High-impact factor syndrome: What, why, and what to do

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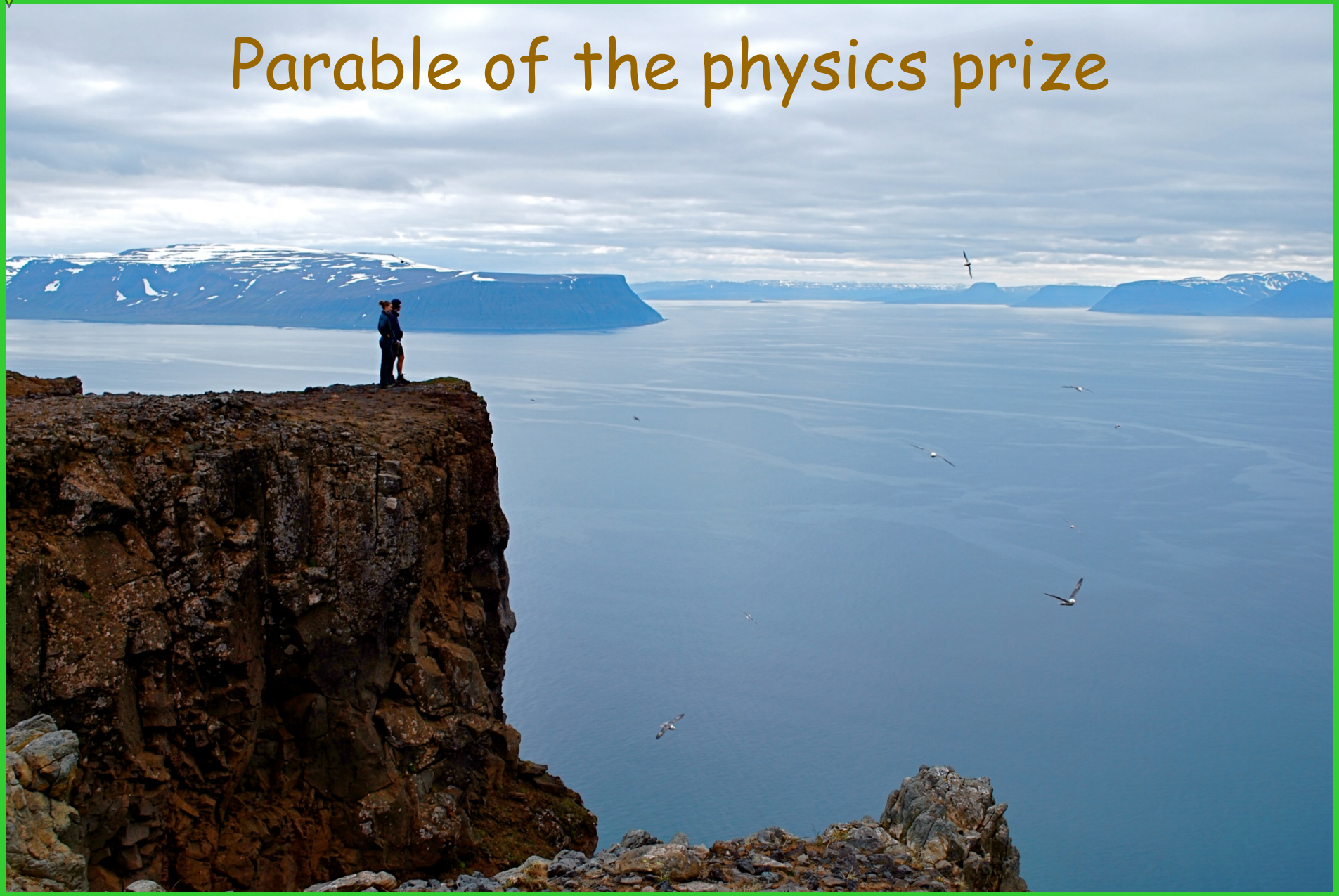
This is opinion, and the opinions are mine.

Parable of the physics prize



Holstrandir Peninsula overlooking Ísafjarðardjúp
Westfjords, Iceland

High-impact-factor syndrome (HIFS)

High-impact-factor syndrome (HIFS) is a disease of scientists and administrators. The most virulent manifestation of the disease lies in judging the accomplishments of individual scientists, especially junior scientists, in terms of the number of publications in high-impact-factor (HIF) journals.

C. M. Caves, "High-impact-factor syndrome," *APSNews* **23**(10), 8,6 (2014 November). Back-page opinion piece on HIFS.

R. Werner, "The focus on bibliometrics makes papers less useful," *Nature* **517**, 245 (2010 January 15). Focus on use of citation metrics; peculiar anti-*PRL* animus, displayed unambiguously in subsequent blog posts.

PI Predictor, in Science Careers (simplified version of original in Current Biology), as summarized by J. Austin, "What it takes," Science **344**, 1422 (2014 June 20):

- **Be male.**
- **Be selfish (insist on being first author).**
- **Be elite (from one of the top ten institutions in the Shanghai Academic Ranking of World Universities).**
- **Publish in HIF journals.**

High-impact-factor syndrome (HIFS) is the practice of using number of publications in HIF journals as a proxy for individual research accomplishment or potential.

San Francisco Declaration on Research Assessment (DORA): Putting Science into the Assessment of Research.

Chief recommendation: **Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions.**

D. Hicks, P. Wouters, L. Waltman, S. de Rijcke, and I. Rafols, "Bibliometrics: The Leiden manifesto for research metrics," Nature **520**, 429–431 (2015 April 23):

Several universities base promotion decisions on threshold h-index values and on the number of articles in "high-impact" journals. Researchers' CVs have become opportunities to boast about these scores, notably in biomedicine. Everywhere, supervisors ask PhD students to publish in high-impact journals … . In Scandinavia and China, some universities allocate research funding or bonuses on the basis of a number: for example, by calculating individual impact scores to allocate "performance resources" or by giving researchers a bonus for a publication in a journal with an impact factor higher than 15.

High-impact-factor syndrome (HIFS)

I am not talking for the present about

- **The purpose of scientific publication in the age of the arXiv.**
- **Whether an individual should publish a particular paper in *Nature* or its babies, *Science,* or even *PRL* or *PRX.***
- **The use of impact factor to assess the quality of a journal.**
- **Using publication in HIF journals as a proxy for assessing countries, states, institutions, and units within institutions.**
- **The general use of citation metrics (bibliometrics) as a tool for assessing research accomplishment.**

I will have something to say about each of these in a bit, because they are all related to HIFS.

Parable of the two physicists

Cable Beach
Western Australia

What is journal impact factor (IF)?

How to get the 2013 IF for *Physical Review Letters*

Take all the papers published in *PRL* in 2011 and 2012. The standard (two-year) 2013 IF is the average number of citations accumulated by these papers in 2013, in a list of "indexed journals" maintained by Thomson Reuters Web of Science.

Web of Science indexes over 8,000 science and technology journals and issues an annual report, called the Journal Citation Reports (JCR), which lists IFs and other measures of journal impact. For example, you will also see five-year IFs, which are computed using a time horizon of five years instead of the two years for standard IF. For a given journal, IF (five-year IF) is the average annual citation rate for papers that are on average 1.5 (3) years old.

2013 IF

Journal	2-year IF	5-year IF
Nature	42.351	40.783
Nature Physics	20.603	20.059
Nature Photonics	29.958	32.342
Nature Medicine	28.054	26.501
Nature Geoscience	11.668	13.930
Nature Communications	10.742	11.023
Science	31.477	34.463
Cell	33.116	35.020
Reviews of Modern Physics	42.860	52.577
Physical Review Letters	7.728	7.411
Physical Review A	2.991	2.729
Physical Review B	3.664	3.564
Physical Review C	3.881	3.551
Physical Review D	4.864	4.046
Physical Review E	2.326	2.302
Physical Review X	8.385	-
New Journal of Physics	3.673	3.678

Lessons

There is variation across

- **Disciplines. Interdisciplinary journals vs. disciplinary journals.**
- **Types of articles. Review journals and those with a mix of article types vs. just research articles.**
- **Types of journals. Cherry-picking mags vs. journals of record.**
- **Variation across papers in any journal. Even if you love bibliometrics, IF is a poor metric for assessing individuals.**

Who ordered 4 or 5 figures?.

IF

M. Antonoyiannakis and S. Mitra, “Editorial: Is PRL too large to have an ‘impact’?” PRL **102**, 060001 (2009).

Research articles published in *Nature Physics* in 2011 and 2012

312 research papers
18,050 citations on Web of Science as of May 1, 2015 (3.25 years since publication on average)
57 citations/paper

2013 IF: 18.8 (compare to reported 20.6)

All 312 papers: 17.8 citations/paper-year

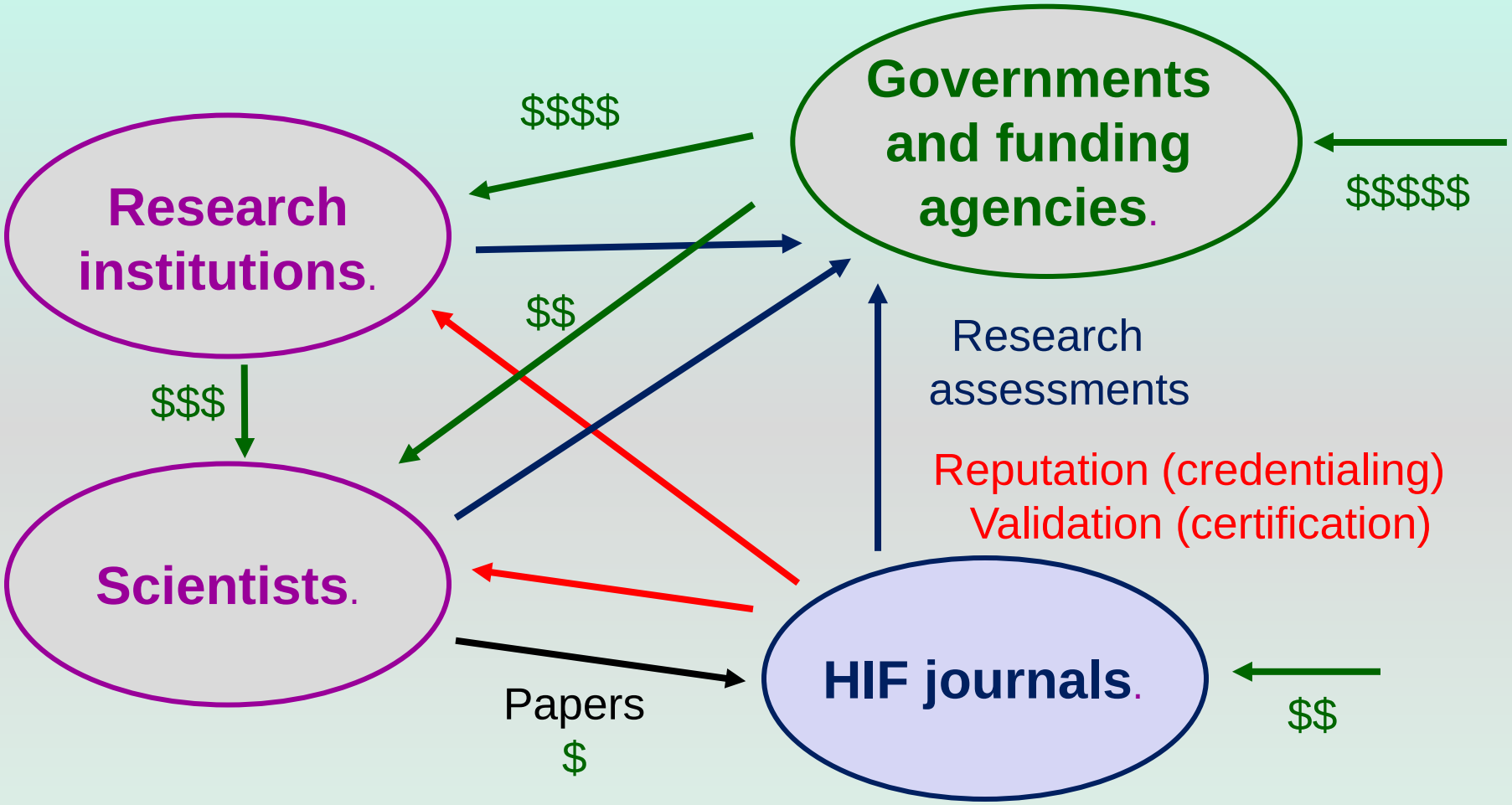
The 38% of the papers with 58 citations or more account for 68% of the citations, with a rate of 32.6 citations/paper-year.

The bottom 50% of the papers have a citation rate of 7.4/paper-year, about the PRL impact factor.

Parable of the formal research assessment

Pinnacles National Park
Central California

HIF incentive structure



The data are available:
TR Web of Science
Google Scholar

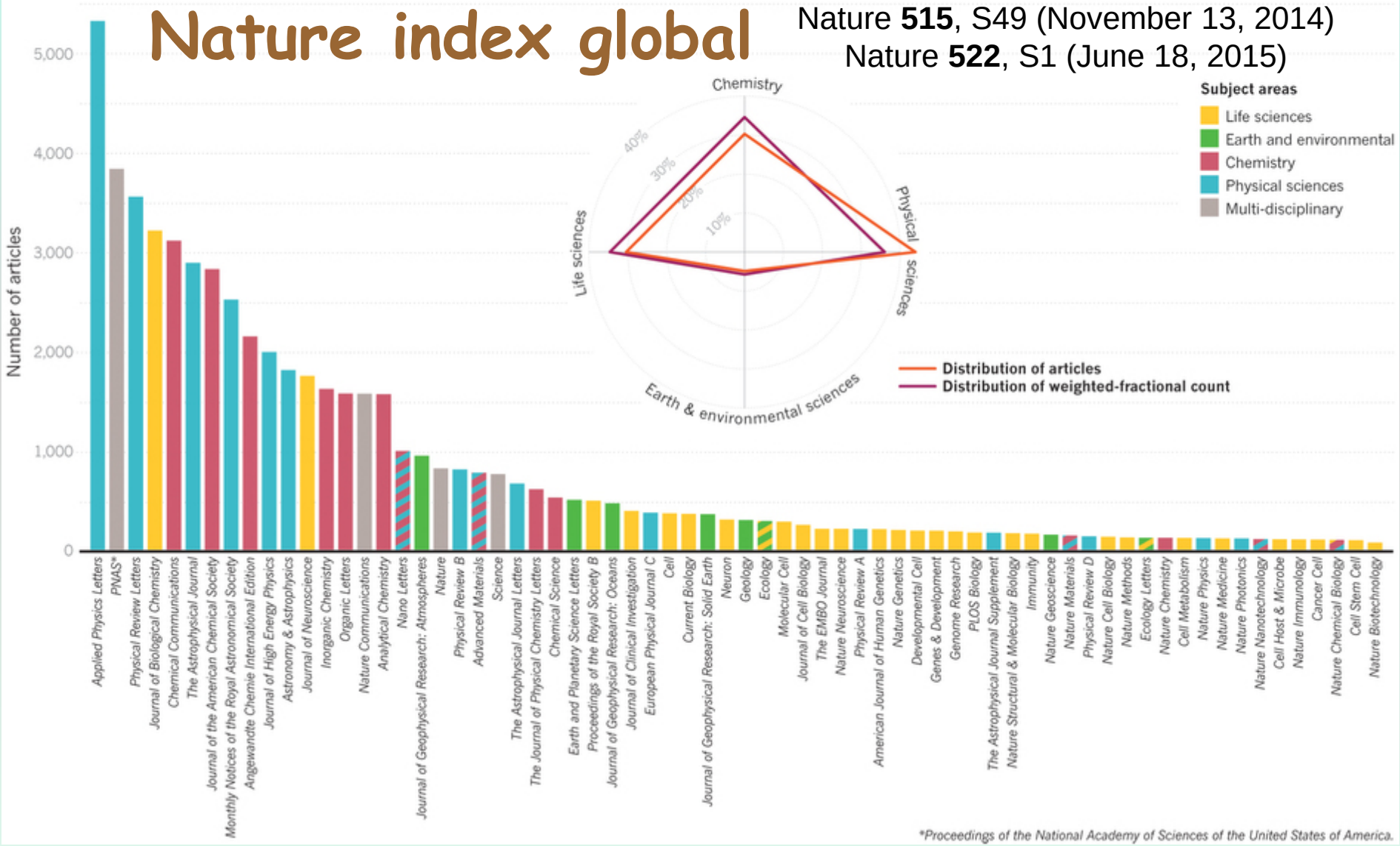
Pre-massaged:
Nature Index

JOURNAL, ARTICLE AND SUBJECT DISTRIBUTION

There are 68 journals in the Nature Index. The number of articles published in 2013 and included from each journal is shown below, alongside how these map to the four main subject categories. Note: for *Physical Review A*, *Physical Review B* and *Physical Review D* only research papers in the Rapid Communications section and/or those selected to be 'Featured in Physics' (the website that spotlights the research of broad interest from the American Physical Society journal collection) were included in the Nature Index.

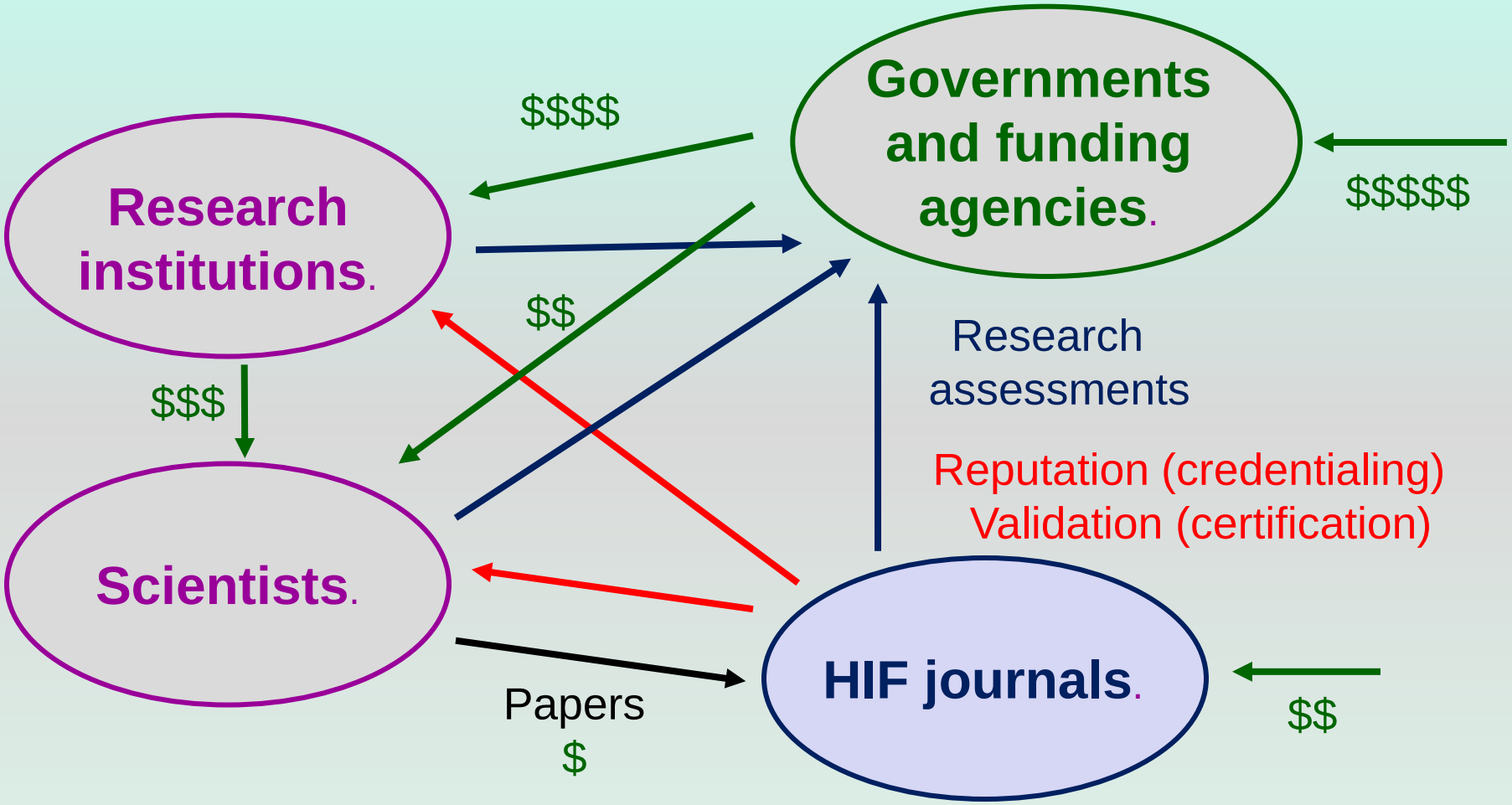
Nature index global

Nature **515**, S49 (November 13, 2014)
Nature **522**, S1 (June 18, 2015)



*Proceedings of the National Academy of Sciences of the United States of America.

HIF incentive structure



The data are available:
TR Web of Science
Google Scholar

Pre-massaged:
Nature Index

And trumpeted

Nature index

Chinese Academy of Sciences

CHINA TOPIX

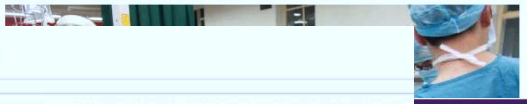
12:03 AM EDT, FRI, APR 22, 2016

HOME WORLD POLITICS BUSINESS SOCIETY TECH SCIENCE ENTERTA

SCIENCE

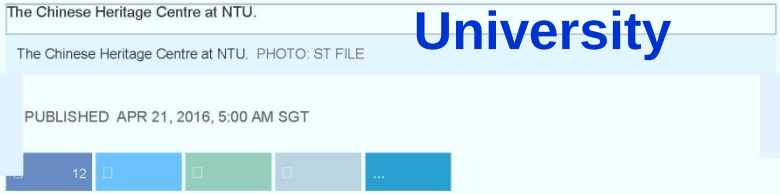
Chinese Academy of Sciences Outshines Competition in Global Nature Index

By Jenia Cane | Apr 22, 2016 12:03 AM EDT



Nanyang Technical University

NTU ranked higher on Nature Index



It is 37th on list tracking quality scientific articles published

Global ranking by science output

Rank	Institution
1	Chinese Academy of Sciences
2	Harvard University
3	French National Centre for Scientific Research
4	Max Planck Society (Germany)
5	Stanford University
6	The University of Tokyo
7	Massachusetts Institute of Technology
8	Helmholtz Association of German Research Centres
9	Oxford University
10	Cambridge University
37	**Nanyang Technological University**
46	**National University of Singapore**
162	**Agency for Science, Technology and Research**

Source: NATURE INDEX 2016 STRAITS TIMES GRAPHICS

UT Austin

UT News

UT News > Press Releases > UT Austin Ranks No. 25 Globally for Science in Latest Nature I

UT Austin Ranks No. 25 Globally for Science in Latest Nature Index

April 20, 2016

Rania Eldam (B.S. '13) conducts geochemistry research aimed at understanding the geologic history of a subduction zone with assistant professor Jaime Barnes (left). *Photo courtesy of the Jackson School of Geosciences*

AUSTIN, Texas — The University of Texas at Austin ranked No. 25 in the world among academic institutions for publication of scientific research, according to the latest annual report from the Nature Index.

UT Austin ranked No. 16 among all U.S. universities and No. 7 among U.S. public universities.

UQ Brisbane

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Australia's number one in influential Nature

Twitter

ENVIRONMENT + SUSTAINABILITY, RESEARCH, SCIENCE

Protecting migratory

Best university in Germany

a

rch organisation.

s institutions and countries according to the r

earch publications across 68 of the world's lea

ading journals within and outside the Nature p

LMU München

LMU does well in NATURE's Index 2014 Global

München, 11/14/2014

LMU is the best placed German university in the NATURE Index 2014 Global, which assesses the publication records of research institutions and universities, based on papers accepted by 68 journals the sciences.

"We are highly gratified to learn that LMU is rated best among universities in Germany in Nature's Index 2014 Global," says LMU President Professor Bernd Huber. "This ranking testifies to the high quality of the work being done by our researchers here at LMU."

The Nature Index Global is published this year for the first time. The index is based on the scientific publications that have appeared in a

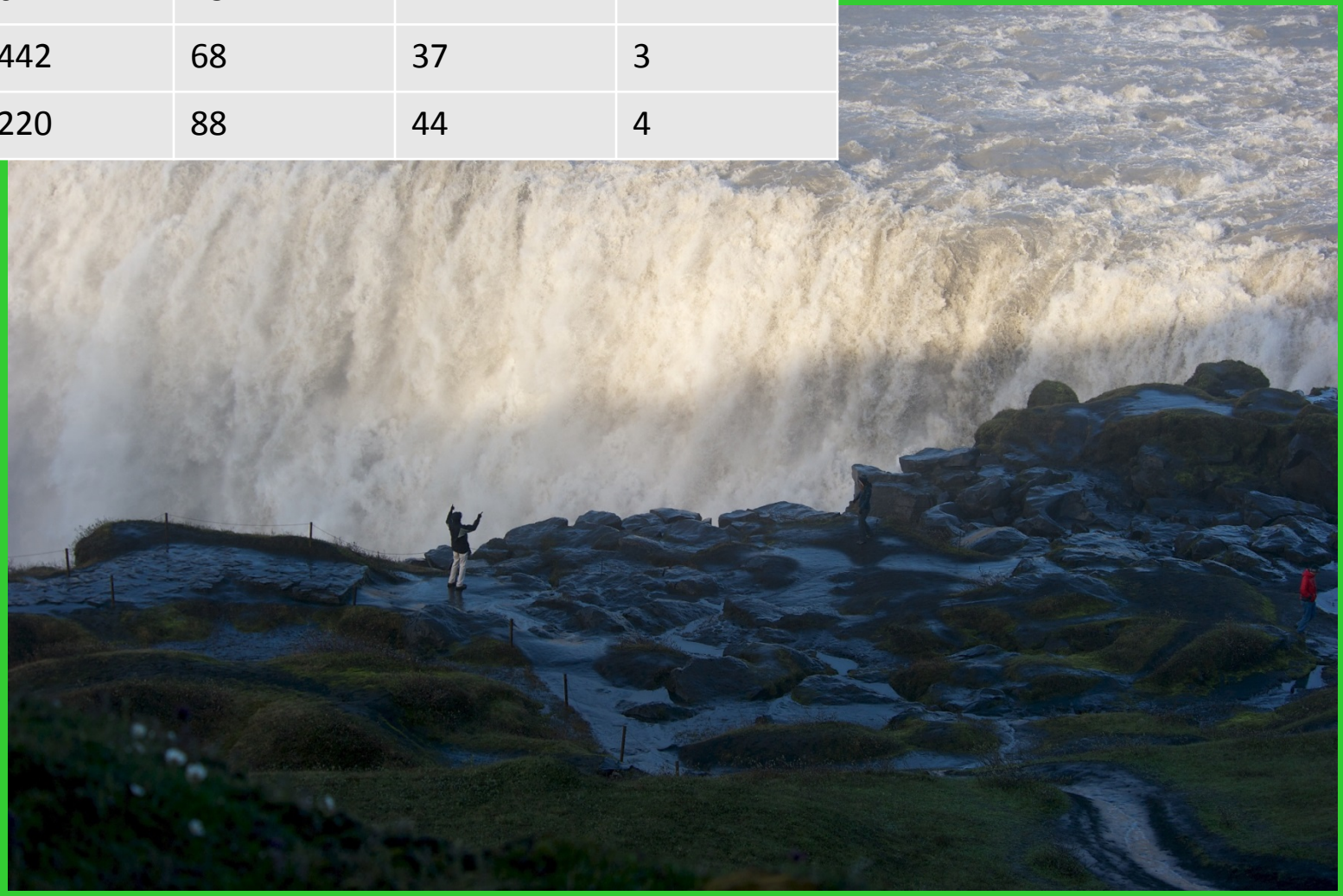
Consequences of HIFS

- **Poor decisions in hiring, funding, promotions, and prizes and awards, especially when administrators without technical expertise are inserted into the process or when an institution hires in a field new to it.**

Should we eschew bibliometric data in assessing research impact?

Six QI theorists

Articles	Citations	Per article	h-index	100h-index
331	15,796	48	60	3
135	11,825	88	46	5
135	10,137	75	47	4
199	8,627	43	42	4
124	8,442	68	37	3
93	8,220	88	44	4



Dettifoss
Iceland

Bibliometrics

The Leiden manifesto

Nature **520**, 429–431 (2015 April 23)

1. ***Quantitative evaluation should support qualitative, expert assessment.***
2. **Measure performance against the research missions of the institution, group, or researcher.**
3. **Protect excellence in locally relevant research.**
4. **Keep data collection and analytical processes open, transparent, and simple.**
5. **Allow those evaluated to verify data and analysis.**
6. ***Account for variation by field in publication and citation practices.***
7. **Base assessment of individual researchers on a qualitative judgement of their portfolio.**
8. ***Avoid misplaced concreteness and false precision.***
9. ***Recognize the systemic effects of assessment and indicators.***
10. ***Scrutinize indicators regularly and update them.***

Consequences of HIFS

- **Poor decisions in hiring, funding, promotions, and prizes and awards.**

Should we eschew bibliometric data in assessing research impact?

Bibliometrics, used carefully within a suite of assessment tools and calibrated appropriately, can provide useful information in assessing an extended research record, as in promotion decisions.

But hiring and funding decisions want a snapshot, weighted toward potential instead of accomplishment. This is where the temptation to succumb to HIFS is greatest, but it is marginally informative at best and nearly useless as a measure of individual potential.

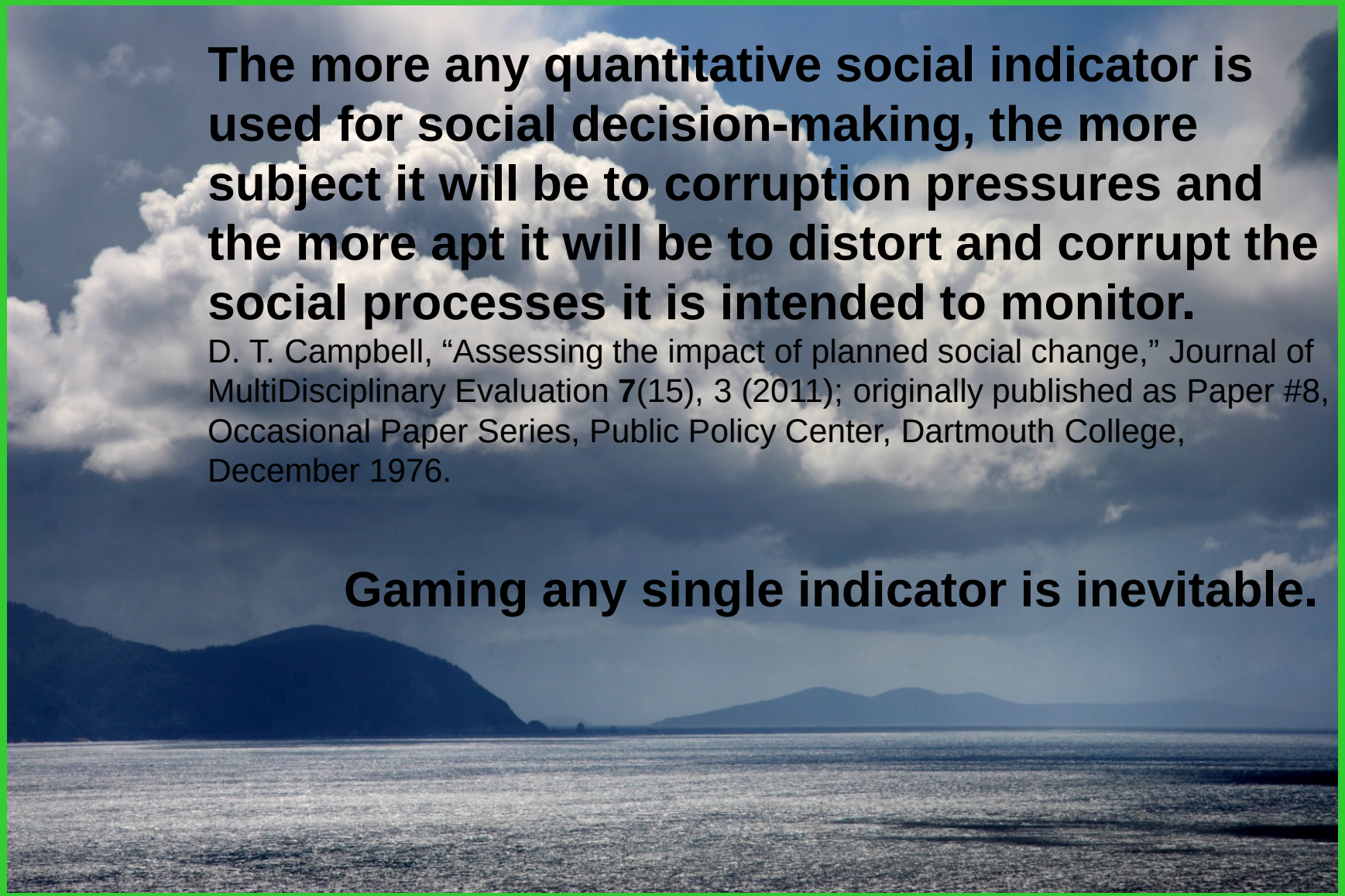
You are more likely to assemble a team of individuals who can satisfy an institutional imperative for researchers who have high impact by doing a complete, well-rounded evaluation of individual research records.

Consequences of HIFS

- **Poor decisions in hiring, funding, promotions, and prizes and awards, especially when administrators without technical expertise are inserted into the process or when an institution hires in a field new to it.**
- **Surrender of the scientific research agenda to the editors of *Nature* and its babies, *Science*, and *Cell.***
- **Fragmentation of the scientific literature into short, punchy, hit-and-run papers aimed at HIF journals. Literature becomes a jungle for students and junior researchers.**
- **Trend toward hype, fluff, and salesmanship as primary values in scientific research and a reduction in commitment to scientific integrity and the search for truth, the two things that set science apart as a social enterprise.**

All these exact a price down the road. I worry that the mechanisms of scientific feedback—exacting the price—are now too slow, making HIF-based decisions a self-fulfilling prophecy. We could end up with a sales force instead of scientists.

Campbell's law



The more any quantitative social indicator is used for social decision-making, the more subject it will be to corruption pressures and the more apt it will be to distort and corrupt the social processes it is intended to monitor.

D. T. Campbell, "Assessing the impact of planned social change," Journal of MultiDisciplinary Evaluation **7**(15), 3 (2011); originally published as Paper #8, Occasional Paper Series, Public Policy Center, Dartmouth College, December 1976.

Gaming any single indicator is inevitable.

View from Cape Hauy
Tasman Peninsula, Tasmania

Consequences of HIFS

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- Campbell's law. Gaming and goal displacement.

What to do?

- Scientists
- Society journals

Snow geese
Bosque del Apache, central New Mexico

What to do? Scientists

Appeals to good behavior and scientific integrity

- Renew your commitment to effective scientific communication.
- When evaluating candidates for positions, promotions, and prizes or awards, commit to a technically informed evaluation of each candidate's record.
- When writing letters of recommendation, write a technically informed evaluation of a candidate's capabilities and impact, including a description and evaluation of important research.
- Educate administrators that the HIF shortcut, though not devoid of information, is only marginally useful.
- If you are a senior or mid-career scientist who advertises yourself by categorizing your publications in terms of HIF journals, stop doing that.
- Help the public-relations people at your institution to identify and publicize important research contributions, independent of where they are published.
- Take a look at the San Francisco Declaration on Research Assessment (DORA), which is aimed directly at combating HIFS.

What to do? Scientists

- Include in ads for positions a standard statement along the following lines: “Number of publications in high-impact-factor journals will not be a factor in assessing research accomplishments or potential.”
- Support social scientists working with scientists in developing a suite of discipline-specific tools for assessing individual research accomplishment and potential and for assessing journals.

Tent Rocks
Kasha-Katuwe National Monument
Northern New Mexico

What to do? Society journals

What is the point of scientific publication?

- **Dissemination of knowledge**

  Most effective communication of knowledge

  Taking advantage of online, electronic publishing: interactive graphics, pop-up supplemental material, videos, video abstracts, invitations to similar papers, more effective search that uses cites, downloads, etc. to rate.

  But how is all of this to be made archival? There is a danger of turning science into performance art.

- **Certification and credentialing**

  This is the value-added of publication in scientific journals. It needs constant attention.

Value-added certification and credentialing

Parties: authors, editors (staff editors, associate editors, editorial boards), referees

How to *allocate a scarce resource* accurately, fairly, and efficiently? Issues are especially acute for journals that provide a higher level of credentialing, by publishing *important* or *key* papers, but are accountable to the scientific community in ways the commercial journals are not (i.e., cannot retreat to the criterion of what sells the mag). How to make the process accurate and fair without being absurdly tedious?

Authors:

- **Help in writing effective papers**
- **Editorial affirmation when a referee is off base**

Effective peer review:

- **Rejection without review**
- **Feedback to referees**
- **Culling unreliable reviewers and reviews**
- **Training in reviewing**
- **Rewarding good referees (annual report with grade; top *x*%)**

Avoiding fad bubbles