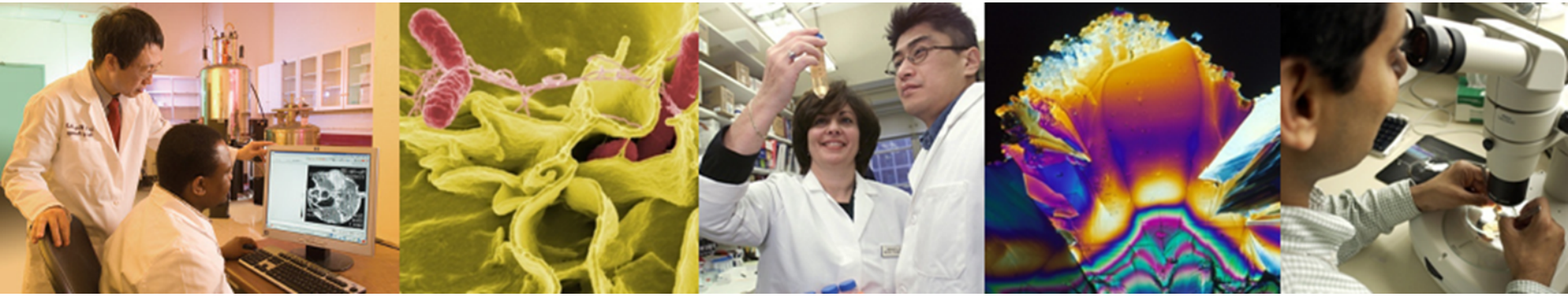
Enhancing Stewardship: New Efforts to Promote a Stronger and More Stable Biomedical Research Workforce

5th Joint Meeting (4th CRAN) of the National Advisory Council on Alcohol Abuse and Alcoholism, National Cancer Advisory Board, and the National Advisory Council on Drug Abuse

May 3rd, 2017

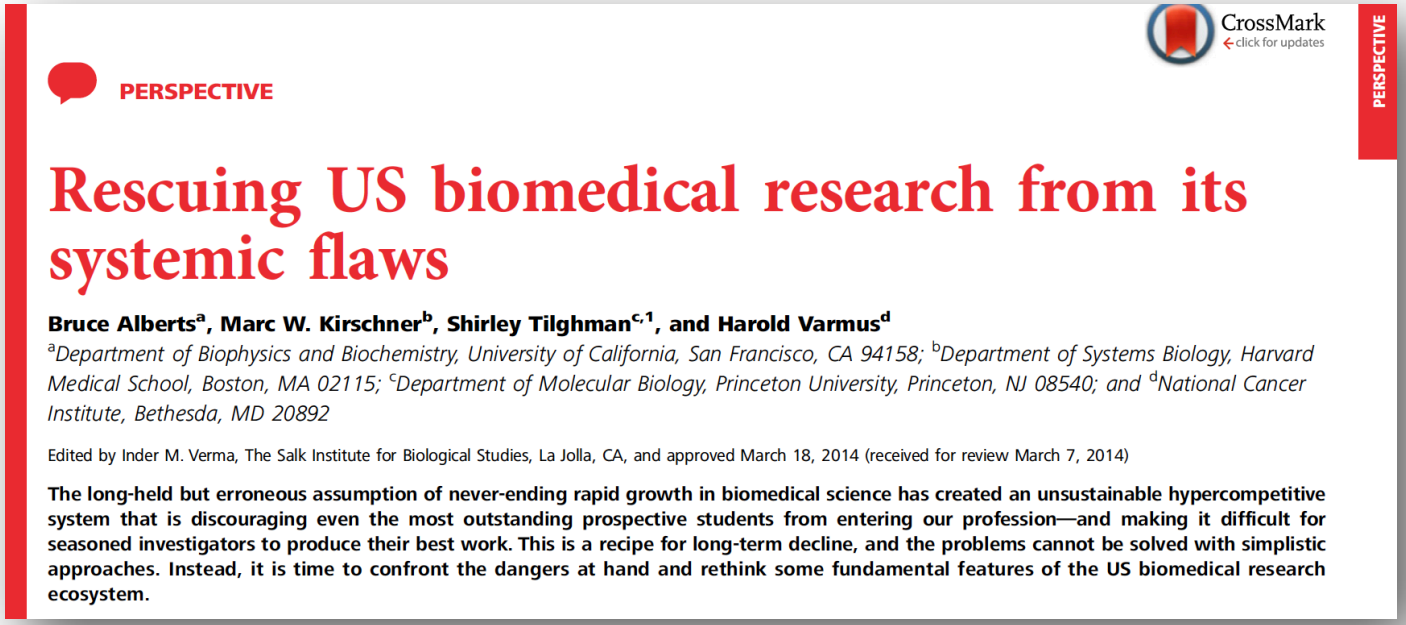


Lawrence A. Tabak, DDS, PhD
Principal Deputy Director, NIH
Department of Health and Human Services

NIH is entrusted to maximize the impact of the research dollars that we expend

We are also committed to develop and sustain the most qualified biomedical research workforce possible

The Observation



PERSPECTIVE

Rescuing US biomedical research from its systemic flaws

Bruce Alberts[a], Marc W. Kirschner[b], Shirley Tilghman[c,1], and Harold Varmus[d]

[a]Department of Biophysics and Biochemistry, University of California, San Francisco, CA 94158; [b]Department of Systems Biology, Harvard Medical School, Boston, MA 02115; [c]Department of Molecular Biology, Princeton University, Princeton, NJ 08540; and [d]National Cancer Institute, Bethesda, MD 20892

Edited by Inder M. Verma, The Salk Institute for Biological Studies, La Jolla, CA, and approved March 18, 2014 (received for review March 7, 2014)

The long-held but erroneous assumption of never-ending rapid growth in biomedical science has created an unsustainable hypercompetitive system that is discouraging even the most outstanding prospective students from entering our profession—and making it difficult for seasoned investigators to produce their best work. This is a recipe for long-term decline, and the problems cannot be solved with simplistic approaches. Instead, it is time to confront the dangers at hand and rethink some fundamental features of the US biomedical research ecosystem.

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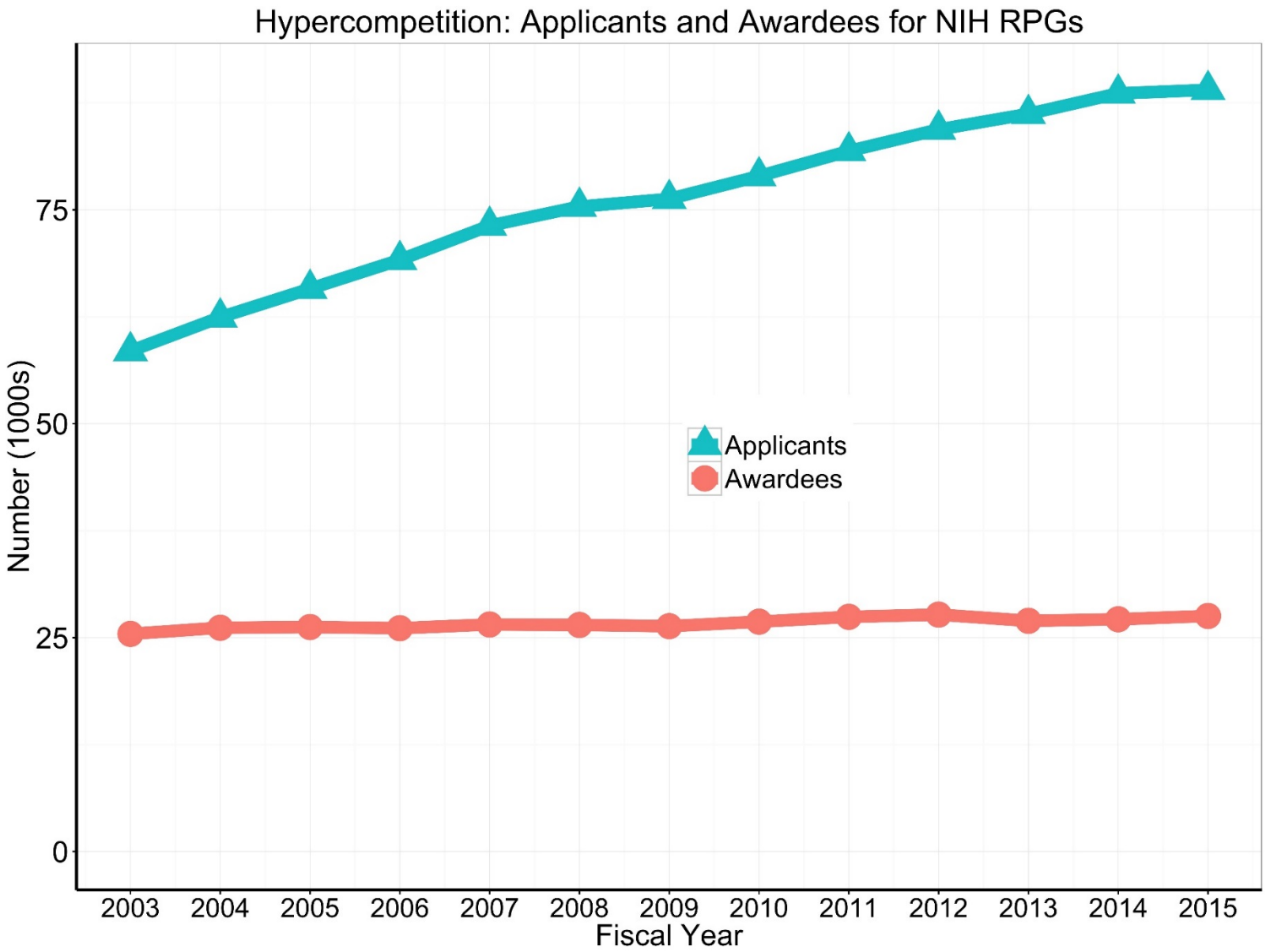
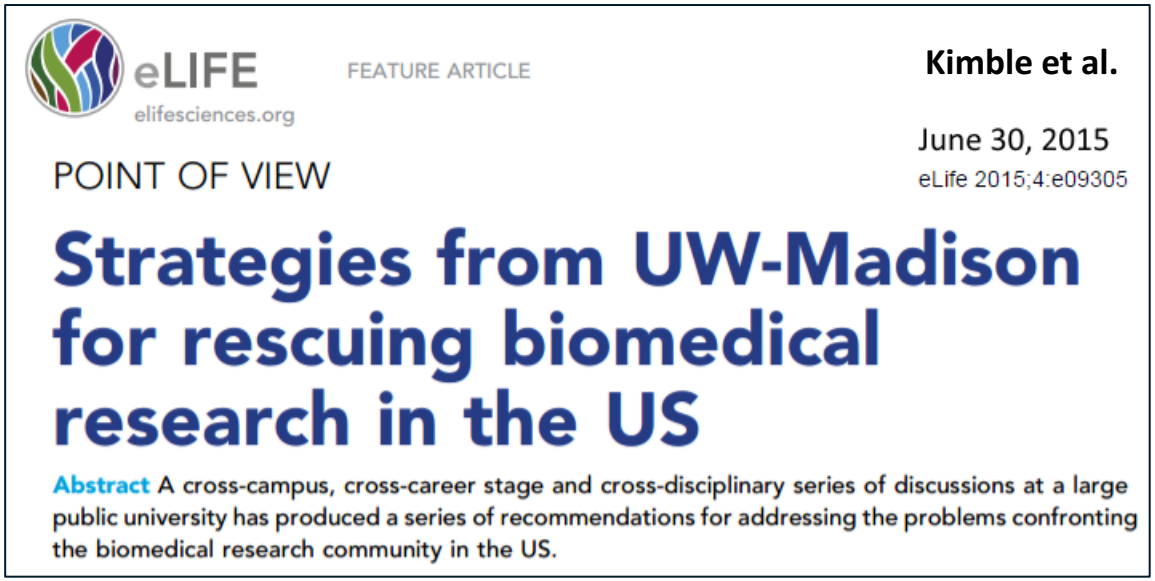
Alberts B et al. PNAS. 2014;111:5773-7


Hypercompetition: Applicants and Awardees for NIH RPGs
Number (1000s)
0
25
50
75
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Fiscal Year
Applicants
Awardees

The Observation



eLIFE elifesciences.org

FEATURE ARTICLE

Kimble et al.

June 30, 2015

eLife 2015;4:e09305

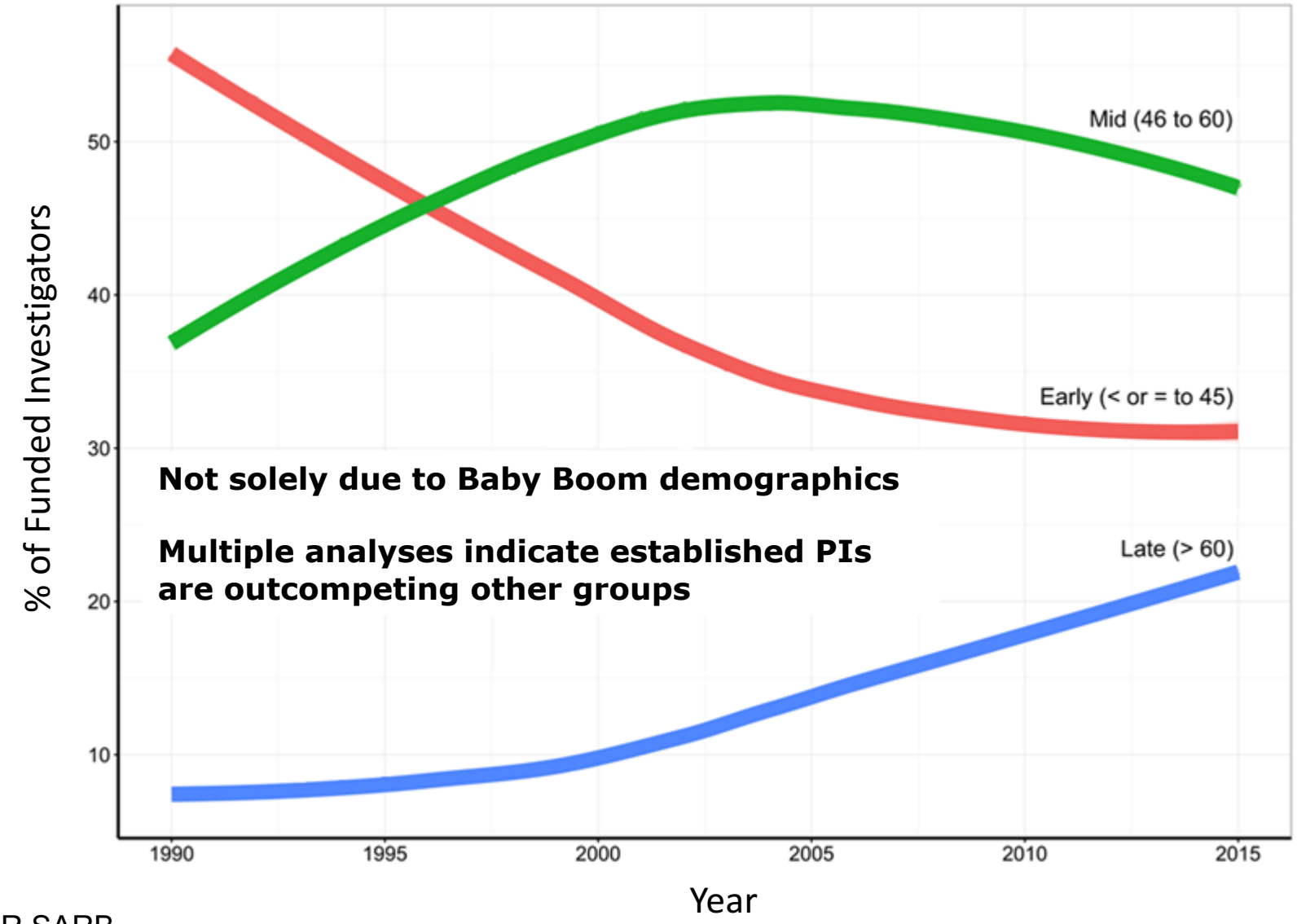
POINT OF VIEW

Strategies from UW-Madison for rescuing biomedical research in the US

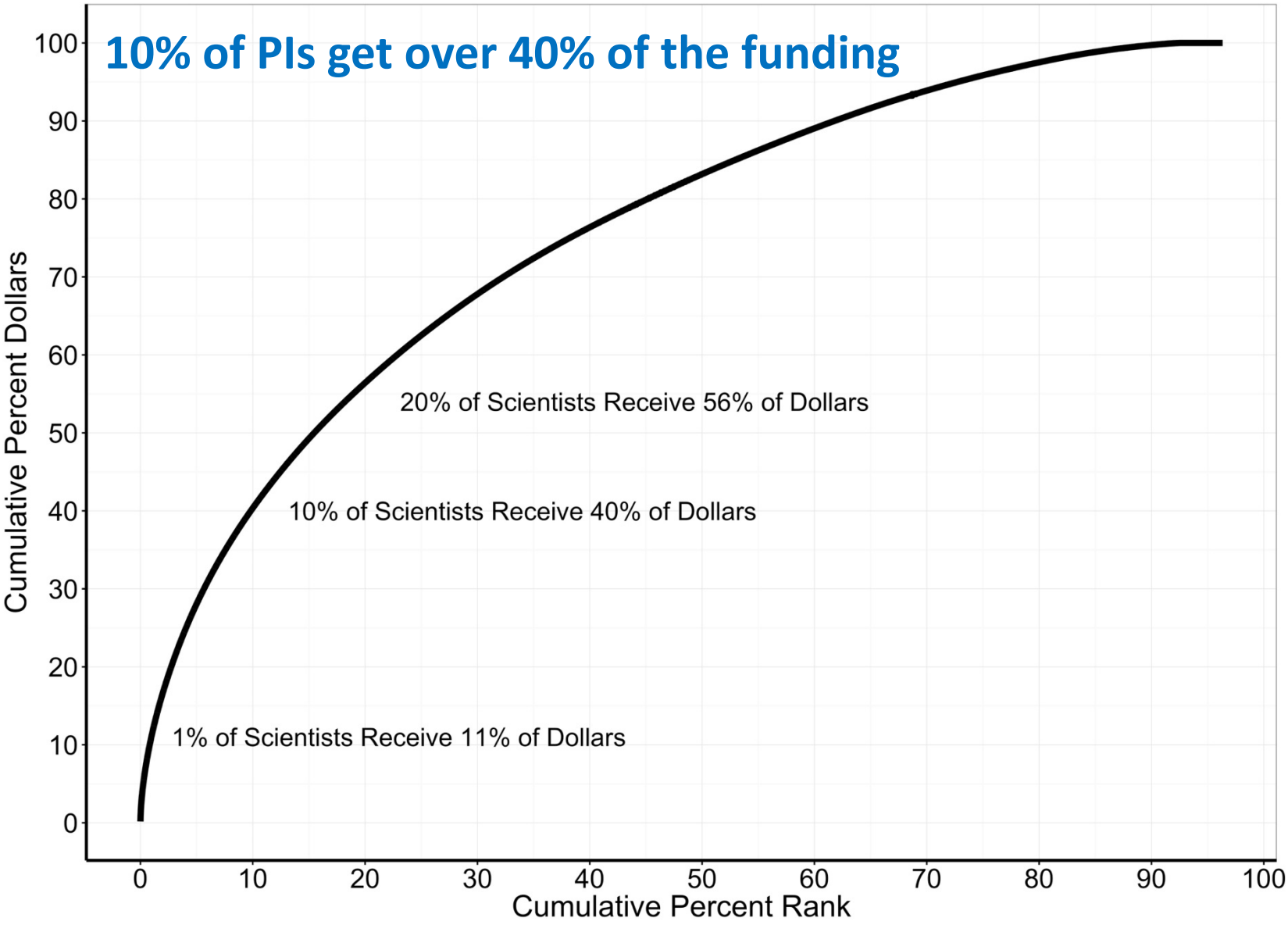
Abstract A cross-campus, cross-career stage and cross-disciplinary series of discussions at a large public university has produced a series of recommendations for addressing the problems confronting the biomedical research community in the US.

Our process identified two core problems that the US biomedical research community faces: Too many researchers vying for too few dollars. Too many postdocs competing for too few faculty.

Age of Investigators Funded by NIH



Skewed Distribution of Resources



The concentration of resources among our most senior investigators challenges our ability to maintain a future biomedical research workforce

But, does this skewed distribution of resources yield optimal productivity?

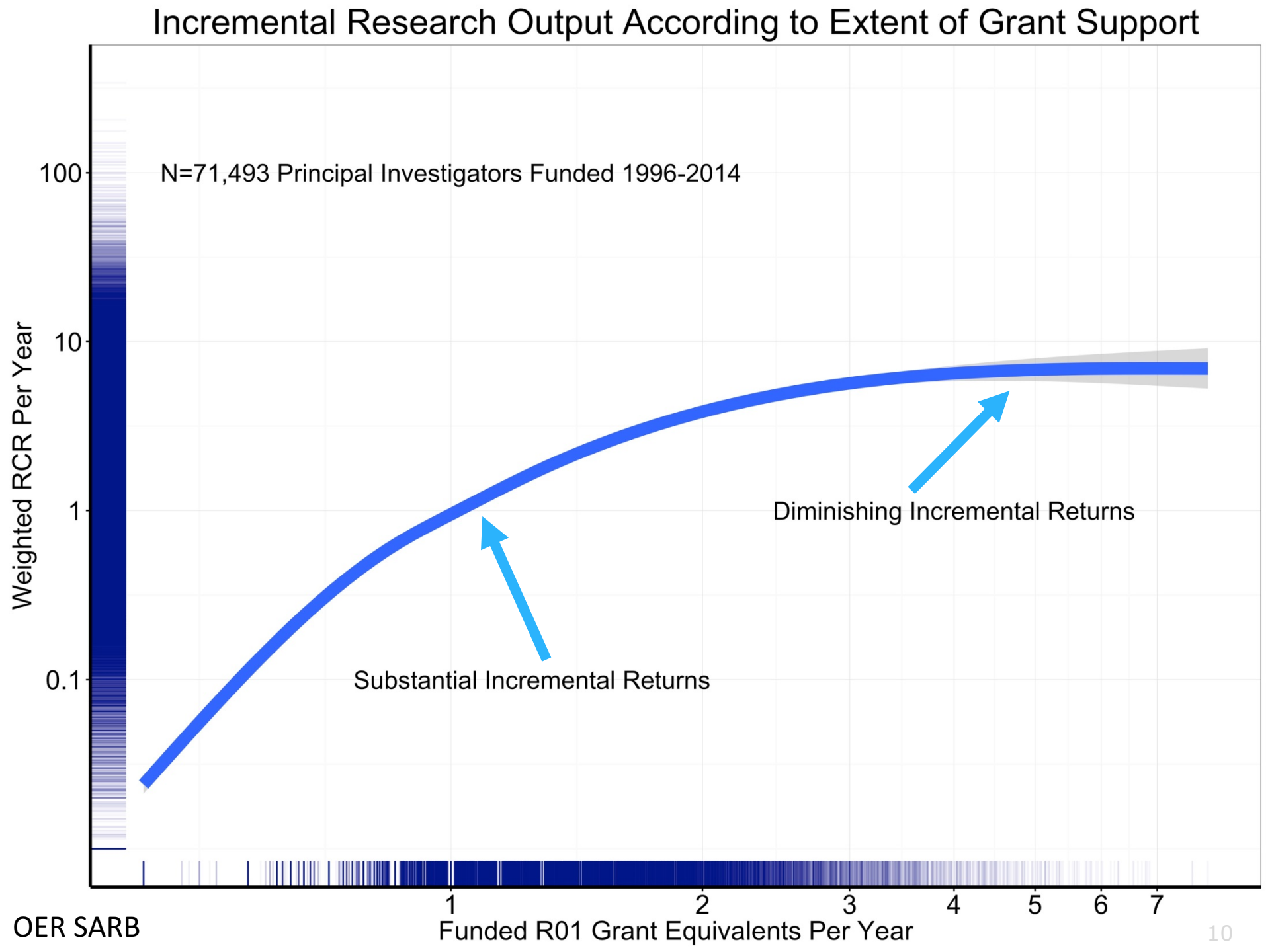
Can bibliometrics be used to compare the influence of publications or productivity of an award?

Commonly used measures

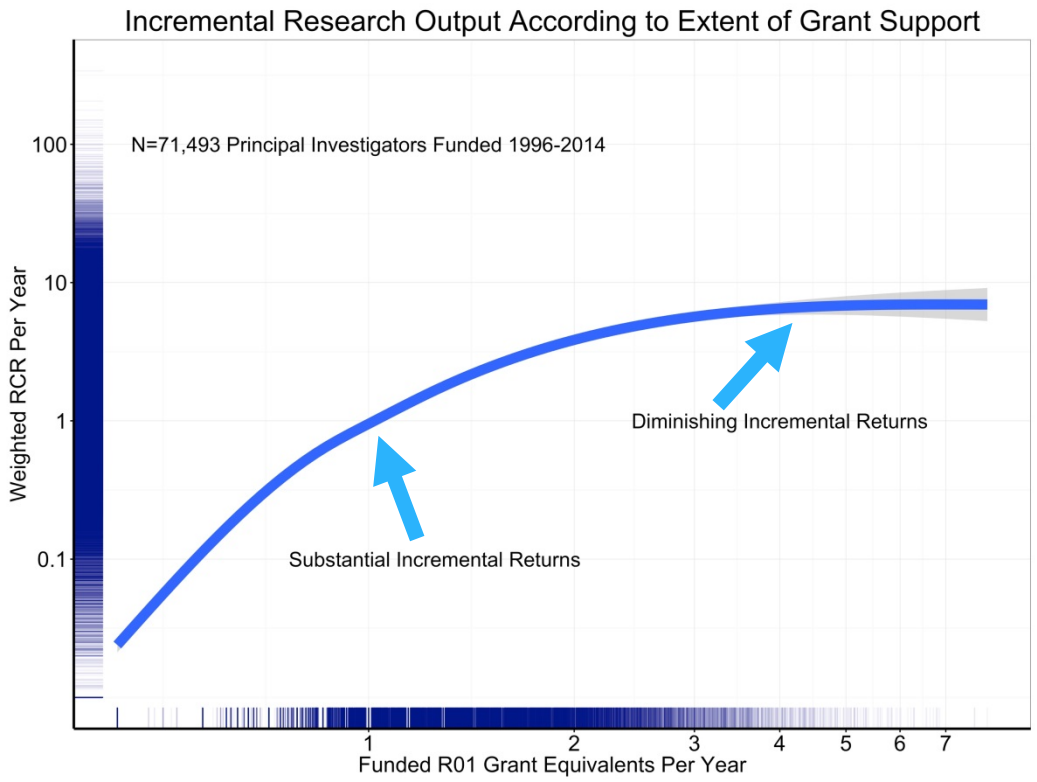
- *Publication Counts*: field-dependent, use-independent
- *Impact Factor*: journal-level not article-level
- *Citation Rates*: field- and time-dependent
- *h-index*: field-dependent and time-dependent
- *Relative Citation Ratio**: article level and field independent

Hutchins et al., 2016, *PLOS Biology

NIH National Institutes of Health
Office of Portfolio Analysis


Incremental Research Output According to Extent of Grant Support
N=71,493 Principal Investigators Funded 1996-2014
Weighted RCR Per Year
100
10
1
0.1
Substantial Incremental Returns
Diminishing Incremental Returns
1
2
3
4
5
6
7
Funded R01 Grant Equivalents Per Year

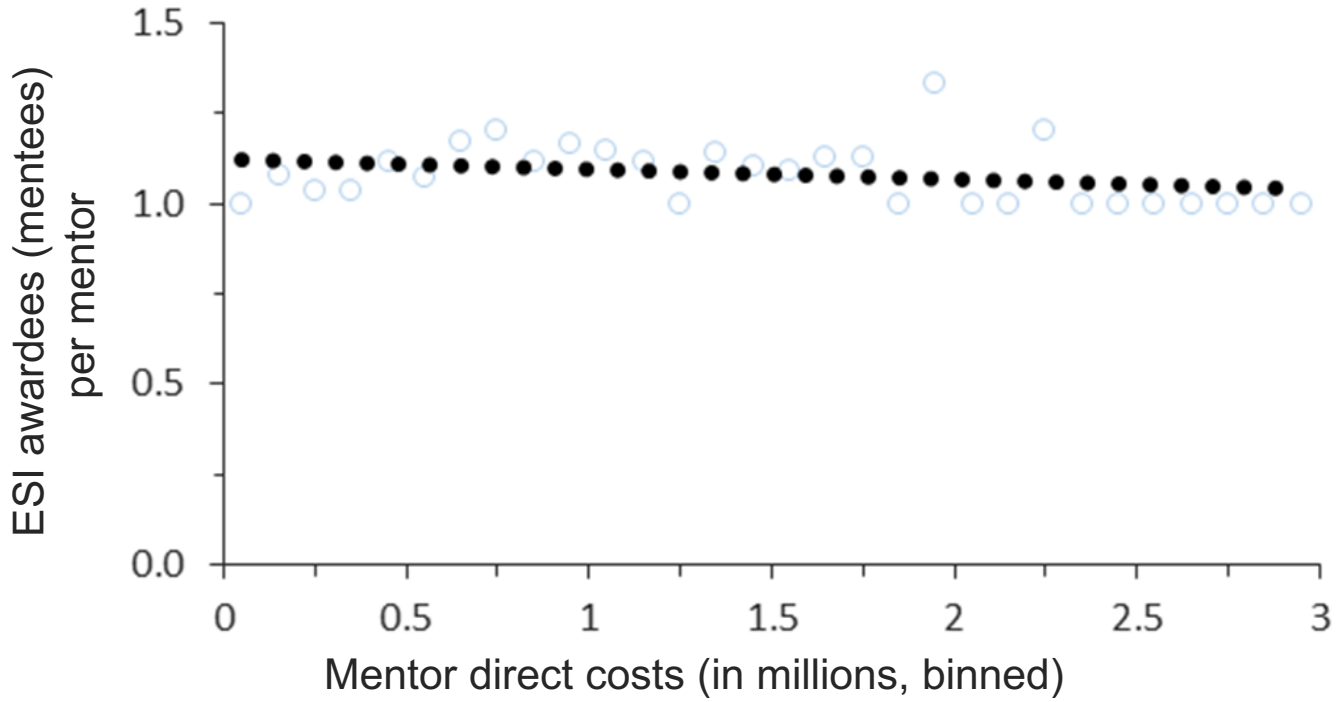
Increment in productivity is reduced as investigators receive more resources



Well-funded investigators are very productive, but when NIH is thinking about awarding a grant, on average, will we get a greater return by awarding a fourth grant to someone, or by awarding a grant to a highly promising investigator who would otherwise have no resources?

ESIs who are successful at obtaining an NIH RPG are no more likely to come from well-funded labs

ESI RPG awardees per mentor versus
the FY16 direct costs of their RPG-funded mentors



NIH National Institutes of Health
Office of Portfolio Analysis

OPEN ACCESS Freely available online

PLOS ONE

Big Science vs. Little Science: How Scientific Impact Scales with Funding

Jean-Michel Fortin, David J. Currie*

Ottawa-Carleton Institute of Biology, University of Ottawa, Ottawa, Ontario, Canada

Abstract

Agencies that fund scientific research must choose: is it more effective to give large grants to a few elite researchers, or small grants to many researchers? Large grants would be more effective only if scientific impact increases as an accelerating function of grant size. Here, we examine the scientific impact of individual university-based researchers in three disciplines funded by the Natural Sciences and Engineering Research Council of Canada (NSERC). We considered four indices of scientific impact: numbers of articles published, numbers of citations to those articles, the most cited article, and the number of highly cited articles, each measured over a four-year period. We related these to the amount of NSERC funding received. Impact is positively, but only weakly, related to funding. Researchers who received additional funds from a second federal granting council, the Canadian Institutes for Health Research, were not more productive than those who received only NSERC funding. Impact was generally a decelerating function of funding. Impact per dollar was therefore lower for large grant-holders. This is inconsistent with the hypothesis that larger grants lead to larger discoveries. Further, the impact of researchers who received increases in funding did not predictably increase. We conclude that scientific impact (as reflected by publications) is only weakly limited by funding. We suggest that funding strategies that target diversity, rather than "excellence", are likely to prove to be more productive.

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Fortin and Currie. PLoS One. 2013;8(6):e65263

PeerJ

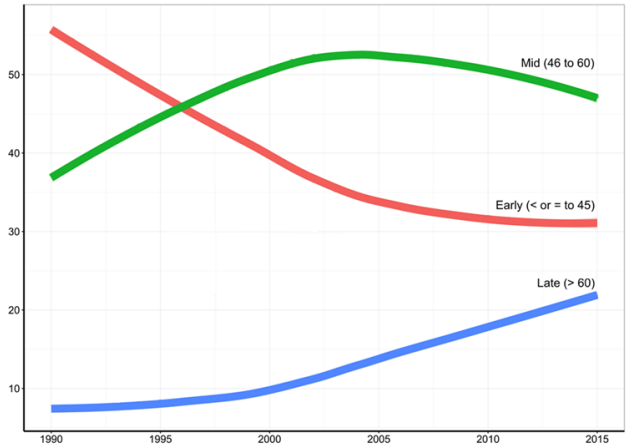
Research groups: How big should they be?

Isabelle Cook, Sam Grange and Adam Eyre-Walker

School of Life Sciences, University of Sussex, Brighton, United Kingdom

We show that three measures of productivity, the number of publications, the impact factor of the journals in which papers are published and the number of citations, are all positively correlated to group size, although they all show a pattern of diminishing returns—doubling group size leads to less than a doubling in productivity.

PeerJ 3:e989; DOI 10.7717/peerj.989

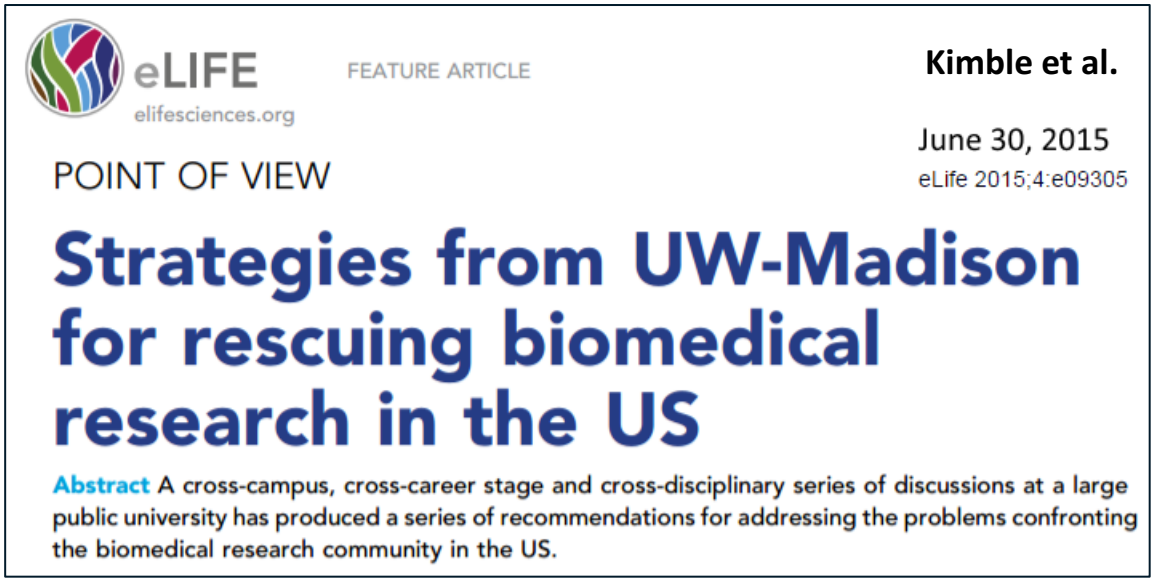


How do we Increase the Number of Early-Career Funded Scientists?

How do we Stabilize the Career Trajectories of Scientists?

How do we Maximize the Impact of NIH Funding?

Approaches to Consider



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Our process identified two core problems that the US biomedical research community faces: Too many researchers vying for too few dollars. Too many postdocs competing for too few faculty.

Our recommendations are designed to reverse these trends by redistributing funds to support both junior investigators and pioneering projects. That redistribution will be painful, especially for established senior investigators, but necessary to support the next generation and cutting edge research.

Sustaining Discovery in Biological and Medical Sciences

A Framework for Discussion

FASEB Federation of American Societies for Experimental Biology
www.faseb.org/sustainingdiscov

Approaches to Consider

2.8 Research sponsors should monitor the amount of funding going to a single individual or research group to ensure a broader distribution of research funding

Limiting the amount of funding awarded to any individual scientist or laboratory would enable more people to be actively engaged in research. With more "hands at the bench," the number of ideas would increase, and this could expedite progress in many areas of science. Analyses produced by NIH as part of the call for suggestions on "Ways of Managing NIH Resources"[96] show that limiting a principal investigator's total RPG support to $1 million would enable the funding of 2,000 additional RPG awards at an average cost of $400,000.

Evidence suggests that limiting the amount of funding to investigators might enhance the productivity of the portfolio overall. An analysis of NIGMS grants found that the correlation between funding and the number of research publications became attenuated at the highest funding levels.[97]

Approaches to Consider

Request for Information (RFI): Optimizing Funding Policies and Other Strategies to Improve the Impact and Sustainability of Biomedical Research

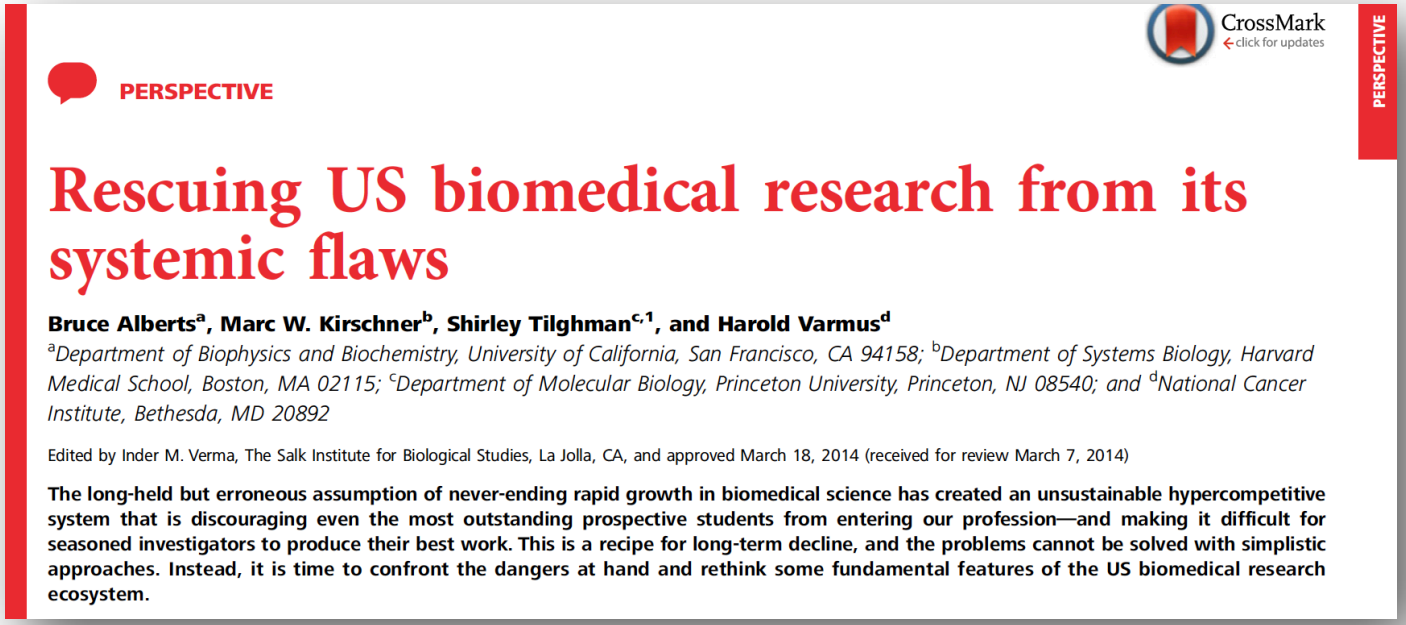
Notice Number: NOT-OD-15-084

Key Dates

Release Date: April 2, 2015
Response Date: May 17, 2015

Capping the number of NIH grants or amount of funds a PI can have were among the most common suggestions by both individual and institutional respondents.

Approaches to Consider



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Agencies should be sensitive to the total numbers of dollars granted to individual laboratories…—although different research activities have different costs—at some point, returns per dollar diminish.

Alberts B et al. PNAS. 2014;111:5773-7

The Proposed Plan

- NIH is committed to support investigators at all career stages
  - We will carefully track funding patterns of scientists across all career stages
  - ICOs will continue to use current approaches to “bend the curves” including:
    - Adherence to the ESI policy
    - Expansion of R01 investigator initiated research at the “expense” of Institute-solicited FOAs
    - Encouraging R56 Bridge Awards for ESIs to increase R01 resubmission success rates
    - Targeting R35 award for Mid-career “Emerging Investigators”

The Proposed Plan (cont.)

- NIH is committed to support investigators at all career stages
  - None of the current approaches addresses directly the issue of diminishing returns in the labs of highly funded investigators
  - Most highly funded investigators are supported by two or more ICOs
    - Therefore, we will institute a new trans-NIH policy that resets expectations for the support provided to any single investigator
    - This will begin with applications being submitted this fall; application of the policy will be “rolling” with submission of a new application or a competitive renewal

The Grant Support Index (GSI)

- Measure of PI's grant support
  - Effectively, a modified grant count to estimate the "bandwidth" of principal investigators
- Not simply measure of dollars
  - Some science is more expensive
- Benchmarked to R01 (7 points)
  - R03, R21 less
  - R35, P50 more

The Grant Support Index (GSI) (cont.)

Some Outstanding Issues

- How best do we account for complex clinical trial networks and other complex infrastructure programs?
- How can we account for team science?
- Are special considerations required to account for the need to attract highly talented investigators into new fields of science?

We are seeking input to help us work through the implementation

The Proposed Plan (cont.)

- Resetting expectations for the support provided to any single investigator
  - Monitor levels of PI "bandwidth" using the Grant Support Index (GSI)
    - NIH will automatically calculate GSI for every PI
- Work with the applicant to limit the "bandwidth" of any single PI to a GSI of 21 (roughly, equivalent to 3 RO1s)
- Applicants that designate investigators above a GSI of 21 will present a plan with any new or competing application that mitigates any increase to such investigators' GSI

The Proposed Plan (cont.)

- Resetting expectations for the support provided to any single investigator
  - A rigorous “exceptions” process can be initiated by ICO Directors, that takes into account:
    - The unique research requirements of an ICO
    - The success of the ICO to support investigators at all career stages
    - The need to maximize productivity of grant resources
  - Final decisions will be made centrally by the NIH Director’s Office

The Proposed Plan (cont.)

- If the maximum GSI across all of NIH was 21 and all mechanisms were included:
  - We estimate that ~6% of investigators would be affected
  - This would free up resources to make ~1600 new awards over the next several years

An analogous program will be put into place for the NIH Intramural program

Summary and Implementation Considerations

- NIH remains committed to assuring the robustness and stability of the next generation of biomedical scientists
- Further, we remain committed to optimizing the use of our resources to obtain the maximum impact possible
- We will use a variety of approaches to “bend the curves” including resetting expectations on support provided to any one investigator
- We will monitor and track all resources used for this purpose to identify and mitigate unintended consequences

Acknowledgements

- Dr. James Anderson – DPCPSI
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- Ms. Jill George – OCPL
- Dr. Patricia Haggerty – NIAID
- Ms. Adrienne Hallett – OLPA
- Dr. Richard Ikeda – OER
- Dr. Stephen Katz – NIAMS
- Ms. Rebecca Kolberg – OCPL
- Dr. Michael Lauer – OER
- Dr. Aviva Litovitz – DPCPSI
- Dr. Jon Lorsch – NIGMS
- Dr. John J. McGowan – NIAID
- Dr. Andrew Miklos – NIGMS
- Dr. Lauren Milner – IMOD
- Ms. Julie Muroff – OGC
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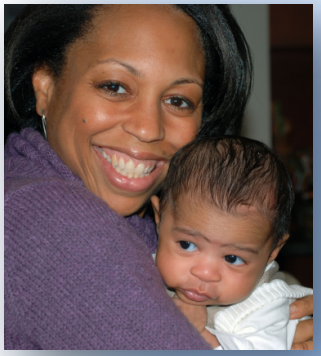
- Dr. Roderic Pettigrew – NIBIB
- Dr. Deepshikha Roychowdhury – OER
- Dr. George Santangelo – DPCPSI
- Dr. Tara Schwetz – IMOD
- Dr. Brent Stanfield – NIDDK
- Dr. Neil Thakur – OER
- Dr. Carrie Wolinetz – OSP

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Turning Discovery Into Health