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Trends in American Biomedical Research: Science, Money, and Politics

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Science and Money

You cannot do good science in America without good money. True or false? If you are an experimentalist, as most of biomedical researchers are, you can hardly afford high quality and efficient research without substantial funding, so the statement is very much true. If you are a theorist, like many physicists are, you can accomplish groundbreaking discoveries without much funding, so the statement is false. (Einstein changed our view on the universe without any funding.) The issue becomes more complicated given the fact that there is no clear correlation between the level of funding and productivity of researchers in terms of publications.

Let's consider the recent trends in biomedical research in the U.S. and the role of its major patron, the National Institutes of Health (NIH). Over the decades, the NIH's budget has increased continuously albeit unevenly. Before 1998, the annual budget increments were modest but more than enough to compensate for the inflation. Starting in mid-1990's, U.S. science output started showing an alarming trend, i.e. plateauing of the number of publications, the main indicator of the efficiency of basic research [1,2]. The government took action to fuel up scientific research by pumping more money into it. The period of 1998-2003 was the golden era of biomedical research as the government doubled the NIH's budget within five years, from ~$13.5 bln. to ~$27.0 bln., an unprecedented act that allowed funding of a large number of new proposals and renewals of the existing ones. This resulted in a significant increase in the academic research and development (R&D) workforce but failed to alter the zero slope of academic publications, including those in biomedical sciences [1,3,4]. This was followed by a disastrous "flattening" of NIH budget which actually was a negative slant as the annual increments were (and still are) less than the annual inflation [5]. Only during the last two years, the NIH suffered a 1% budget cut [6]. The shift from the big bang to the big crunch had a shocking effect on the scientific landscape, including freezing of new hires, lab closures, loss of jobs, and overall stagnation of U.S. science productivity [1-3,7]. The NIH funding cuts inevitably resulted in a drop of proposal success rate (pay-line) to "catastrophically low levels" [7], from above 25% in 2000 to below 10% in 2007. This, in turn, caused turmoil and frustration among the researchers across the country. Previously productive and successful scientists were suddenly witnessing a new reality where meritorious, potentially high impact proposals were being triaged, unscored, not-discussed by NIH study sections. When there is not enough money to fund all, or at least most of, outstanding proposals, things get unruly. Factors other than pure scientific reasoning, such as the applicant institution and the influence of the principal investigator (PI), become important issues. The situation was exacerbated by the burden of new administrative regulations, such as requirements of excessive documentation for research on animals or human subjects, which exerted a "suffocating" effect on the biomedical research as a whole [8]. Thus, while the amount of money invested in science may not have an immediate effect on scientific output, sudden changes in funding, especially abrupt cuts, are certainly destructive. The government needs to work out a long term, consistent strategic plan about how American science should be funded.

The Review Process: Very Good = Very Bad?

The NIH administration, on the other hand, was facing the same challenging situation of ever increasing number of proposals (over 80,000 proposals annually) and ever decreasing budget [5,9]. They had to invent mechanisms to a) reduce the number of incoming proposals and b) justify rejections of meritorious proposals. These goals were partially accomplished by adopting a practice of "rotating the reviewers," i.e., using new reviewers for evaluation of the amended proposals, and by reducing the number of allowed amendments from two to one. The latter gives the PI just one single chance to amend the proposal. If it does not reach the fundable level, then you are done; you can never again submit the same or even a similar proposal to NIH. If you do, it will be "administratively withdrawn" without review. Worse yet, the reviewer rotation mechanism gave the NIH a powerful lever to reject excellent proposals. Typically, a good proposal might get a good but non-fundable score at the original submission and, after significant improvement by addressing all reviewers' concerns, might get a worse score or no score at all because of new concerns raised by a new reviewer. A specific aim considered "the most comprehensive analysis developed to date" at the original submission and "the particular strength of the proposal" at the A1 revision, was "less well received" and criticized at the A2 revision, thus killing the proposal. (Quotes from reviews of a real-life proposal.) In another scenario, the proposal might get good, or even very good scores that are only marginally away from the pay-line. Eventually, the proposer gets praised and lauded but…rejected, which may cost the proposer his/her whole career.

In natural (especially biomedical) sciences, the ultimate measure of success tends to be the number of research dollars you are able to garner, which determines a researcher's fate in terms of promotion, tenure, and eventually the job security. For example, one can hardly get tenured at a medical school without a sizeable grant such as an R01 [3,9]. The university administration will certainly consider your teaching, publications, citations, and your *h*-index, but most importantly, will shake your pockets. The absence of the golden jingle may not play in your favor. In other words, a scientist with no money is a poor scientist.

The extremely challenging pay-line implied a large number of rejected proposals, forcing the researchers to spend most of their time writing and re-writing proposals instead of concentrating on research and training the students. In addition, more than 15,000 researchers specialized in various fields of life sciences spend 1 to 3 months a year reviewing the proposals and working at the NIH study sections,

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away from research and training activities [9]. Thus, paradoxically, the marathon for research dollars is exerting an overall destructive effect on research itself.

The new, futile reviewing mechanism raged the researchers, who started bombarding the NIH with appeals, protesting the inconsistencies in the review system. A typical response from the NIH director's office might read like this: "The apparent discrepancies you referred to in your letter are not unique and may be better understood by examining the peer review process. About 25 % of the reviewers in various study sections are rotated yearly, so new reviewers are able to add their own scientific opinions…The decision was made not to fund your application. The choices the NHLBI must make are challenging indeed as we take the appropriate steps to manage our research support responsibilities at a time of such fiscal constraint." (Quote from a real letter from the NIH director's office, 2006.) Thus, the NIH officials admit the existence of discrepancies but explain it in a strange way: the reason for discrepancies is they rotate the reviewers and they do it to somehow cope with the fiscal constraint. This indicates that the new review policies adopted by the NIH are really aiming at rejection of proposals that would pass provided a fair review process was in place.

The idea of scoring the proposal at the "very good" level and declining it might have been borrowed from NSF, where it is being practiced for a very long time. Having been rejected by NIH and forbidden to knock on the door again, many researchers have submitted their proposals to NSF. Not many might have succeeded, however, as NSF is reluctant to treat this kind of proposals favorably. One thing NSF especially dislikes is the large, R01-size budget. NSF program officers will tell you the budget does not matter, the only things that matter are the scientific merit and the broader impacts. However, when the proposal receives only very good and excellent scores, and even is rated as "superior", the NSF officer will refuse to recommend it for funding because the proposal was "in the cluster portfolio which is a robust category and consequently is not a funding priority area at this point in time." (Quote from a real NSF program officer's comments, 2009.) Again, an outstanding proposal can easily be rejected for reasons other than its scientific value. In summary, thousands of promising and innovative proposals that might contribute to the progress of the society have been thrown in the trashcan because of bureaucratic and administrative hitches.

Politics

Why is the U.S. government reluctant to be more generous in funding of R&D? The answer can be found in the overall attitude of the country's population. Progressive constituents would press on their representatives to give science funding a high priority. However, the 2011-2012 race for Republican presidential nomination indicated that most progressive ideas find little support among U.S. citizens whereas conservative, anti-high-education and pro-religious rhetoric is readily embraced by many. On the other hand, the main concern of the Republicans is maintaining and augmenting the defense spending, and that of the Democrats is social security and healthcare, such as Medicare and Medicaid. It appears that neither the government nor the citizens consider science and technology a priority. In the same time, in other parts of the world, such as China, India, Russia, and most of Europe, higher education, science and technology are given highest priority, which results in decisive economic growth [10,11]. If America wants to stay competitive, more efforts should be made like the 2010's "America Competes Act" initiative, which projected $46 bln. for science and technology funding. While President Obama claims "Our generation's Sputnik moment is back," indicating full appreciation of the importance of scientific and technological development in overall progress of the society, regressive ideas that put religion above education still are influential among many Americans.

What Can Be Done?

Let's start with the facts that the U.S., which is believed to be the most developed nation on the globe, is only #6 in higher education enrollment, # 27 in years of secondary education per worker, and # 10 in R&D spending [11]. Certainly, "reducing funds for education, scientific research, air-traffic control, NASA, infrastructure and alternative energy… will hurt the economy's long-term growth." [11]. This is exactly what we are witnessing today in America. It should be clearly understood that there is no progress without education; education is the propeller of economic and technological growth. The overall sociopolitical atmosphere in the country should change towards a pro-higher-education ideology. "As long as educational achievement keeps up with technological gains, more jobs are created" [12]. Education must become the highest value in the nation.

The second must is that the government gives science, engineering, and technology a higher priority than it is today. Basic research usually does not bring fruit immediately, but ignoring basic research today will have a long-term, perhaps irreversible damaging effect tomorrow.

In terms of more specific issues like the policies adopted by science-funding agencies such as the NIH or NSF, they may want to reconsider their proposal reviewing tactics. One proposal should be reviewed by the same set of reviewers, as much as possible. Otherwise the researchers are put in a vicious cycle that leads nowhere. Furthermore, a proposal declined two times by the NIH should still be given a chance to be considered for funding. Scientific landscape and priorities change rapidly, so a proposal may be viewed more favorably under new circumstances. Next, more opportunities should be provided for small, R03-type proposals to test new ideas and generate new projects. (Currently not all NIH institutes are accepting investigator-generated R03 proposals.) Finally, the program officers should make funding recommendations based on the scientific merit of the proposal and not the "priority." All proposals considered within a certain panel or study section should have similar priorities; only the scientifically strongest proposals should win.

In conclusion, there is solid ground to reshape the country's attitude towards science and technology, the driving force of the society. "Generations have worked hard and sacrificed much for the country to reach this point, and with further hard work and sacrifice the U.S. will do just fine in the world it has shaped." [13].

References

1. Javitz H, Grimes T, Hill D, Rapoport A, Bell R, et al. (2010) U.S. academic scientific publishing. Working paper SRS 11-201. Arlington, VA: National Science Foundation, Division of Science Resources Statistics.

2. Mervis J (2007) U.S. output flattens, and NSF wonders why. Science 317: 582.

3. Hendrix D (2008) An analysis of bibliometric indicators, National Institutes of Health funding, and faculty size at Association of American Medical Colleges medical schools, 1997-2007. J Med Libr Assoc 96: 324-334. Erratum in: J Med Libr Assoc 2009 97: 74.

4. Cappell MS, Davis M (2008) A significant decline in the American domination of research in gastroenterology with increasing globalization from 1980 to 2005: an analysis of American authorship among 8,251 articles. Am J Gastroenterol 103: 1065-1074.

5. Fang FC, Casadevall A (2009) NIH peer review reform—Change we need, or lipstick on a pig? Infection and Immunity 77: 929-932.

6. Mervis J (2012) Research remains a favored child in budget decisions. Science 335: 25-26.

7. Moore JP (2007) Speaking out about U.S. science output. Science 318: 913.

8. Heffner RS (2007) Speaking out about U.S. science output. Science 318: 913.

9. Scarpa T (2006) Peer review at NIH. Science 311: 41.

10. Zakaria F (2009) Is America losing its mojo? Newsweek Nov 23: 38-41.

11. Zakaria F (2011) Are America's best days behind us? Time Mar 14: 28-33.

12. Foroohar R (2011) What ever happened to upward mobility? Time Nov 14: 26-34.

13. Von Drehle D (2011) Don't bet against the United States. Time Mar 14: 34-35.