

Integrating the history of science into broader discussions of research integrity and fraud

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Abstract

This introductory article frames our special issue in terms of how historicizing research integrity and fraud can benefit current discussions of scientific conduct and the need to improve public trust in science.

Keywords

Research integrity, fraud, scientific conduct, scientific values, public trust

Writing about research integrity and fraud in the midst of the Covid-19 crisis carries an extra sense of urgency. Voices of reason tell us to trust the experts, echoing both the (idealized) scientific method and Ronald Reagan’s response to Soviet promises regarding nuclear disarmament: “trust, but verify.” Great advice, but how easy is it really to identify trustworthy experts? Is the boundary between healthy skepticism and manufactured doubt a simple matter of distinguishing between valid laboratory and publishing protocols on one side and political, economic, or personal interests on the other? Should we follow those who rely on the Mertonian distinction between norm-bound practices

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and “deviant behavior” in our assessment of what constitutes good science?¹ While perhaps easily dismissed as little more than an ivory-tower issue in cases that deal, for example, with whether midwife toads can be made to evolve nuptial pads or the meaning of some obscure fossils, the answers to these questions can be a matter of life and death.²

Consider the current controversy surrounding research into the efficacy of (hydroxy-) chloroquine for treating Covid-19. While greatly complicated by politics, researchers themselves have yet to reach consensus on this drug’s efficacy and how that ought to be ascertained.³ Some have studied registries of patient histories, measuring in situ effects.⁴ Others run randomized trials, the largest of which will include up to 40,000 doctors and nurses in Asia, Africa, and Europe.⁵ In the midst of these developments, the microbiologist and director of the *Institut hospital-universitaire en maladies infectieuses de Marseille*, Didier Raoult, and his colleagues have published and publicized studies that tout the drug’s “game changing” potential.⁶ Raoult was already a controversial figure – to some, a multiple prize-winning and top-cited hero who helped identify almost 20% of the known species of human-borne bacteria and who champions health-related research

1. Harriet Zuckerman, “Norms and Deviant Behavior in Science,” *Science, Technology and Human Values* 9 (1984): 7–13.
2. Alexander Vargas, Quirin Krabachler, and Carlos Guerrero-Bosagna, “An Epigenetic Perspective on the Midwife Toad Experiments of Paul Kammerer (1880-1926),” *Journal of Experimental Zoology, Part B: Molecular and Developmental Evolution* 00B (2016): 1–14; Roger Lewin, “The Case of the ‘Misplaced’ Fossils: A Prominent Australian Scientist Has Examined Two Decades of Work on Ancient Himalayan Geology and Alleges It May Be the Greatest Paleontological Fraud of All Time,” *Science* 244 (1989): 277–9.
3. On the drugs’ politicization, see Katherine Eban, “‘Really Want to Flood NY and NJ’: Internal Documents Reveal Team Trump’s Chloroquine Master Plan,” April 24, 2020, <www.vanityfair.com/news/2020/04/internal-documents-reveal-team-trumps-chloroquine-master-plan> (accessed August 17, 2020); “Bolsonaro Hails Anti-Malaria Pill Even as He Fights Coronavirus,” *New York Times*, July 8, 2020; Marcos Cueto, “Bolsonaro’s Chloroquine: Epidemics, History, and Social Inequality in Brazil,” *Items*, July 9, 2020, <<https://items.ssrc.org/covid-19-and-the-social-sciences/disaster-studies/bolsonaros-chloroquine-epidemics-history-and-social-inequality-in-brazil/?fbclid=IwAR3fbWtHH21JZOIOSYT6TJi7jiILfHNKSov-wfHsLpOGYLXK7G7Pox2aWQ>> (accessed August 17, 2020).
4. See e.g. Mandeep Mehra et al., “Hydroxychloroquine or Chloroquine with or without a Macrolide for Treatment of COVID-19: A Multinational Registry Analysis,” *The Lancet*, published online May 22, 2020, [https://doi.org/10.1016/S0140-6736\(20\)31180-6](https://doi.org/10.1016/S0140-6736(20)31180-6) (accessed May 26, 2020). The study has since been found to be based on questionable data, leading the WHO and other organizations to reopen studies of the drug’s use. “Surgisphere: Governments and WHO Changed Covid-19 Policy Based on Suspect Data from Tiny US Company,” *The Guardian*, June 3, 2020; “Surgisphere: Mass Audit of Papers Linked to Firm Behind Hydroxychloroquine Lancet Study Scandal,” *The Guardian*, June 10, 2020 (accessed August 17, 2020).
5. Kai Kupferschmidt, “Trials of Drugs to Prevent Coronavirus Infection Begin in Health Care Workers” April 7, 2020, <www.sciencemag.org/news/2020/04/trials-drugs-prevent-coronavirus-infection-begin-health-care-workers> (accessed May 26, 2020).
6. See e.g. the lab’s first published study: Philippe Gautret et al., “Hydroxychloroquine and Azithromycin as a Treatment of COVID-19: Results of an Open-Label Non-Randomized Clinical Trial,” *International Journal of Antimicrobial Agents* 56 (2020): 1–6 (Journal pre-proof available online 20 March 2020).

in and for Africa; to others, a tyrannical and publicity-seeking poseur who flamboyantly criticizes research protocols, denies climate change, and mistreats female coworkers.⁷

Critical peers and journalists have focused on what they see as the questionable character of his laboratory's hydroxychloroquine research and publications. They criticize the first published study's small sample size, the decision to remove data on patients who either went into intensive care or died, the non-randomized character of patients included in the study, and the temporal mismatch between the study's duration and application for ethical approval. So too have they questioned the publication process, noting the first publication was peer-reviewed in just twenty-four hours and appeared online only four days after it was submitted.⁸ The International Society of Antimicrobial Chemotherapy's response was to issue an official statement that "the article does not meet the Society's expected standard." Elsevier, publisher of the journal in which the article appears, replied by simultaneously insisting that proper reviewing protocols were followed and initiating (post-publication) an "additional independent peer review."⁹

Raoult, in turn, has answered questions regarding his approach and ethics by questioning those of currently dominant research protocols. He argues that research such as his must be shaped by a doctor's primary duty to save patients' lives, not by protocols such as randomization, which academic science deems necessary for the sake of standardization. To blindly follow such standards, he claims, risks patients' lives. As numerous other researchers also recognize, alternative methods are sometimes necessary precisely because the real world cannot be reduced to fully controlled laboratory conditions governed by one overarching, "objective" value system.¹⁰ Raoult's detractors, meanwhile, argue that we need standardized procedures, including randomization, to ensure reliable and transferable knowledge. Both sides accuse the other of risking lives and being empirically wrong, procedurally confused, and ethically suspect.

7. Scott Sayare, "He was a Science Star. Then He Promoted a Questionable Cure for Covid-19," *New York Times*, May 12, 2020.

8. Gautret et al., "Hydroxychloroquine and Azithromycin" (note 6); Elies Bik, "Thoughts on the Gautret et al. Paper about Hydroxychloroquine and Azithromycin Treatment of COVID-19 Infections" March 24, 2020, <<https://scienceintegritydigest.com/2020/03/24/thoughts-on-the-gautret-et-al-paper-about-hydroxychloroquine-and-azithromycin-treatment-of-covid-19-infections/>> (accessed May 15, 2020).

9. "Statement of IJAA Paper," <www.isac.world/news-and-publications/official-isac-statement> (accessed May 15, 2020); "Joint ISAC and Elsevier Statement on Gautret et al Paper [PMID 32205204]," <www.journals.elsevier.com/international-journal-of-antimicrobial-agents/news/joint-isac-and-elsevier-statement-on-gautret-et-al-paper> (accessed May 15, 2020). Note that the article you are now reading was co-authored by this journal's editor-in-chief.

10. Didier Raoult, "Contre la méthode," lecture delivered on February 13, 2020, <www.youtube.com/watch?v=7TI3Re57X2Y&feature=youtu.be> (accessed May 16, 2020); Matthieu Million et al., "Full-length Title: Early Treatment of COVID-19 Patients with Hydroxychloroquine and Azithromycin: A Retrospective Analysis of 1061 Cases in Marseille, France," *Travel Medicine and Infectious Disease* 35 (2020): 101738 (Journal pre-proof available online May 5, 2020). On more general debates regarding experimental protocols in biomedicine, see A. Sarpatwari and Aaron Kesselheim, "The 21st Century Cures Act: Opportunities and Challenges," *Clinical Pharmacology and Therapeutics* 98 (2015): 575–7.

There is no context-independent way of deciding between these claims because the context – how to understand it and whether to pay attention to it – is itself embroiled in the controversy.¹¹ But if a single method or value system doesn't govern all research, if the protocols by which scientists pursue, publish, and evaluate research are themselves the temporal outcome of historical developments, how do we judge whose research is imbued with ethical and procedural integrity and whose is not?¹² Further, as the complexities of the corona crisis highlight, can we disentangle the norms, values, and interests that guide the behavior of scientific practitioners from those at work in the broader world? Is it more than a coincidence, for example, that Raoult's advocacy of hydrochloroquine has been championed by a mix of maverick doctors, Silicon Valley boosters, and right-wing media and politicians? And what of the fact that many who question the drug's efficacy relied (initially) on questionable data collected by an even more questionable company?¹³ In more general terms, how do and should we critically relate economic and political priorities, scientific research protocols, and public health? Indeed, through what interpretive lens do or should we envision “the public” to which science, the economy, and politics are related?

While these last two questions are impossible to answer without recourse to a subjectively grounded normative stance, they can be seen as the largest possible frame within which to place this special issue. More concretely, as explained by our preface, the issue is directed toward two desiderata. The first, which entails drawing on the history of science to contribute to discussions of research integrity and fraud, provides the focus for this article. Strikingly, a perusal of influential policy guides and regulations for monitoring research integrity shows that they largely address it as a matter of researchers' individual behavior.¹⁴ But, as the contributions to this special issue

11. Joseph Gabriel, “*Medical Nihilism* by Jacob Stegenga: Historical Scholarship and the Question of Effectiveness,” *Studies in History and Philosophy of Biology and Biomedical Science* 81 (2020): 101273.
12. On the historical character of clinical trials as the standard approach in drug testing, see Joseph Gabriel and Bennett Holman, “Clinical Trials and the Origins of Pharmaceutical Fraud: Parke, Davis & Company, Virtue Epistemology, and the History of the Fundamental Antagonism,” *History of Science* 58 (2020): 533–58.
13. Adam Rogers, “Chloroquine May Fight Covid-19 – And Silicon Valley’s Into It,” *Wired* March 19, 2020, <www.wired.com/story/an-old-malaria-drug-may-fight-covid-19-and-silicon-valleys-into-it/> (accessed May 16, 2020); “Surgisphere”, June 3, 2020; “Surgisphere”, June 10, 2020 (note 4). On the challenges of drug testing more generally, Thomas Bodenheimer, “Uneasy Alliance – Clinical Investigators and the Pharmaceutical Industry,” *The New England Journal of Medicine* 342 (2000): 1539-1544.
14. See e.g. *The European Code of Conduct for Research Integrity* (ALLEA – All European Academies, 2017) <<https://allea.org/code-of-conduct/>> (accessed August 17, 2020); House of Commons Science and Technology Committee, *Peer Review in Scientific Publication: Government and Research Councils UK Responses to the Committee’s Eighth Report of Session 2010-12. 10th Special Report of Session 2010-12* (London: Her Majesty’s Stationery Office, 2012); Peter Drenth, Sonia Flacnikova, Maura Hiney, and Livia Puljak, *Fostering Research Integrity in Europe* (European Science Foundation, 2010) <https://www.esf.org/fileadmin/user_upload/esf/ResearchIntegrity_Report2011.pdf> (accessed August 17, 2020); KNAW (Dutch Royal Academy of Sciences), NFW (Netherlands Federation of University Medical Centres), NWO (Netherlands Organisation for Scientific Research), VSNU (Union of Dutch Universities), TO2-federatie (Applied Research Federation), Vereniging Hogescholen (Netherlands Association

highlight, integrity involves more than individuals conforming to a set of research and publication guidelines. Matters of integrity reach beyond individual researchers to encompass the institutions and broader contexts in which and for which they operate. Monitoring conduct needs to take this into account, but in ways that go beyond standard “science and society” considerations. Others have drawn attention to the dangers that have arisen these past fifty years from growing pressures on researchers to compete for funding and rush to publish by evaluation regimes that rely on quantitative performance indicators and the scarcity of financial resources.¹⁵ Taking a longer view, we see how the practices and institutions of science have been fundamentally shaped by their engagement with the broader world. Monitoring conduct should take this more extensive fabric into account, framing and balancing considerations of individual behavior by attention to the conduct of relevant institutions and the larger forces that have shaped them. Importantly, this is not only a question of tracking the role of (competing) interests, but also of recognizing the presence of various values at work in the pursuit and use of science.

Rethinking the history of research integrity and fraud

This special issue aims to offer a historically grounded understanding that can be helpful in responding to what many see as the current crisis of trust in science, its institutions, and its practitioners. Up until now, the study and regulation of integrity in science have largely been framed by a fairly standard origin story.¹⁶ According to this genesis tale, science found a new Garden of Eden in the United States in the wake of World War Two. As a self-regulating marketplace, science in the post-war United States was the world’s greatest locus of progress and productivity, but also proved a prime site of temptation to violate the norms meant to act as the system’s invisible hand. Faced with a number of high-profile cases involving scientists’ “deviant behavior” and questions about the scientific community’s self-policing abilities, the U.S. Congress held hearings on “Fraud in Biomedical Research” in 1981.¹⁷ Such concerns spread alongside the increasing internationalization of science and its recognized links with economic growth, leading national and international organizations in places as diverse as China, Brazil, and the

of Universities of Applied Science), *Netherlands Code of Conduct for Research Integrity* (DANS, 2018) <<https://www.vsnul.nl/files/documents/Netherlands%20Code%20of%20Conduct%20for%20Research%20Integrity%202018.pdf>> (accessed August 17, 2020).

15. Marc Edwards and Siddhartha Roy, “Academic Research in the 21st Century: Maintaining Scientific Integrity in a Climate of Perverse Incentives and Hypercompetition,” *Environmental Engineering Science* 34 (2017): 51–61.
16. See e.g. Nicholas Steneck, “Research Universities and Scientific Misconduct: History, Policies and the Future,” *Journal of Higher Education* 65 (1994): 310–30; Jennifer Horner and Fred Minifie, “Research Ethics I: Responsible Conduct of Research (RCR) – Historical and Contemporary Issues Pertaining to Human and Animal Experimentation,” *Journal of Speech, Language and Hearing Research* 54 (2011): S303–S329.
17. On misconduct and fraud as “deviant behavior,” defined as “departures from cognitive norms,” see Zuckerman, “Norms and Deviant Behavior,” p.7 (note 1). On Congressional hearings, see Barry D. Gold, “Congressional Activities Regarding Misconduct and Integrity in Science,” *Responsible Science: Ensuring the Integrity of the Research Process*, vol. II (Washington D.C.: National Academies Press, 1993), chapter 6.

European Union to take up matters regarding the global rise of scientific misconduct and fraud.¹⁸

There are many reasons to question this narrative. While formal regimes for policing scientific fraud and integrity on national and international levels might only have evolved during the second half of the twentieth century, the contributions to this special issue show that the history of regulating scientific conduct stretches back much further and evinces a more variegated geography; the world wasn't waiting either for American scientists to bite the apple of misconduct or for the United States to provide a model for how to monitor scientific integrity. Neither has this history unfolded in a way that conforms to the linear model, which lurks behind too many codes of conduct and distinguishes between "pure" scientific research and its "application."¹⁹ By the time Congressional hearings were held, faith in the linear model stood in stark contrast to a cluster of recognitions among critical analysts of science. First, as highlighted by Rachel Carson, critics of nuclear power, and others, science isn't "pure" in the sense that it leads to negative as well as positive consequences. Second, as expressed by Thomas Kuhn and others, neither is it "pure" in that, far from being objective or unified, "science" is actually an umbrella category for various, localized sets of practice, partners, and purposes. Third, as witnessed by high-profile cases of (alleged) fraud and misconduct, neither can the "purity" of scientists be counted on. Strangely, institutional and governmental concerns about fraud and misconduct seem largely to have separated the third recognition from the first two and sought to regulate a return to scientific Eden, even as attention has been drawn to the increasing pressures institutional, social, political, and economic demands place on researchers' "performance."²⁰ That is, in spite of contrary evidence and concerns, the conceptions and measurements of integrity currently marshaled to regulate (academic) scientists and their practices invoke an idealized moral economy of science that directs scientists to work communally and disinterestedly toward the same goal.²¹

Contributors to this special issue join those who voice concern with this regulatory orientation by calling for a recognition of science as always already interwoven with other fields of endeavor, the complex contours and overlaps of which are historically, geographically, and culturally specific. Monitoring the behavior of individual scientists

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18. David Resnik and Weiqin Zeng, "Research Integrity in China: Problems and Prospects," *Developing World Bioethics* 10 (2010): 164–71; Sonia Vasconcelos, Martha Sorenson, Edson Watanabe, Dabora Foguel, and Marisa Pálacios, "Brazilian Science and Research Integrity: Where Are We? What Next?" *Anais da Academia Brasileira de Ciências* 87 (2015): 1259–69; Pieter Drenth, "Research Integrity: Protecting Science, Society and Individuals," *European Review* 18 (2010): 417–26.
 19. Benoît Godin, "The Linear Model of Innovation: The Historical Construction of an Analytical Framework," *Science, Technology, & Human Values* 31 (2006): 639–67.
 20. Edwards and Roy, "Academic Research" (note 15).
 21. "Science . . . is the systematized knowledge obtained through observation and experimentation, study and thinking. Scientific research is carried out to determine the nature and principles of what is being studied. In spite of their differences in content and methods all sciences have a common characteristic: they depend on arguments and evidence, i.e. observations of nature or of humans and their actions and products." *The European Code of Conduct*, p.3 (note 14).

to see whether they adhere to standard research and publishing protocols is therefore bound to be an inadequate method for ensuring integrity. Importantly, this isn't only a question of tracking competing interests – the lure of commercial success, institutional control, political power, and the like. It is as much a matter of recognizing the play of contending values. As our initial example of debates over how to judge hydroxychloroquine's efficacy illustrates, researchers can be and often are motivated by different and quite defensible goals. How, for example, is one to weigh the value of saving a life against the value of attaining knowledge that might (or might not) save lives in the future? This essential tension among competing interests and values requires further discussion, but first a word about terminology.

A closer look at terminology

Writing about research integrity and fraud is complicated by the lack of terminological stability.²² Prior to 1975, (at least Anglo-American) talk was largely focused on “deviant” threats to scientific “norms,” as normal science was viewed as helping to propel the twin motors of progress and democracy.²³ Since then, articulated concerns were increasingly directed toward “preventing scientific misconduct.” Behind this choice of rhetoric was, among other things, experience with the pitfalls of trying to distinguish between conscious fraud and sloppy science or poor judgment. Because of the legal burden of proof required in cases of fraud, organizations such as the National Science Foundation were counseled to speak instead of “misconduct.”²⁴ While talk of “scientific misconduct” continues, it has been joined – sometimes overshadowed – by the promotion of “integrity” since the 1990s. This terminology seems to have spread from policymakers, university administrators, and Anglo-American scholars to other parts of the globe. There remains, however, a lack of uniformity of use in current-day regulatory documents and guidelines, manifestos, and scholarly publications alike, which sometimes speak of “scientific integrity” and sometimes of “research integrity.” In 2019, for example, a bill entitled the “Scientific Integrity Act” was introduced in the U.S. House of Representatives to mandate the establishment of “certain scientific integrity policies for Federal agencies that fund, conduct, or oversee scientific research.”²⁵ On the other hand, the highly

22. Serge Horbach and Willem Halfmann, “Promoting Virtue or Punishing Fraud: Mapping Contrasts in the Language of ‘Scientific Integrity’,” *Science and Engineering Ethics* 23 (2017): 1461–85; Kathleen Montgomery and Almaya Oliver, “Shifts in Guidelines for Ethical Scientific Conduct: How Public and Private Organizations Create and Change Norms of Research Integrity,” *Social Studies of Science* 39 (2009): 137–55, 138.

23. Michael Mulkay, “Norms and Ideology in Science,” *Social Science Information* 15 (1976): 637–56.

24. Daniele Fanelli, “The Black, the White and the Grey Areas: Towards an International and Interdisciplinary Definition of Scientific Misconduct,” in Tony Mayer and Nicholas Steneck (eds), *Promoting Research Integrity in a Global Environment* (Singapore: World Scientific Publishing, 2012), pp.77–90; Howard K. Schachman, “What Is Misconduct in Science?” *Science* 261 (1993): 148–9 and 183, 148.

25. HR 1709 – 116th Congress (2019–20), text available at <www.congress.gov/bill/116th-congress/house-bill/1709/text?q=%7B%22search%3A%5B%22scientific+integrity+act%22%7D&r=1&s=1> (accessed August 17, 2020).

regarded World Conferences on Research Integrity Foundation was established in 2017 and looks forward to organizing its seventh conference in 2021. Previous conferences have resulted in the promulgation of official statements “on Research Integrity.”²⁶ As if to underscore the confusion, the Association of Universities in the Netherlands (VSNU) speaks of “*wetenschappelijke integriteit*” (scientific integrity) in Dutch but uses the term “research integrity” in official English translations on its website and in its official “Code of Conduct.”²⁷ One possible explanation for this could be the more limited meaning usually attached to the word “science” in the Anglo-American world, which conventionally distinguishes between the natural, exact, and social sciences, on one hand, and humanities research on the other. Research integrity, in this case, expresses broader disciplinary coverage. To be clear, this special issue focuses primarily on the natural and exact sciences.

The significant question here is not whether “science” or “research” is the more appropriate term, but how relevant actors define and use them. Along these lines, Benoît Godin and Désirée Schauz have traced the definitional expansion of the term “research” since the early twentieth century and its subsequent restriction to mean laboratory research and marginalization as an explanation for economic progress.²⁸ Similarly, Schauz and David Kaldewey contrast the pure/applied science dichotomy with the discursive distinction historically drawn between “basic” and “applied” research, examining the latter through the method of conceptual history (*Begriffsgeschichte*). They explain that: “Dichotomies such as ‘pure versus applied science’ or ‘basic versus applied research’ played an important role within the development of modern science policy across national borders by building on and transforming values that had been previously conveyed in the ancient and early modern distinction between ‘theory’ and ‘practice’.”²⁹ As we know, the “theory/practice” dichotomy was often wielded to maintain elite dominance over the institutions and practices of knowledge production, associating the first with the mind and the second with the hand.³⁰ Similarly, contrasting “basic” and “applied” research supported a hierarchy that valued one sort of research and researcher over another.

So too has much been written about the problems that attend using an ahistorical definition of “science,” as is too often the case in relevant policy documents and literature on scientific/research integrity.³¹ It carries the risk of erasing the contributions made by a host of diverse peoples and individuals, activities, and interactions situated

26. World Conferences on research Integrity, <<https://wcrif.org>> (accessed July 13, 2020).

27. VSNU, *Nederlandse gedragscode wetenschappelijke integriteit/Netherlands Code of Conduct for Research Integrity* (September 30, 2018), <https://doi.org/10.17026/dans-2cj-nvwu> (accessed July 13, 2020).

28. Benoît Godin and Désirée Schauz, “The Changing Identity of Research: A Cultural and Conceptual History,” *History of Science* 54.3 (2016): 276–306.

29. Désirée Schauz and David Kaldewey (eds), *Basic and Applied Research: The Language of Science Policy in the Twentieth Century* (New York: Berghahn Books, 2018), p.3.

30. Lissa Roberts, Simon Schaffer, and Peter Dear (eds), *The Mindful Hand: Natural Inquiry and Invention from the Late Renaissance to Early Industrialization* (Amsterdam: Edita, 2007).

31. Henry Cowles, *The Scientific Method: An Evolution of Thinking from Darwin to Dewey* (Cambridge, MA: Harvard University Press, 2020).

in diverse locations around the globe, and a wide range of practices and approaches. So too does it risk projecting science as an autonomous field of endeavor, even as scientists are called upon to engage in socially and economically relevant projects. And, finally, by obscuring the various interests, values, and approaches that characterize scientific work through the attribution of a single set of idealized norms, it risks homogenizing the public image and expectations of science. Unreasonable expectations, in turn, leave the public vulnerable to those who seek to undermine scientific authority for their own ends.³²

Among those who attend to how science has changed over time are voices that claim a fundamental transition has occurred in recent decades from “traditional” science to something new. Among them is a group of well-placed science policy researchers whose collaboration led to the much cited book *The New Production of Knowledge*.³³ Traditional science, according to them, was marked by basic research that might be subject to application but was not driven by it. The new mode of knowledge production, which emerged in the 1950s, is characterized by research that – from the start – takes place in the context of application. It thereby replaces the boundaries that once gave meaning to the phrase “science and society” with a situation in which scientific research is always already rooted in and entangled with society.³⁴

Bruno Latour claims instead that we have transitioned from the age of autonomous “science” to an age of “research.”³⁵ He sees a culture having recently arisen in which research is directed as much by the concerns, investments, and involvement of social groups other than scientists (patient groups, AIDS and climate activists, etc.) as by the interests, values, and goals of scientists as a professional cadre. He sums up the fundamental difference between “science” and “research” as follows: “If we consider Galileo alone in his cell muttering, ‘And yet it moves!’ with the recent [climate change] meeting at Kyoto – where heads of states, lobbyists, and scientists were assembled together in the same palace to discuss the Earth – we measure the difference between science and research.”³⁶

As numerous authors have pointed out and contributions to this special issue highlight, the social entanglement of research that Latour and the advocates of a “new mode of production” describe as a relatively recent phenomenon actually has a long history.³⁷ Latour’s reference to Galileo as a lone scientist bears the hollow sound of rhetorical

32. Naomi Oreskes, *Why Trust Science?* (Princeton: Princeton University Press, 2019).

33. Michael Gibbons, Helga Nowotny, Simon Schwartzman, Peter Scott, and Martin Trow, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* (London: SAGE, 1994).

34. As numerous authors have pointed out and contributions to this special issue underscore, this entanglement has in fact been the case for a long time. See e.g. Dominique Pestre, “The Production of Knowledge between Academies and Markets: A Historical Reading of the Book, *The New Production of Knowledge*,” *Science, Technology and Society* 5 (2000): 169–81.

35. Bruno Latour, “From the World of Science to the World of Research,” *Science* 280, 5361 (1998): 208–9.

36. *Ibid.*, 209.

37. See e.g. Pestre, “Production of Knowledge” (note 34).

flourish; we know too much about Galileo's biography for this sort of image to stand.³⁸ No matter where or when one chooses to set the origins of scientific research as a hybrid undertaking in which the goal of knowledge production is inextricably bound with social, cultural, political, and commercial ends, however, what we too often find when we examine how research integrity is institutionally monitored is a regime that zeroes in on narrowly construed research and publication practices of individual researchers, measured against standards rooted in a single set of norms.³⁹ Among other things, this ignores the need to recognize research as framed by porous institutional boundaries that are themselves interactively shaped by ambient circumstances and populated by practitioners who operate across fields of endeavor, in keeping with heterogeneous interests, values, and goals. Rather than matters of institutional integrity being subject to similar monitoring, however, pressure on research institutions to engage in more equitable hiring and promotion practices, divest themselves of investments that support industries responsible for damaging the environment, decline research funding from questionable sources or that are earmarked for questionable ends, and other such matters that speak to institutional integrity, predominantly stems from the efforts of concerned faculty, students, and citizen groups.

Interests and values

We have repeatedly claimed that all research and matters of integrity are shaped by the interplay of interests and values. It's time to explore this in more detail. Much has been written about how vested interests can corrupt the conduct of research and related activities. There seem to be three trends in such studies. The first focuses "internally" on the behavior of scientists as researchers, authors, and reviewers. It deals generally with stories of "bad apples" who fake evidence, cook data, plagiarize, and abuse the peer-review process to enhance their reputations. The second trend looks at how changes in institutional organization since the 1980s – particularly the corporatization of universities – have impacted the direction and conduct of research: how they encourage researchers to collaborate with self-interested corporate partners; how they stimulate the growth of "predatory journals"; how they have narrowed options for researchers by cutting direct university and public funding, turning researchers toward the types of research for which funding is available thanks to the interests of corporate sponsors and partners; how they have led away from the ideal of science as a public good, toward increased secrecy and

38. See e.g. Mario Biagioli, *Galileo Courtier* (Chicago: University of Chicago Press, 1993).

39. Horbach and Halfmann, "Promoting Virtue" (note 22). The *Singapore Statement on Research Integrity*, drafted at the 2010 World Conference on Research Integrity, included a provision for "societal considerations": "Researchers and research institutions should recognize that they have an ethical obligation to weigh society benefits against risks inherent in their work." Crucially, the social responsibility of scientists was construed as distinct from their "professional responsibilities to uphold the accepted standards and practices of science for conducting and reporting research." Mark Frankel, "Intersection of Research Integrity with Social Responsibility," in Nicholas Steneck, Tony Mayer, Melissa Anderson, and Sabine Kleinert (eds), *Integrity in the Global Research Arena* (Singapore: World Scientific Publishing, 2015), pp.261–8, 261.

concern for intellectual property protection.⁴⁰ The third looks at the interests of “external” parties – corporations, politically motivated think tanks, and so forth – and how they have led researchers astray, tainted research, and increased public distrust of science. The best-known exposé of this genre, perhaps, is Naomi Oreskes and Erik Conway’s *Merchants of Doubt*.⁴¹ But concerns have been more broadly voiced, including attention for situations in which individual (groups of) researchers are funded directly by industrial sponsors, private foundations, and government agencies and thereby escape university oversight; this seems now to be the rule rather than the exception, for example, in the American field of biomedical research.⁴²

Of note is that behind all three of these trends is a view that contrasts disinterested science with the perverse effects of interest. According to the longtime chair of the British Council for Science and Society, John Ziman, this translates into a contrast between research for the benefit of society – science as a self-critical public good – and instrumental research for the narrower material benefit of specific parties. This is no simple contrast, however. If credibility is considered a cornerstone of disinterested science, so too does it buttress instrumental research. And if individual researchers are motivated by interests such as career advancement, those interests are tempered by the need to engage in research that is – or at least appears – credible.⁴³ But what is credibility? Both the word and the phenomenon it is taken to express involve an act of faith – the belief that something is creditable or true. What this tells us is that disentangling interests from values (such as credibility) is no easy feat, a point to which we will return.

First, defining science as a public good and equating it with research for society’s benefit opens up a number of questions. Is society sufficiently homogeneous for benefits to be universal? Who is qualified to determine what constitutes a benefit and which benefits are worthy of being pursued? Along these lines, the European Commission has identified a set of “grand societal challenges” and earmarked funding for research that addresses them.⁴⁴ Among the categories of these challenges is “health, demographic change and wellbeing.” But should matters of health be addressed by having researchers partner with for-profit drug companies to develop and distribute new cures, and if so, for which ailments? Alternatively, should research emphasize the impact of poverty and racism on public health? Another category is “secure, clean and efficient energy.” Should this include research into the development of nuclear energy? Should researchers be

40. Risa Lieberwitz, “The Corporatization of Academic Research: Whose Interests are Served,” *Akron Law Review* 38 (2005): 759–70; Jamie Brownlee, “The Corporate Corruption of Academic Research,” *Alternate Routes: A Journal of Critical Social Research* 26 (2015): 23–50.

41. Naomi Oreskes and Erik M. Conway, *Merchants of Doubt. How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2010).

42. Mark Yarborough and Richard Sharp, “Restoring and Preserving Trust in Biomedical Research,” *Academic Medicine* 77 (2002): 8–14, 10.

43. John Ziman, “The Continuing Need for Disinterested Research,” *Science and Engineering Ethics* 8 (2002): 397–9.

44. European Commission, “Societal Challenges,” <<https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges>> (accessed June 12, 2020).

required to include analyses of the environmental impact of resource extraction and supply chains related to energy infrastructures as well as of the energy sources themselves? Answers to such questions are not only a matter of setting research priorities.⁴⁵ They also structure the research that is subsequently done – the methods employed, the topics analyzed, and the (types of) answers obtained, as well as the distribution of benefits. In other words, they take us to the heart of the research process, from initial conception to application of results. What they tell us is not only that disinterested science can never be more than an ideal. They reveal that it isn't an apt one. For better or worse, truly aspiring to it would have to entail abandoning the values that shape and give meaning both to the societies we inhabit and the research we pursue.

Rather than measure research against such an unobtainable and undesirable ideal, it seems more reasonable to examine it as it is actually pursued and consider the role of values that are ever-present in its shaping and pursuit. One need not begin from scratch. In the volume *Value-Free Science?: Ideals and Illusion*, for example, a group of philosophers of science illuminatingly discuss whether science is or can be value-free and what it might mean to answer yes or no.⁴⁶ Among other things, they examine the often-made distinction between epistemic and non-epistemic (moral, political, social, etc.) values. Epistemic values are taken to include goods such as truth, accuracy, simplicity, and predictability; by 1980, they were widely accepted as part and parcel of so-called “value-free” science.⁴⁷

But many have questioned the distinction between epistemic and non-epistemic values. Though she doesn't use these terms, Lorraine Daston, for example, argues that paths of knowledge production such as quantification, empiricism, and objectivity are paved by more than cognitive goods; they are built on what she calls “moral economies of science,” defined as historically contingent “web[s] of affect-saturated values that stand and function in well-defined relationship to one another.” A reigning moral economy, she explains, provides a scientific community and its practices with rules and regularity that simultaneously satisfy scientific practitioners and ensure their integrity. It is “integral to science: to its sources of inspiration, its choice of subject matter and procedures, its sifting of evidence, and its standards of explanation.”⁴⁸ Daston distinguishes her use of the term “moral economy” from that earlier introduced by the historian E. P. Thompson, who analyzed the moral frame within which eighteenth-century English workers viewed the world and their rights within it in order to understand what motivated their ultimately violent resistance to socioeconomic change.⁴⁹ While she recognizes the cultural roots

45. See e.g. Matthew Wallace and Ismael Ràfols, “Institutional Shaping of Research Priorities: A Case Study of Avian Influenza,” *SPRU Working Papers Series* (2018), <www.sussex.ac.uk/webteam/gateway/file.php?name=2016-02-swps-wallace-et-al.pdf&site=25> (accessed June 12, 2020).

46. Harold Kincaid, John Dupré, and Alison Wylie (eds), *Value-Free Science?: Ideals and Illusion* (Oxford: Oxford University Press, 2007).

47. Heather Douglas, “Rejecting the Ideal of Value-Free Science,” *ibid.*, pp.120–40, 120.

48. Lorraine Daston, “The Moral Economy of Science,” *Osiris* 10 (1995): 2–24, 4, 6.

49. E. P. Thompson, “The Moral Economy of the English Crowd in the Eighteenth Century,” *Past and Present* 50 (1971): 76–136.

of the values that shape a scientific community's moral economy, Daston takes their practical specifics to be unique to science. The result is a view that enriches our understanding of organized scientific practice as suffused with underlying regard for and commitment to emotional and moral worth.

Daston's perspective does have its limitations. As others have noted, it excludes consideration of the political or ideological character of ambient contributions to the moral economies of science.⁵⁰ It thus considerably narrows the fundamental lesson of *Leviathan and the Air Pump*, that "solutions to the problem of knowledge are solutions to the problem of social order."⁵¹ As such, it cannot account for cases in which a society's reigning cultural interests and values envelop its scientific community to the point that it plays a demonstrably dominating role in that community's knowledge-making and related decision-making processes. In her contribution to this special issue, Tatjana Buklijas examines one such case. Focusing on *fin-de-siècle* Vienna, she reveals how its scientific community's judgment of a member's character and the knowledge he produced were distilled in the same alembic of anti-Semitism.⁵² One might want to respond that this case deals with an aberration in which ugly prejudice perverted the "natural" course of science. But mounting evidence suggesting the active role of supposedly non-epistemic values in the daily practice of research seems incontrovertible. Numerous historians, for example, have discussed the ways in which post-World War Two science was shaped by and served as a vehicle to promote Cold War values, enunciated in terms of progress and democracy.⁵³ Other historians and philosophers of science point to the roles played by androcentrism and a culturally rooted commitment to gender dimorphism in an extensive range of biological research. What such evidence suggests, among other things, is the benefit that could be drawn by shifting from a discussion of whether cultural values creep into otherwise "value-free" science to a conversation about which values are worth supporting in the formulation and furtherance of scientific research.⁵⁴

It would be naïve, of course, to expect that such a conversation would end in consensus. Extrapolating from political theorist Chantal Mouffe's view of democracy to

50. Didier Fassin, "Moral Economies Revisited," *Annales. Histoire, Sciences Sociales* 64 (2009): 1237–66.

51. Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton: Princeton University Press, 1985), p.332.

52. Tatjana Buklijas, "Publicity, Politics and Professoriate in *Fin-de-Siècle* Vienna: The Misconduct of the Embryologist Samuel Leopold Schenk," *History of Science* 58 (2020): 458–84.

53. John Krige, "The Ford Foundation, European Physics and the Cold War," *Historical Studies in the Physical and Biological Sciences* 29 (1999): 333–61; Paul Forman, "Behind Quantum Electronics: National Security as Basis for Physical Research in the United States," *Historical Studies in the Physical and Biological Sciences* 18 (1987): 149–229; David Kaiser, "Cold War Requisitions, Scientific Manpower, and the Production of American Physicists After World War II," *Historical Studies in the Physical and Biological Sciences* 33 (2002): 131–59.

54. Phyllis Rooney, "On Values in Science: Is the Epistemic/Non-Epistemic Distinction Useful?" *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association* 1992 (1992): 13–22, 18–19.

science, they are both best seen, not separately and through the idealization of consensus, but in tandem as interactive fields of disagreement and contest. The challenge is to harness the energy of contest in a way that makes debate healthy and productive rather than debilitating or destructive.⁵⁵ Part of this involves appreciating how the longstanding confluence that marks the relationship between the scientific, socioeconomic, and political orders has continued to inform and reflect scientific development in ways that indelibly tie research and researchers to commercial, industrial, social, and political endeavors. Researchers have long straddled the institutional boundaries that officially separate the realms of scientific knowledge production and commerce.⁵⁶ So too have they simultaneously served the ends of expanding our understanding of nature and a state's military might.⁵⁷ And the quest to improve health, cure the sick, and prevent the spread of disease has long been directed by an uneasy mix between humanitarian ideals and pecuniary interests.⁵⁸ With this in mind, it comes as no surprise that research and researchers not only share a variety of competing interests and values, but that those interests and values often pierce the porous boundaries of scientific institutions to link research and researchers with other fields of endeavor as well. As evidenced by the contributions to this special issue, this is what makes it so difficult to agree upon a single definition of "research integrity" and to govern its conduct. Historically speaking, it is as much the attempt to mediate between conflicting values as between contending interests that has provided answers to questions such as "How precise is precise enough?," "When is it acceptable for a scientist to recommend a commercial product?," and "Who deserves credit for a scientific discovery?" In some cases, the results have been to charge someone with misconduct or fraud; in others, to find an institutional *modus vivendi* between contending parties, or to pass legislation (think, for example, of the Bayh Dole Act of 1980). But some value clashes prove extremely resistant to resolution. What is the answer, for example, when productivity – a valuative measure that spans laboratory, scientific, and industrial activity – clashes with values such as trustworthiness, privacy, or the sanctity of life? As both researchers and citizens, we live with such value clashes on a daily basis and recognize how morally and politically laden their resolution is. The evaluation of scientific integrity should embrace this understanding and work to identify both the contending values and interests at play in the institutions and broader contexts in which researchers operate in order to enhance the democratic character of the whole.

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55. Chantal Mouffe, *The Democratic Paradox* (New York: Verso, 2000).

56. Hal Cook, *Matters of Exchange: Commerce, Medicine and Science in the Dutch Golden Age* (New Haven: Yale University Press, 2007).

57. Michael Reidy, *Tides of History: Ocean Science and Her Majesty's Navy* (Chicago: University of Chicago Press, 2009).

58. Mark Jenner and Patrick Wallis (eds), *Medicine and the Market in England and its Colonies, c. 1450-c. 1850* (Houndsmills, Basingstoke: Palgrave Macmillan, 2007).

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