Research Integrity Matters

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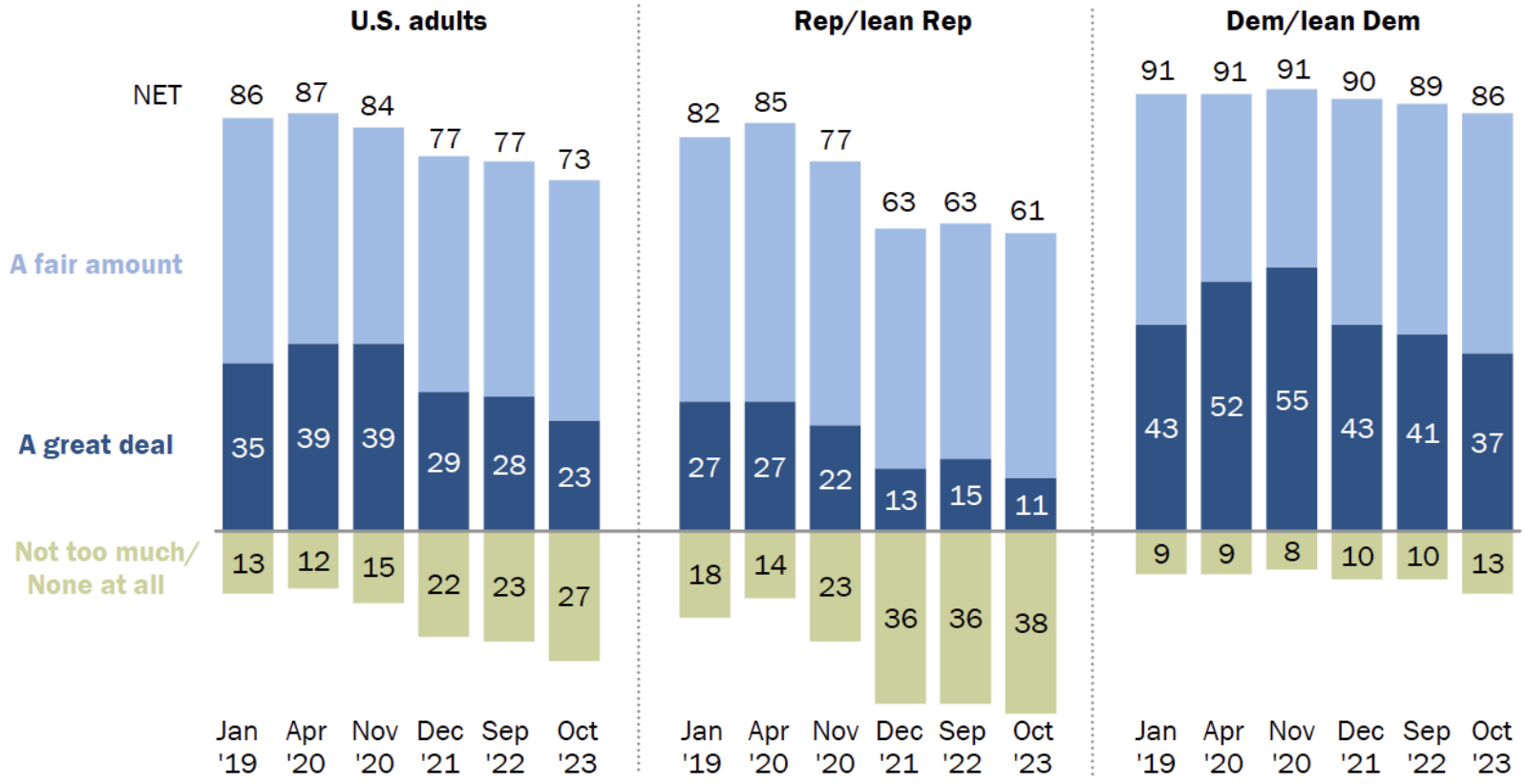
- Public confidence in science is declining as a result of both external and internal forces.
- Retractions and high-profile misconduct cases are on the rise.
- Paper mills and AI-generated work are making the problem worse.
- Distinguishing between “research misconduct” and “questionable research practices” can be tricky.
- Why are questionable research practices so common?
- What can we do?

Declining levels of public trust in scientists

*% of U.S. adults who have ___ of confidence in **scientists** to act in the best interests of the public*

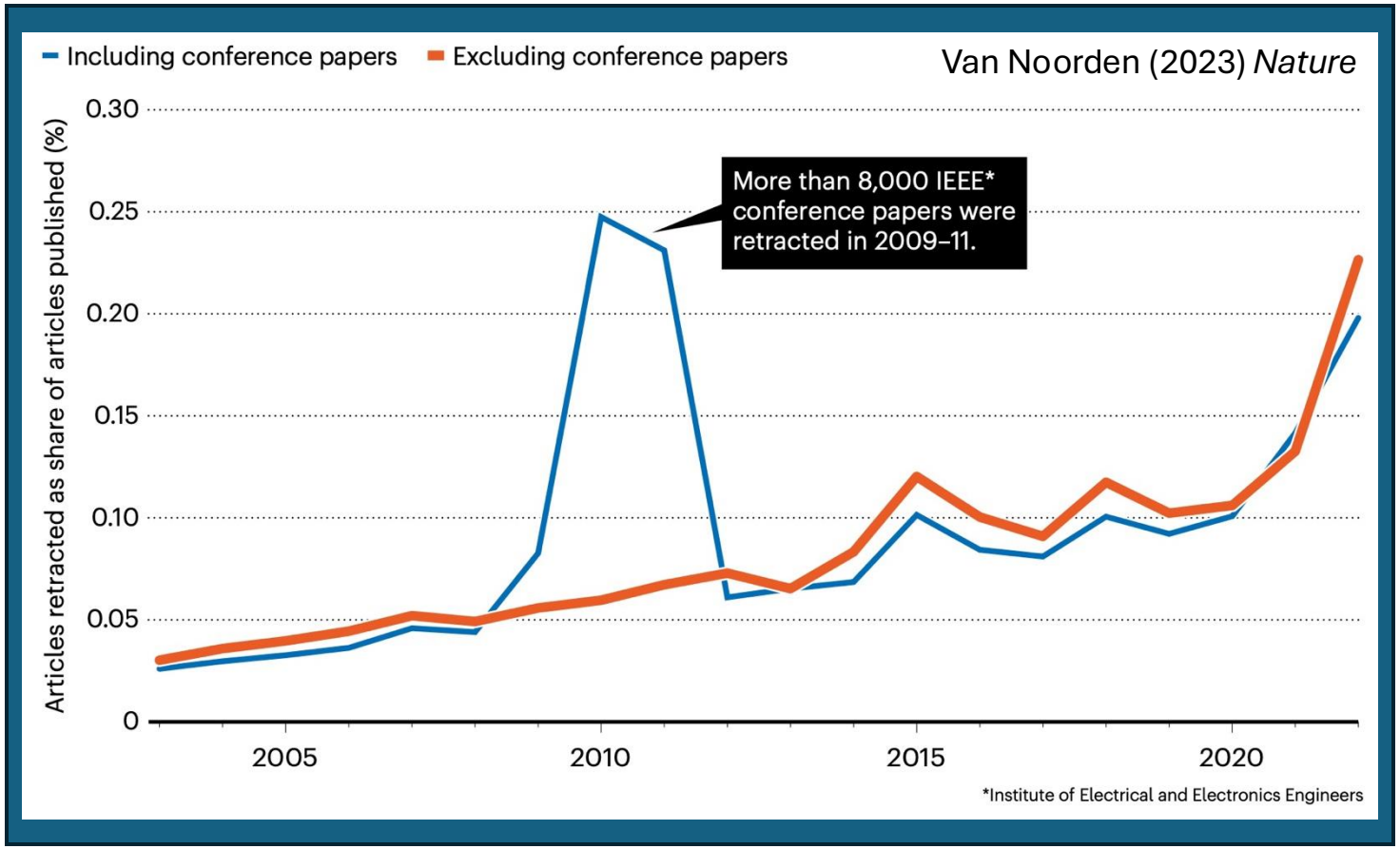


Note: Respondents who did not give an answer are not shown.
Source: Survey of U.S. adults conducted Sept. 25-Oct 1, 2023.
"Americans' Trust in Scientists, Positive Views of Science Continue to Decline"

PEW RESEARCH CENTER

Some of this is politics, but do scientists share some of the blame?

Retraction Rates are Skyrocketing: Why?



Retractions happen when journal editors no longer have confidence in a paper.

Journal Publishers Are Concerned

- In 2021, *John Wiley & Sons* paid nearly $300 million for about 250 journals published by *Hindawi*.
- Within a couple of years, it became apparent that many of the papers in these journals were fake and that peer review was often compromised (e.g., by "peer review rings").
- Wiley lost > $60 million on this acquisition, closed multiple *Hindawi* journals and has stopped using the Hindawi brand name.

> "Other publishers have announced large batches of retractions recently. **IOP Publishing** earlier this month said it planned to retract nearly 500 articles likely from paper mills, and **PLOS** in August announced it would retract over 100 papers fromits flagship journal [*PLOS ONE*] over manipulated peer review."
> – *Retraction Watch*, Aug 2022

Retraction Watch Leaderboard

n = Number of Retracted Papers

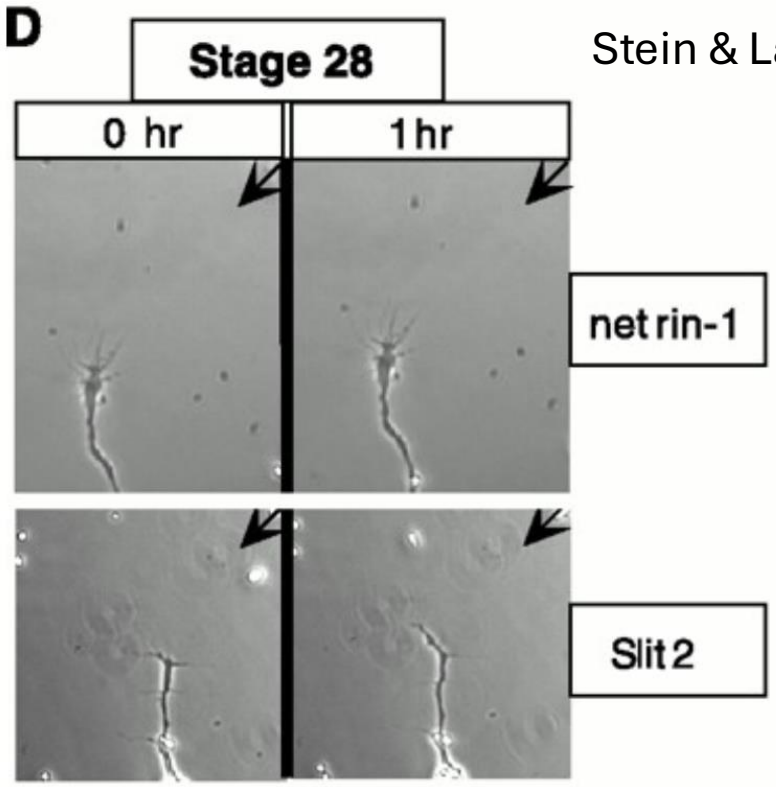
- Joachim Boldt (n=210)
- Yoshitaka Fujii (n=172)
- Hironobu Ueshima (n=124)
- Yoshihiro Sato (n=122)
- Ali Nazari (n=103)
- Jun Iwamoto (n=90)
- Diederik Stapel (n=58)
- Yuhji Saitoh (n=56)
- Adrian Maxim (n=48)
- A Salar Elahi (n=44)
- Chen-Yuan (Peter) Chen (n= 43)
- Jose L. Calvo-Guirado (n=42)
- Fazlul Sarkar (n=41)
- Shahaboddin Shamshirband (41)
- Hua Zhong (n=41)
- Shigeaki Kato (n=40)
- James Hutton (n=36)
- Hyung-In Moon (n=35)
- Dong Mei Wu (n=35)
- Antonio Orlandi (n=34)

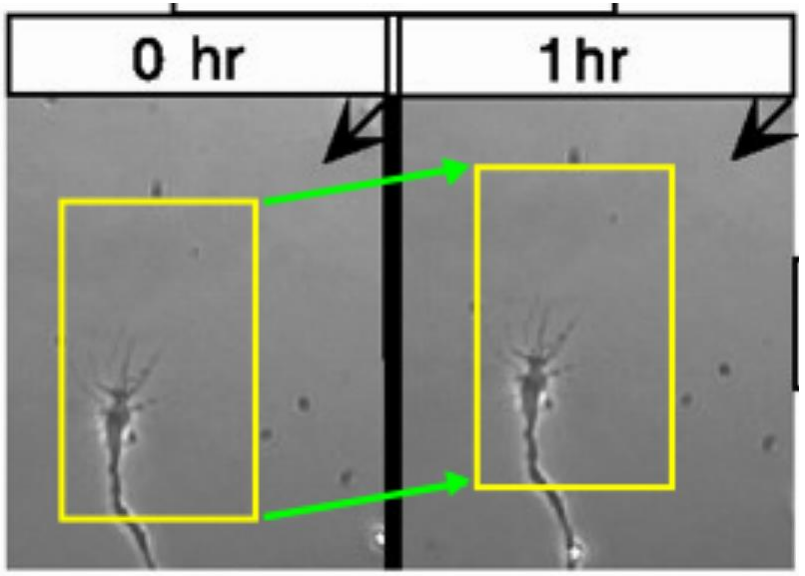
An Interesting "Early" Case: John Darsee

- He was an extremely productive research fellow at Harvard and, before that, chief resident in cardiology at Emory; offered a faculty job at Harvard in 1981, at age 33.
- First suggestion of fabrication reported in 1981 by a technician; later found problems in 7 papers and many abstracts. At least five papers ultimately retracted, plus many abstracts.
- His job offer at Harvard was withdrawn. NIH barred him from federal funding for 10 years. NY State Board revoked his medical license in 1984.
- Havard-affiliated hospital had to pay back $122,371 to NIH.
- Many co-authors, reviewers, editors to blame. Why didn't they notice the "obvious inconsistencies" (Steward and Feder, 1987)?

The Troubles of Stanford's President: Marc Tessier-Lavigne

Stein & Lavigne, 2001, *Science*



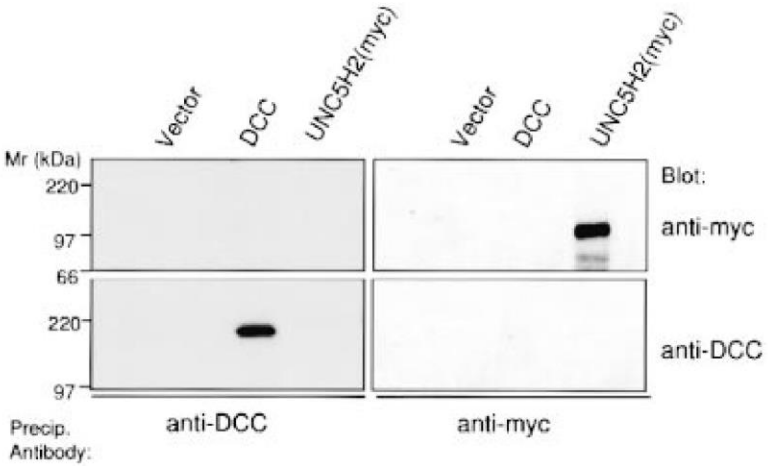


Can you see the axon grow towards the netrin-containing pipette (at the arrowhead)?

Paper retracted in 2023

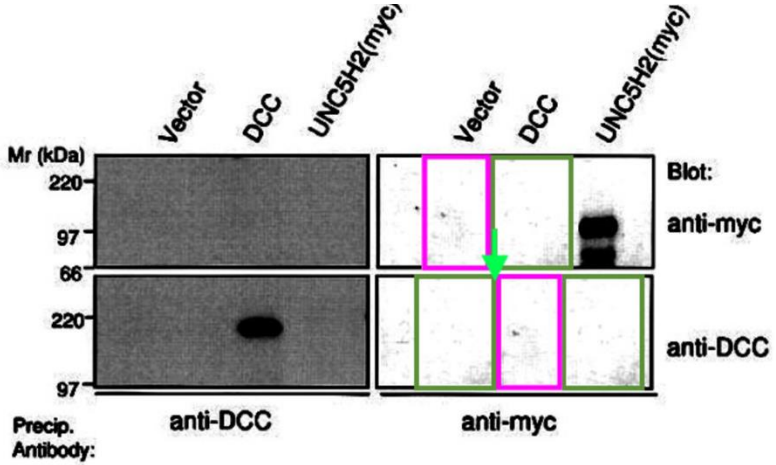
The Troubles of Stanford's President, continued

Hong et al, 1999, *Cell, F*ig. 3A



This Western blot supposedly showed that the two antibodies used in this study were specific to DCC and myc, respectively.

But look what adjusting the image brightness revealed!



Paper retracted in 2023

Problems also in several other papers!

Ultimately, Tessier-Lavigne resigned his presidency. Insufficient supervision of his lab!

Some have warned:
Scientists, get your house in order!

"Of all human endeavours, science is one of the most successful – prodigious in benefits, low in cost. But science, vulnerable to abuse from within by its practitioners, is perhaps even more vulnerable to harm by regulation, and at some point the cost of further regulation will outweigh the benefits."

Scientists have to an unusual degree been entrusted with the regulation of their own professional activities. Self-regulation is a privilege that must be exercised vigorously and wisely, or it may be lost."

– Steward & Feder (1987) *Nature*

EDITORIAL

Science, July 3, 2025

Sluggishness and defensiveness helped enable an executive order on research integrity

H. Holden Thorp

Editor-in-Chief of *Science*

It is possible to support science and hold it accountable at the same time. The adherence to a false choice that only one or the other is possible has made it easier for anecdotally driven attacks to succeed politically and for reforms to be externally imposed. It is within the collective control of the scientific enterprise to change the response and the perception. □

Paper Mills

They create fake papers and then sell authorships

Hu et al. (2018) reported a >59% incidence of breast cancer in males (38/64 subjects)

Liu et al. (2020) found ovarian cancer in 28 males among 49 subjects

Pan et al. (2019) reported prostate cancer in 27 females among 52 subjects

All these studies were published in a journal with an impact factor of 3.
In all studies, genders were described as binary, i.e., exclusively biological male and female, and none of the study subjects were indicated as being transgender.

Jaime A. Teixeira da Silva. (2021) *NOWOTWORY J Oncol* 71: 255–256.

AI Generated Papers

Contents lists available at ScienceDirect

Surfaces and Interfaces

journal homepage: www.sciencedirect.com/journal/surfaces-and-interfaces

The three-dimensional porous mesh structure of Cu-based metal-organic-framework - aramid cellulose separator enhances the electrochemical performance of lithium metal anode batteries

Manshu Zhang [a,1], Liming Wu [a,1], Tao Yang [b], Bing Zhu [a], Yangai Liu [a,*]

This paper also
Copied 2 figures
From another paper

RETRACTED

1. Introduction

Certainly, here is a possible introduction for your topic:Lithium-metal batteries are promising candidates for high-energy-density rechargeable batteries due to their low electrode potentials and high theoretical capacities [1,2]. However, during the cycle, dendrites forming on the lithium metal anode can cause short circuit, which can affect the safety and life of the battery [3–9]. Therefore, researchers are indeed focusing on various aspects such as negative electrode structure [10], electrolyte additives [11,12], SEI film construction [13,14], and collector modification [15] to inhibit the formation of lithium dendrites.

chemical stability of the separator is equally important as it ensures that the separator remains intact and does not react or degrade in the presence of the electrolyte or other battery components. A chemically stable separator helps to prevent the formation of reactive species that can further promote dendrite growth. Researchers are actively exploring different materials and designs for separators to enhance their mechanical strength and chemical stability. These efforts aim to create separators that can effectively block dendrite formation, thereby improving the safety and performance of lithium-ion batteries. While there are several research directions to address the issue of dendrite formation, using a separator with high mechanical strength and chem-

"Problematic Paper Screener" flags "tortured phrases", now on PubPeer

“Phantom Studies” Cited in an AI-assisted Report

SCIENCEINSIDER | HEALTH

Trump officials downplay fake citations in high-profile report on children’s health

References to phantom studies comes after White House pledge to practice “gold standard” science

30 MAY 2025 • 4:50 PM ET • BY PHIE JACOBS

May 2025

The Federal Definition of Research Misconduct (1999)

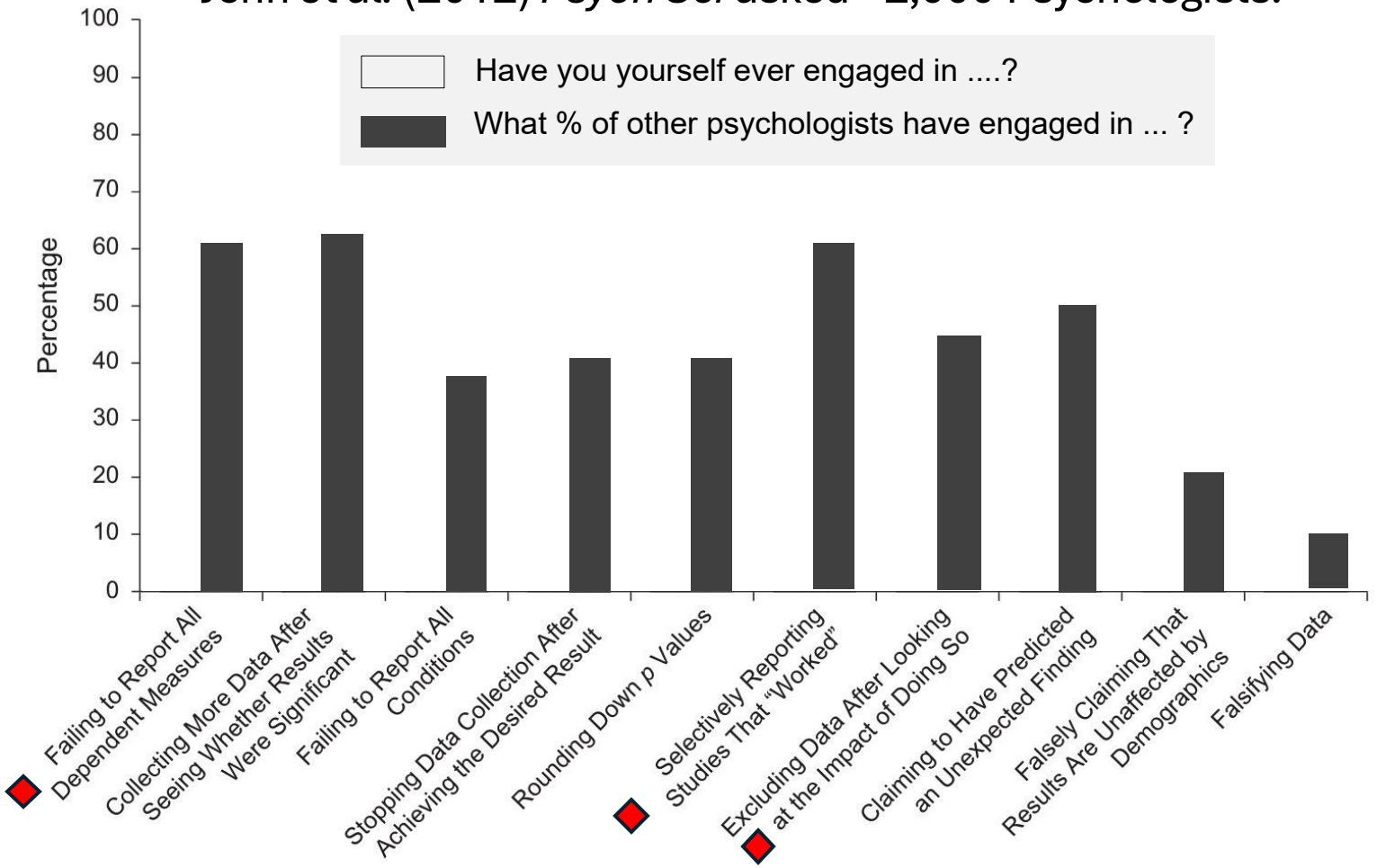
Research misconduct is defined as:

- **Fabrication, Falsification, or Plagiarism** in proposing, performing or reviewing research, or in reporting research results (excludes "honest mistakes; see later)
- The data may be in laboratory notebooks, grant applications, progress reports to NIH, publications, patent applications or similar documents
- **Plagiarism** includes the **appropriation of another person's ideas, processes, results, or words without giving appropriate credit**, including those obtained through confidential review of others' research proposals and manuscripts.

In the 19th Century the called it "hoaxing, forging, trimming, and cooking"

Even more common than Research Misconduct are Questionable Research Practices (QRPs)

John et al. (2012) *Psych Sci* asked ~2,000 Psychologists:



"QRPs are the steroids of scientific competition"

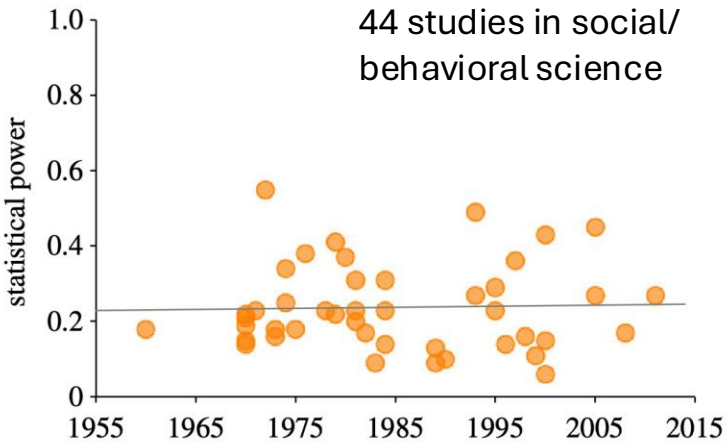
The natural selection of bad science

Paul E. Smaldino[1] and Richard McElreath[2]

Royal Society Open Science, 2016

"Philosophers of science have discussed how scientific theories evolve by variation and selective retention. But scientific *methods* also develop in this way. ... Methods which are associated with greater success in academic careers will, other things being equal, tend to spread."

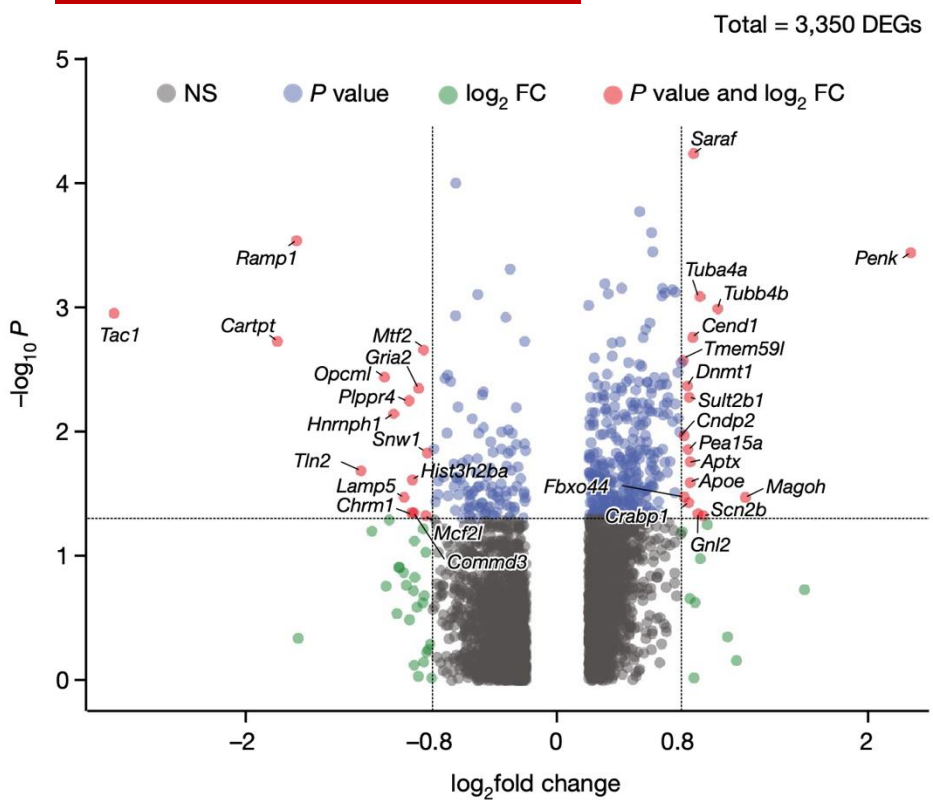
"It is clear that low-powered studies are more likely to generate false negatives. Less clear, perhaps, is that low power can also increase the false discovery rate and the likelihood that reported effect sizes are inflated."



"In an academic environment that only publishes positive findings and rewards publication, an efficient way to succeed is to conduct low power studies."

Testing Multiple Hypotheses With the Same Data: Adjusting Your Stats

Sun et al., 2024, *Nature*



They identified 32 genes differentially expressed (at p<0.05) in one type of neuron after fear conditioning (versus control).

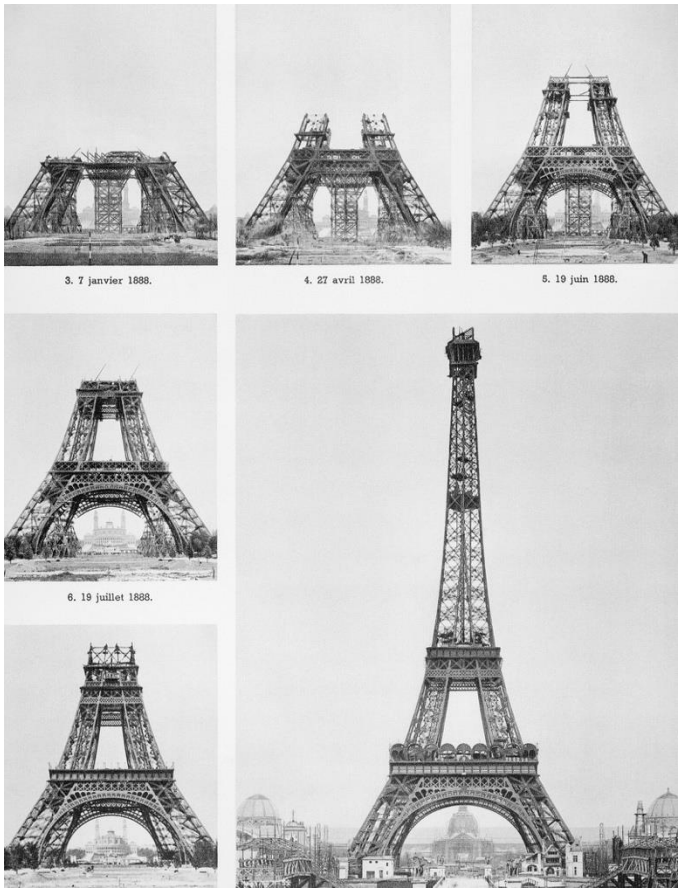
However, Mukamel and Yu (at UCSD and UCI; *Nature*, June 2025) reported that all these differences become statistically insignificant once you adjust for multiple comparisons (i.e., once you account for the fact that they looked at 3,350 genes, not 32).

"When testing the effect of a treatment on thousands of genes, around 5% of the tested genes are expected to pass an unadjusted significance threshold (p<0.05) even in the absence of any true effect." – Mukamel and Yu, 2024, BioRxiv

What Can We Do?

- Focus on Building a Solid Foundation

Don't look down on scientists who build their "story" gradually, methodically, with lots of "backfilling".



Yes, science does self-correct in the (very) long run, but think of the poor graduate student (or postdoc, or assistant professor) who's trying to build on work that doesn't hold up! What a waste …

What (Else) Can We Do?

- Pre-registered experiments are a good idea, but we also need exploratory research, clearly identified as such.
- Be a skeptic. In Robert Merton's (1942) phrase: Science is "organized skepticism". In the words of Richard Feynman (1974): "you must not fool yourself, and you are the easiest person to fool". That is, don't be afraid to ask probing questions (even of yourself).

- As a PI, help set clear limits on what practices are (un)acceptable. Write down "mutual expectations"!
- As a community, let's value quality over quantity, strong science over flashy stories.
- Let's make a greater effort to learn about each other's work, so we can tell what's strong and what is weak.