

## Coupling industry to basic research

These must be busy times for the people charged by our foreign industrial competitors with translating American science into their new products. Last year the US won *all* the Nobel Prizes in the physical sciences. Obviously, our foreign competitors have much to learn and much to apply if they are to continue beating US industry to the punch in markets for steel, low-maintenance, fuel-efficient automobiles, RAM chips, stereo systems and television sets. Or so, at least, the argument sometimes goes.

This argument reflects a grossly false paradigm of technological innovation in industry. Even more important, it reflects a false understanding of the reasons for the success of foreign competitors in US markets. With only a few exceptions, their success has not come from the early application of new science, but from providing the consumer with better quality, greater dependability and lower prices. Blaming US industry for insufficiently exploiting Nobel Prize research, while ignoring these matters, can lead to wildly counterproductive strategies for restoring US industrial competitiveness.

Nevertheless, such criticism is partly right, even if for the wrong reasons. There is an accelerating need to integrate basic research more closely with the commercial innovation system. As technologies become more complex, new science often affords the only basis for progress. Except for a few large corporations, industry still does little basic research, but this situation may be changing. According to the National Science Foundation, industry's basic research expenditures rose 12 percent between 1982 and 1983 to about \$2 billion, while overall R&D funding in industry grew by about 11 percent to an estimated \$44 billion in 1983 and an estimated \$52 billion in 1984. And between 1970 and 1983, industry's annual support for basic and applied research at the universities has increased by nearly 150% (even after excluding the effects of inflation) and in 1983 reached an estimated \$360 million (or roughly 7% of the total Federal support). Significant increases in industry support are also coming through new cooperative programs in such fields as microelectronics, biotechnology and chemistry, programs not recognized in the NSF figures. The most encouraging features of these programs are their diversity and their expression of local initiatives based on common interests and common needs.

Such features imply the optimum mode for producing successful research agreements between industry and the universities. It is not for the Federal government to mastermind the marriage between basic

research and technology for commercial development, as proposed in the current "Advanced Technology Foundation Act" (HR 4361). It is not for the Federal government to create "generic" research centers to produce the science and technology that industry "should" be producing. It is for the parties concerned to forge relationships reflecting the specific needs of each. It is for governments to *encourage* these relationships, through programs like those initiated by the NSF, or through "centers of excellence" being set up at universities by many state governments (including my own state of New Jersey). It is for the national laboratories to be brought into the equation, as the current Administration has been attempting to do. And it is also for the Federal government to shift its civilian R&D funding more toward basic research at the universities, as the Administration has also been doing.

But much more remains to be done. A perpetual problem for basic research is preserving investigator initiative. Today, industry seems ready to provide more money more quickly for high-risk basic research than cumbersome Federal review processes will allow. Another problem is the uneven distribution of excellence. Thus, a major industry consortium for supporting basic research in the universities, the Semiconductor Research Corporation, is seeking to upgrade relatively have-not university research departments that are located near its industrial members.

Not least is the task of improving the human interface. With this in mind, Exxon's Corporate Research Science Laboratories, for example, currently have on staff some 25 postdoctoral fellows, most of whom are expected to assume university positions. In this and other programs, the goal is to enhance the professional development of the participating scientists, to make them aware of industry interests and capabilities and, above all, to create a basis for continuing scientific dialog without depriving universities of essential professional resources. It is this dialog that will lead to broad insight, and, eventually, to innovation, new wealth and new jobs.

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