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The Role of Medicine in the Development of Early Greek Science

LLOYD G. E. R., *The role of medicine in the development of early Greek science: Lampas VIII 1975 327-333.* | Par le développement des idées sur les causes et le traitement des maladies, les écrits médicaux nous renseignent sur les arguments employés pour dégager la science de la superstition, et sur les facteurs qui encouragèrent l'emploi des méthodes empiriques.

There are three principal strands to Greek science in the period from the sixth to the fourth century B.C., namely philosophy — that is, chiefly, physical and cosmological speculation — mathematics and medicine. The evidence for the first two of these is scanty, that for pre-Platonic mathematics being worse even than that for pre-Platonic philosophy, both in the number and extent of the extant fragments, and in the general reliability of the interpretative comments of later sources. The position as regards medicine is far more favourable in that we have, in the Hippocratic Corpus, a substantial body of original texts most of which date from the fifth or fourth century B.C. Much notable work towards evaluating Hippocratic medicine has recently been done by Joly, Kudlien, Lanata and others¹, following, and often modifying the conclusions of, earlier studies by scholars such as Heidel, Edelstein and Bourgey². Yet from some points of view the use of this material for the study of certain key problems in the development of Greek science can be said to have only just begun. In particular the Hippocratic evidence can provide insights into aspects of the social background to the development of Greek science, and can be used to help define the nature of the Greek achievement in initiating the Western scientific tradition, in ways that have yet to be fully exploited.

What developed in Greece in the sixth to the fourth centuries B.C. was not 'science' as such, so much as the three largely distinct³ disciplines that I have identified, philosophy, mathematics and medicine. There are important differences, both as between these three fields, and as between different individuals working in the same field, in the views that were taken of the nature of the investigations they engaged in. In philosophy — as I have argued elsewhere⁴ — so far as the earlier Presocratics down to Parmenides are concerned, it is fairly clear that none of them placed himself in any category of 'philosopher' or 'inquirer into nature' that included all the others, and it is even uncertain how far any of them saw themselves as part of a single developing investigation, even though they were often aware of one another's ideas. In medicine, the texts of the Hippocratic Corpus were evidently written by men of very different types, with different social roles and different conceptions of the nature of medicine. The influence of rhetoric and the sophistic movement is marked in a number of treatises, some of which may well have been composed by men who were professional sophists or teachers, rather than practising doctors. On the other hand others were clearly produced by and for medical practitioners. Again several borrow ideas freely from contemporary cosmology: but others, notably *On Ancient Medicine*, strongly criticise what they represent as the intrusion of philosophical ideas and, especially, methods into medicine. Whereas philosophy as such

did not provide a livelihood until it came to be a subject that was taught for a fee, the doctors by contrast could always earn a living (or supplement their income) both from the practice of medicine and from teaching, where the taught might include not only intending practitioners but also men who wished to learn about such subjects as the constitution of the human body and the causes of diseases as part of their general education⁵. Moreover such works as *On the Nature of Man* throw light on the context in which some scientific discussion was conducted. Evidently such topics as the constituent elements of the human body or those of physical objects as a whole could be, and sometimes were, the subject of public debates, with opposing speakers each attempting to persuade a lay audience who adjudicated the result by declaring the winner⁶. Although this was, of course, not the only form that such discussions took, this evidence helps to explain both the predominant role of argument in, and the 'agonistic' or competitive character of, some Greek scientific writings.

The chief point that must be emphasised is the fragmentary nature of early Greek science, the variety of heads under which what we may call scientific inquiry was conducted. There was no role for the scientist as such, and much of what we know as early Greek science was done by men who saw themselves primarily as, for example, doctors or teachers. The pluralism of Greek science had certain advantages in the very variety of methods and aims of investigators who had different primary interests. Thus if knowledge for its own sake was often the goal of the philosophers, the doctors, by contrast, tended to show a greater interest in the practical applicability, and the testability, of their theories. At the same time the attendant, and probably more important, disadvantage was that there was no framework for the discussion of the nature of science or scientific method as such. It is characteristic that one of our most important early texts on method, the treatise *On Ancient Medicine*, is largely concerned with what we may call a demarcation dispute between philosophy and medicine⁷.

Apart from illuminating certain aspects of the social background to early Greek science, the Hippocratic texts provide evidence that helps to define the nature of the Greek achievement in this field. We speak of the Greeks originating or inventing the Western scientific tradition itself, but precisely what this means is often left unclear. Attention is usually focussed on speculative philosophy, on the contrast between the cosmologies of the earlier Presocratics and pre-philosophical mythologies. But the medical texts serve to elucidate other aspects of the problem, and the evidence of medicine has the particular advantage of the possibility of *control*: we can make direct comparisons not only between different conceptions of medicine within the Greek world, but also between the Greeks and their ancient near Eastern neighbours⁸, or again between the Greeks and what anthropologists have reported from modern societies.

One aspect of the development of science that has often been stressed is the substitution of rational for mythical explanations of natural phenomena. Whilst the large number of accounts of earthquakes, lightning and thunder and so on that are attributed to the early Presocratics in our late secondary sources may partly reflect a bias in those secondary sources themselves⁹, the early philosophers do indeed appear to have been particularly interested in marvellous phenomena, many of which had traditionally been associated

with, or ascribed to, the gods or supernatural agencies — although among later Presocratic cosmologists there is at least one, namely Empedocles, who so far from always insisting on naturalistic explanations himself claimed, in one fragment, to be able to control the weather and even to bring the dead back to life¹⁰. But we have again to turn to the medical writers for extended original texts *explicitly* criticising supernaturalist explanations.

The author of *On the Sacred Disease*, especially¹¹, mounts a sustained attack on those who thought that the 'sacred disease' — that is, epilepsy — was caused by divine agency and could be cured by ritual purifications. Now the reports of anthropologists show that there is nothing unusual about doubts being expressed concerning particular witch-doctors, diviners, wise men and the like. Evans-Pritchard, for example, remarks on this in his classic study of the Azande¹². Yet Evans-Pritchard went on to note that the Zande rejection of individual witch-doctors, so far from being accompanied by scepticism about witch-doctorhood in general, tends to confirm that belief: 'scepticism explains failures of witch-doctors, and being directed towards particular witch-doctors even tends to support faith in others'¹³. What is exceptional in *On the Sacred Disease* is the *general* attack on the beliefs of the 'purifiers' that diseases can be caused by supernatural agencies, and that spells and incantations can have any effect either on the course of diseases or on any other natural phenomena¹⁴. Moreover it is not the case that, in attacking the beliefs of the 'purifiers', the Hippocratic author had — we should say — any clear idea of the causes of epilepsy (where he develops a largely fanciful notion of the effects of phlegm blocking the 'veins' in the body) or that he had any effective remedy for it¹⁵ (although he claims that this, as indeed every other disease, can be cured by adjusting the balance of opposites in the patient's regimen)¹⁶. To judge from this evidence, the general rejection of this set of supernaturalist beliefs depended not on the availability of alternative, more effective means of dealing with the problem to which those beliefs related, but on the development of a new conception of nature that excluded any idea of direct divine intervention in natural phenomena.

But if this treatise provides important direct evidence concerning the precise form that certain arguments against magical or superstitious beliefs took, the study of other aspects of Greek medicine helps to define the limits of what was achieved in this respect. The attempt to refute 'magic', both inside and outside¹⁷ medicine, was at most only partially successful. The idea that gods can cause diseases, though rejected by certain Hippocratic authors, survived not only in popular belief, but also among the educated¹⁸. Although *On the Sacred Disease* dismisses the use of spells and purifications, their effectiveness, and that of amulets and prayers, continued to be controversial topics on which the medical writers themselves adopted opposing positions¹⁹. It was not only the followers of Asclepius who held that dreams can be used in diagnosis and sometimes indicate the treatment to be followed, for we find examples of both beliefs from the Hippocratic work *On Regimen* right down to Galen²⁰. The terms 'magic' (μαγεία) and 'charlatanry' (ἀλαζονεία) were frequently used to express what any particular writer disapproved of, but what counted as 'magic' varied considerably from one writer to another²¹.

The evidence of medicine is again crucial in evaluating the methods used in early Greek science. The alleged failure of the Greeks to experiment has been much discussed.²² But a more fundamental question relates to the role of observation in early Greek science.²³ Despite the evident curiosity of the Presocratic philosophers, they are, with the possible exception of Democritus, largely innocent of any attempt at sustained research involving observations deliberately directed to a particular topic or problem. This may reflect, in part, the influence of Parmenides' attack on the validity of sense-perception, although in practice the attitude of most philosophers was not one of total rejection of the senses, so much as one of qualified acceptance.²⁴ It may, then, be more relevant to note that many of the geological, meteorological and astronomical phenomena the Presocratics were interested in (such as lightning and earthquakes) cannot be investigated directly — where early Greek theorists had recourse, understandably, to analogies mostly with quite familiar phenomena.²⁵ Yet that still leaves certain problems concerning which observations were possible, but in which no systematic research appears to have been undertaken. Thus although condensation and rarefaction were often appealed to as an explanation of the differences between physical objects²⁶, there seem to have been no systematic investigations of the nature of those processes. Such observations of the movements of the heavenly bodies as were carried out in the fifth century were the work not of men like Empedocles, Anaxagoras or Democritus, but of the astronomers Meton and Euctemon, and the main such observations (of the length of the solar year and the lunar month) were conducted with a particular practical purpose in mind, the regulation of the calendar. We hear from Plato (*Republic* 531a-c) of certain empirical investigations carried out by the Pythagoreans in harmonics, investigations which were, we may assume, conducted in connection with, and to provide support for, the doctrine that all things are numbers. Although we find certain rather general pronouncements, in the philosophers, about the need to search to find out the truth²⁷, and that 'phenomena are the vision of what is unclear'²⁸, there is no clear statement of the importance of empirical research as a foundation of physical theories, nor — to judge from the extant remains of most of the Presocratics — can such a principle be said to have been generally accepted and implemented.²⁹

Once again the more extensive information in the medical writers throws important further light on the problem. In one area, at least, namely the study of the signs and symptoms of diseases, there are not only medical texts that describe in detail the signs that are to be looked for³⁰, but also others (notably *Epidemics* I and II) that establish that sustained and detailed observations of the daily progress of individual patients were indeed carried out in practice. It is for this reason, above all, that the doctors can be claimed to provide some of the best early examples of the empirical approach in Greek science, and *On Ancient Medicine*, in rejecting the use of arbitrary hypotheses or postulates that cannot be tested, advocates what is, broadly, an empiricist methodology. Even so, two cautions are necessary. First it is well known that over and above any desire to be thorough, there is an additional motive for the *daily* recording of patient's symptoms in *Epid.* I and II, namely the doctrine of critical days. One reason why the author or authors of these works are so meticulous in the daily reports on their patients is because

of their theoretical interest in the periodicities of diseases and in particular in the possible significance of odd and even days in the progress of fevers.³¹

Secondly we must once again acknowledge the general limitations of the empirical tendencies in Greek medicine. If in diagnosis and prognosis extensive observations of patients' urine, stool, vomit and so on were undertaken by some Hippocratic doctors with great care and patience, in other areas they were slow to exploit the opportunities for research. The history of the early use of dissection illustrates this. The idea that this method originates with Alcmaeon has been challenged recently by both Professor Mansfeld and myself³². It is however clear from the evidence of Aristotle that dissections had been carried out by some of his predecessors, and we find some, though rare, indications of this in the Hippocratic Corpus³³. Thus one treatise that refers to the idea of carrying out a post mortem examination on an animal in order to verify a particular pathological theory is *On the Sacred Disease*³⁴. Yet the extent of the use of dissection was very limited, even though there are plenty of treatises that put forward more or less detailed — but usually quite fanciful — anatomical theories, for example about the vascular system in the body. Even in Aristotle himself, who does draw attention to the need for direct study of the internal as well as the external parts of animals, the actual extent of the dissections carried out by him and his assistants is certainly not as great as some of his programmatic statements might lead us to expect. The successful exploitation of this important technique of research depended not merely on a theoretical recognition of its value (which was, in fact, quite slow in coming), but also and above all on learning, in detail, what to look for, and that often meant the redefinition of the problems and the formulation of new ones, as well as the forging of a new anatomical and physiological vocabulary to express what was discovered. From Aristotle, through the Hellenistic anatomists, right down to Galen, what we have is a complex interaction of theory and practice: the perception both of the data and of the problems to be investigated is transformed as the new method comes to be extended.

In conclusion, I would argue that medicine provides us with invaluable evidence concerning certain aspects of the development of science in ancient Greece. If the development of a concept of 'nature' and of the contrast between it and the 'supernatural' is one essential feature of the growth of science, one important context in which we can trace such a development is in relation to ideas about the causes and cures of diseases, where the frontier between science and 'superstition' was the scene of a continuing battle throughout antiquity and where the early medical writers provide us with direct evidence on the nature of some of the arguments used. Secondly medicine provides us with precious information about the development of empirical methods in Greek science. If the epistemological debate was mainly carried on by the philosophers, it is chiefly in the medical writers that we can trace the development of the use of empirical methods and study the factors that encouraged or inhibited their growth.

Notes

- 1 See especially R. Joly, *Le niveau de la science hippocratique*, Paris 1966, F. Kudlien, *Der Beginn des medizinischen Denkens bei den Griechen*, Zürich 1967 and 'Early Greek primitive medicine', *Clio Medica* 3, 1968, pp 305-336, and G. Lanata, *Medicina Magica e Religione Popolare in Grecia*, Rome 1967.
- 2 e.g. W.A. Heidel, *Hippocratic Medicine, its spirit and method*, New York 1941, L. Edelstein, 'Greek medicine in its relation to religion and magic', in *Bulletin of the Institute of the History of Medicine* 5, 1937, pp 201-246 (reprinted in *Ancient Medicine*, ed. O. and C.L. Temkin, Baltimore 1967) and L. Bourgey, *Observation et expérience chez les médecins de la collection Hippocratique*, Paris 1953.
- 3 That is not to deny that there are important overlaps between the three. In particular the topic of the origins of diseases was tackled by a number of writers (including Plato) whose primary interest was philosophy and who never practised medicine.
- 4 'The social background of early Greek philosophy and science' in *Literature and Western Civilization*, ed. D. Daiches, Vol 1, ch 16, especially pp 387ff.
- 5 See e.g. Aristotle, *Politics* 1282 a 3f.
- 6 See *Nat. Hist.* ch 1.
- 7 See *VM* ch 1 and 20 especially.
- 8 See, for example, the articles by A. Leo Oppenheim ('Mesopotamian medicine', pp 97-108) and J.A. Wilson ('Medicine in ancient Egypt', pp 114-123) in the *Bulletin of the History of Medicine* 36, 1962. The famous Edwin Smith papyrus demonstrates that the recording of clinical data began in Egypt long before classical Greek medicine, and the tone of this document – unlike so much of the rest of extant Egyptian, and more especially Babylonian, medicine – is generally restrained. Yet, even this papyrus refers at one point to the charm that has to be recited to ensure the effectiveness of the remedy prescribed. Nor is there any suggestion, here or anywhere else in the extant remains of ancient near Eastern medicine, of direct general criticisms of magical medical beliefs. This point remains valid even though it is possible – as R.O. Steiner and J.B. de Cuij-Saunders have argued (*Ancient Egyptian and Coptic medicine*, Berkeley 1959) – that certain Egyptian pathological ideas directly influenced Greek, particularly Cnidian, medicine.
- 9 We should, however, remark that Aristotle already makes extensive references to his predecessors in his discussion of geological and meteorological phenomena in the *De Caelo* and *Meteorologica* 10 Fr 111, cf also Fr 112.
- 10 Cf also *Afr.* ch 22 on the alleged sacred character of the impotence afflicting certain Scythians (and contrast Herodotus 1 105). I have discussed the arguments in *Morb. Sacr.* in some detail in *Aspects of the interrelations of medicine, magic and philosophy in ancient Greece* *Aperion* 9, 1975, pp 1-16.
- 11 I was surprised to find a considerable body of sceptical opinion in many departments of Zoroastrian culture, and especially in regard to their witch-doctors, E.E. Evans-Pritchard, *Witchcraft, Oracles and Magic among the Azande*, Oxford 1937, p 183.
- 12 Evans-Pritchard, op. cit., p 193, cf p 185: 'I particularly do not wish to give the impression that there is anyone who disbelieves in witch-doctorhood.' Cf also K. Thomas, writing about astrological beliefs in 16th and 17th century England: 'everyone knew that some practitioners were better than others and that the profession was infested by charlatans and quacks... The paradox was that the mistakes of any one astrologer only served to buttress the status of the system as a whole, since the client's reaction was to turn to another practitioner to get better advice, while the astrologer himself went back over his calculations to see where he had slipped up', *Religion and the Decline of Magic*, London 1971, p 401.
- 14 e.g. ch 1, 64 61ff, ed. Gensemann: 'If these people claim to know how to draw down the moon cause an eclipse of the sun, make storms and fine weather, rain and drought, to make the sea too rough for sailing or the land infertile, and all the rest of their nonsense, then whether they claim to be able to do it by rites or by some other cunning or practice, they seem to me to be impious.'
- 15 This runs counter to the thesis of Malinowski (found also in Evans-Pritchard and many others) that mystical beliefs and practices are particularly common in relation to situations beyond the technological capabilities of the group or society concerned. For one recent use of the thesis, see for example, R. Horton, *African traditional thought and western science*, Africa 37, 1967, pp 50-74 and 197-207.

- 16 See the end of the treatise, ch 18, 88 26ff Gensemann.
- 17 Outside medicine, the main examples are those of astrology and 'alchemy', both of which involve a nexus of beliefs that are as complex and – for the ancients themselves – as controversial as the definition of, and response to, magical practices in medicine.
- 18 Such a belief is alluded to by a wide variety of authors, both of the classical period and later. See for example, Sophocles *Tr.* 1235f, Plato *Phdr.* 244de, Plutarch *de superstitione* 168bc, Plotinus *Enneads* II 9 14 and Porphyry (who endorses it, *de abstinentia* II 40). It is clear from a passage in Galen's *Commentary on the Prognosis* (CMG V 9, 2 pp 205f, Heeg = XVIII B 17f Kühn) that it was shared by some who were sufficiently well read to cite Hippocrates himself as an authority for their view (doing so by misinterpreting, as Galen himself insists, the reference to considering 'what is divine' in *Prognosis* ch 1, II 112 5ff Littré). The whole topic has been much discussed, e.g. by O. Weinreich, *Antike Heilungswunder, Untersuchungen zum Wunderglauben der Griechen und Römer*, Religionsgeschichtliche Versuche und Vorarbeiten 8, Gießen 1909-10, E. Stenplinger, *Antike und moderne Volksmedizin*, Das Erbe der Alten 10, Leipzig 1925, E.R. Dodds, *The Greeks and the Irrational*, Berkeley 1951, ch 3 and in the studies of Edelstein and Lanata cited above (nn 1-2).
- 19 But equally the use of the pulse in diagnosis was sometimes taken to be no better than divination. See, for example, Galen XIV 637 Kühn.
- 20 See, for example, Galen VI 833-835, X 972, XI 314f Kühn.
- 21 Thus the attitudes of such writers as Pliny towards astrology and magic are characteristically ambivalent. He rejects the deceptions of the magicians, but his work is a mine of information concerning folk medicine, where he endorses, or at least does not criticise, far more often than he rejects, the beliefs and practices he reports.
- 22 I discuss this problem in 'Experiment in early Greek philosophy and medicine', *Proceedings of the Cambridge Philological Society*, 190 N.S. 10, 1964, pp 50-72.
- 23 Cf the remarks of G.E.M. de Ste Croix in *Scientific Change*, ed. A.C. Crombie, London 1963, pp 81ff.
- 24 See, for example, Heraclitus *Fr* 55, 101a, Empedocles *Fr* 3, Democritus *Fr* 11, 125 and contrast Melissus *Fr* 8.
- 25 See my *Polarity and Analogy*, Cambridge 1966.
- 26 It is striking that the same phenomenon is sometimes used by different Greek philosophers to illustrate and support quite different physical theories. Thus the condensation of air to water is cited in our secondary sources for Anaximenes to illustrate his theory of the condensation and rarefaction of the primary substance air (e.g. Simplicius *In Ph.* 24 29ff, DK 13 A 5, *Hip. Ref.* 1 7 (3), DK A 7), and it also appears, in a modified form, in Anaxagoras *Fr* 16 to support his quite different doctrine that there is a portion of everything in everything.
- 27 e.g. Xenophanes *Fr* 18, cf Alcmaeon *Fr* 2, but contrast Heraclitus' rejection of $\pi\omicron\lambda\upsilon\mu\alpha\theta\acute{\iota}\eta$, *Fr* 40.
- 28 Anaxagoras *Fr* 21a.
- 29 Again Democritus may be an exception, to judge from the range of subjects he is reported to have tackled, although how he dealt with them is a matter of conjecture.
- 30 Especially *Prognosis*, where the account of the signs to be looked for in a patient's face, for example, is far more detailed than any to be found in a modern textbook on clinical medicine.
- 31 e.g. *Epid.* I ch 26, cf case 1; *Epid.* III ch 6 and cases 3, 10 and 12 in the second series. However the match between the data set out in the case-histories in *Epid.* I and III and the theoretical discussions of periodicities embedded in those treatises is not a good one.
- 32 See J. Mansfeld, 'Physikos' or 'Physician?' in *Kephalaion*, Studies in Greek Philosophy and its Continuation offered to C.J. de Vogel, ed. J. Mansfeld and L.M. de Rijk, Assen 1975, pp 26-38, and G.E.R. Lloyd, 'Alcmaeon and the early history of dissection', *Sudhoff's Archiv*, 59, 1975, pp 113-147.
- 33 The chief example, *Cord.*, is, however, evidence for dissection after not before Aristotle and so must be discounted (see most recently I.M. Lönne, 'The paradoxical text "On the Heart"', *Medical History* 17, 1973, pp 1-15 and 136-153.) The absence of the use of dissection in the surgical treatises, in the account of anatomical structures in *VM* ch 22 and in such contexts as the descriptions of the development of the embryo chick in *Nat. Puer.* ch 29, VII 530 10ff Littré and of the short-lived *Arteriae* in *Arteriae* ch 10 VIII 640 10ff Littré, and the absence of the