

## Materials Researchers Confront Reality at Solid State Sciences Forum

"Driving Innovation Through Materials Research" was the theme of the 1996 Solid State Sciences Committee Spring Forum, held February 12-13 at the National Academy of Sciences in Washington, DC. For two days, 200 leaders from the materials research community met with agency heads and policymakers to discuss the changing landscape of materials research and development in the broader context of the future of the U.S. research and development effort. The vitality of materials research and its central importance in a strong economy clearly emerged in stark contrast with expectations for a continuing downward trend in federal investment in R&D.

Thomas Weimer, Staff Director of the Basic Research Subcommittee of the House Science Committee, presented a sobering outlook for federal support for R&D. Noting that federal investment in R&D peaked in inflation-adjusted dollars in 1987, he traced the decline in R&D funding through three administrations and five Congresses. While there have been ideological differences in *how* investments are made, the direction has been steadily downward, with additional reductions of up to 30% projected over the next seven years.

This downward trend is being driven by unprecedented geopolitical and competitive changes in the world. The U.S. research establishment is being impacted by global competition (including competition in R&D), corporate downsizing, the political imperative for balancing the federal budget, and the emergence of the commercial sector (rather than national defense) as the driver for leading-edge technology. Even the paradigm relating economic growth to technological change is being questioned. Erich Bloch, Distinguished Fellow from the Council on Competitiveness, noted that "with a similar growth in new technology, we are not seeing the same indicators of [economic] growth as we did some twenty or thirty years ago." Bloch, speaking on reinventing R&D, argued for an inclusive national dialogue to set priorities and develop a roadmap for R&D to maximize the benefits for the country.

Reinventing R&D will also require significant changes in U.S. research institutions and their relationships. Al Narath, President of Lockheed Martin's Energy and Environment Sector (which operates three Department of Energy [DOE] national laboratories), spoke of the "Balkanization" of science, where we trip over words like basic and applied, and

focus the national R&D debate on the distribution algorithm. Arguing that industry, universities, and national laboratories are essential cornerstones of an interactive national R&D system, Narath added that "an obsessive preoccupation with the financial term is driving our institutions toward predatory behavior at a time when cooperation and coordination among R&D performers is more likely to yield positive results."

The university system is also under severe stress. Speaking on the future of the research university, Arden Bement of Purdue University emphasized the need to broaden the horizons of graduate education (viewing industry as a customer); reduce the time to the PhD degree; increase collaborations; and rebalance education, research, and service roles. Despite the pain of unmet employment expectations, many institutions feel compelled to educate as many graduate students as they can support. Increasing pressure for a broader geographical distribution of funding threatens the established research centers. And the potential impacts of distance learning (via video links) and other new information technologies on higher education are not yet understood. A sustainable research university system will have to come to grips with these and other challenges within the constraints of declining resources.

In the competition for federal funding, research can survive only if there is an electorate whose representatives are convinced of the value of research. Neal Lane, Director of the National Science Foundation, spoke of the need for materials researchers to step forward and assume the role of the "civic" scientist, bringing home the message that materials research generates wealth. Lane cautioned that "the United States is getting ready to run an experiment it has never done before—to see if it can cut the federal investment in R&D by one-third and still be a world leader in the 21st century." Martha Krebs, Director of the DOE Office of Energy Research, appealed to the com-

munity to work together and use the accomplishments of materials research to make the case for all of science. Cooperation across disciplines and among universities, industry, and government laboratories is a defining strength of the nation's R&D system—interfactual bickering will only create losers.

Despite the austere funding projections for science, materials research continues to be an outstanding example of the value of supporting research. William F. Brinkman (Lucent Technologies), Charles Shanley (Motorola), Michael Polcari (IBM), and Norman Gjostein (Ford) recounted numerous examples where materials science is enabling technological advances with impacts in the tens of billions of dollars. These advances are improving our lives and strengthening the economy. Special materials properties and characteristics, the product of materials research, are essential to the implementation of virtually all advanced technologies.

Materials research is an interdisciplinary science, dependent on the innovation of the individual researcher as well as the power of the latest national facilities, and strengthened by a tradition of cooperation among universities, industry, and government laboratories. Materials research is also essential to our quality of life and to economic competitiveness. From this unique vantage point, materials researchers bear a special responsibility to make the case for the support of science and to demonstrate the value of working together across disciplines and institutions. While confronting the reality of budget cuts, we must reinvent our institutions and their relationships and articulate the future economic cost of proposed R&D reductions. In many ways, materials research will define the future—we cannot afford to be silent.

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*FMS is an umbrella organization whose members and affiliates represent the professional societies, universities, and national research organizations that are involved with materials science, engineering, and technology.*