Does science correct itself?

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Does science correct itself?

(and what if it doesn’t?)

1. Expectations about correction
2. Examples of correcting
3. What can we reasonably expect?
4. Consequences

Expectations

Why is there
relatively little fraud in science?

Science is about refuting hypotheses: the reputational rewards for correcting claims are as big as for making them.

Harriet Zuckerman (1937 -), sociologist of science

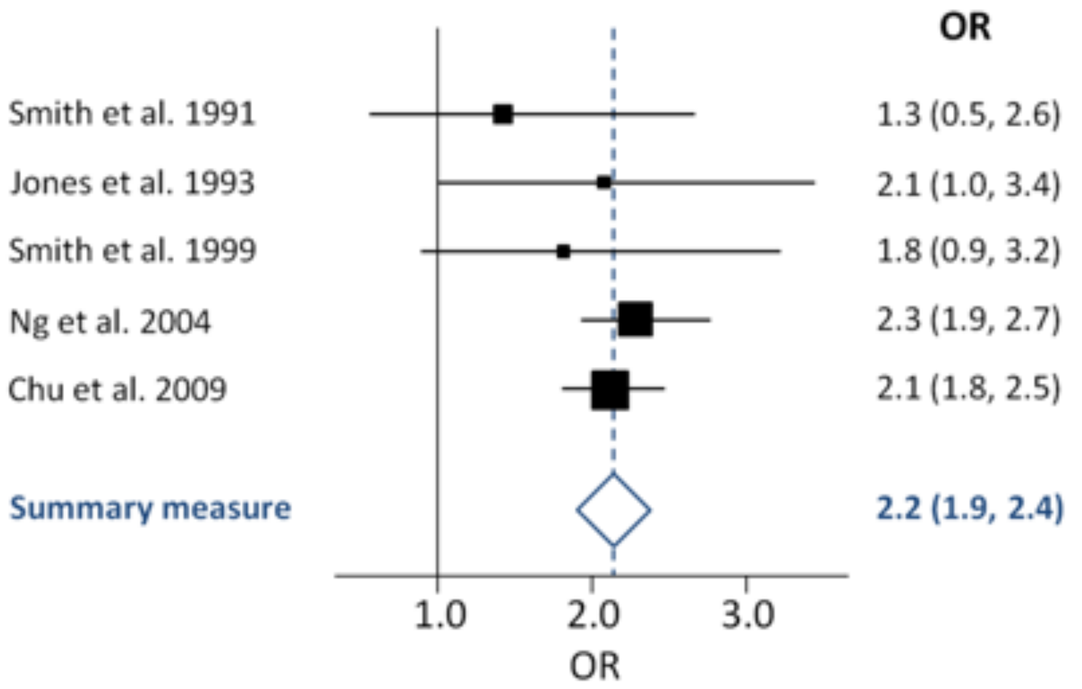
Zuckerman, H. (1977). Deviant Behavior and Social Control in Science.
In E. Sagarin (Ed.), Deviance and Social Change (Vol. 1, pp. 87-138). Beverly Hills/London: Sage.

‘The literature’

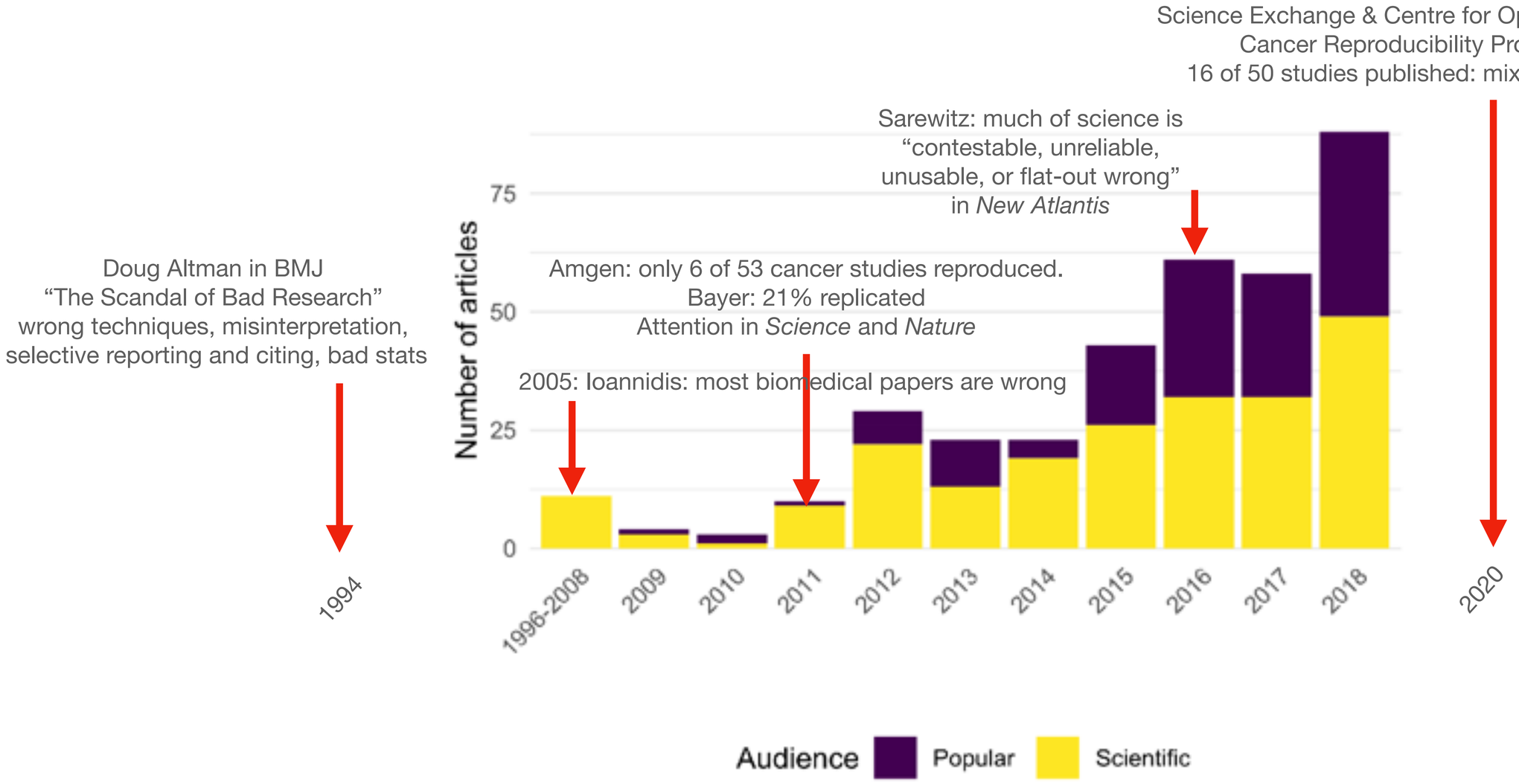
We tell students to rely on peer reviewed literature, not Google.

Meta-studies rely on (screened) peer reviewed literature.

Scientific policy advice (eg IPCC) relies on peer review as standard.



Wikipedia schematic of a forest plot as used in meta-analyses.

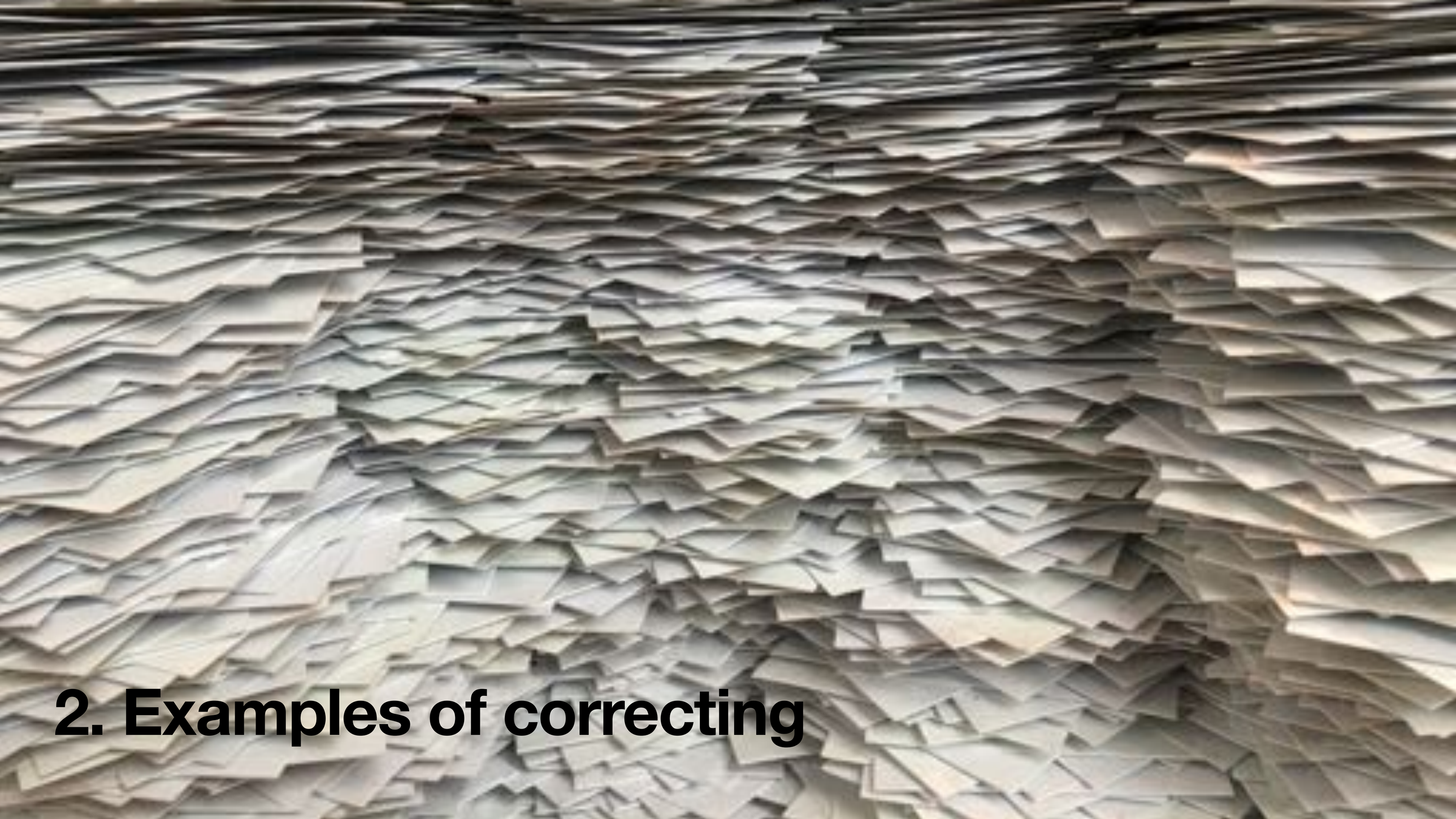


The growth of the literature on the ‘replication crisis’ (biomedicine, psychology and other disciplines).

Nelson, N. C., Ichikawa, K., Chung, J., & Malik, M. (2020). Mapping the discursive dimensions of the reproducibility crisis: A mixed methods analysis. *MetaArXiv Preprints*. doi:10.31222/osf.io/sbv3q

“The case against science is straightforward: much of the scientific literature, perhaps half,
may simply be untrue. Afflicted by studies with small sample sizes, tiny effects,
invalid exploratory analyses, and flagrant conflicts of interest, together with an obsession
for pursuing fashionable trends of dubious importance, science has taken a turn towards darkness.”

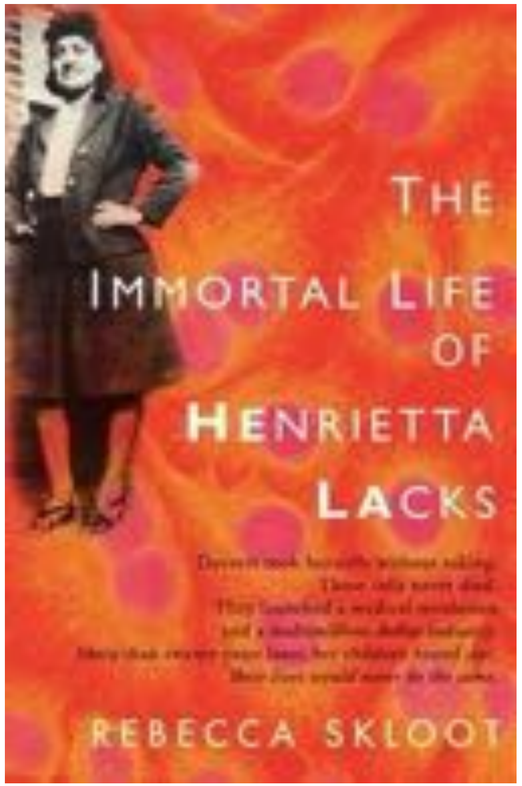
Richard Horton, *Lancet* chief editor, 2015.



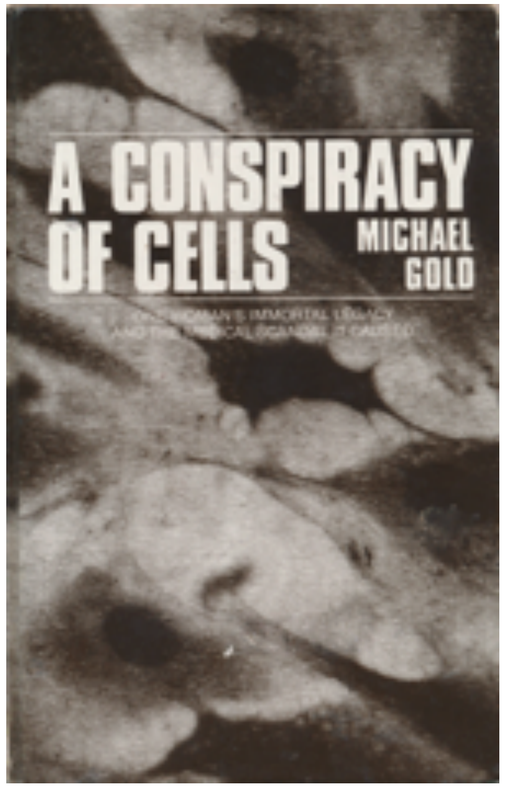
2. Examples of correcting

The history of HeLa and misidentified cell lines.

1951: the first immortalised cell HeLa in culture by Otto Gey



The 2010 book, later partly dramatised in film with Oprah Winfrey



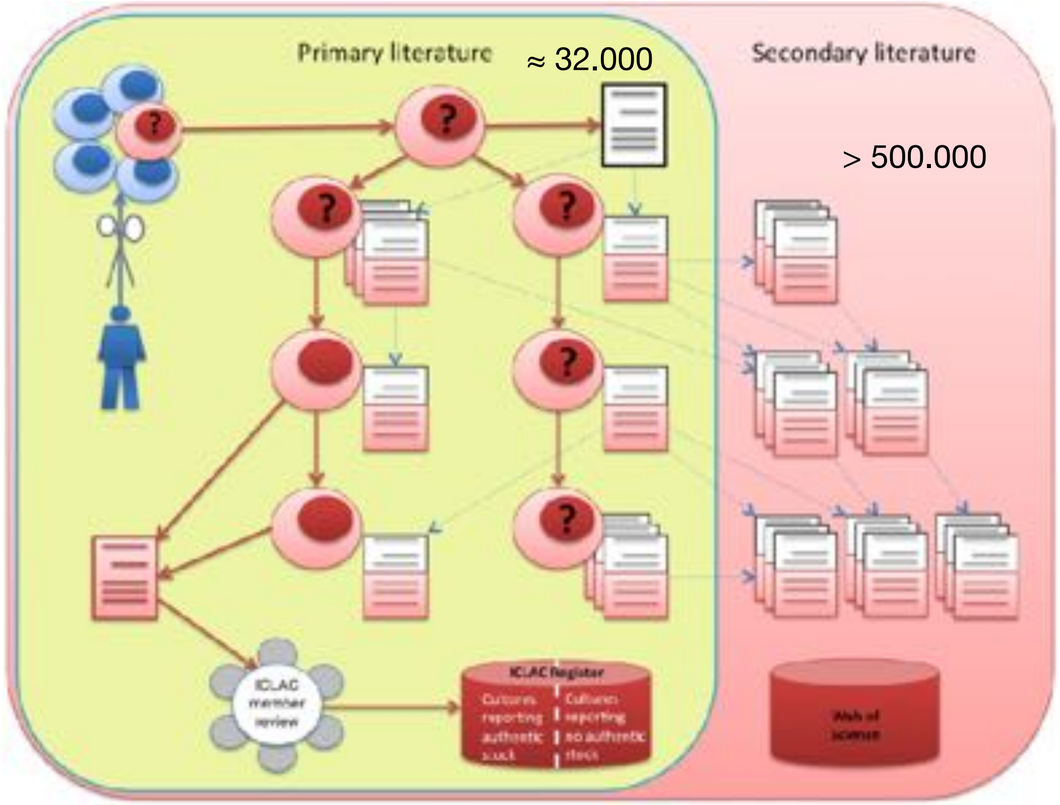
1986 account of misidentifications, long out of print

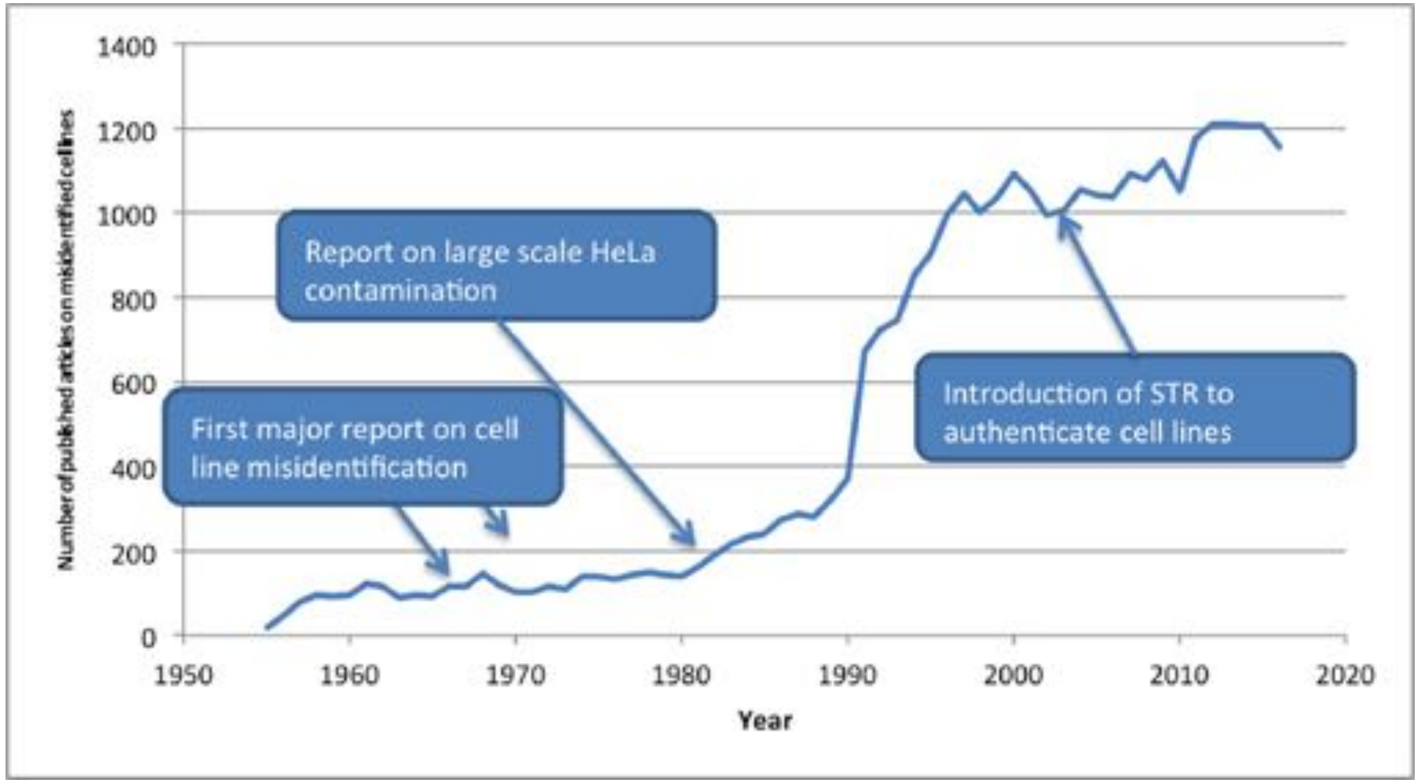
Walter Nelson-Rees end 1960s & 70s: cross-contaminated cell cultures. Your cells are HeLa cells.

Misidentified Cell Line	Registration ID	Claimed Species	Claimed Cell Type	Misidentified Cell Line, Cellosaurus Ac	Contaminating Cell Line	Actual Species	Actual Cell Type	Contaminating Cell Line, Cellosaurus Ac	Misidentification Reported By
C16 (MRC-5 derivative)	ICLAC-00296	Human	Lung cells, fetal	CVCL_2322	HeLa	Human	Cervical adenocarcinoma	CVCL_0030	ECACC website
C-433	ICLAC-00395	Human	Giant cell tumor, benign	CVCL_1969	RD-ES	Human	Sarcoma (Ewing's)	CVCL_2169	DSMZ website
CAC2	ICLAC-00362	Human	Salivary gland, adenoid cystic carcinoma	CVCL_6883	Unknown	Rat	Unknown	None	Phuchareon et al, 2009
CaMa (clone 15)	ICLAC-00034	Human	Breast carcinoma	CVCL_1714	Unknown	Syrian hamster and mouse	Unknown	None	Nelson-Rees et al, 1981

The International Cell Authentication Committee, register of misidentified cell lines: 509 known misidentified cells.

Can we assess the size of this problem?
How many papers use misidentified cells?





Horbach, S. P. J. M., & Halffman, W. (2017). The ghosts of HeLa: How cell line misidentification contaminates the scientific literature. PLoS ONE, 12(10), 16. doi:10.1371/journal.pone.0186281

Correction?

Not really.

2021: 122 retractions/corrections (retractionwatchdatabase.org)

Errors are not considered worth correcting.

Attempts at correction are met with fierce resistance. ICLAC members too.

Wetenschapspsychologie

Voor dit onderzoek zijn de verkeerde cellen gebruikt

Zo'n 33 duizend studies naar zaken als kanker en virale ziektes blijken gebaseerd op andere cellen dan men dacht. Bizar, zegt de onderzoeker. Maakt niet veel uit, zeggen betrokkenen.

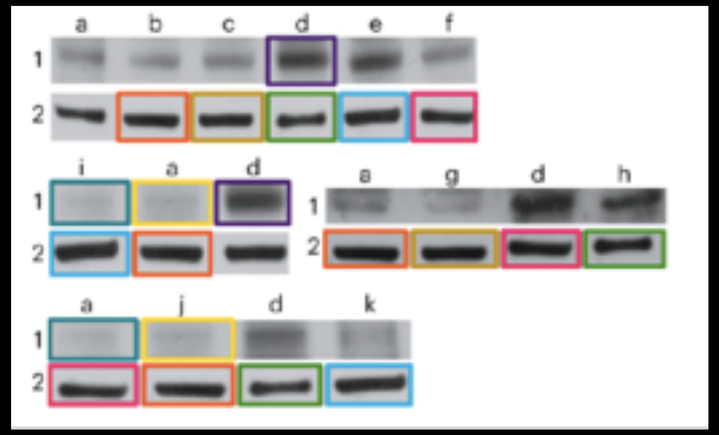
Door Maarten Keulemans

Volkskrant article about our paper (14.10.2017).
"Does not matter, say involved researchers."

2020 Interview in *Nature* with Elisabeth Bik, ‘image sleuth’.

Bik has an eye for photoshopped images in biomedical publications.

After discovering she could not reproduce an experiment that turned out to be fake, she started her detective work.



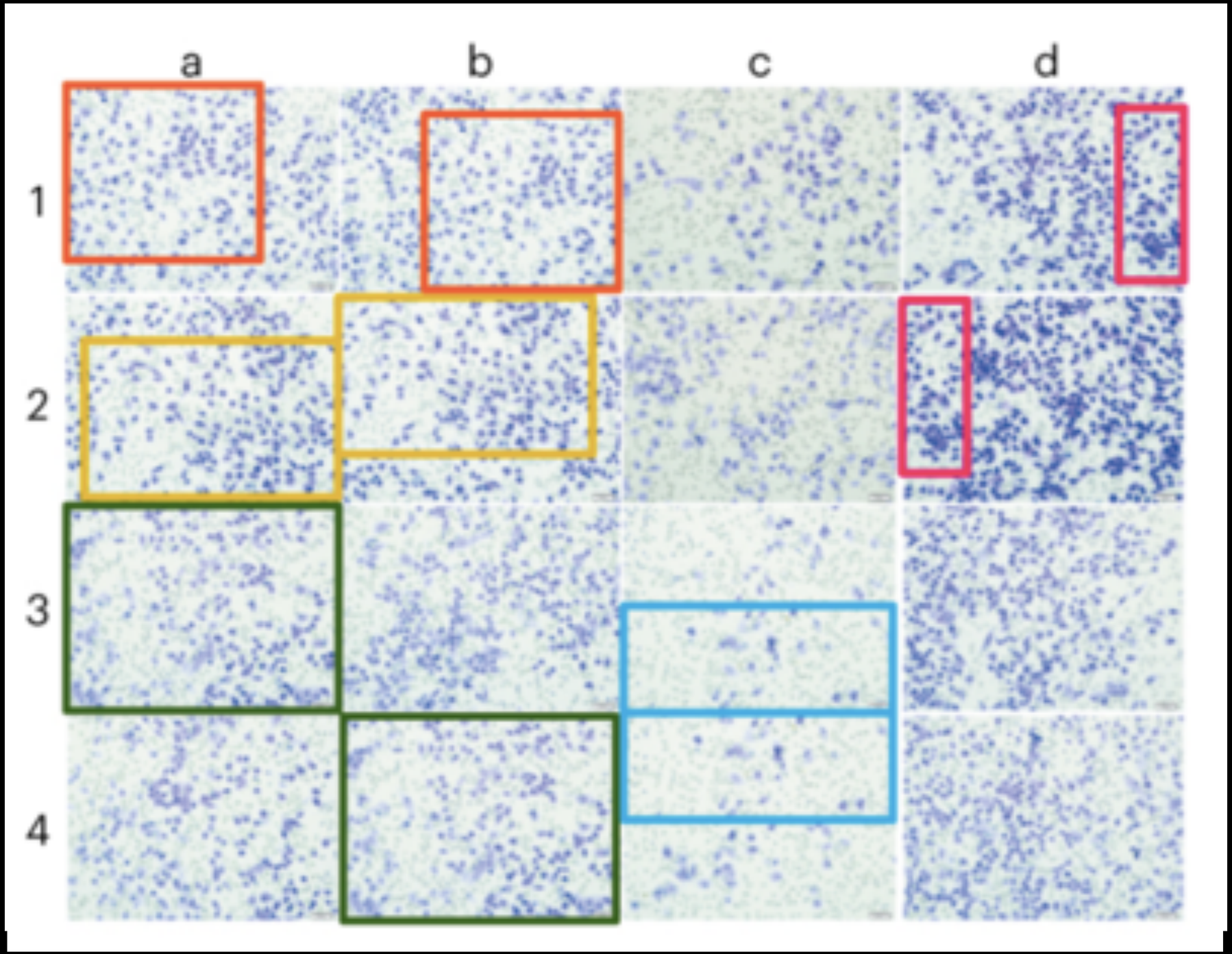
Nature 581, 132-136 (2020)
https://doi.org/10.1038/d41586-020-01363-z

NEWS FEATURE · 13 MAY 2020

Meet this super-spotter of duplicated images in science papers

Elisabeth Bik quit her job to spot errors in research papers – and has become the public face of image sleuthing.

Helen Shen



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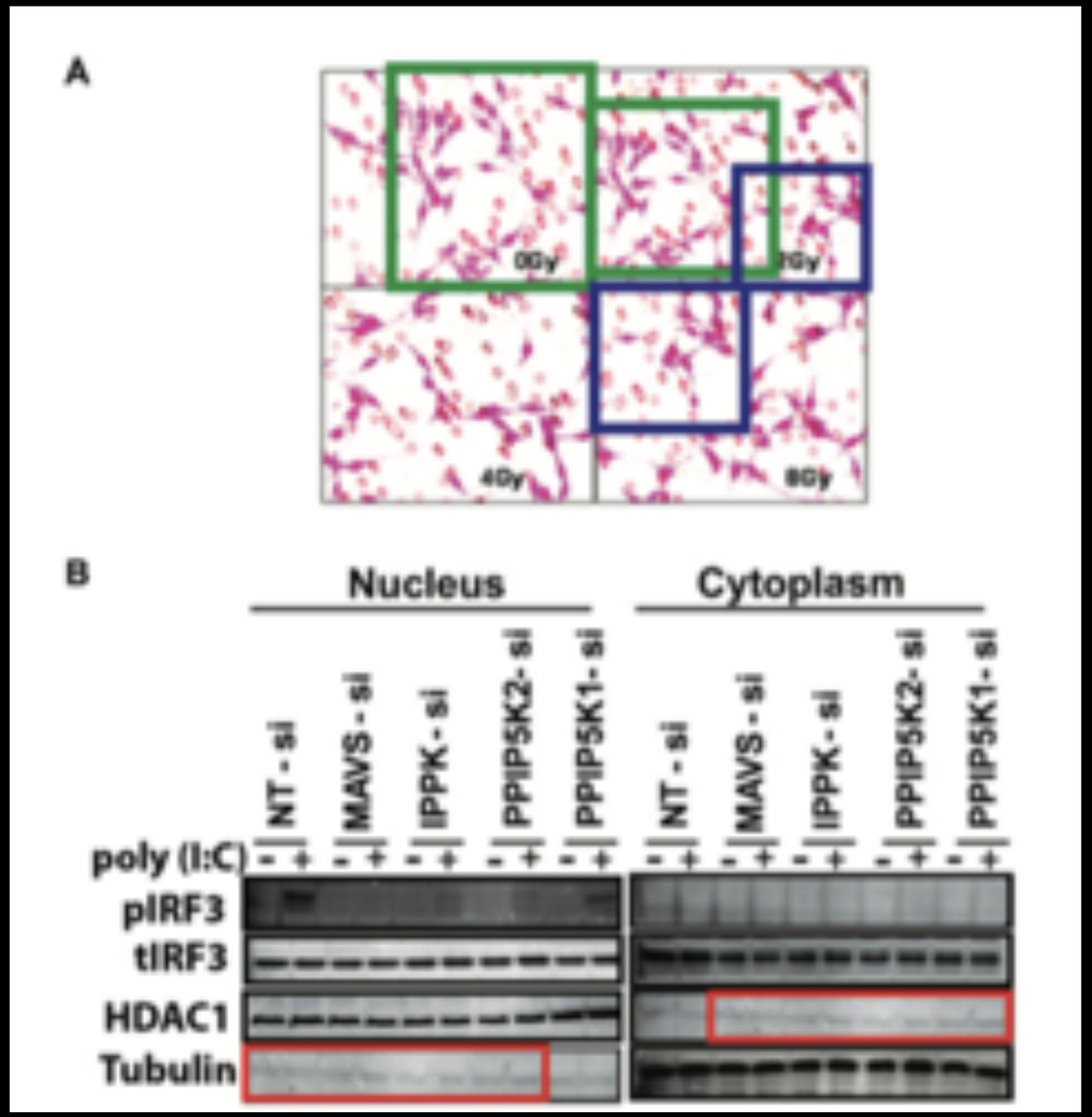
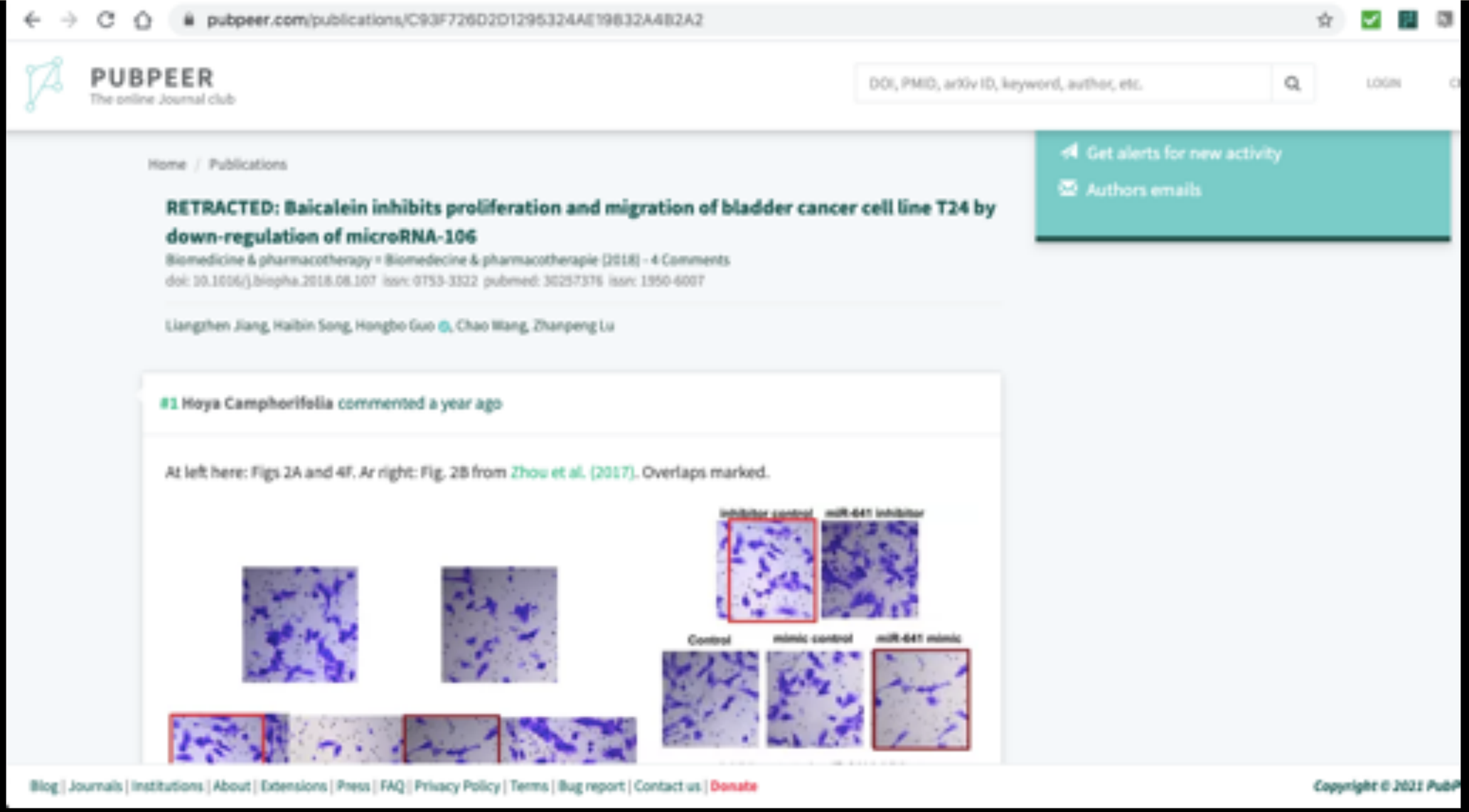


Bik and her network have now scanned 20.000+ papers.

They found that 3,8% have ‘problematic’ figures, and about half of those showed clear signs of deliberate manipulation.

Only 30-40% have been retracted or corrected in the literature.

Bik, E. M., Casadevall, A., & Fang, F. C. (2016). The Prevalence of Inappropriate Image Duplication in Biomedical Research Publications. mBio, 7(3), e00809-00816. doi:10.1128/mBio.00809-16



PubPeer, a post-publication peer review overlay,
is the major resource for Bik and a range of anonymous helpers to flag papers,
leading to many retractions (here a Tadpole paper mill paper).

French professor faces disciplinary case over hydroxychloroquine claims

Didier Raoult stands accused of touting drug as a coronavirus treatment without evidence

Didier Raoult's promotion of the drug as a Covid treatment was taken up by some populist world leaders. Photograph: Christophe Simon/AFP/Getty Images

A French professor who touts the anti-malaria drug hydroxychloroquine as a coronavirus treatment – without evidence, scientists say – will appear before a disciplinary panel charged with ethics breaches, an order of doctors has said.

The Guardian, 12 Nov 2020.
https://www.theguardian.com/world/2020/nov/12/covid-professor-didier-raoult-hydroxychloroquine

SCIENTIFIC-IMAGE SLEUTH FACES LEGAL ACTION FOR CRITICIZING PAPERS

Researchers say the complaint filed against Elisabeth Bik could have a 'chilling effect' on scholarly criticism.

By Holly Else

A prominent French microbiologist has filed a criminal complaint against a world-renowned research-integrity specialist after she publicly flagged concerns about his published work, including papers suggesting that the drug hydroxychloroquine was effective at treating COVID-19, a claim that has now been refuted. support her in an open letter that claims the case could have a "chilling effect" on scholarly criticism.

Potential problems

Raoult leads the IHU, an institute dedicated to the study of infectious diseases, and is well known for his work on gigantic mimiviruses. Early in the COVID-19 pandemic, he shot to global prominence after he authored a pre-

Nature 27 May 2021 (594), 17-18. doi:10.1038/d41586-021-01430-z

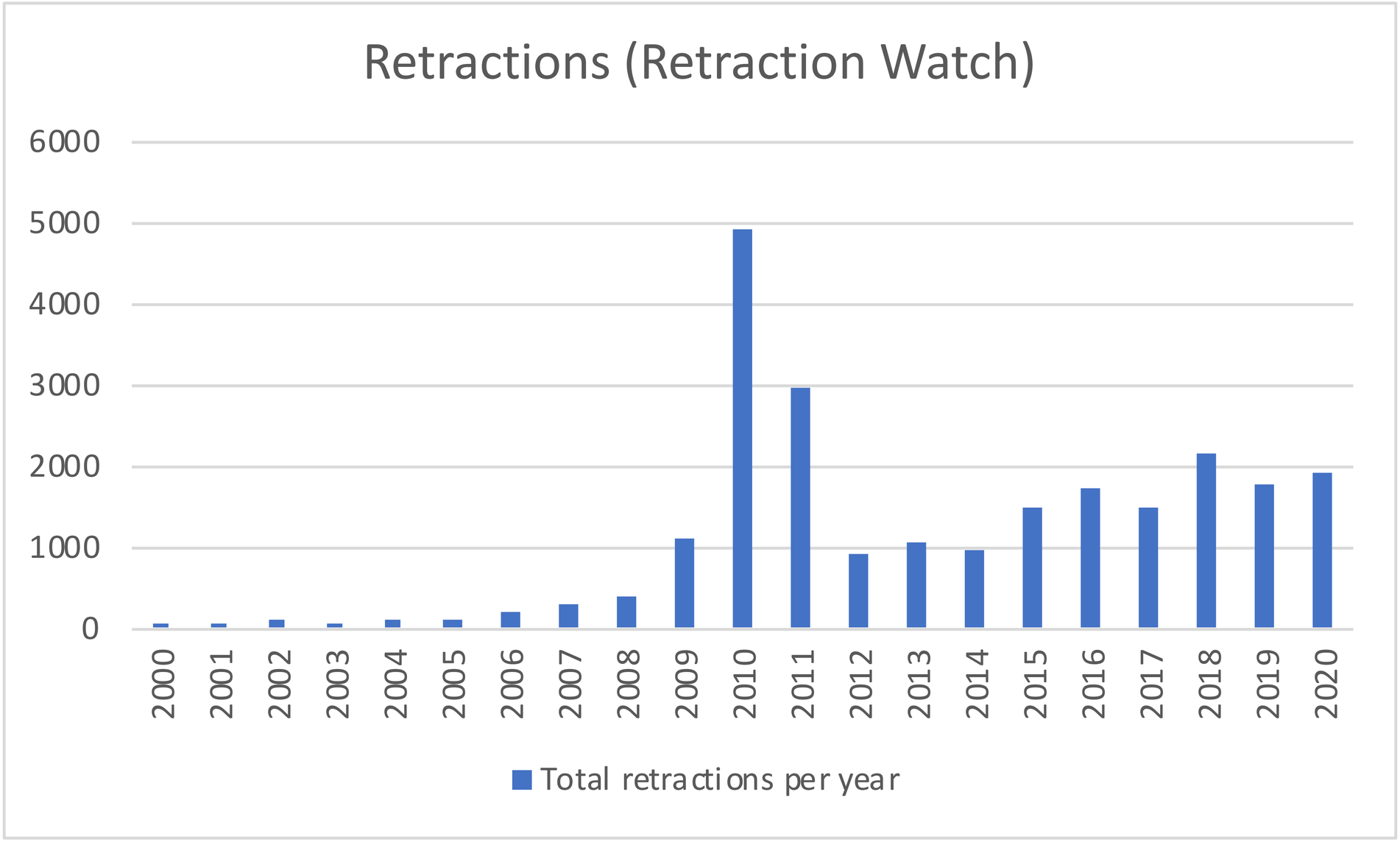
“predatory journals”

–No peer review
–No (or very little) indexing
–No editorial support
–High publishing fees

Business model: charge scientists to get published.
(And then publish whatever nonsense they want)

Jeffrey Beall’s list:
18 predatory publishers in 2011
923 in Dec. 2016 - and then disappeared under legal threats.

J. Beall



But even retracted papers continue to get cited as evidence!

e.g. Bar-Ilan, J., & Halevi, G. (2017). Post retraction citations in context: a case study. Scientometrics, 113(1), 547-565. doi:10.1007/s11192-017-2242-0

“Negative” citations, explicitly questioning other literature, are rare: <5%.

“Our study shows that contradicting citations are very uncommon and that retracted or corrected articles are not more contradicted in scholarly articles than those that are neither retracted nor corrected but they do generate more comments on Pubpeer, presumably because of the possibility for contributors to remain anonymous. Moreover, post-publication peer review platforms, although external to the scientific publication process contribute more to the correction of science than negative citations.”

Bordignon, F. (2020). Self-correction of science: a comparative study of negative citations and post-publication peer review. Scientometrics, 124(2), 1225-1239. doi:10.1007/s11192-020-03536-z

So does science correct itself?

Rarely, at least in the literature.

Attempts to correct are often faced with fierce resistance.

It appears that failing research is abandoned, rather than corrected.

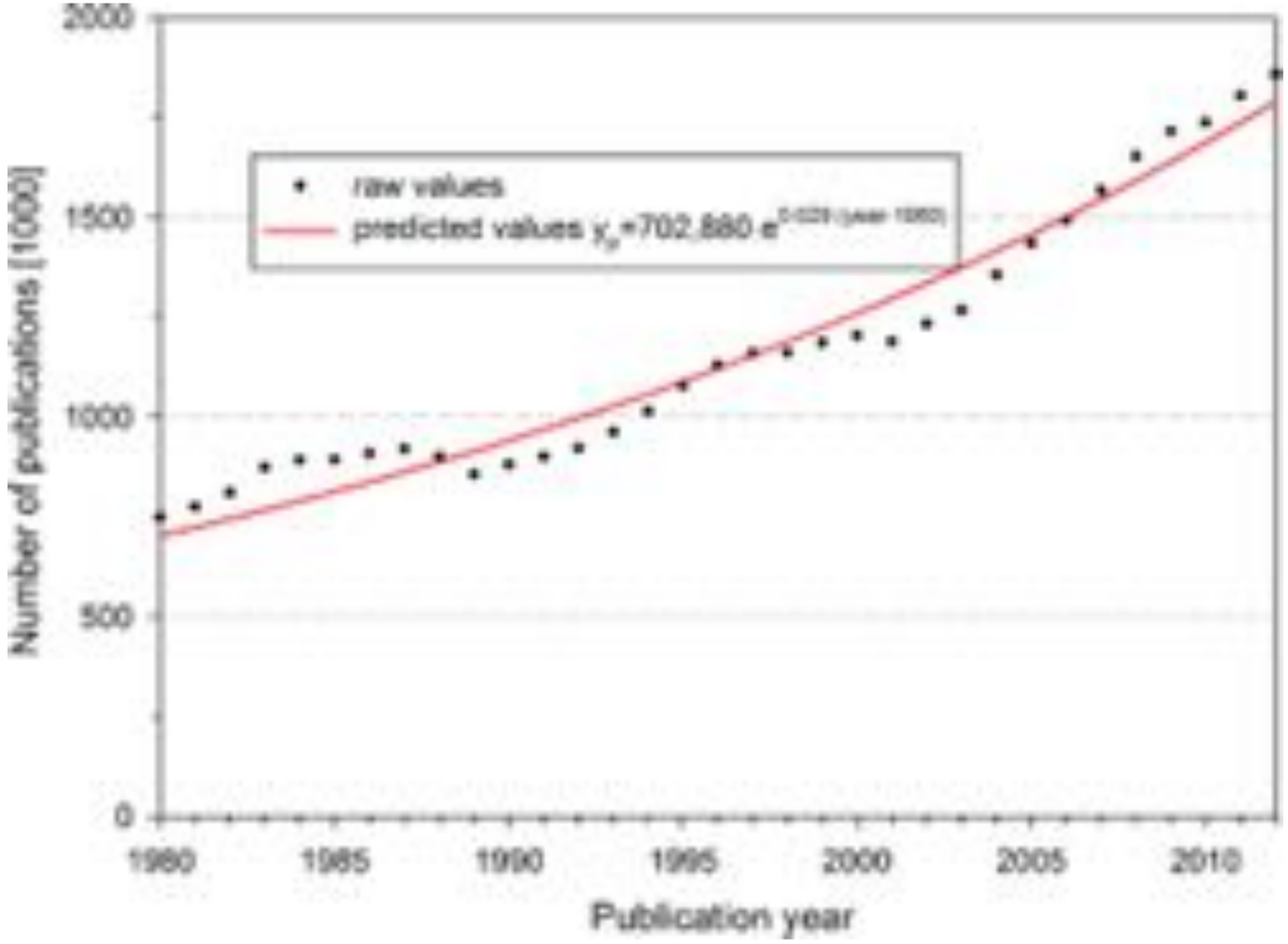
Simple reliance on the literature does not seem warranted.

3 What can we expect?

Meta-science movement: hold on to the old ideals

- stricter methods
- replication projects
- increases transparency and documentation

vs science studies: is this how science works/has worked/can work?



WoS 2020?

3,111,310 publications

Exponential growth of scientific output from 1980 to 2010.

Bornmann, L., & Mutz, R. (2015). Growth rates of modern science: A bibliometric analysis based on the number of publications and cited references. JASIST, 66(11), 2215-2222. doi:https://doi.org/10.1002/asi.23329

Competing expectations of ‘the literature’.

Library or database?

Archive of research accounts
Access: catalogue
Retrieve: text
Error resolution: commentary
The reader integrates knowledge: reference literature and comment
knowledge: accumulation of insights

Archive of data (results)
Cross-referenced database, factcheck
Retrieve: data, protocol
Error resolution: correction (removal)
Algorithmic knowledge integration: use as information, re-calculate
knowledge: accumulation of facts

Turning a library into a database?

The world of research is diverse: diverse epistemic styles and standards.

Some fields rely more on insight that on fact accumulation.

Some may need a library more than a database.

Shifting to a database may destroy library qualities - a dystopian project?

But is science equal to what is in the literature?

(Freek Oude Maatman)

What if the literature is a resource, rather than the outcome of knowledge?

What if scientific knowledge is primarily located in labs, universities, people?

What about codification: what ends up in handbooks, courses?

What about databases proper: accumulated factual knowledge (eg proteins)?

How do scientists use the literature?

Blindly? Not generally.

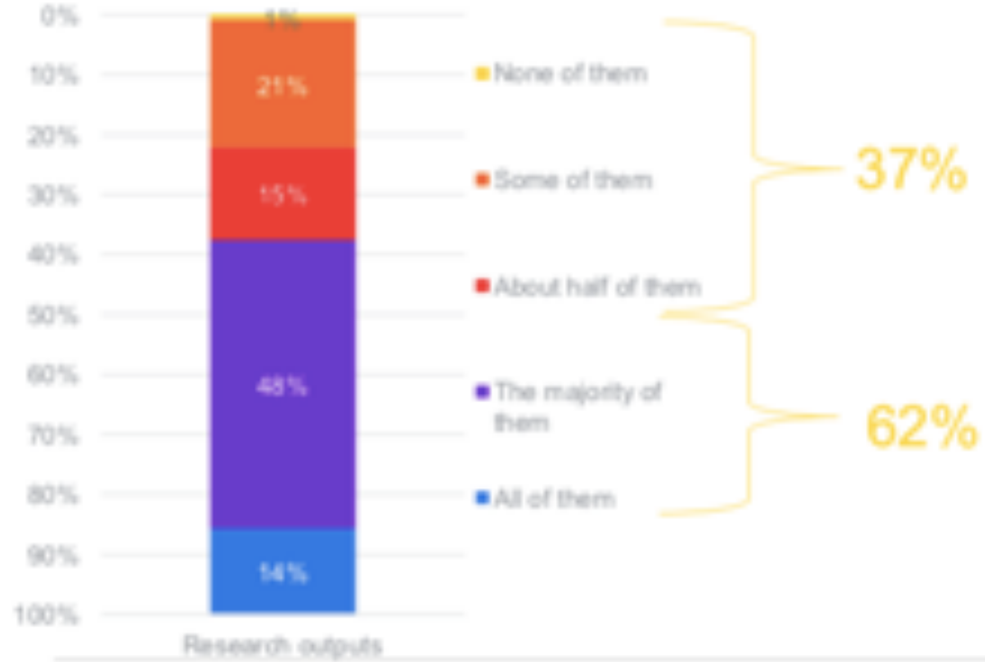
Check the technical details - if there is time, if it is important.

Most go for social cues: reputations of authors, labs, journals

Collins, H. M. (2014). Rejecting knowledge claims inside and outside science. Social Studies of Science, 44(5), 722-735.

TRUSTWORTHINESS OF RESEARCH OUTPUTS: Although 62% of researchers trust the majority of research outputs, a proportion doubt the quality of some of the research outputs they encounter. To compensate they check supplementary material/data carefully, read only information associated with peer reviewed journals or seek corroboration from other trusted sources.

Thinking about the various research outputs that you interacted with (or encountered) last week what proportion of the outputs would you consider trustworthy?



Base: All respondents (n=3133)

Which of the following mechanisms do you employ to compensate for any lack of confidence you have in the content you are considering reading/accessing?

Base: All respondents that do not think all research outputs are trustworthy (n=2715)

CustomerInsights

Elsevier, & Sense About Science. (2019). Trust in Research: Researcher survey results. https://www.elsevier.com/__data/assets/pdf_file/0011/908435/Trust_evidence_report_summary_Final.pdf

Do we replicate?

Dominant story in science: replications are rare.

However, informal replication attempts are much more common.

- Can we use this technique too?
- We tried it, but it did not work for us. We took a different route.
- I tried it, but my equipment may not be as good.
- It’s probably me: I’m doing something wrong.

Currently, the main way to learn about such attempts is informal communication.

Peterson, D., & Panofsky, A. (2021). Self-correction in science: The diagnostic and integrative motives for replication. *Social Studies of Science*, 03063127211005551. doi:10.1177/03063127211005551

4 Consequences?

Dark

Are literature retractions futile?

Is meta-analysis at all possible?

If the literature requires expert judgement,
should everybody have access?

Does this mean mainly big publishers
can provide adequate quality controls?

Is the literature fatally broken?

Bright

Can we build extra quality checks
in/on top of the literature?

Is post-publication peer review
the way forward?

Can we create ways to raise concerns
without being perceived as threat?

Can we organise correction elsewhere,
if correction of the current literature is so hard?

How can we ‘slow down’ research?

Thank you