Open Science, Reproducible Research, and R

An Overview

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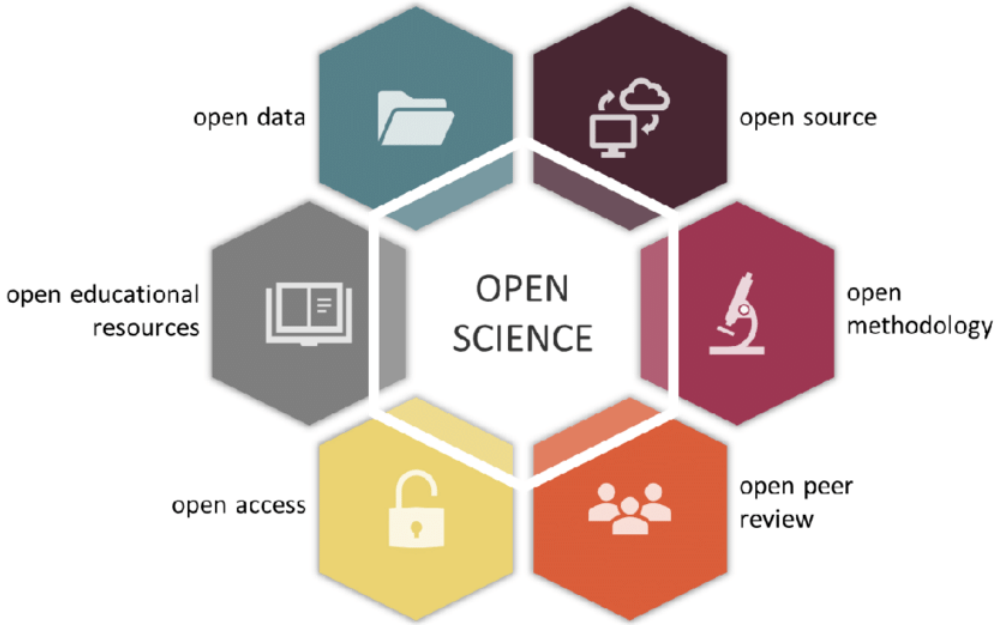
Outline

1. What is Open Science?
2. What is Reproducible Research?
3. Why Reproducible Research?
4. How to do Reproducible Research?

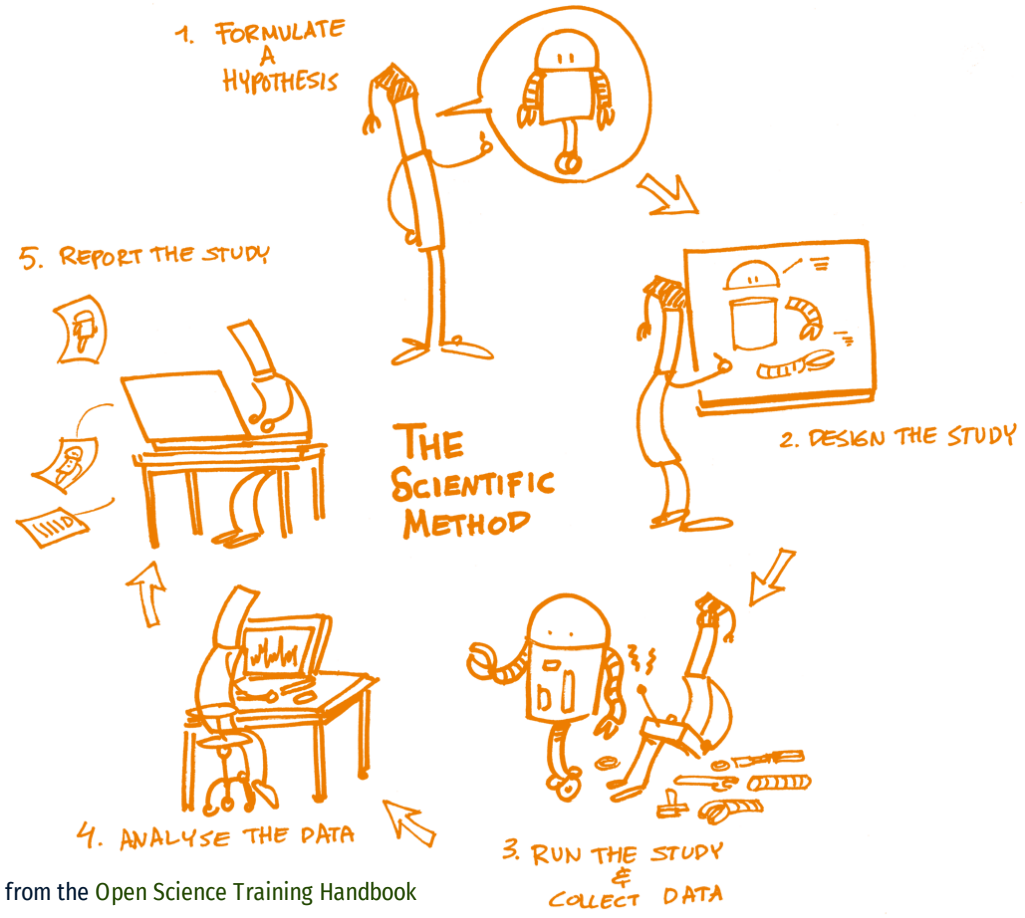
What is Open Science?



- movement to make scientific research and dissemination accessible to anyone
- aims for greater transparency in research and remove barriers for sharing outputs, resources, methods or tools at any stage of the research process

based on UNESCO concept 2021

What is Reproducible Research?

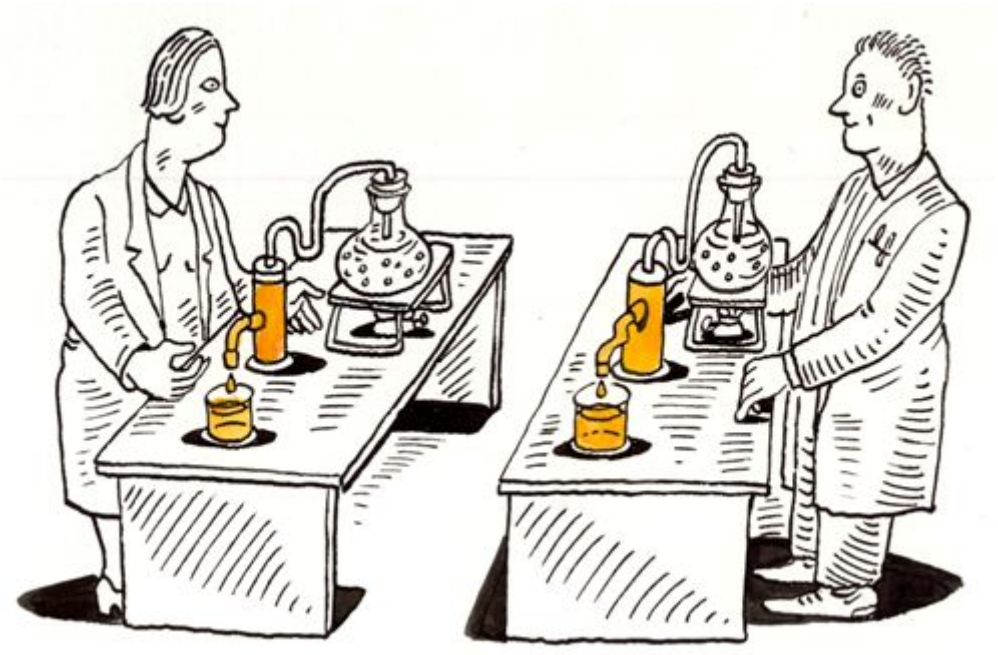


from the Open Science Training Handbook

- The concept of reproducibility is directly linked to the scientific method
    1. Formulating a hypothesis
    2. Designing the study
    3. Running the study and collecting the data
    4. Analyzing the data
    5. Reporting the study
- Each of these steps should be clearly reported by providing clear and open documentation, and thus making the study transparent and reproducible.

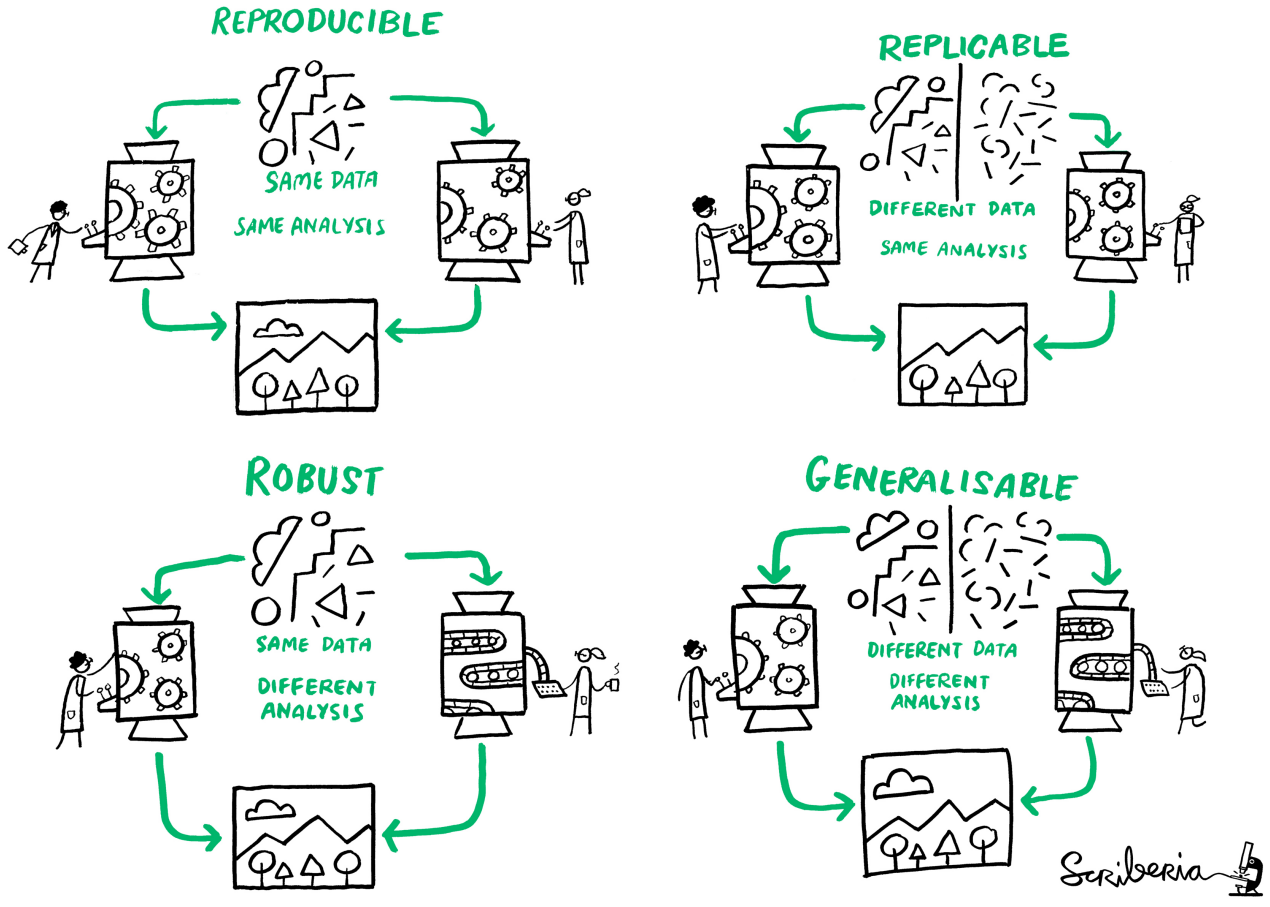
What is Reproducible Research?

- Research papers with accompanying software tools that allow the reader to directly reproduce the results and employ the methods that are presented in the research paper (Gentleman and Lang, 2004)
- Research data and code are made available so that others are able to reach the same results as are claimed in scientific outputs (Open Science Training Handbook)
- The standard of reproducibility calls for the data and the computer code used to analyze the data be made available to others (Peng, 2012)

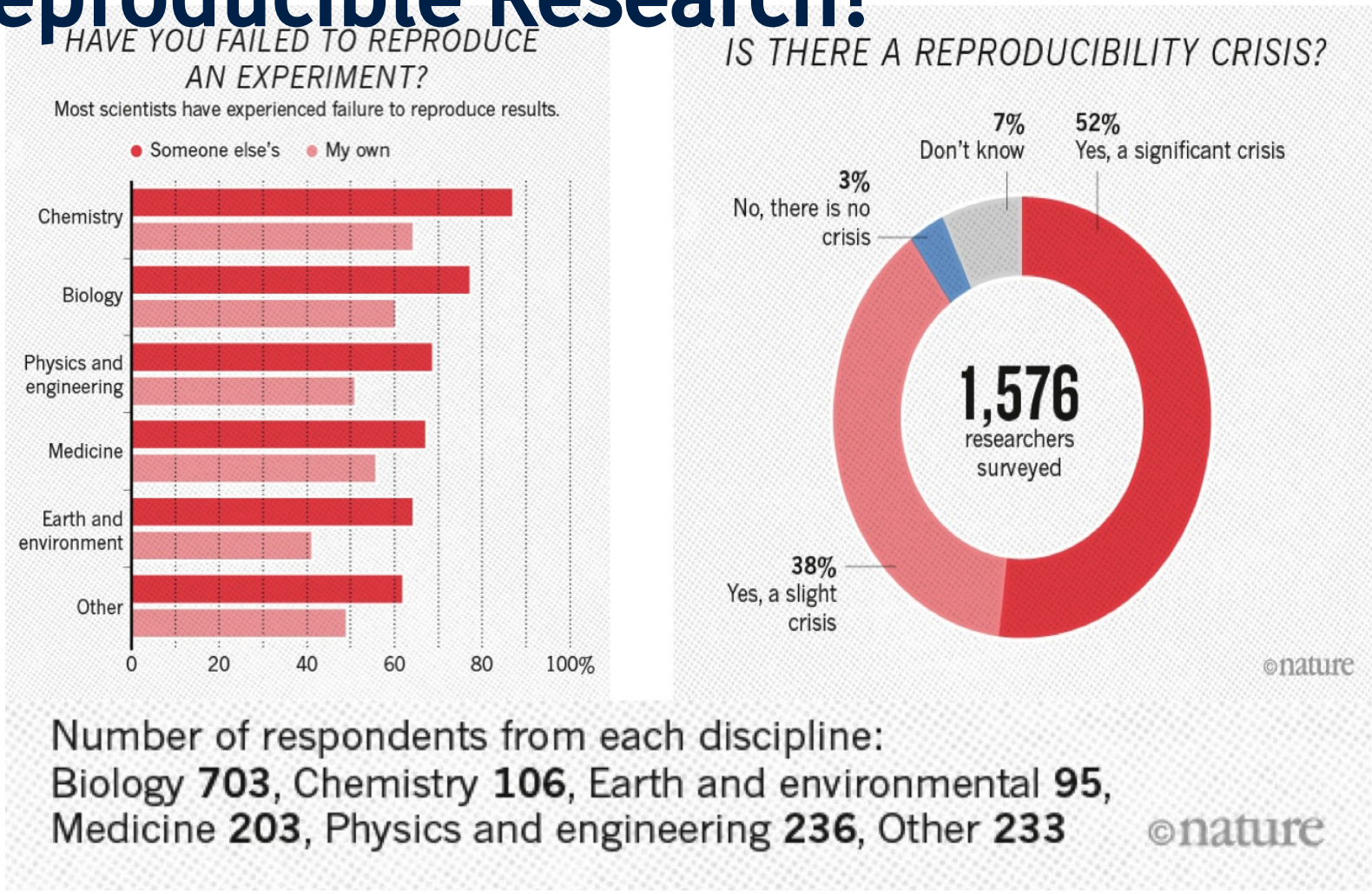


from https://www.displayr.com/what-is-reproducible-research

Differentiating Reproducible Research

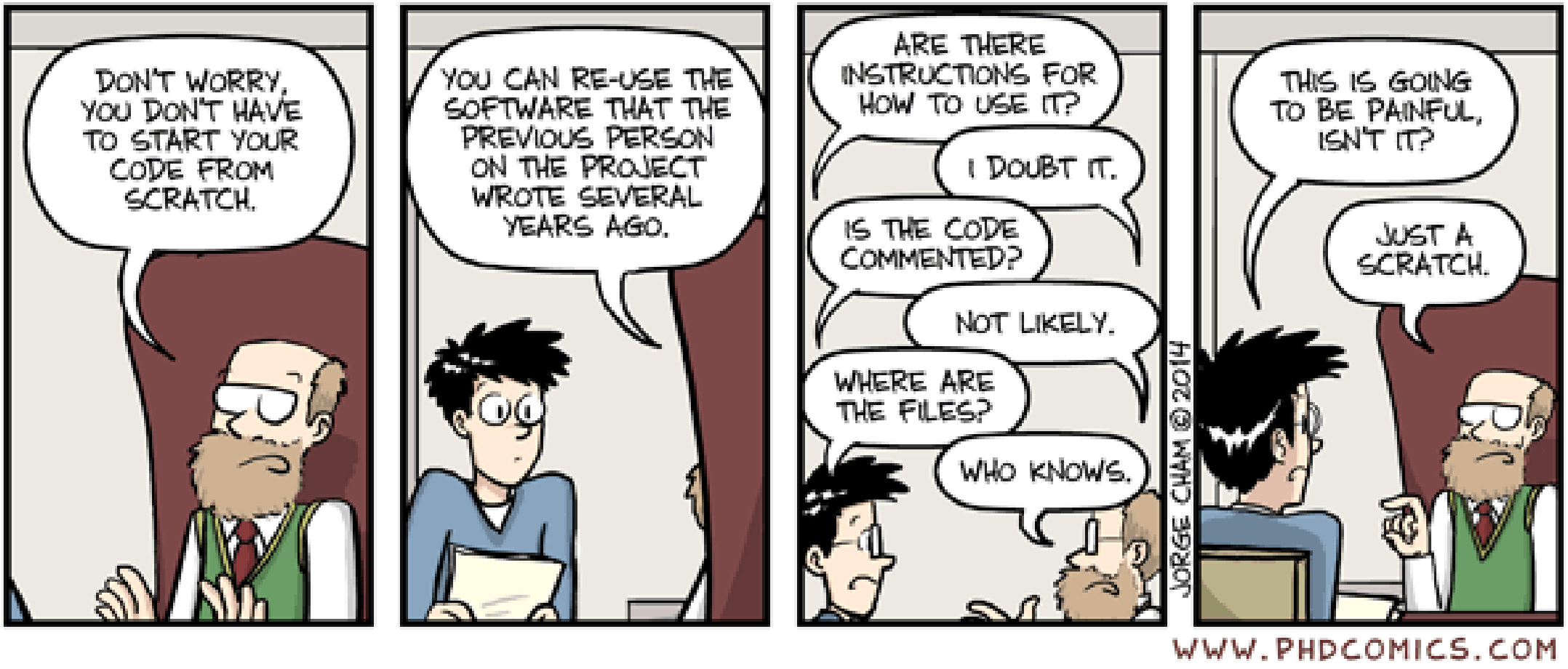


Why Reproducible Research?



Baker, M. 1,500 scientists lift the lid on reproducibility. Nature 533, 452–454 (2016). https://doi.org/10.1038/533452a

Factors in irreproducible research

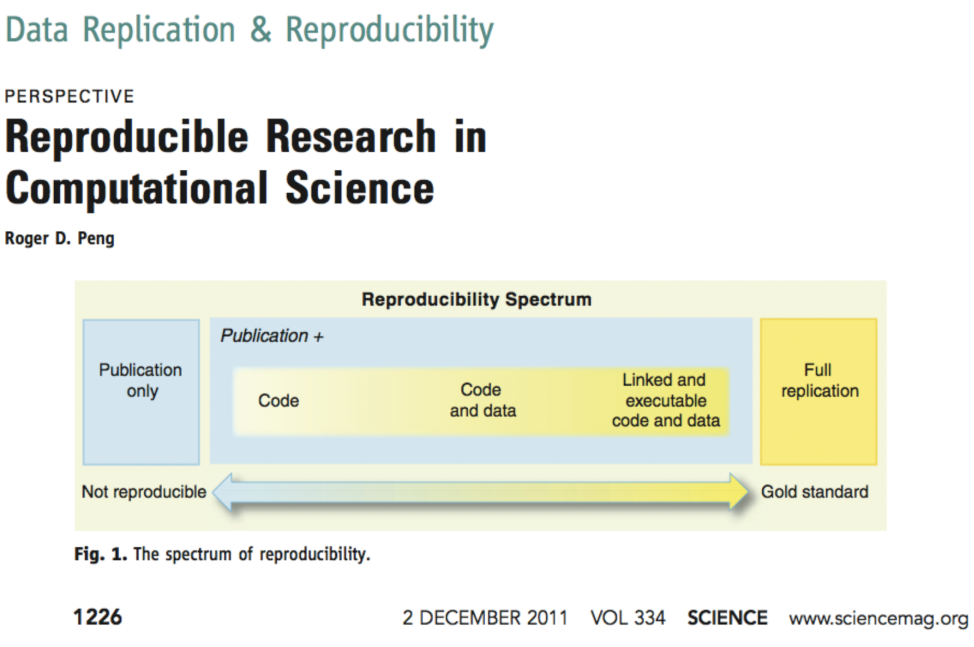


Factors in irreproducible research

- Not enough documentation on how experiment is conducted and data is generated
- Data used to generate original results unavailable
- Software used to generate original results unavailable
- Difficult to recreate software environment (libraries, versions) used to generate original results
- Difficult to rerun the computational steps

How to do Reproducible Research?

The reproducibility spectrum



Data Replication & Reproducibility

PERSPECTIVE

Reproducible Research in Computational Science

Roger D. Peng

Fig. 1. The spectrum of reproducibility.

Steps in reproducible research

- Record the project's provenance
- Data and metadata curation
- Establish a testing/analysis workflow
- Test, document, and publish your code
- Share

Why R for Reproducible Research?

- freely available
- huge user and developer community
- has a robust set of user- and community-developed packages that support reproducible research

Questions?

Thank you!

Slides can be viewed at https://OxfordIHTM.github.io/open-reproducible-science/session1.html

PDF version of slides can be downloaded at https://OxfordIHTM.github.io/open-reproducible-science/pdf/session1-open-reproducibile-science.pdf

R scripts for slides available at https://github.com/OxfordIHTM/open-reproducible-science