Digital badge

- Reproducible research

Brendan Palmer,

Clinical Research Facility - Cork &

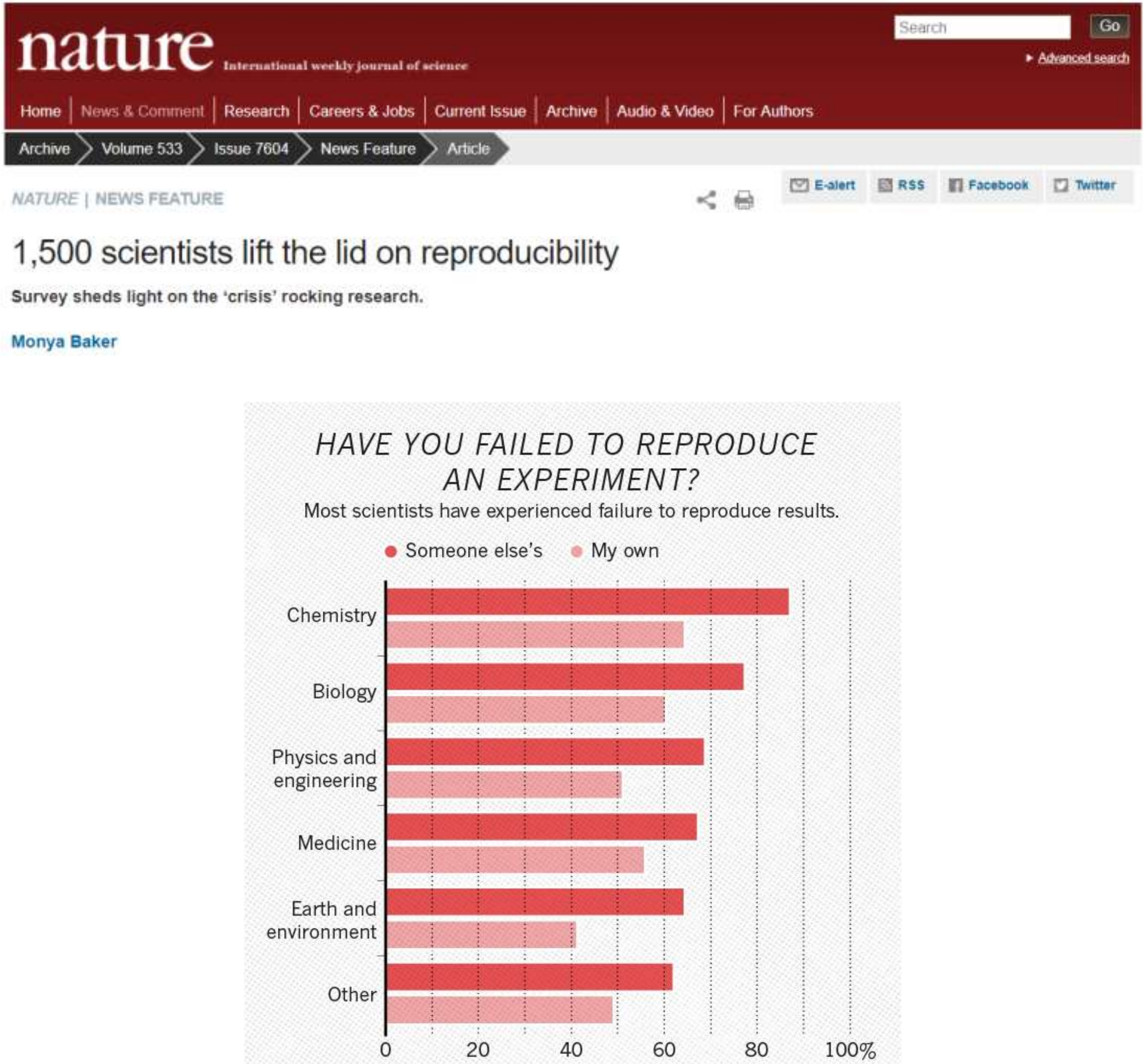
School of Public Health

@B_A_Palmer

CRF-C
HRB Clinical Research Facility Cork

University College Cork
2019
Responsible Conduct of Research
Coláiste na hOllscoile Corcaigh

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh
School of Public Health



nature International weekly journal of science

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NATURE | NEWS FEATURE

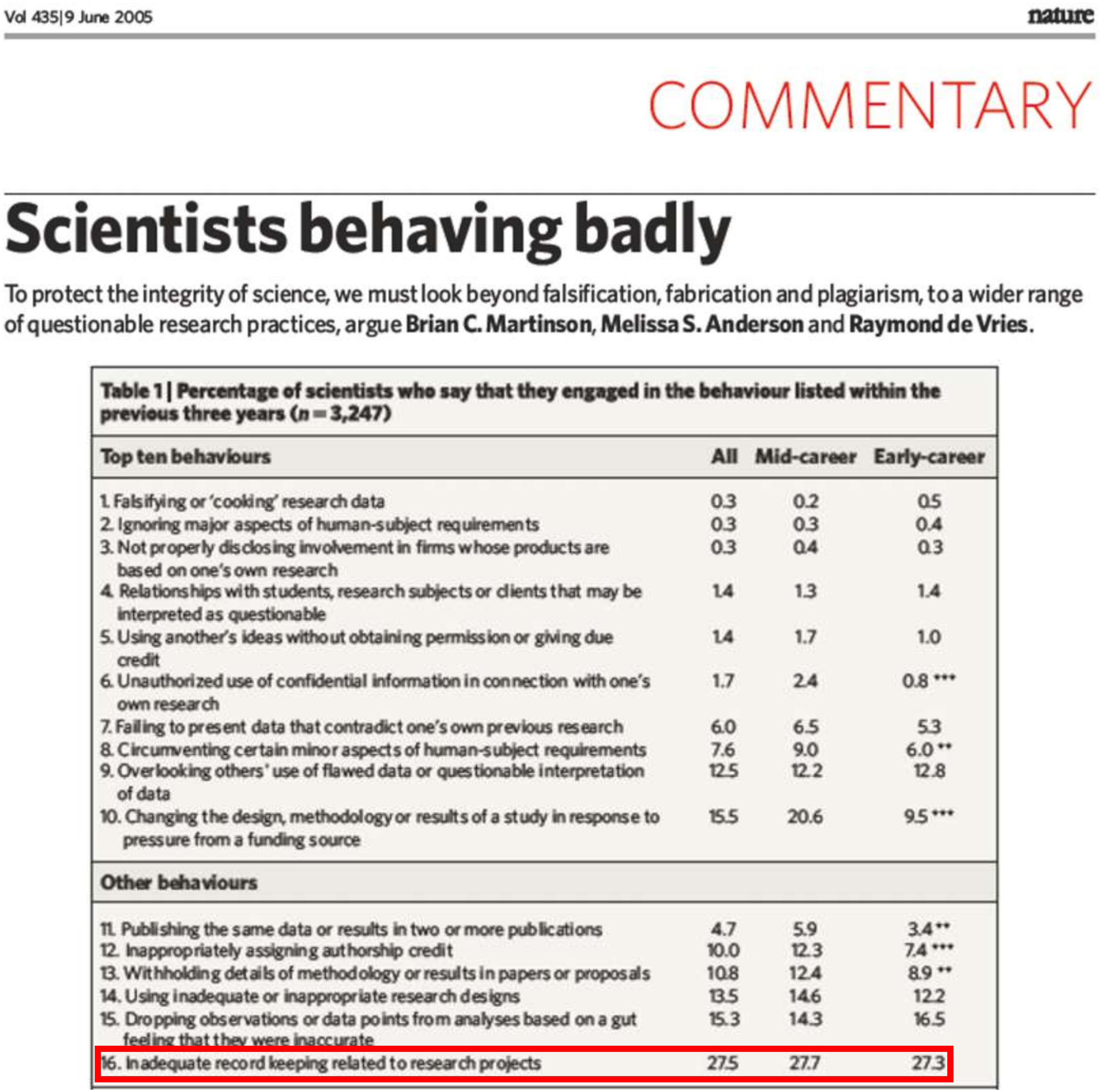
1,500 scientists lift the lid on reproducibility

Survey sheds light on the 'crisis' rocking research.

Monya Baker

HAVE YOU FAILED TO REPRODUCE AN EXPERIMENT?

Most scientists have experienced failure to reproduce results.



Vol 435|9 June 2005 nature

COMMENTARY

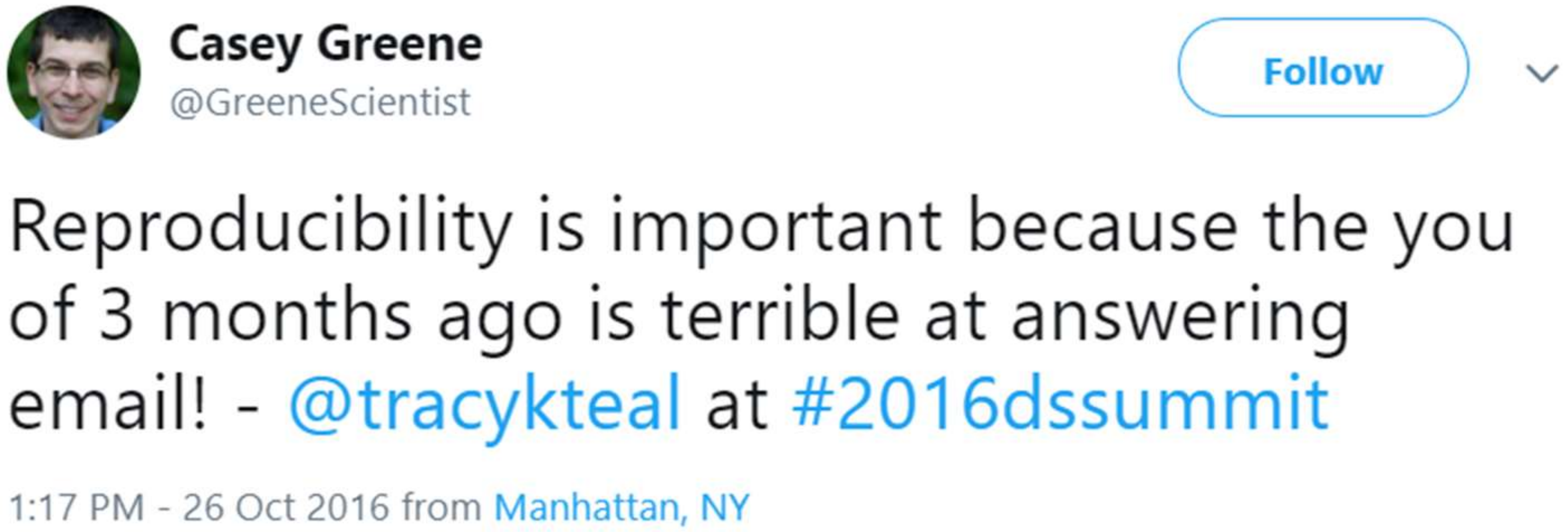
Scientists behaving badly

To protect the integrity of science, we must look beyond falsification, fabrication and plagiarism, to a wider range of questionable research practices, argue **Brian C. Martinson**, **Melissa S. Anderson** and **Raymond de Vries**.

Table 1 | Percentage of scientists who say that they engaged in the behaviour listed within the previous three years (*n* = 3,247)

Top ten behaviours	All	Mid-career	Early-career
1. Falsifying or 'cooking' research data	0.3	0.2	0.5
2. Ignoring major aspects of human-subject requirements	0.3	0.3	0.4
3. Not properly disclosing involvement in firms whose products are based on one's own research	0.3	0.4	0.3
4. Relationships with students, research subjects or clients that may be interpreted as questionable	1.4	1.3	1.4
5. Using another's ideas without obtaining permission or giving due credit	1.4	1.7	1.0
6. Unauthorized use of confidential information in connection with one's own research	1.7	2.4	0.8 ***
7. Failing to present data that contradict one's own previous research	6.0	6.5	5.3
8. Circumventing certain minor aspects of human-subject requirements	7.6	9.0	6.0 **
9. Overlooking others' use of flawed data or questionable interpretation of data	12.5	12.2	12.8
10. Changing the design, methodology or results of a study in response to pressure from a funding source	15.5	20.6	9.5 ***
Other behaviours			
11. Publishing the same data or results in two or more publications	4.7	5.9	3.4 **
12. Inappropriately assigning authorship credit	10.0	12.3	7.4 ***
13. Withholding details of methodology or results in papers or proposals	10.8	12.4	8.9 **
14. Using inadequate or inappropriate research designs	13.5	14.6	12.2
15. Dropping observations or data points from analyses based on a gut feeling that they were inaccurate	15.3	14.3	16.5
16. Inadequate record keeping related to research projects	27.5	27.7	27.3

Who benefits most from reproducibility?



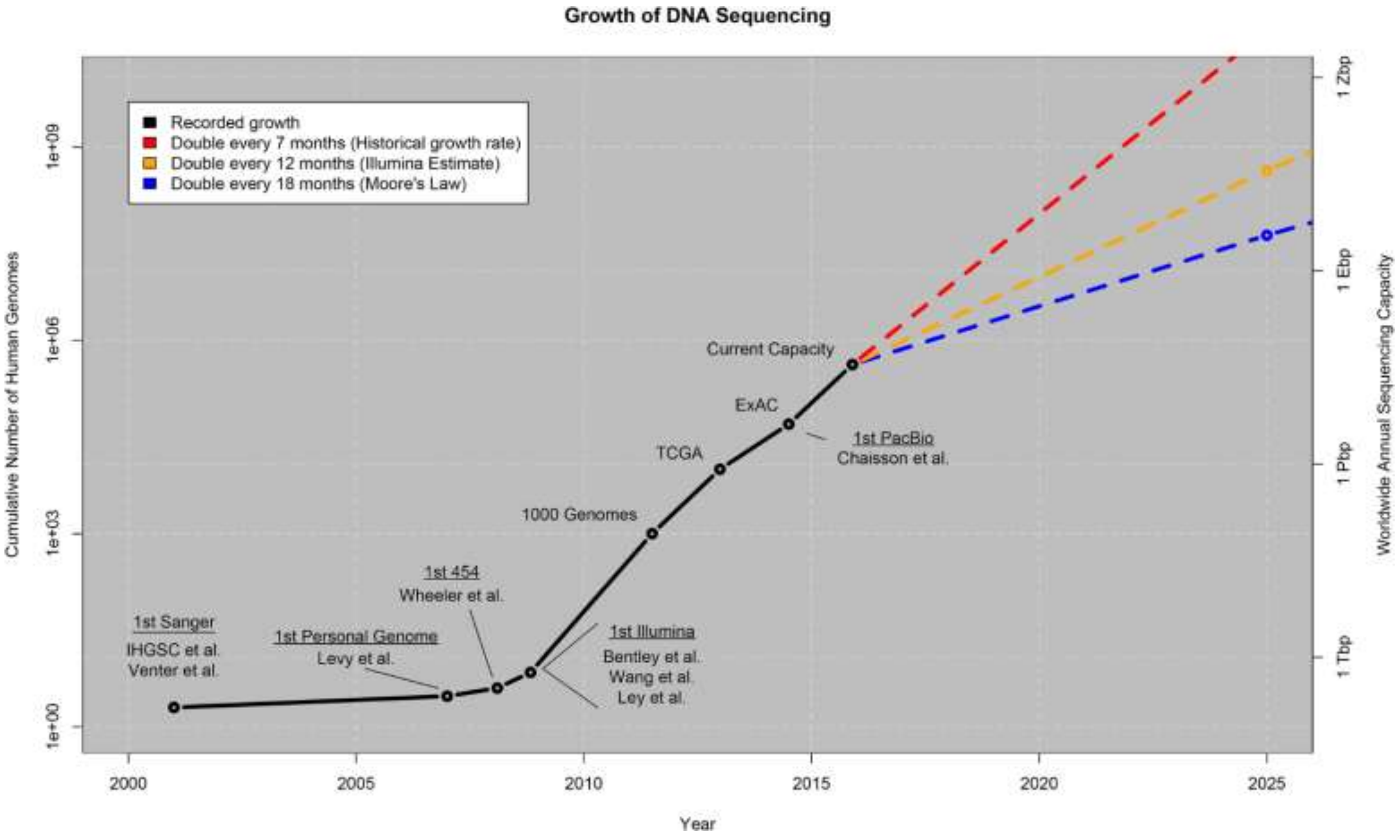
Casey Greene
@GreeneScientist

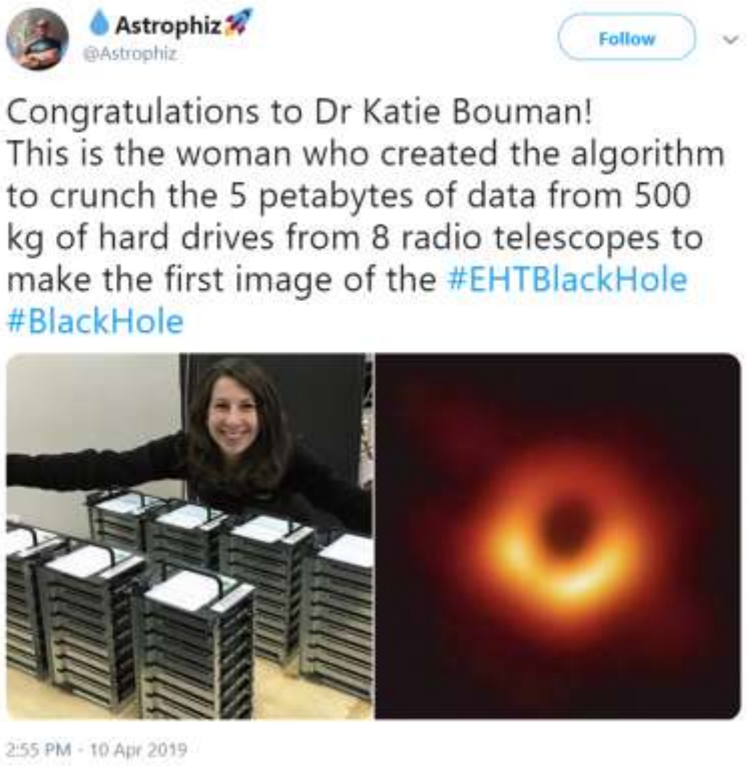
Reproducibility is important because the you of 3 months ago is terrible at answering email! - @tracykteal at #2016dssummit

1:17 PM - 26 Oct 2016 from Manhattan, NY

Where to begin…

The challenge



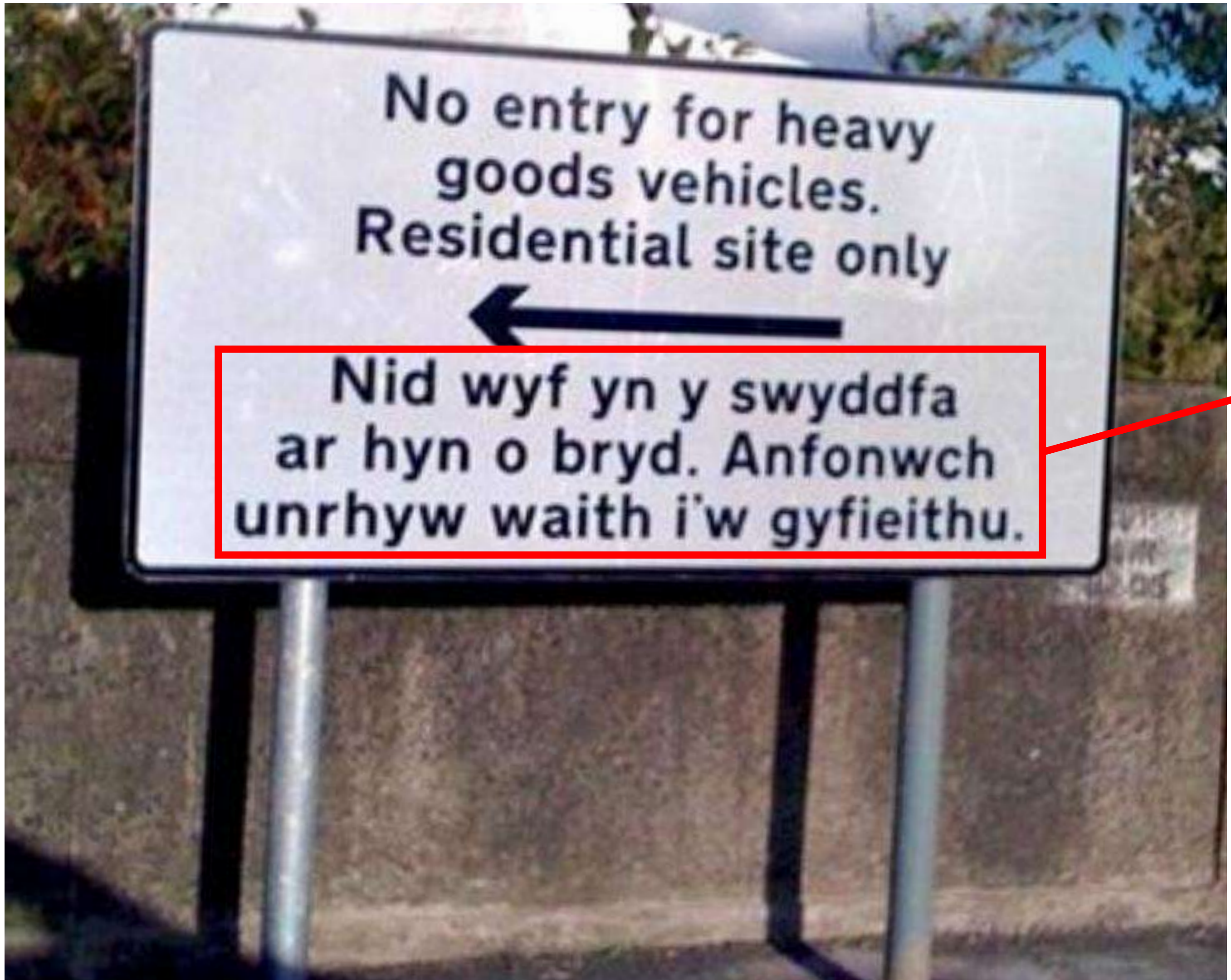


Congratulations to Dr Katie Bouman! This is the woman who created the algorithm to crunch the 5 petabytes of data from 500 kg of hard drives from 8 radio telescopes to make the first image of the #EHTBlackHole #BlackHole

2:55 PM - 10 Apr 2019

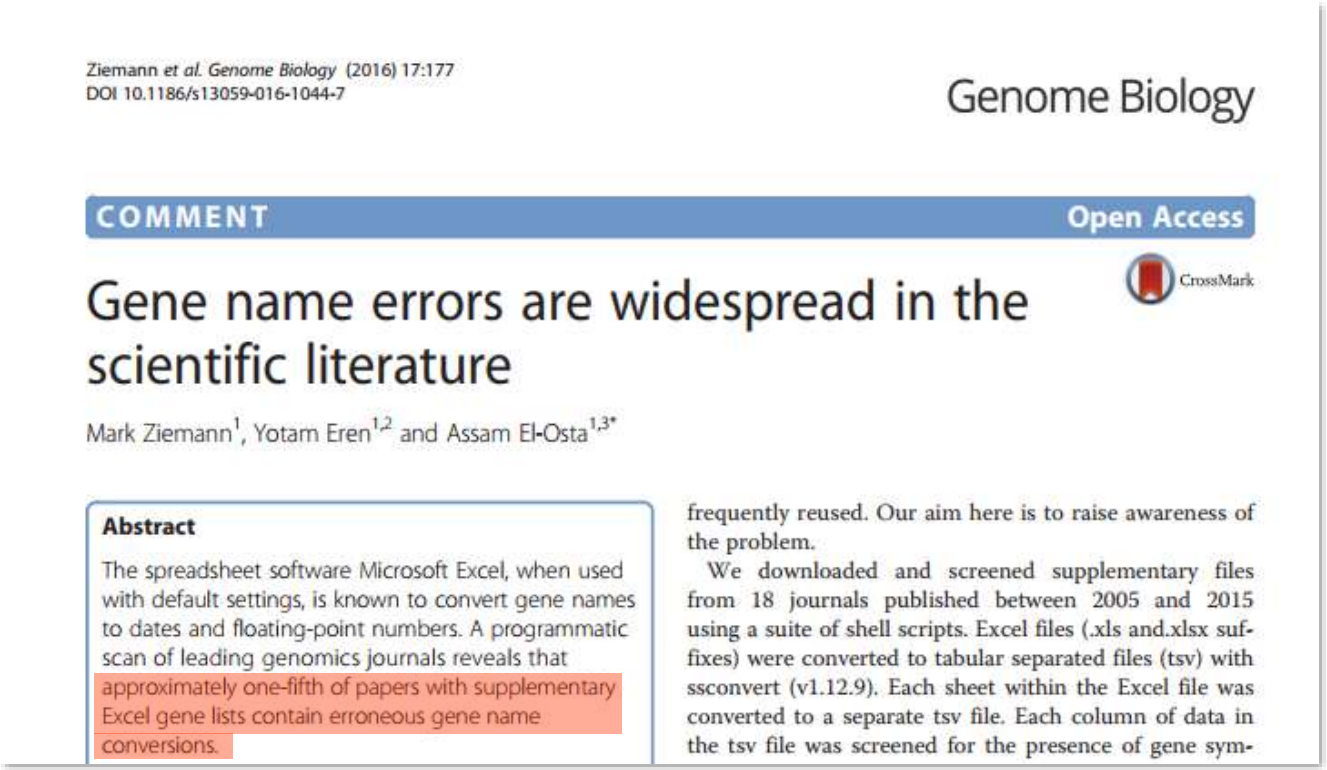
Stevens et. al., 2015, Plos Biology

Fundamental problem


No entry for heavy goods vehicles. Residential site only
Nid wyf yn y swyddfa ar hyn o bryd. Anfonwch unrhyw waith i'w gyfieithu.

I'm not in the office at the moment. Send any work to be translated

Beware of default settings



Ziemann *et al. Genome Biology* (2016) 17:177
DOI 10.1186/s13059-016-1044-7

Genome Biology

COMMENT Open Access

Gene name errors are widespread in the scientific literature

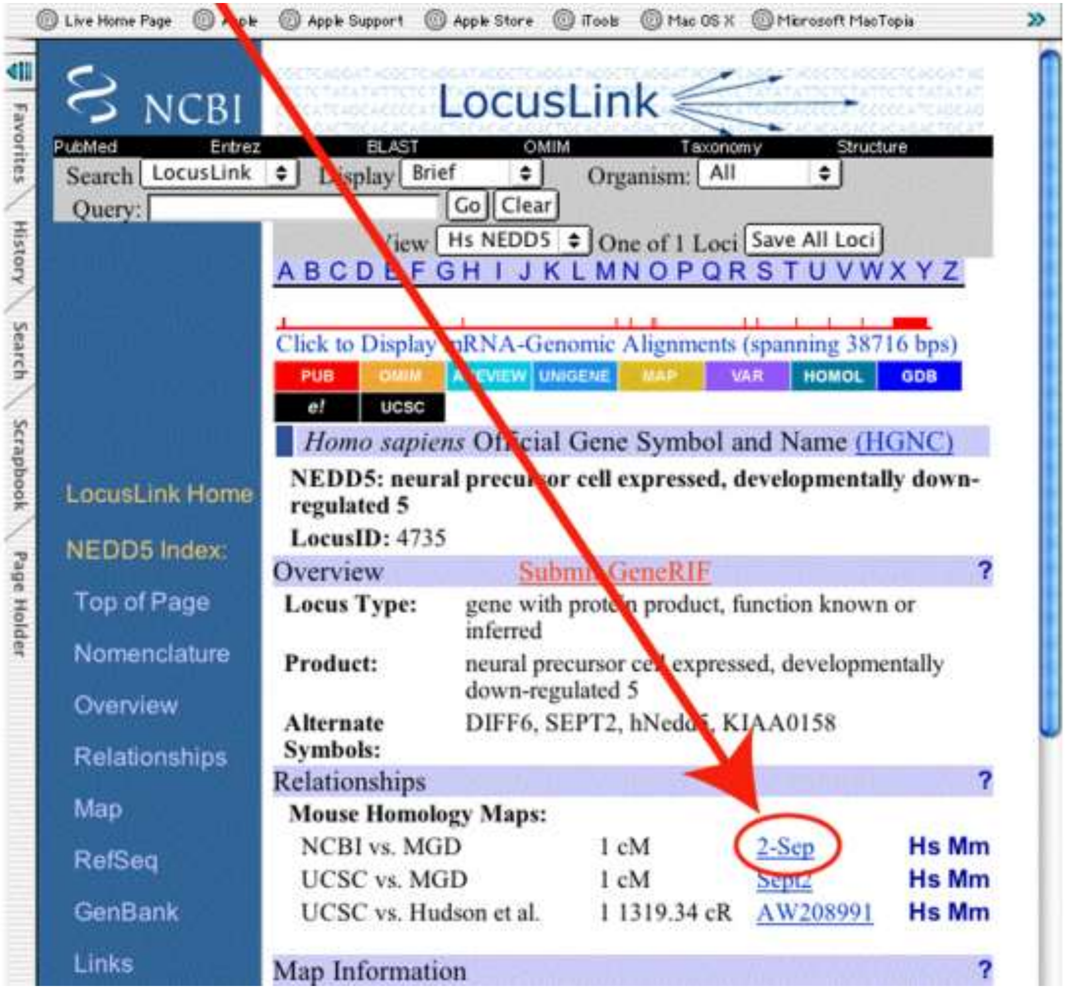
Mark Ziemann[1], Yotam Eren[1,2] and Assam El-Osta[1,3*]

Abstract

The spreadsheet software Microsoft Excel, when used with default settings, is known to convert gene names to dates and floating-point numbers. A programmatic scan of leading genomics journals reveals that approximately one-fifth of papers with supplementary Excel gene lists contain erroneous gene name conversions.

frequently reused. Our aim here is to raise awareness of the problem.

We downloaded and screened supplementary files from 18 journals published between 2005 and 2015 using a suite of shell scripts. Excel files (.xls and.xlsx suffixes) were converted to tabular separated files (tsv) with ssconvert (v1.12.9). Each sheet within the Excel file was converted to a separate tsv file. Each column of data in the tsv file was screened for the presence of gene sym-



Search LocusLink Display Brief Organism: All

Query:

View Hs NEDD5 One of 1 Loci

Click to Display mRNA-Genomic Alignments (spanning 38716 bps)

Homo sapiens Official Gene Symbol and Name (HGNC)

NEDD5: neural precursor cell expressed, developmentally down-regulated 5

LocusID: 4735

Overview

Locus Type: gene with protein product, function known or inferred

Product: neural precursor cell expressed, developmentally down-regulated 5

Alternate Symbols: DIFF6, SEPT2, hNedd5, KIAA0158

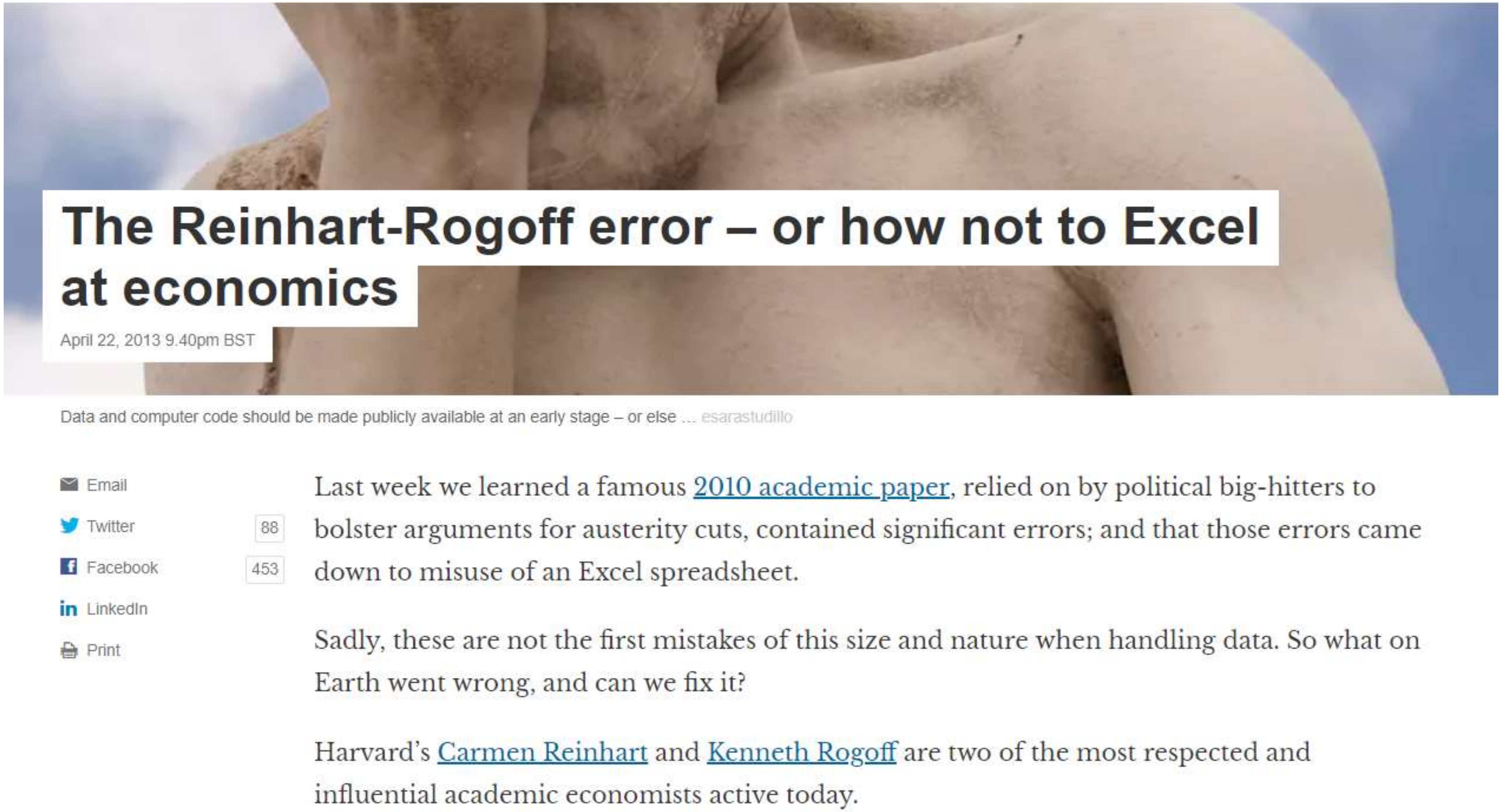
Relationships

Mouse Homology Maps:

NCBI vs. MGD	1 cM	2-Sep	Hs Mm
UCSC vs. MGD	1 cM	Sept2	Hs Mm
UCSC vs. Hudson et al.	1 1319.34 cR	AW208991	Hs Mm

Map Information

Beware of default settings



The Reinhart-Rogoff error – or how not to Excel at economics

April 22, 2013 9.40pm BST

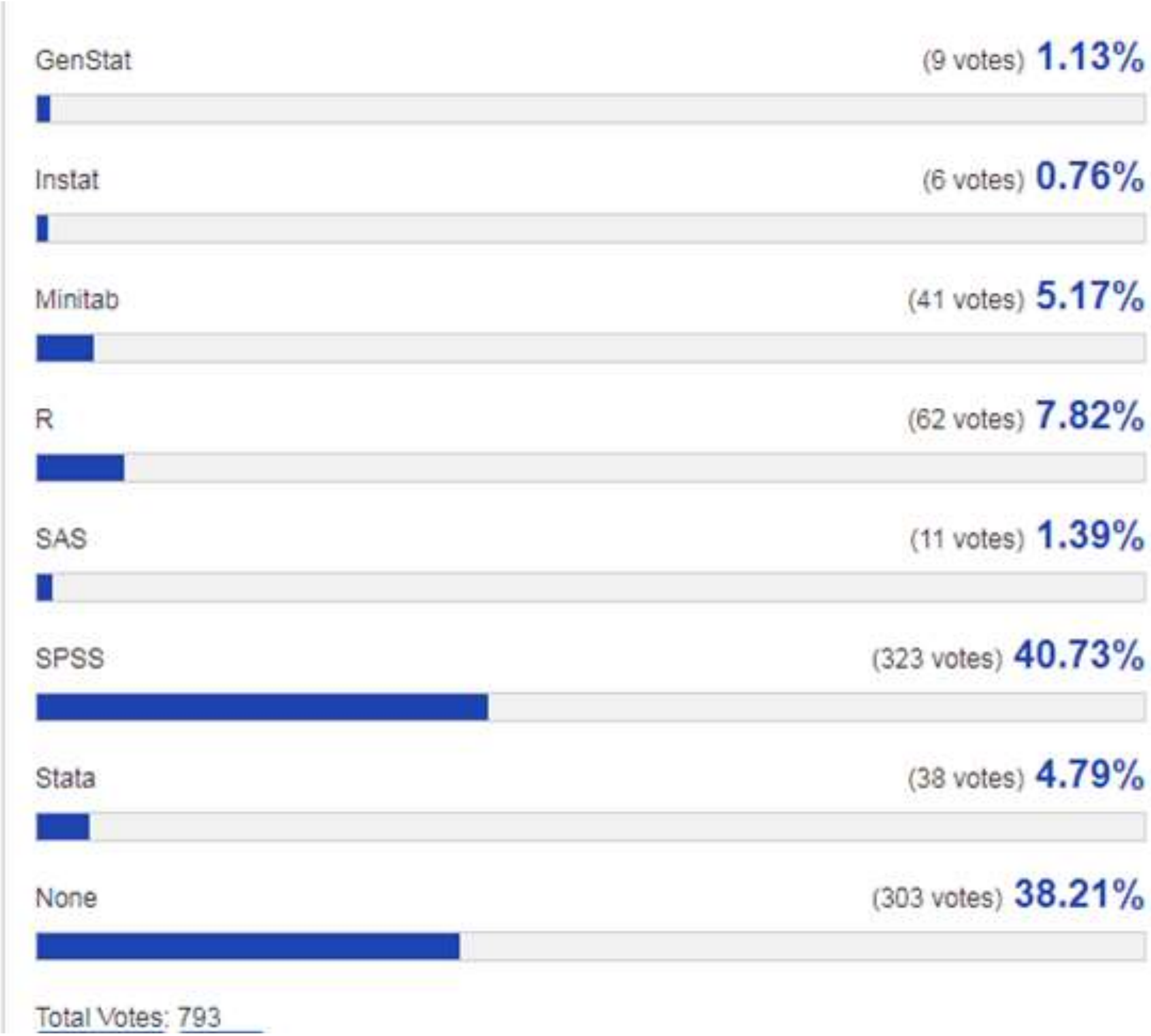
Data and computer code should be made publicly available at an early stage – or else … esarastudillo

Last week we learned a famous 2010 academic paper, relied on by political big-hitters to bolster arguments for austerity cuts, contained significant errors; and that those errors came down to misuse of an Excel spreadsheet.

Sadly, these are not the first mistakes of this size and nature when handling data. So what on Earth went wrong, and can we fix it?

Harvard's Carmen Reinhart and Kenneth Rogoff are two of the most respected and influential academic economists active today.

Where are we all coming from?



GenStat	(9 votes)	1.13%
Instat	(6 votes)	0.76%
Minitab	(41 votes)	5.17%
R	(62 votes)	7.82%
SAS	(11 votes)	1.39%
SPSS	(323 votes)	40.73%
Stata	(38 votes)	4.79%
None	(303 votes)	38.21%

Total Votes: 793

Putting the pieces together

A: Define a project structure

B: Set a naming convention

C: Use scripted workflows

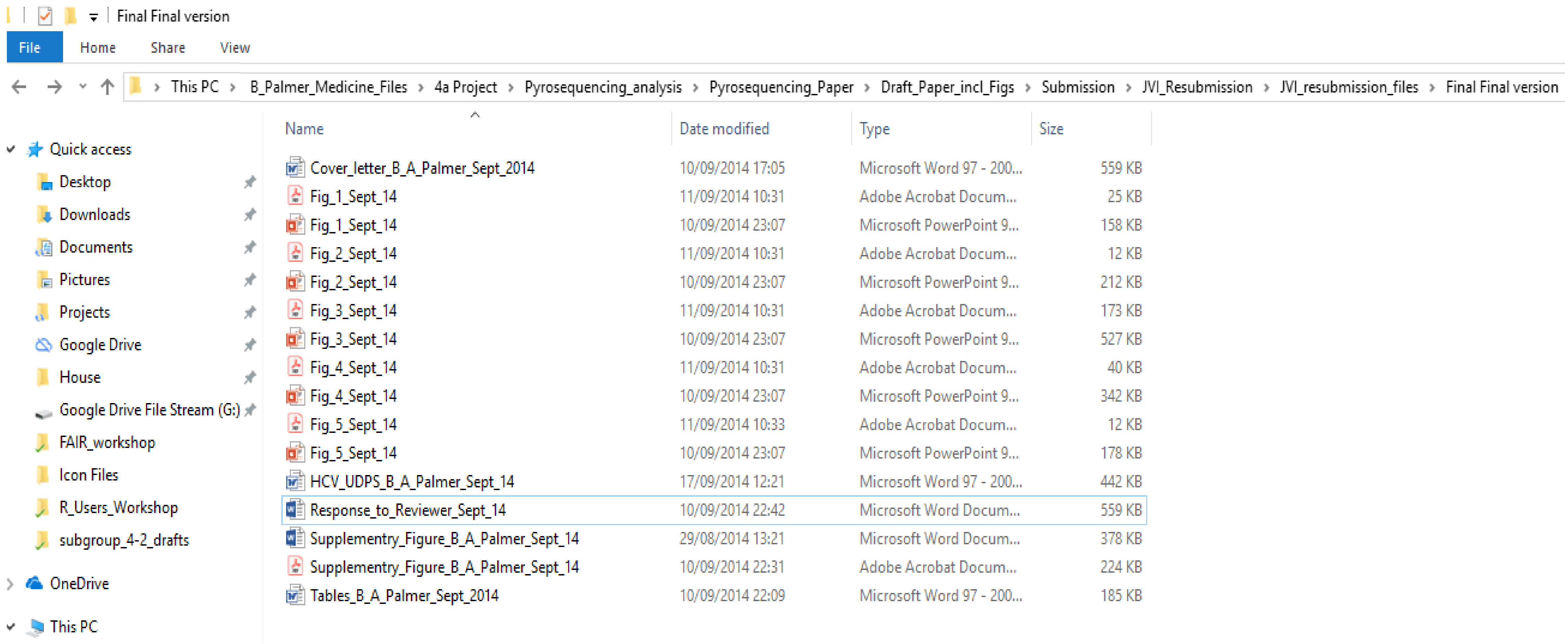
D: Digital notebooks

Reproducible research

Run, or he's going to tell us about **R** again!

Still haven’t found what I’m looking for

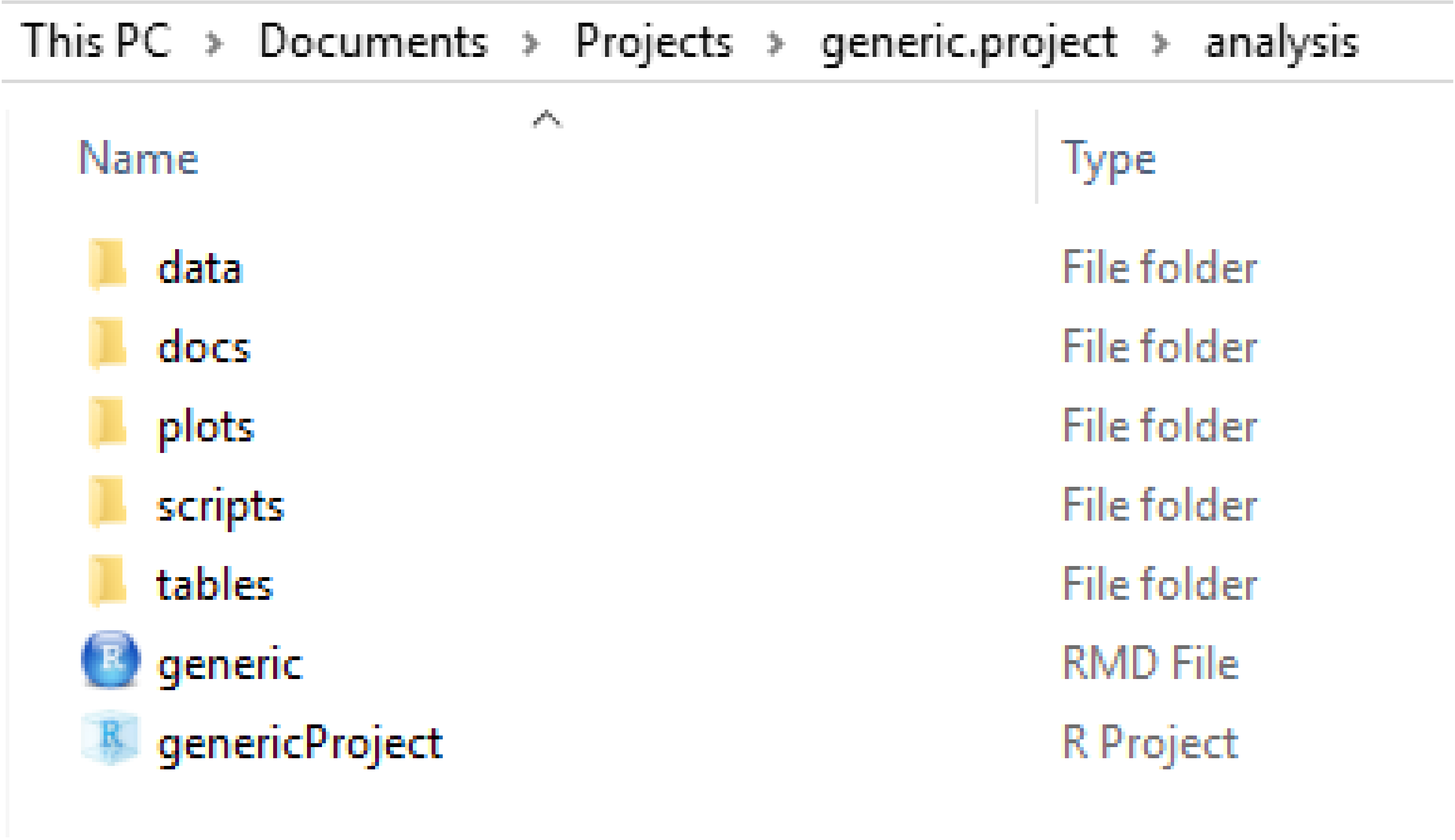
- Help your future-self



This PC › B_Palmer_Medicine_Files › 4a Project › Pyrosequencing_analysis › Pyrosequencing_Paper › Draft_Paper_incl_Figs › Submission › JVI_Resubmission › JVI_resubmission_files › Final Final version

Name	Date modified	Type	Size
Cover_letter_B_A_Palmer_Sept_2014	10/09/2014 17:05	Microsoft Word 97 - 200...	559 KB
Fig_1_Sept_14	11/09/2014 10:31	Adobe Acrobat Docum...	25 KB
Fig_1_Sept_14	10/09/2014 23:07	Microsoft PowerPoint 9...	158 KB
Fig_2_Sept_14	11/09/2014 10:31	Adobe Acrobat Docum...	12 KB
Fig_2_Sept_14	10/09/2014 23:07	Microsoft PowerPoint 9...	212 KB
Fig_3_Sept_14	11/09/2014 10:31	Adobe Acrobat Docum...	173 KB
Fig_3_Sept_14	10/09/2014 23:07	Microsoft PowerPoint 9...	527 KB
Fig_4_Sept_14	11/09/2014 10:31	Adobe Acrobat Docum...	40 KB
Fig_4_Sept_14	10/09/2014 23:07	Microsoft PowerPoint 9...	342 KB
Fig_5_Sept_14	11/09/2014 10:33	Adobe Acrobat Docum...	12 KB
Fig_5_Sept_14	10/09/2014 23:07	Microsoft PowerPoint 9...	178 KB
HCV_UDPS_B_A_Palmer_Sept_14	17/09/2014 12:21	Microsoft Word 97 - 200...	442 KB
Response_to_Reviewer_Sept_14	10/09/2014 22:42	Microsoft Word Docum...	559 KB
Supplementry_Figure_B_A_Palmer_Sept_14	29/08/2014 13:21	Microsoft Word Docum...	378 KB
Supplementry_Figure_B_A_Palmer_Sept_14	10/09/2014 22:31	Adobe Acrobat Docum...	224 KB
Tables_B_A_Palmer_Sept_2014	10/09/2014 22:09	Microsoft Word 97 - 200...	185 KB

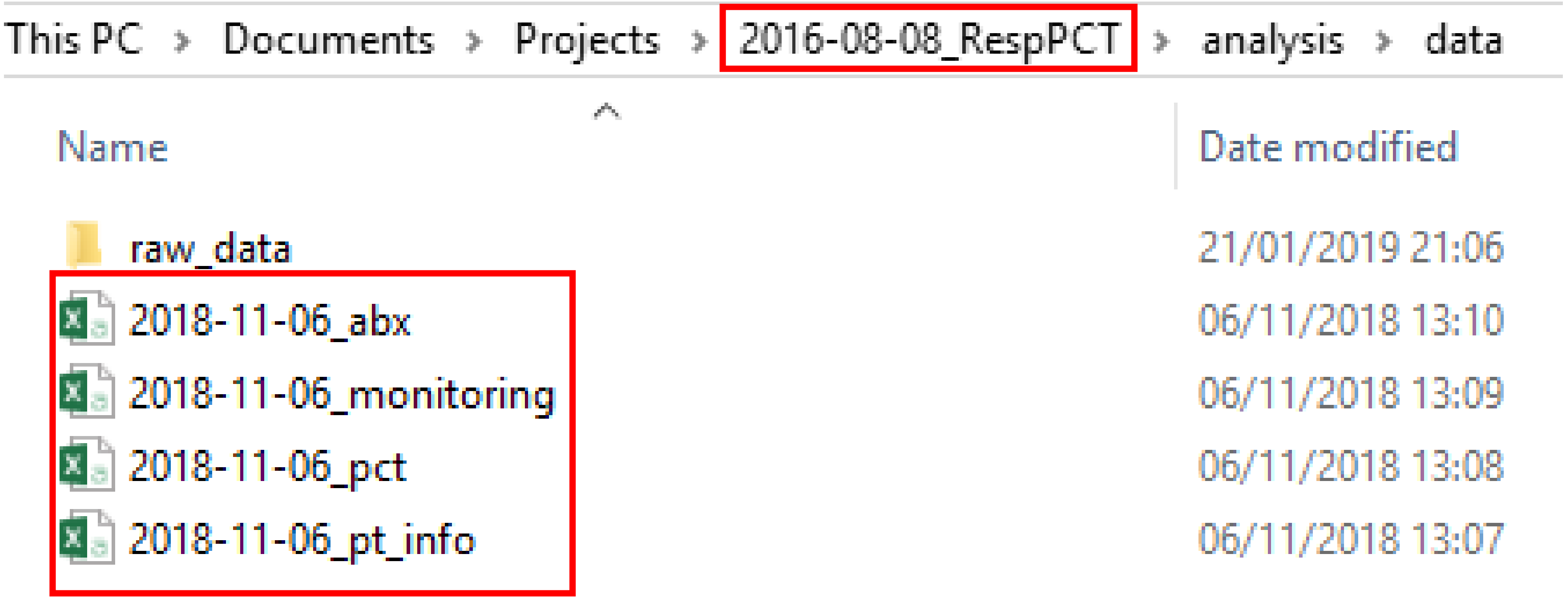
A: Define a generic project structure



This PC › Documents › Projects › generic.project › analysis

Name	Type
data	File folder
docs	File folder
plots	File folder
scripts	File folder
tables	File folder
generic	RMD File
genericProject	R Project

B: Give your files and folders informative names



This PC › Documents › Projects › 2016-08-08_RespPCT › analysis › data

Name	Date modified
raw_data	21/01/2019 21:06
2018-11-06_abx	06/11/2018 13:10
2018-11-06_monitoring	06/11/2018 13:09
2018-11-06_pct	06/11/2018 13:08
2018-11-06_pt_info	06/11/2018 13:07

Outline a file naming convention

Machine readable:

- Inherent order
- Avoid spaces
- Avoid punctuation
- Remove case-sensitivity

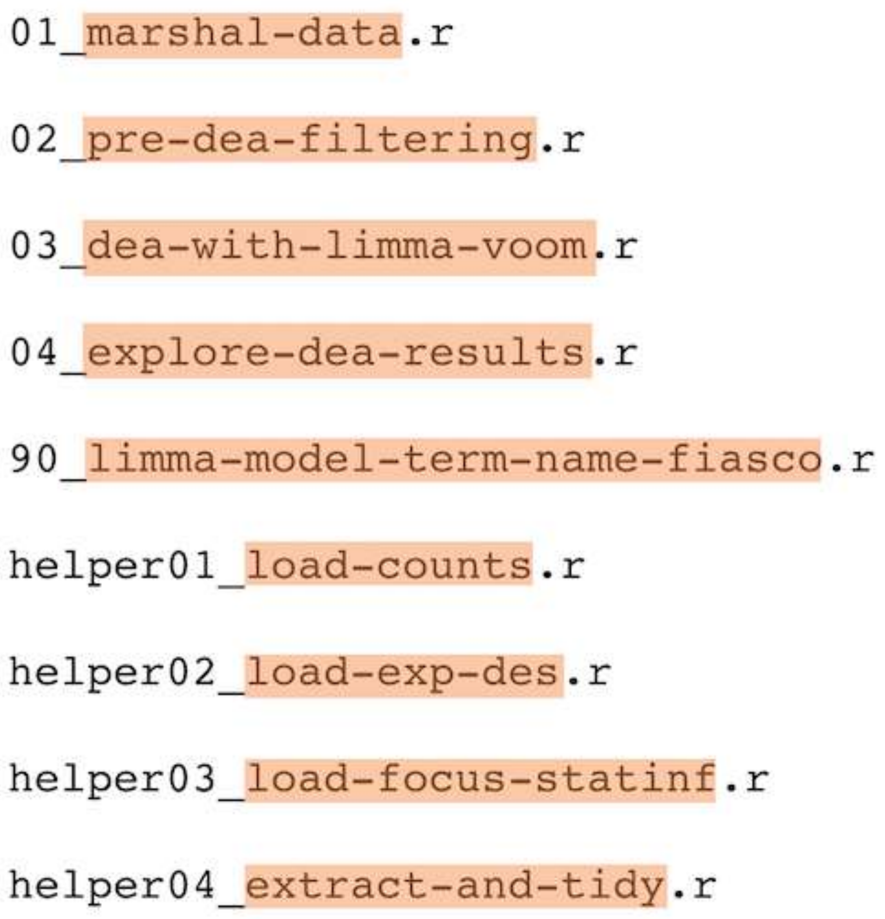
Human readable:

- Contains info on content
- Avoid spaces
- Avoid punctuation
- Remove case sensitivity

Metadata:

Separate with underscores ("_")

- Avoid punctuation
- Remove case-sensitivity

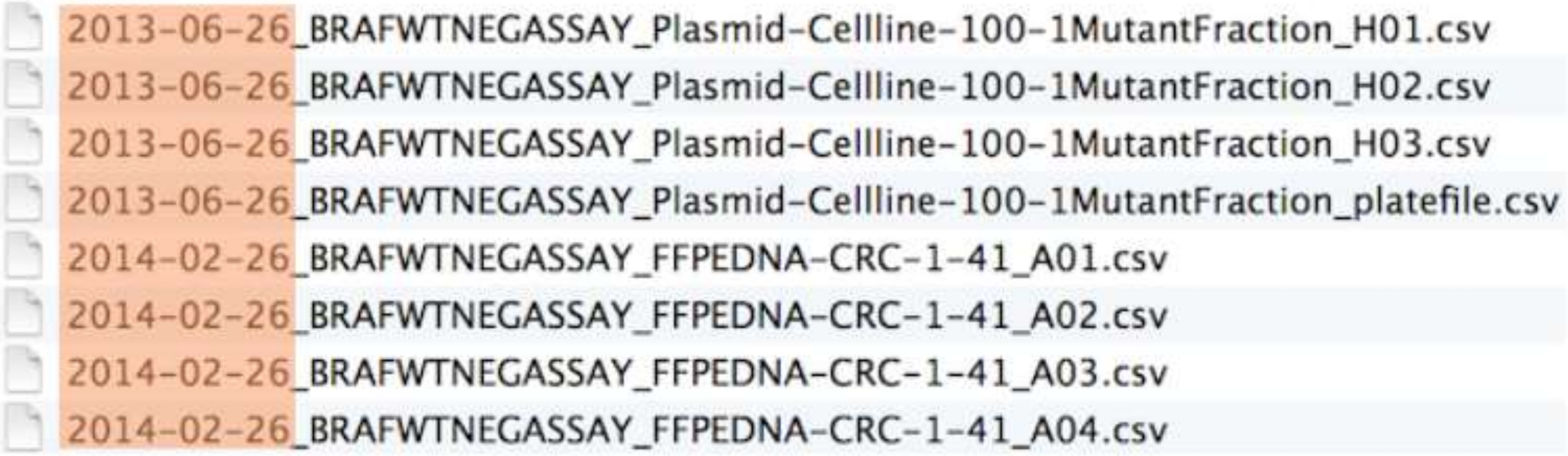


```
01_marshal-data.r
02_pre-dea-filtering.r
03_dea-with-limma-voom.r
04_explore-dea-results.r
90_limma-model-term-name-fiasco.r
helper01_load-counts.r
helper02_load-exp-des.r
helper03_load-focus-statinf.r
helper04_extract-and-tidy.r
```

Image from Data Carpentry webpage

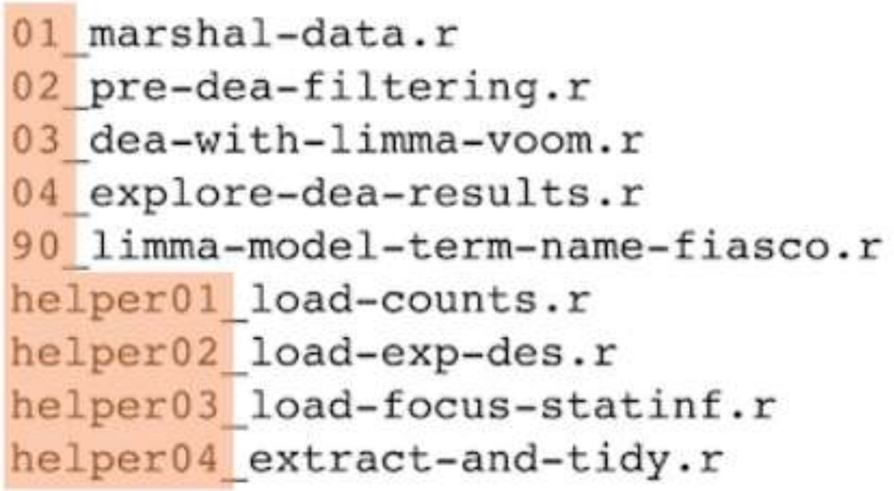
Outline a file naming convention

Chronological order:



```
2013-06-26_BRAFWTNEGASSAY_Plasmid-Cellline-100-1MutantFraction_H01.csv
2013-06-26_BRAFWTNEGASSAY_Plasmid-Cellline-100-1MutantFraction_H02.csv
2013-06-26_BRAFWTNEGASSAY_Plasmid-Cellline-100-1MutantFraction_H03.csv
2013-06-26_BRAFWTNEGASSAY_Plasmid-Cellline-100-1MutantFraction_platefile.csv
2014-02-26_BRAFWTNEGASSAY_FFPEDNA-CRC-1-41_A01.csv
2014-02-26_BRAFWTNEGASSAY_FFPEDNA-CRC-1-41_A02.csv
2014-02-26_BRAFWTNEGASSAY_FFPEDNA-CRC-1-41_A03.csv
2014-02-26_BRAFWTNEGASSAY_FFPEDNA-CRC-1-41_A04.csv
```

Logical order:



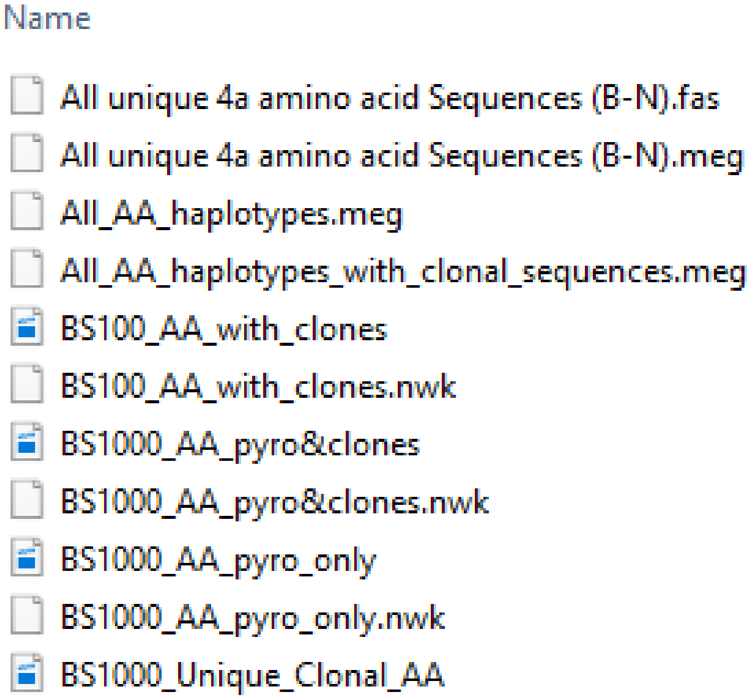
```
01_marshal-data.r
02_pre-dea-filtering.r
03_dea-with-limma-voom.r
04_explore-dea-results.r
90_limma-model-term-name-fiasco.r
helper01_load-counts.r
helper02_load-exp-des.r
helper03_load-focus-statinf.r
helper04_extract-and-tidy.r
```

Image from Data Carpentry webpage

Everything in its right place

- Make your file names:
    1. Machine readable
    2. Human readable
    3. Work with default ordering

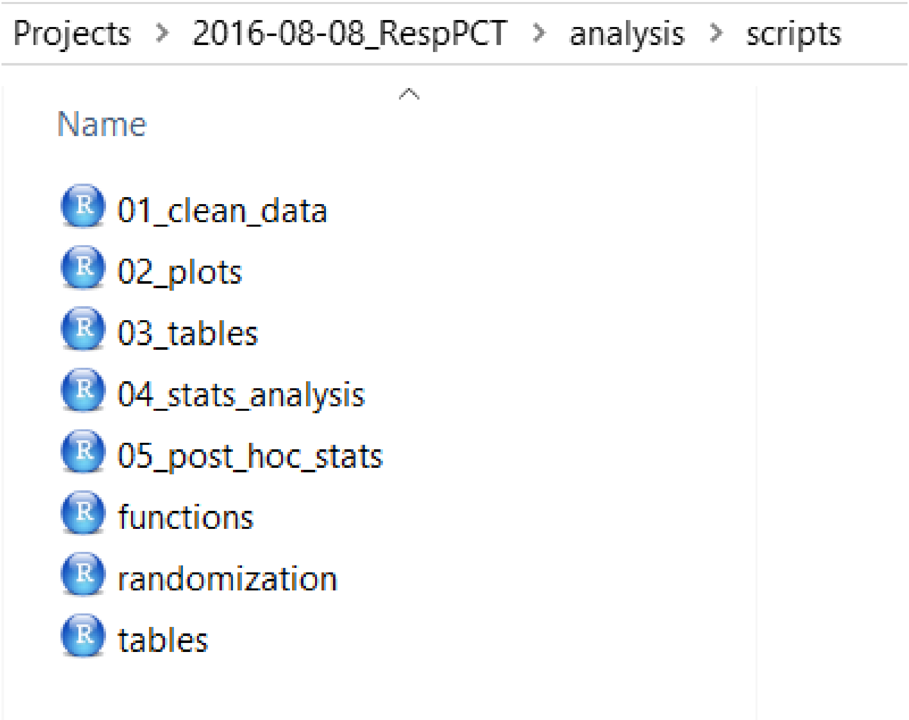
NO



Name

All unique 4a amino acid Sequences (B-N).fas
All unique 4a amino acid Sequences (B-N).meg
All_AA_haplotypes.meg
All_AA_haplotypes_with_clonal_sequences.meg
BS100_AA_with_clones
BS100_AA_with_clones.nwk
BS1000_AA_pyro&clones
BS1000_AA_pyro&clones.nwk
BS1000_AA_pyro_only
BS1000_AA_pyro_only.nwk
BS1000_Unique_Clonal_AA

Yes



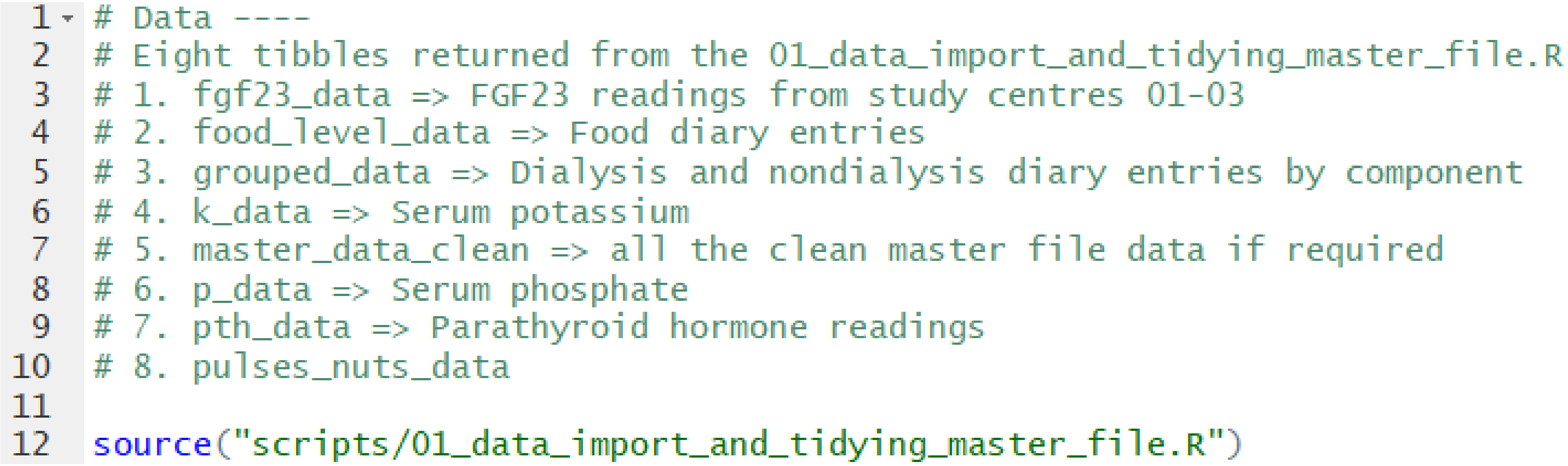
Projects › 2016-08-08_RespPCT › analysis › scripts

Name

01_clean_data
02_plots
03_tables
04_stats_analysis
05_post_hoc_stats
functions
randomization
tables

C: Joined up thinking

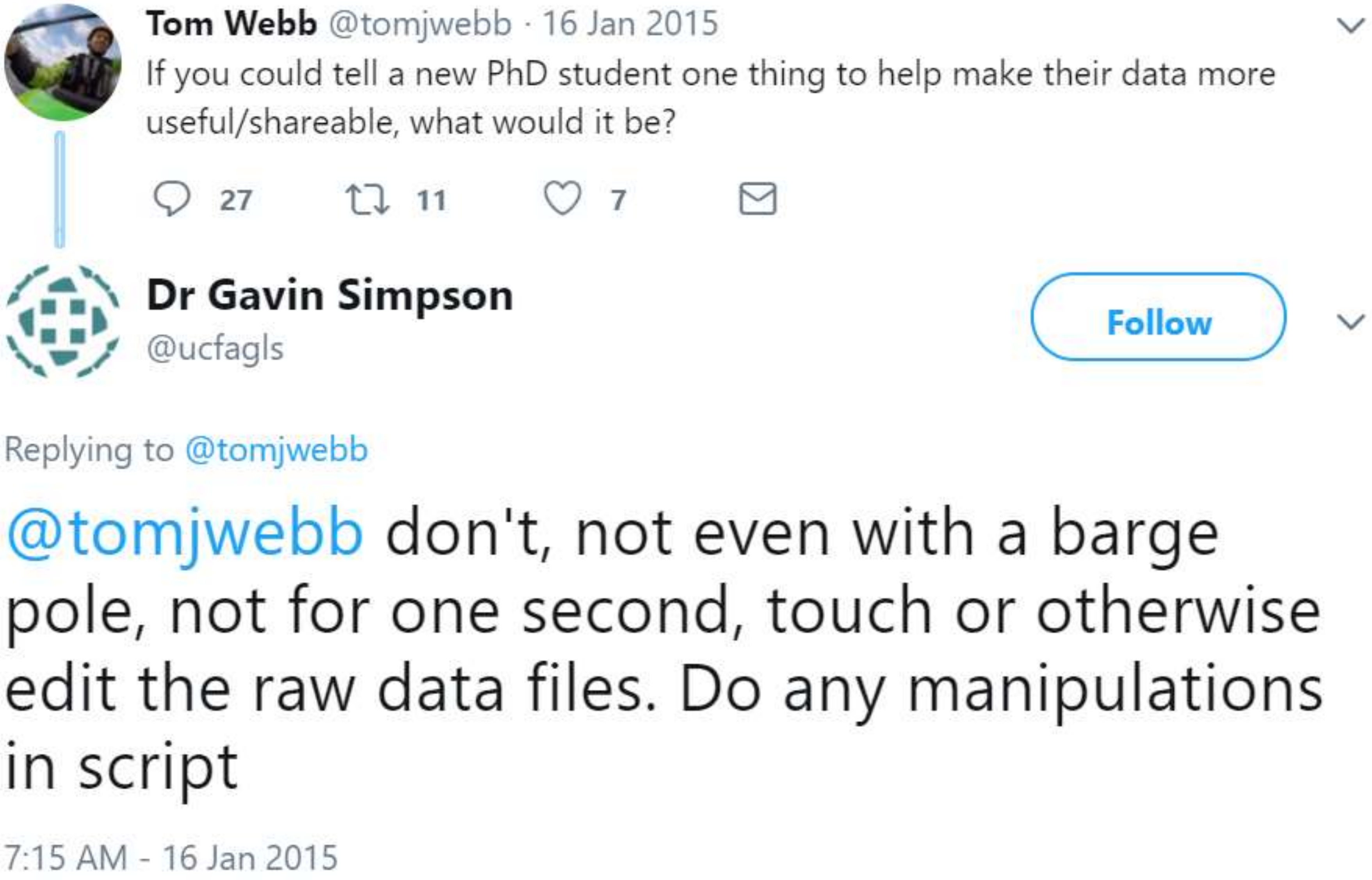
- The R scripts should also be human readable
    - Annotate the code
    - Break up the scripts into dedicated tasks
    - Interlink to other project scripts



```r
# Data ----
# Eight tibbles returned from the 01_data_import_and_tidying_master_file.R
# 1. fgf23_data => FGF23 readings from study centres 01-03
# 2. food_level_data => Food diary entries
# 3. grouped_data => Dialysis and nondialysis diary entries by component
# 4. k_data => Serum potassium
# 5. master_data_clean => all the clean master file data if required
# 6. p_data => Serum phosphate
# 7. pth_data => Parathyroid hormone readings
# 8. pulses_nuts_data

source("scripts/01_data_import_and_tidying_master_file.R")
```

Work from the raw data ALWAYS!!



Tom Webb @tomjwebb · 16 Jan 2015

If you could tell a new PhD student one thing to help make their data more useful/shareable, what would it be?

Dr Gavin Simpson
@ucfagls

Replying to @tomjwebb

@tomjwebb don't, not even with a barge pole, not for one second, touch or otherwise edit the raw data files. Do any manipulations in script

7:15 AM - 16 Jan 2015

D: R Markdown

- R Markdown combines the code you wrote, the output produced and you own comments

- You can view it as a digital lab notebook, where you are both recording what you're doing, and what you were thinking while you were doing it!

- R Markdown outputs can take many forms
    - Word documents, PDFs, slideshows etc.

- Once created the .Rmd file get sent to knitr, which executes the chunks of code and creates a new markdown document
    - this is then processed by pandoc which creates the finished file
        - knitr and pandoc are external websites

R Markdown

YAML header

```
---
title: “This is a reproducible document"
date: 19th June 2019
output: html_document
---
```

Chunks of code

~~~
```{r setup, include = FALSE}
library(ggplot2)
library(dplyr)
smaller <- diamonds %>%
filter(carat <= 2.5)
```
~~~

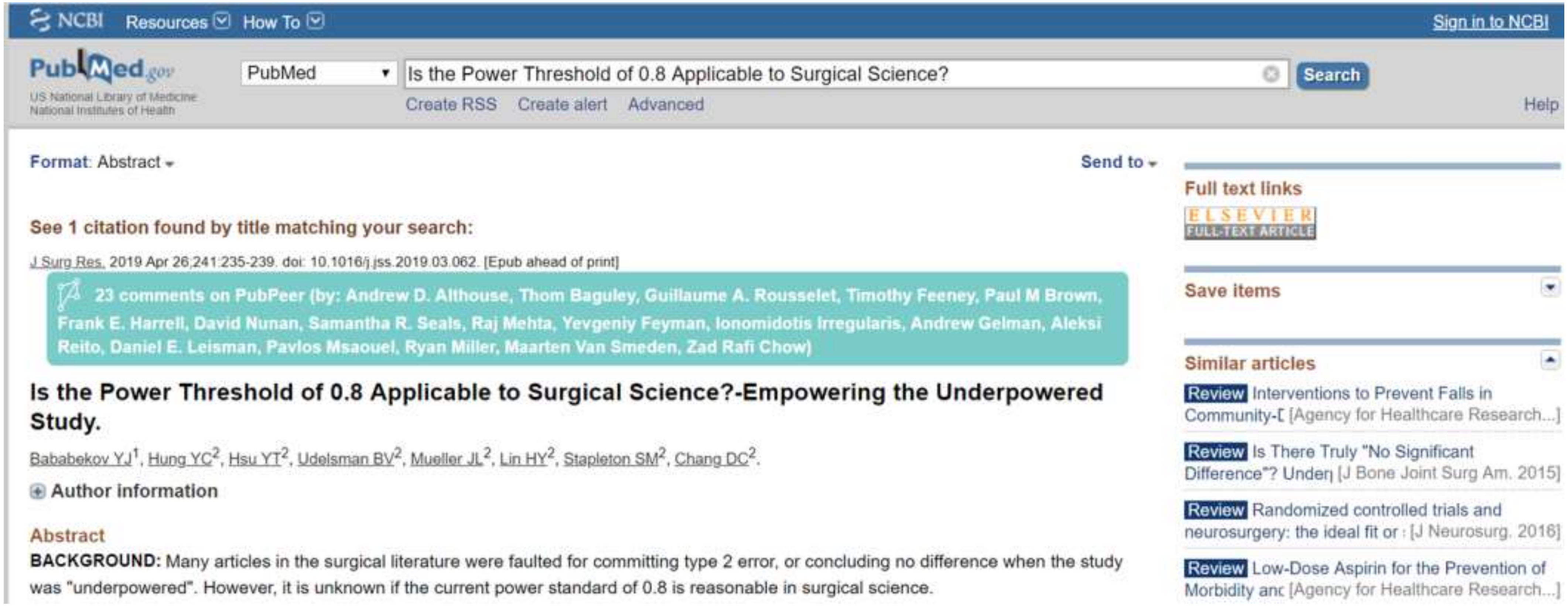
Plain text with data outputs from R code

```
We have data about `r nrow(diamonds)`
diamonds. Only
`r nrow(diamonds) - nrow(smaller)` are
larger than
2.5 carats. The distribution of the
remainder is shown below:
```

Chunks of code

~~~
```{r, echo = FALSE}
smaller %>%
ggplot(aes(carat)) +
geom_freqpoly(binwidth = 0.01)
```
~~~

Install the Chrome plugin PubPeer



Is the Power Threshold of 0.8 Applicable to Surgical Science?

See 1 citation found by title matching your search:

J Surg Res. 2019 Apr 26;241:235-239. doi: 10.1016/j.jss.2019.03.062. [Epub ahead of print]

23 comments on PubPeer (by: Andrew D. Althouse, Thom Baguley, Guillaume A. Rousselet, Timothy Feeney, Paul M Brown, Frank E. Harrell, David Nunan, Samantha R. Seals, Raj Mehta, Yevgeniy Feyman, Ionomidotis Irregularis, Andrew Gelman, Aleksi Reito, Daniel E. Leisman, Pavlos Msaouel, Ryan Miller, Maarten Van Smeden, Zad Rafi Chow)

Is the Power Threshold of 0.8 Applicable to Surgical Science?-Empowering the Underpowered Study.

Bababekov YJ[1], Hung YC[2], Hsu YT[2], Udelsman BV[2], Mueller JL[2], Lin HY[2], Stapleton SM[2], Chang DC[2].

⊕ Author information

Abstract

BACKGROUND: Many articles in the surgical literature were faulted for committing type 2 error, or concluding no difference when the study was "underpowered". However, it is unknown if the current power standard of 0.8 is reasonable in surgical science.

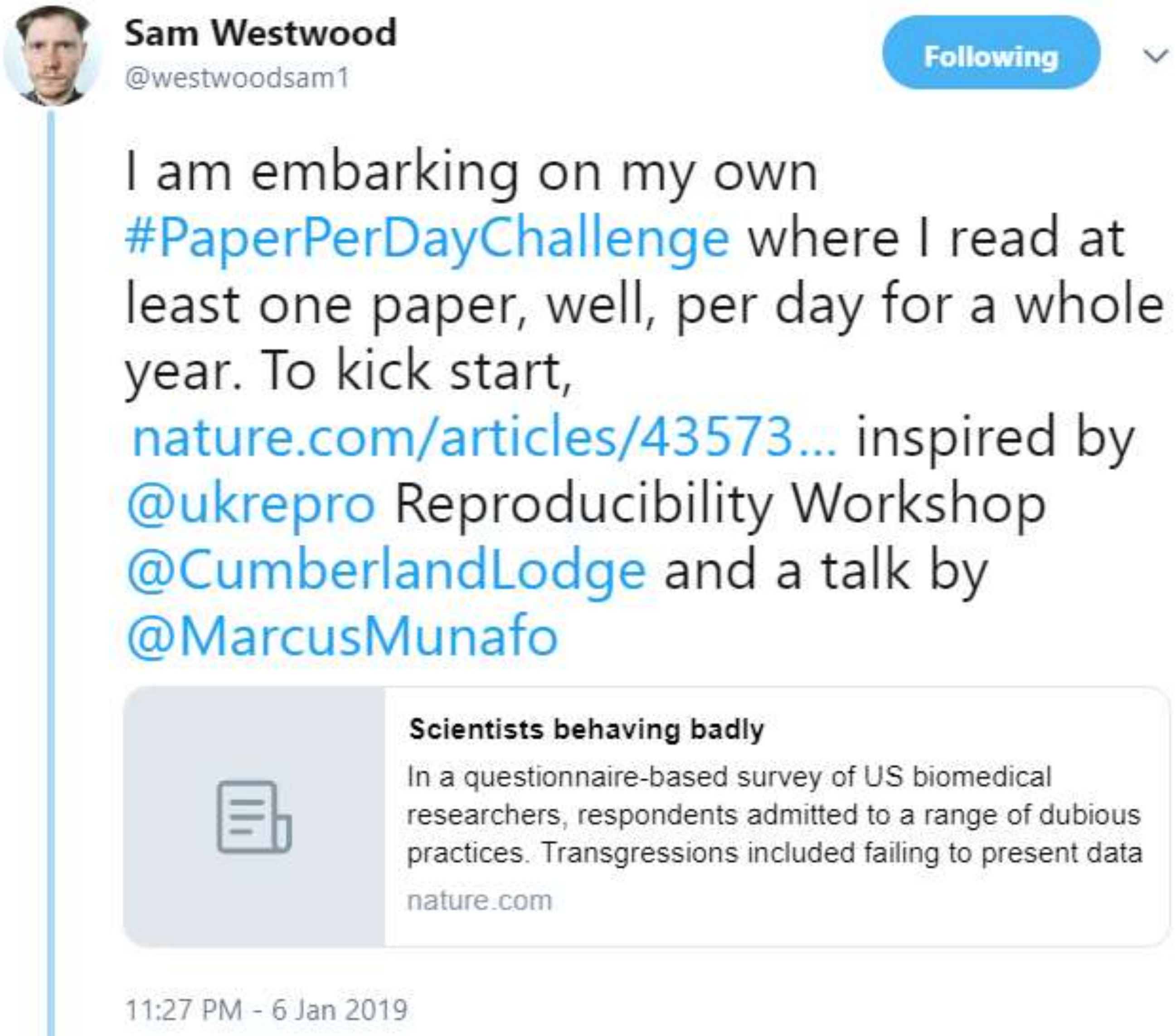
Review Interventions to Prevent Falls in Community-[[Agency for Healthcare Research...]

Review Is There Truly "No Significant Difference"? Under[[J Bone Joint Surg Am. 2015]

Review Randomized controlled trials and neurosurgery: the ideal fit or : [J Neurosurg. 2016]

Review Low-Dose Aspirin for the Prevention of Morbidity anc [Agency for Healthcare Research...]

Further reading



Sam Westwood
@westwoodsam1

I am embarking on my own #PaperPerDayChallenge where I read at least one paper, well, per day for a whole year. To kick start, nature.com/articles/43573… inspired by @ukrepro Reproducibility Workshop @CumberlandLodge and a talk by @MarcusMunafo

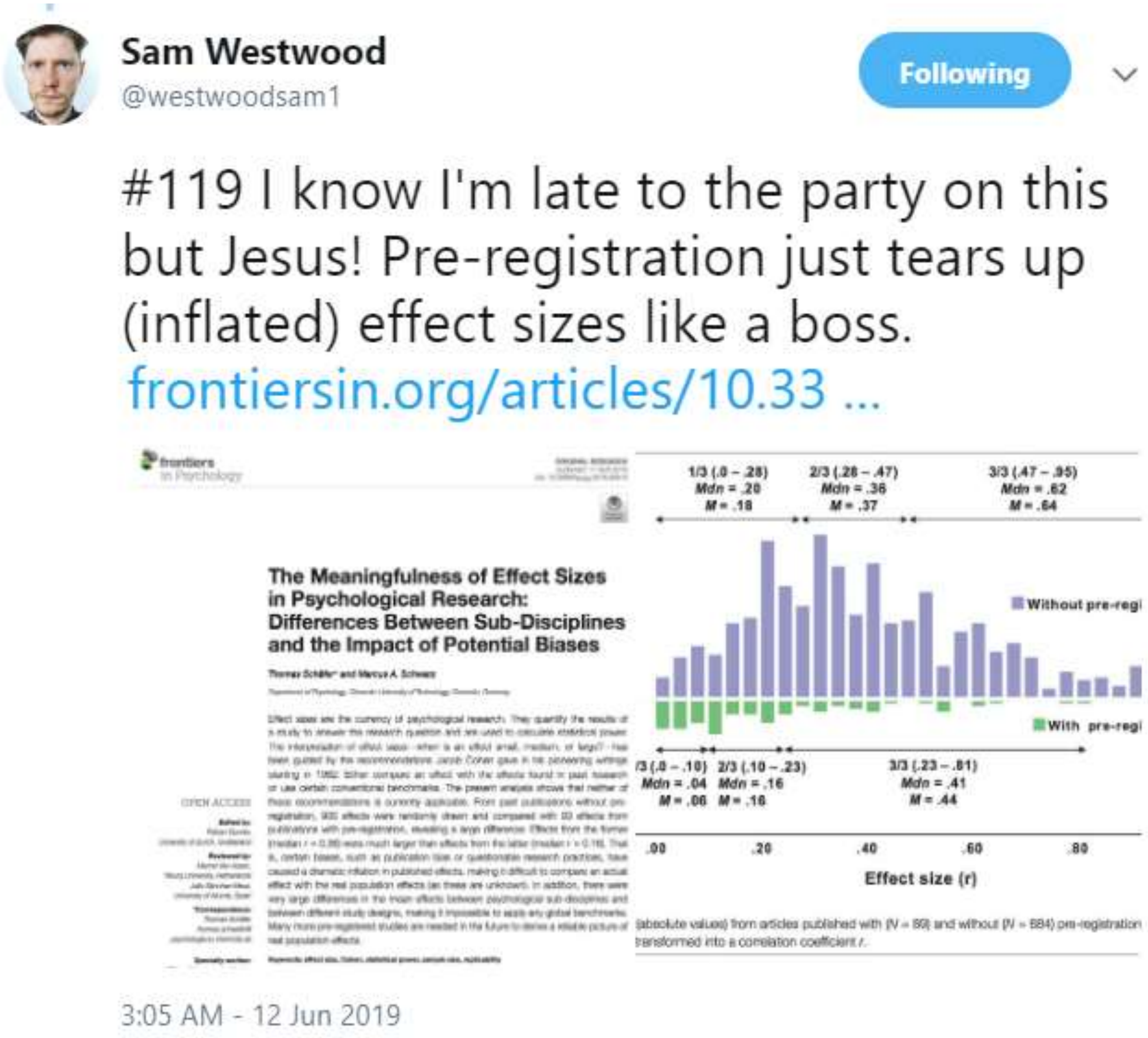
Scientists behaving badly

In a questionnaire-based survey of US biomedical researchers, respondents admitted to a range of dubious practices. Transgressions included failing to present data

nature.com

11:27 PM - 6 Jan 2019

Further reading



Sam Westwood
@westwoodsam1

#119 I know I'm late to the party on this but Jesus! Pre-registration just tears up (inflated) effect sizes like a boss. frontiersin.org/articles/10.33 ...

The Meaningfulness of Effect Sizes in Psychological Research: Differences Between Sub-Disciplines and the Impact of Potential Biases

Thomas Schäfer* and Marcus A. Schwarz

Department of Psychology, Chemnitz University of Technology, Chemnitz, Germany

Effect sizes are the currency of psychological research. They quantify the results of a study to answer the research question and are used to calculate statistical power. The interpretation of effect sizes—when is an effect small, medium, or large?—has been guided by the recommendations Jacob Cohen gave in his pioneering writings starting in 1962: Either compare an effect with the effects found in past research or use certain conventional benchmarks. The present analysis shows that neither of these recommendations is currently applicable. From past publications without pre-registration, 900 effects were randomly drawn and compared with 93 effects from publications with pre-registration, revealing a large difference: Effects from the former (median r = 0.36) were much larger than effects from the latter (median r = 0.16). That is, certain biases, such as publication bias or questionable research practices, have caused a dramatic inflation in published effects, making it difficult to compare an actual effect with the real population effects (as these are unknown). In addition, there were very large differences in the mean effects between psychological sub-disciplines and between different study designs, making it impossible to apply any global benchmarks. Many more pre-registered studies are needed in the future to derive a reliable picture of real population effects.

OPEN ACCESS

Edited by:

Reviewed by:

Correspondence:

Specialty section:

Keywords: effect size, Cohen, statistical power, sample size, replicability

(absolute values) from articles published with (N = 89) and without (N = 684) pre-registration transformed into a correlation coefficient r.

3:05 AM - 12 Jun 2019