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### Computational Science Spans Barriers Between Traditional Disciplines

By FLORENCE OLSEN

Every science and engineering discipline, whether it is materials

**ALSO SEE:** \_\_\_\_\_ science, biology, or meteorology, struggles with the "grand challenge" problem of a Model Effort \_\_\_\_\_ modeling "the enormous time scales and \_\_\_\_\_ spatial scales of the phenomena we are trying to understand," says Yousuff Hussaini, the founding director of Florida State University's School of Computational Science and Information Technology.

The new school, which is awaiting the Board of Regents' approval of its graduate-degree programs, will take an approach that is anything but traditional, Mr. Hussaini says. In traditional schools, the barriers between disciplines and departments "are extreme." The new school, he says, "is a first step toward pulling down those barriers."

Cutting across computer science, mathematics, engineering, and other disciplines, the computational-science school brings together knowledge and problem solving to meet the challenges of multi-scale modeling, Mr. Hussaini says. Scientists find it immensely difficult to write computer programs that give both large and small snapshots of the same dynamic process -- snapshots, for instance, of both global tradewinds and local thunderstorm cells.

Florida State administrators say that an International Business Machines supercomputer purchased for the school may help Florida State attract more researchers who are interested in science problems that require multi-scale modeling. "So many disciplines can benefit," says Lawrence G. Abele, provost and vice president for academic affairs.

Last year, Florida State hired Geoffrey Fox, a physicist from the California Institute of Technology, as the first director of the school's computational- and information-science laboratory.

Mr. Fox, sounding more like an evangelist than a physicist, says, "I believe in computational science. I've believed in it for a long time."

To make progress in modern physics, he says, a researcher must acquire "deep knowledge" of computer networks by studying the architecture of parallel supercomputers and by becoming familiar with key developments in software.

"One advantage Florida State has over other places is that it's expanding," Mr. Fox says. The computational- and information-science school, which is just a year old, has the financial resources to hire 30 new faculty members, he says, noting that there are still 20 faculty positions to fill.

Administrators are seeking professors in the fields of climate dynamics, structural biology, materials science, hydrogeology, basic science, and computer science -- almost any scholar whose research requires high-performance computing. Computational climate dynamics, for example, is a discipline that fuses the traditional disciplines of meteorology, oceanography, and geography. "We want to do a few very large applications that have great significance," Mr. Fox says.

Florida State is not the first institution that has recognized the value of computational science. The State University of New York at Brockport is among the few institutions offering undergraduate as well as graduate degrees in computational science.

The primary components of computational science -- computer modeling and visualization techniques -- are immensely useful for studying things that are otherwise too big, too small, too expensive, too scarce, or too inaccessible to study, says Osman Yasar, a professor who is chairman of the computational science and engineering department at Brockport.

But for the most part, academe has been slow to accept computational science as an interdisciplinary academic field, Mr. Fox says. "Industry and the national labs have endorsed computational science more than has academe," he says.

With advances in supercomputers and the World Wide Web, he argues, "we are, in some sense, living in a golden age for computational science and information technology."

But even a golden age brings new challenges. Along with tremendous hardware development over the past 40 years, there have been equally vast improvements in algorithms, the instructions that computers are asked to follow, says John P. Boyd, a professor of atmospheric, oceanic, and space sciences at the University of Michigan at Ann Arbor.

"But as computers have more and more processors," he says, "the

challenge of making algorithms that run efficiently on them keeps getting amplified."

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