When do open science practices lead to higher quality data?

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What should science be?

- Ideal-case scenario:
  - Researchers formulate a question (based on previous literature)
  - They design a study that can answer the posed question
  - Collect data on a sample of adequate size (adequately powered)
  - Publish their findings, regardless of whether they are “positive” or “negative”
  - Future research builds upon these findings (cumulative nature of science)
  - In time, we have a good idea of which findings are “solid” (replicated) and which are not (self-corrective nature of science)
  - We can make informed decisions, not just in the academic domain
- Is this how it really works?

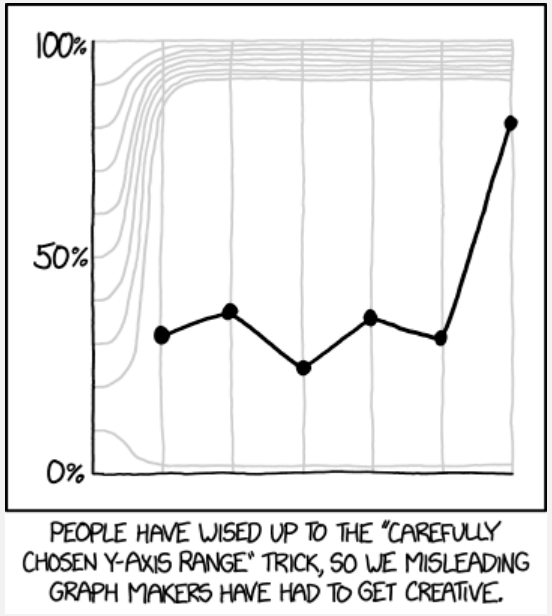
Problems with science

- "In 2011, German researchers in the drug company Bayer found in an extensive survey that more than 75% of the published findings could not be validated."

- "In 2012, scientists at the American drug company Amgen published the results of a study in which they selected 53 key papers deemed to be "landmark" studies and tried to reproduce them. Only 6 (11%) could be confirmed."

Why is this so?

- The interests of science and scientists are not always the same
- The scientific process is “hidden” from the public for the most part
- This leaves room for different questionable research practices (QRPs)
- What information do we actually have on the quality of data that we work with?



Open science practices

- A surge of initiatives supporting open science
- Almost undisputed acceptance
- The idea that open science can help prevent questionable research practices (QRPs)
- We will go through several mechanism by which open science practices could lead to better quality data
- And will also look into some (yet) unresolved issues

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Study design	Paper rejection based on „unfavorable“ results

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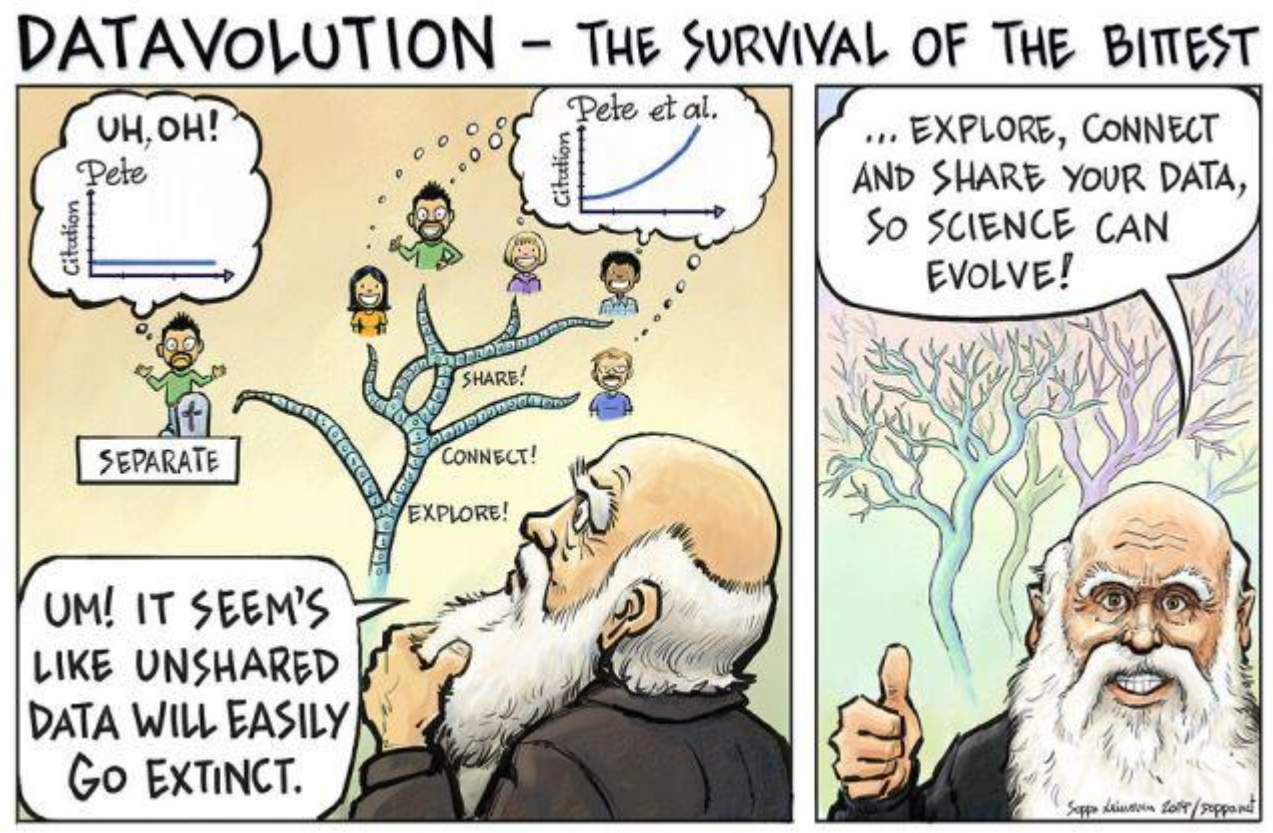

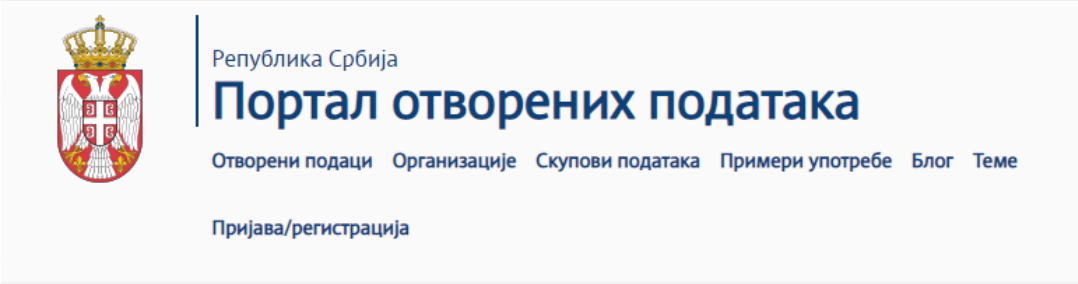

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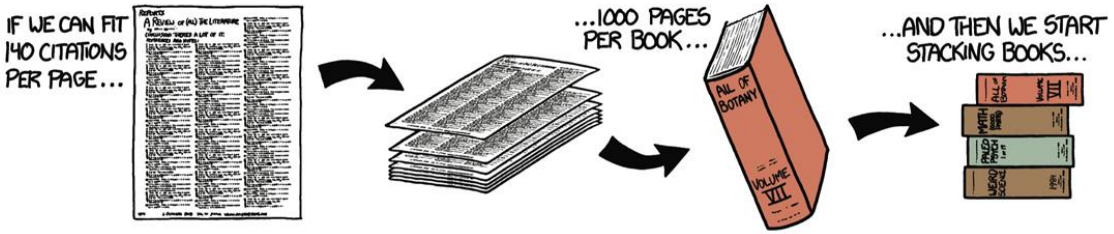
Materials	Better understanding of the scope and generalizbility of findings; prerequisite for replications

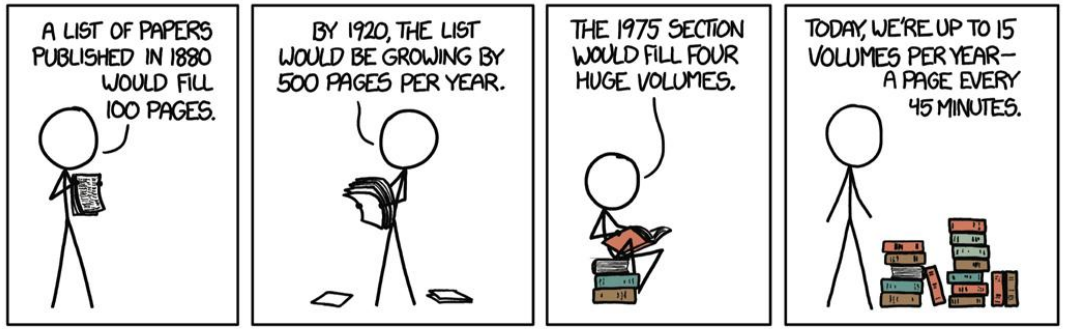
Opening access to published manuscripts

- Making manuscripts available to all – no paywall
- Reduces inequalities between researchers coming from different countries / institutions
- When everyone is up to date, global resources are put to better use
- New options for sharing pre-print versions of manuscripts (e.g., ArXiv, OSF, bioRxiv, PrePubMed) and receiving feedback from the scientific community

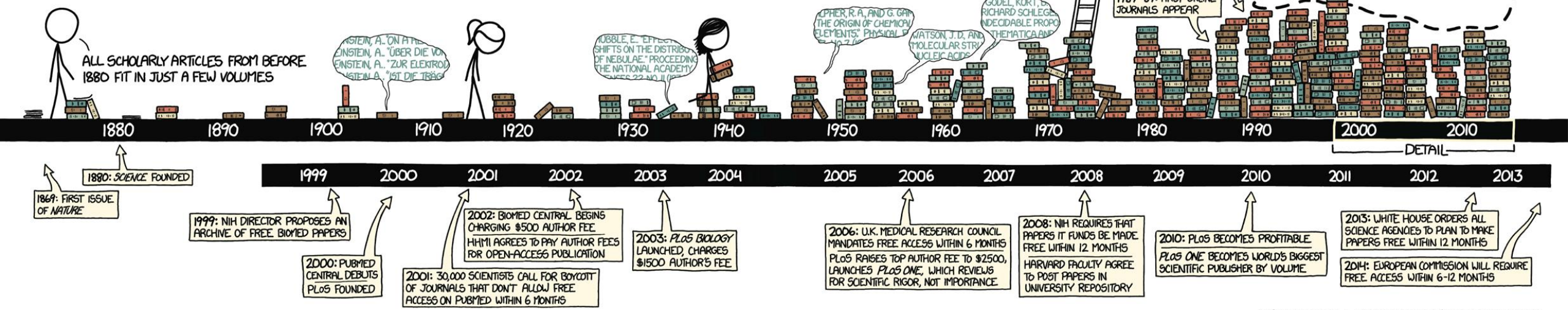
HOW MUCH SCIENCE IS THERE?

SCIENTIFIC PUBLISHING HAS BEEN ACCELERATING—A NEW PAPER IS NOW PUBLISHED ROUGHLY EVERY 20 SECONDS. LET'S IMAGINE A BIBLIOGRAPHY LISTING *EVERY* SCHOLARLY PAPER EVER WRITTEN. HOW LONG WOULD IT BE?



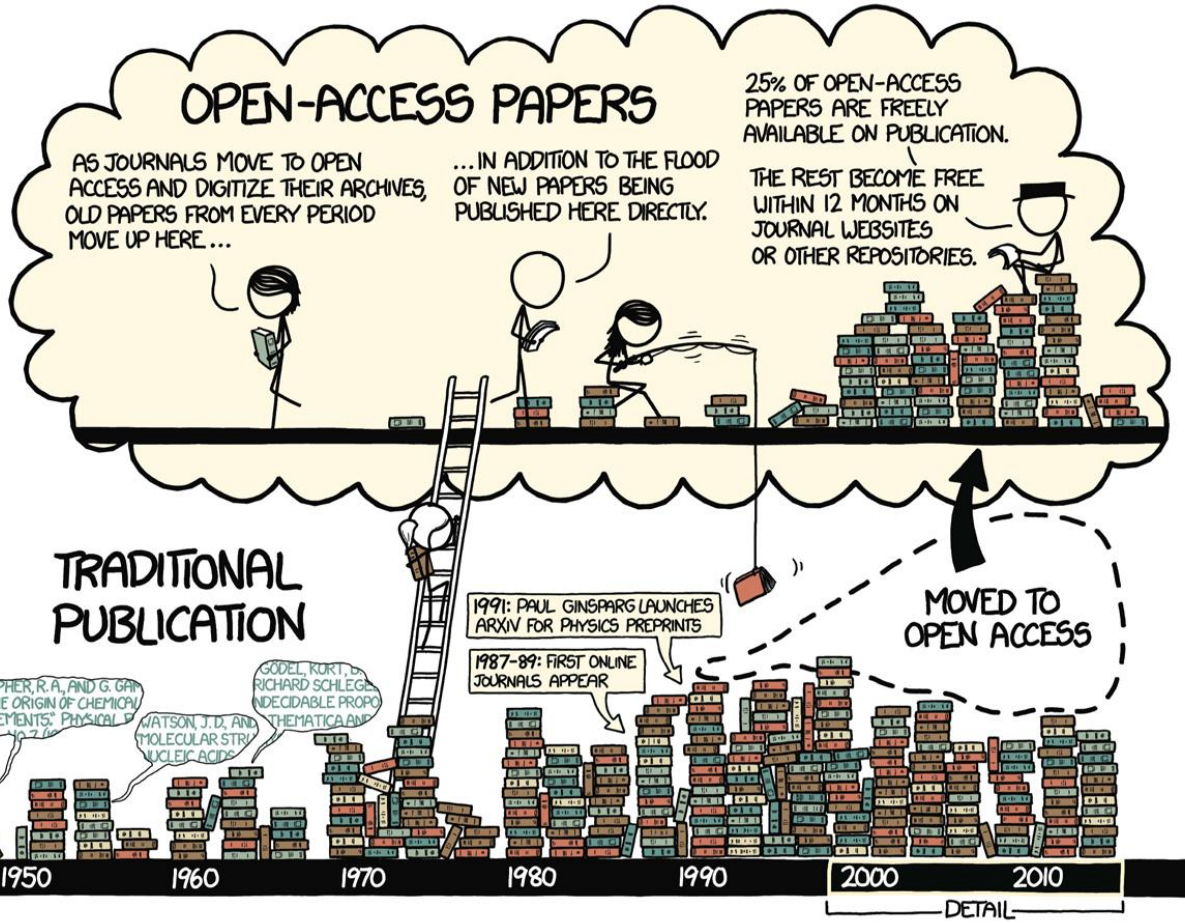


...THIS IS WHAT THE FULL LIST WOULD LOOK LIKE:



HOW OPEN IS IT?

SINCE THE ADVENT OF THE WEB, MUCH OF SCIENTIFIC PUBLISHING HAS BEEN MOVING TO *OPEN ACCESS*. ACCORDING TO SCIENCE-METRIX, OPEN ACCESS REACHED A "TIPPING POINT" AROUND 2011: MORE THAN 50% OF NEW RESEARCH IS NOW MADE AVAILABLE FREE ONLINE.



BY RANDALL MUNROE • REPORTING BY JOCELYN KAISER AND DAVID MALAKOFF

Scientific collaborations

- Increase the sheer quantity of data
- But also its quality:
  - Usually stringent in terms of study design and methodology
  - High power to detect effects of interest
  - Diverse (sub)samples
  - Higher academic impact
  - Reducing inequalities and strengthening all partners for future data collection

Open questions on open science practices

- Open science practices are relatively new, so a number of issues have yet to be resolved
  - Overuse of shared materials – lack of diversity in the data
  - Focusing only on replicated findings – we still need to do exploratory analyses
  - Anonymizing open data
  - Making sure non-experts do not make the wrong conclusions based on open data
  - Ownership of open data
  - Bureaucratic load on researchers practicing open science
  - …
- The most important thing is to be transparent about the desicions we make and aware of the limitations of our practices

Thank you for your attention!

Questions?

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