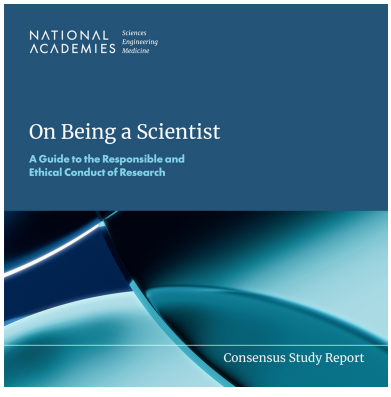
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The fourth edition of the National Academies' *On Being a Scientist* is an ambitious and comprehensive guide to the responsibilities of research. Coordinating contributions from a large number of experts is a considerable achievement. The Guide is intended primarily for undergraduate and graduate students, postdoctoral scholars, and early career researchers in academic, industrial and government settings in the United States, and it should also be useful to mentors and those teaching research ethics. I found much to commend, while having reservations about the balance of some sections and the clarity with which certain principles are reconciled.

Section 1: Introduction—The Joys, Benefits, and Responsibilities of Being a Researcher. This opening section provides a broad account of the benefits and responsibilities of research. In my reading, however, the examples of research misconduct and harm—including the Tuskegee syphilis study and the experience of the Marshall Islands after nuclear testing—make the responsibilities more vivid than the joys. These examples are important and should not be omitted. My suggestion is that they be balanced with positive accounts of curiosity, discovery and research that have benefited society. Max Perutz's *Is Science Necessary?* (Perutz, 2019), with its discussions of science and food production and science and health, offers 'joyful' examples of how the value of science can be communicated to non-specialists.

The discussion of the Mpemba effect is a potentially engaging example of curiosity. Burridge & Linden (2016) challenged the claim, however, that hot water cools more quickly than cold water under the conditions they studied. More generally, the Guide's account of discovery could usefully include examples that show both individual insight and the collaborative nature of contemporary research. The Higgs-boson story, for example, illustrates the difficulty of assigning a complex achievement to a single person or a small number of people. Celebrating individual role models such as Marie Curie, Dorothy Hodgkin or Richard Feynman in the Guide would show how individual contributions and team science can coexist.

Section 1 identifies important trends and articulates responsibilities well, and its extensive references will be useful. My reservation is chiefly about the relative balance of the section's three themes of joys, benefits and responsibilities.

Section 2: Collaborating Responsibly. This is one of the Guide's strongest sections. It offers practical insights on authorship, agreements, roles and norms, data responsibilities, conflict resolution, and harassment. Its recognition that traditions vary by discipline is particularly important for interdisciplinary research, where expectations about author order and contribution can differ. The discussion should help early career researchers recognize issues that are best addressed explicitly and before collaborations start.

Section 3: Earning and Maintaining Trust. This section also contains valuable guidance, and the use of boxed examples is effective. Boxes 3-1 and 3-2 discuss the Havasupai case and ambiguity in disclosure expectations and institutional guidance. These are important cautionary examples, but they are again predominantly negative. So, the section could be strengthened by adding a positive example showing how trust was earned and sustained

through meaningful engagement, transparent communication, and respect for the people or communities involved. Its summary rightly notes the challenges posed by misinformation, polarization and institutional failures. Box 3-3, on communicating via social media, is a useful reminder that researchers should distinguish scientific communication from personal beliefs or political views and take great care over how their public statements may be understood.

The Guide's emphasis on sharing also raises an important question of trust and authority. Some Indigenous communities have challenged assumptions that research data and knowledge should automatically be made open, particularly where sharing may conflict with community authority, cultural responsibilities or protection against exploitation. These positions should not be generalized to all Indigenous peoples of course: views and governance practices can vary between communities and kinds of knowledge. Nevertheless, the issue deserves explicit attention. The CARE principles—collective benefit, authority to control, responsibility and Ethics—provide a useful complement to the FAIR principles (findable, accessible, interoperable and reusable) and help explain why making data technically accessible is not always sufficient to ensure that sharing is responsible. Professor Maggie Walter's keynote (https://www.un.org/en/os25/maggie_walter) and the subsequent discussion at the UN Open Science and Open Scholarship Conference provide a relevant point of entry to this debate.

Section 4: Openness and Security. The relationship between openness and security is a central issue for contemporary research. On page 97, the Guide states that fundamental research should be open. I agree that openness is an important scientific norm, but the practical position becomes more complicated when research involves intellectual property, confidential industrial work, personal or community data, export controls, or other legitimate restrictions. In crystallography, for example, a researcher may create a new crystallization condition with potential intellectual-property implications. The Guide could do more to explain how open dissemination, protection of legitimate interests and the public benefit of research can be considered together. The *Lambert Review of Business–University Collaboration* (Lambert, 2003) is a useful reference for the relationship between university research and industry, UK based but offering admiration for how US universities succeed with licencing to industry in contrast to the UK universities' emphasis on spinouts, which can often be fraught.

On page 98, the subsection on openness, sharing and access as a default in science presents a catalogue of discoveries across the centuries. This is engaging material, and some of it might also have served well in the opening section on the joys and benefits of research. It also raises a practical question: to what extent are the original publications describing these discoveries openly accessible or behind paywalls? If the Guide wishes to promote open science, a few representative examples of the accessibility of the underlying papers or data would make the argument more concrete. Gold open-access charges can also be prohibitive for researchers and institutions, including those in the Global South; openness of access for readers and affordability for authors are related but distinct questions. Of course, diamond open access is being sought by policy makers, but it remains unclear how to make such journals sustainable.

UNESCO's *Recommendation on Open Science* (2021) uses the formulation '*as open as possible, as closed as necessary*'. I find this a useful statement of the balance required in practice. The Guide does recognize controlled access, intellectual property and security restrictions, so I would not describe it as advocating unrestricted openness. Rather, its strong presumption in favour of sharing as the default would benefit from being related more explicitly to UNESCO's formulation and to the reasons why access may need to be restricted in particular circumstances. Box 4-1, on export-controlled technical data, does warn researchers not to assume that all work falls within ordinary open-science practices. Read alongside the discussions of intellectual property and 'reasonable openness' later in the chapter, this advice points to a real challenge for early career researchers: how to apply a general commitment to openness while complying with legal, ethical and contractual obligations. The Guide provides elements of an answer, including the need for context-sensitive judgement and explicit expectations, but could make the relationship between these elements more direct.

Section 5: Responsible Conduct and Stewardship of the Research Process. Box 5-1, 'Questions for Conceptualizing Curiosity', is a useful device for helping early career researchers decide which lines of inquiry to pursue. Its questions about feasibility, consequences, the value of null results, downstream use and incentives are well chosen. Box 5-3, 'Questions for Designing Research', is also useful. The discussion of reproducibility and replicability draws on the National Academies' 2019 report, which I regard as an authoritative treatment of the subject and have cited many times.

Box 5-2 discusses conflicts of commitment, including the difficulty of saying yes to too many invitations. The Guide could usefully supplement this discussion with practical tools for managing competing priorities, such as a time-management matrix.

Similarly, the Guide discusses recognizing and mitigating risk and provides important examples of research security and human-subject protection. It does not develop a step-by-step method for estimating and ranking project risks, recording them in a risk register, and identifying mitigation actions for each. Such a worked example would turn the Guide's general advice into a practical skill that early career researchers could use. This is a recommendation to extend the existing guidance.

The appendices, including the statement of task and the resources for further reading, demonstrate the thorough process used to prepare this fourth edition.

In considering the territory of advocacy within the scientific advice and research environment, I have questioned such a recommendation (Helliwell, 2018*a*). The Guide takes a nuanced position: it cautions researchers not to present advocacy positions as if they were neutral scientific assessments,

while acknowledging that the boundary between the roles can blur. That is a sensible distinction, and it would be useful to keep it visible in discussions of public engagement and policy.

Bernal's *The Social Function of Science* (Bernal, 1939), particularly its discussion of science and politics, remains relevant to the debate about scientific activism and its risks even today nearly 90 years later. Bernal recognized the dangers of scientists being regarded as tendentious when they move beyond neutral assessment, while also arguing that engagement may be justified in particular circumstances. The current pressures on US research, including funding uncertainty and concerns about political influence over scientific work, seem particularly relevant. Gerwin (2026) describes scientists continuing their research amid funding cuts.

Research on the research workplace also remains important; *e.g.* very recently Tietze *et al.* (2026), in an empirical study of chemistry PhD students in Germany, identified challenges to student well being and called for structural reforms in doctoral education and research environments. Their findings underline the value of connecting guidance on individual conduct with the institutional conditions in which early career researchers work.

Skills and career development. My own publications on staff training have focused on skills development, including in *Skills for a Scientific Life* (Helliwell, 2016). The Guide refers to skills in several places and includes a potentially useful reference to the University of Illinois 'Labs that Work for Everyone' programme, which aims to support ethical laboratory practice, cultural awareness and effective leadership. I would welcome more explicit links between the Guide's principles and opportunities for structured development in leadership, communication, risk assessment, project management and practical skills advice.

The Royal Society's '*Practical Advice For an Independent Research Career*' https://royalsociety.org/about-us/what-we-do/supporting-researchers/independent-research-careers/) offers a different way of producing advice, where they make available short 5 min-read blog-style contributions from researchers with relevant experience, focused on specific topics. These are intended to provide pragmatic, implementable advice rather than a comprehensive account of the research ecosystem. This format complements the broader remit of the National Academies' Guide.

My own books offer a third route to guidance for scientists and even school pupils considering science education and training. I have books addressing our scientific life as to why (Helliwell, 2018*b*), what (Helliwell, 2019), when and where (Helliwell, 2021), and, for people already in science, how (Helliwell, 2016) we do science. The Guide mentions 'why' only a few times in its text. A word count is not in itself a measure of importance, but I would welcome a more sustained reflection on scientific purpose and the motivation to discover, alongside the careful treatment of responsible conduct of scientists

Overall assessment. The fourth edition is a substantial and valuable resource. Its treatment of collaboration, trust, research integrity, reproducibility and the responsibilities of researchers offers much to students, early career researchers and their mentors. Its extensive references and boxed examples are very useful features.

My principal suggestions concern the Guide's emphasis and practical implementation. The Guide could (i) balance cautionary examples with a greater number of positive accounts of discovery and trust; (ii) explain more explicitly how a presumption in favour of openness is reconciled with Indigenous data sovereignty and legitimate restrictions; and (iii) provide descriptions of workplace tools for risk assessment and time management. In these respects, I see opportunities to strengthen the Guide's coherence and practical usefulness. The Royal Society's focused career resources and other specialist training programmes could usefully complement it.

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