LETTER

Rescuing US biomedical research: Some comments on Alberts, Kirschner, Tilghman, and Varmus

Alberts, Kirschner, Tilghman, and Varmus (1) should be commended for initiating a discussion of important issues associated with the current crisis in the US biomedical enterprise. The authors provide an excellent description of the advances in scientific knowledge and human health that have accrued as a result of the long-standing public investment in biomedical research. Alberts et al. also correctly note that the opportunities for further advances, leading to further improvement in human well-being, have never been greater in our history. Finally, the authors clearly describe the pessimism that permeates the scientific community because many potentially important scientific opportunities cannot be pursued with the currently available resources.

Alberts et al. argue that the "root cause of the widespread malaise is a longstanding assumption that the biomedical research system in the United States will expand indefinitely at a substantial rate" (1). The authors also argue that there are fundamental structural flaws that render the current system unsustainable. These arguments lead them to recommend changes that would preemptively reduce the size of the enterprise. We question these assertions. We believe that to accept the current stasis/decline in the US biomedical enterprise as inevitable is premature and will likely contribute to a further deterioration of the morale of established scientists and trainees alike. We must recognize that the last decade is quite exceptional in the history of public support of research in the United States and, rather than accepting it as a "new normal," we should make the case for a renewal of the long-standing American consensus that investment in basic research pays great dividends.

In considering whether the biomedical research enterprise is "sustainable," it is instructive to look at the history of the growth in National Institutes of Health (NIH) funding for biomedical research relative to the growth of the economy as a whole as measured by gross domestic product (GDP). We suggest that this history clearly reveals the underlying cause of the current crisis and that this cause is not an unrealistic expectation of indefinite growth.

Fig. 1 shows the growth of NIH expenditures and the growth of the GDP for the 30-y period from 1984 to 2013. The numbers are corrected for inflation and shown in 2009 dollars. They do not include American Recovery and Reinvestment Act expenditures. We also show NIH expenditures as a percentage of total GDP, which is perhaps the most useful metric.

There are three distinct periods in this history. From 1984 to 1998, the year just before the doubling of the NIH budget, NIH expenditures increased at a somewhat faster rate than the GDP. This small difference presumably reflected the high value that society attached to investment in health-related research. As a result of modestly faster real growth, NIH expenditures as a fraction of the GDP increased from 0.12% in 1984 (a value that had been relatively constant since the early 1960s) to 0.15% in 1998. Our conclusion from the data is that although public support for biomedical research through the NIH has grown continuously, it has not greatly outpaced the growth of the economy as a whole. In the 1960s, 1970s, 1980s, and 1990s this level of growth was sufficient to maintain a healthy biomedical research system and did not fuel unrealistic expectations. We suggest that there is no fundamental reason why investment in biomedical research could not continue to grow indefinitely at a pace commensurate with the growth of the GDP.

These considerations raise the question of what has changed in the last 10–15 y. The short answer is that there has been unprecedented volatility in federal support for research. First, Congress passed legislation to increase the nominal NIH budget twofold over a 5-y period, 1998–2003. As a result of this historic initiative, expenditures of the NIH increased from 0.15% of the GDP to 0.23% of the GDP. It seems obvious that any rational plan for an expansion of the federal research budget of this magnitude would implicitly require that growth continue at a reasonable pace after the expansion; it would not make any sense to expand the research system and then contract it. However, in fact, that is exactly what happened. From a high point of 0.23% of the GDP in 2003, NIH expenditures have declined to about 0.17% of the GDP in 2013. This fraction of economic activity is similar to that of the year 2000, so much of the effect of doubling the NIH budget has been lost. It is this volatility that is the central cause of the current crisis. After significantly expanding the research enterprise (with every good intention), the federal government allowed it to contract over the subsequent decade. During the same period, the GDP increased at an average annual rate of about 2%. If the NIH budget had simply continued to increase at the same rate as in the years 1984–1998, total NIH expenditures would be similar to what they are today and it is unlikely that we would be discussing a crisis in biomedical research, much less considering a contraction. It follows from these considerations that the current crisis is not a result of fundamental structural flaws in the system (although there is plenty of room for improvement). The opposite is the case: the structural flaws perceived by Alberts et al. (1) are the result of the recent gyrations of funding, which are unique in United States postwar history.

We believe that a number of the specific recommendations of Alberts et al. (1) are useful, especially the proposal that the government undertake longer-term planning of federal funding for research and the suggestions for further improvement of the grant review process. (See also the report of the 2008 NIH study of peer review that led to a number of significant changes in the process: http://enhancing-peer-review.nih.gov.) However, we question whether we should adopt the substantive recommendation of

Author contributions: T.K. and K.M. wrote the paper.

The authors declare no conflict of interest.

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www.pnas.org/cgi/doi/10.1073/pnas.1408267111

Alberts et al. (1) that we embark on a major contraction of US biomedical research by undertaking measures that would limit the number of trainees coming into the system. We think that it is hard to judge what impact such measures would have, and it seems entirely possible that they would prove counterproductive by needlessly reducing the future scientific workforce. The available data are probably insufficient to determine the optimum number of trainees, and it seems possible that market forces may optimize this number more effectively than central planning by the NIH. If we truly believe that the current decline in federal funding for research will continue indefinitely, then we will have no recourse but to accept a long-term contraction of the research enterprise and the loss of American leadership in science. We retain the hope that America will return to the long-standing national consensus that investment in biomedical research is good for the country and that a sustainable rate of growth will ultimately be restored. Encouraging this eventuality should be our major effort.

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1 Alberts B, Kirschner MW, Tilghman S, Varmus H (2014) Rescuing US biomedical research from its systemic flaws. *Proc Natl Acad Soc USA* 111(16):5773–5777.

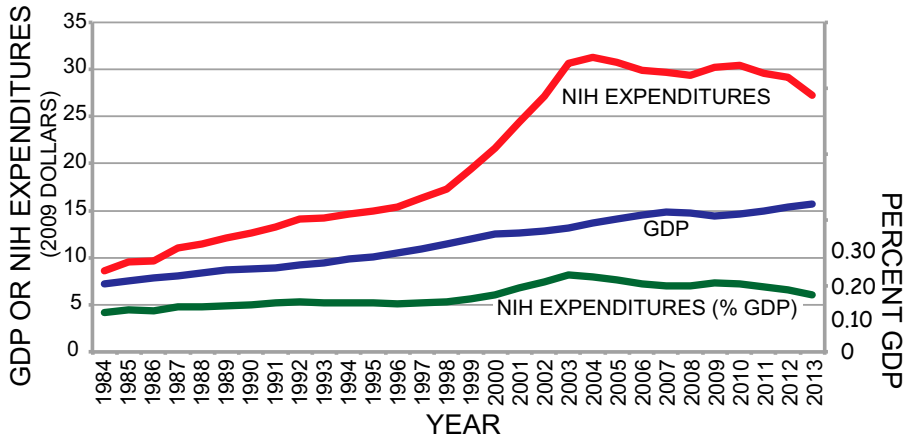

Fig. 1. NIH Expenditures vs. GDP 1984–2013. GDP data from www.bea.gov/national/xls/gdplev.xls. NIH Expenditures from http://officeofbudget.od.nih.gov/spending_hist.html. American Recovery and Reinvestment Act spending not included. GDP in trillions, NIH expenditures in billions of 2009 dollars.