

The natural selection of bad science

Worrying signs we scientists could do much better

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

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Why Most Published Research Findings Are False

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NATURE | NEWS

Irreproducible biology research costs put at \$28 billion per year

Study calculates cost of flawed biomedical research in the United States.

Monya Baker

09 June 2015



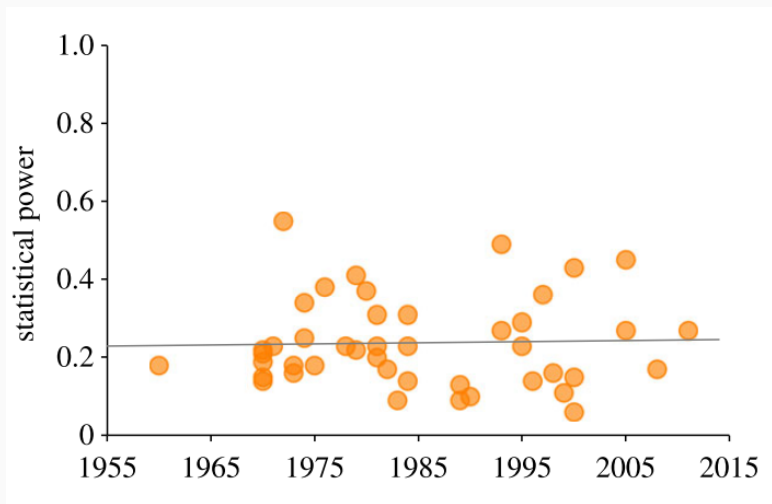
Statisticians issue warning over misuse of P values

Policy statement aims to halt missteps in the quest for certainty.

Must try harder

Too many sloppy mistakes are creeping into scientific papers. Lab heads must look more rigorously at the data – and at themselves.

Despite repeated calls, statistical power does not increase



Smaldino & McElreath 2016

MOLECULAR ECOLOGY

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Opinion

The $K=2$ conundrum

Jasmine K Janes [✉](#), Joshua M Miller, Julian R Dupuis, René M Malenfant,
Jamieson C Gorrell, Catherine I Cullingham, Rose L Andrew

Accepted manuscript online: 21 May 2017 [Full publication history](#)

82/386). A troubling finding was that very few studies performed the hierarchical analysis recommended by the authors of both ΔK and STRUCTURE to fully explore population subdivision. Furthermore,

IS THERE A REPRODUCIBILITY CRISIS?



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Why don't we do better?

Why don't we do better?

1. We're useless
2. We're lazy
3. Something else

A E E T

ASOCIACIÓN ESPAÑOLA
DE ECOLOGÍA TERRESTRE

Ecosistemas 25(2): 83-92 [Mayo-Agosto 2016]
Doi.: 10.7818/ECOS.2016.25-2.11

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Ciencia reproducible: qué, por qué, cómo

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LETTERS

Academia's failure to retain data scientists

Francisco Rodríguez-Sánchez^{1,*}, Ben Marwick^{2,3}, Ed Lazowska², Jake VanderPlas²

+ See all authors and affiliations

Science 27 Jan 2017:

Vol. 355, Issue 6323, pp. 357-358

DOI: 10.1126/science.aam6116

1. Incentives
2. Training
3. Retention

There are no incentives to do better (actually the opposite)

“No one is incentivised to be right”

Richard Horton, editor of *The Lancet*

Bad science has selective advantage!

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The natural selection of bad science

Paul E. Smaldino¹ and Richard McElreath²

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 career advancement. Some normative methods of analysis have

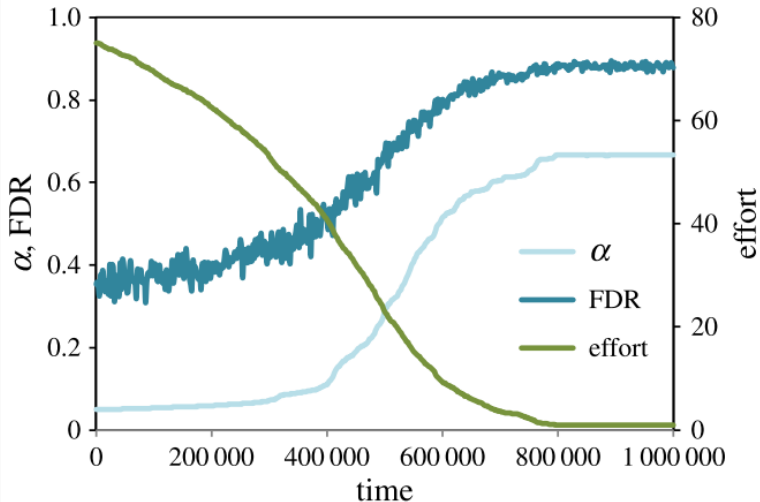
Conditions for natural selection

1. There is variation
2. Variation has consequences on survival/reproduction
3. Variation is heritable

Conditions for natural selection

1. There is variation (in publication rates)
2. Variation (in publication rates) has consequences on survival/reproduction
3. Variation is heritable (same lab or emulation)

Evolution towards lower effort -> more false discoveries



Hence:

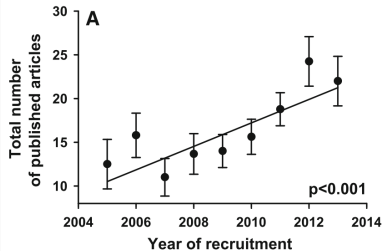
- Poor methods are **expected** if scientists' success based on n. publications
- Calls for improvement **won't work** unless incentives change

Number of publications is overwhelmingly important

Scientometrics (2015) 103:333–336
DOI 10.1007/s11192-015-1534-5

Academia's never-ending selection for productivity

François Brischoux · Frédéric Angelier



N papers at hiring doubled in 10 years

“Today I wouldn't get an academic job.

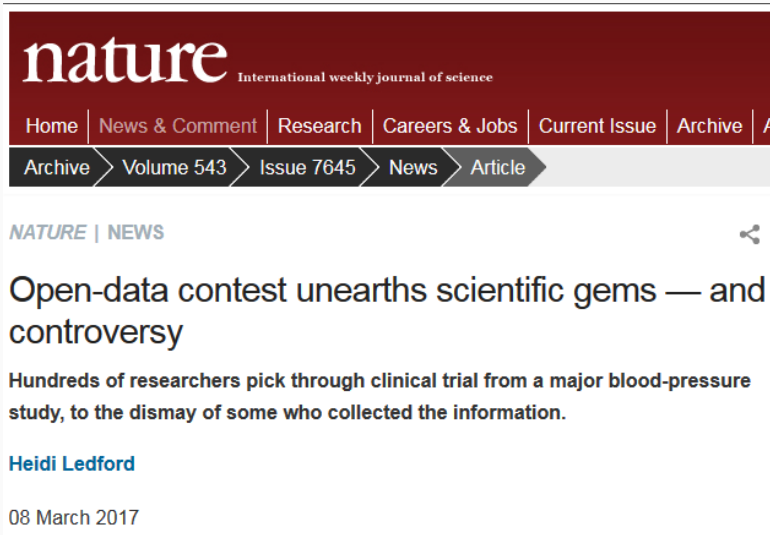
It's as simple as that.

I don't think I would be regarded as productive enough”

Peter Higgs (Nobel prize)

When a measure becomes a target,
it ceases to be a good measure.

Bad incentives lead to scientists lamenting scientific progress because missed publications




The image shows a screenshot of the Nature journal website. At the top, the word "nature" is written in a large, white, serif font on a dark red background. Below it, in a smaller white font, is the text "International weekly journal of science". A horizontal navigation bar with a dark red background contains several white text links: "Home", "News & Comment", "Research", "Careers & Jobs", "Current Issue", "Archive", and "A". Below this bar is a secondary navigation bar with a dark grey background, featuring white text and right-pointing chevrons: "Archive", "Volume 543", "Issue 7645", "News", and "Article". The main content area has a white background. It starts with the text "NATURE | NEWS" in a blue font, followed by a share icon. The main headline is "Open-data contest unearths scientific gems — and controversy" in a large, dark blue font. Below the headline is a sub-headline in a smaller, dark blue font: "Hundreds of researchers pick through clinical trial from a major blood-pressure study, to the dismay of some who collected the information." The author's name, "Heidi Ledford", is written in a blue font. At the bottom left, the date "08 March 2017" is displayed in a dark grey font.

nature International weekly journal of science

Home | News & Comment | Research | Careers & Jobs | Current Issue | Archive | A

Archive > Volume 543 > Issue 7645 > News > Article

NATURE | NEWS 

Open-data contest unearths scientific gems — and controversy

Hundreds of researchers pick through clinical trial from a major blood-pressure study, to the dismay of some who collected the information.

Heidi Ledford

08 March 2017

What can we do?

Young scientists can't change this.

Fix must come top-down:

Change incentives!

Look beyond productivity