one or two enzymes. As the work progressed, he discovered more and more enzymes with an essential role in the process. He might have been able to produce large amounts of DNA polymerase, if molecular biological techniques had been available; but could he have known that there are at least three DNA polymerases? The disciplines of enzymology and molecular biology must necessarily complement one another, and scientists must continue to study both. The need for such expertise is only emphasized by the recent recognition of the catalytic activity of some forms of RNA. Interestingly, Kornberg talks of enzymes only as proteins and ignores the enzymatic functions of RNA.

It's a good book, and it would have been better if Kornberg and his family and colleagues had been more central. As it is, the detailed description of science overshadows the human aspects of a great career.

PHILIP K. BONDY
Department of Internal Medicine
Yale University School of Medicine

THE FINANCING OF BIOMEDICAL RESEARCH. By Eli Ginzberg and Anna B. Dutka. Baltimore, MD, The Johns Hopkins University Press, 1989. 144 pp. $18.50.

World War II fundamentally changed popular American opinion of scientific research. Many people considered that medical and technological breakthroughs played a key role in securing the Allied victory. Increased funding for all types of biomedical and scientific research was strongly supported by the public after the war. Major improvements were expected in health care in the following decades, including cures for cancer and heart disease.

As a result, Congress dramatically increased biomedical research funding in the post-WW II years. The Financing of Biomedical Research surveys the history of this funding over the last four decades and analyzes the resulting trends and patterns. This book divides these years into three distinct periods:

1. Rapid Growth (1950–1965): During this period the federal government became the major funding source for biomedical research in the United States. The large increase in federal funding more than offset a concomitant decline in private sources of funds. These monies greatly contributed to a period of rapid growth and evolution in the infrastructure of universities, medical schools, and teaching hospitals. Staff and facilities were expanded to contribute to the vast accumulation of scientific and technological knowledge. It is evident, therefore, that the U.S. government accomplished its goal of developing a large and productive biomedical research complex.

2. Slow Growth (1966–1982): During President Johnson's administration, the effectiveness of financial support for biomedical research began to be questioned. Although technological and scientific advances had been made, it was not clear that patients had benefited in any significant fashion. It was clear, however, that many Americans had been unable to take advantage of the advances in health care that had been made. As a result, Congress was convinced to redirect biomedical research funds toward the expansion and improvement of access to health care for the uninsured and underinsured (through the creation of Medicare and Medicaid). Spiraling inflation also contributed to the diminished flow of money to biomedical research and further slowed its growth. In spite of increasing costs, the size of the traditional award actually declined in constant dollars during this period.
3. Renewed Growth (1983–1987): During these years, the federal government renewed its commitment to research. Reduced inflation also allowed Congress to increase federal funding. Several differences, however, distinguish this period from the earlier period of rapid growth in the 1950s. First, the federal government began to emphasize the funding of basic scientific research rather than applied research and development. Industry has consequently utilized its resources to increase funding for applied research and development. Second, the federal government began to fund an increasing proportion of research investigators in an attempt to support as many talented people as possible.

One of the most important chapters analyzes the question of “How Many Dollars Are Enough?” The discussion describes the effects of early ground-breaking basic research on recent advances in applied research and development (R & D), including clinical diagnosis and therapy. The possible economic returns of public R & D spending on biomedical research was analyzed by Jeffery Harris, a physician and economist at the Massachusetts Institute of Technology. He outlines the inherent difficulties in even a complex cost-benefit approach to economic returns. The chapter concludes that (1) the federal government should remain the primary funding source for basic research in this country; (2) current academic research centers should be targeted for increased support, as it is not practical to establish entirely new centers of excellence in biomedical research; and (3) it is now desirable to encourage philanthropy to strengthen funding of critical areas neglected by other funding mechanisms.

The remaining chapters deal with the role of philanthropy and academic medicine in future prospects for biomedical research. A survey of ten academic health centers showed a tendency to ignore the philanthropic dimension during the early years of rapidly escalating federal funds. When federal funds were cut back in the early eighties, however, the potential for increased funding from philanthropic sources was recognized by almost all of the major medical research centers.

The last chapter is a timely discussion of “Open Issues on the Nation’s Biomedical Research Agenda.” These issues include the loss of U.S. competitiveness in the world economy and the lack of realistic cures for most diseases, including cancer, heart disease, and AIDS. Also important are the growing levels of interaction between public support, private universities, and the business-industrial communities. These business-science-government interactions are, unfortunately, discussed only briefly; they are, however, becoming increasingly important. For example, science is based upon the free exchange of information. Business interests, however, often demand high levels of secrecy until patent rights are obtained. This conflict illustrates only one of the problems encountered in expanding the role of joint science-business ventures.

This book will be an excellent resource for all scientists and administrators interested in how we came to support the structure of our billion-dollar biomedical research agenda. In light of the huge federal deficit, and probable constricted funding for future projects and scientists, the information overview obtained in this volume should be increasingly useful.

Maureen A. Smith
Medical Student
Yale University School of Medicine