

Ray Orbach Asks Science to Serve Society

For a decade, chemist Radoslav Adzic has explored the basic structure of metal-electrolyte interfaces at Brookhaven National Laboratory in Upton, New York. His employer, the U.S. Department of Energy (DOE), has long sponsored fundamental science on catalysis in such systems in hopes of making hydrogen fuel cells efficient enough to one day replace fossil fuels as an energy source. But it wasn't until 2004 that Adzic decided to tackle a research question with more direct applications: how to use monolayers of platinum to build cheaper fuel cells, focusing on hydrogen.

It wasn't a random decision. The year before, President George W. Bush had proposed an 8-year, \$1.2 billion hydrogen fuels program that would begin with applied engineering studies. After attending a DOE-sponsored workshop to discuss the basic research needed to turn hydrogen into a commercially viable fuel, Adzic won a \$700,000 grant to study how monolayers of platinum could lead to cheaper fuel cells. Although it's still basic research, there's a clear product in mind.

That program, and others like it, reflects changes sweeping through DOE's \$4-billion-a-year Office of Science under the leadership of Raymond Orbach. A physicist and former chancellor of the University of California, Riverside, Orbach joined DOE in 2002 and has won praise for grafting an applied component onto DOE's basic science portfolio without diluting the quality of the research itself. Michael Lubell, a lobbyist for the American Physical Society, calls the hydrogen funds "a testament to Ray" and praises his success in enlarging the pot for such work without ceding control of it to more technology-focused parts of DOE. Adzic agrees: "Rather than just characterizing a system, I'm helping to solve certain showstoppers."

Bolstering research on hydrogen fuels is only one of Orbach's achievements. He's also brought international renown to DOE's once-puny civilian supercomputing program and made progress on lab safety procedures. And physical scientists applaud how he helped his boss, Energy Secretary Samuel Bodman, sell the White House on a 10-year doubling of federal spending in the physical sciences by emphasizing its role in U.S. competitiveness (*Science*, 17 February, p. 929).

In June, Orbach donned a second hat by becoming the department's first undersecretary for science. His mission: Optimize the research goals that span DOE's work in energy, science, weapons, and waste by offering the fruits of the Office of Science's basic research portfolio to the rest of the agency. "There isn't a single thing that DOE does that's not grounded in science. [So] having someone who can ask scientific questions [about] each of the missions is crucial," says David Goldston, staff director of the House Science Committee. "He's the perfect person for the job."

Keys to the kingdom. No one doubts that fundamental research could better fulfill energy needs. A 1997 report by the President's Council of Advisors on Science and Technology, for example, called for "better coordination" between basic and applied energy research. "Everyone knows it's a problem, but nothing's happened," says physicist George Crabtree, a manager at DOE's Argonne National Laboratory in Illinois.

One obstacle is the current rewards system in academia. Take the science behind superconductivity, which holds the promise of low-resistance power lines or incredibly efficient transformers. The kind of discovery that earns a scientist a paper in a top journal—learning why a material changes phase at a certain temperature—is too theoretical to help a company trying to make superconducting materials. But a commercially valuable yet incremental improvement in that technology wouldn't interest those top-tier journals. So a scientist might not even bother to record such an advance. "If the currency is just *PRL* [*Physics Review Letters*], *Nature*, and *Science*, you'll just move on," says materials scientist John Sarrao of

Los Alamos National Laboratory in New Mexico.

Another barrier to developing new technologies, says Bodman, is DOE's current compartmentalized bureaucracy. In July, he sent out a memo giving Orbach "detailed access" to DOE's vast empire, hoping that regular meetings among disparate programs will break through that mentality. It's not a new concept, Orbach says, but "what's new is the intensity and importance" of those meetings.

Money greases the wheels of cooperation. In addition to the hydrogen initiative and a similar effort in solar energy, Orbach has called for \$250 million for biofuel start-ups involving industrial scientists, technologists, and genomicists (*Science*, 11 August, p. 746). Sharlene Weatherwax, a DOE program manager, says a previous partnership with DOE's technology program might have consisted of a single grant.

Orbach knows that change doesn't come easily for areas, such as nuclear weapons development, that have traditionally been walled off from civilian research. In initial meetings with applied-research managers, he admits, "people don't quite know what to make of us." But Edward Moses, director of the National Ignition Facility, a superlaser at Lawrence Livermore National Laboratory in California, says Orbach is helping him grow a civilian research community to utilize an instrument designed to maintain the nation's nuclear arsenal.

Some fear that such cross-fertilizing could weaken basic science at DOE. "There is a danger of letting the basic program become a technical-



Teammates. Ray Orbach (left) hopes researchers can help his boss, Energy Secretary Samuel Bodman, (right) do his job, too.

support enterprise for the applied programs," says energy expert Robert Fri, a former Environmental Protection Agency official who believes unfettered basic work can "cook up" whole new energy ideas. Materials scientist Ward Plummer of the University of Tennessee, Knoxville, decries a 20% decline in funding core, unsolicited research within DOE's Office of Basic Energy Sciences in the last 3 years at the same time that solar energy, nanotechnology, and hydrogen programs have grown.

Plummer and others hope that DOE's new effort to define so-called grand challenges will stop that erosion. And although Orbach says he has no plans to "fuzz the boundaries" between basic and applied work, he is looking for greater cooperation between the two camps. A recent discussion with managers studying how fluids flow in dry soil at DOE's planned nuclear waste fuel repository at Yucca Mountain, Nevada, proves its value, he says. "When we met with Fossil Energy and learned more about carbon dioxide sequestration," Orbach recalls, "it suddenly popped out that that's the same problem."

Whatever happens, Orbach says DOE is determined to squeeze more impact out of its science. That's good news for Adzic, who relishes taking on challenges "directly important to society." It's also a good deal for academics. "If you publish something relevant" to a problem, says Adzic, "your paper is more [often] cited."

—ELI KINTISCH

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