Science Quality, Budgets, and the Public Interest*

by Ellis Cowling, John Sigmon, and Charles Putman**

This year is the 50th anniversary of Vannevar Bush's Science: The Endless Frontier. Bush believed that science could be used to "insure our health, prosperity, and security as a nation." Bush was right, Congress provided support, and the nation prospered. "Today, however," Congressman George Brown asserts in his 1992 report on the Health of Science, "the United States faces wide-ranging crises and challenges ... This paradox--growing knowledge, accompanied by growing societal crises--implies a complex, non-linear relationship between advances in knowledge and advances in society."

Inspired by George Brown's concern that the social compact between science and American society was falling short of Bush's vision, we began a comparison of value-returns from science in two large sectors of society -- medicine and agriculture. When we looked into the outcomes from application of scientific knowledge in these two sectors we were surprised to learn that:

-- Americans pay a *higher* percentage of their gross domestic product for health care products and services than any other developed nation of the world -- 11.8 percent in the US, compared to 8.7 percent in Canada, 8.2 percent in Germany, 6.7 percent in Japan, and 5.8 percent in the United Kingdom.

-- Americans also pay a *lower* percentage of their GDP for food and fiber products and services than any other developed nation around the world -- 8.7 percent in the US, compared to 9.4 percent in Canada, 11.5 percent in Japan, 11.8 percent in Germany, and 12.9 percent in the United Kingdom.

In searching for an explanation of these remarkably divergent outcomes, we were also astonished to discover the extent to which certain aspects of the methods of decision-making about public investments in medical and agriculture research, and choices about the kinds of research that are undertaken in these two fields, have contributed to the differences in costs, benefits, and value-returns from these investments.

We recognized that decisions about funding in the medical sciences are made mainly by a highly-evolved, scientific-merit focused, curiosity-driven, largely federal-government financed and operated system of competitive-grants to universities. By contrast, decisions about funding for agricultural research are made mainly by formula based, curiosity- and relevancy-driven, highly consultative processes involving state, county, federal, university, and agribusiness interests. In addition, we recognized that the objectives of medical and agricultural research are quite different -- medical research has focused mainly on understanding disease in humans and using this knowledge to help individuals who

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* The general ideas in this article are developed more fully in a paper in the Spring 1995 issue of Issues in Science and Technology. A more extended and carefully annotated analysis also has been submitted for publication in the journal Science and Public Policy.

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are sick recover from disease and that agricultural research has focused mainly on understanding how crops grow and using this knowledge to feed a growing population of humans. We also recognized that understanding disease in humans and how crops grow are only parts of the larger challenges of delivering high quality medical services and wholesome food to citizens. Translation and transfer of discoveries in science into useful, cost-effective, and readily-available information about practices, products, and services also are essential.

While analyzing these factors, we were even more astonished to discover that while agricultural economics is a well-developed discipline within the agriculture sciences, medical or health economics is still struggling for recognition as a scientific discipline. Courses and graduate degrees in agricultural economics are offered by sizable departments in 60 universities in the US. The Department of Agriculture has maintained an Economics Research Service since the 1930s. The American Agricultural Economics Association and its regional affiliates publish six refereed journals dealing with contemporary issues in agricultural economics.

By contrast, courses in medical economics are available in some (but not all) colleges of medicine and schools of public health. Most academic specialists and graduate students in health economics are appointed in departments of economics -- mainly within schools of business management or colleges of arts and sciences. Until very recently, there were no professional societies of either medical or health economics. Furthermore, there are only two regularly published journals (*Health Economics* and *Health Affairs*), both of which are published by profit-making corporations rather than professional societies.

Thus, it appears that about 4,000 professionals in the US derive their livelihood from scholarly analysis of how this country uses about 9 percent of its gross domestic product in feeding itself. By contrast, only about 300 to 400 professionals derive their livelihood from scholarly analysis of how this country uses about 12-14 percent of its gross domestic product in keeping itself healthy.

When we inquired more deeply into these matters we learned that a series of near-simultaneous events during the 1940s served to insulate the rapidly expanding biomedical sciences from the realities of health care economics. The Public Health Service Act of 1944 provided increased authority for the National Institutes of Health to conduct biomedical research. The need for more effective treatments for wounds during World War II, development of sulfa drugs, and Fleming's discovery of antibiotics provided major impetus for improved biomedical research during the period after World War II. This remarkable success story was part of the background that led Vannevar Bush to prepare his famous report. The Public Health Service Act of 1946 established the Office of Research Grants in NIH. The entrepreneurial spirit of this office, and the substantial and continuing confidence of Congress in the public benefits that would flow from the science funded through that office, led NIH and the Public Health Service to become the largest agencies in the federal government in terms of dollars expended for basic and applied research.

About this same time (1947), the first private insurance system was developed to help individuals and their employers pay the costs of medical services. In 1965, the federal government established Medicare and Medicaid to help pay the costs of medical services for some elderly and lower income persons. The generosity of these “third party payers” for medical services decreased the motivation for doing research on the cost-effectiveness of various medical and surgical procedures, practices, and health-care systems. Thus, sustained funding for discovery and adoption of high-cost medical technologies, coupled with continuing lack of funding for comparative health-outcomes and health-economics research, contributed to the rapid rise in the cost of medical- and health-care services in the US.

From this admittedly very brief (and undoubtedly incomplete) outcomes-based analysis of the performance of the agricultural and medical sciences, we offer a few observations and suggestions for further debate that we believe will increase value-returns to society from its investments in science:

1) Competitive peer-review mechanisms for decisions about scientific research contribute to the quality of science. We believe this is true both in the agricultural and in the medical sciences.

2) Competitive peer-review mechanisms for decisions about alternative investments in scientific research provide little assurance that an optimal value return will be derived by society from that investment.

3) The agricultural sciences can learn a valuable lesson from the medical sciences by investing a larger proportion of their resources in competitive grants which are open to all the creative minds that can be attracted to the intellectual problems of agriculture and natural resource management.

4) The medical sciences can learn an important lesson from the agricultural sciences by investing a larger proportion of their resources in extension, outreach, public-education, and technology-transfer activities, and by giving increased attention to research aimed at optimizing the costs of health-care services both to individuals and to society as a whole.

5) Greater attention should be given to development of university-based and NIH-based programs of graduate education and research in health economics, and national and regional associations of health economics professionals. It is not clear that it will be necessary to develop departments of health economics within colleges of medicine and schools of public health. But much stronger ties are needed between health economics researchers (in whatever academic units and other organizations they serve) and: a) faculty members and students within colleges of medicine and schools of public health, b) biomedical research scientists and leaders in NIH, c) academic medical research centers, d) state, regional, county, and municipal boards of health, e) health maintenance organizations, and
f) health insurance organizations. It may even be worthwhile to consider establishment of a National Institute of Health Economics Research and Education.

In these latter connections, we applaud the recent decision of NIH to sponsor an NIH Economics Roundtable on Biomedical Research. The charge to members of this Roundtable was:

> "to identify optimal analytical approaches and the data and methodology needed for the development of an ongoing, effective research benefits assessment program that would assist the NIH to:
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> - evaluate the contributions of biomedical research in extending life and reducing the burden of illness and disability and its impact on health care costs;
> - demonstrate the effect of publicly funded research on [medical education and] training, and on the performance of research universities, pharmaceutical firms, and related industries in developing new products and services; and,
> - identify the value of spin-offs from biotechnology and biomedical research that are applied in other industries.

Finally, we believe that the quality of science and value-returns from public investments in medicine, agriculture, and other fields of science and engineering will be enhanced if more of us recognize the wisdom in Sterling Hendricks's assertion:

"The opportunity to inquire into the nature of things is a rare privilege granted to a few [scientists among them!] by a permissive society."