

***The Irreproducibility Crisis of Modern Science:
Causes, Consequences, and the Road to Reform***

National Association of Scholars

Overview

A reproducibility crisis afflicts a wide range of scientific and social-scientific disciplines, from epidemiology to social psychology. Improper use of statistics, arbitrary research techniques, lack of accountability, political groupthink, and a scientific culture biased toward producing positive results together have produced a critical state of affairs. Many supposedly scientific results cannot be reproduced in subsequent investigations.

The Irreproducibility Crisis, a new report by the National Association of Scholars, examines the different aspects of the reproducibility crisis of modern science. Our goal is to bring the reproducibility crisis to the forefront of public awareness and to call on policymakers to take effective steps to address it. We also include a series of policy recommendations, scientific and political, for alleviating the reproducibility crisis.

The Facts

- In 2012 the biotechnology firm Amgen tried to reproduce 53 “landmark” studies in hematology and oncology, but could only replicate six.
- In 2012 the director of the Center for Drug Evaluation and Research estimated that up to 75% of published biomarker associations could not be replicated.
- A 2015 article in *Science* presented the results of 100 replications of articles published in prominent psychological journals. 97% of the original studies had yielded statistically significant results; only 36% of the replications did.

The full report highlights many additional examples of the reproducibility crisis.

The Findings

- **Problematic Science.** Some of the crisis stems from flawed statistics, faulty data, deliberate exclusion of data, and hypothesizing after the fact.
- **Facilitating Falsehood.** Other problems arise from researcher freedom to adjust research parameters and the absence of open data and research procedures.
- **Professional Culture.** Science’s culture encourages publishing positive results instead of negative results or replication studies. Disciplinary and political groupthink discourage researchers from double-checking congenial results.

The Recommendations

NAS's 40 recommendations offer remedies for scientists, policymakers, and the public. They address statistical standards, data treatment, research practices, pedagogy, university policies, professional associations, professional journals, scientific industry, private philanthropy, government funding, government regulation, federal legislation, state legislation, government staffing, and judiciary reforms. The most important include:

- **Statistical Standards.** Researchers should adopt the practice of the most rigorous sciences and define statistical significance as $p < .01$ rather than as $p < .05$.
- **Research Practices.** Researchers should pre-register their research protocols with an appropriate scientific journal, professional organization, or government agency.
- **Schools.** Schools should integrate basic statistics into high school and college math and science curricula, emphasizing the limited certainty statistics provides.
- **Government Funding.** Government granting agencies should immediately adopt the National Institutes of Health (NIH) reproducibility standards.
- **Regulation.** Government agencies should require all regulations with scientific justifications to rely solely on research that meets strict reproducibility standards.
- **Legislation.** Congress should pass a Reproducible Science Reform Act to prevent government agencies from making regulations based on irreproducible research.

The full report makes these 40 recommendations in detail.

Contact:

David Randall, co-author | 917-551-6770 | randall@nas.org

Christopher Welser, co-author | 518-316-0275 | cswelser@gmail.com

Peter Wood, president, National Association of Scholars 917-551-6770 | pwood@nas.org

About the authors: David Randall is the director of research at the National Association of Scholars, and the author of *Making Citizens: How American Universities Teach Civics* (2017). Christopher Welser is a research associate at the National Association of Scholars, and presently teaches Latin in Minneapolis. He has a longstanding interest in the irreproducibility crisis.

About the National Association of Scholars: The National Association of Scholars is a network of scholars and citizens united by their commitment to academic freedom, disinterested scholarship, and excellence in American higher education. It upholds the standards of a liberal arts education that fosters intellectual freedom, searches for the truth, and promotes virtuous citizenship.