

COFFEE



LECTURE

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**Irreproducible
results in
scientific articles**
Rare incident or
prevalent problem?



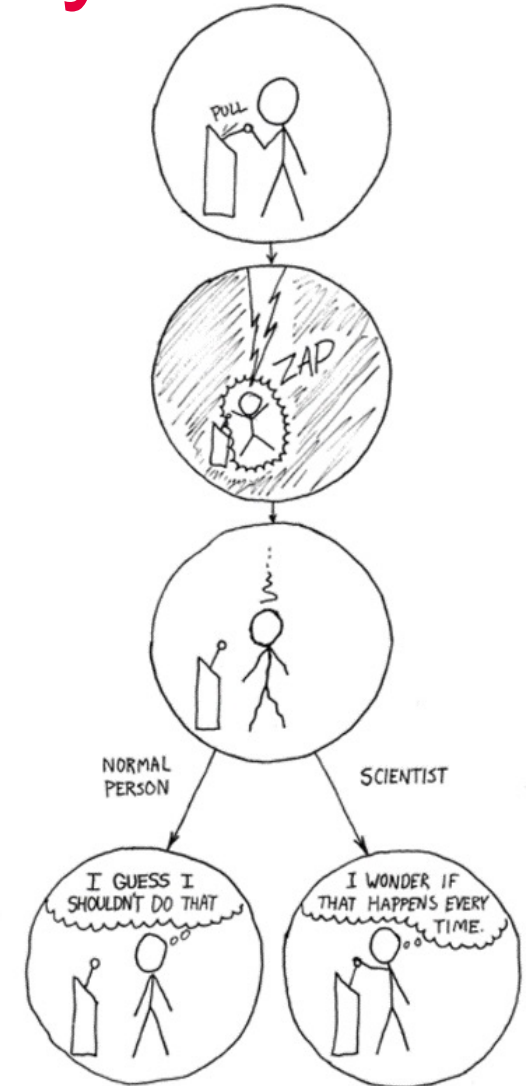
Dr. Nuria Plattner
Research Support Team Science Library
UB Bern

Thursday
11.05.2023
13:00, Zoom

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Science is based on reproducibility

- A scientific fact can only be established if a reproducible procedure to verify it can be defined
- **Reproducibility vs. Repeatability:**
 - **Repeatability:** an experiment can be repeated under the same conditions by the same person using the same instruments
 - **Reproducibility:** a reproducible experiment can be replicated anywhere by anyone following the same procedure (documented in literature)
- Challenges in reproducing research differ between research areas; standardization of methods is favorable for reproducibility

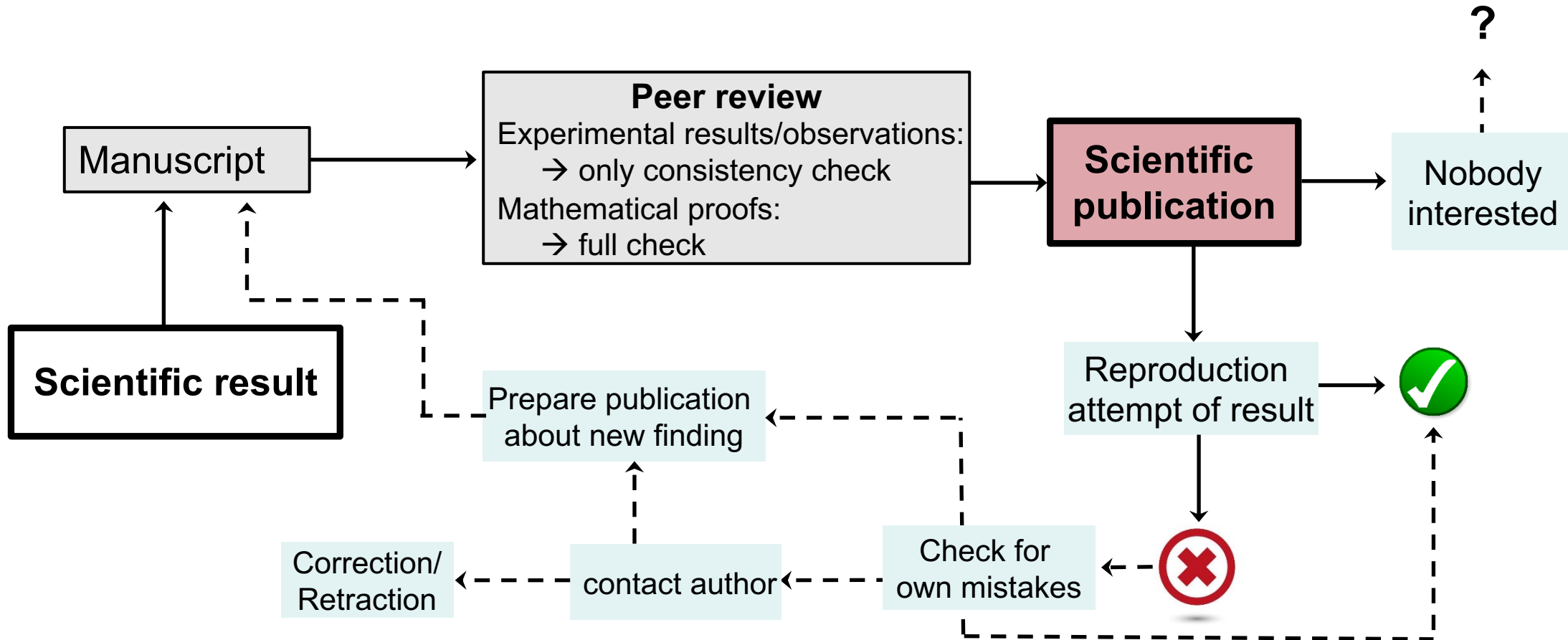


<https://3c1703fe8d.site.internapcdn.net/newman/gfx/news/hires/2016/howscientist.png>

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Irreproducible results in the scientific publication process

Publication process and lifecycle



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Irreproducible results in the scientific publication process

Post publication peer review

- Several platforms allow reviewing and commenting published papers
- PubPeer is currently the most popular platform for post publication comments
- Comments can be started for any article using a unique identifier
- Comments can be made anonymously and address major or minor issues of a paper
- Authors are alerted automatically if there are comments on their paper

The screenshot shows the PubPeer website interface. At the top, the PubPeer logo is visible with the tagline "The online Journal club". Navigation links for "LOGIN" and "CREATE ACCOUNT" are in the top right. Below the header, there is a search bar with the text "The PubPeer database contains all articles. Search results return articles with comments." and a search input field with a magnifying glass icon. Below the search bar, there is a note: "To leave the first comment on a specific article, paste a unique identifier such as a DOI, PubMed ID, or arXiv ID into the search bar." Below this, there is a list of articles. The first article is "Introducing Peeriodicals: where you are the editor in chief" from "PubPeer Blog (2018)" with "2 months ago" and "15 comments". The second article is "Occurrence and effects of plastic additives on marine environments and organisms: A review" from "Ludovic Hermabessiere, Alexandre Dehaut, Ika Paul-Pont, Camille Lacroix, Ronan Jezequel, Philippe Soudant, Guillaume Duflos" with "18 minutes ago" and "3 comments". A notification banner at the bottom of the article list says "You have not yet installed the PubPeer browser plugin and will not see PubPeer comments on other websites. Install it here!". At the very bottom, there is a footer with navigation links and the copyright notice "Copyright © 2021 PubPeer Foundation".

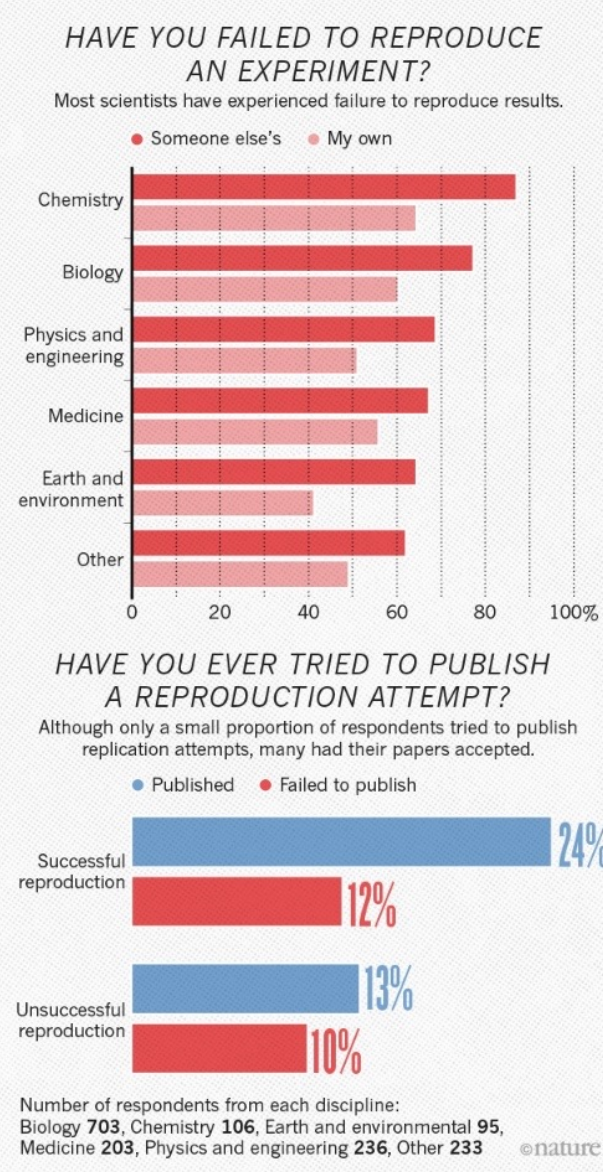
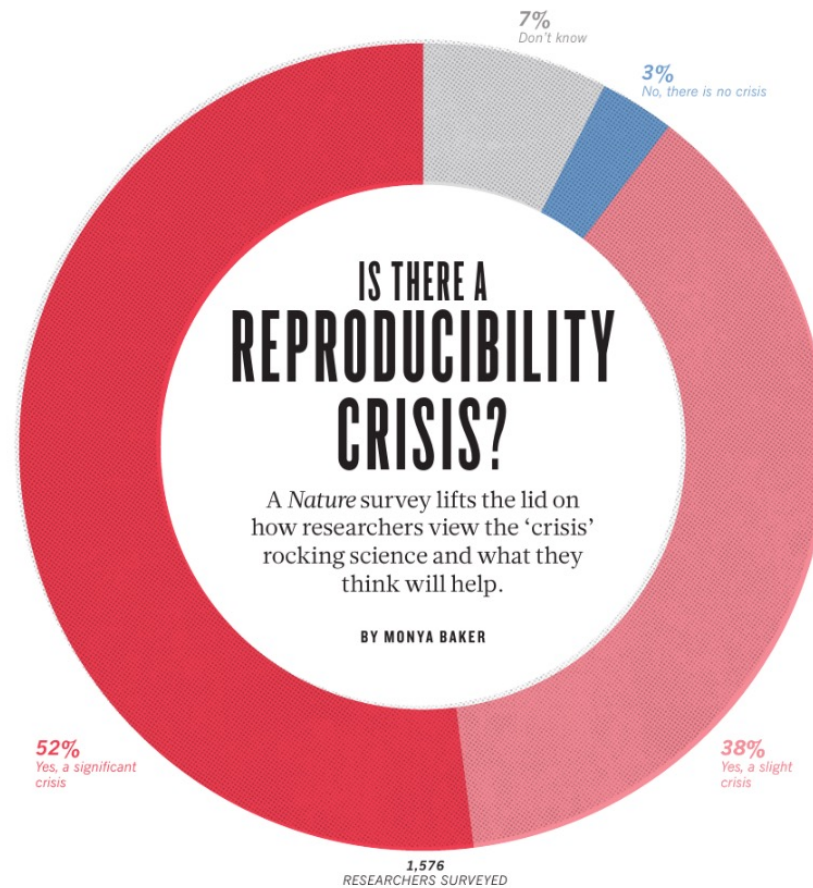


<https://pubpeer.com>

Is there a reproducibility crisis?

1500 scientists lift the lid on reproducibility

- Nature survey, 1576 researchers
- 52% agree that there is a significant crisis in reproducibility
- <31% think that non-reproducible results are wrong
- Most scientist still trust published literature



Baker, M.. *Nature* **533**, 452–454 (2016). <https://doi.org/10.1038/533452a>

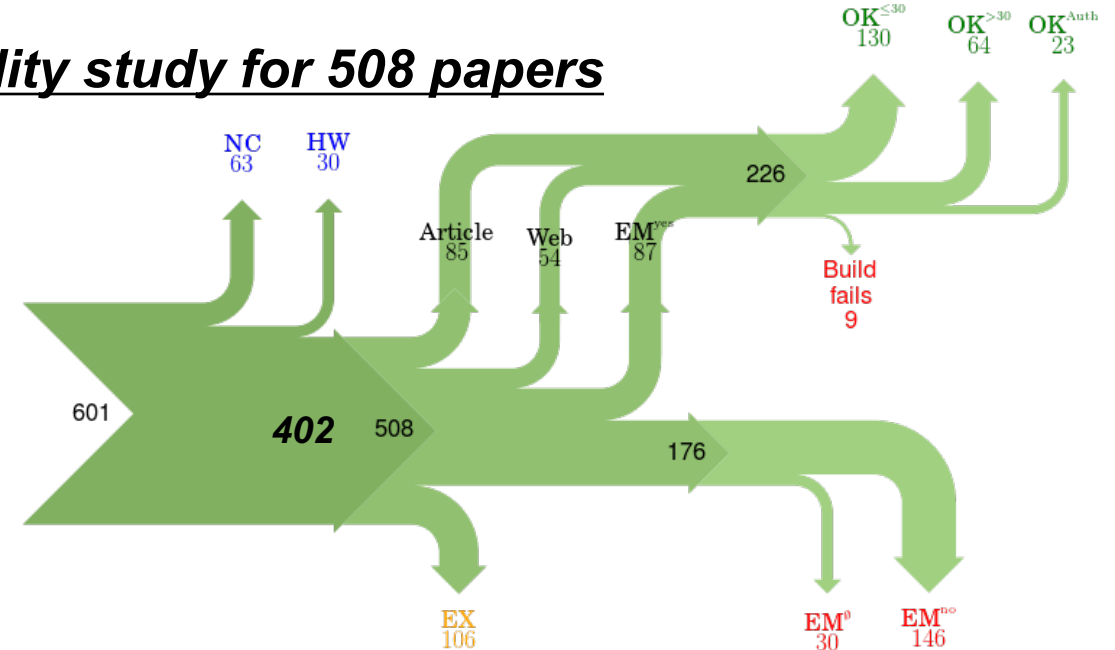
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Examples for lack of reproducibility

Missing code / documentation

Results of reproducibility study for 508 papers

- Sharing for repeatability is essential to ensure that other researchers can evaluate results based on accurate and complete evidence
- Repeatability study 2015 examines extent to which computer systems researchers share their source code and code builds
- This is referred to as weak repeatability



Legend			
Classification	Code Location		Build Results
BC	Paper where the results are backed by code.	Article Code is found from link in the article itself.	OK ^{≤30} We succeed in building the system in ≤30 minutes.
NC	Paper excluded due to results not being backed by code.	Web Code is found from a web search.	OK ^{>30} We succeed in building the system in >30 minutes.
HW	Paper excluded due to replication requiring special hardware.	EM ^{yes} Code is provided by author after email request.	OK ^{>Author} We fail to build, but the author says the code builds with reasonable effort.
EX	Paper excluded due to overlapping author lists.	EM ^{no} Author responds that the code cannot be provided.	Builds We fail to build, and the author doesn't respond to survey or says code may have problems building.
		EM ^o Author does not respond to email request within 2 months.	Builds

@ <http://reproducibility.cs.arizona.edu/>

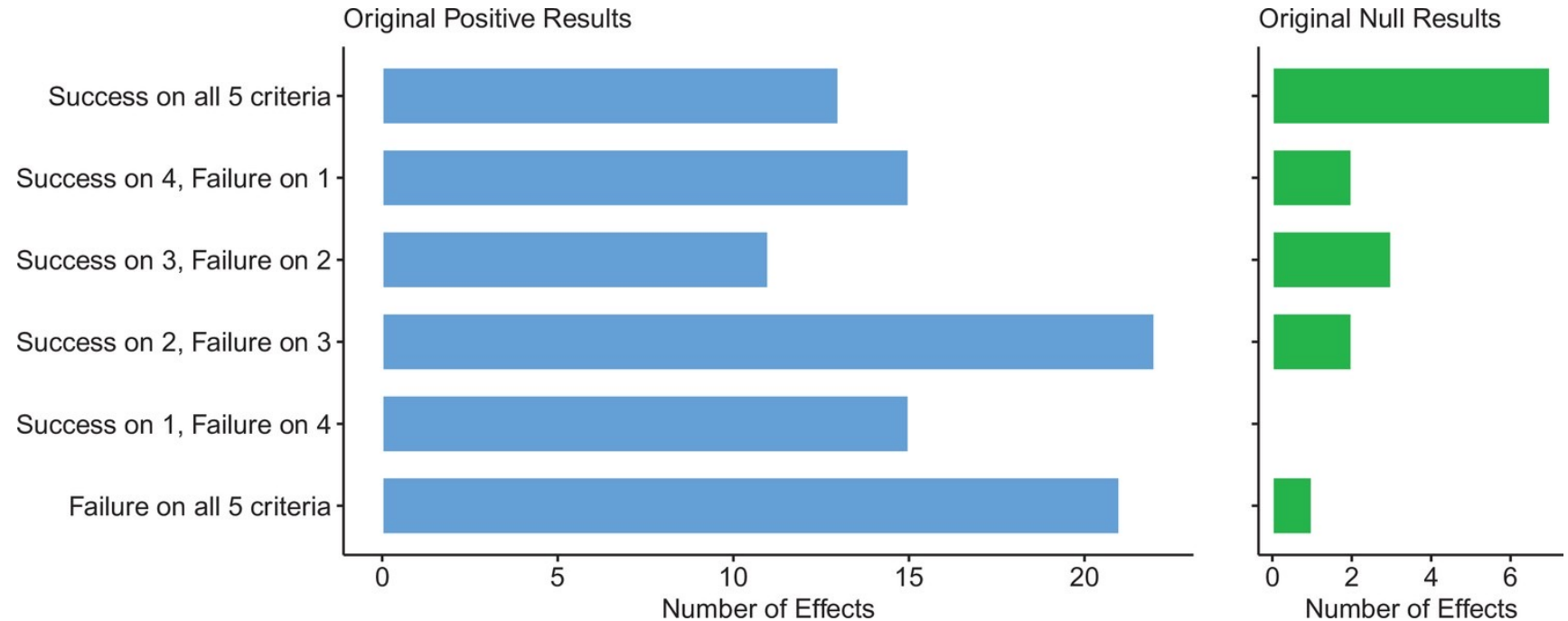
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Examples for lack of reproducibility

The reproducibility project: cancer biology

Investigating reproducibility in preclinical cancer research

- 50 experiments from 23 high-profile papers were repated
- Data about the replicability of a total of 158 effects generated
- The success rate of replication was 46%



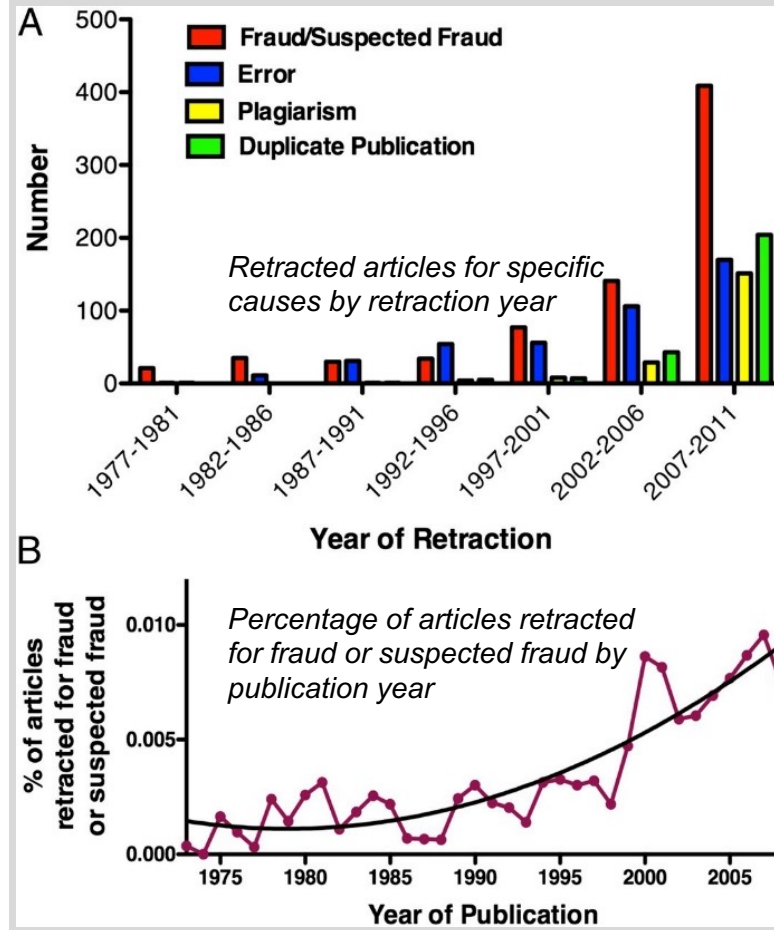
Five criteria used to assess replications could be used for both positive and null effects: (i) direction and statistical significance; (ii) original effect size in replication 95% confidence interval; (iii) replication effect size in original 95% confidence interval; (iv) replication effect size in original 95% prediction interval; (v) meta-analysis combining original and replication effect sizes is statistically significant.



u^b Trends in paper retraction

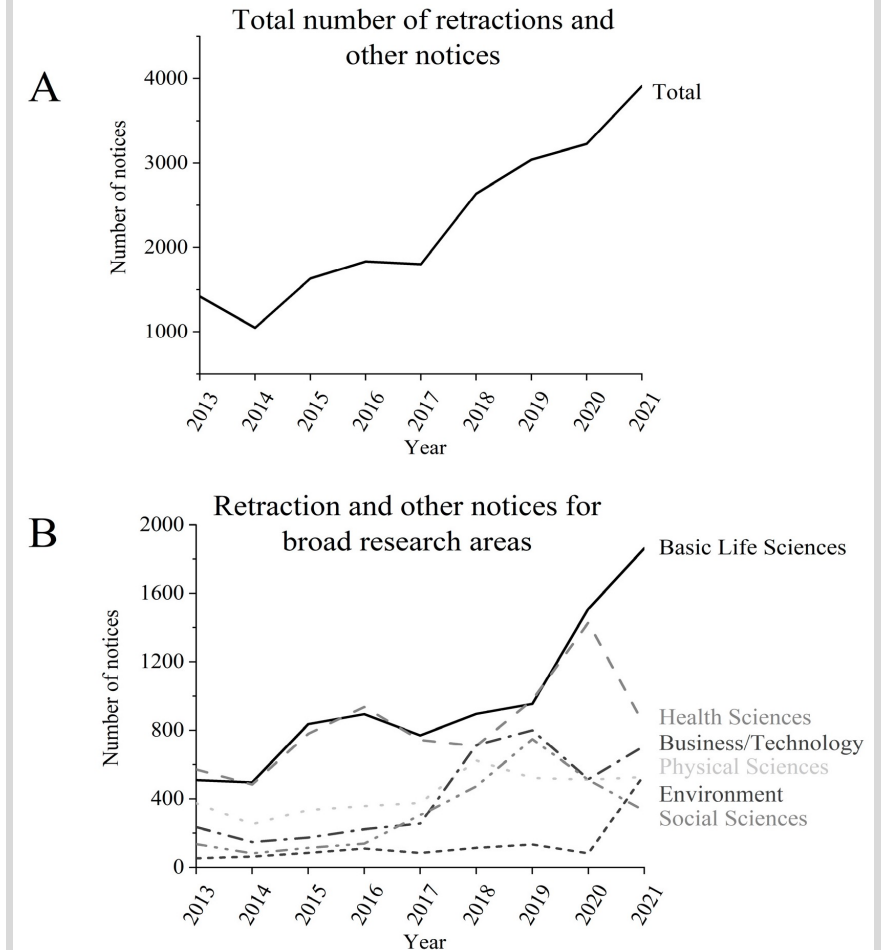
- Paper retractions are on the rise
- Only papers with significant flaws are retracted
- Minor corrections usually added to paper as erratum (if anything)
- Main retraction causes: fraud or conceptual scientific mistake

Misconduct accounts for the majority of retracted scientific publications



F. C. Fang, R. G. Steen, and A. Casadevall, *Proc. Natl. Acad. Sci.* **109**, 17028-17033, (2012).
<https://doi.org/10.1073/pnas.1212247109>

Sustained Rise in Retractions in the Life Sciences Literature during the Pandemic Years 2020 and 2021




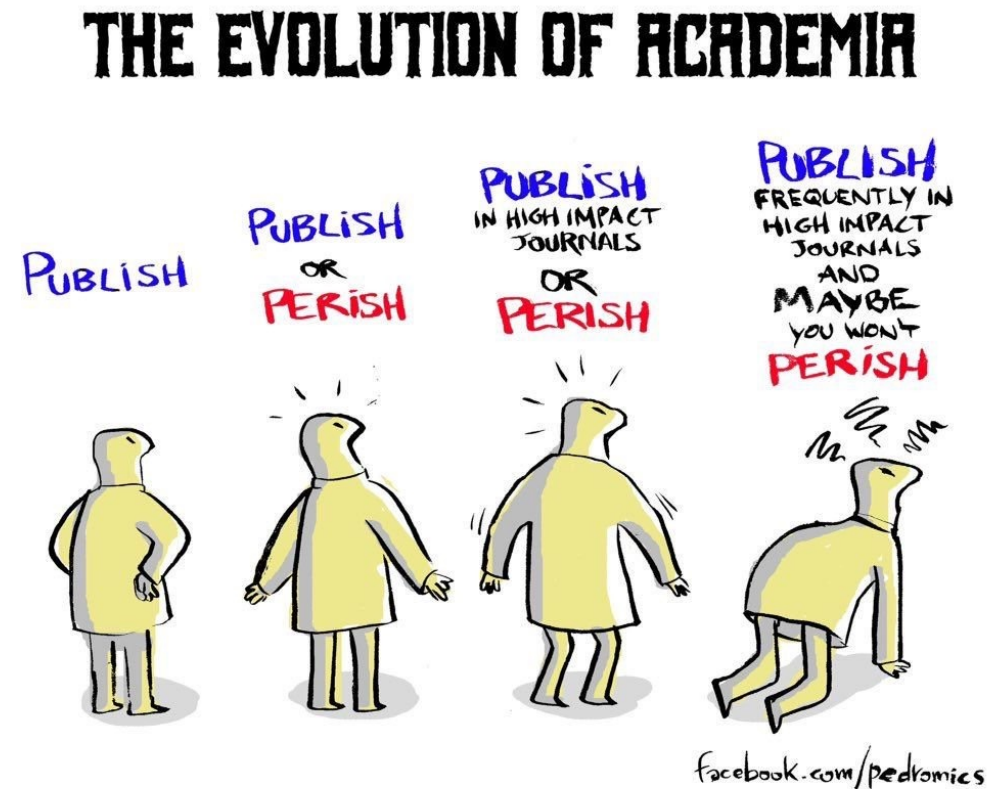
Yeo-Teh, N.S.L.; Tang, B.L., *Publications* **2022**, *10*, 29.
<https://doi.org/10.3390/publications10030029>

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Systemic reasons for lack of reproducibility

Publication pressure

- Scientists spend time publishing as much as possible, rather than spending time developing research
- No time for confirmation of experiments
- Limited time for peer-review
-  Only 45% of articles published in top 4500 scientific journals are cited within first 5 years
- Only 42% of the papers receive more than one citation, 5-25% of these are self-citation



 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3999612/>

How to keep track of retracted publications ?

Retraction watch database

Version: 1.0.6.0
ISSN 2692-465X

The Retraction Watch Database
Please see this [user guide](#) before you get started.
And please consider a [U.S. tax-deductible donation](#) to allow us to continue to update and make this resource available.

Author(s): Giese, Bernd Country(s):
Title: Type to search
Reason(s) for Retraction:
Subject(s): Article Type(s):
Journal:
Publisher:
Affiliation(s):
Notes:
URL:

Original Paper
From Date: To:
PubMedID: mm/dd/yyyy
DOI:

Retraction or Other Notices
From Date: To:
PubMedID: mm/dd/yyyy
DOI:
Nature of Notice: Paywalled:

[Clear Search](#) [Search](#)

Retraction or Other Notices Title/Subject(s)/Journal --- Publisher/Affiliation(s)/Retraction Watch Post URL(s)	Reason(s)	Author(s)	Original Paper Date/PubMedID/DOI	Retraction or Other Notices Date/PubMedID/DOI	Article Type(s) Nature of Notice	Countries Paywalled? Notes
1 Item(s) Found						
Mutations in CLCN2 encoding a voltage-gated chloride channel are associated with idiopathic generalized epilepsies (BLS) Genetics; (BLS) Neuroscience; (HSC) Medicine - Neurology; <i>Nature Genetics</i> --- <i>Nature Publishing Group</i>	+Error in Data	Karsten Haug	03/03/2003	09/01/2009	Letter	Chile
Institut für Humangenetik, Universitätsklinikum Bonn, Bonn	+Error in	Maike Warnstedt	12612585	19710717	Research Article	Germany
Lehr und Forschungsgebiet Physiologie, RWTH Aachen, Aachen	Image	Alexi K Alekov	10.1038/ng1121	10.1038/ng0909-1043	Retraction	United States
Abteilungen für Angewandte Physiologie und Neurologie, Universität Ulm, Ulm	+Error in	Thomas Sander				No
Neurologische Klinik, Arbeitsgruppe Epilepsie-Genetik, Universitätsklinikum Charité, Campus Virchow Klinikum, Humboldt Universität zu Berlin, Berlin	Results and/or	Alfredo Ramirez				
Klinik für Epileptologie, Universitätsklinikum Bonn, Bonn	Conclusions	Barbara Poser				
Departments of Human Genetics and Biostatistics, University of California, Los Angeles, California	+Error in Text	Snezana Maljevic				
Klinik für Pädiatrie, Universitätsklinikum Bonn, Bonn	+Results Not	Simon Hebeisen				
Institut für Biochemie, RWTH Aachen, Aachen	Reproducible	Christian Kubisch				
Centro de Estudios Científicos, Valdivia		Johannes Rebstock				
		Steve Horvath				
		Kerstin Hallmann				
		Joern S Dullinger				
		Birgit Rau				
		Fritz Haverkamp				
		Stefan Beyenburg				
		Herbert Schulz				



<http://retractiondatabase.org>

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How to keep track of retracted publications ?

Retraction watch blog

Most cited retracted papers (03/2023)

Article	Retraction year	Citing Articles before retraction	Citing Articles after retraction	Total cites (Web of Science)
1. Primary Prevention of Cardiovascular Disease with a Mediterranean Diet. N ENGL J MED; APR 2013. <i>Estruch R, Ros E, Salas-Salvado J, Covas MI, Corella, D, Aros F, Gomez-Gracia E, Ruiz-Gutiérrez V, Fiol M, Lapetra J, Lamuela-Raventos RM, Serra-Majem L, Pinto X, Basora J, Munoz MA, Sorli JV, Martinez JA, Martinez-Gonzalez MA, et al., for the PREDIMED Study Investigators</i>	2018	1905	950	2855
2. Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. LANCET; FEB 28 1998. <i>Wakefield AJ, Murch SH, Anthony A, Linnell J, Casson DM, Malik M, Berelowitz M, Dhillon AP, Thomson MA, Harvey P, Valentine A, Davies SE, Walker-Smith JA</i>	2010	643	940	1583
3. Visfatin: A protein secreted by visceral fat that mimics the effects of insulin. SCIENCE; JAN 2005. <i>Fukuhara A, Matsuda M, Nishizawa M, Segawa K, Tanaka M, Kishimoto K, Matsuki Y, Murakami M, Ichisaka T, Murakami H, Watanabe E, Takagi T, Akiyoshi M, Ohtsubo T, Kihara S, Yamashita S, Makishima M, Funahashi T, Yamanaka S, Hiramatsu R, Matsuzawa Y, Shimomura I.</i>	2007	232	1232	1464



<https://retractionwatch.com>

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How to improve reproducibility?



BMJ 2016;353:i2770 doi: 10.1136/bmj.i2770 (Published 24 May 2016)

Page 1 of 2

- ➔ Important: detailed description of results and methods
- ➔ sharing of data and code, open science



EDITORIALS

Money back guarantees for non-reproducible results?

There are better solutions to the “reproducibility crisis” in research

Eric J Topol *director*

Scripps Translational Science Institute, La Jolla, CA 92037, USA



- More fundamental changes: structural incentives need to be changed

Thanks



**for your
attendance**

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Next Coffee Lectures:



Research Support Services
Science and Medical Libraries
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support_med.ub@unibe.ch

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Slides and Screencast:

Science Library



Medical Library



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Now there is time for...

Questions & Discussion

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