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## Prepared Minds

In its efforts to restore American prestige, productivity, and strength, the Reagan Administration should not lose sight of the crucial roles of education and basic research. All administrations, when faced with public demands for budget cutting, are tempted to sacrifice long-term needs for short-term political advantages. The present status of the country reflects the consequences of more than a decade of shortsighted policies.

The need for a continuing flow of well-trained scientists and engineers is obvious. But the continuation of support for basic research at universities is not guaranteed and may require sturdy defense. A variety of questions have been raised. For example, why should this country conduct so much of its basic research at universities? Why not do it in industrial laboratories or concentrate it in specially created institutes? Why is it necessary for the United States to support basic research? After all, the Japanese attained their strong industrial position without doing much basic research. Aren't the present stocks of knowledge sufficient? Why increase them when the libraries are already bulging?

It is not my intention to answer all these questions here. Most of them have been treated elsewhere, though the importance of conducting basic research at universities merits repeated emphasis. Faculties at universities know that teaching and research are closely intertwined. The professor who stops doing research usually ceases to be intellectually active and ceases to be an effective teacher. To be effective as an educational institution, a university must do more than certify that a student has completed the requisite number of courses. Merely taking courses and spending 4 or 8 years at a university can be a costly waste of the individual's as well as the public's money. Much more than reading books and regurgitating facts on demand is required. To attain the best results, students must experience a superior, stimulating, exciting intellectual climate. The students will mutually provide some of this, but an essential portion must be derived from professors who are intellectually vibrant. Beyond that, students of science and engineering can be adequately trained only if they have access to the kinds of equipment they will be using when later employed elsewhere.

Another matter that has not been adequately discussed is the value of stocks of knowledge. In one sense, books and bound volumes of journals are the most valuable assets possessed by humanity. Yet in another sense they are worthless—mere accumulators of dust and mold. They are valuable only insofar as prepared minds can use their contents. In science, the people who can best use the stocks of knowledge are those who are engaged in creating them. They can interweave their special knowledge, experience, and judgment with facts from books or computers to create valid interpretations and new insights.

Participation in a highly active, highly competitive field of basic research requires unusual dedication and self-discipline. In its way, it demands an effort analogous to that of athletes who train to become champions. A few of the intellectual athletes receive recognition as Nobel laureates, but in general, the physical athletes are far more highly rewarded. What is not generally appreciated is the enormous potential value to the nation of creative scientists as problem solvers. To get a measure of this value one has only to peruse Vannevar Bush's book *Modern Arms and Free Men*. During World War II a few thousand scientists and engineers, mainly drawn from academic-type institutions, created a series of weapons systems that saved hundreds of thousands of lives and hundreds of billions of dollars. Before the war most of the key people were engaged in basic research. Times have changed, and it is unlikely that basic research scientists will play much of a role in the coming Reagan rearmament program. Most of the funds will be used to procure arms and to train people to fight. How much will be spent to enable the nation to function well under the unpredictable circumstances that will prevail 10 years from now is problematical.

—PHILIP H. ABELSON