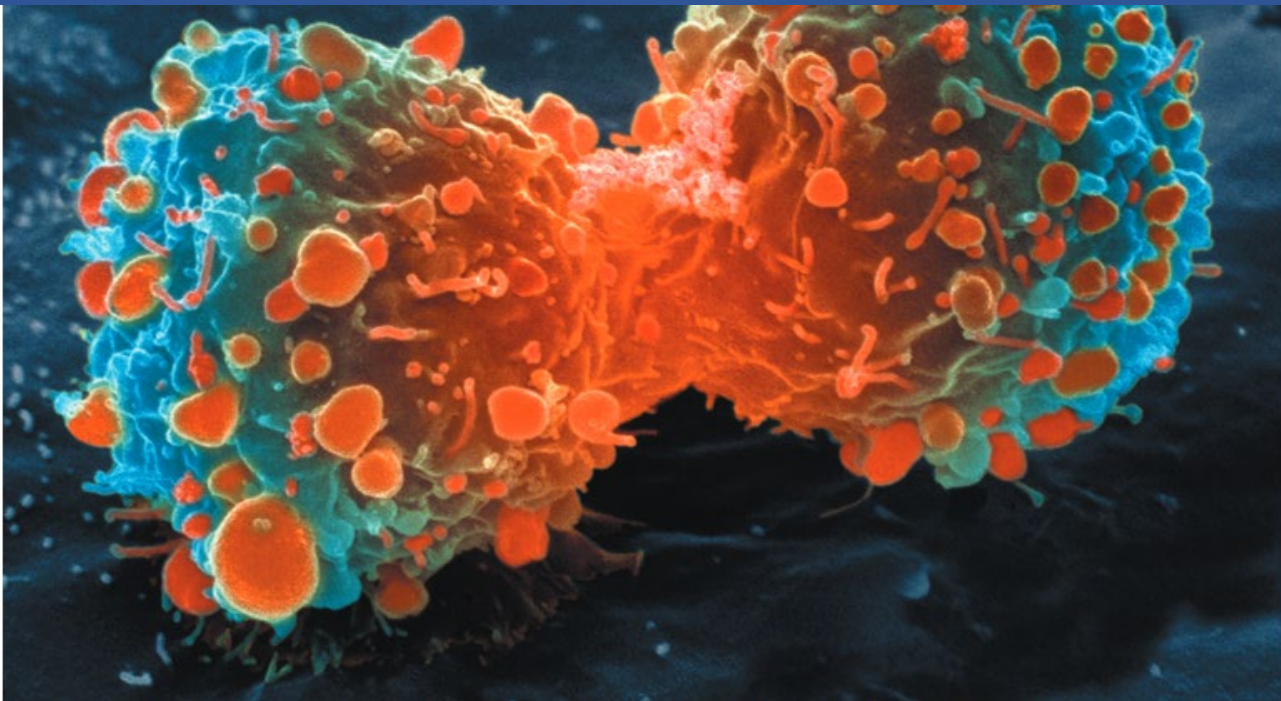


# Rigor & Reproducibility: Why Libraries?

Melissa L. Rethlefsen, MSLS  
Associate Dean, George A. Smathers Libraries &  
Fackler Director, Health Science Center Libraries



Many landmark findings in preclinical oncology research are not reproducible, in part because of inadequate cell lines and animal models.

# Raise standards for preclinical cancer research

C. Glenn Begley and Lee M. Ellis propose how methods, publications and incentives must change if patients are to benefit.

Over the past decade, before pursuing a particular line of research, scientists (including C.G.B.) in the haematology and oncology department at the biotechnology firm Amgen in Thousand Oaks, California, tried to confirm published findings related to that work. Fifty-three papers were deemed 'landmark' studies (see 'Reproducibility of research findings'). It was acknowledged from the outset that some of the data might not hold up, because papers were deliberately selected that described something completely new, such as fresh approaches to targeting cancers or alternative clinical uses for existing therapeutics.

Nevertheless, scientific findings were confirmed in only 6 (11%) cases.

Even knowing the limitations of preclinical research, this was a shocking result.

# Estimating the reproducibility of psychological science

Open Science Collaboration<sup>\*,†</sup>

+ See all authors and affiliations

Science 28 Aug 2015:  
Vol. 349, Issue 6251, aac4716  
DOI: 10.1126/science.aac4716

Original Investigation

## Evolution of Reporting *P* Values in the Biomedical Literature, 1990-2015

David Chavalarias, PhD; Joshua David Wallach, BA; Alvin Ho Ting Li, BHSc; John P. A. Ioannidis, MD, DSC

## Biomedical researchers lax about validating antibodies for experiments

A common research component could under-

## Sex bias exists in basic science and translational surgical research

Dustin Y. Yoon, MD, MS, Neel A. Mansukhani, MD, Vanessa C. Stubbs, MD  
Teresa K. Woodruff, PhD, Melina R. Kibbe, MD

PlumX Metrics

DOI: <http://dx.doi.org/10.1016/j.surg.2014.07.001>

## HARKing: Hypothesizing After the Results are Known

Norbert L. Kerr  
Department of Psychology  
Michigan State University

## The Extent and Consequences of P-Hacking in Science

Megan L. Head, Luke Holman, Rob Lanfear, Andrew T. Kahn, Michael D. Jennions

Published: March 13, 2015 • <https://doi.org/10.1371/journal.pbio.1002106>

# SLICED & DICED

## The Inside Story Of How An Ivy League Food Scientist Turned Shoddy Data Into Viral Studies

Brian Wansink won fame, funding, and influence for his science-backed advice on healthy eating. Now, emails show how the Cornell professor and his colleagues have hacked and massaged low-quality data into headline-friendly studies to “go virally big time.”

Posted on February 25, 2018, at 5:45 p.m.

Wansink also acknowledged the paper was weak as he was preparing to submit it to journals. The p-value was 0.06, just shy of the gold standard cutoff of 0.05. It was a “sticking point,” as he put it in a Jan. 7, 2012, email.

“It seems to me it should be lower,” he wrote, attaching a draft. “Do you want to take a look at it and see what you think. If you can get the data, and it needs some tweeking, it would be good to get that one value below .05.”

# Promoting an open research culture

Author guidelines for journals could help to promote transparency, openness, and reproducibility

By **B. A. Nosek,\* G. Alter, G. C. Banks, D. Borsboom, S. D. Bowman, S. J. Breckler, S. Buck, C. D. Chambers, G. Chin, G. Christensen, M. Contestabile, A. Dafoe, E. Eich, J. Freese, R. Glennerster, D. Goroff, D. P. Green, B. Hesse, M. Humphreys, J. Ishiyama, D. Karlan, A. Kraut, A. Lupia, P. Mabry, T. A. Madon, N. Malhotra, E. Mayo-Wilson, M. McNutt, E. Miguel, E. Levy Paluck, U. Simonsohn, C. Soderberg, B. A. Spellman, J. Turitto, G. VandenBos, S. Vazire, E. J. Wagenmakers, R. Wilson, T. Yarkoni**

**T**ransparency, openness, and reproducibility are readily recognized as



<http://cos.io/top>

# TOP Guidelines 8 Standards

1. Data citation
2. Data transparency
3. Analytic methods (code) transparency
4. Research materials transparency
5. Design and analysis transparency
6. Preregistration of studies
7. Preregistration of analysis plans
8. Replication

# Reporting guidelines



CONSORT

TRANSPARENT REPORTING of TRIALS



equator  
network

**Enhancing the QUALity and  
Transparency Of health Research**

# Preregistration

 U.S. National Library of Medicine

*ClinicalTrials.gov*

## Open Science Framework

A scholarly commons to connect the entire research cycle





# Establish a workflow

Google

All **Images** Videos News Shopping More Settings Tools View saved SafeSearch

jupyter notebook docker hadley capital reproducible research computational diagram carto data visualization python repeatability output workshop

**Stage III: Data Analysis**

preprocessed data (stored on SD) → non-reproducible preprocessing on supercomputer → cached results (stored on SD) → compare VM results to cached results → autogenerate LaTeX tables → manuscript (LaTeX)

Generate python package → run everything on local computer → run everything on VM → generate local web reports → organize code into github repo

Identify software dependencies (R, python, binary) → create virtual machines using vagrant

Acquire data → Reformat and clean data → Explore alternatives → Edit analysis scripts → Execute scripts → Inspect outputs → Write reports → Take notes → Hold meetings → Share experiment

Reflection → Dissemination → Deploy online → Archive experiment

report Rmd → knit → report md → bookdown → pandoc → report pdf, report html, report docx

**Fig 3** Relationships among the different R packages and tools used to generate reports from RMarkdown files.

**Stage I: Data Input** → **Stage II: Data Processing** → **Stage III: Data Analysis**

**Methodology**

Generate Abstract Workflow → Create an executable workflow → Refine workflow → Annotate and check quality → Bundle Resources into a Research Object

**Lab Notebook**

GitHub repo: by year repo layout, jekyll archive, figshare

Stages I, II, III

Publication: GitHub repo: by project repo layout, R package archive, zenodo

**Traditional business analysis'** focus on solving a specific case is a barrier to reproducible thinking.

Scientist: Abstraction → Specific Business Cases

Reproducibility Taxonomy (Stodden et al., 2012): Open/Reproducible, Auditable, Collaborative, Replicable, Reviewable

Waiting for www.google.com...

# Data and analysis sharing

## Open Science Framework

A scholarly commons to connect the entire research cycle



**GitHub**



**box**



# Vision

The Smathers Libraries  
drive research integrity  
and quality across  
campuses

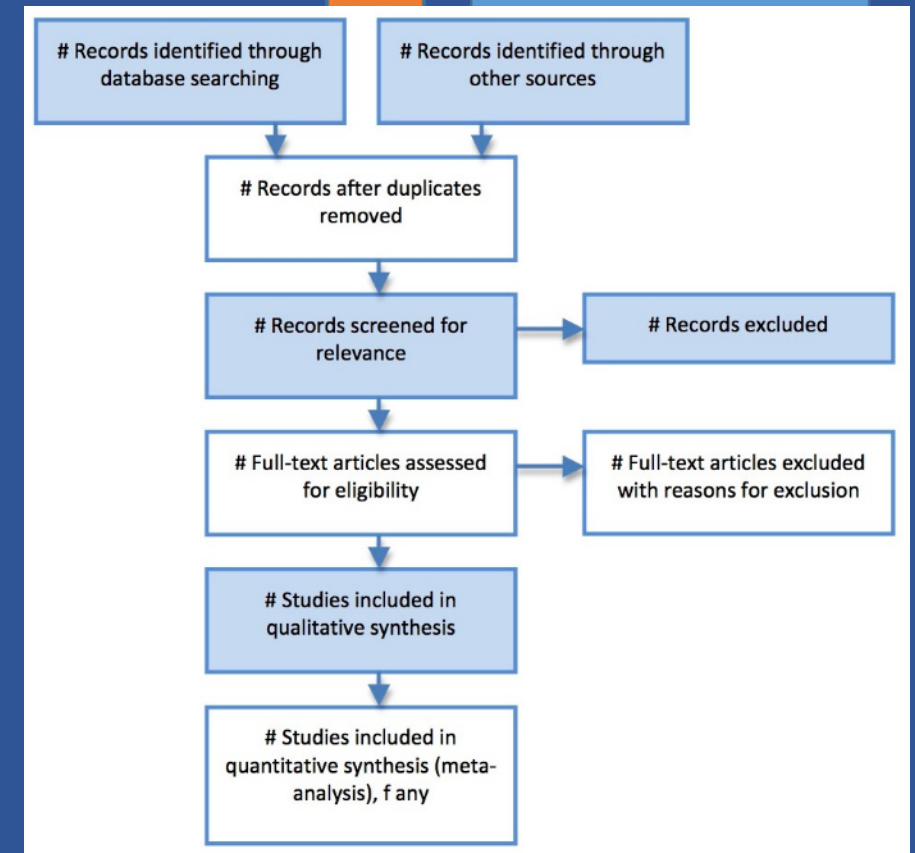


# Systematic Review Service with CTSI

CTSI/HSCL Systematic Review Service launching this year

Librarian participation on systematic review teams is correlated with improved:

- Reproducibility
- Quality
- Adherence to Standards



# Reproducibility

- Hiring Reproducibility Librarian
- Alignment of data and reproducibility services
  - ARCS (Academic Research & Consulting Services)
  - HSCL faculty with data interest
- Institutional software to support reproducibility
  - OSF
  - GitHub for Education
- Data repository (non-clinical)
- Research Reproducibility conference



# Questions?

Thank you!

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