There are as many ways of doing that as there are schools in the program. But the governing principle for all is a shift from sheer volume of facts to understanding the scientific process, says biology teacher Mike Brugh of Luther Burbank High School in Sacramento. And the trick to teaching that understanding, Brugh says, is to find subjects that will engage the students' interest and exploit them as examples of scientific reasoning.

For example, Brugh has created a unit in forensics for his ninth graders, "because kids love blood and guts." Not only does forensics use principles of physics, chemistry, and biology, but the unit will also teach students to think in the way scientists do, asking questions such as: How do you know what's true? What evidence do you have? Why do you believe it? How would you test it? "They will have to learn the skills of observation," Brugh says, "in order to tell who killed who."

Creativity like Brugh's is an asset. But with science teachers all going their own way, the result could be chaos. Yet Sachse thinks the chaos will be creative—that from it the best ideas will emerge and be widely adopted. To assist in that process, the state has set up a computer network through which teachers can share ideas.

How soon will anyone know if this revolutionary, bottom-up educational experiment is working? Evaluation of the project will begin almost immediately, with surveys to determine student interest and the effectiveness of the teaching materials. But the real test will be when the first students graduate from the 7-year program and are tested for scientific ability against their peers in traditional schools.

Meanwhile, NSTA's Aldridge is just a bit worried about the California experiment. Eager as he is to see his own idea adopted, he wonders whether California is plunging in without enough control from the top. He favors the moderate approach taken in the Baylor project, where Linda Crow will work closely with every teacher in the three Houston schools that will introduce SSC this fall. "Linda had the foresight to focus her resources," Aldridge says. "She will be meeting with her teachers each week. You can't do that when you've got 100 schools. They're going to have to rely more heavily on their own resources."

Sachse acknowledges that some of his colleagues share Aldridge's view. But he decided to put faith in his teachers and move ahead, based on the notion that science education is too desperately in need to justify waiting. "It's man the torpedoes now," he says, "if we're really serious."

■ MARCIA BARINAGA

Turning Teachers on to Science

Chicago—After a long career studying elementary particles, Leon Lederman is now making his presence felt in elementary education. The former director of the Fermi National Accelerator Laboratory has persuaded a clutch of organizations, including two federal agencies, to sponsor an ambitious effort to train 17,000 Chicago public school teachers in science and math. The goal is to expose 3000 teachers a year to the latest techniques for teaching science and math to kids from kindergarten through high school. And, to help fire up the teachers' enthusiasm for science, they will get a chance to do some experiments themselves at Fermilab, Argonne National Laboratory, and other science centers around Chicago. A new institute, the Academy for Mathematics and Science Teachers, is being established on the campus of the Illinois Institute of Technology to run the effort.

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Leon Lederman

Lederman, who is now science adviser to the governor of Illinois, first hatched the idea of such an academy 2 years ago as the result of a conversation with Energy Secretary James D. Watkins. A long-time advocate of getting the national labs involved in education, Watkins promised to help secure federal funds for such an initiative. Lederman then quickly convinced Mayor Richard Daley, Governor James Thompson, local schools, and science centers to support it.

His dream will finally take shape with the recent announcement from the Department of Energy that it will give the academy a $215,000 planning grant this year and $2 million next year. The National Science Foundation is also providing $200,000 to help get the venture off the ground. The academy will open its doors to the first batch of 50 teachers in December. When it is in full swing, it should have a staff of 100 and a budget of more than $30 million.

Some critics have argued that an academy to upgrade Chicago teaching should focus on reading rather than on science and math. But Lederman points to the crisis in science education, which remains in a dismal state 7 years after the 1983 "Nation at Risk" report warned that poor preparation in science and math among U.S. students will harm the nation's economic competitiveness. "What better place to start than Chicago, which has been called the worst school system in the country," says Lederman, who hopes the academy will emerge as a model that can be copied in the nation's largest 25 cities.

A lot of the credit for fleshing out Lederman's idea goes to Gordon Berry, an atomic physicist at Argonne who is on loan to the academy as acting director, pending the appointment of a permanent director by the academy's board of directors. Berry, together with the education staffs of Fermilab and Argonne, put together the academy's program. In addition to doing some hands-on science themselves, teachers will receive what the academy calls professional development once a week for 10 weeks from instructors experienced in using innovative teaching programs for science and math. Academy staff members will observe the teachers in their classrooms after they complete the program and offer them advice. The academy will also develop new instructional materials and work with local colleges and universities to help revamp teacher training programs.

A key objective, says Berry, is to teach children how to apply principles learned in science and mathematics to real-life situations. But the academy is facing a tough challenge in changing the real-life situation facing many Chicago schoolteachers. "Many teachers of elementary and secondary mathematics and science lack deep understanding of the content of their subject areas," says a report issued by Berry for the academy. "Underqualified teachers cannot be expected to inspire confidence, excitement, and competence in their students."

Lederman stresses that the involvement of scientists in the Chicago area will be critical to the academy's success. "It's the ultimate responsibility of scientists to train young people to ensure our future. And we'll be beating them with whips until they spend time at the academy," he added with a laugh. ■ MIN-WEI LEE

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