

Descartes' Natural Philosophy

Edited by

**Stephen Gaukroger, John Schuster
and John Sutton**



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Descartes' Natural Philosophy

The most comprehensive collection on Descartes' scientific writings ever published, this volume offers a detailed reassessment of his scientific work and its bearing on his philosophy. Written by some of the world's leading scholars, the book focuses on Descartes as a pioneer of the mechanical philosophy, and practitioner of mathematics, mechanics, optics, anatomy, physiology and psycho-physiology.

The collection looks at Descartes' work in the sciences as an aspect of his natural-philosophical agenda. Among the key topics examined are:

- Descartes' novel contributions to mechanics, optics, and cosmology
- the central place of medicine in his overall project
- the connections between his investigations of specific psychological capacities and his ethics of self-government
- the debates and controversies into which he and his followers were drawn, and their role in shaping Cartesian natural philosophy.

By placing natural philosophy, rather than a sceptically driven epistemology, at the centre of Descartes' concerns, this book subjects many central themes in Cartesian philosophy to fundamental reassessment. It will therefore be of vital interest to all historians of philosophy or science.

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References to Descartes' works

References to Descartes' works are to the standard edition: Charles Adam and Paul Tannery (eds.), *Oeuvres de Descartes*, 2nd. edn (11 vols., Paris, 1974–86). The edition is abbreviated to AT throughout, and reference is made to volume number and page number by Roman and Arabic numerals respectively, e.g. AT iv. 123. In the case of the *Principia* and the *Passions*, however, references are to Part and Article number, since this is a more convenient way of locating the relevant passage. Descartes' works are referred to by their original titles, in the original language.

A number of Descartes' natural-philosophy works are missing from, or appear only in a truncated form in what is now the standard English translation of Descartes' works: John Cottingham et al, *The Philosophical Writings of Descartes* (3 vols., Cambridge, 1984–91). Full English translations of the major works missing from this edition can be found as follows:

La Dioptrique, Les Météores, La Géométrie in Paul J. Olschamp (trans.), *René Descartes: Discourse on Method, Optics, Geometry, and Meteorology* (Indianapolis, 1965).

Principia Philosophiae in V.R. and R.P. Miller (trans.), *René Descartes: Principles of Philosophy* (Dordrecht, 1991).

Le Monde, L'Homme, Description du Corps Humain in Stephen Gaukroger (trans.), *Descartes, The World and Other Writings* (Cambridge, 1998).

Introduction

This volume gathers together a number of new studies of Descartes' natural philosophy. We have not concerned ourselves with the textbook image of Descartes in philosophy or the history of ideas, as father of modern philosophy, or as the inventor of modern epistemology, mind/body dualism, or advocate of a universal method. Rather, we focus on Descartes in the context of his times as a pioneer of the mechanical philosophy and leading practitioner of mathematics and a number of the then existing specialised traditions of scientific endeavour, such as mechanics, optics, anatomy, and physiology (including psycho-physiology). We view Descartes, moreover, as a natural philosopher whose aims and agendas were not independent of the social and intellectual contexts within which he was working; and as someone who, over time, not only achieved numerous remarkable successes, but who also endured several deflections of aim, tactical retreats and outright failures.

The theme of our volume is not entirely new. In recent years a small but growing body of research has examined aspects of Descartes' natural philosophy as part of a reassessment of his role in the history of Western thought. Our aim here is to represent and consolidate some of the present concerns in the area of Descartes' natural philosophy and to bring to light a number of new possibilities for its study. How these aims are viewed will inevitably depend in large measure upon how the term 'natural philosophy' is understood, both in general, and in the particular case of Descartes.

The term 'natural philosophy' has often been used, particularly in the literature in the history of science, in two ways: either it is used in an anachronistic way as a synonym for 'science' – an anachronism, since 'science' as a term denoting the presumed unity, methodological and institutional, of all inquiry into nature, is a nineteenth-century coinage. Or, with more justification it is used as a synonym for 'the sciences', meaning the set of narrower traditions of intellectual practice that existed in the early modern period on the basis of classical models, such as astronomy, optics, mechanics, anatomy, music theory, and the like. Strictly speaking, however, in the early modern period the term 'natural

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philosophy' denoted attempts to explain in a systematic way the nature of matter, the cosmological structuring of that matter, the principles of causation and the methodology for acquiring or justifying such natural knowledge. The dominant genus of natural philosophy – and the exemplar for its form, content, and the grammar of articulation – was, of course, Aristotelianism in various neo-scholastic guises, but the term similarly applied to challengers and alternatives of similar scope and aim; that is, to any particular species of the various competing genera: neo-Platonic, mechanistic (as in Descartes' work) or, later, Newtonian.

The construction of any particular natural philosophy in the early modern period was complicated by three further sets of considerations. First, each natural philosophy had to make out discursive linkages or articulations to matters of theological, political, and pedagogical interest, as well as, increasingly, to matters pertaining to the status and content of the practical arts. The patterning of these linkages went a long way to defining the character of a particular natural philosophy, and can reveal a great deal about the aims and interests of its author and the contextual forces to which he was responding.

Second, each natural philosopher had to consider the set of narrower traditions of science-like practice which existed at the time, such as astronomy and anatomy, setting priorities and possibly exclusions amongst them, and linking them conceptually to his natural philosophy. This too created a pattern of discursive linkages characteristic of a particular natural philosophy. Natural philosophers competed for status and precedence, and part of that competition involved attempts to co-opt and direct the practice of the already existing traditions of scientific endeavour. The practice of a subordinate science under the aegis of a particular natural philosophy was coloured by the nature of the conceptual linkage involved, as in Descartes' manner of mechanising physiology or optics. However, the macro-history of such sub-fields obviously eluded the control of any given natural philosophy and consisted in the interplay and concatenation, over time, of the ways it was linked to, and thus practised under, competing natural philosophies. The larger history of physiological or optical inquiry would show this character in the early modern period, with Descartes' interventions shaping moments in the process.

Finally, natural philosophising constituted an evolving sub-culture. Institutionalised Aristotelianism faced a host of challengers and the fate, as well as the meaning, of any particular natural philosophy was in the hands of its proponents and adversaries as the process of cultural bidding and competition unfolded over time. In this connection it should be noted that a natural philosophy did not have to exist in an explicit, frozen, systematised form. In any case the degree to which a natural philosophy had become consolidated, and the legitimacy of this consolidation were open to challenge, debate and negotiation. Nothing in fact prevented an individual natural philosopher from offering differently systematised

natural philosophies (or versions of the ‘same’ natural philosophy) in different circumstances. Descartes notoriously did this, there being considerable differences between the mechanism of *Le Monde* and that of the *Principia* in terms of attempted metaphysical grounding, pedagogical systematisation, and articulation of fundamental concepts. All this points to the shaping of particular natural philosophies by local circumstances and their character as continually renegotiated cultural entities. Indeed many scholars would now acknowledge that the struggles over natural philosophies, which entrained and coloured struggles within the narrower traditions of scientific practice as well, defined the rhythms and moments in that process usually termed the ‘Scientific Revolution’ of the seventeenth century.

It follows from our perspective, as well as from recent developments in the literature, that neither Descartes’ natural philosophy, nor anyone else’s, could be produced by applying a universal method, or ‘deduced’ from metaphysics. Many modern scholars now hold that, although Descartes himself may have believed in the efficacy of his method (at least until it met severe difficulties in the late 1620s), grand, set-piece doctrines of scientific method such as Descartes’ cannot and do not control and guide the actual practice in any given field of research, let alone the entire gamut of disciplines. Descartes’ technical achievements in mathematics and the sciences cannot therefore be explained as applications of his method, nor can use of his method explain the complex and shifting architecture of his natural philosophy.

Similarly, it is now virtually impossible to believe Descartes deduced his entire system of natural philosophy from metaphysical principles. This folklore arose from the deductivist tone of Descartes’ abortive method and from some of his more offhand public and private statements about the issue. It is clear that in his mature work, after abandoning the *Regulae* in 1628, Descartes increasingly came to see that neither the details of particular explanatory models, nor the facts to be explained, could be deduced from metaphysics. In the *Principia* his position became very clear: we may know with certainty from metaphysical deduction that the essence of matter is extension, but we cannot deduce from this truth more detailed explanatory mechanistic models for such phenomena as gravity, light, magnetism, planetary motion, sensory perception and animal locomotion. The best one can say is that such models should not contradict metaphysically derived certainties and that relevant facts must also be considered in shaping explanatory models. Hence, such lower-level models are necessarily hypothetical and can achieve at best only ‘moral certainty’.

Given all this, our approach to Descartes’ natural philosophy may be termed dynamic rather than static, a perspective shared by most of the papers included in the collection. By this we mean that Descartes’ natural philosophy, including his work in the subordinate domains of practice, was continually in process, contested and negotiated during his life and

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after his death. This is not to say that Descartes lacked systematising aims or failed to pursue them; rather, it means that we do not believe he ever finally espoused one temporally frozen system, let alone a system deducible from metaphysics or method. To study Descartes' natural philosophy is thus to study his natural-philosophising: his various attempts at systematic explanation of matter, cosmos, causation and method in relation to his practice of those more narrow science-like traditions particularly favoured by him, such as optics, statics and hydrostatics, music theory, anatomy, and physiology. It also necessarily involves the study of his situationally shaped attempts, over time, to enrol followers, marginalise competitors, and defeat opponents, as well as the continuation of these processes by his supporters and detractors, even after he had vanished from the natural-philosophical scene.

Many of the contributions to the collection pay much greater attention to Descartes' immediate predecessors, contemporaries, and immediate successors than is usual. The first is important because we must understand the context in which Descartes' work began: what tradition bequeathed to his generation as problems, techniques, and solutions. The second is important because we need to know how Descartes' contemporaries understood and reacted to his natural philosophy if we are to reach a better sense of just what was at issue for Descartes. What exactly his immediate successors took up, and why they took up what they did, is also of critical importance because twentieth-century understandings of Descartes often bear little relation to how he was interpreted before the twentieth century. This is nowhere more striking than on questions of cognition and the nature of the mind, for Descartes was generally taken as a dangerous materialist from the mid-eighteenth to the end of the nineteenth century, and as the antithesis of a materialist from then on. Paramount among influential modern caricatures of Descartes are Gilbert Ryle's *Concept of Mind* (1949) – with its idea of the Cartesian mind as 'the ghost in the machine', a mysterious spiritual being somehow concealed within a robotic exterior, implicated in a bewildering bifurcation of inner and outer lives – and Richard Rorty's account in *Philosophy and the Mirror of Nature* (1980), whereby philosophy has since Descartes become divorced from questions of practical, moral, and political importance through its arid attempts to ward off epistemological scepticism.

Much of the misunderstanding that lies behind these kinds of account comes from a refusal to take the category of natural philosophy seriously, or even to take any notice of it at all. A distinction between philosophy and science, although it has often been recognised as problematic (especially in the last twenty years), has dominated twentieth-century thinking. This distinction has been applied to physical theory, separating out the properly metaphysical/epistemological/methodological bits from the properly scientific bits, and to cognition, where it has motivated a separation between those questions appropriate to empirical psychology and

neurophysiology, and those appropriate to epistemology. The result is the carving up of questions and domains which, for Descartes and other seventeenth-century thinkers, were part of an integrated project, so that something that made perfectly good sense and had a clear rationale now becomes at best problematic and at worst indefensible.

If one takes the category of natural philosophy seriously, however, we are forced to recognise a number of themes cutting across his project which ultimately must be brought together. These include: his technical work in the various sciences as a function of his natural-philosophical agenda, including especially his little-studied deep concern with anatomy and physiology; his insistence on the central place of medicine in his overall project; the connections between his detailed investigations of specific psychological capacities and his developing ethics of self-government and the management of the passions; the associated, previously almost unexamined issue of his strategies for the organisation and supervision of empirical and experimental evidence; the contrast between his formal doctrine of method, used rhetorically in the presentation of his work, and his actual working styles and techniques in natural philosophy and the subordinate sciences; the links between his theorising about the idiosyncratic dynamics at the basis of his mechanical philosophy and his work in optics and mechanics; his early aims and techniques in natural philosophising; the debates and controversies into which he and his later followers were drawn, and their effects in shaping Cartesian natural philosophy.

The overall thrust of the view of Descartes' natural philosophy presented in the essays in this volume is of something dynamic, something that changes both in response to internal developments and in response to external pressures which shape the milieu in which Descartes pursues his natural-philosophical programme. Although he perhaps failed in terms of his own vision of his mature projects and aims, Descartes' interventions shifted the ground of debate in several key areas of natural philosophy, mathematics and the narrower technical sciences. Our aim is to develop an assessment of Descartes as a central figure in the Scientific Revolution of the seventeenth century, and to go some way to changing the conceptual space within which discussions of Descartes have traditionally proceeded. The essays help to establish that we must recognise, in his work, the priority of natural-philosophical considerations over the kinds of epistemological considerations that came to dominate philosophy in the era of Malebranche, Locke, and Berkeley. Indeed, the detailed accounts of the explicitly natural-philosophical way in which Descartes pursues questions of perceptual cognition, in the later essays in the volume, stands in stark contrast to the idea that the *cogito* and dualism motivate and guide his treatment of cognition.

The volume is split up into relatively discrete areas or topics, and a guide to these areas follows, but the reader will have realised by now that

such divisions are not always sharp, that there are themes which underpin the whole Cartesian enterprise, and that these themes are manifested in different ways in different areas. The kinds of considerations that regulate the mechanist programme in cosmology are very different from those that regulate it in physiology, for example, although there may be unexpected and quite precise parallels, as in the very distinctive and key role of fluids in Descartes' cosmology and physiology.

Mechanics and cosmology

The essays begin with an account of the natural-philosophical tradition in which Descartes was reared and which he saw his own system as replacing. Descartes mentions Aristotelian authors by name only a few times, and the commentaries of the Coimbraans and of Franciscus Toletus are mentioned but once. Yet, as Dennis Des Chene argues, for Descartes, as for other innovators of the seventeenth century, the commentaries and the *cursus*, or textbooks, that gradually took their place in Aristotelian teaching were inescapable. The *Summa quadripartita* of Eustachius a Sancto Paulo, which draws heavily on the Coimbraans, comes up several times when Descartes contemplates using the work as an exemplar against which to set the comprehensive presentation of his natural philosophy that eventually became the *Principia*. Des Chene focuses on the immense project of the Jesuit teachers at the University of Coimbra in Portugal. He surveys the background to the writing and publication of the commentaries, examines the literary character of the texts, and explicates their natural philosophical content. He shows that the commentators, charged as they were with the defence of the faith, strove to clarify Aristotle, to reconcile Aristotelianism with the tenets of the Church, and to shear off the extravagances of their Medieval predecessors, while incorporating some of the achievements of contemporaries, often presenting what was in fact new thought under the guise of commentary, or in the *quaestiones* that accompanied the explication of Aristotle. The commentaries and *cursus* were, by and large, the historically effective Aristotle, the basis of university instruction: whether philosophers rejected, as Descartes did, the philosophy of the Schools, or, like Leibniz, mollified their leave-taking with gestures of reconciliation, or, like Honoré Fabri, continued to adhere to Aristotelian principles while contributing to the new science, for most of them the Aristotelianism of the textbooks provided a vocabulary, especially in logic and metaphysics, that was only gradually superseded. Aristotelianism, moreover, defined to some extent the problems to which philosophers addressed themselves: as is clear from the chapters in the second half of the volume, for example, the range of biological and psychological topics that Descartes took as targets for revisionary mechanistic explanation matches that of the scholastic tradition. Des Chene's essay documents the living culture of systematic natural philosophising, under dominant forms of neo-

scholasticism, into which Descartes and his contemporaries were inducted as adolescents.

Descartes' induction into natural philosophy had a second source, however. It is well known that when Descartes met Isaac Beeckman in Breda in 1618, they became intimate friends, with Descartes serving a sort of second natural-philosophical apprenticeship under Beeckman. They discussed several problems in mathematics and natural philosophy, approaching them with a loose amalgam of mathematics and corpuscular-mechanical theorising, which they termed 'physico-mathematics'. Ten years later, when Descartes went to Holland once again, he and Beeckman renewed their friendship and Beeckman showed Descartes his private *Journal*, in which he had noted several new ideas concerning his mechanical philosophy. Soon, however, their friendship deteriorated into open animosity. Klaas van Berkel looks at this relationship and throws new light on the reasons for its breakdown, thus explicating the first documented instance of conflict over Descartes' natural-philosophical projects. Descartes' letters to Mersenne testify to his fear that Beeckman might claim to have instructed Descartes in his mechanical philosophy. Van Berkel suggests that Descartes was alarmed by Beeckman's intention to publish his mechanical philosophy just at a time when Descartes was considering this as well. Descartes knew all too well that Beeckman and he shared some important conceptions regarding natural philosophy. Hence Beeckman's publication might destroy his claims to being the first to have discovered the right way of doing natural philosophy. Descartes' behaviour towards Beeckman and Mersenne therefore was aimed at discouraging Beeckman from publishing his booklet. In this, van Berkel shows, Descartes succeeded.

It was noted above that Descartes' particular version of the mechanical philosophy embodied his own idiosyncratic style of dynamics. In his chapter, Stephen Gaukroger explores this issue, arguing that what underlay Descartes' physical theory was not kinematics, as is generally thought, but statics and hydrostatics. He notes that Galileo, too, had used a hydrostatic model in his early account of free fall, in *De Motu*, later switching to a kinematic account of free fall in the *Two New Sciences*, where free fall in a void is taken as the core case. Descartes' strategy, according to Gaukroger, was quite different, but no less reasonable at the time, for he continued to use a statically based model. Gaukroger shows that in applying this model to cosmology, Descartes was able to explain the stability of planetary orbits, the transmission of light, and the lunar orbits in terms of the nature of the fluid separating the Sun, the planets, and their satellites. Similarly, he argues that the problematic nature of Rule 4 of Descartes' Rules of Collision can be explained if we assume that there is a static model lying behind Descartes' kinematics. He concludes that while Descartes' static and hydrostatic models produced undeniably problematic results, the success of the kinematic route to dynamics – followed by