June 23, 2025

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Michael J. Kratsios
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        Director, Office of Science and Technology Policy

SUBJECT: Agency Guidance for Implementing Gold Standard Science in the Conduct &
           Management of Scientific Activities

"I am calling upon you to blaze a trail to the next frontiers of science. We have the opportunity to cement America's global technological leadership and usher in the Golden Age of American Innovation. We are not just competing with other nations; we are seeking, striving, fighting to make America greater than ever before."

– President Donald J. Trump

As directed by President Trump's Executive Order (EO) 14303, "Restoring Gold Standard Science" (May 23, 2025), this memorandum provides guidance to Federal departments and agencies (agencies) on implementing Gold Standard Science in the conduct and management of all aspects of their scientific activities, from research design to public communication. By adopting these standards, agencies will strengthen scientific inquiry, rebuild public trust, and ensure the United States continues as the global leader in rigorous, evidence-based science.

As directed by the EO, each agency shall report to me the actions they are taking to implement this Guidance within 60 days (by August 22, 2025). More details on the contents of this required report are outlined in Section 3 of this memorandum.

1. Importance of Gold Standard Science

Gold Standard Science represents a commitment to the highest standards of scientific integrity, defined by nine core tenets: reproducible; transparent; communicative of error and uncertainty; collaborative and interdisciplinary; skeptical of its findings and assumptions; structured for falsifiability of hypotheses; subject to unbiased peer review; accepting of negative results as positive outcomes; and without conflicts of interest. These tenets ensure that federally-supported research, and research used in Federal decision-making, is transparent, rigorous, and impactful, enabling Federal decisions to be informed by the most credible, reliable, and impartial scientific evidence available.

The need for Gold Standard Science stems from the crucial role of scientific integrity in tackling complex challenges to address critical areas, such as energy innovation and national security. In an age of rapid technological progress and heightened public scrutiny, federally-funded and

federally-performed science, and its use in Federal decision-making, must be beyond reproach. This Guidance establishes a proactive approach to ensure science generated and utilized by agencies withstands scrutiny, fosters cross disciplinary collaboration, and remains free from bias or undue influence.

2. Tenets of Gold Standard Science

As defined in the EO, Gold Standard Science refers to science conducted in a manner that abides by nine key tenets. This section defines these tenets and describes agency responsibilities regarding each tenet.

- **Reproducible**

  Reproducibility in science is the ability of independent researchers to test a hypothesis through multiple methods and consistently achieve results that confirm or refute it, ensuring findings are generalizable and robust across different approaches. Replicability is the ability to perform the same experiment or study using the same methods and conditions to achieve the same result. Both are essential pillars of the scientific method: replicability ensures the integrity and precision of specific experiments, while reproducibility validates broader scientific claims. These concepts are fundamental to the scientific method, ensuring that findings are sound and verifiable, and not due to chance, bias, or error.

  To advance reproducible and replicable science, agencies shall prioritize disciplined scientific methods and experimental design. This includes requiring clear, standardized, and justifiable protocols; comprehensive documentation; robust statistical methods; adequate sample sizes; validated methodologies; and appropriate controls. Agencies should encourage depositing raw data and code that contributes to research outcomes in publicly accessible repositories, where appropriate, to facilitate exact replication and support reproducibility through diverse methodological approaches. Agencies should address barriers—such as incomplete reporting or resource constraints—by fostering training, shared infrastructure, and incentives for open science practices. Agencies should establish incentives, such as grant programs, awards, or recognition, to encourage researchers and institutions to prioritize both reproducibility and replicability, reinforcing their complementary roles in open science. These efforts also provide the foundation for transparency, ensuring well-documented methods and data are available for open sharing.

- **Transparent**

  Transparency in science entails the open, accessible, and comprehensive sharing of all components of the research process—methodologies, data, analytical tools, and findings—to enable stringent scrutiny, validation, and reuse by the scientific community and the public. Transparency builds trust, fosters accountability, and promotes collaboration while reducing errors and bias. It complements reproducibility by ensuring that the materials and processes needed to replicate studies are accessible and clearly reported. It requires detailed disclosure of experimental protocols, raw data, software tools, and potential conflicts of interest, facilitated through platforms such as open-access journals, public data repositories, and standardized reporting frameworks.

Agencies shall prioritize transparency in scientific research to ensure accountability and public trust. Transparency includes prioritizing clear, detailed reporting of methodologies, making raw data and analytical tools publicly available when feasible and lawful, and disclosing funding sources or conflicts of interest. Data sharing plans should be required in grant applications, to include timelines and platforms for public release. As feasible, agencies shall adopt and support standardized metadata formats and data-sharing platforms to ensure accessibility and interoperability. Transparency also extends to peer and merit review processes, where agencies shall, as appropriate and feasible, disclose review criteria publicly, and share anonymized reviewer comments with applicants.

- **Communicative of Error and Uncertainty**

Communicating error and uncertainty in science entails the clear, precise, and accurate disclosure of limitations, variability, and potential sources of error or limitations in measurements or research findings, enabling other scientists to critically assess, replicate, and extend the work. This practice is essential for advancing scientific discovery, as it upholds the integrity of new knowledge, fosters scrupulous inquiry, and supports collaborative innovation by providing a trustworthy foundation for future research. Effective communication of error and uncertainty requires researchers to quantify statistical uncertainties, document and report potential sources of error, clearly articulate assumptions and methodological limitations, and disclose potential biases. Communication of error and uncertainty can be accomplished by leveraging tools such as comprehensive documentation, statistical metrics, visualizations, and standardized reporting formats.

Agencies shall prioritize the communication of error and uncertainty in scientific research to drive robust generation of new science. Research reporting should include quantitative measures of uncertainties—such as confidence intervals, error margins, or sensitivity analyses—alongside clear explanations of methodological constraints and assumptions and the intended scope of the research, including what the scientific findings do and do not establish. Agencies should encourage standardized formats for reporting uncertainty, such as graphical visualizations or concise, accessible summaries, to enhance clarity and utility for the scientific community. To prevent overstatement of results, agencies should promote cautious, evidence-based language in reports, publications, and public communications. Agencies should discourage speculative claims or extrapolations that extend well beyond the data's scope, especially when science is used in an operational or regulatory context.

- **Collaborative and Interdisciplinary**

Collaborative and interdisciplinary science refers to the strategic integration of a wide range of expertise, methodologies, and perspectives across disciplines and sectors to address complex scientific challenges and catalyze transformative discoveries. This approach is vital for generating new knowledge, as it fosters synergy, leverages complementary skills, and promotes the synthesis of ideas to raise new questions and tackle multifaceted problems that transcend traditional disciplinary boundaries. Effective collaboration and interdisciplinarity require open communication, shared resources, and inclusive frameworks, often supported by joint research initiatives, interoperable data-

sharing platforms, cross-disciplinary training programs, and development of shared terminology.

Agencies shall prioritize collaborative and interdisciplinary approaches in scientific research to accelerate discovery and innovation. These approaches include recognizing limitations in an individual's or an agency's expertise and engaging other divisions within an agency, or other agencies, for complementary expert support when appropriate to address cross-disciplinary problems. Further, agencies shall foster partnerships across agencies, disciplines, institutions, and sectors by supporting joint funding opportunities, interdisciplinary research centers, user facilities, and accessible data-sharing platforms. Agencies should promote team science by encouraging clear protocols for collaboration, such as shared digital workspaces, interoperable software, and the use of tools for effective communication and data integration.

- **Skeptical of its Findings and Assumptions**

  Maintaining constructive skepticism of findings and assumptions in science refers to the critical and open-minded evaluation of research findings, methodologies, and underlying assumptions to ensure their validity, robustness, and reliability. This approach is essential for generating reliable new knowledge, as it encourages scientists to challenge conclusions, explore alternative hypotheses, and identify potential biases or errors, thereby strengthening the scientific process. Effective skepticism requires researchers to employ robust validation methods—such as peer and merit review, replication studies, sensitivity analyses, and uncertainty assessments—while cultivating an open mindset that embraces scrutiny, iterative refinement, and intellectual humility. A key component of constructive skepticism is actively avoiding confirmation bias—the tendency to favor evidence that supports pre-existing beliefs or hypotheses while dismissing contradictory data.

  Agencies shall foster a culture of constructive skepticism in scientific research through policies and programs that emphasize critical evaluation, transparency, and objectivity. Agencies shall support innovative methods to promote constructive skepticism, such as support for adversarial collaborations where teams with differing hypotheses design studies to rigorously test results, minimizing confirmation bias. They shall fund replication studies and statistical validation methods, such as sensitivity or uncertainty analyses, to critically assess the reliability of research results. Agencies shall also cultivate environments that incentivize critical inquiry by supporting fora where research premises and results are thoroughly evaluated, potential overinterpretations are challenged, and alternative explanations explored.

- **Structured for Falsifiability of Hypotheses**

  Structuring science for falsifiability of hypotheses entails designing research studies and experiments to enable hypotheses to be carefully tested and potentially disproven through empirical evidence. This approach is essential for generating new knowledge, as it anchors scientific claims in testable, refutable predictions—promoting rigor and preventing the perpetuation of unverified assumptions. Effective falsifiability requires researchers to formulate precise, testable hypotheses, design experiments with measurable outcomes, and employ rigorous methodologies—such as controlled

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experiments, randomized trials, or advanced statistical tests—to systematically challenge predictions.

Agencies shall prioritize scientific research that is structured for falsifiability of hypotheses. Research programs should be designed to allow for the rejection of hypotheses based on empirical evidence, prioritizing studies that advance knowledge through thorough testing. Agencies should promote research proposals that articulate clear, testable hypotheses with explicitly defined, measurable criteria for falsification, supported by solid experimental designs and statistical methods. Agencies should promote practices that enhance falsifiability, such as pre-registration of study protocols, use of appropriate control groups, and transparent reporting of null or negative results in publications and data repositories.

- **Subject to Unbiased Peer Review**

Subjecting science to unbiased peer review (sometimes referred to as merit review) refers to the impartial and independent evaluation, by qualified experts, of both research proposals and manuscripts that report results of federally-supported research, to ensure validity, quality, and credibility prior to funding, publication, or dissemination. This process is critical for generating trustworthy new knowledge that minimizes bias, ensures methodological rigor, and upholds scientific standards through objective scrutiny. Effective unbiased peer review relies on transparent, well-defined review criteria, competent and independent reviewers, and robust mechanisms to minimize conflicts of interest, often facilitated by double-blind or open peer review by qualified experts.

Agencies shall prioritize unbiased peer review to advance sound science in the review, selection, and awarding of Federal grants and contracts, including competitive and discretionary awards. Research proposals should undergo independent, impartial peer review, guided by clear, transparent evaluation criteria and standardized, streamlined processes to ensure objectivity and consistency. Agencies should ensure appropriate reviewer selection, prioritizing expertise, independence, and viewpoint diversity, and adopt double-blind review where appropriate, with clear disclosure of potential conflicts of interest. The review, selection, and awarding of Federal grants and contracts must be consistent with relevant provisions of the Federal Acquisition Regulations or 2 CFR Part 200 (Uniform Guidance), its supplements, and other relevant regulations. Awards must be granted based on merit, without bias in the selection of awardees, in accordance with the Constitution, the Civil Rights Act of 1964, the Americans with Disabilities Act of 1990, and other relevant laws.

- **Accepting of Negative Results as Positive Outcomes**

Accepting negative results as positive outcomes in science refers to recognizing and valuing—as meaningful contributions to knowledge generation—null or unexpected findings that fail to support a hypothesis. This approach is essential for advancing pioneering science, as it counters publication bias, encourages comprehensive reporting, and provides valuable insights into ineffective approaches, thereby guiding future research directions and avoiding redundant efforts. Embracing negative results requires researchers to transparently document and share null findings using accepted

methodologies, clear reporting formats, and accessible platforms, such as open-access journals or data repositories.

Agencies shall recognize negative or null results as valuable contributions to scientific knowledge, fostering integrity and innovation. This recognition includes expectations that funded research projects transparently report all outcomes, including null or negative results, in publications and publicly accessible data repositories, accompanied by clear, detailed documentation of methods, analyses, and limitations. Agencies should promote standards that encourage the submission and dissemination of negative findings, such as establishing dedicated journal sections or specialized repositories for null results, integrating these outcomes into broader research narratives.

- **Without Conflicts of Interest**

  Conducting science without conflicts of interest refers to ensuring that research is designed, executed, reviewed, and reported free from financial, personal, or institutional influences that could bias outcomes or undermine objectivity. This approach is important for generating trustworthy and credible new knowledge, as it upholds scientific integrity, fosters public confidence, and ensures that results reflect evidence rather than external agendas. Maintaining freedom from conflicts of interest requires researchers, reviewers, and managers to disclose all relevant affiliations, funding sources, and relationships relevant to the science conducted, adhering to stringent ethical standards supported by strong institutional oversight, transparent reporting systems, and independent expert review mechanisms.

  Agencies shall prioritize conducting and managing scientific research free from conflicts of interest to advance unbiased science. Agencies shall require disclosure of all relevant conflicts of interest by researchers, reviewers, and agency officials involved in the funding or performance of Federal research. These efforts include requiring comprehensive, standardized disclosure of all financial, personal, or institutional interests in research proposals, publications, peer and merit reviews, and data repositories, with clear and standardized protocols to identify, mitigate, and manage potential biases. Agencies should mandate the use of independent oversight approaches and enforce strict conflict-of-interest policies.

3. Agency Implementation

To align with the EO, Federal agencies shall implement Gold Standard Science tenets in all agency-managed scientific activities, including both intramural and extramural research, from the selection phase throughout closeout. Agencies are encouraged to adapt implementation to their unique missions while upholding scientific merit and excellence.

As agencies implement this Guidance, they must adopt streamlined approaches that achieve the goals of Gold Standard Science while minimizing administrative burdens, avoiding excessive bureaucratic requirements that can divert resources and impede scientific progress. To enhance efficiency, agencies should explore the use of artificial intelligence and other advanced technologies for implementing Gold Standard Science, such as automated tools for validating reproducible protocols, standardizing transparent data reporting, quantifying uncertainty,

facilitating interdisciplinary collaboration, detecting biases in peer and merit review, and managing conflict-of-interest disclosures. By integrating these technologies into research frameworks, agencies can optimize compliance efficiency, reduce administrative overhead, and enable researchers to focus on discovery, thereby enhancing the credibility, rigor, and impact of scientific outcomes.

Within 60 days of this memorandum, agencies shall submit to OSTP and post on their agency's website (at https://<agency main URL>/GSS) a report outlining their implementation plans for Gold Standard Science. At a minimum, these plans shall include:

- Descriptions of how the agency is addressing each of the tenets of Gold Standard Science, including how these tenets are reflected in the agency's culture, funding opportunities, budget and other resource allocations, award selection and reporting, and other agency actions relevant to the conduct and management of scientific activities.

- Development of standardized metrics and evaluation mechanisms to assess adherence to these tenets and their impact on scientific quality, incorporating technology when practicable to facilitate data collection and analysis.

- Plans for providing training and resources to ensure agency personnel understand and adhere to the tenets of Gold Standard Science, including the use of AI-driven tools when practicable for efficient compliance.

- Discussion of how technology will be leveraged for implementing Gold Standard Science.

- Descriptions of any challenges encountered in the implementation of Gold Standard Science.

After the first report submitted by August 22, 2025, future annual reports are due to OSTP by September 1st of each year, beginning in 2026.

If there are any questions regarding this Guidance, please contact Dr. Lynne Parker, Principal Deputy Director, White House Office of Science and Technology Policy, at 202-456-4444.