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This volume presents a detailed critique of modern science, highlighting its problematic consequences by including analysis of those who are excluded by modern science. However, there is an asymmetry between the science that is referred to and the revised versions that are used to critique science. The limitations and evils of nonmodern and non-European cultural narrations of nature are not identified, whereas the limitations of modern science are delineated extensively. This is despite the contributions by Sujata, Joseph, and Srinivas, which present accounts of alternate visions of nature and science, asserting that a science based on views of nature other than the dominant one is possible. More importantly, while we know, or think we know, why modern science makes progress in the West, the articles do not investigate the real reasons why non-Western science, or sciences of non-European origin, might not develop along similarly progressive lines. Significantly, some, including Srinivas, claim that, despite some differences, Indian mathematics has many similarities to European mathematics.

Notwithstanding these issues, *Science and Narratives of Nature: East and West* highlights important ways to interrogate science through distinct narratives of nature, both general and specific, and is held together by an excellent introduction from the editors.

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Jutta Schickore. *About Method: Experimenters, Snake Venom, and the History of Writing Scientifically*. Chicago: University of Chicago Press, 2017. Pp. 316. \$50.00 (cloth). ISBN 978-0-226-44998-2.

About Method is a book as much about the progressive refinement of experimentation as it is about the progressive loss of confidence in experimentation. It is a book that quietly challenges whatever hopes we might have for finding the one true scientific method, while loudly showing us how intricate and creative diverse experimental methodologies have always been. The focus of *About Method* is not on what philosophers have to say about proper experimental methodology but on what practicing scientists have to say about it. To this end, Jutta Schickore provides an invaluable tool for researchers and students of history and philosophy of science (HPS): what she calls “methods discourse.” This is an analytic category that the HPS researcher can use to track scientists’ talk about experimental methodology. *About Method* is far

less interested in what scientists actually do and far more interested in what scientists have to say about what they do.

For the most part, recent trends in HPS regarding experimentation have focused on the instruments and tools used in experimentation, on the social and material contexts of experimental activity, and on the multilayered ways in which experimental practices are valuable epistemic endeavors. And this has led to a turn away from the use of scientific texts themselves in HPS. Schickore's book makes a return to the scientific text (5), but not from the traditional perspective of the justification of theories and explanations. Rather, her interest is in the ways in which scientific texts indicate methodological commitments. While aware that the methodological talk of scientists is not a trustworthy barometer for what they actually do, Schickore takes this talk to be extremely salient for HPS researchers, as it is here that they can find "important indicators of scientists' views about proper experimental procedure" (6). Put otherwise, methodological talk is normative in the sense that it guides, both retrospectively and prospectively, the conceptualization of what good experimental practice is. Retrospectively, at the very least, it guides scientists' own assessments of their experimental activities and the ways in which they matter. Prospectively, methodological talk guides the practice of future experimenters, not just as a blueprint to be followed but also as a tool to be improved upon.

Schickore takes on a double role in this book. In one role, she is a "historian of methods discourse" (112), focusing on explaining the internal dynamics of the centuries-long research program on snake venom. From this perspective, she is interested in how methodological talk itself informed and changed how different researchers attempted to account for the nature of snake venom and the mechanism by which snake bites are poisonous to other animals. One does not need to be a historian of the study of snake venom in order to appreciate the impressive range of Schickore's historical research. She traces snake venom research from the early days of experimentation in seventeenth-century Italy (and, to a lesser extent, England) well into the nineteenth century and its intersection with various biological subfields in the United States.

The book begins with a short overview of Robert Boyle's experiments with snake venom (chap. 1), then it moves into the dispute between Francesco Redi and Moyse Charas in the later decades of the seventeenth century (chaps. 2–3). Schickore then looks at Richard Mead's attempt to align snake venom research with Newtonianism (chap. 4), before considering Felice Fontana's work, which was the starting point for investigations of snake venom throughout the nineteenth and twentieth centuries (chaps. 5–6). The final four chapters are concerned with a variety of nineteenth-century biologists interested in finding the chemical composition of venom, among whom Schickore pays most attention

to Silas Weir Mitchell (chaps. 7–8), Simon Flexner, and Hideyo Noguchi (chaps. 9–10).

The second role that Schickore takes on is as a historian and philosopher of methods discourse as such: a second-order historian and philosopher of methods discourse, investigating what was at stake in how scientists conceptualized proper experimental practice and what drove both the continuities and the changes in these conceptualizations. Schickore unearths the histories of many aspects of today's experimental methodologies—some aspects that we tend to take for granted (and about which scientists today are mostly silent in the methodological sections of their journal articles) and some that have simply been discarded altogether.

Before I go on to discuss a few of the great variety of methodological facets Schickore discusses, let me say a few words about the first chapter of the book, because it is here that I take Schickore to show why methods discourse is a valuable analytical framework for HPS. Chapter 1 shows that, in the early modern period, there was considerable variety in the motivations for a commitment to experimentalism. It also shows that methods discourse is a framework with which these variations can be tracked. The chapter sets out distinct layers of methods discourse: (1) protocols that encompass the procedures, experimental design, and setup; (2) broader commitments to experimentation as the method for acquiring knowledge; (3) methodological statements about, for instance, how procedures secure empirical results; and (4) metareflections on, and justifications of, these layers, which involve appeal to a broad range of factors, such as new theoretical ideas or new techniques of investigations, as well as metaphysical conceptions about nature, causality, and even experimentation itself (225).

These different layers are “helpful tools for a fine-grained analysis of methods discourse in different fields and historical periods as well as for comparisons across fields and periods” (214). Here, we see Schickore's explicit intent to make methods discourse (and its distinct layers) part of the analytical tool kit of the HPS researcher. And what makes this tool particularly promising is that it “transcend[s] individual and localized experimental contexts” (16), while still doing justice to the complexities of local research environments. When focused on methods discourse, histories of scientific methodologies will avoid the central criticism frequently marshaled against HPS, namely, radical contextualization, while still paying due credit to the ways in which synchronic and diachronic contexts are crucial in accounting for specific continuations and changes within methods discourse. This is partly what is at stake in Schickore's book: offering a history of conceptualizations of experimental methodologies that avoids both radical contextualization and

triumphalist and anachronistic tendencies. And this is a major way in which the appeal to methods discourse is successful in an HPS framework.

Chapters 2 and 3 trace how the dispute between Redi and Charas was shaped by commitments to, respectively, experimental repetition and comparative experimentation. Methodologically, Redi substantiated his claim, that a yellow liquor discharged through the teeth was responsible for the effects of snakebites in other animals, through experimental repetition. He took this to be necessary in order to secure the reliability of experimental results, since a wide range of contingencies can affect an individual experimental situation; only by sustained repetitions can such contingencies be made conspicuous. By contrast, Charas was rather indifferent to repetition. Instead, he relied on comparative experimentation in order to show that what killed the bitten animal was the snake's anger, which released the "vexed spirits" (46).

Alongside nuances of the experimental commitments in the Redi-Charas dispute, what Schickore tracks in minute detail is the struggle involved in making experimental repetition (whose virtues we today take to be almost self-evident) into a respectable methodology. But the history of why and how experimental repetition matters is not restricted to this episode. In chapter 6, Schickore returns to the topic and shows that, for Fontana, experimental repetition, alongside systematic variations of the experimental conditions, was important in determining how the circumstances (what Redi had called "contingencies") impinged on experiments. So, where Redi saw only contingencies to be avoided via repetition, Fontana saw methodological opportunity, such that accounting for the circumstances of experimental investigations with the help of repetition became the heart of his experimental protocol. The respectability of repetition, combined with an increased emphasis on measurement, led to new changes in experimental protocols throughout the eighteenth century. Schickore traces these changes in chapters 5 and 6.

A similar story can be told about comparative experimentation. For Charas, comparative experimentation was used to demonstrate that the success of "trials was due to the presence or absence of the cause" (39). For Charas, appeal to comparative experimentation is not investigative or evidential but demonstrative, in that it is supposed to show the operating cause at work. But the functions Charas gave to comparative experimentation are less important to Schickore's story than Charas's use of it without methodological reflection, which was also the case for both Redi (46) and Fontana (99). Comparative methods were legitimized only in the nineteenth century, Schickore shows, when scientists began to reflect on what is at stake in comparative experimentation and how it is supposed to work. Schickore traces the status of the commitment to comparative experimentation by looking at how Mitchell and John Call Dalton

made active use of different conceptualizations of the method of comparative experimentation in their work.

In tracing these developments, Schickore corrects assumptions that take appeals to comparative methods to be exemplifications of John Stuart Mill's method of difference. She argues that in the biological sciences, at least, there was some distrust of Mill's method, largely because of its optimism about successfully securing scientific results. She shows how this played out in the Mitchell and Dalton cases. Mitchell's terminology of tests and checks, and his apparent trust in the reliability of experimental results, seems to suggest that he followed the method of difference more closely, but this did not stop Dalton from interpreting Mitchell's methodology along the lines of Claude Bernard's theory of comparative experimentation, which was far more distrusting of the possibility of securing the certainty of experimental results. Bernard's approach was a "pragmatic, realistic alternative to the ideal search for causes as it was encapsulated in Mill's methods of inquiry" (151). Yet, neither Mill's method of difference nor Bernard's method of comparative experimentation became the norm for experimental practices or experimental justification in venom research.

What remains somewhat unclear is the extent to which the methodological commitments exemplified in snake venom research are novel within that research or are borrowed from broader research traditions. If the latter is the case, one might be left wondering what the specific advantage is in looking into venom research rather than those areas in which the actual methodological advancements were happening. Could it not be the case that venom research has always just been part of normal science? That it was a puzzle to be solved by using whatever were the most advanced, appropriate methodologies available? Chapters 4, 9, and 10 in particular seem to suggest this much. I suspect that Schickore would not claim otherwise but would point out that the fine-grained, long-term history of snake venom research shows that such appropriation is never done without important shifts and adjustments in the methods discourse itself. And each of the chapters of her book testifies to such shifts and adjustments.

From very early on, experimenters were pragmatic and opportunistic in appropriating methodological strategies in dealing with the complexity of experimental situations. Schickore shows that this had been the dominant attitude since the early days of experimentalism and that it could not have been the result of the application of one programmatic method or another. Rather, the programmatic methods themselves are produced in hindsight, as a result of a period of methodological innovation. Once such programmatic methods get articulated, they become the backdrop against which researchers develop

their specific methodological opportunism (Schickore does not use the latter term, but I think it nicely reflects the methodological attitude of many of the researchers she discusses): they reflect on which of the methods available are best at addressing the task at hand and most helpful in dealing with the circumstances underpinning the complexity of the experimental situation itself.

Schickore's reconstructions of the nitty-gritties of methodological talk show that methodological advancement is indeed real, as new and more sophisticated techniques did steadily develop over the period studied in the book. But they also show that, in order to manage the complexities, the contingencies, and the countless circumstances involved in experimental situations, these advancements were coupled with an ever-increasing loss of confidence in experimentation itself. It shows that, no matter how trailblazing one's methodologies become, "the means through which we make sense of the world might forever remain precarious" (227). In *About Method*, the history and philosophy of methods discourse shows us precisely this at almost every turn. As such, *About Method* is a wonderful example of long-term microhistories having a long-lasting philosophical payoff—including an increasing acceptance that we might never actually reach our supposedly beloved scientific method, because the experimental situations are forever too complex to be completely controlled.

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David Landy. *Hume's Science of Human Nature: Scientific Realism, Reason, and Substantial Explanation*. London: Routledge, 2018. Pp. xi+266. £120.00 (cloth). ISBN 978-1-138-50313-7.

David Landy's book is an unorthodox, intellectually stimulating, and to our mind by and large convincing exposition of the epistemic commitments and philosophical practice underlying Hume's theory of human nature. The book introduces Hume's science of man as implementing an epistemic ideal. That ideal, as the book's subtitle announces, is centered on 'scientific realism' and aims at 'substantial explanations' based on inferences to the best explanation provided by 'reason'.

The realism in question is a practical commitment that precedes scientific theorizing to grasp the real structures underlying observed phenomena.