The Way and the Word: Science and Medicine in Early China and Greece by Geoffrey Lloyd and Nathan Sivin

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Lloyd and Sivin have been engaged for over a decade on a project of which this book is the first full-length joint publication. They aim to explore the 'beginnings of science and medicine in early China and Greece' [xi], covering the six centuries 400 BC to 200 AD; and they do this by delineating them through comparison of what they call the 'cultural manifold' of science in each civilization. By 'cultural manifold' they mean the continuum of thinkers' concepts, social goals, professional milieu, mode of discourse, and political associations [xi–xii, 3]. They focus on two questions, that of the circumstances of the origins of inquiry about the natural world, and that of the paths that those inquiries opened. Their intended readers are those curious about Greek or Chinese science and their respective manifolds, or those who seek a novel viewpoint thereon. The authors do not expect deep or extensive knowledge of Greek or Chinese social or intellectual history, although Lloyd learned Chinese for the purpose of the project.

The importance and novelty of their results warrants a detailed summary, and their approach deserves further exploration. I should mention at the outset that, whereas I was privileged to attend two of the early lecture series of this project that were held at Cornell in 1993 and 1995, I offer this review from the perspective of a student of Greek science who has spent some time reading up on ancient China but who cannot read Chinese. As is often the case for books that bridge disciplines, few to no reviewers exist who have all the requisite training. I do not know Sivin's work, which treats ancient Chinese alchemy, cosmology, and medicine; but this book stands in the ranks of Lloyd's works exploring the origins of Greek science,

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works such as *The Revolutions of Wisdom* (1987). Lloyd has also published two other books on the topic of Greek and Chinese science: *Adversaries and Authorities* (1996) and recently *The Ambitions of Curiosity: Understanding the World in Ancient Greece and China* (2002), his Isaiah Berlin lectures of 2000, which draws upon the book here reviewed.

In their opening chapter, Lloyd and Sivin explain their aims and methods. They acknowledge that the use of modern terms for ancient concepts may mislead, but allow that many concepts lack a reasonable alternative term [4–6]. They define the science they cover as the 'bid to comprehend aspects of the physical world' [4: cf. 1]; but throughout they focus on studies of numbers, the sky, and health. Had they included geography, mechanics, alchemy, or pharmacy, their work would have exceeded the practical limits of the volume's size; and in any case, for the period covered, they say there is little material on alchemy or geomancy [38–39: cf. 59–60, 232–234, 237–238, 264]. Nevertheless, such a focus results in a somewhat traditional foregrounding of sciences that achieved some still-approved results, i.e., mathematics, astronomy, and medicine, although Lloyd and Sivin eschew explicit comparison of ancient with modern *results* [xiii]. Still, in each culture geography was connected closely enough with astronomical and cosmological speculation that its inclusion would have usefully broadened Lloyd and Sivin's work; and I suspect that the dearth of Chinese geographical sources is not absolute—but if it were, even that would have made for a revealing contrast. Pharmacy is briefly treated in a discussion of the work often known in transliteration as *Pen Ts'ao Ching*, translated by Lloyd and Sivin as *Divine Husbandman's Materia Medica* [cf. 75, 191, 232-333]; but more could have been extracted from the medical texts, much as has been done elsewhere for Hippocrates. Lloyd [2002, 98–125] explores some Greek and Chinese medical texts with a view to understanding the use of technical terms in Greek and Chinese scientific writing.

Their choice of period is explained [9–16] as due to the 'fortunate accident' that Greece and China underwent analogous transitions and left comparably rich records in that era; furthermore, in both cultures, a natural terminus exists, since after 200 AD a foreign religion began to dominate thought (Buddhism in China, Christianity in the Greco-Roman world). They also provide further grounds for their chosen *comparanda*: (a) people in both cultures saw the need for, and engaged in, inquiries about a wide range of natural phenomena, not being content to accept traditional beliefs, (b) in both cultures specialist groups often took the lead in such studies, and, moreover, (c) in both cultures such studies were value-laden in that their results were intended to, and actually did, affect socio-political thought and writing. They acknowledge the difficulties of making such cross-cultural comparisons, but believe the risks are worth the rewards [6–9], much as Lloyd has argued earlier [1996, 1–19].[1]

It is clear, however, that for Lloyd and Sivin the chief justification of their chosen *comparanda* lies in the fruitfulness of their work [xii, 8], and when viewed in this way one would describe their book as a successful experiment in scholarship that should provoke other such efforts. For example, I expect that a similar study of early scientific thought in India, using both Greek and Chinese *comparanda*, would be similarly fruitful: note the rise and dissolution of the Mauryan Empire (comparable to the course of the Hellenistic empires and the Han dynasty), the relative importance of astrology and medicine in the scientific thinking of the times, and the advent of Mahayana Buddhism as marking the end of the era.

The main body of Lloyd and Sivin's work is chiastically structured. Chapters 2 and 3 explore the social and institutional framework of Chinese then Greek science; chapters 4 and 5 describe the fundamental issues of Greek then Chinese science. A sixth concluding chapter offers the comparison and explains the title; and two appendices give a novel sketch of Chinese cosmology and a brief comparative timeline.

On the Chinese side [ch. 2], practitioners were nearly all members of the elite who sought patronage, valued consensus, and worked within a well-defined 'lineage'. Most known practitioners of Chinese science in the period studied appear to have been upper class, in particular, *shih* or gentlemen, for whom literacy and proper observance of Confucian ritual were marks of membership in the elite [16–22]. The degree and kind of social mobility changed over six centuries,

[1] Shankman and Durrant [2000] perform a comparative analysis of the *Shi Ching* (*Poetry Canon*) and Homer's *Odyssey*, of Thucydides and Sima Qian, and of the philosopher and the sage, based on a similar argument that the cultures can indeed be compared.

but there is little evidence of lower-class literate practitioners. Physicians were at first reckoned among lower-class artisans, but by the Han dynasty (from 200 BC) there were literate physicians; throughout, astronomers were members of the elite [22–27]. The later imperial patronage of science evolved from the rulers' earlier practice of maintaining an extensive coterie of *k'o* (friends or guests) during the Warring States period (400–200 BC) who were expected to provide useful services to the ruler; moreover, the Han state created out of that tradition its well-known bureaucracy and civil service [27–42, 55–58]. Here Sivin and Lloyd miss an opportunity for comparison, since much the same phenomenon is found in the royal Macedonian and Hellenistic practice of maintaining *xenoi*, among whom surely are to be numbered many of the physicians and scholars known to us from Alexandria, Antioch, Pergamon, and Syracuse.

The importance of subsidies in Chinese science consolidated the cultural preference for consensus over argument and led to the writing of works in the literary form of memorials to the ruler advocating positions or presenting results, a form that Lloyd and Sivin deny existed among Greek scientists [61–68, 77–79]. However, I would cite the *Letter* of Diocles, the *Belopoiica* of Biton, the pseudo-Aristotelian *On the Cosmos*, and others, as evidence that a similar form was produced, albeit not commonly, by Hellenistic Greek scholars and practitioners seeking patronage at court.[2] Chinese writings on science also existed in genres such as treatises, dialogues, and commentaries, the latter increasingly common during the Han dynasty; but the book *per se* developed later in China than in Greece because writing was originally done on long strips of wood, tied together 'like bamboo shades' and rolled up for storage, thus imposing a rather strict and low limit on the length of a work [70–77]. One would imagine that Sumerian, Assyrian, and Babylonian works suffered the same limitation, being written on clay tablets whose sole 'binding' was their association on the shelf.

Perhaps the most significant aspect of the social and institutional framework of Chinese science is the role of 'lineages' and 'canons' [42–61, 73–74]. The Chinese norms of intellectual endeavor were identification with a group and rhetorical adherence to, or even

[2] Cf. 138: 'some... treatises were addressed to rulers'.

aspiration toward, a perceived orthodoxy. The ideal was to operate within a lineage descending from a known and respected figure of high antiquity whose works one preserved and explicated in the company of a contemporary master and his disciples, as if within a family. Such lineages elevated certain works ascribed to their founder to the status of canonical texts and proliferated during the Warring States period; but the only philosophical lineage to persist through the Han dynasty was the Confucian. Similar lineages existed within science, such as the one preserving the *Yellow Emperor's Canon of Internal Medicine* (*Huang Ti Nei Ching*); and Lloyd and Sivin compare them to the Greek philosophical sects [55] as well as to the canon-preserving sects of the Judaeo-Christian-Muslim tradition [73]. A more precise parallel might be the lineage of Pythagoras, whose adherents displayed most of the features of a Chinese lineage without, however, offering a canonical text [cf. 104–105].

On the Greek side [ch. 3], the social origins of philosophers and scientists were much more diverse than in China, patronage played a much more restricted role, and face-to-face debate remained the paradigm of presentation. Although the primary social fissure in the Greek world always remained the distinction between slave and freeman, the earlier aristocracies of birth gave way to oligarchies more often based upon wealth [82–87]. But literacy was never confined to an elite and by the fifth century BC all citizens, at least in Athens, were expected to be literate; on the other hand, 'higher education' never became standardized as in China [87-89]. That the modes of literacy in Greece and China contrasted strongly seems clear, although Lloyd and Sivin acknowledge that details are debatable. In fact, the debate about the extent of Greek literacy is fierce. A few Greek philosophers and scientists were aristocrats, while others were working-class, freed slaves, or foreigners; but most appear to have been from what might loosely be called the middle class, and this heterogeneity increased in the Hellenistic period [89–95]—all in strong contrast to the Chinese situation. Although Hellenistic rulers sought to attract a 'brilliant' retinue both to augment their own prestige and for practical benefit, the evidence suggests that physicians and other practical scientists more often benefited than did philosophers, mathematicians, or astronomers [95–104]. Thus, most Greek intellectuals were comparatively more isolated from rulers than were their

Chinese counterparts, and there was little bureaucratization of science or philosophy and no qualifications were explicitly required of a practitioner. Patronage was far less important than reputation.

A significant feature of the social and institutional framework of Greek science is the role of schools or sects [104–118]. These groups were founded by an individual for the purpose of teaching and were maintained by their members over many generations in organic continuity. Most did not attempt to adhere closely to the founder's thought, although the Pythagoreans and Epicureans maintained a more conservative stance than did others. Students, moreover, did not display strict loyalty or lifelong commitment; and only the Pythagoreans and some Hippocratics employed the terminology of familial relations for their sect. Lloyd and Sivin describe the philosophical schools as 'close-knit alliances for defensive and offensive argument' [111] that were intended to attract pupils and win arguments. They were not canon-centric, as the example of the Aristotelian school's apparent loss of many of Aristotle's works for several centuries would attest (not cited by Lloyd and Sivin); nor was doctrinal purity required, as the manifold changes of the Academy (Platonic) school show. The Hellenistic medical sects, such as the Empirics and the Methodists, or those founded by Herophilus and Erasistratus, had similar characteristics. Lloyd and Sivin emphasize the magnitude and persistence of the divergences among fellows of a given school.

The role of oral presentation and the contentiousness of intellectual debates in Greek science are strongly emphasized by Lloyd and Sivin [118–139: cf. Lloyd 1996, 74-92]. The primary forms of written presentation were the dialogue and lecture, both of which display unmistakable signs of their oral origin and performance. Lloyd and Sivin discuss the role of rhetoric and argumentation, whether overt or latent, at length. Treatises and commentaries were also composed, the latter being more common in the Hellenistic period [130–136]; but the increasing authority of the past that led to the production of commentaries did not preclude the writers of those commentaries from intervening in the debate or even criticizing the authority upon whom they commented [136-138]. Lloyd and Sivin conclude [138] that much Greek science seems 'haunted by the law court'.

In chapter 4 [140–187], Lloyd and Sivin address how certain questions, whose terms were not inevitable, became fundamental for

Greek science. They discuss element-theory [142–158], preoccupation with causality [158–173], and assumptions in cosmology [174–183)]. Their analysis does not claim that social, political, and institutional factors *determined* Greek scientific thought; but attempts to show instead how those factors formed key parts of the cultural manifold within which Greek science developed [183–187]. In particular, Greek political experience encouraged the consideration of radical alternatives, but Greek cosmology was never drafted to underpin an imperial regime.

Lloyd and Sivin [142–158] examine among others the terms for element, nature, and substance or reality, showing how each evolved gradually from the era of Hesiod and Homer in the eighth century BC to the work of Aristotle at the end of the fourth century BC. (Here they build on Lloyd's work on elements [1996, 12–15] and on *phusis* [1991, 417-434].) Although the data are uncontroversial, the emphasis is welcome. Lloyd and Sivin also stress the degree to which, in the period studied, there was no single standard theory, citing as challenges to Aristotelian four-element theory both the Stoic theory of *pneuma* (from 300 BC), to which they draw a parallel to Chinese *ch'i* (following Sambursky), and the Epicurean revival of the Democritean doctrine of atoms and void.

Lloyd and Sivin [158–173] point out that examining the nature of the Greek view of causation illuminates their modes of inquiry and the characteristics of their science. In particular, Greek interest in causation is far more explicit than in China, where the emphasis is on discovering correlations. Lloyd and Sivin [161–165)], following an argument Lloyd has offered earlier [1996, 93–117], suggest that the Greek view of causation developed from courtroom debates about blame and that, therefore, the apparent incontrovertibility of mathematics became the paradigm of the best argument [165-173]. In a welcome further development, Lloyd [2002, 21–43] explores how the differing notions of causation were put to different predictive uses.

Lloyd and Sivin [174-183] emphasize that cosmology in both Greece and China is wedded to the moral and political domain and that both societies explored the double analogy of cosmos to state and of state to human body. Cosmology in both cultures incorporated notions of harmony and order, although the details differed greatly. Greek thinkers deployed three basic presumptions: that the cosmos was alive, was governed by providence, and was created by craftsmanlike activity. The Greek cosmos was prior and superior to humankind, whereas the Chinese saw an interdependence mediated by the emperor. Greek views of hierarchy typically postulated the relative independence of the higher from the lower. Here also Lloyd and Sivin miss an opportunity for comparison, not with Greek but with Egyptian or Mesopotamian beliefs about the key mediating role of the pharaoh or king.[3]

In chapter 5 [188–238], Lloyd and Sivin address the fundamental concepts of the Chinese sciences, preferring the plural so as to recognize that in contrast to Greek science no synthesis was ever attempted [226–227]. They consider in turn the aims of scientific inquiry [89–193], the evolution of the Chinese cosmological synthesis [193–203, with 253–271], the four oppositions (sometimes misunderstood as similar to Greek notions of appearance versus reality) [203–213], the notions of macrocosm and microcosm [214–226], and lastly the concepts of astronomy, mathematics, and medicine [226–234].

Chinese scholars undertook scientific speculation as a means of self-cultivation for illumination and always with a view to the moral significance and political relevance of their work. The ideology of astronomy and medicine was centered on the imperial will so that the meaning of any astronomical order was political. The authority of sagely origin, the original revelation to a sage-emperor or other ancient wise man, made scientific endeavor the recovery of what the archaic sages already knew.

The Chinese cosmological synthesis evolved in three stages, of which Lloyd and Sivin offer here a new account. An early flat-earth concentric cosmology whose axis was China and which included numerous lists of distinct entities (such as the five colors and the six illnesses) began to be augmented in the late Warring States period with four doctrines. Chief among these were the five phases (*wu-hsing*) of material existence (i.e., wood, fire, earth, metal, and water) that were used to explain change and were, hence, quite distinct as a concept from Greek element theory. A second development was the theory of *ch'i* according to which various perceptible but intangible influences were explained as due to a pervading fine material, i.e.,

[3] For Egypt, see Silverman 1995, 49–92; Tyldesley 2000, 16–33. For Mesopotamia, see Oppenheim 1977, 98–105; Nemet-Nejat 1998, 217–221.

ch'i. An old pair of opposites, *yin* and *yang*, were made to serve as 'paired, complementary divisions for any configuration in space or process in time' [197]. A fourth item was the rise of the notion of the *tao* (path or way) as the mystical ground of process [200]. In the third stage of this evolution, which took place during the early Han period (last two centuries BC), scholars made *ch'i* into the material and energetic basis of objects and their changes and the five phases became aspects of *ch'i*.

Lloyd and Sivin [203–213] offer four oppositions that scholars have misunderstood as analogous to the Greek contrast of appearance and reality, an analogy that Lloyd and Sivin rule out of court as inconsistent with the straightforward Chinese acceptance of physical appearances. These oppositions are evident in the claims that the *tao* manifests itself as either accessible or ineffable [204–205], that the sage possesses special knowledge and insight unavailable to ordinary folk [205–208], that words expressing risible or false opinions are 'empty' rather than 'full' [208–210], and that the sage needs to be aware of spurious resemblances which can fool those who lack specialist knowledge [210–213]. All four of these claims amount to a distinction between those possessing insight and wisdom on the one hand and those lacking them on the other, not to a distinction of appearance and reality.[4]

The Chinese notions of macrocosm and microcosm [214–226] grew out of a belief that celestial anomalies were ominous, a belief augmented by the further belief that the ruler's ritual behavior controlled (or at least affected) the prosperity and function of his realm. Medical doctrines, for example, described the bodily systems not anatomically but as bureaucratic offices or functions, almost an inversion of the Greek mode of explanation; and a key to medical practice was to know the true hierarchy of bodily systems [219]. Similarly, the cosmos itself was like a state, the celestial North Pole, for example, being the 'Central Palace' [223].

The concepts of astronomy, mathematics, and medicine in China were essentially pragmatic and bureaucratic [226–234]. That bureaucratic character also explains the lack of synthesis since the respective functionaries, astrologers, accountants, and physicians, were scattered throughout the imperial bureaucracy. Astronomy, for example,

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[4] Such claims have been discussed in more detail in Lloyd 1996, 118–139.

remained primarily based on tables whereas arithmetic was understood as a small set of example problems or algorithms offered without proof.[5] A comparison with the apparently similar, algorithmic, character of Babylonian mathematics would have been welcome; but again, that would have increased the bulk of the work.

A brief concluding chapter [239–251] draws together the main threads of the book to compare formally the development of Greek and Chinese science(s). Lloyd and Sivin propose a number of widespread (not universal) traits and reject the possibility of a one-way causal account since in both China and Greece society and science coexisted within a single interactive manifold. Although cosmology and medicine were undertaken in each society with similar aims in mind, the undergirding assumptions sufficiently differed that the results were quite dissimilar—for example, where we have elements and *phusis* on one hand, we have *tao* and phases on the other. The prospects for livelihood differed greatly since Chinese intellectuals aspired to advise the ruler while Greeks had to fend for themselves, an institutional difference [cf. Lloyd 2002, 126–147]. Greek and Chinese cosmologies compared the body, the state, and the cosmos; but Greeks argued for analogies and debated constitutions, while Chinese saw synecdoches and agreed on monarchy [cf. Lloyd 1996,165–208]. The deepest and broadest set of contrasts lies in the processes of science: Greeks argued, innovated, and sought victory; whereas Chinese advised, preserved, and sought consensus [244–250: cf. Lloyd 1996, 20–46].

Lloyd has been pursuing his ambition to explain the social role and setting of ancient Greek science for many years, and this coauthored book with its predecessors, *Adversaries and Authorities* and *Ambitions of Curiosity*, show both how far he is willing to travel and how far along that way he has come. As he writes, the ambition to understand the cosmos was the ambition ‘to understand what had never been understood before’ [2002, 147]; and here Lloyd and Sivin seek a way, perhaps a *tao*, to understand that ambition in Greece and China.

[5] The differing approaches to numbers in China and Greece have also been discussed elsewhere by Lloyd [2002, 44–68] in the light of evidence from a wider variety of texts, including harmonics and optics; he there qualifies the statement that Chinese mathematics were ‘always’ pragmatic’ [2002, 62–63].

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