

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)

INTRODUCTION

Michael H. Shank and David C. Lindberg

After asking what we do for a living, people often find the answer jarring. “The history of medieval science?” How, indeed, can one use a synonym for “backward” to modify a noun that signifies the best available knowledge of the natural world? Yet the history of medieval science is a recognized and productive area of scholarship, whose practitioners not only use the expression freely but also are acknowledged as significant reinterpreters of medieval history itself.¹ To bridge the chasm between popular and scholarly understandings, we must grapple briefly with the two terms in “medieval science,” the way the tension between their meanings arose, and the way the Middle Ages as a general historical category has shaped the framework of medieval science.

THE POSTHUMOUS MIDDLE AGES

When the fourteenth-century poet Petrarch looked back at the Roman Empire, he saw “darkness” separating it from his own day. Although he did not think of this interval as a full-blown historical period, he nevertheless characterized it as contemptible. Barbarians from the misnamed Emperor Charlemagne onward had usurped a title and a dominion that rightly belonged to Romans. The fifteenth century gave this period such names as *media tempestas* or *medium aevum*, the “middle era.” For many European intellectuals of that day, the Middle Ages were a useful invention that contrasted the political fragmentation and barbarous degenerate Latin of the recent past with the lost glory and beautiful language of Rome, to which they

¹ Marcia Colish, *Remapping Scholasticism* (The Etienne Gilson Series, 21) (Toronto: Pontifical Institute of Medieval Studies, 2000), pp. 13–15, reprinted in Colish, *Studies in Scholasticism* (Aldershot: Ashgate, 2006).

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)

2

Michael H. Shank and David C. Lindberg

aspired.² To invoke the Middle Ages when discussing empire, language, or art was implicitly to narrate history with the radical discontinuity of a sorry, if not necessarily vacuous, millennium.

By the late seventeenth century, Christoph Cellarius (1638–1707), a Lutheran scholar at the University of Halle, gave the “middle era” a major role in historical periodization. After writing a separate *Historia medii aevi* . . . , he integrated it into his history of the world: *Historia universalis . . . in antiquam et medii aevi ac novam divisa* (“Universal history . . . divided into ancient, and of the middle era, and new”). He ended antiquity with Emperor Constantine (d. 337), and the “Middle Era” with the Ottoman conquest of Constantinople (1453). His 200-odd pages of medieval history included some culture. The Middle Ages ended with the resurgence of “Latin letters out of darkness,” the invention of printing, the foundation of new universities, and medieval theologians’ foreshadowing of the Reformation, which would begin the New Era.³ The medieval period and modernity each opened with landmarks in the history of Christianity: Constantine, who legalized it, and Luther, who reformed it. The confessional, even parochial, character of Cellarius’s divisions did not undermine their universal reach. They applied not merely to Europe but to the world.

This schema has had an astonishing career. In a few centuries, a slur born from Petrarch’s nostalgia for lost Roman power grew into the central hinge of the European past. By the nineteenth century, a layering of humanist, Protestant, and Enlightenment sensibilities had transformed Cellarius’s tripartite division into the framework that historians from the European colonizing nations routinely used to structure their understanding of the globe. The Middle Ages thus became a standard period of world history, which even the critical outlook of Marxist historiography not only left untouched but also helped to entrench and to export.⁴

The threefold division of global history remains firmly anchored in our conceptualization of the past, despite long-standing criticisms.⁵ It may take

² Jean Dagenais and Margaret Greer, “Decolonizing the Middle Ages: Introduction,” *Journal of Medieval and Early Modern Studies*, 30 (2000), 431–48, and the literature cited therein; Theodor E. Mommsen, “Petrarch’s Conception of the ‘Dark Ages,’” in Theodor E. Mommsen, *Medieval and Renaissance Studies*, ed. Eugene F. Rice, Jr. (Ithaca, N.Y.: Cornell University Press, 1959), pp. 106–21 (original 1942); and Paul Lehmann, “Mittelalter und Küchenlatein,” *Historische Zeitschrift*, 137 (1928), 196–213s, especially pp. 206–13.

³ Lehmann, “Mittelalter und Küchenlatein,” p. 201; Ilja Mieß, “Die Frühe Neuzeit: Definitionsprobleme, Methodendiskussion, Forschungstendenzen,” in *Die frühe Neuzeit in der Geschichtswissenschaft: Forschungstendenzen und Forschungserträge*, ed. Nada Boškovska Leimgruber (Paderborn: Ferdinand Schöningh, 1997), pp. 17–38, especially pp. 18–19. I cited here Cellarius, who was not the first to use it with positive historical content, from the general preface, pp. 11–12 of the seventh edition (Jena, 1728). See Christophorus Cellarius, *Historia medii aevi a temporibus Constantini Magni ad Constantinopolim a Turcis captam deducta* . . . (1688; 7th ed.: Jena: Bielke, 1724), pp. 214–18.

⁴ Timothy Reuter, “Medieval: Another Tyrannous Construct?” *Medieval History Journal*, 1 (1998), 25–45.

⁵ For example, Oswald Spengler, *Der Untergang des Abendlandes: Umriss einer Morphologie der Weltgeschichte* [1923 ed.] (Munich: Deutscher Taschenbuch Verlag, 1972), Introduction, especially

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)*Introduction*

3

the future dominance of Asian historiography to dislodge it. Upon hearing the expressions “medieval China” or “medieval India,” few wince, but everyone should who understands that for these civilizations the withering of the Western Roman Empire and the fall of Constantinople mean little. Meanwhile, “medieval Islam” designates its earliest centuries; that is, ancient or classical Islam. Such universalized usages conveniently avoid verbal “time warps” between cultures, but the price of calling everything between 400 and 1450 “medieval” is that the deeply entrenched unflattering connotations associated with the European Middle Ages automatically color other civilizations.

Significantly, the problems of the category “Middle Ages” are also severe when applied to Europe, where it originated. For historians, the most pernicious trait associated with the thousand-year label is the implication that the period shares a fundamental unity rooted in the “medieval mentality” and its many ramifications, all of which change as one approaches 1450–1500. As Jacob Burckhardt, one of the most influential creators of the Renaissance, evocatively characterized the contrast in 1860: “In the Middle Ages both sides of human consciousness – that which was turned within as that which was turned without – lay dreaming or half awake beneath a common veil. The veil was woven of faith, illusion and childish prepossession, through which the world and history were seen clad in strange hues.”⁶ More recent quotations in a similar vein could be cited for medieval religiosity, the medieval cosmos, and other aspects of medieval thought and life. Newspaper editorials and ordinary language continue to cast a pall of negativity on the period and its image.⁷

Once upon a time, the modern world immediately followed the Middle Ages. Later, it was buffered by “Renaissance and Reformation”; nowadays, more cautiously, by the “early-modern” world.⁸ The further we recede from 1500, the more qualifications “modern” is likely to receive. The crux of the problem is that, in any guise, modernity and early modernity are fundamentally European categories, the universalization of which is far more than academic; they implicitly turn the idiosyncrasies of European/Western

pp. 21–30; Rainer Thurnher, “Oswald Spengler: Sa théorie de l’histoire et ses implications politico-idéologiques,” in *Expansions, ruptures et continuités de l’idée européenne*, ed. Daniel Minary, 3 vols. (Paris: Diffusion Les Belles Lettres, 1993–1997), (Annales Littéraires de l’Université de Besançon, 562), vol. 2, pp. 155–70, especially pp. 161–2.

⁶ Jakob Burckhardt, *The Civilization of the Renaissance in Italy*, trans. S. G. C. Middelmore (London: Penguin Books, 1990), Part II, chap. 1, pp. 97–8.

⁷ Skeptics should browse the World Wide Web or watch the film “Pulp Fiction” (1994) to see astonishing uses of the expression “going medieval.”

⁸ Charles H. Parker, “Introduction: Individual and Community in the Early Modern World,” and Jerry H. Bentley, “Early Modern Europe and the Early Modern World,” in *Between the Middle Ages and Modernity: Individual and Community in the Early Modern World*, ed. Charles H. Parker and Jerry H. Bentley (Lanham, Md.: Rowan and Littlefield, 2007), pp. 1–9, 13–31, respectively, especially pp. 1–3; Lorraine Daston and Katharine Park, “Introduction: The Age of the New,” in *The Cambridge History of Science*, vol. 3: *Early Modern Science*, ed. Katharine Park and Lorraine Daston (Cambridge: Cambridge University Press, 2006), pp. 1–20.

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)

history into a normative developmental pattern and impose these expectations on vast areas of the world that are still wrestling with the legacies of colonialism. To be “not yet modern” is implicitly to be medieval.⁹

Most of our knowledge of the vast medieval period has been uncovered since Burckhardt, whose seductive oversimplifications historians now overwhelmingly reject. In political and institutional history, the expressions “medieval” and “the Middle Ages” have long enjoyed more neutral connotations than they do in either ordinary language or the history of high culture, including science. After all, general historians could discuss *something* rather than nothing – rulers, battles, even economic and social practices and institutions. In these domains, once the expression “medieval civilization” ceased to be a contradiction, scholars of the period embraced the former slur and called themselves “medievalists.” By the late twentieth century, one distinguished medievalist went so far as to proclaim the Middle Ages “a true period.”¹⁰ It could now partake of the real and the good.

Assigning a positive affect to the old monolithic periodization adds nothing to our critical understanding, however. More helpful are the scholarly challenges to it embodied in such journals as *Mediaeval and Renaissance Studies* (1941–) and the *Journal of Medieval and Early Modern Studies* (1971–). A few generations ago, such titles would have met with disbelief. Despite their use of “medieval,” they obviously reject a sharp break and reflect a principled skepticism about the traditional periodization of European history. Other historians go further and want altogether to eliminate “medieval” and “Middle Ages” from our lexicon. One, who has called these “the worst terms that have ever found their way into the vocabulary of historians,” has promoted “Old Europe” as a more coherent unit spanning roughly 1000–1800. Some historians of law and science, among other fields, have tried spans that avoid making 1450–1500 the central hinge of recent history.¹¹ Such approaches perform an invaluable service by usefully correcting two of the most misleading aspects of the traditional periodization: the false unity implied by lumping a very diverse millennium under a single heading and the false impression that everything changed circa 1450–1500. The preceding millennium was also a period of great change in almost every facet of human life, from the movements of peoples to the creation of institutions and the

⁹ See the suggestive remarks of Dagenais and Greer, “Decolonizing the Middle Ages,” pp. 435–7.

¹⁰ Cited in Wilhelm Kamlah, “Zeitalter überhaupt, ‘Neuzeit,’ und ‘Frühneuzeit,’” *Saeculum*, 8 (1957), 313–32, especially pp. 319–22.

¹¹ Dietrich Gerhard, *Old Europe: A Study of Continuity, 1000–1800* (New York: Academic Press, 1981), p. 3; Howard Kaminsky, “From Lateness to Waning to Crisis: The Burden of the Later Middle Ages,” *Journal of Early Modern History*, 4 (2000), 85–125, especially pp. 123–5; Harold Berman, *Law and Revolution: The Formation of the Western Legal Tradition* (Cambridge, Mass.: Harvard University Press, 1988) goes to the twentieth century; A. C. Crombie, *Augustine to Galileo: The History of Science, A.D. 400–1650* (London: Falcon Press, 1952) and later editions; and Stephen Gaukroger, *The Emergence of a Scientific Culture: Science and the Shaping of Modernity, 1210–1685* (Oxford: Oxford University Press, 2006).

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)*Introduction*

5

transformation of ideas. As Marcia Colish phrased it, “diversity, inconsistency, and contradiction, and the ability to live with them and to thrive on them, are features of medieval culture that militate against any monolithic or schematic understanding of it.”¹²

These alternative periodizations allow us to avoid the easy contrasts in which the traditional schema imprisons us. The old tripartite schema will, however, die very hard. It is entrenched in the lexicon, readers expect it, it defines academic positions and curricula, and many historians use it unself-consciously. Under the circumstances, our best hope is to treat the Middle Ages as a conventional name and subvert the stereotype associated with it, notably by using jarring expressions like “medieval science” and publishing books about it.

THE SCIENCE IN MEDIEVAL SCIENCE

Early-twenty-first-century English typically uses the word “science” to denote the systematic study of natural phenomena. This dictionary-like definition is purposefully very general. (In other modern languages, the equivalent word is even more general, encompassing all systematic knowledge, whether of nature or not). When we are talking about science as it is practiced today, we implicitly modify this general definition with such specific connotations as professionalization, governmental funding, large laboratories, and experimental activity, sometimes on a grand scale.

Clearly, science in 1300 or even 1800 did not involve white lab coats or Nobel prizes. The fact that the meanings of “science” today are not precisely what they were in the past is no reason to ban the term from speech about the past, as some want to do. Let us not forget that, as used throughout the world today, the meanings of “science” and its cognates are far from unified. Many people disagree about them now.

If historians of science were to investigate only those past practices and beliefs about the study of nature that most resemble the latest science, the result would be both thin and seriously distorted. We would not be responding to the richness and variety of the past as it existed but filtering it through a modern grid. To be as fair as possible to the past in its own terms, we must refrain from scouring it only for examples or precursors of the latest science. We must respect the various ways in which earlier generations investigated nature, acknowledging that they are of great interest even though many of their approaches differed from the modern ones. Most obviously, some belong to our immediate intellectual ancestry

¹² Marcia Colish, “When Did the Middle Ages End? Reflections of an Intellectual Historian,” in *Schooling and Society: The Ordering and Reordering of Knowledge in the Western Middle Ages*, ed. Alasdair McDonald and Michael Twomey (Leuven: Peeters, 2004), pp. 213–23, especially pp. 222–3.

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)

(e.g., mathematical astronomy) and can help us to understand how modern science became what it is. But other related activities with no counterpart in modern science (e.g., medical astrology) were also important to our predecessors and deserve our attention for that reason alone. Historians, then, require a very broad working definition of “science” – one that will permit investigation of the vast range of practices and beliefs about the operations of nature that preceded the modern scientific enterprise and that can help us to understand how the latter came about. We need to be broad and inclusive – even broader, the farther back we go – rather than narrow and exclusive.¹³

English, a relatively new language, adopted the word “science” from the much older Latin. This history means that translation is at the heart of what the historian of early science must do. Obviously, many meanings of “science” before 1800 differ from some of the many meanings of the word in 1850 or today (many other words face the same problem). But these meanings have evolved in describable ways and for the most part have not changed into their opposites. Thankfully, adjectives allow us to qualify nouns and specify the range of their meaning. Using the expressions “Babylonian science” or “medieval science” does not presuppose that science has an unchanging essence, only that general terms are useful in communicating family resemblances and can be qualified as needed.¹⁴ Our readers will grasp at once that “medieval science” means something different from both “ancient science” and “contemporary science” while sharing some similarities with them.

Long before 1500, we encounter languages for describing nature, the systematic collection and analysis of data about it, methods for exploring or investigating it (including some experiments), factual and theoretical claims (sometimes stated mathematically) that derive from such explorations and lead to new ones, and criteria for judging the validity of these claims. Moreover, in the planetary astronomy, geometrical optics, natural history, and some aspects of medicine of the Middle Ages, we clearly recognize a close kinship with what we now call science. This is not to deny significant differences – in motivation, instrumentation, institutional support, methodological preferences, mechanisms for the dissemination of theoretical results, economic importance, and social function. Despite such differences, terms like “science” or “natural science” were used in the various contexts of the Middle Ages for goals and activities that bear a family resemblance with those of modern scientific disciplines, to whose history they therefore squarely belong. It is the burden of this volume to illustrate the similarities as well as the differences.

¹³ See David Pingree’s definition: “Science is a systematic explanation of perceived or imaginary phenomena, or else is based on such an explanation.” See David Pingree, “Hellenophilia versus the History of Science,” *Isis*, 83 (1992), 554–63, especially p. 559.

¹⁴ See the wise words of David Hull, “The Professionalization of Science Studies: Cutting Some Slack,” *Biology and Philosophy*, 15 (2000), 61–91, especially p. 64.

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)*Introduction*

7

The chapters that follow will use “science” for purposes as broad as those of the historical actors whose intellectual efforts they seek to understand. Additional distinctions and unusual terminology will also appear. At their most general, many medieval theoretical efforts fell under the general rubric of what scholars in the Byzantine, Arabic, and Latin worlds called “philosophy.” Much, but by no means all, medieval scientific activity fell under the rubric of “natural philosophy.” It is this expression that ancient and medieval scholars in the Greek tradition generally applied to investigations involving the causes of change in nature. In the medieval civilizations that interacted with the Greek heritage, natural philosophy was closely identified with, but not restricted to, topics covered by the large corpus of Aristotle’s writings devoted to nature – the elements and transformations of them, the growth, decay, and classification of living things, motion, the heavens, and so forth.¹⁵ Long after Aristotle’s thought ceased to structure the natural world, the expression “natural philosophy” was still a synonym for “physics” in the late nineteenth century. The category was not all-encompassing, however. Another broad area of activity, albeit one with fewer practitioners, drew heavily on mathematical analysis and grouped its disciplines into various “mathematical sciences,” most notably astronomy, optics, and the “science of weights.” Significantly, much intriguing work occurred in areas in which natural philosophy and the mathematical sciences overlapped, shared questions, and contested each other’s boundaries. Not least, practitioners developed a technical vocabulary for identifying subdisciplines with their own specific foci, notably astronomy, optics, meteorology, metallurgy, the science of motion, the science of weights, geography, the natural history of both plants and animals, medicine, and others. In the chapters that follow, then, “science” and its cognates signify the attempts to acquire, to evaluate, or to create systematic knowledge of the natural world, and occasionally to exploit it. The reader’s close attention to context should in every case make the meaning clear.

In the medieval period as today, most literate individuals interested in such questions about nature were already drawing on a long tradition of past activity. Accordingly, many of their efforts were “bookish” or textual in nature. They occurred in a study or a library or a disputation hall, and proceeded by reading arguments in the books of predecessors and contemporaries, reflecting critically on their contents, and scrutinizing or debating their conclusions, in disputations and in writing. (Contemporary scientists do a lot of this, too.) But medieval science also had an empirical component, especially in what we now call biology and the biomedical sciences (botany, zoology, and medicine) but also in such physical sciences as

¹⁵ Edward Grant, *A History of Natural Philosophy* (Cambridge: Cambridge University Press, 2007), pp. 234–8.

astronomy, optics, and alchemy, which used tools of measurement and sometimes performed experiments.

In the millennium between roughly the fifth and the fifteenth centuries, investigations of nature were not homogeneous across time or space. They underwent significant changes and developed notable local emphases across the vast lands from the Atlantic to Central Asia covered by this volume.

THE HISTORY OF MEDIEVAL SCIENCE AS A FIELD

Although a few individual scholars had worked on aspects of the subject since the late eighteenth century, the history of medieval science came into being as a field of study in the early twentieth century. The catalyst was a series of provocative claims about the role of fourteenth-century Parisian natural philosophy in explaining the science of the sixteenth and seventeenth centuries. Medieval science thus represented a new milestone in the sketchy linear narrative connecting classical Greece to Isaac Newton. Although the impetus for the new field began with an almost exclusively European focus, it has now expanded vastly beyond those limitations, chronologically and geographically. The newest growth area is the scientific enterprise in Islamic civilization, which is drawing more of the attention it richly deserves. The pioneering work of Joseph Needham's *Science and Civilization in China* and of David Pingree in the exact sciences in India have laid the groundwork for new fundamental scholarship in these areas. The field seems poised to "go global."¹⁶

Before the history of medieval science could become a field, it had to overcome several centuries of contempt for its subject matter. For Cellarius, as we have seen, medieval political history already had some content; for his immediate predecessors, however, medieval scientific efforts were null. In *The Advancement of Learning*, the English philosopher Francis Bacon (1561–1626) wrote of the "degenerate learning" of the schoolmen, who like spiders "did out of no great quantity of matter, and infinite agitation of wit, spin out unto us those laborious webs of learning which are extant in their books." "In the inquisition of nature," Bacon continued, the schoolmen "ever left the oracle of God's works and adored the deceiving and deformed images which the unequal mirror of their own minds or a few received authors or principles did represent unto them."¹⁷ Similar themes were ubiquitous in the eighteenth

¹⁶ Nathan Sivin, *Granting the Seasons: The Chinese Astronomical Reform of 1280, with a Study of its Many Dimensions and an Annotated Translation of its Records* (Berlin: Springer, 2009).

¹⁷ Francis Bacon, "Of the Interpretation of Nature," in *The Works of Francis Bacon*, ed. Basil Montagu, 3 vols. (Philadelphia: A. Hart, 1852), vol. 1, p. 84; Francis Bacon, "Of the Advancement of Learning, I," in *The Works of Francis Bacon*, ed. James Spedding, Robert Leslie Ellis, and Douglas Denon Heath, 7 vols. (London: Longmans, 1857–1874), vol. 3, pp. 285, 287; and David C. Lindberg, "Conceptions of the Scientific Revolution from Bacon to Butterfield: A Preliminary Sketch," in

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)*Introduction*

9

and nineteenth centuries. The French *philosophe* Voltaire (1694–1778) wrote of the degeneracy of the human spirit after the fall of Rome, illustrated by the scholastic theology of the Middle Ages, “the bastard offspring of the Aristotelian philosophy, badly translated, and as ill understood, did more injury to understanding and polite studies than ever the Huns and Vandals had done.”¹⁸ These witty diatribes articulated a broad intellectual consensus that associated the medieval universities with idolatrous pre-Reformation Christianity, debased barbarous intellects, and bad philology.

More serious because they were more cogently argued were the views of the Cambridge scholar William Whewell, one of the most prolific and influential historians and philosophers of science in the nineteenth century. Whewell saw the medieval period as a

long and barren period, which intervened between the scientific activity of ancient Greece, and that of modern Europe; and which we may, therefore, call the Stationary Period of Science. . . men’s Ideas were obscured, their disposition to bring their general views into accord with Facts was enfeebled. They were thus led to employ themselves unprofitably, among indistinct and unreal notions. And the evil of these tendencies was further inflamed by moral peculiarities in the character of those times – by an abjectness of thought on the one hand, which could not help looking towards some intellectual superior, and by an impatience of dissent on the other.¹⁹

Whewell’s outlook was consistent with the triumphalist narratives of “rebirth” of such contemporaries as Jules Michelet (*La Renaissance*, 1855) and Jacob Burckhardt (*Die Cultur der Renaissance in Italien*, 1860). Since rebirth presumes prior death, invoking the Renaissance presupposes a dead or dying antecedent.

Many otherwise well-educated people have long taken this picture for granted. No one has diffused it more widely than astronomer Carl Sagan (1934–1996), whose television series *Cosmos* drew an audience estimated at half a billion. In his 1980 book by the same name, a timeline of astronomy from Greek antiquity to the present left between the fifth and the late fifteenth centuries a familiar thousand-year blank labeled as a “poignant

Reappraisals of the Scientific Revolution, ed. David C. Lindberg and Robert S. Westman (Cambridge: Cambridge University Press, 1990), pp. 3–5.

¹⁸ Voltaire, “Ancient and Modern History in Seven Volumes,” in *The Works of Voltaire: A Contemporary Version*, trans. William F. Fleming, 43 vols. (Akron, Ohio: Werner, 1905), vol. 26, p. 54; Eugenio Garin, “Medio Evo e tempi bui: concetto e polemiche nella storia del pensiero dal XV al XVIII secolo,” in *Concetto, storia, miti et immagini del medio evo*, ed. Vittore Branca (Florence: Sansoni, 1973), pp. 199–224, especially p. 208; and Voltaire, *Works*, trans. Tobias Smollett and others, 39 vols. (London: J. Newbery et al., 1761–1774), vol. 1, pp. 41–42.

¹⁹ William Whewell, *History of the Inductive Sciences*, 3rd ed., 3 vols. (London: John W. Parker, 1857), vol. 1, p. 181.

Cambridge University Press

978-0-521-59448-6 - The Cambridge History of Science: Volume 2: Medieval Science

Edited by David C. Lindberg and Michael H. Shank

Excerpt

[More information](#)

10

Michael H. Shank and David C. Lindberg

lost opportunity for mankind.”²⁰ The timeline reflected not the state of knowledge in 1980 but Sagan’s own “poignant lost opportunity” to consult the library of Cornell University, where he taught. In it, Sagan would have discovered large volumes devoted to the medieval history of his own field, some of them two hundred years old.²¹ He would also have learned that the alleged medieval vacuum spawned the two institutions in which he spent his life: the observatory as a research institution (Islamic civilization) and the university (Latin Europe).

PIERRE DUHEM (1861–1916)

Sagan also overlooked the ten volumes of Pierre Duhem’s *Le Système du monde* (1916–54), subtitled “a history of cosmological doctrines from Plato to Copernicus” and devoted mostly to the Middle Ages. Duhem was a French physicist who made fundamental contributions to physics and the history and philosophy of science. Late in his career (1903–4), Duhem became very excited upon learning that the “science of weights” of the thirteenth-century Parisian master Jordanus Nemorarius anticipated views associated with Leonardo da Vinci and Galileo.²²

When Duhem’s research turned up more precursors, he became convinced that late-medieval Parisian criticisms of, and alternatives to, Aristotle’s views marked the origins of modern science, which had wrongly been ascribed to the sixteenth and seventeenth centuries. Paradoxically, Duhem argued that the bishop of Paris’s condemnation in 1277 of 219 propositions defended by university masters freed their successors to think outside the Aristotelian box and to propose views about motion, for example, that eventually led to the theories of Copernicus and Galileo. Duhem developed this startling

²⁰ Carl Sagan, *Cosmos* (New York: Random House, 1980), p. 335. Sagan’s outlook recently regained currency thanks to Alejandro Amenábar’s spectacular and spectacularly anachronistic film “Agora” (2009), which portrays Hypatia (d. 415) as on the verge of discovering the law of free fall and heliocentric planetary ellipses before she is murdered by fanatical monks.

²¹ Jean-Etienne Montucla, *Histoire des mathématiques*, 2 vols. (Paris: Charles Antoine Jombert, 1758) (2nd ed. in 4 vols., Paris: Henri Agasse, 1799–1802; repr. Paris: Blanchard, 1968); Jean-Baptiste J. Delambre, *Histoire de l’astronomie au moyen âge* (Paris: V. Courcier, 1819); and Guillaume Libri, *Histoire des sciences mathématiques en Italie depuis la renaissance des lettres jusqu’à la fin du dix-septième siècle*, 4 vols. (Paris: Jules Renouard et Compagnie, 1838; repr. New York: Elibron Classics, 2003), especially vols. 1–2. Outstanding scholarship also includes C. A. Nallino, *Al-Battānī sive Albategni Opus astronomicum* (1904); Baldassare Boncompagni, *Bullettino di bibliografia e di storia delle scienze matematiche e fisiche*, 20 vols. (Rome, 1868–1887); Maximilian Curtze, *Urkunden zur Geschichte der Mathematik im Mittelalter und der Renaissance*, 2 parts (Leipzig: Teubner, 1902); and Paul Tannery, *Les Sciences exactes au moyen âge*, vol. 5 of his *Mémoires scientifiques* (Toulouse: E. Privat, 1922).

²² A few specialists had been aware of Jordanus’s work since Montucla, *Histoire des mathématiques*. See Tannery, *Sciences exactes au moyen âge*, p. 316; and John E. Murdoch, “Pierre Duhem (1861–1916),” in *Medieval Scholarship: Biographical Studies on the Formation of a Discipline*, ed. Helen Damico, 3 vols. (New York: Garland, 2000), vol. 3 (Philosophy and the Arts), pp. 23–42, especially p. 26.