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Balancing the Research Portfolio

Wm. A. Wulf

Over time, the balance of governmental support for basic research among different fields should change, but it should change in a reasoned and purposeful way, not as the result of politics. The negative effects that can result from the politics of the "disease du jour" are familiar to readers of *Science*. Another case is less well known and perhaps even counterintuitive—the effects of proposed legislation in the U.S. Congress to increase nondefense R&D. A shift in federal underwriting of R&D overlooks the vital role the Department of Defense (DOD) plays in funding academic basic research.

This oversight reflects the mistaken belief that all research supported by DOD is motivated solely by military applications. In fact, basic and applied research funded by DOD includes a significant fraction of academic basic research; for example, 69 percent of electrical engineering, 60 percent of computer sciences, 40 percent of materials science and engineering, and 27 percent of mathematical sciences. DOD supports some 9000 graduate students, as compared with 15,000 supported by the National Science Foundation (NSF). The simplistic notion that R&D funding by DOD should not be increased would have a disproportionately negative impact on specific disciplines that are essential to the country.

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There are two cases in which DOD has become a critical funder of academic basic research. In hindsight, both were almost historical accidents. In the first, the initial motivation is defense but the major application is not. The Internet, for example, grew from the desire for more reliable defense communication. In the second, a community of scholars grows up around a defense problem and continues to be funded by DOD long after the motivating problem is solved. Several areas in the mathematical sciences fit this pattern.

We cannot predict who will benefit most from basic research funded by DOD—the defense sector, the civilian sector, research itself, or all three. In many cases it has been all three. In computer science and engineering, basic research supported by DOD extended our ability to do research in virtually all areas of engineering and science. The data from the Hubble Space Telescope, the Mars Pathfinder mission, and the modeling of the climatic effects of greenhouse gases were all enabled by computer advances from DOD-sponsored research. The effect of applying this leverage to all research is often lost in the debate over defense spending.

Although some argue that the money allocated for basic research now supported by DOD should be transferred to another agency (possibly NSF), the development of legislation through the congressional committee structure makes this very difficult to accomplish. In addition, DOD has shown itself to be a reliable and patient supporter of academic basic research. Such a transfer would run counter to the very sensible policy of including a role for basic research in the mission of each federal agency or department. This practice not only provides greater diversity in the nation's R&D portfolio but also adds to these agencies' abilities to carry out their missions. As it stands, the pluralistic nature of research funding in this country is a great strength. It is not immediately clear that any benefit could be gained by reducing that plurality.

Congress is currently reviewing DOD research activity, and legislation has been introduced in the Senate authorizing a 2 percent real increase in defense R&D over 10 years. Unfortunately, this still leaves a large and widening gap between fields heavily funded by DOD and those that are not. The appropriation for the academic research supported by DOD does not compete directly with that for other research; it is not a zero-sum game. In the past, cuts in DOD research funds have been used to increase operational funds, not research funded by other agencies and departments. It is likely that future increases will come from within the defense budget. Making the basic research component of DOD's funding increase comparable to that of the nondefense agencies would increase the pie for all academic research and strengthen the country in the process.

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