CHAPTER 1

Comparative studies and their problems: methodological preliminaries

The aim of this introductory chapter is to review some of the methodological issues involved in the comparison between ancient Greek and Chinese science. First, what does it mean to use the term 'science' at all in this context? Secondly, what, given the limitations and the bias in our sources, can we realistically hope to achieve in such a study? Thirdly, what are the primary questions we should be addressing, and how should we address them, that is, within the framework of what assumptions?

Some preliminary points need to be made on each of these three topics. First, it is obvious that in antiquity we are not dealing with science as we know it today, that is, with the highly institutionalised practice that is carried on in modern universities and research laboratories. On the strictest interpretation of science, we have to concede that the term is not applicable to anything before the present century. But that is, no doubt, to be unduly restrictive, and I shall use the term conventionally as a place-holder for a variety of specific inquiries we can identify in both Greece and China. Three of the most prominent, which will occupy much of our attention throughout, are astronomy, mathematics and medicine: a fourth is cosmology and whatever passes as natural philosophy or physics: others that could be added are geography, optics, harmonics, mechanics and so on.

All of these terms for specific domains are, to be sure, themselves problematic – and not just because two of them, mathematics and medicine, stretch beyond the bounds of what some would count as science. In each case we have to rid ourselves of the prejudices generated by modern expectations of how each of these subjects is to be pursued – the teleological assumption that bedevilled so much of the early history of science. Rather,

the primary task is to analyse what the ancient investigators themselves thought they were trying to do, their conceptions of their subject-matter, their aims and goals.

This is not to say, of course, that we can ever put ourselves in their shoes. All history has, to be sure, to be evaluative: none can be neutral. That in turn means that it is not merely a matter of reporting what the ancients *said* they were doing, as if we have to take their word for it: for we clearly can and must inspect what they actually did and reflect (as the ancients themselves sometimes did) on the matches and mismatches between what some claimed to do and what they did, between theory and practice. But how *they* saw the subjects they were engaged in must be our starting-point.

So I take 'astronomy' to encompass what *they* included in the study of the heavens. That comprised not just calendar studies, and the description of the constellations and investigation of the movements of the sun, moon and planets, but also – in both Greece and China, though in different ways – the study of celestial omens or other attempts to predict events on earth, in other words what we call astrology. Again by 'medicine' I mean whatever theories and practices of healing we find. And similarly 'mathematics' must be held to comprise the study of numbers and figures, however that was pursued and with whatever ambitions, including, for instance, the ambition to master the universe by cracking its numerological codes.

My second initial question related to how much we can hope to achieve. We are faced with formidable difficulties stemming from the nature and limitations of our sources. All of our evidence, for Greek and for Chinese antiquity, has been mediated through distinctive and long-drawn-out processes of transmission, and both the information we have, and the gaps in it, reflect the judgements of those who have participated in those processes. Every act of recording or commenting on the ideas or practices of earlier periods incorporates such judgements. We have to ask ourselves why the texts that have been preserved, were preserved, and conversely why those that have not been, were not. Similarly, the interpretations of commentators have to be read against the background of their interests and motivations. We are particularly disadvantaged because of the shortcomings and the bias in our sources, on the Chinese side for the Mohists, for example,

and on the Greek, for the –5th-century atomists and for many of the early Hellenistic medical writers and astronomers.

Those of us who study ancient periods should not delude ourselves that our subject-matter is simple, just because the evidence is often rather impoverished. It is salutary to remind ourselves of the complexity of the problems of interpretation that some of our colleagues who deal with later periods face, for example in the West those who have wrestled with the problems surrounding the circumstances of the industrial revolution, or those relating to any of the major modern political revolutions East or West. They are all recognised to be extremely difficult to characterise reasonably, let alone to explain or understand. *We* should not expect to do *better*: we can hardly expect to do a fraction as well, with the far less detailed documentation available for the types of interpretative problems we face.

My third question concerned how we should go about our task of comparing. This may best be approached, in the first instance, indirectly, with two negative points about how *not* to do so. These relate to the dangers of generalisation even *within* a single culture, and to some of the converse problems attending the attempt to make direct comparisons between individual theories and concepts *across* cultures *as if* they were addressed to the *same* issue. I shall call these the anti-generalisation point and the anti-piecemeal point.

The anti-generalisation point covers a variety of negative recommendations. One particular tactic that I have recently attacked elsewhere (Lloyd 1990) represents generalisation carried to extraordinary lengths. This is the appeal to a distinct mentality as what is in play in China or in ancient Greece. My first objection to that is that, whatever credibility such talk may have, it provides not even the beginnings of an explanation, but at most a statement of what has to be explained. Moreover, secondly, as such a statement, it obscures rather than clarifies the issues, since it locates the problems in the scarcely directly investigable domain of the *mental*. The whole argument then often turns out to be circular, since the evidence for the mentality hypostasised *is* the evidence that that mentality is supposed to explain.

However there is a further difficulty, not just with talk of mentalities, but with *any* grandiose generalisation about Greek, or Chinese, ways of thought, and that is that they make the unjustified assumption of a *uniformity* in the relevant characteristics

across different domains and at different periods. Take first periods: we must surely be very cautious about most of the generalisations that purport to hold true of the *whole* of Chinese thought before the Qin unification (in –221), let alone of the four centuries after that unification *as well*. On the Greek side, Hellenists are well used to working with rough and ready periodisations, archaic (down to the end of the –6th century), classical (to the death of Alexander in –323), Hellenistic (to the fall of Alexandria to Rome in the late –1st century), and so on. Yet there too all the diversity tends to get set aside all too readily when the grand generalisation about *Greek* thought is attempted.

A similar point holds also for the differences between *domains*. We must surely be prepared to recognise that what may be true of mathematics (either in China or in Greece) may not be the case also of medicine, or again of natural philosophy, or again of technology. The circumstances in which each of these was practised and developed vary very considerably in both ancient civilisations, and we had better not ignore that in striving for grand syntheses.

As far as Greece goes, we should go further. It is no good attempting generalisations about 'Greek medicine' that relate to, and are based on, a study of just Hippocratic medicine and its successors. Indeed Hippocratic medicine itself is far from homogeneous. It was all the product of *literate* individuals at least, but that does not take us very far. Nor will it do to take whatever we happen to believe to be genuinely Hippocratic in Hippocratic medicine as the basis for generalisations about Greek medicine as a whole. Any attempt at a general overview of ancient Greek medicine has to take into account four or five distinct other traditions as well, difficult as it is to reconstruct some of these, thanks (again) to the bias in our sources.[1] There is, for example, temple medicine, and the medicine of the itinerant purifiers, and again that of the root-cutters and the drug-sellers, and again that of female healers ('midwives'), the last especially poorly represented in our extant evidence. No more, on the Chinese side, should we underestimate the diversity of the ancient – and indeed living – traditions of healers there.[2]

1. Some of the complexities of the relations between these rival traditions of medicine in ancient Greece are analysed in Lloyd 1983.
2. See, for example, Sivin 1987, pp. 20ff.

But it is not just medicine that offers a good illustration of the anti-generalisation point. The same is true, if to a lesser degree, of Greek mathematics, for besides the Euclidean axiomatic-deductive tradition, there are others, such as that represented by the metrical geometry of Hero of Alexandria, and again the algebraic tradition that culminates in Diophantus. The same is true, too, of philosophy in Greece. There too I would resist any sweeping generalisation to the effect that there is just the *one* notion of *what philosophy is* at work in *all* the individuals we lump together under that rubric.

The diversity *within* philosophy, or mathematics, or medicine, or technology, *may* be greater in ancient Greece than in ancient China. That is possible, though it is also possible that the diversity in ancient Greece is just better documented. We shall address questions to do with the dialectical presentation of Greek thought in Chapter 2. However, in the case of medicine, the pluralism of literate and non-literate traditions is sufficiently well attested in both China and Greece to make the point, even while we may recognise that the ways in which different individuals responded to that pluralism vary in the two cultures: for instance, some reacted to others' views by accommodating them as far as possible, but others by attacking or rejecting them, or using them as a basis of a claim for the superiority of their own solutions to the problems. Yet as a general methodological warning, the dangers of generalising *across* the principal domains we are dealing with should be obvious enough.

My other preliminary negative point, the rejection of a 'piecemeal' approach, is, in a way, the converse of the first. It is clearly not possible, without courting disaster, to proceed to a comparison and contrast between individual theories or concepts seriatim in China and Greece *as if* they were addressing the same questions. Worse still would be the assumption that the questions they were addressing were the ones we consider important in twentieth-century science.

Thus we cannot start from the Greek side, let us say, by identifying some particularly prominent theory or concept and then asking what the Chinese equivalent is – as if it is a foregone conclusion that there will *be* any such equivalent. We cannot assume, in the periods we are dealing with, that there *is* a single set of theories or concepts fundamental to early science that will

turn out to play analogous roles in both China and Greece. Indeed the very diversity in the forms that mathematics, astronomy, medicine and natural philosophy took in ancient times, and the implications of that diversity for our understanding of the origins of science, will be two of the central themes of these studies.

Some examples will bring out the importance of the anti-piecemeal point. Take what seems a fundamental Greek notion, *phusis*, 'nature', where we have to be particularly careful since we often unguardedly take *our* idea of 'natural science' to be more or less continuous with theirs. Now on the Greek side, the concept of *phusis* is extremely complex and in many respects it does not at all behave in the way we might expect.

First it is as much normative as descriptive. Of course, our own notion of 'nature' is too. Even so the normative use of *phusis* is particularly strongly marked, and it encompasses some surprising items, as when humans are said by Aristotle (*On the Parts of Animals* 656a10ff) to be the only creatures where the natural parts are in their natural positions. Secondly, *phusis* covers much that we might think has to belong to culture, not to nature – as when Aristotle defines humans as by *nature* political animals, or more strictly as animals that live in city-states (e.g. *Politics* 1253a2f), or when he treats slavery as a *natural* institution (*Politics* 1253b14ff, 1254a17ff).

The Greek concept of *phusis* is problematic, controversial and disputed. The argument I have developed elsewhere (Lloyd 1991a, ch. 18) is that those ancient disputes are not just contingent or accidental. Rather, the concept was forged in controversy. Many of those who used it in the early classical period did so as a means of legitimating their way of doing what they held to be proper science and philosophy. They used it to put down rivals, not just from among traditional claimants to wisdom, but also from among their own immediate competitors who also claimed to be philosophers, sophists or whatever.

But what is essential for our purposes here is that there is no straight equivalent to *phusis* in classical Chinese. Of course, a variety of terms, 天 (*tian*, heaven), 物 (*wu*, things), 性 (*xing*, character), 理 (*li*, pattern), 道 (*dao*, the way), 自然 (*zi ran*, spontaneity, literally 'self so'), do service perfectly adequately, in different contexts, to express ideas where the English translation would be in terms of nature, the Greek in terms of *phusis*, or

their cognates. Yet that is still not to say that there is a concept of nature in classical Chinese, just the one, nor that it was a major preoccupation. Rather, the evidence from ancient China shows how well they got along *without* any such central preoccupation.

So what we must at all costs avoid is the assumption that there is a single concept of nature towards which both Greeks and Chinese were somehow struggling, let alone that it was *our* concept of nature as in 'natural science'. It would introduce massive distortions in the interpretation of both Greek and Chinese science if we took it that the work of ancient investigators was targeted at that goal: I stress once again that we must resist any such teleological assumption.

The ancients were not to know the future. They could not anticipate the eventual development of natural science, however much some of those responsible for some of the later developments in European science were to claim, for their part, that they were following and elaborating ancient traditions. Of course, in the history of those later developments, we can trace the use, and transformation, of ancient ideas, and also the rhetoric of both the appeal to, and the rejection of, antiquity. But if we are to understand how *phusis* was used in –5th-century Greece, we have to locate that term in –5th-century argument and debate, to identify the aims and ambitions of those who used it then, to see how they used the inquiry they dubbed the 'investigation concerning *phusis*'.

We cannot assume that the ancient Chinese, for their part, had our concept of 'natural science' as their goal either, let alone that they were fumbling towards some ancient Greek notion of *phusis*. The point can, of course, be tested. One of the more promising texts in which to do so is the 自然 (*zi ran*) chapter, of the 論衡 (*Lun Heng*) of 王充 (Wang Chong) in the +1st century, even though he is, from several points of view, an exceptional and idiosyncratic writer. His chief articulating contrast is that between 有為 (*you wei*) and 無為 (*wu wei*) (very roughly, 'ado' and 'no ado'), and he has some subtle points to make about spontaneity and intentionality, as we might put it. There are, to be sure, points of similarity to ancient Greek discussions that focus on *phusis* and other concepts such as *proairesis* (choice). But evidently to see Wang Chong's programme as working towards *those* ideas is drastically to distort *his* polemic with *his*

rivals and opponents. His chief concern is to pour cold water on the attribution of intentionality to a variety of things, particularly some that had often been taken as signs or omens.

That is an example where I began from the Greek side, with *phusis*. But there is no shortage of similar examples where the same holds true if we start from Chinese concepts. One has only to think of the splendidly rich materials relating to the classical notion of the *dao*. Almost anything can be said to have a *dao*, whether objects or skills. Thus a plant may, though this is not a matter of its eternal essence conceived statically, but rather of the way it grows, and there can be a *dao* of any number of human activities, from butchery to calligraphy. Then again the *dao* is the proper path of life, the one the sage follows spontaneously, and as such the goal, though not an item of theoretical knowledge that secures understanding, but rather an internalised mode of being and doing.

What was the Greek equivalent? Parmenides, to be sure, speaks of philosophy in terms of ways, using the word *hodos*. Yet he has both a Way of Truth *and* a Way of Seeming. It would have seemed paradoxical in the extreme, to Chinese of the classical period – by which I here mean down to the end of Han times in +220 – to admit that there could be a *Way* of *Seeming*. Again some favour *logos* as closer to Chinese concerns. But clearly that juxtaposition, too, reveals more differences than it does similarities, not least because of the presuppositions of expressibility that Greek *logos* generally entails.

The harder the point is pressed, the clearer it should become that any such pursuit of an equivalent takes the *wrong question* as its starting-point. Of course, *dao* is a very special term, and so might be thought exceptional. But the point can be made with plenty of others, 氣 (*qi*, breath, 'pneuma'), 陰陽 (*yin yang*, the negative and positive principles), 天 (*tian*, 'heaven'), concepts to which we shall be returning in the studies that follow – and that is before we appeal to more domain-specific concepts, such as, for example, 邪 (*xie*, 'heteropathy'), used in medicine.[3]

So far my principal points have been negative ones and serve to underline the complexities of the task that faces any comparativist history of ancient science. Yet it may be possible to

3. See Sivin 1987, pp. 49, 102ff.

glean some positive recommendations from the negative ones I have so far made. I do not just mean the necessary, but not very helpful, stipulation to be as scrupulous as possible about recontextualising the materials we are dealing with, making sure that we do full justice to the *original* debates and concerns in *each* of the separate areas in *each* period in *both* great ancient civilisations. No doubt it would be better to *begin* any attempt at comparison and contrast only *after* deeply immersing ourselves in *everything*. To that, I would just say that the whole point about methodology is to try to develop appropriate procedures not to cut corners, but to give focus to our inquiry. Besides, methodology, whether conscious or not, is inevitable, in that however unselfconscious a scholar's methods and assumptions may be, they will be pervasive. So they had better be as explicit as we can make them.

One suggestion that may be thought to emerge from my anti-piecemeal reflections is that we should not begin with a comparison between the *answers* or *results*: we should ask first what the *questions* were to which the answers were thought to be the right answers. I have insisted that we cannot assume that the theories or concepts were addressed to the same questions. So it follows that we must problematise the questions.

What were the questions or problems that the Chinese were concerned with that led to the answers they gave being the answers they were? And what, similarly, were the key questions or problems on the Greek side? Thus instead of trying a direct comparison between Chinese and Greek physical speculation, as if both were answers to the *same* questions, we should explore first, for example, what the Chinese considered to be the important issues to which talk of the five phases, 五行 (*wu xing*), provided the basis of an answer.[4] Again, what did the Greeks think to be the key questions they were answering with their talk of elements, *stoicheia*?

Let me come back to elaborate both the general point, and the particular example of phases and elements, a little later. But let me first mention three obvious objections my proposed question-oriented approach might be thought to run into. First

4. The most recent authoritative study of the development, and range of application, of this concept is Sivin 1995c: cf. also Graham 1989, pp. 340ff, and see further below, pp. 122ff.

it looks as if my way of putting it (asking what the questions are, to which the answers were thought to be the right answers) involves or presupposes a certain type of determinism – as if the answers were *determined* by the questions. But no: because it is not as if the answers were entirely *uniform* in either China or Greece. While the language of the five phases was common to many writers from Han times (–2nd century) onwards, and the five were generally agreed (namely 木, *mu*, 火, *huo*, 地, *di*, 金, *jin*, 水, *shui*, that is, roughly, 'wood', 'fire', 'earth', 'metal' and 'water'), there was still plenty of variety in the way they were used and even about how far they are to be used. Thus their introduction into medicine marks an important turning-point in the development of medical speculation. Much more obviously, in the example I took before, while just about everyone agreed on the importance of the *dao*, knowing what the *dao* was, or rather how to follow it, or more strictly actually following it, was what sagehood was all about. This was not for the ordinary person.

So too, on the Greek side, even among those who, from the –4th century onwards, agreed that for physical theory you needed elements, the variety of answers is almost as great as the number of philosophers who put them forward. Atomic theories competed with continuum ones, monistic theories with pluralist ones, and there were plenty of different kinds of pluralism in the field. Aristotle's privileging of earth, water, air and fire was just one of several such, and although it came to be the most influential ancient Greek theory, the impression of its dominance over its rivals strengthens the further from antiquity one goes.

But then the second objection, and the third, to my approach are that, if we work at a different *level*, in our comparisons, turning to questions or problems, rather than to theories or concepts, we shall never have anything significant to say about the *contents* of theories, only about their forms, and worse still, we shall often be going well beyond anything for which we have direct evidence in the ancient Greek or Chinese texts themselves, since in many cases they do not address my second-order questions, of the questions their theories are directed at, explicitly. So one objection would insist that the substance of the Greek and Chinese theories in question is going to slip through the net of our inquiry, and the other is that that inquiry is, in any case, going to have to be all too speculative.