# Science and the New Administration

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With a new presidential Administration now in office, the scientific community is hopeful that measures will be taken to enhance research and the contributions it can make to our society. What little was said of research during the presidential campaign concerned technological improvement and economic stimulus. This limited focus probably arose from the necessities of electoral politics. Now it is important to broaden the discussion to include aspects of the scientific enterprise that are essential for its long-term viability.

The opportunities for progress through science are greater than ever. However, the last decade has witnessed an accelerating erosion of the infrastructure for fundamental research in the United States. If that erosion is not reversed soon the pace of discovery will necessarily decline, with widespread consequences for industry, health care, and education.

In hopes that President Clinton and Vice President Gore will soon address the prospects for basic science in the United States, we offer our view of how fundamental research benefits our nation and what should be done to secure those benefits for the future. We speak here for biomedical research, our area of expertise, but believe that our remarks illustrate problems and opportunities found throughout science.

## The Promise of Biomedical Research

Recent progress in biomedical research has brought an understanding of molecules, cells, and organisms far beyond anything anticipated a generation ago. The benefits of this progress include the makings of a revolution in preventive medicine; novel approaches to the diagnosis and treatment of cancer, heart attacks, infections, inherited diseases, and other ailments; the prospect of improving agricultural productivity in ways never imagined by the Green Revolution; new tools for environmental protection; and a renewed impetus to stimulate and inform public interest in science.

The economic benefits of these gains are substantial. Consider two examples: First, it is often argued that advances in research increase the costs of health care. However, biomedical research typically generates simpler and less costly devices: Inexpensive viral vaccines now save the United States billions of dollars annually; new tests for viruses have helped cleanse our blood supply, greatly reducing the economic losses from diseases that are spread by transfusion; and growth factors for blood cells are cutting the costs of caring for patients who receive bone marrow transplantation or chemotherapy for cancer. Second, fundamental research spawned the biotechnology industry, of which our nation is the undisputed leader. Biotechnology is a growing contributor to our economy, a source of diverse and gratifying employment, a stimulus to allied industries that produce the materials required for molecular research and development (R&D), and a vigorous partner to our academic institutions in the war against disease.

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## Challenges to Biomedical Research

Despite the progress, preeminence, and promise of American biomedical research, the enterprise is threatened by inadequate funding of research and its infrastructure, flawed governmental oversight of science, confusion about the goals of federally supported research, and deficiencies in science education.

The productivity of biomedical research is limited most immediately by financial resources. In 1992 the nation spent about $10 billion on biomedical research, mostly by congressional appropriations to the National Institutes of Health (NIH). This investment is too small by several measures: (i) The United States currently devotes between $600 and $800 billion annually to health care, yet less than 2% is reinvested in the study of disease. In contrast, the defense industry spends about 15% of its budget on research. (ii) U.S. expenditures on R&D as a percentage of our gross national product have been declining steadily and are now lower than those of Japan and Germany. Moreover, 60% of our R&D dollars is designated for defense. (iii) The funding of approved NIH grant applications has fallen below 15% in some categories and under 25% in many, compared with rates of 30% or more in the preceding two decades, when progress was so rapid. Under these conditions, outstanding proposals cannot be pursued, first-rate investigators have become dispirited, and even the best students are discouraged from pursuing a career in science. (iv) Outstanding institutions lack funds for laboratories and replacement of inadequate instruments; as a result, the conduct of biomedical research is constrained and even dangerous.

Biomedical research is also impeded by outmoded procedures for the federal administration of science. Agencies that should be working together to promote research in the life sciences instead remain separated in competing departments. NIH has suffered from a chain of command that requires approval from secretaries and undersecretaries with little expertise or interest in science. Some sources of funding for research in the life sciences lack appropriate mechanisms or expertise for initiating, judging, and administering programs, and others have not adapted their mechanisms appropriately to the progress that has been made in research. For example, many of the NIH study sections, traditionally the pride of the peer-review system, are now organized according to outmoded or otherwise inappropriate categories. In addition, the government has not learned how to involve the scientific community adequately in administrative decisions to initiate targeted projects. To cope with a decaying infrastructure, Congress has occasionally appropriated substantial funds for construction, but they have done so in a way that circumvents peer review and serves local needs rather than the advancement of science as a whole.

The confidence that the scientific community once had in the federal governance of biomedical research has been further eroded by the use of inappropriate criteria for appointments to high-ranking positions, particularly within the Department of Health and Human Services. In recent administrations, it has become commonplace to consider political views on issues such as abortion and the use of fetal tissue in research. This tendency has compromised our ability to select leaders on the basis of their scientific accomplishments and their capacity to manage complex programs and make objective decisions.

These administrative problems have been compounded by confusion over the goals of federally supported biomedical research. Economic woes have encouraged calls for increased application of current knowledge to practical problems in all branches of science. These appeals have special resonance in biomedical science now that so many opportunities for practical applications are at hand. In recent months, such calls for applied science have gained further prominence because they have been championed by National Science Foundation (NSF) director Walter Massey and Representative George Brown (D–CA), a long-time friend of science (*1*).

Claims that "society needs to negotiate a new contract with the scientific community

. . . rooted in the pursuit of explicit, long-term social goals" (2) are, however, based on debatable assumptions and threaten the viability of our greatest asset—basic research. Such claims imply that basic research has become an entitlement program, although evidence shows it to be underfunded. They presume that basic and applied research can be unambiguously distinguished, although the experimental objectives of academic and industrial sectors of biomedical research are often synonymous. They seem to deny that science has produced benefits for society, although its positive effects on health and the economy can be readily measured. Finally, in asking that federally supported academic investigators become responsible for practical applications, they ignore the demonstrated ability of the biotechnology and pharmaceutical industries to develop the fruits of basic science.

Enactment of policies that favor practical applications over basic science or narrowly defined objectives over scientific excellence is likely to come at the expense of traditional, broadly conceived explorations of biology. At this stage in the growth of biomedical science, when major discoveries are still unpredictable, this sacrifice would jeopardize the scientific progress required for social benefits and economic growth in the future. This year, for example, the NSF budget for basic research declined, despite an overall increase that benefited more applied areas.

The long-range future of biomedical science is also jeopardized by the deterioration of our educational programs in math and science. Academic institutions and the biotechnology and pharmaceutical industries depend on the nation's schools to supply a competent work force by stimulating interest in scientific thought and by training students in scientific methods. Many indicators show that we are failing to achieve these goals, especially with students in their early school years and when our performance is compared to those of other countries. We are also failing to produce an informed public that can respond intelligently to scientific advances.

## Recommendations

If the United States is to realize the promise of science for our society, the new Administration should take action on several fronts.

1) Develop an economic strategy for optimizing investment in biomedical research, which would take into account the new opportunities that have been made available by the recent revolution in biology, the potential for reducing health-care costs, and the benefits to agriculture and industry. Until a full evaluation has been completed, we recommend increasing the NIH budget by 15% per year, which would double the budget in current dollars by 1998. This increase would provide funds for approximately 30% of approved grants, thereby retaining healthy competition and exploiting the major areas of scientific opportunity.

2) Generate a comprehensive plan for the best use of federal funds for biomedical research. Development of new strategies, programs, and funding mechanisms should include the active participation of the scientific community and not originate solely from administrative directives.

3) Institute a mechanism for the periodic evaluation of peer-review procedures, utilizing scientists from inside and outside the government. Efforts should be made to ensure that the thematic alignments of review panels accurately reflect contemporary progress and opportunities in biomedical research.

4) Facilitate the application of fundamental discoveries by encouraging technology research in the private sector, stimulating alliances between industry and academia, and clarifying the federal stance on conflict of interest.

5) Ensure that new departures by the NIH and NSF in education and technology do not diminish the support of basic research. If the Administration or Congress provides new mandates or new requirements for the NIH and NSF, it should also provide the necessary additional funds.

6) Strengthen the position of the presidential adviser on science and technology. The adviser should have strong credentials as a scientist and as an administrator, be alert to contemporary developments in both the biological and physical sciences, be encouraged to consult the diverse representatives of the research community, and have regular access to the president and vice president.

7) Establish the NIH as an independent federal agency and consolidate the authority of the director over the individual institutes.

8) Apply appropriate criteria to the choice of science administrators. Appointments should be based on stature in the research community and administrative ability rather than on political and religious considerations.

9) Implement a uniform and comprehensible policy for indirect costs that provides incentives to institutions for cost savings and ensures that the funds will be used only to support the infrastructure required for research.

10) Create a program for long-term investment in research laboratories and equipment based on peer review of merit and need rather than on political affiliations.

11) Increase federal attention to science education. Measures could include the development and dissemination of new curricula and textbooks, enrichment programs for established teachers, improvements in the training of science teachers, and scholarships and other incentives for prospective science teachers.

## Conclusion

We look to our new president and vice president for leadership in fulfilling the promise of science for our nation. We hope that they will not fall prey to the view that the problems of our society might be solved by a shift in emphasis from basic science to applied research. Instead, the U.S. federal government should act decisively and soon to revitalize the support of fundamental as well as applied research. President Clinton and Vice President Gore have spoken clearly on health care, economic policy, and education. We ask them to do the same on the issues that confront science (3).

### REFERENCES AND NOTES


1. D. Thompson, *Time* **140**, 84 (28 November 1992).
2. G. Brown, *Los Angeles Times* (8 September 1992), p. 12.
3. This policy forum is based in part on a statement prepared in November 1992 by the Joint Steering Committee for Public Policy, representing the American Society for Cell Biology, the American Society for Biochemistry and Molecular Biology, the Biophysical Society, and the Genetics Society of America.