Enhancing Scientific Reproducibility in Biomedical Research Through **Transparent Reporting**

Sharing knowledge is what drives scientific progress—each new advance in biomedical research builds on previous observations. However, for experimental findings to be broadly accepted as credible by the scientific community, they must be verified by other researchers. An essential step is for researchers to report their findings in a clear and understandable manner so that others in the scientific community are able to validate the original results and build upon them. In recent years, concern has been growing over a number of studies that have failed to replicate previous

results and evidence from larger meta-analyses, which have pointed to the lack of reproducibility in biomedical research. Funders, publishers, and other key stakeholders have recognized the need to encourage and enhance transparent reporting of preclinical research findings across the biomedical research life cycle. On September 25 and 26, 2019, the National Academies of Science, Engineering, and Medicine hosted a

public workshop in Washington, DC, to discuss the current state of transparency in the reporting of preclinical biomedical research and to explore opportunities for harmonizing reporting guidelines across journals and funding agencies. This workshop built on recent consensus reports by the National Academies, including Reproducibility and Replicability in Science, Open Science by Design: Realizing a Vision for 21st Century **Research**, and **Fostering Integrity in Research**.

The Need for

Reproducibility and Replicability in Science To establish a foundation for the

workshop discussions, Harvey Fineberg, president of the Gordon and Betty Moore Foundation and workshop chair, elaborated on the findings and recommendations of the recently published National Academies report, Reproducibility and Replicability in Science.



easy to attain. Harvey Fineberg, President, Gordon and **Betty Moore Foundation**

"This is not one entity's problem alone to solve." Stakeholders should consider working

collectively to identify and address the cultural barriers to rigor, transparency, and replicability. Carrie Wolinetz, Acting Chief of Staff and Associate Director for Science Policy, Office of the Director,

National Institutes of Health (NIH)



The scientific community should take action to send "consistent and meaningful signals" regarding which studies reflect scientific norms.

Marcia McNutt, President, **National Academy of Sciences**

benevolence."

Marcia McNutt, president of the National Academy of Sciences and former

Public Trust in

Science

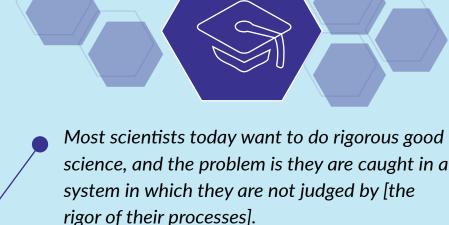
editor-in-chief of Science, delivered a keynote address on the importance of fostering a sense of trust within the scientific community and with the public.



Transparent

Reporting in

opportunities associated with transparent reporting and replicability in science.



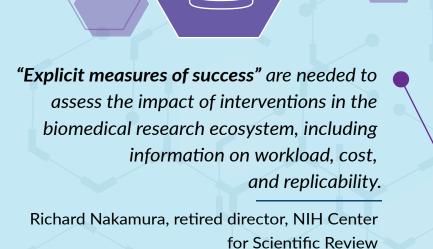
Arturo Casadevall, professor, Johns Hopkins University and Editor-in-Chief, mBio

Education on transparent reporting of

biomedical research should be targeted for

early career faculty, postdoctoral fellows,

graduate students, and undergraduates to raise awareness about the need for transparent reporting of biomedical research. Yarimar Carrasquillo, investigator, NIH National Center for Complementary and Integrative Health



Rewards and incentives can inspire behavior, but enforcement is also needed. Journal editors can play a key role in the adoption of policies requiring adherence to reporting guidelines or transparency principles. Brian Nosek, cofounder, Center for Open

Science; and An-Wen Chan, associate professor,

University of Toronto

translatable preclinical science that influences and enables reproducibility. Magali Haas, CEO and president, Cohen

Strategic partners can help build platforms that accelerate rigorous, reproducible, and

Veterans Bioscience

rooted in the current culture of science and incentive structures. Several participants emphasized the importance of coordination across all stakeholders in fostering a culture of transparency.

Lessons Learned

and Best Practices

Workshop participants discussed how

the barriers to transparent reporting are

approach adds burden. Sowmya Swaminathan and Malcolm Macleod, Professor, University of Edinburgh

Journals are "at the end of the process."

require initiatives targeting the beginning,

Achieving a broad shift in research practice will

within laboratories and academic institutions.

Sowmya Swaminathan, Head of Editorial Policy &

Checklists can improve transparent reporting

checklists should be mandatory and compliance

and potentially shift research practice, but

endorsement by journals is insufficient;

should be monitored, even though this

Research Integrity, Nature Research

tested to determine whether they are meaningful for the end users. "Less is more" when promoting checklist compliance. Steven Goodman, Professor and Co-director of METRICS, Stanford University; Veronique Kiermer, executive editor, PLOS; and Shai Silberberg, director of research quality, NINDS

Checklist items should be prioritized and pilot

Reproducibility of **Biomedical Research**

Toward Minimal

Standards for

improving reproducibility of

biomedical research

Improving

Workshop participants discussed potential stakeholder actions to harmonize guidelines and support uptake of minimal reporting standards for

Checklists and

Workshop participants delved further

checklists for enhancing transparent

into the practical application and

reporting of biomedical research.

effectiveness of guidelines and

Guidelines

"[Increased] transparency will be the legacy of this rigor, reproducibility, transparency **movement.**" Moving toward better

Biological Sciences, Duquesne University

experimental design in the long term is

Benedict Kolber, Associate Professor of

important, but reporting guidelines can be

implemented to improve transparency now.

Publishers and funders can help "bookend

reporting through a number of activities, like

the process" of promoting transparent

aligning reporting requirements with

expectations are clear for researchers

transparent reporting practices so

throughout the research life cycle.

Veronique Kiermer and Valda Vinson, Editor, Research Education at Science Improving research practices must be driven by scientists reforming their own fields with the help of experts in rigor and

reproducibility, impelled by institutional

leadership, manifest by structures

and metrics.

Steven Goodman

Opportunities for Promoting

Transparent Reporting Participants broke into small groups to

consider the roles and responsibilities

of researchers, publishers, institutions,

and funders in improving transparent

reporting of biomedical research.



statistics, methods) could be an approach to share the burden of peer review. Benedict Kolber and Shai Silberberg A commonality of successful guidelines is that

together investigators, collaborators, and research support staff to share the workload. Franklin Sayre, STEM librarian, Thompson Rivers University

they facilitate team science, which brings

The research community and publishers should work collaboratively toward culture change.

If you want [to make] science better, make

Valda Vinson

better science easier. Leslie McIntosh, cofounder and chief executive officer

of Ripeta

SOURCE: NASEM. 2020. Enhancing Scientific Reproducibility in Biomedical Research Through Transparent Reporting: Proceedings of a Workshop

Statements, recommendations, and opinions expressed are those of the individual participants. They are not necessarily endorsed by the National Academies of Sciences, Engineering, and Medicine and should not be construed as reflecting any group consensus.