



UNIVERSITY OF
BIRMINGHAM

Reproducible Research

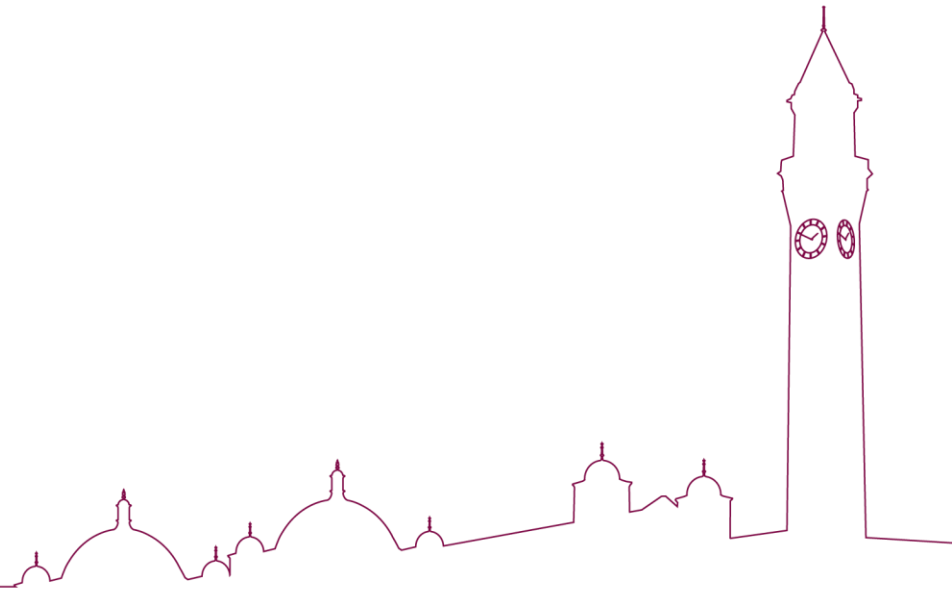
The Hacker Within – Monday 15th October 2018

Simon Branford

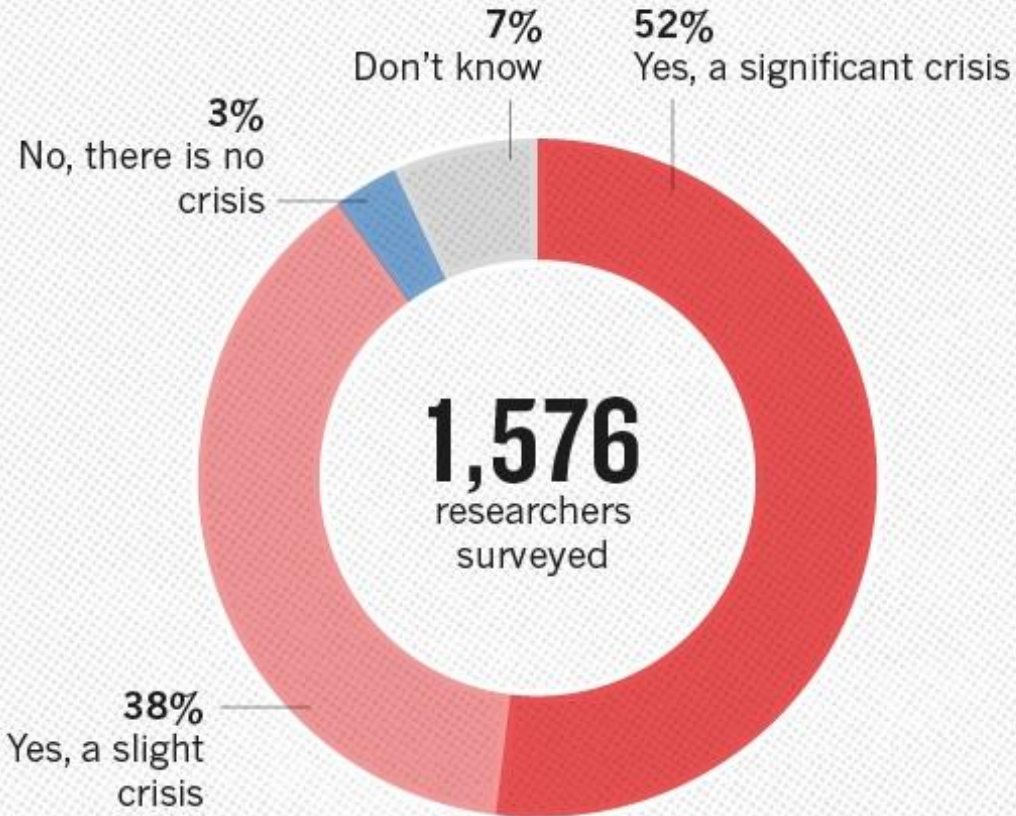


Advertising vs. Scholarship

- Jon Claerbout: “An article about computational results is advertising, not scholarship. The actual scholarship is the full software environment, code and data, that produced the result.”

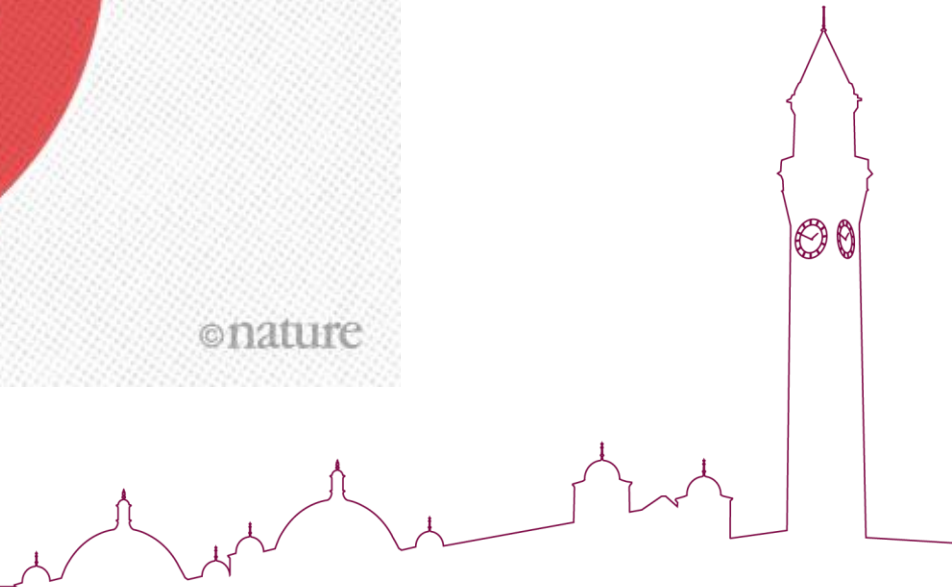


IS THERE A REPRODUCIBILITY CRISIS?



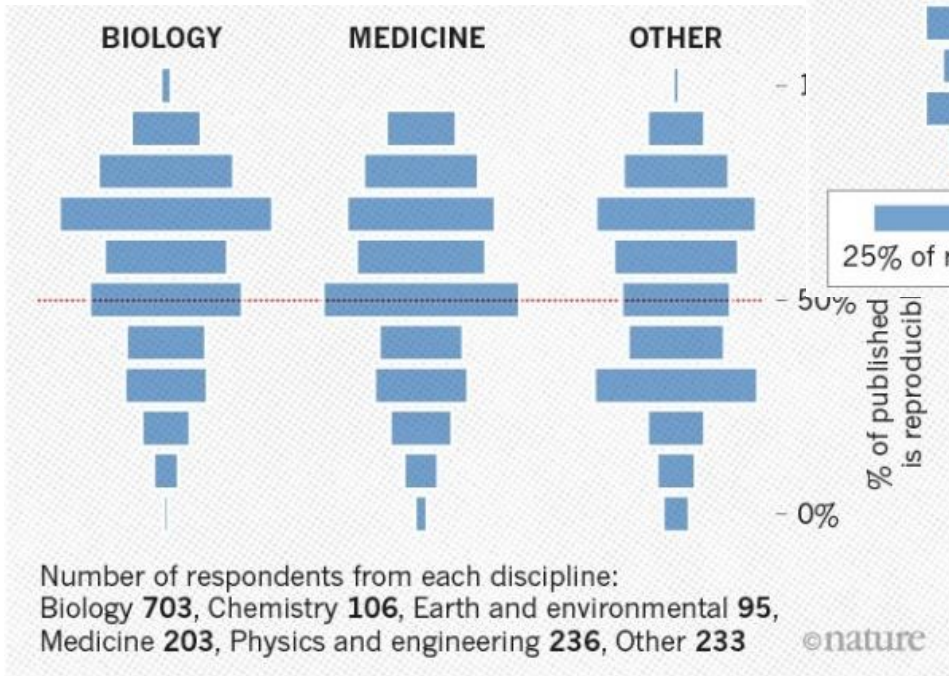
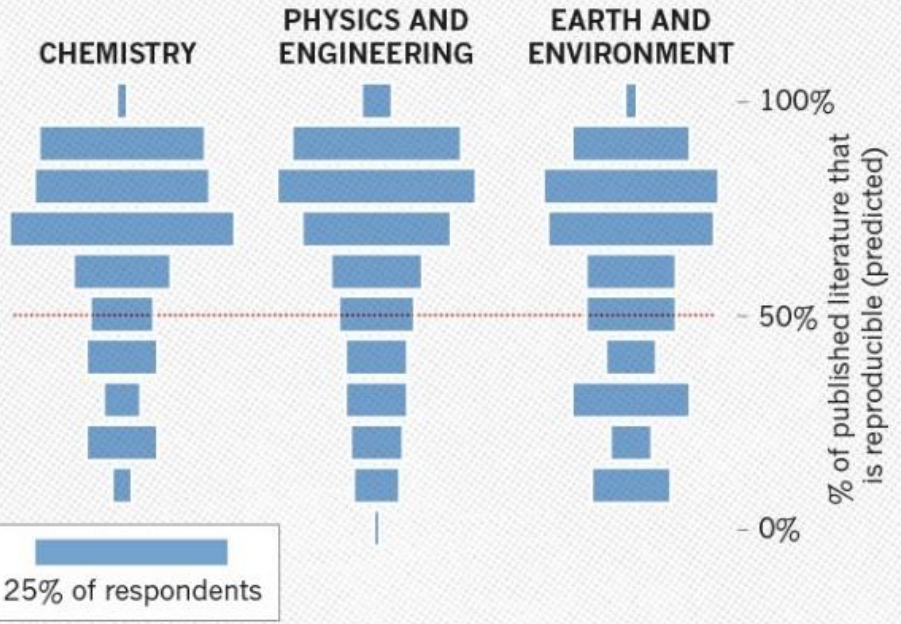
©nature

Nature 533
452–454
26 May 2016
10.1038/533452a

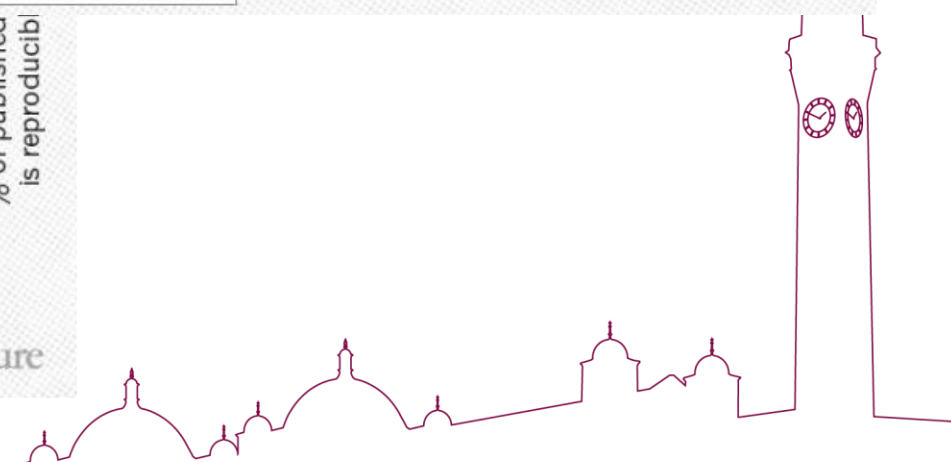


HOW MUCH PUBLISHED WORK IN YOUR FIELD IS REPRODUCIBLE?

Physicists and chemists were most confident in the literature.

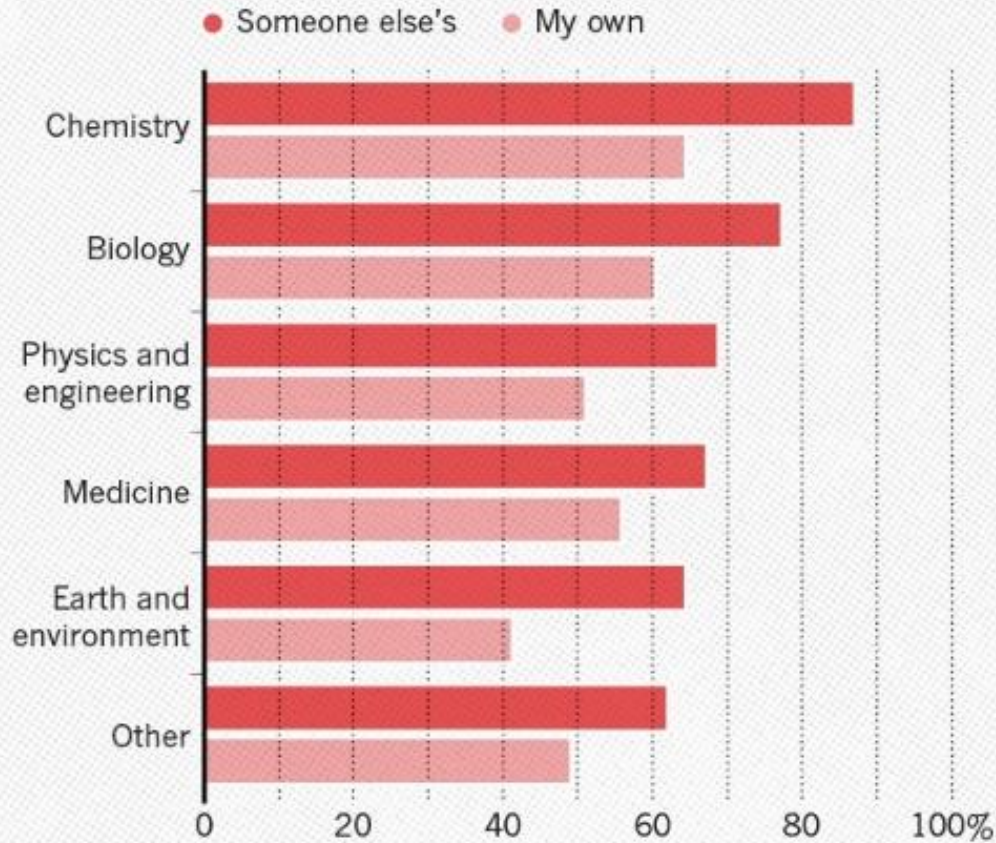


Number of respondents from each discipline:
 Biology 703, Chemistry 106, Earth and environmental 95,
 Medicine 203, Physics and engineering 236, Other 233



HAVE YOU FAILED TO REPRODUCE AN EXPERIMENT?

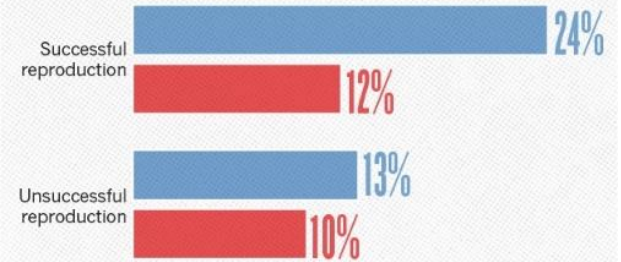
Most scientists have experienced failure to reproduce results.



HAVE YOU EVER TRIED TO PUBLISH A REPRODUCTION ATTEMPT?

Although only a small proportion of respondents tried to publish replication attempts, many had their papers accepted.

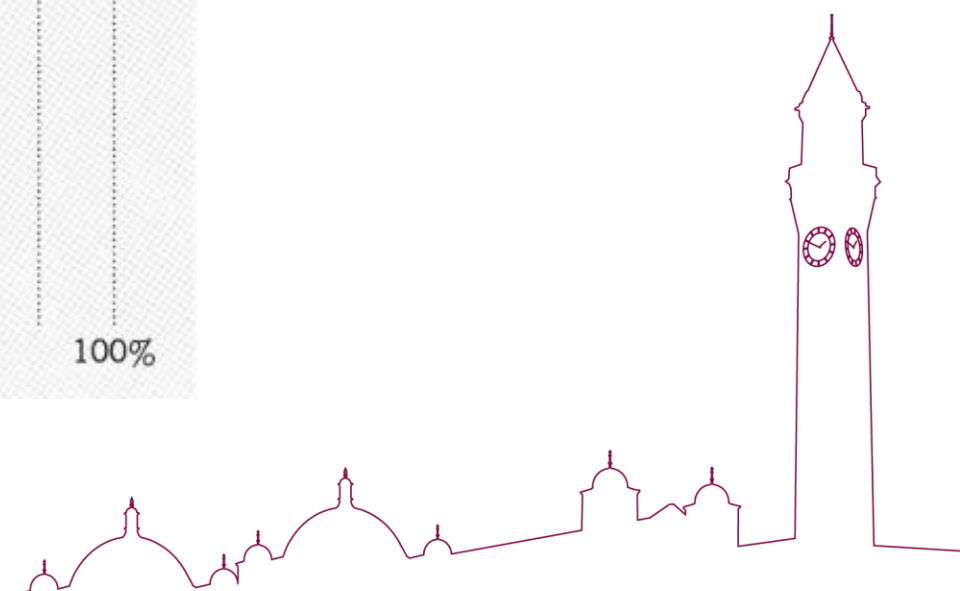
● Published ● Failed to publish



Number of respondents from each discipline:

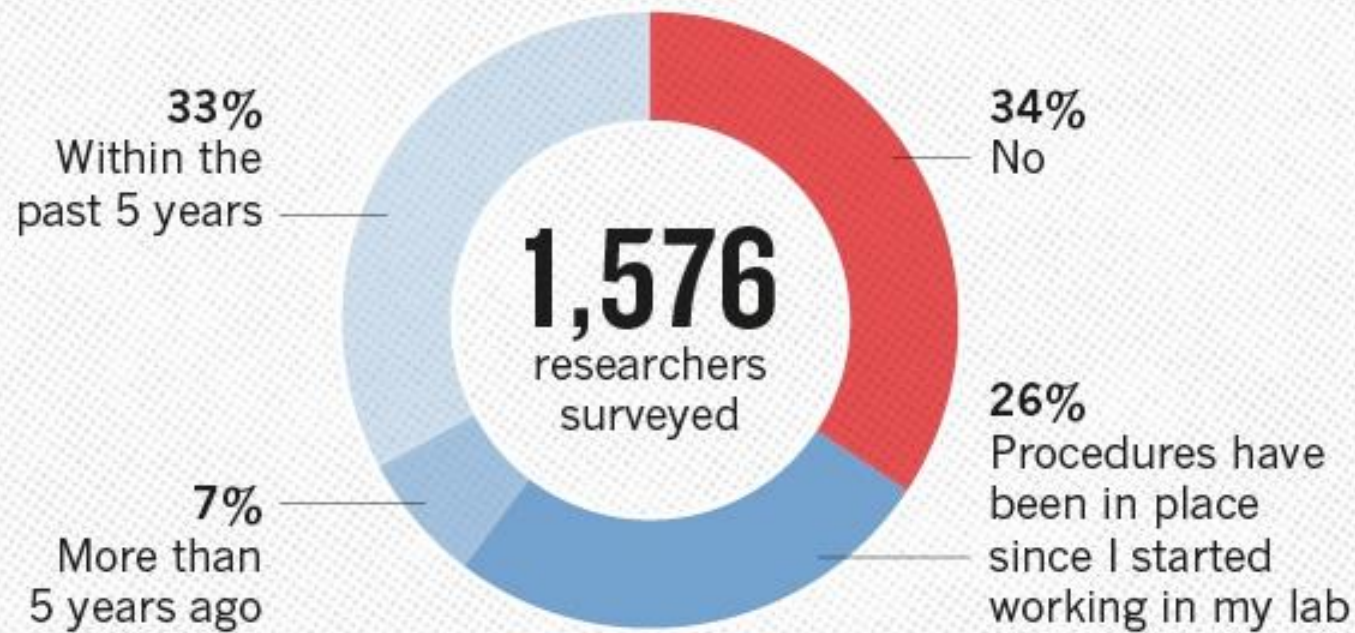
Biology 703, Chemistry 106, Earth and environmental 95, Medicine 203, Physics and engineering 236, Other 233

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HAVE YOU ESTABLISHED PROCEDURES FOR REPRODUCIBILITY?

Among the most popular strategies was having different lab members redo experiments.



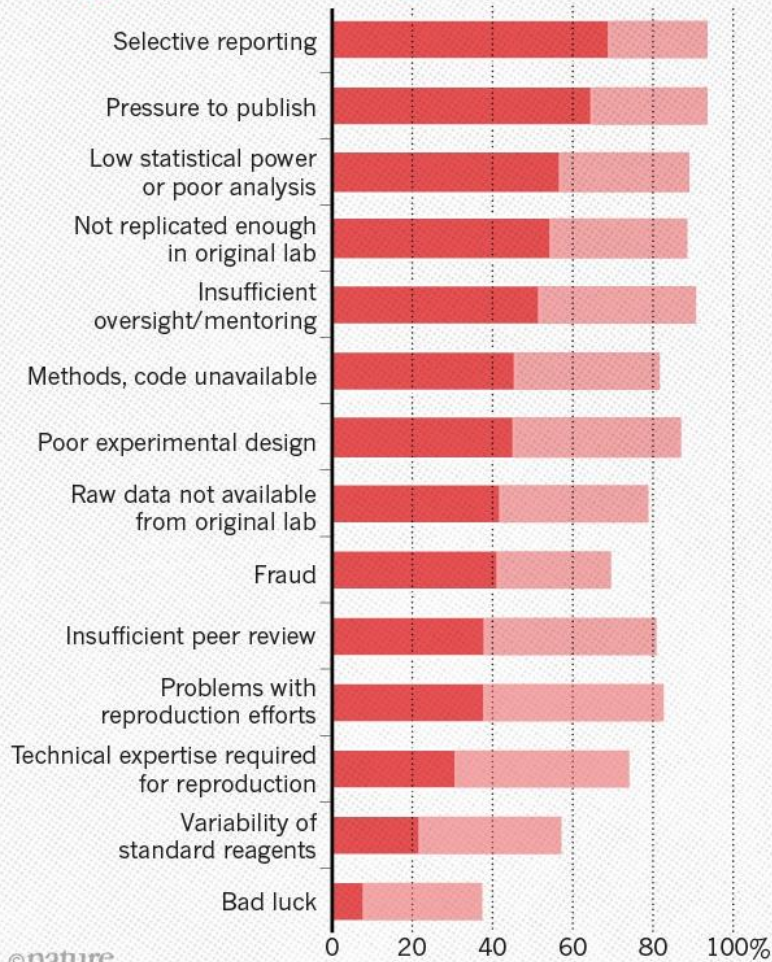
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WHAT FACTORS CONTRIBUTE TO IRREPRODUCIBLE RESEARCH?

Many top-rated factors relate to intense competition and time pressure.

● Always/often contribute ● Sometimes contribute

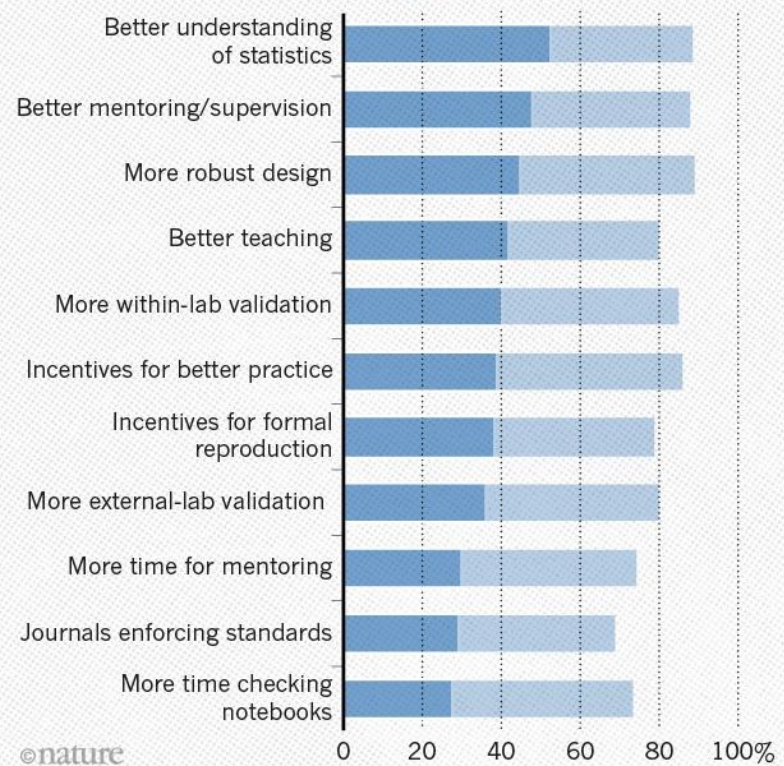


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WHAT FACTORS COULD BOOST REPRODUCIBILITY?

Respondents were positive about most proposed improvements but emphasized training in particular.

● Very likely ● Likely

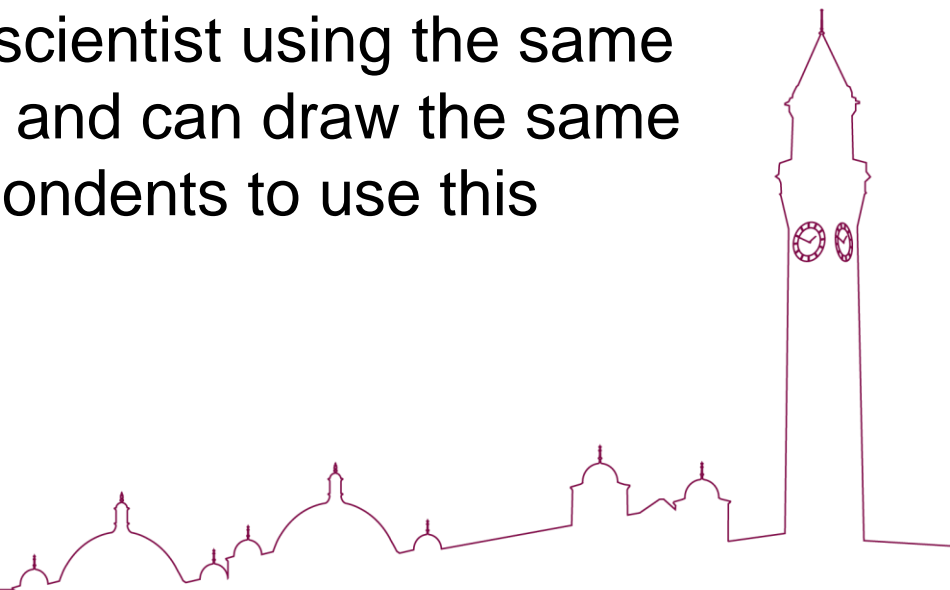


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What is Reproducibility?

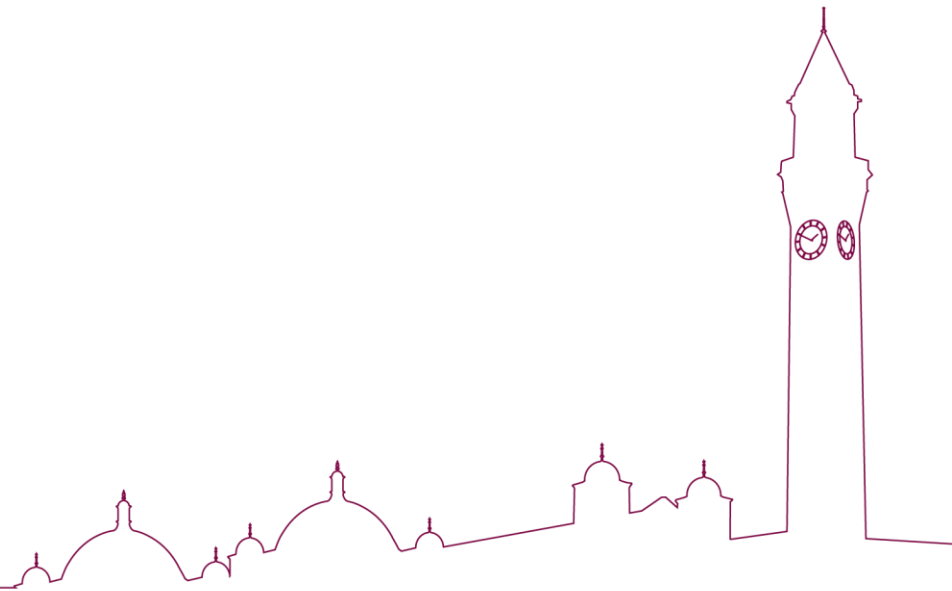
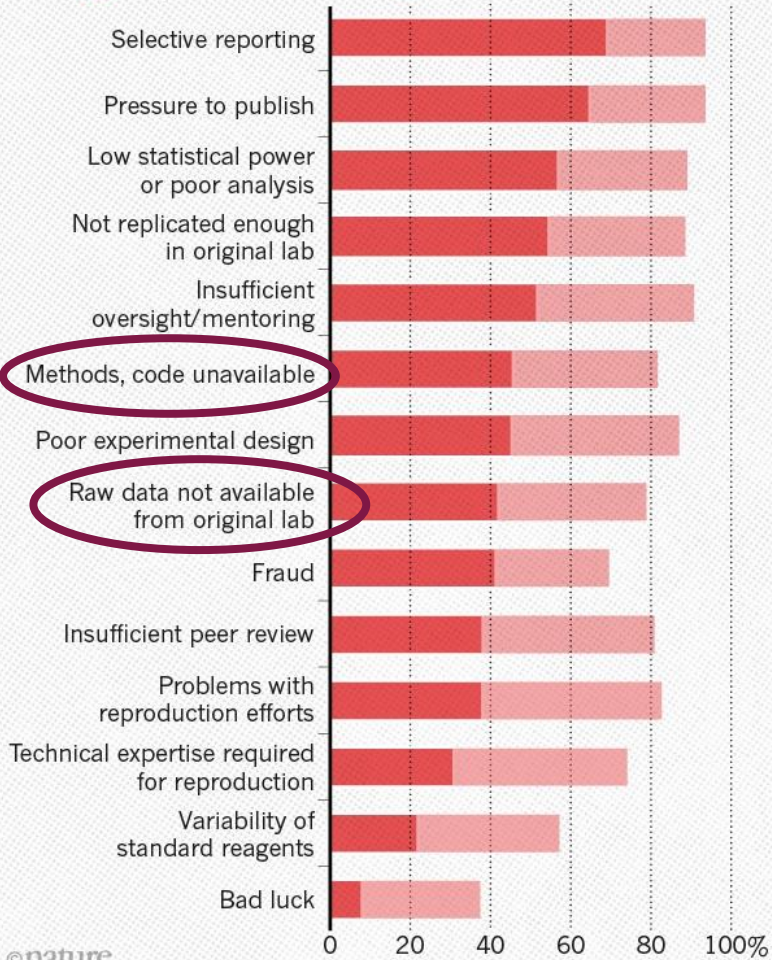
- “Economists and social scientists often use the term to mean that computer code and data are available so that someone would be able, if so inclined, to redo the same analysis using the same data. For bench scientists, who made up most of our respondents, it usually means that another scientist using the same methods gets similar results and can draw the same conclusions. We asked respondents to use this definition.”



WHAT FACTORS CONTRIBUTE TO IRREPRODUCIBLE RESEARCH?

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● Always/often contribute ● Sometimes contribute



Version Control



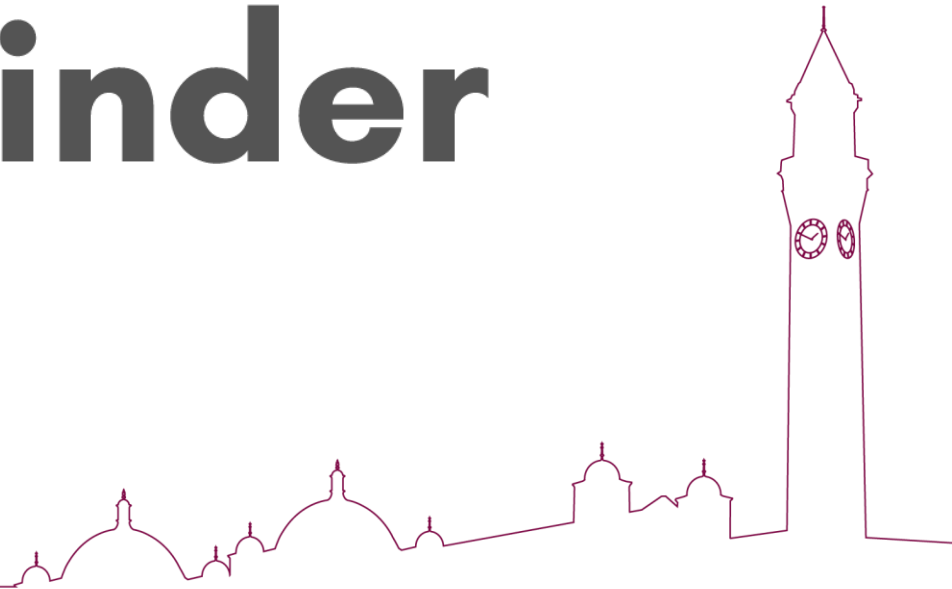
GitHub



GitLab



Code Notebooks



Data

- May not want the data in VCS
 - Binary file formats not great in VCS
- Systems where metadata is in a repository or database
 - Files in a file store
 - Quickly and easily get back and forth from file to metadata



Electronic Laboratory Notebook

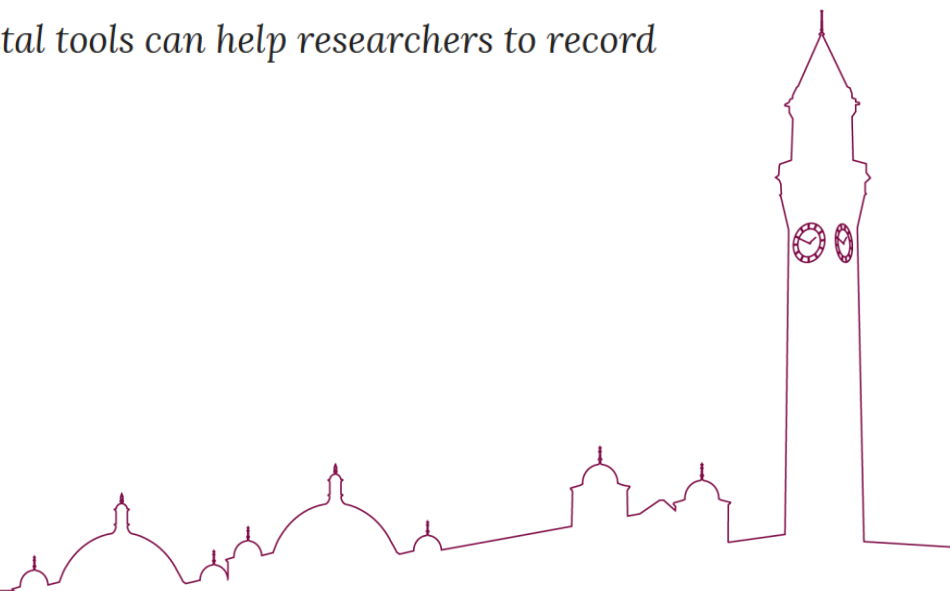
□ There are a plethora to choose from!

– <https://www.nature.com/articles/d41586-018-05895-3>

TOOLBOX • 06 AUGUST 2018

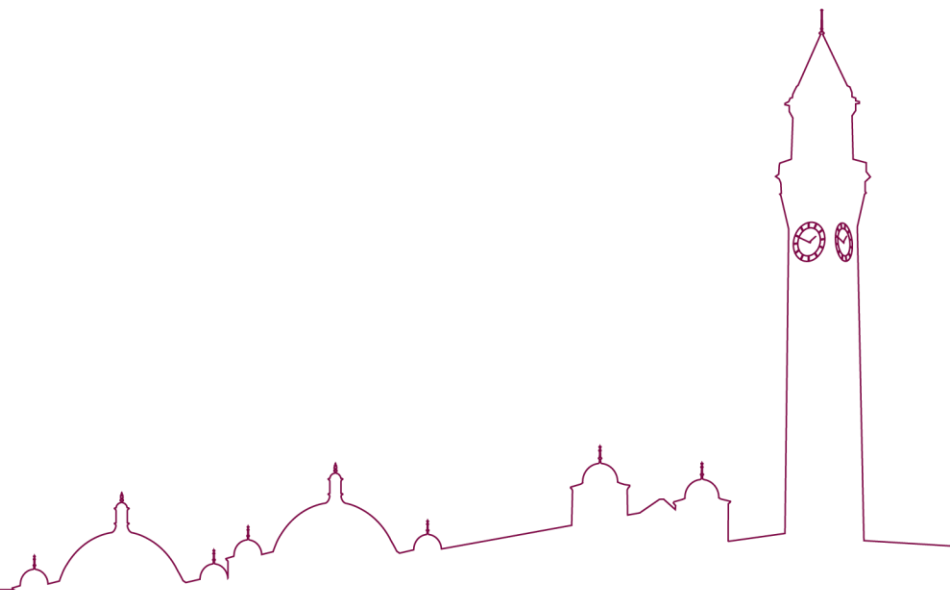
How to pick an electronic laboratory notebook

Choosing wisely from a burgeoning array of digital tools can help researchers to record experiments with ease.



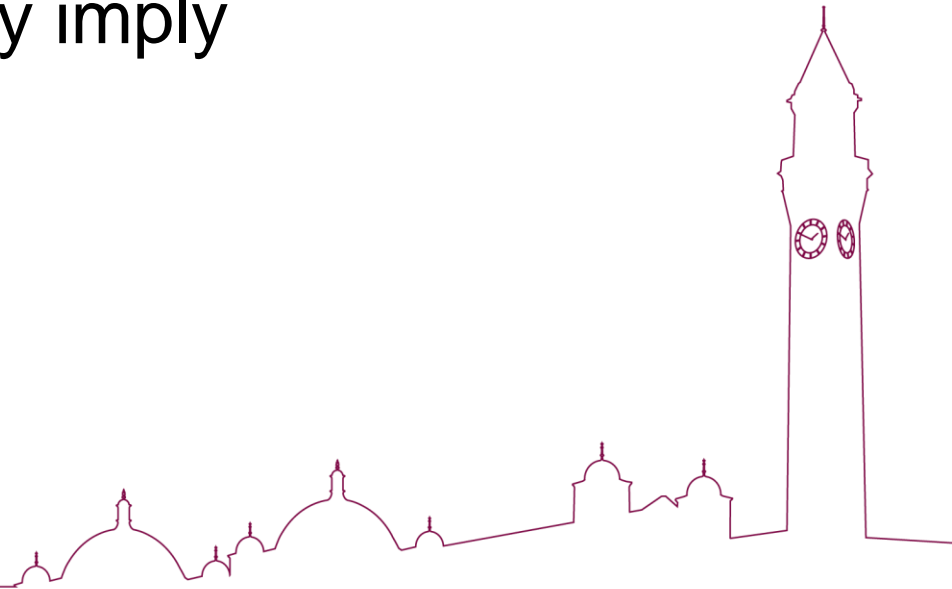
Computational Reproducibility

- Setting the Default to Reproducible -
Reproducibility in Computational and
Experimental Mathematics, Stodden et al. –
2013
 - Five sections



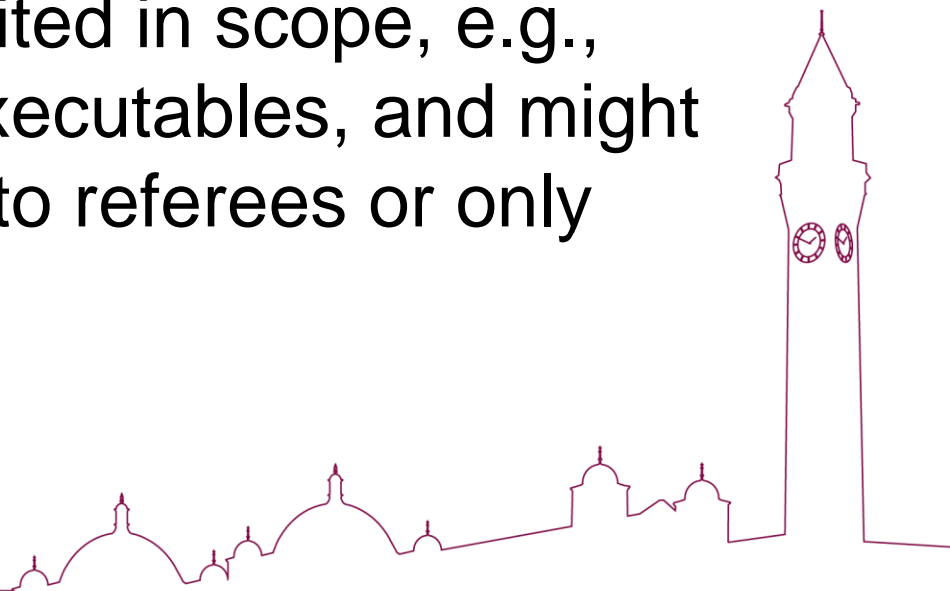
Reviewable Research

- The descriptions of the research methods can be independently assessed and the results judged credible. (This includes both traditional peer review and community review, and does not necessarily imply reproducibility.)



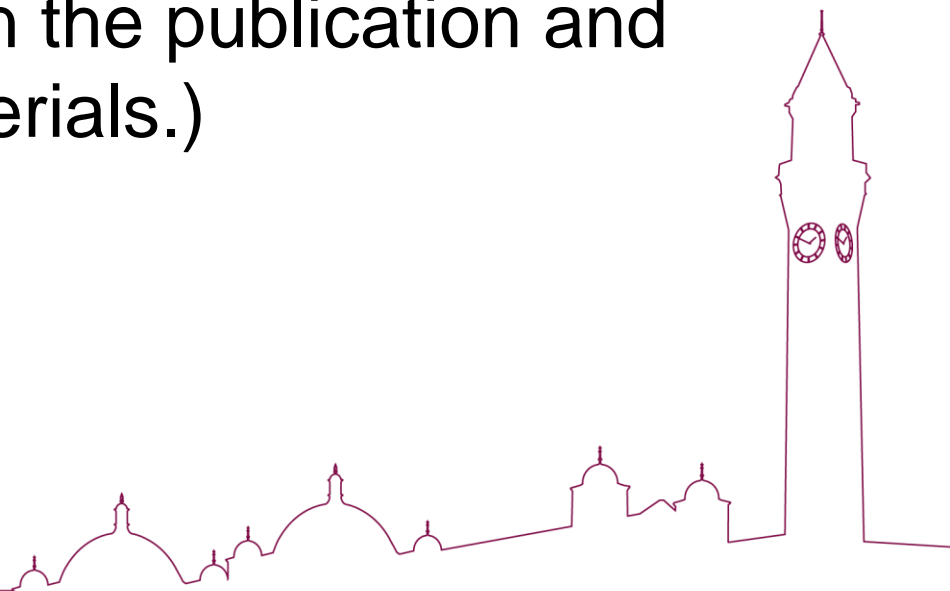
Replicable Research

- Tools are made available that would allow one to duplicate the results of the research, for example by running the authors' code to produce the plots shown in the publication. (Here tools might be limited in scope, e.g., only essential data or executables, and might only be made available to referees or only upon request.)



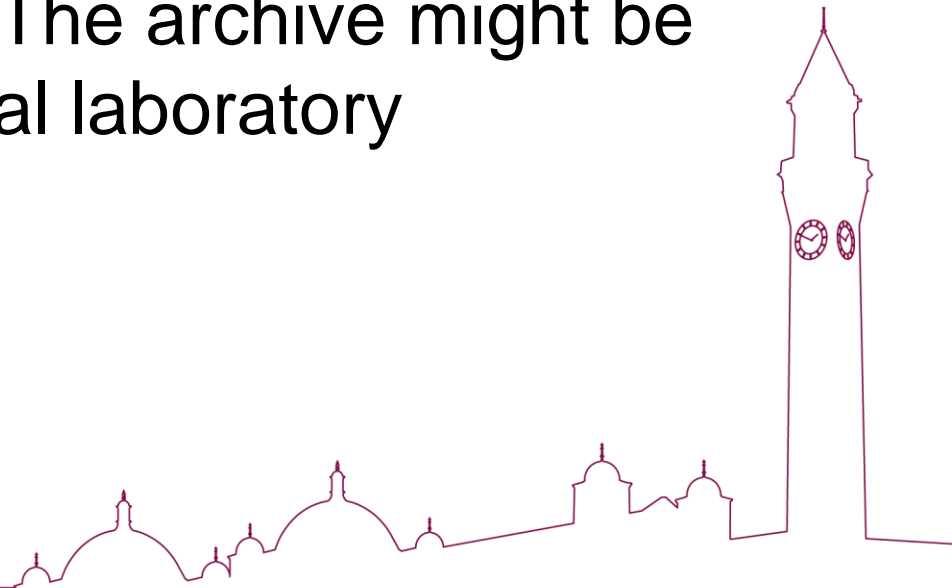
Confirmable Research

- The main conclusions of the research can be attained independently without the use of software provided by the author. (But using the complete description of algorithms and methodology provided in the publication and any supplementary materials.)



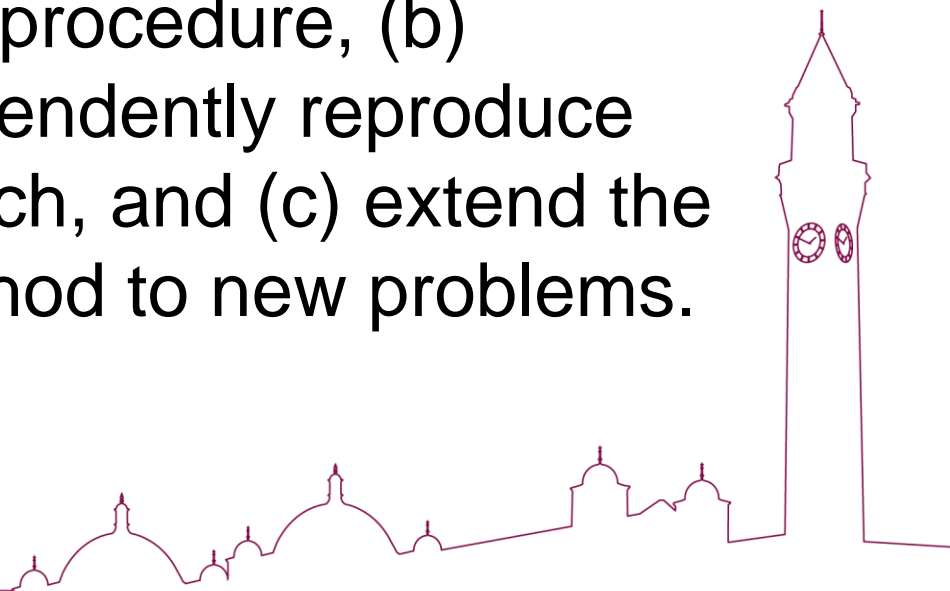
Auditable Research

- Sufficient records (including data and software) have been archived so that the research can be defended later if necessary or differences between independent confirmations resolved. The archive might be private, as with traditional laboratory notebooks.



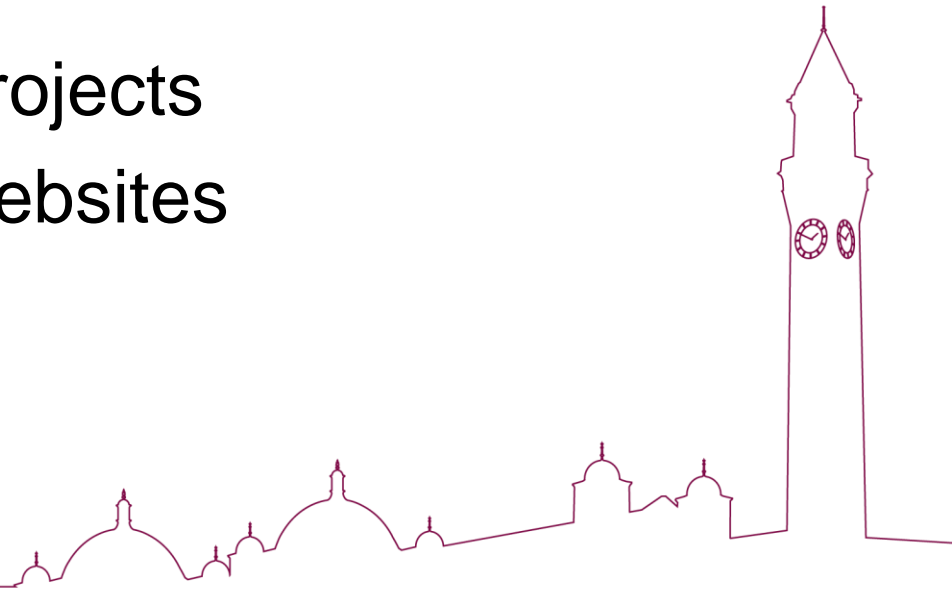
Open or Reproducible Research

- Auditable research made openly available. This comprised well-documented and fully open code and data that are publicly available that would allow one to (a) fully audit the computational procedure, (b) replicate and also independently reproduce the results of the research, and (c) extend the results or apply the method to new problems.



Consider

- Testing
- Documentation
- Licensing
- Standard systems
- People join and leave projects
- Permanent email and websites



- Mike Croucher talk, mentioned by Ed
 - http://mikecroucher.github.io/MLPM_talk/

