Tom Sorell, **G. A. J. Rogers**, and **Jill Kraye**, eds.
'Scientia' in Early Modern Philosophy: Seventeenth-Century Thinkers on Demonstrative Knowledge from First Principles.
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This narrowly focused collection of papers seeks to explicate competing notions of *scientia* in the works of 17th century natural philosophers and to show how natural science conceived as a unified domain of enquiry gradually emerged from these disparate sources. The quality of the entries is consistently high and their variety is refreshing. Where a monograph on the same theme might provide a more comprehensive and homogeneous account, this volume offers valuable fragments that draw well on the expertise of each contributor and reveal the complex etiology of science. The papers can be read profitably by anyone interested in the history and philosophy of science in the early modern period, though the primary reader will be the specialist who will get a glimpse of some very interesting scholarly controversy and a choice assortment of historical tidbits with which to pepper lectures. Overall, this book is a great success.

In the first paper, Daniel Garber casts doubt on the common view that a scientific revolution occurred in the 17th century. On the contrary, science as a cultural entity first came into being at the end of the century through the efforts of such thinkers as Bacon, Newton and Locke to redirect and unify the various disciplines studying natural phenomena by reference to a common goal. In the year 1600, there was no such intellectual category as science—no one group of people that could be called 'scientists' and no common institution to which they all belonged—and so there was simply nothing there to be reformed. Garber identifies a major shift in the 'disciplinary geography' of the period, and tries to give an impression of the complex process by which various loosely connected domains of inquiry were transformed into subfields of physical science as we know it. The chief interest of the paper lies in the historical evidence that Garber assembles, though one might still ask with some justice whether the merging of various fields of enquiry into a single entity does not in fact constitute a reform of intellectual, broadly 'scientific', practice.

Stephen Gaukroger argues that the idea of the unity of science—achieved through the articulation of a reductionist and foundationalist account of all natural phenomena in terms of the collision of atoms—was the most important contributing factor to the consolidation of the western scientific tradition. In contrast to Aristotelian *scientia*, which attempts to explain only those processes or events that follow from the essential natures of things, the modern mechanistic account can explain both natural and unnatural occurrences, including those that arise contingently or from purely extrinsic conditions. (Mechanism can explain, for instance, why water falls to the ground when poured out of a bucket—a 'natural' occurrence—as well as why water can be lifted by a mechanical device—an 'unnatural' occurrence from the point of view of Aristotelian physics). It is

characteristic of contemporary culture to model all cognitive values on scientific values, but Gaukroger claims that this intellectual subordination of the nonscientific to the scientific is possible only if a notion of the unity of science is presupposed. This notion was provided, he seems to suggest, by the 17th century mechanistic philosophers.

Catherine Wilson claims that renewed attention to the works of Epicurus and Lucretius in the 17th century played a significant role in the development of non-Aristotelean science. Where scientific explanation for Aristotle's medieval followers emphasized formal and final causality and typically invoked incorporeal agents as explanatory hypotheses, the new science reverted to and revised the creed of the ancient atomists, who held that every natural phenomenon could be explained fully in terms of efficient causes and contact action between particles of matter. Wilson focuses on the relatively neglected question of the immortality of the soul in mid- to late-17th century natural philosophy. Most interesting, though somewhat confusing, is her discussion of Locke, whose evasiveness on this issue Wilson thinks holds the key to understanding his *Essay Concerning Human Understanding*. Locke entertained the possibility of thinking matter, though he refrained from taking a definite stance with respect to the soul's supposed immortality. The inherent modesty of Locke's method prevented him from making any positive assertion one way or the other. By placing both unsensed incorporeal substances and the unsensed material causes of sensation beyond the reach of 'practical, efficacious human knowledge', Locke was laying the basis for a new form of science along Epicurean-Gassendist lines, one that did not require reference to unknown theoretical entities. Here Wilson's argument becomes difficult to interpret, since an Epicurean-Gassendist theory of atoms *would* require reference to unknown theoretical entities, and Wilson concedes that matter is 'absolutely' essential in Locke's system as an explanatory principle (50). Perhaps Wilson could just distinguish more clearly between Locke's historical, plain method and the excursion into natural philosophy in which he posits corpuscles as the unknown causes of sensation. Her distinction between the 'epistemolgocial level of discourse' and an 'atom-based' ontology is insufficiently sharp to clarify anything (50).

Stephen Clucas offers a compact summary of Joachim Jungius' *Logica Hamburgensis*. Clucas argues convincingly that Jungius' attempt in this much neglected work to apply logic to the empirical investigation of nature made a significant contribution to the development of the scientific method in the 17th century. Descartes was one of Jungius' great admirers, and Clucas' sketch of the points of disagreement between these two thinkers helps to underscore the historical importance of the latter.

Tom Sorell identifies two conceptions of science operative in Descartes' works on physics and metaphysics and attempts to show that there is no tension between them. There is, on the one hand, an exacting conception of *scientia* involving an explicit grasp of the general reasons for confidence in the faculties of knowledge properly employed—this is Descartes' divine guarantor—and, on the other, a less exacting sense presupposing no explicit awareness of the availability of a theistic proof of the reliability of the methodically applied human intellect. Sorell claims that the second, less exacting sort of scientific knowledge can be raised to the level of *scientia* when understood in the light of

Descartes' metaphysics. Specimens of physical science such as the laws of refraction or optics are to be regarded as 'edited extracts' from *scientia* in the restrictive sense and qualify as knowledge proper insofar as the suppressed principles of fundamental physics and metaphysics (as established in the *Meditations on First Philosophy*) can be reinserted at any time. Explanations of particular phenomena are thus comparatively intelligible even without their entire context—their grounding in a warrant-conferring metaphysical system—being made explicit.

The famous mind-better-known-than-body doctrine of the second Meditation notwithstanding, Nicholas Jolley claims that Descartes did not believe that *scientia* with respect to the mind was possible. Descartes' position here has recently received limited endorsement from certain commentators who maintain that he was justified in asserting epistemic parity between knowledge of the mind and knowledge of body. Nolan and Whipple, in particular, hold that Descartes had good reason for claiming to have achieved *scientia* regarding both mind and body. Jolley suggests that this defense of Descartes relies on a mistaken conception of *scientia*. As Jolley sees it, *scientia* is for Descartes a *body* of interconnected principles. Isolated intuitions get us nowhere without the guarantee of God's veracity that makes systematicity in knowledge (and thus, *scientia*) possible. Descartes' knowledge of his own mind in the second Meditation, lacking at that stage the divine guarantee, does not fit into the system of knowledge and so, strictly speaking, does not qualify as *scientia*. Whether or not Jolley is right about this as an account of Descartes, the distinction he draws between the priority of the *cogito* within the regimen of doubt and the priority of *scientia* as systemcatic knowledge highlights the subtlety of the position.

Don Garrett explains the differences between opinion, reason and *scientia intuitiva* in Spinoza's *Ethics*. Garrett raises a number of interesting interpretative questions about *scientia intuitiva* in particular, and though the exposition is sophisticated throughout, it is almost as difficult to follow as Spinoza's text itself, and the point of the exercise is not entirely clear, since Garrett never articulates a definite thesis. Presumably, the point is just to clarify what *scientia intuitiva* is for Spinoza, but the answer Garrett gives will leave many readers perplexed.

Douglas Jesseph explains why Hobbes restricts *scientia* to geometry and politics. Hobbes apparently believes that *scientia* is possible only of those things that we ourselves construct—it is a sort of 'maker's knowledge'—and geometry and politics are the only two disciplines that generate their own objects. Jesseph's analysis illuminates Hobbes' understanding of *scientia* very well and it is additionally—perhaps unintentionally—suggestive of Kant, so the paper has more than one layer of historical interest.

G. A. J. Rogers gives a clear and compelling picture of Locke's philosophy of science that explains why progress in the science of body is sharply limited by the physiology of perception. Were sensory experience able to disclose the fundamental properties of things, accurate demonstrative knowledge would be no less attainable in physics than it is, according to Locke, in geometry and ethics.

Given the breadth of the volume, and the depth of the entries, this collection will prove extremely useful for a variety of purposes, including the amusement of pedants and the stoking of scholarly debate.

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