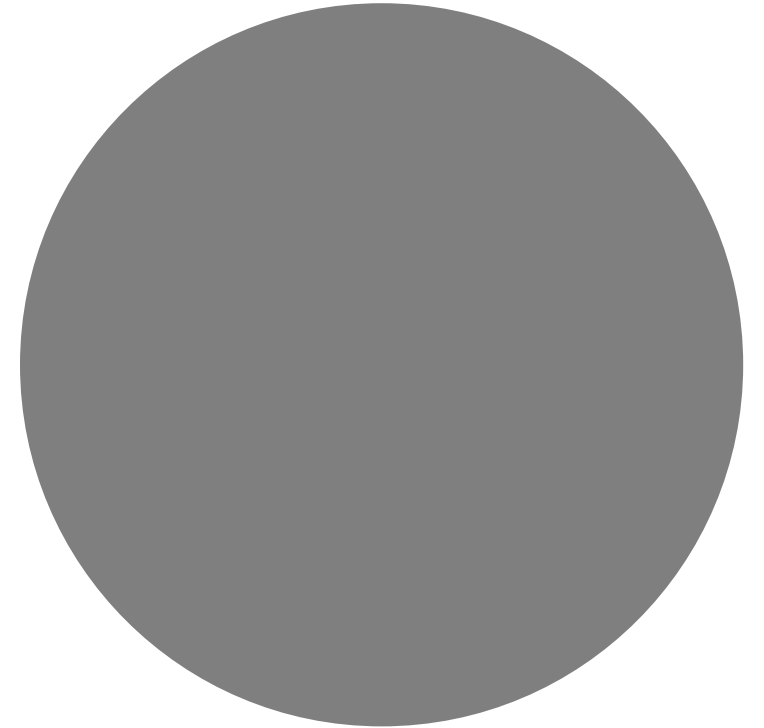


Data and Code for Reproducible Research

Lessons Learned from the NLM
Reproducibility Workshop

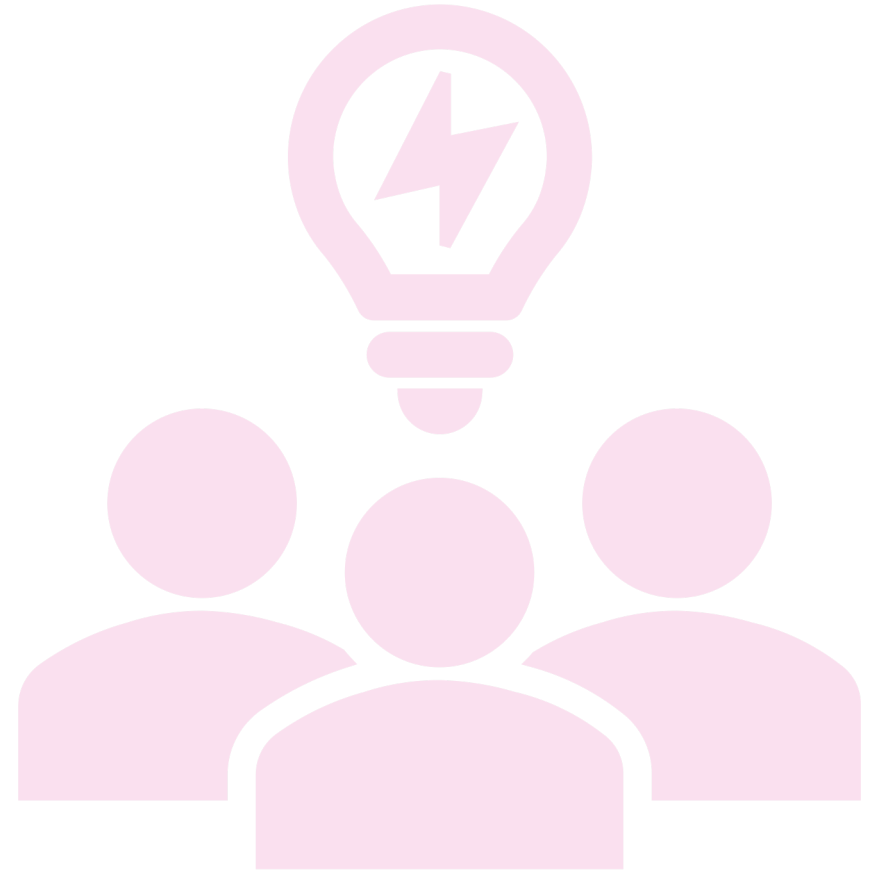
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National Library of Medicine





THOUGHT EXPERIMENT

What can we learn by trying to reproduce published research?



01

Knowledge of tools for reproducible research and NLM data resources for bioinformatics

02

An understanding of how to incorporate these tools into their own research practices

03

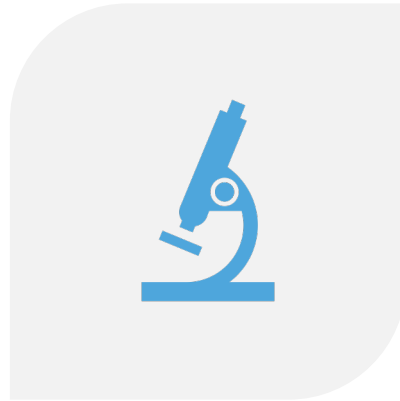
A path towards a deliverable, in the form of an executable notebook and/or publication

The goal was to provide participants with...

... while also helping us think about ...



How might a curriculum
around reproducibility
take shape?



How are researchers
approaching
reproducibility?



What is some low-
hanging fruit to promote
reproducible research
practices?

Structure: NLM Reproducibility Workshop

- Three-day workshop for 25 intramural NIH researchers
- Worked in 5 teams to reproduce a bioinformatics paper, with underlying data available in NLM-hosted repositories
- Day 1
 - Primer on open science and reproducibility
 - Three 30-minute tutorials on
 - Executable notebooks (Jupyter)
 - Version control (Git and Github)
 - Containerization (Docker)
- Days 2-3: Teams work in groups, code-a-thon style

TAKEAWAYS



No papers were
successfully reproduced

Reproducibility is not trivial



Missing underlying data



Missing software and tools



Inadequate descriptions of
software and tools



Workflows inadequately
described or difficult to follow

Need better minimum standards for peer review



Underlying raw data are made readily available



All software and tools must detail the appropriate version



Underlying analysis tools are made readily available

Still many different ways to interpret reproducibility



Raw versus processed data




Re-using scripts versus re-engineering them



Re-creating the computing environment versus using an environment that's "close enough"



Re-generating the figures versus re-generating the general conclusions



Clarity and community
consensus around
expectations for
reproducibility could go a
long way

Communication for open science

- Some teams reached out to corresponding authors for data or with questions about methods
- Authors responded within hours, suggesting that lack of reproducibility, in many cases, isn't the result of bad faith!





QUESTIONS?

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