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Early Science: A Universal History of Particulars

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The articles collected in this volume of *Science in Context* have as their common theme the history of early science. The reader will note the great diversity of the subjects dealt with in this volume, and also some strong commonalities. In our view, this tension between diversity and commonality is central to the historiography of early science, and may represent an important value of this study. To see this, let us first consider the papers in sequence.

Hsu's paper, "Tactility and the Body in Early Chinese Medicine," makes a radical claim for the specificity of Chinese medicine (of the pre-Confucian period): unlike its early modern European counterpart, where the dominant perceptual modality was visual, early Chinese medicine was predominantly tactile. This startling claim for an entire mode of scientific activity is made based on philological as well as contextualized, historical analysis.

The following paper, Burnyeat's "Archytas and Optics," as it were answers Hsu's recovered Chinese tactility by recovering, perhaps, the first origins of the Western tradition of the science of the visual. Burnyeat pieces together a compelling case, based on philological and philosophical considerations. His conclusion: that the first Greek author of a study in optics was the fourth-century Pythagorean, Archytas of Tarentum. This opens up a new understanding of Archytas within the Pythagorean tradition, and especially of his reception by Plato and Aristotle, respectively. We would say that this article underlines Archytas' pivotal role in the rise of Greek science in the strict sense.

But is the expression "science in the strict sense" not in itself to be problematized? A series of papers by Vallance, Wardy, and Sharples all serve to raise this question, by looking at the nature of Peripatetic science as positioned in between the metaphysical and the empirical. Vallance's paper, "Minerals, Morals, and the Hidden Purpose of Nature," argues that Theophrastus' highly empirical and detailed study of minerals is ultimately motivated by the metaphysical interest in the teleological structure of the universe. Studying the detail of Theophrastus' science, as well as his metaphysics, Vallance argues that the selection of minerals for discussion seems to be motivated by the question, what are minerals good for? In partial disagreement with Vallance' paper, Wardy's following paper, "The Mysterious Aristotelian Olive" looks at objects that seem to defy any neat Aristotelian classification into metaphysical categories.

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Domesticated plants are products both of art and of nature, and the potential clashes between the two undercut any simple answer to the question, what their true essence is. Are they what they are, so as to serve human purposes, or so as to serve some other, "natural" purpose? Wardy's interest is not only in the way in which Aristotle tries to solve this problem but also, no less, in the way in which he does *not* try to solve it: how Aristotle allows the details of empirical science to override the demands of a metaphysical system. A similar concern informs Sharples' paper, "Some Thoughts on Aristotelian Form: With Special Reference to *Metaphysics Z8*." Whereas the preceding two papers approach the tension between the empirical and the metaphysical from the side of the particular – studying Aristotle's science in light of his metaphysics – Sharples approaches the same tension from the side of the universal – studying Aristotle's metaphysics in light of his science. Addressing once again the question of Aristotle's use of terms such as "universal" and "form," Sharples suggests how a more nuanced understanding of his metaphysics may serve to make his philosophy cohere more closely with his science. Both "universal" and "form," Sharples argues, are not to be understood in a narrow, dogmatic fashion.

The three articles on Aristotelian science share a methodology that brings together philosophical as well as wider contextual issues. This combination is among the most fruitful in the study of ancient science. The following paper, Nutton's "The Fatal Embrace: Galen and the History of Ancient Medicine," represents another fruitful combination: the bringing together of intellectual history and of historiography. By considering the program underlying Galen's use of his predecessors, together with a careful reading of the scattered evidence we have, more directly, of those predecessors themselves, Nutton argues for a re-thinking of several central assumptions in the history of early Western medicine, one that gives rise to a much more heterogeneous model: it is not as if pre-Galenic medicine, at any period, was as simple to describe and classify as Galen makes out it to be.

With Chemla's paper, "Geometrical Figures and Generality in Ancient China and Beyond: Liu Hui and Zhao Shuang, Plato, and Thabit ibn Qurra," we return to early Chinese science. As the title of the paper suggests, Chemla takes a wide comparative sweep across cultural traditions, considering the proofs for the so-called Pythagorean theorems in Chinese and Arabic contexts (with a glance at a Greek setting, not in Euclid but in Plato). Alongside this universalizing move – to consider the same proof in different cultural settings – Chemla makes a particularizing move, in localizing, in both cultures, the historical details: specifically different uses of diagrams are related to different emphases concerning the role of generality in proof. In point of fact, Chemla ends up localizing generality itself: the very scientific act of generalizing is a product of specific historical goals and practices.

The articles span cultures and domains. The final contribution, Lloyd's "The Potential of the Comparative History of Pre-Modern Science," opens up the methodological issue of the role of comparative studies in ancient science, and even, in more general terms, of the future of ancient science as a discipline. Without anticipating

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Lloyd's conclusions, we would wish to pause now ourselves for a few remarks, based on the papers in this collection.

The evident intellectual thread linking the papers collected here is the tension between the universal and the particular. This tension is, in our view, to be lauded as marking a stage of maturity in the study of ancient science. To explain: let us consider, first, the two papers that make an explicit comparative move, those by Hsu and Chemla. The tradition of comparing East and West has changed significantly in the last couple of decades. This tradition was marked by essentialism wherein "China" and, no less, the "West" were lumped together as single entities, each with its own immutable character. Recent scholarship is now much more sensitive to the variety of approaches within each cultural tradition, synchronically as well as diachronically, so that both papers, by Hsu and Chemla, concentrate not only on the ways in which Chinese science differs from the West but also on the ways in which it *changed*. The same sensitivity to variety is apparent in the papers dedicated to Western science. Burnyeat's paper – among other things – serves to underline the divide separating Archytas' science from its Platonic reception, and so to mark the variety of Greek approaches to science in the fourth century B.C., not only in terms of the well known opposition between Plato and Aristotle but also within the Pythagorean-Platonic tradition itself. Nutton's paper underlines the great variety of pre-Galenic Greek medicine while the three papers by Vallance, Wardy, and Sharples, finally, are all dedicated to the tensions and ambiguities between Aristotle's metaphysics and Aristotle's science, as well as within the Aristotelian scientific program itself.

The emphasis on tension and ambiguity goes hand in hand with what may be seen as the broadening of the horizons: the cartography of early science has now moved to cover previous *terrae incognitae*, previous borderlands. It is typical of recent scholarship, for instance, that the scholars of Aristotle now bring in Theophrastus as a matter of course, indeed that studies of Aristotle look at the detail of his biology no less than at his more philosophical works. But in an earlier generation, the study of Aristotle's science was almost confined to the study of the growth of his metaphysical outlook away from Plato's theory of forms, with perhaps a glance at his cosmology. It is also typical of recent scholarship that Greek medicine is now understood as a complex social and intellectual phenomenon. In an earlier generation, the field was understood mainly in the terms of isolating the doctrines of Hippocrates and considering their growth into those of Galen. (Even the study of the great Hellenistic physicians is a relatively recent phenomenon, while the less well-attested figures between Hippocrates and Galen were practically neglected.) And it is typical of recent scholarship that the scholars of East and West are at least aware of each other's findings, and that the field is understood in truly global terms.

All of this is a radical departure, as mentioned above, from the earlier historiography of early science. The field was traditionally approached via two avenues. One was that of the general histories of science where the mention of antiquity was usually motivated by a teleological model. Considering early science from this perspective, it was seen as

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preparation for the positive achievements of modern science. This historiography of praise – and, occasionally, blame – was inherently framed in terms of "the ancients" as against "the moderns," where "the ancients" were effectively synonymous with "the ancient Greeks." It was thus given by the very terms of the problem that early science was to be approached as a monolith.

The other avenue (in terms of the sociology of the discipline, this may well be even today the most dominant) is that of ancient philosophy. Up until very recent times, this largely speaking meant a study of the Pre-Socratics, and then of Plato and Aristotle. Ancient Science, seen from this perspective, is of course once again completely Greek, and then again it is very narrow in character: at best, the monopoly of "The Ancients" becomes, in this historiography, a duopoly of "Platonism" and "Aristotelianism," the first abstract and mathematical, the second empirical and biological. This, indeed, served as the starting point for the historiography of the kind mentioned above so that, when general histories of science considered early science, they approached it primarily in terms of the philosophies of science ascribed (simplistically) to Plato and to Aristotle.

The study of ancient science tended to be, as we see, both truncated and one-sided. It was narrow in scope – concentrating on Greek science of the fourth century B.C. – and yet largely speaking insensitive to the detail of early science, not only in its totality but even when concentrating on Plato and Aristotle themselves. The study of early science was neither universal, nor particular enough.

A few attempts at a more universal approach to science may be noted. Neugebauer's studies in the *Exact Sciences in Antiquity* took a very wide view of the entire development of Mediterranean science, at least, while Needham, of course, has made possible the synoptic view of Chinese science as a whole.[1] It is however perhaps typical that both scholars were committed to a strongly positivistic program, concentrating on the technical detail of science and uncovering the precise antecedents of the achievements of modern science itself. The urge to universalize, in the case of Neugebauer and of Needham, went hand in hand with a preconceived notion of science as a single object with a single set of values. While very rich in the detail of scientific results they cover, the works of Neugebauer and of Needham ultimately create a picture of science with few tensions and ambiguities, with very little historical change in the nature of science as such. There is only one science, for Neugebauer and Needham, which merely happens to unfold in time and in space. Such an outlook is of course inimical to the study of empirical variety.

The double move in contemporary studies of early science – both to particularize and to universalize – is therefore a remarkable break with the recent history of the discipline. As historians of ideas ourselves, our instinct would be to look for explanations for such a development in terms of deep, underlying causes, perhaps looking at the

[1] Especially Needham 1954-, six volumes so far. Needham died in 1995; the historiographical approach of the series has changed quite a lot over the years.

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sociology of the field. But the truth is that the sociology of the discipline did not change as dramatically as did its methodology. Most of us are still, professionally, either ancient philosophers or general historians. Courses and textbooks dedicated to the field are rare, and it tends to exist, instead, as individual lectures and classes set within wider introductions. The recent developments in the methodology of early science owe a great deal to wider developments in Classics and in the history of science as a whole, but they may well result, among other things, from the influence of a single author who has shaped, more than anyone else, the development of the discipline over the last forty years – Sir Geoffrey Lloyd. Professionally an ancient philosopher, Lloyd's first book, *Polarity and Analogy* (1966), started out precisely from the tradition of considering early intellectual history as a reflection of the development from the Pre-Socratics, via Plato, to Aristotle – and in the process transformed the understanding of this development. The center of gravity of the discipline has moved decisively from the metaphysical doctrines to the details of scientific reasoning. This transformation led on to an ever-widening research program, which included a new focus on the substantial corpus of medical authors, the political and ideological setting of ancient science, the later authors of Hellenistic, Roman, and Late antique periods, and finally the cross-cultural comparative approach to the study of early science. In the institutional terms that we as historians of science are now familiar with, we can see how the growth of the discipline was personally shaped by Geoffrey Lloyd. Indeed, some of the authors in this volume (including the guest-editors) were Lloyd's Ph.D. students while others studied with him in other capacities, whether as his students or as his peers. This may be seen as a purely sociological thread linking the articles collected here together. But their unity of course runs deeper.

The intellectual value of the recent move in the study of early science is obvious: paying attention to the richness of the past, allowing for tensions and ambiguities, considering the widest possible corpus, simply makes for a more truthful picture of history. We would wish to note the important moral value of this endeavor. It is by considering history in the widest scale that cultures can engage in dialogue, but it is by considering history in its detail that such a dialogue can become meaningful. Culturally sensitive historiography, in other words, is the best antidote against the essentialist view of foreign cultures. Surely such an antidote is to be valued in our time. It is all the more to be regretted that, just as the study of early science reaches its intellectual and ideological maturity, its institutional footing becomes ever more precarious. This, indeed, may be the paradoxical outcome of the intellectual achievement itself. It is now recognized that early science is a fully fledged discipline, not to be seen as a mere appendage to general history of science or to ancient philosophy. Many academic leaders recognize ancient science as a gap in their academic structures. But who, in the current budgetary position of the humanities, can consider building up departments by adding in new sub-fields? No longer a field for amateurs, the discipline of early science calls for a new generation of professionals. It is to be hoped that the way would be found to train – and employ – this new generation.

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References

Lloyd, G. E. R. 1966. *Polarity and Analogy: Two Types of Argumentation in Early Greek Thought*. Cambridge: Cambridge University Press.
Needham, J. ed. 1954–. *Science and Civilization in China*. Cambridge: Cambridge University Press.
Neugebauer, O. 1969. *The Exact Sciences in Antiquity*. New York: Dover.

https://doi.org/10.1017/S0269889705000323 Published online by Cambridge University Press