have approved the course if there were only five students from Cincinnati enrolled," Mr. Gass says. "But if there are two more from Ohio State and another three from Toledo, then that's a course that makes sense to run."

The Regula school also has strong backing from state business leaders, who helped draft the goals for students' skills that have guided each institution in developing its courses. Ohio-based companies, like Goodyear and Procter & Gamble, are heavy users of computational modeling and simulation in their product development, notes Steven I. Gordon, the school's executive director.

Michael E. Bellor, who earned both bachelor's and master's degrees in computational physics at Brockport, says his studies gave him a solid grounding for work in software development at a Lockheed Martin supercomputing center near Washington. In fact, he says, when his bosses are making new hires they often look for people who combine his skills in math and computer science.

Computational science "gives you a whole range of skills," Mr.

Bellor says. "We've had positions sit open for months because we couldn't find the right person."