

The now of Science Crises and Reformation

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Where to find this talk: www.andreasaltelli.eu





Science's crisis makes it to the headlines

The Economist

Washington's lawyer surplus How to do a nuclear deal with Iran Investment tips from Nobel economists Junk bonds are back

DCT00ER 19TH-25TH 2013

tconomist.com The meaning of Sachin Tendulkar

On the radar: October 2013











WRONG.

Why Most Published Research Findings Are False 2005

John P. A. Ioannidis

Essay

for most study
designs and settings,
it is more likely for a
research claim to be
false than true …



John P. A. Ioannides

J. P. A. Ioannidis, Why Most Published Research Findings Are False, PLoS Medicine, August 2005, 2(8), 696-701.



Snapshots of the crisis: a rich ecosystem

Failed replications, fraudulent peer reviews, predatory publishers, perverse metrics, misleading science advice, statistics on trial, post-truth, ...

The crisis is methodological, epistemological, ethical and metaphysical

REPRODUCIBILITY IN CANCER BIOLOGY

Making sense of replications

REPRODUCIBILITY -PROJECT-CANCER BIOLOGY

Abstract The first results from the Reproducibility Project: Cancer Biology suggest that there is scope for improving reproducibility in pre-clinical cancer research. DOI: 10.7554/eLife.23383.001 January 19, 2017

BRIAN A NOSEK AND TIMOTHY M ERRINGTON





Brow



SCOMON CON

The Economic Journal, 127 (October), F236–F265. Doi: 10.1111/ecoj.12461 © 2017 Royal Economic Society. Published by John Wiley & Sons, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

^G OPEN ACCESS June 21, 2017

Why Most Clinical Research Is Not Useful

John P. A. Ioannidis 🖸

Published: June 21, 2016 • https://doi.org/10.1371/journal.pmed.1002049

THE POWER OF BIAS IN ECONOMICS RESEARCH*

John P. A. Ioannidis, T. D. Stanley and Hristos Doucouliagos

October 27, 2017

Rather than isolated instances of corruptions now entire fields of research are found diseased



Reconstruction of a Train Wreck: How Priming Research Went off the Rails



"[…]questions have been raised about the robustness of priming results … your field is now the poster child for doubts about the integrity of psychological research…"

https://replicationindex.wordpress.com/2017/02/02/reconstruction-of-a-train-wreckhow-priming-research-went-of-the-rails/comment-page-1/

A new record: Major publisher retracting more than 100 studies from cancer journal over fake peer reviews

with 11 comments

Springer is <u>retracting 107 papers</u> from one journal after discovering they had been accepted with fake peer reviews. Yes, 107.

To submit a fake review, someone (often the author of a paper) either makes up an outside expert to review the paper, or suggests a real researcher — and in both cases, provides a fake email address that comes back to someone who will invariably give the paper a glowing review. In this case, Springer, the publisher of *Tumor Biology* through 2016, told us that an investigation produced "clear evidence" the reviews were submitted under the names of real researchers with faked emails. Some of the authors may have used a third-party editing service, which may have supplied the reviews. The journal is now published by SAGE.



Use and abuse of metrics: from self-citation to citation cartels to citation stacking

CITATION STACKING

In 2011, four Brazilian journals published seven review papers with hundreds of references to previous research (2009–10) in each others' journals. This raised their 2011 impact factors.



*Rev. Assoc. Med. B., Revista da Associação Médica Brasileira; J. Bras. Pneum., Jornal Brasileiro de Pneumologia; Acta Ortop. Bras., Acta Ortopédica Brasileira.

Richard Van Noorden, 2017, Brazilian citation scheme outed. Thomson Reuters suspends journals from its rankings for 'citation stacking'. Nature, 27 August 2013



Evidence-based medicine has been hijacked: a report to David Sackett John P.A. Ioannidis^{a,b,c,d,*} Power asymmetries in the framing of issues: those who have the deepest pockets marshal the best evidence; Instrumental use of quantification to obfuscate; (Saltelli and Giampietro, 2017)

Evidence based medicine hijacked to serve corporate agendas. "Under market pressure, clinical medicine has been transformed to finance-based medicine" (Ioannidis, 2016)

JAMA Internal Medicine

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September 12, 2016

Special Communication | September 12, 2016

Sugar Industry and Coronary Heart Disease Research

A Historical Analysis of Internal Industry Documents

ONLINE FIRST

Cristin E, Kearns, DDS, MBA^{1,2}; Laura A, Schmidt, PhD, MSW, MPH^{1,3,4}; Stanton A, Glantz, PhD^{1,5,6,7,8}

[+] Author Affiliations

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JAMA Intern Med. Published online September 12, 2016. doi:10.1001/jamainternmed.2016.5394
                                                                                    Text Size: A A A
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See also https://www.theguardian.com/society/2016/apr/07/the-sugar-conspiracyrobert-lustig-john-yudkin, and the story of US President Dwight Eisenhower heart attack,…

"our findings suggest the industry sponsored a research program in the 1960s and 1970s that successfully cast doubt about the hazards of sucrose while promoting fat as the dietary culprit in CHD [coronary hearth disease]"

http://archinte.jamanetwork.com/ article.aspx?articleid=2548255

Online First > Special Communication | September 12, 2016 Sugar Industry and Coronary Heart Disease Research A Historical Analysis of Internal Industry Documents Internal

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JAMA Internal Medicine

JAMA Intern Med. Published online September 12, 2016. doi 10.1001/jamainternmed.2016.5394

Feature

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Coca-Cola's secret influence on medical and science journalists

BMJ 2017 ; 357 doi: https://doi.org/10.1136/bmj.j1638 (Published 05 April 2017) Cite this as: *BMJ* 2017;357:j1638



April 5, 2017

Research - Education - News & Views - Campaigns -

"Industry money was used to covertly influence journalists with the message that exercise is a bigger problem than sugar consumption in the obesity epidemic, documents obtained under freedom of information laws show.

Ethebini
Research < Education < News & Views < Campaigns </td>

Feature

Coca-Cola's secret influence on medical and science journalists

BMJ 2017 ; 357 doi: https://doi.org/10.1136/bmj.j1638 (Published 05

April 2017)

Cite this as: BMJ 2017;357:j1638

Old and new heroes, while history repeats itself (Love canal, Flint…)





Lois Gibbs Marc Edwards



http://www.andreasaltelli.eu/file/repository/LOVE_CANAL.pdf https://en.wikipedia.org/wiki/Flint_water_crisis; http://flintwaterstudy.org/; http://www.nytimes.com/2016/08/21/magazine/flints-water-crisis-andthe-troublemaker-scientist.html

Fixing science?



John and Laura Arnold









Brian Nosek, the John Ioannidis, Meta-Reproducibility research innovationProject. centre at Stanford

Ben Goldacre, alltrials.net

Gary Taubes, The case against sugar

https://www.wired.com/2017/01/john-arnold-waging-war-on-bad-science/

Different cultures, different reactions



Yoshiki Sasai

http://www.nature.com/news/stem-cell-pioneer-blamedmedia-bashing-in-suicide-note-1.15715



Science's establishment choses denial



Please cite this paper as:

OECD (2015), "Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists", *OECD Science, Technology and Industry Policy Papers*, No. 21, OECD Publishing, Paris. http://dx.doi.org/10.1787/5js33l1jcpwb-en



OECD Science, Technology and Industry Policy Papers No. 21

Scientific Advice for Policy Making

THE ROLE AND RESPONSIBILITY OF EXPERT BODIES AND INDIVIDUAL SCIENTISTS A Summary Report to the Secretary-General of the United Nations from the SCIENTIFIC ADVISORY BOARD

The Future of

SCIENTIFIC ADVICE TO THE UNITED NATIONS

United Nations Sustainable Educational, Scientific and Development Cultural Organization Goals

September 2016

OECD



2016

Adopted February 2017 at symposium AAAS after 5 y gestation.

Hundreds of experts involved:

No crisisNo effect of crisis on evidence based policy



Beyond denial, diversion & displacement: a science war against trump, against post truth,



January 27, 2017

To tackle the post-truth world, science must reform itself

Andrea Saltelli, University of Bergen and Silvio Oscar Funtowicz, University of Bergen Scientists must bear some responsibility for the post-truth era and the current crisis in democracy.



November 16, 2016

Science wars in the age of Donald Trump

Andrea Saltelli, University of Bergen and Silvio Oscar Funtowicz, University of Bergen Is the election of Donald Trump going to reignite a futile war between science and anti-science?

... marches for science and persistent scientism.



May 12, 2017

Forcing consensus is bad for science and society

Andrea Saltelli, University of Bergen; Mario Giampietro, Universitat Autònoma de Barcelona, and Tiziano Gomiero, Masaryk University

Insisting that science has a monopoly on the truth invalidates dissent and undermines what should be an open dialogue between science and society.



March 8, 2017

A scientists' march on Washington is a bad idea – here's why

Andrea Saltelli, University of Bergen Trump is not science's biggest problem.



Scholars who saw it coming

• • •

and how they were vindicated In 1963 Derek J. de Solla Price prophesized that Science would reach saturation (and in the worst case senility) under its own weight, victim of its own success and exponential growth (pp 1-32).





Derek J. de Solla Price



de Solla Price, D.J., 1963, Little science big science, Columbia University Press.

~1.5 million articles a year (2009) over ~30,000 journals

newsblog *Nature* brings you breaking news from the world of science

NEWS BLOG

Global scientific output doubles every nine years

07 May 2014 | 16:46 GMT | Posted by Richard Van Noorden | Category: Policy, Publishing

<u>https://www.researchgate.net/publication/229062236_Article_50_million_An_estimate_of_the_number_of_scholarly_articles_in_existence</u>

http://blogs.nature.com/news/2014/05/global-scientific-output-doublesevery-nine-years.html p.22: $[\cdots]$ The problem of quality control in science is thus at the centre of the social problems of the industrialized science of the present period."



Ravetz, J., **1971**, Scientific Knowledge and its Social Problems, Oxford University Press.





Jerome R. Ravetz "If [science] fails to resolve this problem […] then the immediate consequences for morale and recruitment will be serious; and those for the survival of science itself, grave"



Ravetz, J., **1971**, Scientific Knowledge and its Social Problems, Oxford University Press.





Jerome R. Ravetz neoliberal ideologies decreasing state funding of science, which becomes privatized ...
knowledge as a monetized commodity replaces
knowledge as public good ... collapse of quality



Philip Mirowski

Mirowski, P. 2011. Science-Mart: Privatizing American Science, Harvard University Press.



p. 179. For it is possible for a field to be diseased […] reforming a diseased field is a task of great delicacy […] not even an apparatus of institutional structures, can do anything to maintain or restore the health of a field in the absence of an essential ethical element operating through the interpersonal channel of communication.



Ravetz, J., **1971**, Scientific Knowledge and its Social Problems, Oxford University Press.





Jerome R. Ravetz Downloaded from http://rsos.royalsocietypublishing.org/ on September 23, 2016

ROYAL SOCIETY OPEN SCIENCE

rsos.royalsocietypublishing.org



Cite this article: Smaldino PE, McElreath R. 2016 The natural selection of bad science. *R. Soc. open sci.* **3**: 160384. http://dx.doi.org/10.1098/rsos.160384

Received: 1 June 2016 Accepted: 17 August 2016

The natural selection of bad science

Paul E. Smaldino¹ and Richard McElreath²

¹Cognitive and Information Sciences, University of California, Merced, CA 95343, USA ²Department of Human Behavior, Ecology, and Culture, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

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Poor research design and data analysis encourage false-positive findings. Such poor methods persist despite perennial calls for improvement, suggesting that they result from something more than just misunderstanding. The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science. This dynamic requires no conscious strategizing—no deliberate cheating nor loafing by scientists, only that publication is a principal factor for The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science. This dynamic requires no conscious strategizing—no deliberate cheating nor loafing by scientists, only that publication is a principal factor for career advancement.

Smaldino PE, McElreath R., 2016 The natural selection of bad science. R. Soc. open sci. 3: 160384. http://dx.doi.org/10.1098/rsos.160384

As in the real world, successful labs produce more 'progeny,' such that their methods are more often copied and their students are more likely to start labs of their own. Selection for high output leads to poorer methods and increasingly high false discovery rates.

Improving the quality of

research requires change at the institutional level.

Smaldino PE, McElreath R., 2016 The natural selection of bad science. R. Soc. open sci. 3: 160384. http://dx.doi.org/10.1098/rsos.160384

Funtowicz and Ravetz → poor quality in science for policy → post normal science



Funtowicz, S. O. and Ravetz, J. R., **1990**. Uncertainty and quality in science for policy, Dordrecht: Kluwer. THEORY AND DECISION LIBRARY

SERIES A: PHILOSOPHY AND METHODOLOGY OF THE SOCIAL SCIENCES

SILVIO O. FUNTOWICZ AND JEROME R. RAVETZ

UNCERTAINTY AND QUALITY IN SCIENCE FOR POLICY



KLUWER ACADEMIC PUBLISHERS



Statistics under trial



AMERICAN STATISTICAL ASSOCIATION RELEASES STATEMENT ON STATISTICAL SIGNIFICANCE AND P-VALUES

Provides Principles to Improve the Conduct and Interpretation of Quantitative

Science March 7, 2016

+ twenty 'dissenting' commentaries

Wasserstein, R.L. and Lazar, N.A., 2016. 'The ASA's statement on p-values: context, process, and purpose', The American Statistician, DOI:10.1080/00031305.2016.1154108.

See also Christie Aschwanden at http://fivethirtyeight.com/features/not-even-scientists-can-easily-explain-p-values/





COMMENT · 28 NOVEMBER 2017

Five ways to fix statistics

As debate rumbles on about how and how much poor statistics is to blame for poor reproducibility, Nature asked influential statisticians to recommend one change to improve science. The common theme? The problem is not our maths, but ourselves. CORRESPONDENCE · 16 JANUARY 2018



Fixing statistics is more than a technical issue

Andrea Saltelli 🛛 & Philip Stark

CORRESPONDENCE · 16 JANUARY 2018



Integrity must underpin quality of statistics





What to do? (with Silvio Funtowicz) Science exhibits pathologies / corruptions comparable to the traffic in indulgencies which enraged Luther ~1517



Martin Luther



Johann Tetzel

The internet the new press?



Johannes Gutenberg

The combination of corruption, indignation and a revolutionary technology made the Reformation possible; is the same possible for science? Seek inspiration in the radical 1970s-era movements that sought to change the world by changing first science itself

Fight asymmetries; offer expertise to the weaker stakeholders; help those to shape the questions asked of science

Fight methodological corruption, e.g. deconstructing shoddy quantifications

Recast our public conversation about science

About the British Society for Social Responsibility in Science and Science for the People: https://gizmodo.com/how-radical-70s-scientists-tried-to-change-the-world-1681987399



Reading

Futures 91 (2017) 5-11



What is science's crisis really about?

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THE RIGHTFUL PLACE OF SCIENCE: SCIENCE ON THE VERGE

CONTRIBUTORS

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Twitter: @andreasaltelli



DPEN a ACCESS Freely available online

"Positive" Results Increase Down the Hierarchy of the Sciences

Daniele Fanelli*

100%

NNOGEN and ISSTI-Institute for the Study of Science, Technology & Innovation, The University of Edinburgh, Edinburgh, United Kingdom

"odds of reporting a positive result ~5 times higher among papers in the disciplines of Psychology and Psychiatry and Economics and Business than Space Science"

April 7, 2010