

the idea that by editing a piece the journal gets the copyright is strange. Instead publishers should be paid for coordinating peer review, improving readability, and publishing papers with open access on the Web. We [at CERN]

think this is the way scientific articles should be published.

PT: And what will you do next?

AYMAR: I don't quite know. I may retire permanently this time.

Paul Guinnessy

Sandia heads up new nanoengineering institute

Preparing students to work in teams that cut across disciplines and research sectors is a key aim of Sandia's latest educational program.

"Engineering is changing incredibly rapidly, and engineering education must change in major ways in response," says Paul Percy, dean of engineering at the University of Wisconsin-Madison. "The boundaries between science and engineering are fading. Thirty or forty years ago, people worked alone and in small teams. If you think about the next generation of solutions to complex problems, they're going to be obtained by large interdisciplinary teams."

Forging the mindset and connections to nurture large interdisciplinary teams is the aim of the National Institute for Nano-Engineering, a partnership among industry, government, and university researchers that is getting started with the Department of Energy's (DOE's) Sandia National Laboratories in New Mexico as its base. Besides Sandia, 12 universities and 7 companies make up NINE's founding members, but the partnership is open to expansion, and researchers from any

university can participate, says Duane Dimos, Sandia's director of materials science and engineering. NINE's main focus is on undergraduate and graduate students, including developing curricula in nanoscience and nanoengineering that will be both used within NINE and shared openly with academic institutions. "NINE will impedance match to broker internships with industry and collaborations with Sandia," says Paul Fleury, Yale University's dean of engineering.

Hundreds of students

Dimos points to institutes in Europe, Singapore, and South Korea as models for NINE, singling out the 23-year-old IMEC—the Interuniversity MicroElectronics Center in Belgium. In microelectronics and nanoelectronics, he says, "IMEC has become a strong player throughout Europe, and it has a large industrial component. By combining what they do at the center with what they do at their home universities, stu-

dents are getting a really interesting education. We are emulating that, although we will add our own twist in that universities might be more active in driving the program [at NINE]."

Many practical matters are still being worked out, says Dimos. "We anticipate having a central facility in Albuquerque next to the Sandia campus." Participating researchers would work at both Sandia and partner institutions, and they would have access to equipment at Sandia, such as the Microsystems and Engineering Sciences Applications facility (see PHYSICS TODAY, October 1999, page 65).

The institute kicked off this past July with a two-week workshop at Sandia attended by three dozen undergraduate and graduate students. Some 13 projects are under way in topics such as nanowire electronics, flow and rheology of nanomaterials, catalytic function of nanomaterials, and manipulation of nanowires, Dimos says. The goal, he adds, is to eventually involve a couple hundred undergrads and a similar number of graduate students.

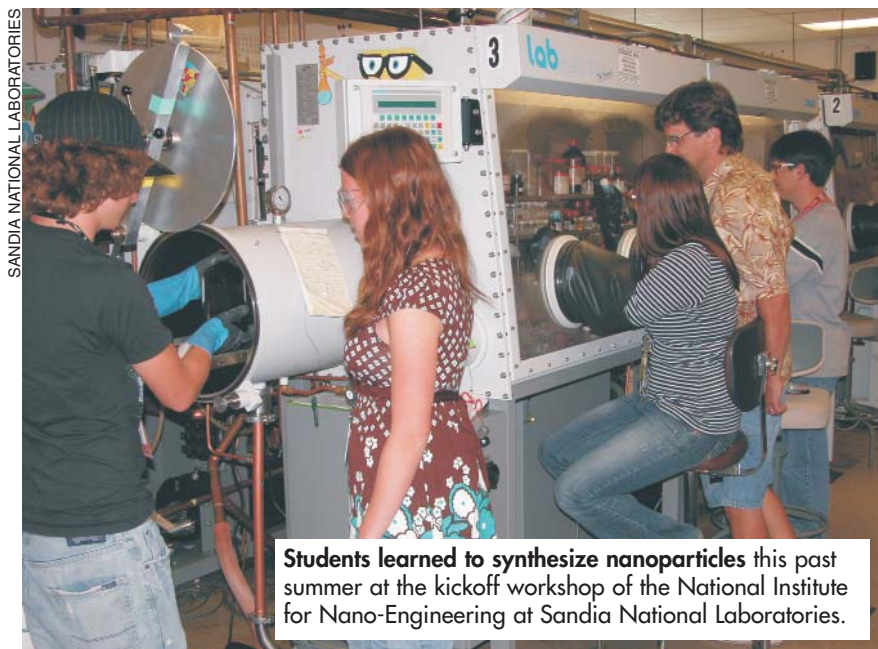
Industrial guidance

"There is a strong belief at Corning that education is falling short of expectations," says Daniel Ricoult, the company's director of technology assessment. "That's why when we heard about the concept of NINE, we were intrigued. It's a nice way to build bridges between industry and academia."

Sharon Smith, who leads Lockheed Martin Corp's efforts in nanotechnology, agrees: "We have to have a really good pipeline of talented scientists and engineers, and we see NINE as an exciting program that will benefit us in the future." Her company, she adds, hires 5% of new engineering bachelor's recipients in the US each year.

"We see nanotechnology as a key area," Smith says, "because it's going to impact virtually every aspect of our business." New materials are lighter and stronger and have new capabilities, she adds, citing as applications multifunctional materials, embedded sensors, and energy. "We have no lack of problems to be solved."

NINE's industrial partners will provide guidance on the technical directions of research, Smith adds. "We will be looking for areas of research that will benefit our industry as a whole, and we will be looking to provide a unique experience for students to learn how what they do in the NINE program could benefit industry." As part of the collaboration, she adds, NINE partners are



Students learned to synthesize nanoparticles this past summer at the kickoff workshop of the National Institute for Nano-Engineering at Sandia National Laboratories.

Founding NINE partners

The founding partners of the National Institute for Nano-Engineering are Sandia National Laboratories; Corning Inc; Exxon Mobil Corp; IBM; Intel Corp; Goodyear Tire and Rubber Co; Lockheed Martin Corp; Procter and Gamble; Harvard University; Harvey Mudd College; Rensselaer Polytechnic Institute; Rice University; University of California, Davis; University of Florida, Gainesville; University of Illinois at Urbana-Champaign; University of New Mexico; University of Notre Dame; University of Texas at Austin; University of Wisconsin-Madison; and Yale University.

working on an overarching agreement on how to handle intellectual property "with the understanding that there may be cases for which the agreement has to be altered."

Sandia has jump-started NINE with \$7.5 million for collaborative research projects. The institute needs funds for a central building plus an annual budget on the order of tens of millions of dollars to pay for research, travel, and curriculum development, Fleury says. Industrial partners may contribute funding, although that is not part of the

current agreement. Rather, NINE coordinators have their hopes pinned on applying to DOE for funding as one of the Discovery Science and Engineering Innovation Institutes outlined in the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act. The COMPETES Act was signed by President Bush on 9 August (see PHYSICS TODAY, September 2007, page 34), but it's too early to say which aspects of it will ultimately be funded.

Toni Feder

Nanotech risk research takes slow step forward

A little more than a year ago, in the House Committee on Science and Technology hearing room on Capitol Hill, then committee chairman Sherwood Boehlert (R-NY) accused administration officials responsible for developing safety standards for the emerging field of nanotechnology of merely "sauntering" toward their goal.

Officials with the federal government's Nanotechnology Environmental and Health Implications (NEHI) Working Group listened glumly as Representative Bart Gordon (D-TN), who has since become the committee chairman, went on to describe the nanotech safety report they had delivered to him just the night before as "a very juvenile piece of work."

NEHI returned in August 2007 with a new research priorities report that administration officials are calling the "second step" on the road to developing a comprehensive program to understand the potential environmental, health, and safety (EHS) issues arising from engineered nanoscale materials. The new report condenses the 75 research proposals in last year's document to 25 priorities in five categories of EHS research.

Although the latest report has yet to draw a reaction from Congress, others involved in nanotech EHS issues offer lukewarm reactions. "It is probably a step in the right direction, but an incred-

ibly small step," said Andrew Maynard, chief science adviser to the project on emerging nanotechnologies at the Woodrow Wilson International Center for Scholars in Washington, DC. "This is where we should have been a year ago, and we should now be talking about broad strategic frameworks rather than picking away at the problem by taking a long list of research needs and making a small list of research needs."

Patrick Lin, an ethicist at California Polytechnic State University in San Luis Obispo, and cofounder of the Nanoethics Group, said the new report "looks okay for what it is," but noted "several major things missing: a budget, a timeline, and a strategy. And there is no mention or proposal that EHS work should happen in parallel with nanotech research."

"Scientists these days must share responsibility in investigating the impact of their creations on society," Lin said. "You can't have on one side the science and on the other side, after the fact, the environmental, health, and safety issues. They should be done together."

Clayton Teague, director of the National Nanotechnology Coordination Office, is aware of the criticism that nanotech-related EHS issues are just "sauntering" along, but he said a lot of behind-the-scenes work has taken place. "I'm comfortable with the pace with which the federal government is moving

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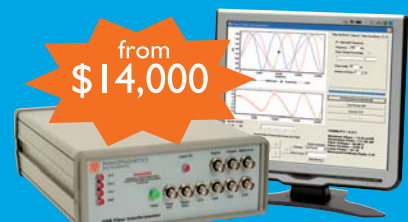
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