9 REPRODUCIBLE RESEARCH THINGS

A PRACTICAL WORKSHOP TO GET RESEARCHERS FURTHER DOWN THE REPRODUCIBLE RESEARCH PATH

Amanda Miotto
Senior eResearch Analyst
Griffith University and QCIF
@amandamiottogu

Julie Toohey
Library Research Specialist
Griffith University
@JulieToohey
WHAT IS REPRODUCIBLE RESEARCH?

One of the core principles of the scientific process is that other scientists are able to repeat your experiment and come to the same conclusion.

It verifies discoveries and turns that discovery into globally accepted knowledge.
SOUNDS LOGICAL- SO WHY ARE WE TALKING ABOUT IT?

A (not small) proportion of modern experiments can't be reproduced

Teaching good practices (especially early on) is essential

You don't know what you don't know
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.

- Someone else’s
- My own

<table>
<thead>
<tr>
<th>Field</th>
<th>Someone else’s</th>
<th>My own</th>
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<tbody>
<tr>
<td>Chemistry</td>
<td>80%</td>
<td>60%</td>
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<tr>
<td>Biology</td>
<td></td>
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<tr>
<td>Physics and engineering</td>
<td>60%</td>
<td>40%</td>
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<tr>
<td>Medicine</td>
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<tr>
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0% 20% 40% 60% 80% 100%
A grad student was caught in the crossfire of fraud — and fought back

In March, 2013, a graduate student joined the lab of a prominent researcher in Australia..

Retraction Watch (Australian papers).

WHY IS IT SO IMPORTANT?

A paleontology journal has retracted a recent paper after discovering it had published the uncorrected version of the manuscript.

The mistake occurred after the authors submitted revisions to the manuscript without tracking the changes, prompting the publisher to believe nothing had been changed and publishing the previous version.

Researchers have retracted a 2015 Nature paper about the molecular underpinnings of immune function after discovering they could not replicate key parts of the results.

Errors may arise from a naïve misunderstanding of the code (as was my problem in 2008), or from a simple typographic error.

I recently caught a collaborator (who will go unnamed) in a tiny R mistake that accidentally dropped half our data, rendering some cool results non-significant (until we figured out the error while writing the manuscript).

http://ecoevoevoevoeco.blogspot.com/2016/12/wrong-lot.html
HELP RESEARCHERS LEARN TO BE REPRODUCIBLE RESEARCHERS
THE 9 REPRODUCIBLE THINGS

LESSON 1 - DOCUMENTATION

LESSON 2 - NAMING CONVENTIONS

LESSON 3 - FOLDER STRUCTURE
THE 9 REPRODUCIBLE THINGS

LESSON 4 - AUTOMATION

LESSON 5 - VERSION CONTROL

LESSON 6 - CLOUD BACKUPS
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LESSON 7 - COMPUTER SECURITY

LESSON 8 - SEPARATING IDENTIFIED VARIABLES

LESSON 9 - PERMANENT IDENTIFIERS FOR YOUR PUBLISHED RESULTS
WORKSHOP DETAILS

• We aim for a two hour session
• Keep it as interactive as possible
• Ask them to write their own action items
FORMAT OF LESSONS

- Keep it simple
- Wanted it to be easy to even take one simple change to their workflow
- Wanted to incorporate guidelines in an accessible, easy to digest way
- Generic enough to apply to most disciplines
- We couldn't think of the 10th thing.
TO CATER FOR ALL LEVELS, WE OFFER STEPS FOR

- Beginner
- Intermediate
- Advanced

Further reading details if they are interested
GUIDELINES WE FOLLOWED

Research Integrity - ARC

Australian Code for the Responsible Conduct of Research 2018
AIM TO HELP RESEARCHERS GET FURTHER DOWN THE PATH

WE DIDN'T EXPECT RESEARCHERS TO BECOME EXPERTS OVERNIGHT.....
USE SCENARIOS TO MAKE IT REAL
What if a key person from your lab disappeared one day (family or personal emergency, no longer contactable)?
What if a key person from your lab disappeared one day (family or personal emergency, no longer contactable)?

- Documentation
- Naming Conventions
- Folder Structures
- Automation
- Version Control
Imagine you're travelling and lose your laptop bag with your external hard drives?

Or your office is robbed? Could you continue your work? Is your data backed up? Encrypted?

- Backing up to the cloud
- Computer Security
- Deidentifying your data
Someone has published contradicting results to your published paper, and you've been asked to provide your data and methods. Could you?
Someone has published contradicting results to your published paper, and you've been asked to provide your data and methods. Could you?

- Storing your data long term (Cloud Backups)
- Documentation
- Versions of software
- Permanent Identifiers for your Published Results
COLLABORATIVE EFFORT

We chose Github and Gitslides to enable cloning and easy altering for other institutes.

Would love feedback on this workshop and the materials.

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LINKS AND CONTACT INFORMATION

Amanda Miotto (a.miotto@griffith.edu.au)
Julie Toohey (julie.toohey@griffith.edu.au)

Link: https://guereslib.github.io/Reproducible-Research-Things/