



hms | hsdm

## office for postdoctoral fellows

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### **Research Rigor & Reproducibility Training for HMS Postdoctoral Fellows**

*Requirements for Formal Instruction in Rigorous Experimental Design and Transparency to Enhance Reproducibility:* NOT-OD-16-034 provides notice of NIH's new Requirements for Formal Instruction in Rigorous Experimental Design and Transparency to Enhance Reproducibility for training grants, career development awards, and individual fellowships. <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-16-034.html>

For Fellowships a "more detailed description of instruction in rigorous experimental design to ensure reproducibility will be required in the section on Institutional Environment and Commitment to Training" Thus, the requirement for formal instruction also applies to postdoctoral fellows applying for an F32, and thus, departments will need to have formal instruction if the school or University does not provide a generalized training course.

#### **Experimental Design for Postdocs (4h)**

*Instructor:* David Glass, MD, Executive Director, Muscle Diseases, Novartis Institutes for Biomedical Research and Lecturer, Department of Cell Biology, HMS

*Description:* Before generating publication quality data, researchers must focus on proper experimental design. In this half-day course, postdocs will be reintroduced to the concepts of asking when, how, and whether hypotheses or questions should be used to frame experiments, and how these frameworks may perturb experimental design and interpretation.

This half-day course will cover the following topics:

- I. Experimental Frameworks
- II. System Validation
- III. Experimental Controls
- IV. Data Gathering, Interpretation & Model Building

*Based on elements from Glass' book and Cell Biology Course entitled "Experimental Design for Biologists".*

#### **Best Practices for Biomedical Research Data Management (2h Workshop; 20h Online Course)**

*Instructors:* Julie Goldman, Research Data Services Librarian, HMS  
and P. Scott Lapinski, Scholarly Communication & Research Librarian, HMS

*Description:* Biomedical research today is not only rigorous, innovative and insightful, it also has to be organized and reproducible. With more capacity to create and store data, there is the challenge of making data discoverable, understandable, and reusable. Many funding agencies and journal publishers are requiring publication of relevant data to promote open science and reproducibility of research. In order to meet to these requirements and evolving trends, researchers and information professionals will need the data management and curation knowledge and skills to support the access, reuse and preservation of data. This course is designed to address present and future data management needs.



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### **Research Irreproducibility: The Seven Deadly Selection Biases (2h)**

*Instructor:* Xiao-Li Meng, PhD, Dean, Graduate School of Arts and Sciences, and the Whipple V.N. Jone Professor of Statistics, Harvard University

*Description:* This talk provides a statistical perspective on the roles the seven S's (sins?) play in increasing the amount of irreproducible research, in medical and life sciences and beyond:

- Selections in hypotheses (e.g., subgroup analysis);
- Selections in data (e.g., deleting "outliers" or only using "complete cases");
- Selections in methodologies (e.g., for goodness of fit);
- Selections in due diligence and debugging (e.g., triple checking only when the outcome seems undesirable);
- Selections in publication (e.g., only when  $p$ -value  $< 0.05$ );
- Selections in reporting/summary (e.g., suppressing caveats);
- Selections in understanding and interpretation (e.g., our preference for deterministic, "common sense" interpretation).

The Big Data Paradox and Simpson's Paradox will be used to demonstrate that the problem of irreproducible research is getting BIGGER with Big Data. A cocktail treatment approach together with a selfish/blowfish test is suggested to combat this problem.

### **Thinking About Data (Ethically): Power, p-Hacking, and Reproducibility (2h)**

*Instructor:* Richard Born, MD, Professor of Neurobiology, HMS

*Description:* Statistics is a powerful set of tools for distilling knowledge from data. However, if these tools are used irresponsibly, they can lead us down the path of false positive science—that is, scientific claims that may, in the short term, garner publications and honors, but that ultimately fail to reproduce. While some failures are expected ("honest mistakes"), many more arise through bad statistical practices, such as "p-hacking" and under-powered experimental design. We will discuss sources of these bad practices, some related statistical pitfalls, and some possible remedies through healthier habits of mind.

### **Irreproducibility in Published Research (2h)**

*Instructor:* Jeffrey F. Flier, MD, Caroline Shields Walker Professor of Medicine, Harvard University Distinguished Service Professor and George Higginson Professor of Physiology and Medicine, HMS (former HMS Dean of Medicine)

*Description:* Research publications will contain errors, despite procedures designed to avoid them. Fortunately, a fundamental attribute of science is its capacity for "self-correction", through published ideas and claims being reviewed and tested by others. But today we face claims that published bioscience research is far less reproducible than anyone previously imagined. This workshop will challenge participants to seriously consider alternatives to our current approach to conducting and publishing research.