



Review

Reviewed Work(s): *The Revolutions of Wisdom: Studies in the Claims and Practice of Ancient Greek Science* by G. E. R. Lloyd

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response to Josephus' works. In sum, this is an informative and stimulating collection.

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THE REVOLUTIONS OF WISDOM: STUDIES IN THE CLAIMS AND PRACTICE OF ANCIENT GREEK SCIENCE. By G. E. R. LLOYD. Berkeley: University of California Press (Sather Classical Lectures 52). 1987. Pp. xii, 468.

MATHEMATICS, medicine, astronomy, optics, harmonics, and various other intellectual disciplines were more or less independently developed in antiquity; in referring to them collectively as "Greek Science," we imply that they nevertheless shared certain essential characteristics. It is fair, then, to ask what these characteristics were. In this expansion of his 1983-84 Sather Lectures, G. E. R. Lloyd poses a variant of this question: "to what extent, and in what way, was there a breakthrough in the understanding of nature and on the question of how to go about securing such an understanding?" Lloyd's approach is to examine the writings of Greek scientific authors for "case studies" that reveal both their actual aims and practices, and what they alleged their aims and practices to be. After an introductory chapter in which Lloyd surveys the not always successful attempts to supplant "mythical" explanations of death, disease, madness, dreams, and destiny with rational accounts, the remaining chapters take up several aspects of Greek scientific practice as exemplified in the mature, specialized disciplines.

Science obviously cannot progress without new theories; but scientific method also demands a reluctance to displace old hypotheses with new ones that are not demonstrably better. In the chapter "Tradition and Innovation, Text and Context," Lloyd is concerned primarily with the stress on originality in early Greek science, a trait that, he argues, distinguishes this period from Egyptian and Mesopotamian cultures, as well as from the authority-bound scientific literature of late antiquity. But the passage from riotous invention to sterile tradition was not, of course, uniform. Even such a late author as Pappus could still uphold original work as the duty of a mathematician, and castigate his contemporaries for their failure to do anything new. "Dogmatism and Uncertainty" is an interesting study of the willingness of scientific writers to admit the limitations and fallibility of their explanations. Lloyd draws his most telling illustrations from the medical literature; it is a pity that he did not include astronomy in the scope of this chapter, since the works of Hipparchus and Ptolemy contain beautiful examples of self-correction. "Measurement and Mystification" exposes as a half-truth the popular generalization that Greek physical science was

hampered by lack of measurement. Admittedly, if we insist on regarding ancient physico-philosophical musings about motion and the elements as the antecedents of modern physics and chemistry, we will find little evidence of theories based on quantitative empirical data. In astronomy, mathematical geography, optics, and harmonics, however, Lloyd has no difficulty in finding abundant instances of measurement underlying theory. The reliability and quality of observational data was an important problem, especially in astronomy. Ptolemy sometimes attempts to estimate the tolerance of measurements from the nature of the instruments used; but he also has *a priori* or logical grounds for preferring one kind of observation to another. Thus he, and Hipparchus before him, preferred to base their lunar theories on eclipse observations rather than on direct observations of the moon's apparent position, not simply (as Lloyd suggests on 237) because eclipses were easier to observe accurately, but because eclipse observations could be analysed without having to account for parallax. In his *Geography* Ptolemy similarly argues for the inherent superiority of astronomical observation over terrestrial distance measurement for determining geographical locations; this bias notoriously led to his grossly stretched Mediterranean, based on the inaccurate reports of the lunar eclipse of 331 B.C. Deliberate discarding of observed phenomena that conflict with hypotheses, and neglect of inconsistencies within a theory, are the central themes of the last chapter, "Idealizations and Elisions." Lloyd finds prominent instances where discords were passed over in biological teleology, especially by Galen. His examples from Ptolemy's *Almagest*, however, are less striking than some that could be drawn from the astronomy of the period between Hipparchus and Ptolemy, such as the device (later preserved in medieval Indian texts) of accounting for a planet's two anomalies by simultaneously imagining it to travel on two different epicycles, the effects of which were then combined by a numerical trick that had no conceivable physical meaning. And it is not true, as Lloyd asserts (319), that Ptolemy's notion of "negligible difference" was vague and unquantified: often he takes the trouble to demonstrate that his mathematical shortcuts do not affect predicted positions by more than one or two minutes of arc, well within the claimed accuracy of observations.

Lloyd's purpose is not to argue for pat theses. The real value of *The Revolutions of Wisdom* lies not in the heavily qualified conclusions about the nature and value of Greek science with which it closes, but in its abundance of detailed and often conflicting vignettes of actual scientific practice. The broad range of subjects and authors that this book discusses may well be its most immediately attractive feature, but it is the accurate understanding and the spirit of fairness with which Lloyd reads these specialized and technical writings that earns the deepest respect.

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