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EDITORIAL

Exploratory Basic Research

Federal policy-makers seem to be in hot haste to curtail exploratory basic research at universities. The short-term benefits of such a move are questionable. The longer-term consequences could be disastrous. The federal research supported is to be highly focused on specific national goals. These have a way of changing suddenly. At present a major goal is global competitiveness.

It also is fashionable to diminish exploratory basic research at major companies and at the national laboratories. During the past few years, many companies have undergone "restructuring," focusing their research and development (R&D) efforts on quick incremental improvements in productivity. The weapons laboratories and other federally supported laboratories are eagerly seeking cooperative research agreements with industry.

Prospects for exploratory basic research in the physical sciences are bleak at universities. Both internal and external sources of support are no longer dependable. Many state schools have endured, and others are facing budgetary cutbacks. They are in no position to supply funds for research, and some state systems are decreasing markedly the number of physical science professors. Many private universities have lost their zest for physical science research. They assert that reimbursements for indirect costs are inadequate.

In the past, the National Science Foundation (NSF) has been a major source of support for academic basic research in the physical sciences. NSF has enjoyed an excellent reputation for the quality of research proposals it has chosen to support, but the funds have been comparatively minuscule. Annual support for chemistry has been $100 million. Most of this money has gone to individual investigators, who in turn have provided stipends for graduate students and post-docs. Basic research has been scoffed at as merely curiosity-driven. In the highly competitive world of academic research, however, curiosity is only a minor motivator. Very gifted individuals wager professional careers and a special place in history on their judgments of possibilities of making significant advances in the understanding of nature. Individuals usually strive more intensely to achieve their own goals than to reach those handed down from above. An important product of their activities is conveying enthusiasm to students and preparing them for careers in industry and elsewhere.

The major companies value the research now being conducted at universities. This is emphasized in a position statement recently issued by the Industrial Research Institute (IRI). The 260 IRI companies invest over $55 billion annually in R&D. Together they generate over $2 trillion in annual sales. The IRI statement calls for several kinds of enhanced interactions between universities and industry. However, the position statement contains the following: "Since industry allocates only a small fraction of its R&D effort to basic research, the success of our industrial R&D enterprise depends heavily on America's colleges and universities for (1) new knowledge, and (2) an adequate number of highly trained and well-educated scientists and engineers....The Institute endorses the premise that the top priority of universities should be to educate their students. Basic research in universities and interaction with the private sector can support and strengthen this educational priority. Transferring knowledge to industry, albeit important to the needs of industry, should have a lower priority."

Industry has been devoting increased funds to collaborations with universities. The extent and kind of interactions will doubtless continue to expand despite the fact that professors and industrial scientists and engineers live in different worlds. Beyond contrasting value systems is an important difference in time constants. Developments affecting global competition often occur unexpectedly and rapidly. The time constant for a graduate student's research is often 4 years or more. If students are to be well trained, they and their professors must not be caught up excessively in short-term, piecemeal efforts.

There is already an enormous momentum for conversion of the previous goals of the national laboratories to other goals, particularly to those involving industry. If the funds now supplied to NSF were diverted from support of academic exploratory research, they would add comparatively little to a huge activity. As a result of the diversion, the universities would be injured, and our world leadership in understanding nature would be weakened. The language [*Science* **261**, 1512 (1993)] in the Senate report in H2471 should not be implemented.

Philip H. Abelson