BIOLOGICAL DATA ANALYSIS

THE RIGHT WAY
JUN 6-10, 2016

CONTACTS

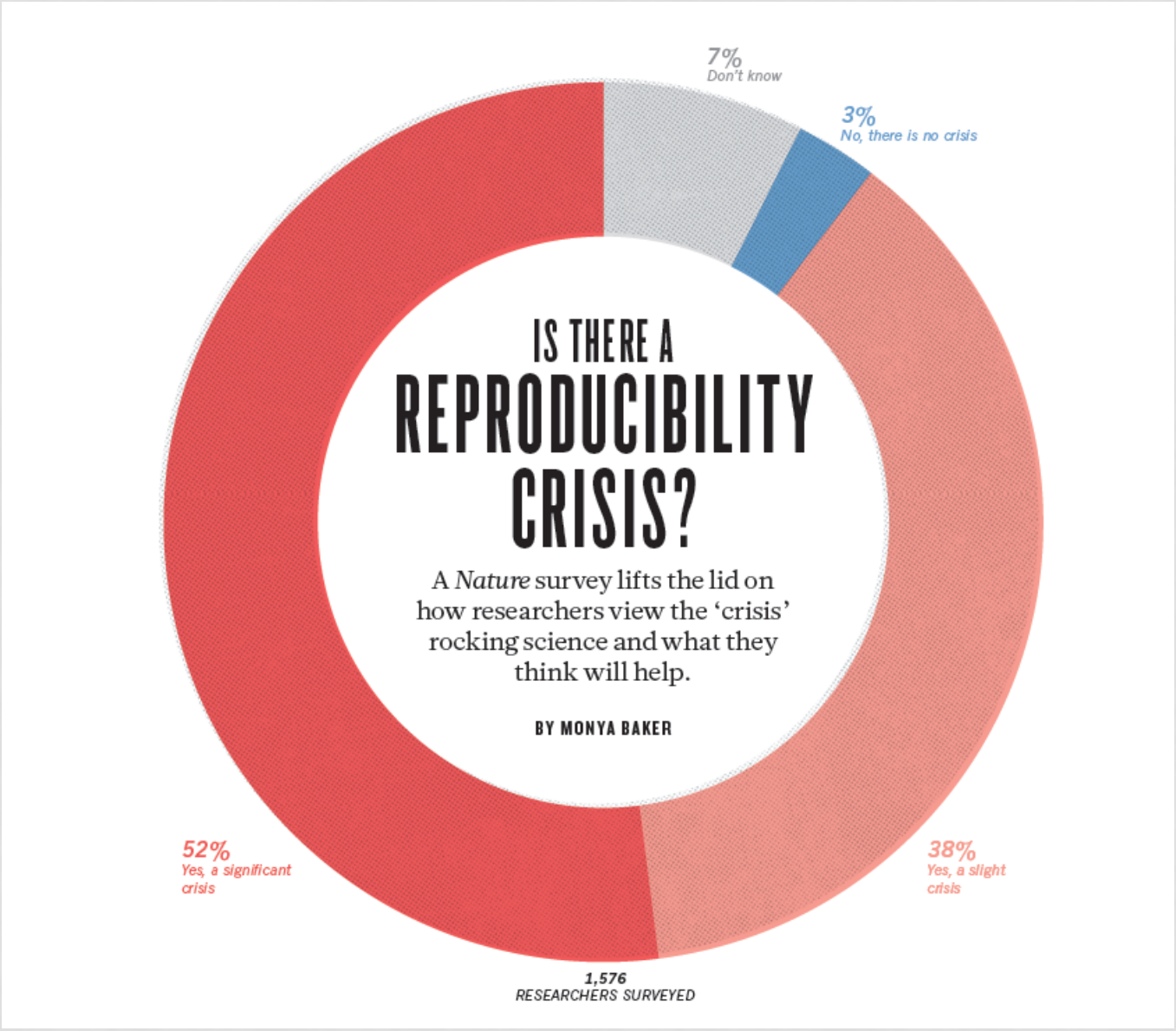
- Di Bruce Chen
  - dxc385@psu.edu
- Dana Coval-Dinant
  - 101 LSB
  - dmc6@psu.edu
- Cooduvalli Shashikant
  - css13@psu.edu
  - 814-883-5572 (cell)

BOOT CAMP

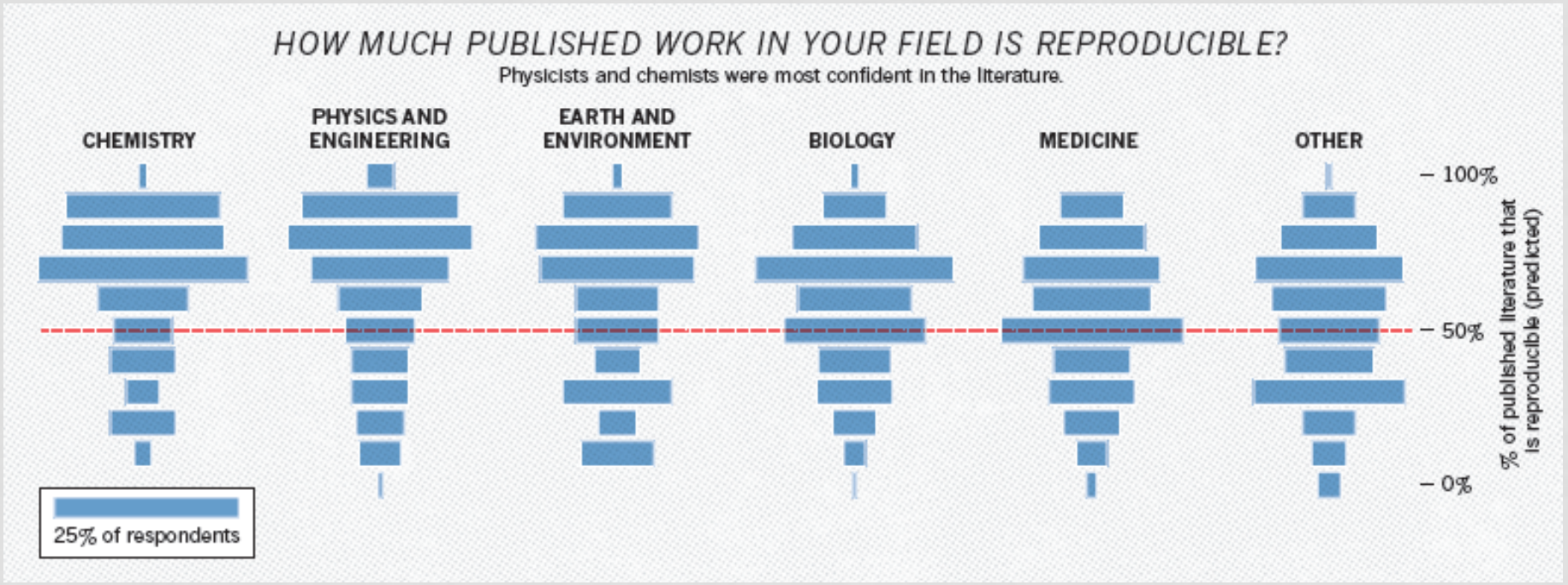
- Monday: Perspectives on Data Reproducibility
- Tuesday: Software Carpentry
- Wednesday: Statistical Analysis
- Thursday: Reproducible Research with Galaxy
- Friday: Summaries and Reviews

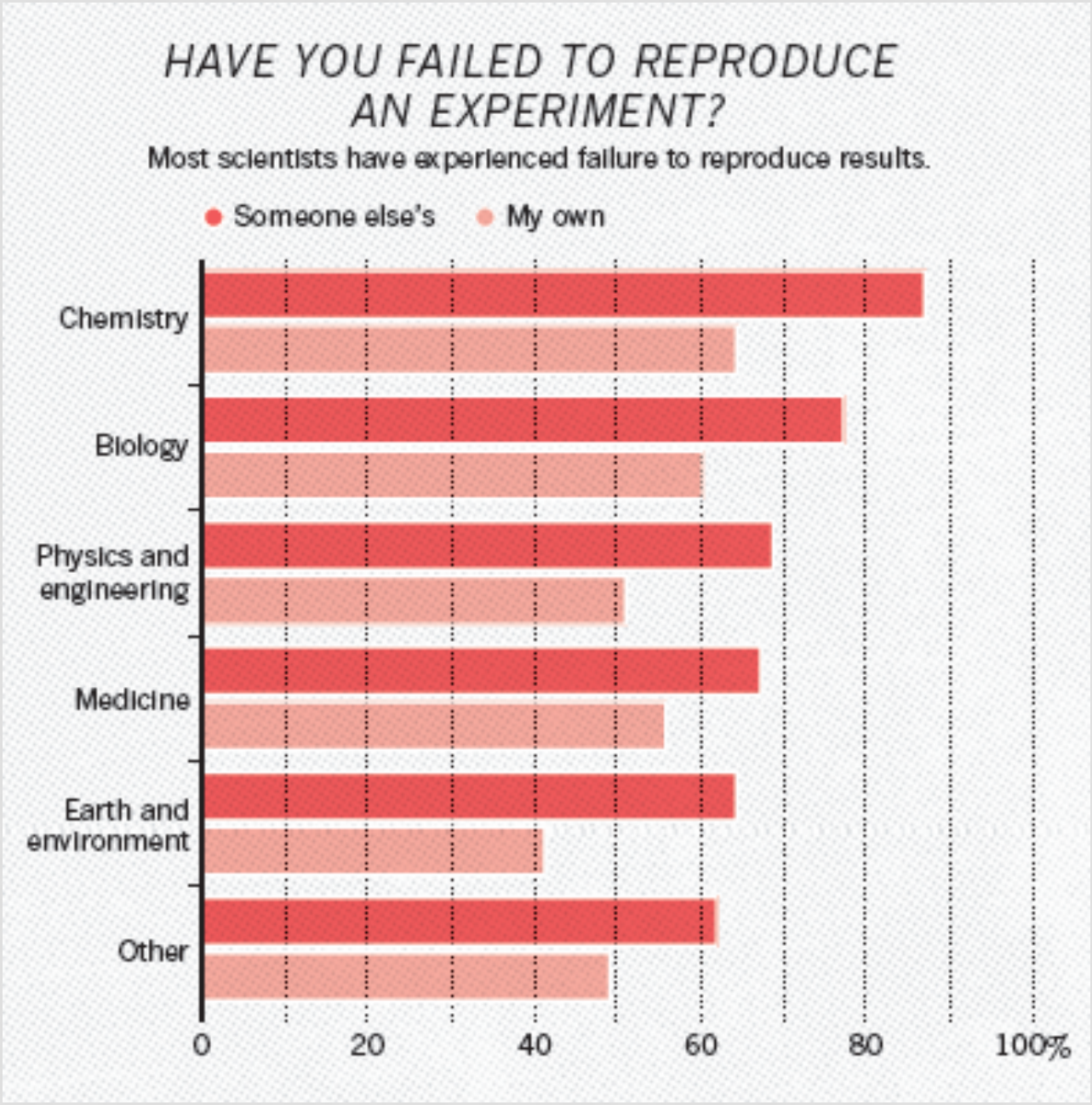
MONDAY
PERSPECTIVES ON DATA REPRODUCIBILITY

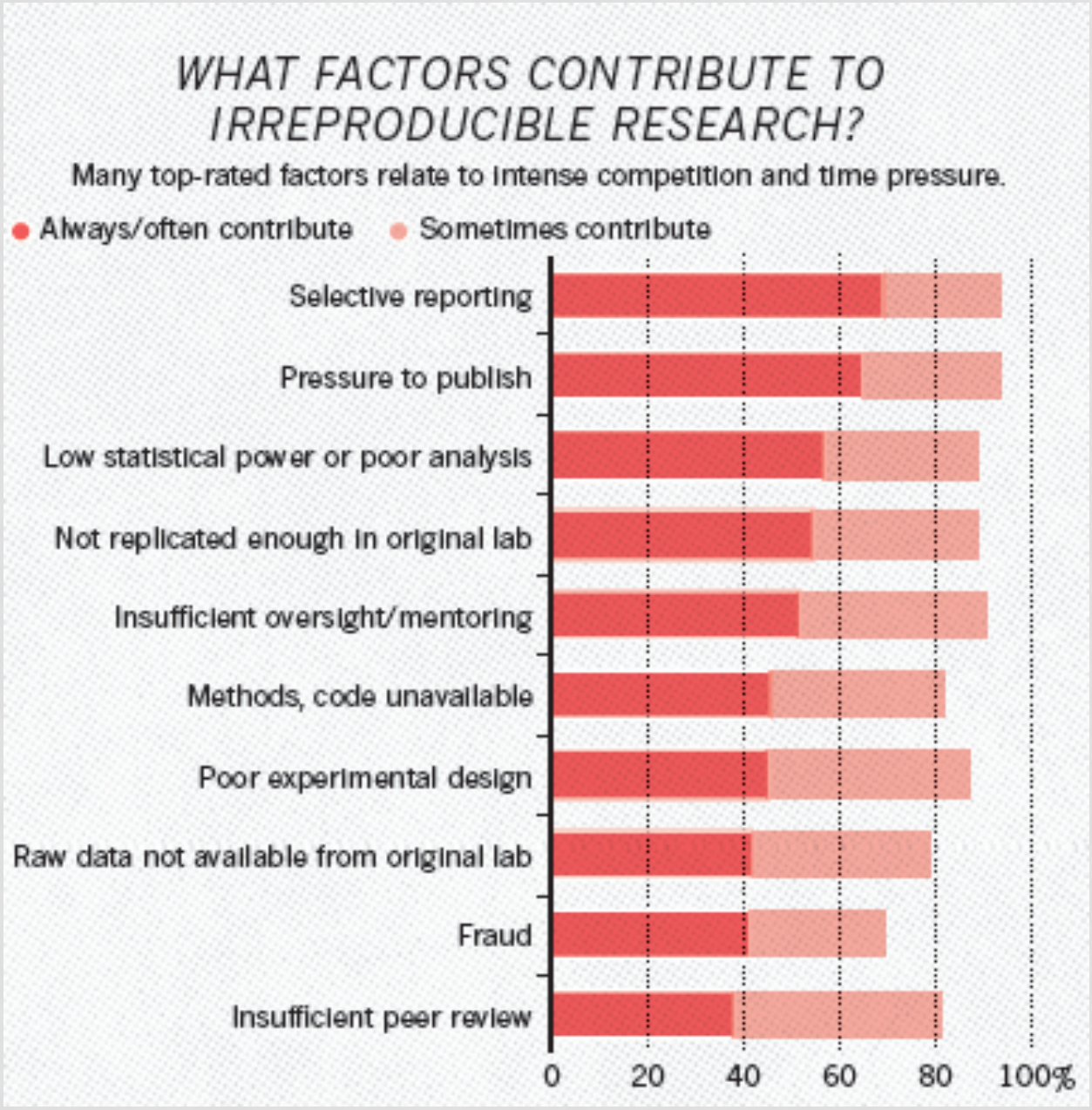
- 8:45 - 9:00 **Coffee and light breakfast**
- 9:00 - 9:45 Dr. Cooduvalli Shashikant
- 9:45 - 9:55 Dr. Frank Pugh
- 9:45 - 10:30 Dr. Ross Hardison
- 10:30 - 11:00 **Coffee break**
- 11:00 - 11:45 Dr. Qunhua Li
- 12:00 - 1:30 **Lunch (provided)**
- 1:30 - 2:15 Dr. George Perry
- 2:15 - 3:00 Dr. James Broach
- 3:00 - 3:30 **Coffee break**
- 3:30 - 4:15 Watch the Baggerly video
- 4:15 - 5:00 Software review and installation
- 6:00 - 7:30 **Dinner (not provided)**
- 7:30 - 9:00 R tutorials by Dr. Naomi Altman

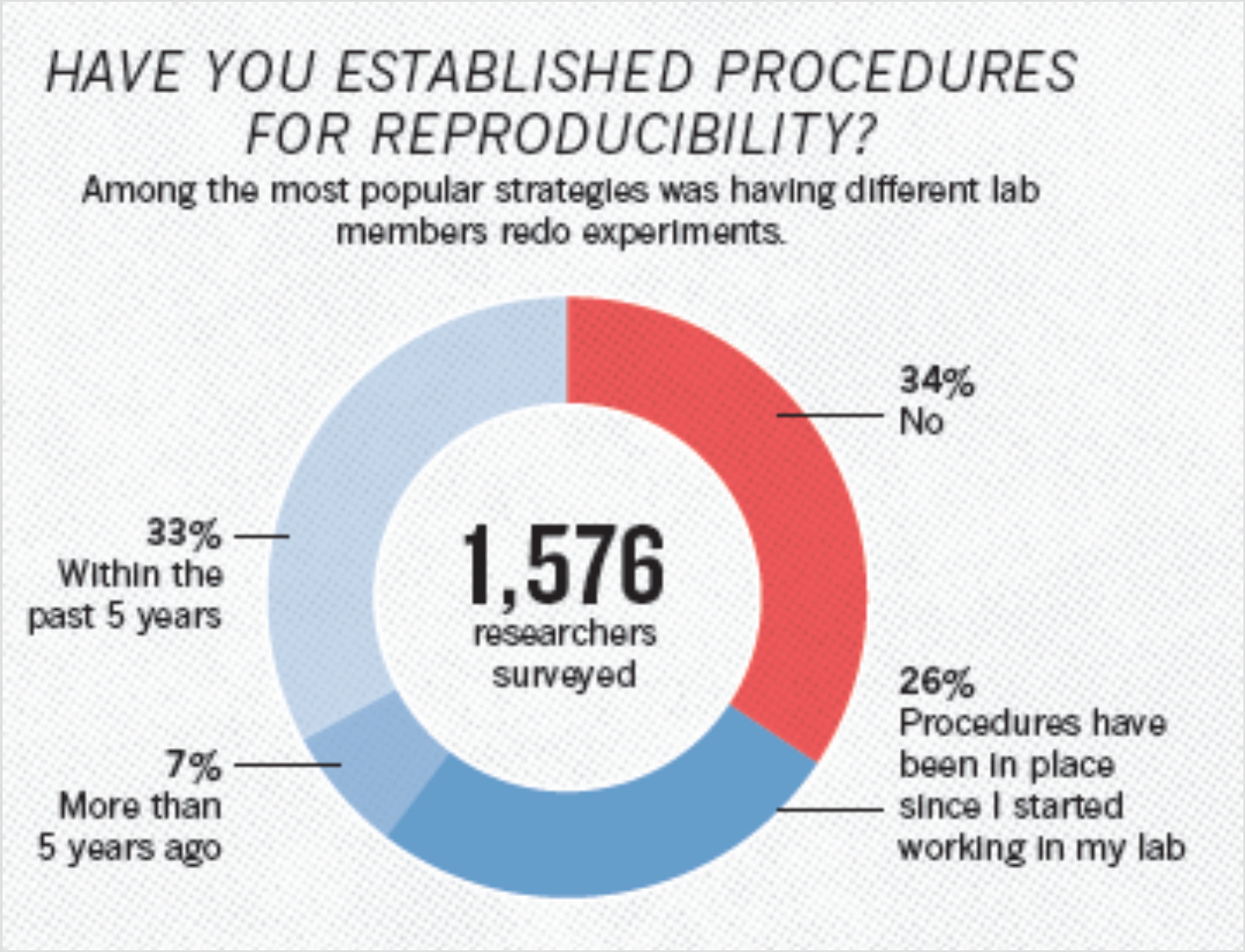


http://www.nature.com.ezaccess.libraries.psu.edu/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970


HOW MUCH PUBLISHED WORK IN YOUR FIELD IS REPRODUCIBLE?
Physicists and chemists were most confident in the literature.
CHEMISTRY
PHYSICS AND ENGINEERING
EARTH AND ENVIRONMENT
BIOLOGY
MEDICINE
OTHER
100%
50%
0%
% of published literature that is reproducible (predicted)
25% of respondents


HAVE YOU FAILED TO REPRODUCE AN EXPERIMENT?
Most scientists have experienced failure to reproduce results.
Someone else's
My own
Chemistry
Biology
Physics and engineering
Medicine
Earth and environment
Other
0
20
40
60
80
100%


WHAT FACTORS CONTRIBUTE TO IRREPRODUCIBLE RESEARCH?
Many top-rated factors relate to intense competition and time pressure.
Always/often contribute
Sometimes contribute
Selective reporting
Pressure to publish
Low statistical power or poor analysis
Not replicated enough in original lab
Insufficient oversight/mentoring
Methods, code unavailable
Poor experimental design
Raw data not available from original lab
Fraud
Insufficient peer review
0
20
40
60
80
100%


HAVE YOU ESTABLISHED PROCEDURES FOR REPRODUCIBILITY?
Among the most popular strategies was having different lab members redo experiments.
34%
No
26%
Procedures have been in place since I started working in my lab
7%
More than 5 years ago
33%
Within the past 5 years
1,576
researchers surveyed

THE NIH INITIATIVE

- ‘NIH has become increasingly concerned that students may not be receiving adequate training early in graduate school in experimental design and other skills related to conducting rigorous and reproducible research’

NEW GRANT GUIDELINES

what you need to know

WHY UPDATE THE GUIDELINES?

The updates focus on four areas deemed important for enhancing rigor and transparency:

1. **PREMISE** — The scientific premise forming the basis of the proposed research
2. **DESIGN** — Rigorous experimental design for robust and unbiased results
3. **VARIABLES** — Consideration of relevant biological variables
4. **AUTHENTICATION** — Authentication of key biological and/or chemical resources

Send inquiries to reproducibility@nih.gov

See also NIH Notice NOT-OD-16-011
http://grants.nih.gov/grants/guide/notice-files/NOT-OD-16-011.html

WHAT ARE THE UPDATES?

1 UPDATES TO RESEARCH STRATEGY GUIDANCE

The research strategy is where you discuss the significance, innovation, and approach of your research plan. Let's look at an R01, for example:

The new **research strategy** guidelines require that you:

- State the strengths and weakness of published research or preliminary data crucial to the support of your application
- Describe how your experimental design and methods will achieve robust and unbiased results
- Explain how biological variables, such as sex, are factored into research design and provide justification if only one sex is used

2 NEW ATTACHMENT FOR AUTHENTICATION OF KEY BIOLOGICAL AND/OR CHEMICAL RESOURCES

From now on, you must briefly describe methods to ensure the identity and validity of key biological and/or chemical resources used in the proposed studies.

These include, but are not limited to:

CELL LINES · ANTIBODIES · SPECIALTY CHEMICALS · OTHER BIOLOGICS

Standard laboratory reagents that are not expected to vary do not need to be included in the plan. Examples are buffers and other common biologicals or chemicals.

- **DO NOT** put experimental methods *or preliminary data in this section*
- **DO** focus on authentication and validation of key resources

3 NEW REVIEWER GUIDELINES

Here are the additional criteria the reviewers will be asked to use:

- Is there a **strong scientific premise** for the project?
- Have the investigators presented adequate plans to address **relevant biological variables**, such as sex, for studies in vertebrate animals or human subjects?
- Have the investigators presented strategies to ensure a **robust and unbiased approach**, as appropriate for the work proposed?

Reviewers will also be asked to comment on that new attachment (see Update 2)!

http://grants.nih.gov/reproducibility/index.htm

TRAINING GRANTS

- Training grants, Career Development and Individual fellowships will require formal instructions in
  - Rigorous experimental design
  - Transparency to enhance reproducibility
- Boot camp supported under ‘Administrative supplements to NIGMS Predoctoral Training Grants (PA-15-136)’
- PSU commitment to conduct boot camp for next five years

ENHANCING REPRODUCIBILITY

- Francis Collins and Lawrence Tabak
  - http://www.nature.com/news/policy-nih-plans-to-enhance-reproducibility-1.14586
- NIGMS site:
  - http://grants.nih.gov/reproducibility/index.htm
  - http://grants.nih.gov/grants/policy/rigor/NIH_Policy_Rigor_For_Reviewers/presentation.html
- Nature collection of articles
  - http://www.nature.com/news/reproducibility-1.17552