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5 'Wonders' and the natural world: natural philosophy and *historie*

This chapter turns from the human world to the world of animals, marvels and the intersection between natural philosophy, medicine and *historie*, or, literally, 'enquiry'. In some parts of the *Histories* the audience is offered information, tales or theories concerning the natural world – animals, geology, biology – which at first glance seem to be very much the preserve of the *physiologoi*, those natural philosophers, at least, who speculated about the animate and visible parts of the natural world. Yet to pin it down so specifically is clearly unwise, since it is virtually impossible to separate subjects dealt with by certain *physiologoi* (Anaxagoras, Democritus, Diogenes of Apollonia) and those treated by writers of the Hippocratic Corpus. There was considerable interaction and sharing of ideas and concepts between them; in terms of methodology, the medical writers can be integrated into a continuous investigation of the development of Greek philosophical and scientific method, though there is debate on the extent to which Greek medicine was based on observation and empirical methods (see pages 153–61). Moreover, not only do we find a community of interests and ideas between *physiologoi* and doctors, but a continuity also between certain Herodotean descriptions and those of writers of the late fifth century and early to mid-fourth century, which is suggestive and exciting. Herodotus' debts to the geographical theories of the early *physiologoi* are well known: for instance his pointed curiosity about the significance of fossils which obviously played a part in earlier attempts to uncover the development of the world,¹ his theory that the northern part of Egypt was once a gulf of the sea, backed by observations about the silting up of river valleys,² and his assured and impressive discussion of theories about the flooding of the Nile itself. But it would be implausible to regard these interests simply as intellectual relics of

¹ II 12.1, combined with other factors for the example of Egypt; cf. Xenophanes on fossils, DK 21, A 33. A. Lloyd, comm. ad loc. suggests perhaps Anaximander; also Xanthos, *FGrH* 765, F12; cf. Brown (1965) on the geographical theories (68–72 on Hecataeus).

² II 10; Hecataeus was interested in sedimentation *FGrH* 1, F301: see A. Lloyd, Commentary ad loc. and 36f.; cf. Thomson (1948), 103 ff.

an older Ionian science, still less as a fossilized preservation of a younger Herodotus who was soon to turn to higher historical questions.³

Let us consider for a moment one subject where Herodotus' discussion has close affiliation with other ideas of the time, the section on the Nile flood. The very length of his section on the flooding of the Nile (II 19–27) suggests that the problem attracted a contemporary fascination, and the section is replete with the language of enquiry (e.g. II 19).⁴ The longest rebuttal is devoted to the theory of Anaxagoras, a contemporary or near contemporary (II 22), and while Herodotus offers a critique of Thales' solution of probably more than a century earlier,⁵ as well as Homer's belief in Ocean adopted by Hecataeus (II 21), his own solution – that the sun is the root cause – has elements which would have been familiar to some earlier Presocratics as well as later fifth-century writers such as Diogenes of Apollonia and Oinopides of Chios (II 24ff.). His stress on evaporation and more especially that the sun 'pulls' (ἐλκεῖ) the water up, recurs in Diogenes' slightly different explanation.⁶ And he reverses the question in such a way as to present the problem as one about why the river level should be so low in winter, rather than so high in summer – a trait shared by Oinopides of Chios.⁷ Whether contemporaries gave an equal attention to the Ister, as Herodotus himself does, is unknown. Meanwhile the Anaxagorean theory involving melting snow was resurrected in a different context by Democritus who thought melting snow in northern countries created clouds and later rain, which with the help of Etesian winds, then fell in the south.⁸ Not only were these still live questions which continued to fascinate, but the manner and ideas with which Herodotus approached them sits easily amongst these other contemporary – and later – theories. Similar suggestions may be made about Herodotus' forays into biology.

³ As Jacoby (1913).

⁴ For analysis of the argument itself, ch. 6 below. See detailed commentary ad loc. by A. Lloyd for the whole section, who comments (p. 104), 'H., as usual, shows himself fully aware of contemporary scientific doctrines'; and Bonneau (1964); Foucart (1943). The modern explanation has nothing to do with melting snow.

⁵ II 20, Etesian winds: DK 11, A 16.

⁶ DK 64, A 18: also involves *ikmas* being 'drawn up' (ἐλκεῖν is a favourite word of Diogenes, though not in the fragment here). See also ch. 2, p. 52 on Diogenes.

⁷ DK 41, A 11 (= FGrH 647, F1 (6), Anon. MS). A. Lloyd sees Herodotus as closest to Oinopides – though Oinopides thought the sun passed below the earth in winter, to diminish the Nile water at its source. Herodotus' complex argument about the movement of the sun between summer and winter would have been shared by other *physiologoi*. Cf. also *Breaths*, ch. 3.3 J, which thinks the 'wind is responsible for the movement of the sun, moon and stars'.

⁸ DK 68, A 99 (= FGrH 647, F1 (4)).

So the argument of the first part of this chapter will have two prongs: firstly it will try to show that, in his treatment of the animal world, Herodotus sometimes works along lines similar to those visible in contemporary and later Greek natural philosophy and medicine, the quest for the nature of the natural world and of man. Secondly, our detailed study will illustrate quite how closely intertwined are the separate disciplines, as they became later, of philosophy, medicine and the enquiry into nature (i.e. of the *physiologoi*). This is not, of course, an unfamiliar notion,⁹ but its application and relevance to Herodotus' *Histories* could be explored more fully than it has been. While it is always important to bear in mind that there was no separate discipline such as history when he wrote, it is harder to imagine exactly what that meant in practice in the mid to late fifth century. The interaction of ideas, as well as the rivalry between incipient disciplines (or *technai*) may do something to illuminate the kind of pre-disciplinary world in which Herodotus wrote. Accordingly the second section of this chapter looks more closely at some elements of this interaction and community of ideas. The final section brings the implications to bear upon Herodotus' *Histories* and our interpretation of his description of his work as an *historie*.

Two further points will lie behind much of the discussion and deserve high-lighting here – both related to the nature of early Greek natural philosophy and medicine. As we have seen occasionally in earlier chapters, early Greek natural philosophy and medicine combines empirical and theoretical methods in varying degrees. Observation and observable phenomena are brought into play but often interpreted by means of theoretical or abstract considerations or unvoiced assumptions about what should be the case.¹⁰ One may even suspect that such enquirers into nature often saw what they thought they should see, observations being theory-led (cf. the notorious modern example of theories about race and intelligence linked to skull size, which were clothed in the impeccable language of science and scientific experiment). Herodotus' enquiries are no different. It is hard to credit his 'description' of the hippo, a creature often inconveniently submerged under water, or the phoenix, a mythical bird he admits he has never seen, except as descriptions borrowed from Hecataeus,¹¹ but in other controversial examples the problem may be

⁹ See works on relation of philosophy and medicine, n. 57 below.

¹⁰ For the degree of observation and experiment in Greek science, n. 57 below; and for a particularly controversial case of 'autopsy', *Nat. Child.* 13, p. 165 below, with n. 98. Expressed rather differently, Corcella's stress on *gnome* in Herodotus (1984, 63–7) touches upon this general issue.

¹¹ As Porphyry: FGrH 1, F 324a for the accusation of plagiarism.

more complex. The propensity even of early Greek science to combine schematic theory with visible phenomena needs constantly to be borne in mind.

This brings us to Herodotus' 'wonders' or *thaumata* (θώματα in the Ionian dialect), his descriptions of marvels and wondrous things. If we tend to see Herodotus mainly within a lineage of historians, and part of the line of historical development from Hecataeus who begins to 'rationalize' Greek myths (that is, remove some of the more far-fetched elements) to Thucydides who is rigorously rationalistic, the presence of marvels in Herodotus is something that calls for some apology – and possibly mild patronizing. Of course marvels often do take their place in the *Histories* simply because they are marvels, as Herodotus says of his reason of extending his coverage of Egypt (II 35.1), not to mention some of the more fabulous descriptions. But wonders also play an important part in early Greek natural philosophy; they are not simply the tools of the story-teller anxious to keep his audience. Democritus for instance is said to have written about 'the most wondrous and paradoxical things of nature' (τὰ θαυμαστά καὶ τὰ παραλογώτατα τῆς φύσεως),¹² and a work appears under the name of Aristotle, which may be genuine, with the title, 'On marvellous things heard'. This forms a list of odd and inexplicable phenomena mostly of the natural world, though it also includes elements from human society, from springs, natural fires, metals, to dangerous animals and multiple births. The unusual, the wondrous, the marvellous might well provide exotic phenomena which need explaining as part of *physis* – the phenomena of silphium, for instance, and of bitumen, brimstone (*theion*), and alum (*stypteria*) were apparently discussed by Democritus (DK 68, A 99a; cf. chapter 2, p. 52 for other connections), just as those medical curiosities, the Scythians with the 'female disease', the Anaries discussed by *Airs*, also demanded to be explained by the laws of natural philosophy. Indeed as with these last people, fantastic 'facts' might be created by *a priori* assumptions – as the author of *Airs* asserts that the Scythians cauterize themselves in several places 'simply because of their moistness and softness'.¹³ Or as Aristotle declares, 'males have more teeth than females, not only in men, but also in sheep, goats and pigs' (*HA* II 3, 501b19f.) – there was no need to check. A perusal of early 'scientific' theories and questions about nature leaves one in no doubt

¹² DK 68, A 99a.

¹³ Ch. 20.2 J. Cf. the statement of *Airs* (ch. 22) that they attempt to cure their condition by cutting a vein behind the ear; *Airs* points out that this would not help, because of the notion that semen starts in the head.

about the role of *a priori* assumption rather than observation in many of these ideas.¹⁴ So the remoter parts of the world may be described because they are remote, exotic, marvellous and therefore fascinating,¹⁵ but not solely for entertainment value and for their quality as *thaumata*. They might also be interesting for the enquiry into nature, in which India is as important as Libya, the Nile as interesting as the Maeander. The Nile constituted a 'marvel', so did its counter-intuitive summer flooding: as Herodotus puts it, its nature (*physis*) is quite different from that of other rivers (II 19.3). Yet Herodotus tries to show at length that there is an explanation which would fit the Nile without contradicting the experience of other rivers – he gives equally full attention to the Ister (IV 50). He is seeking a conformity to what are effectively universal laws of nature, and he reinforces this by explaining how exactly the same would happen to the Ister were the heavens and winds reversed (II 24–7, esp. 26.2).¹⁶ Similarly Democritus mentioned Arabian cattle with good horns as part of a wider discussion of the growth of animal horn, the flowing of humours, *ikmas*, and *phlebes*,¹⁷ Libyan asses (ὄνοι) as part of a discussion of prolific creatures.¹⁸ Later, Aristotle picked up the theme of the 'many-formed' animals of Libya and sought to explain why they were so varied by considering the consequences of an essential practice in Libya, the gatherings of animals at waterholes (*Hist. Anim.* VII (VIII) 606b17–28; cf. chapter 3, p. 96). Marvels were clearly part of the enquiry into the natural world.

Oligogonia and polygonia, and the Arabian snakes

Let us turn to the fascinating case of the Arabian snakes and the matter of prolific birth and its opposite that occur in Herodotus' third book.

In Book III, Herodotus moves from the remarkable list of satrapies of the Persian empire (89–97) to an equally remarkable excursus on some of the peoples at the far edges of the Persian kingdom, beginning with the

¹⁴ See Vlastos (1970); Mansfeld (1980a); G. E. R. Lloyd (1979); and works cited below, n. 57.

¹⁵ See Redfield (1985); Romm (1992). Cf. Greenblatt (1991) for a range of responses and interpretative strategies surrounding the 'wonder' of the New World in the Renaissance and early modern period – mostly, however, as a prelude to conquest or destruction.

¹⁶ For the idea, surely right, that he is underlining the uniformity of nature, Corcella (1984), 80–1.

¹⁷ DK 68, A 153–5, from *Ael. Nat. Hist.* XII 18–20.

¹⁸ A 151: from *Ael. NH* XII 16.

Indians – a series of exotic and marvellous tales. The initial excuse is that he will explain how the Indians acquire the gold which goes to the Persian king. 'Of all those we know about in Asia, and about which we can speak truthfully', the Indians lie furthest east (98.2). Finally we reach the notorious tale of how the Indians acquire gold dust in the face of opposition from terrible giant ants (III 102–5), which always intrigues apologists and cynics alike, though Herodotus seems to want to distance himself from it.¹⁹ Then he declares, 'It is the farthest reaches (*eschatiai*) of the earth that have the most beautiful things, while Greece has by far the best mix of seasons' (III 106.1), both summing up what he said about India and anticipating more on Arabia. For, Herodotus continues, India is very far east, 'as I said earlier', the animals are bigger than elsewhere, they have plentiful gold, and the wild trees grow something better and softer than wool. As for Arabia, it has wonderful spices, though the Arabians can only get at them with great difficulty. There follows a detailed description of the Arabian snakes (ὄφεις, chs. 107–9; 110 ff. continues with the extraordinary methods used for gathering the spices). These snakes are winged and guard the frankincense trees. They would overrun the whole world were it not for the fact that they, like the vipers, procreate in such a way that when the male and female come together, the female bites clean through the male's neck. The male dies, but he is avenged by the unborn young who make their entry into the world by eating through the mother's womb. Hence they do not multiply as fast as their nature (*physis*) would allow (III 109.1).

The whole section is a wonderful description of 'marvels', *thaumata* (used of cinnamon at ch. 111.1). The flying snakes themselves have elicited particular scepticism, especially as they have already made their appearance in highly questionable circumstances in Book II.²⁰ Herodotus'

¹⁹ Cf. III 105.1: 'as it is said by the Persians', and finally again, ὡς Πέρσαι φασί. Note that the tale also requires explanations about climatic heat and camel behaviour! See Fehling (1989), 97–8 for a different view. Pritchett (1993), 90 ff., mentions various 'explanations' for the ants; marmots resurrected by Michael Peissel, anthropologist and explorer of Tibet (*Times*, 4 Dec. 1996). Perhaps a mistranslation: the Persian calls these creatures 'mountain ants'.

²⁰ II 75. Cf. Fehling (1989), 24–7 for scepticism on the snakes (which surely most would share): whether or not Herodotus or his informants believed the tale is, however, quite another matter. There have been many ideas on the presumably garbled origin of these 'snakes': Rawlinson favoured locusts; cf. A. Lloyd, Commentary on Book II, pp. 75f.: he thinks II 75 'may owe something to Hecataeus'; he favours flying lizards and suggests that III 107 was the result of elaboration of tales about them from the East, travellers like Scylax etc.

statement about the *eschatiai* has been seen, surely rightly, as part of his over schematic division of the world, a tendency to see geography in terms of binary opposites, and a schematic apportioning of the world into the extreme and atypical on the margins, and the mixture in the centre.²¹ Romm suggested that Herodotus is at times working with two slightly contradictory models of world geography, one in which the furthest places are deserted (*eremoi*), the other, more mythical, in which they contain wonderful or idyllic peoples like Ethiopians and Hyperboreans.²²

But wonders turn out to be important for an understanding of the natural world. In the remarkable and rather neglected section following the statement about the *eschatiai* on the one hand, and the snakes in Arabia on the other, we are treated to what is almost a lecture on biology in miniature, and an almost Darwinian theory about the survival strategies of different species of animal.²³ We move in other words from one 'theoretical' or schematic framework to another.

The flying snakes guard the trees of frankincense (III 107). 'The Arabians also say this', that the whole land would be filled with them, if they were not checked, as Herodotus adds, 'in the way I know happens with the vipers' (108.1). It is not till later (ch. 109) that we learn precisely how the snakes' and vipers' breeding habits manage to reduce their numbers spectacularly in a horrible example, as Herodotus points out, of animal 'retribution' between male and female.²⁴ But first, he continues:

²¹ See particularly Redfield (1985), esp. 110–12 ('We place the fabulous beyond the edges of the known world, he [Herodotus] suggests, not only because they are beyond our knowledge, but because, as we move toward the edges, we encounter more extreme conditions and therefore atypical forms, both natural and cultural', p. 110). Cf. also Romm (1992), 38 ff., 68–70, on the *eschatiai* producing the best, and on the difficulties of getting at these benefits (but see n. 22); also Romm (1989). Heinemann (1945), 22–3, stressing the schematization, talks in terms of the scheme of classification of Ionian *historie*. On Hdt. III 106 see also: Immerwahr (1966), 49f. (antithesis), 102f.; Detienne (1972), 20f., 36f. (ch. 1); Romm (1987) – for the five stories about acquiring the gold etc.; Nesselrath (1995).

²² Romm (1992), 38; he is over-schematic: he sees Herodotus' account of how Arabians and Indians obtained these valuable products as 'hard primitivism', in which 'a bare living has to be wrested at great cost' (p. 68): the rough distinction ('hard' and 'soft') is often useful (see Redfield 1985), but the point here in Herodotus is that these *fabulously* rich or valuable commodities can only be obtained with difficulty and pertinacity – he is not talking about scraping a living.

²³ Nestle (1908), 16–18, discussed an aspect of this (see below). Note esp. Demont (1994a) – concentrating on Plato's *Prot.*, Herodotus and providence (less on wider context). Romm (1992), 38 ff., 69–70, on 'hard primitivism', and geographical schemata. Falus (1977) has strikingly little to say about content or context.

²⁴ Cf. Demont (1995) on motif of *revenge*.

The god's foresight is wise, as is likely (ὥσπερ καὶ οἰκός ἐστι), for it has ensured that those animals which are cowardly and edible are all prolific (πολύγονα), while all those which are savage and troublesome, have few progeny (ὀλιγόγονα). (108.2)²⁵

So it is by the 'foresight' of the divine that timid animals are prolific (*polygona*), the others are *oligogona*, they have few offspring. He then gives detailed examples to back up this statement: the hare is the example of the timid creature (to which we return), the lion is the opposite. For the lioness conceives only once in her life and 'the reason is' that the lion cub in the womb has such sharp claws that the womb is ripped to shreds with the one birth (108.4). Vipers (*echidnai*) and the winged snakes have a similarly self-destructive way of procreating (see 109 and above).

There is much in this surprising passage which suggests a serious physiological angle in the midst of what seems to be a typical section of merely exotic wonders. Let us start with the concepts of *oligogonia* and *polygonia*.

Herodotus is the first writer in extant Greek literature to use the word *oligogonos*, the first in which the dual concepts appear together.²⁶ This in itself is interesting (though the limitations of 'extant' literature should be stressed: both appear in Plato's *Protagoras*: we return to this below). However, *Airs, Waters, Places* has a brief section on the same phenomenon, and in connection with the Scythians. The Scythians are characterized by their moistness, 'their bodies grow relaxed and squat', and various other physical characteristics follow from this moistness (ch. 20). They are characterized as 'least prolific' (ch. 19.1 J), and at ch. 21.1, 'Such a nature cannot be prolific (πολύγονον)' – because of the moistness of their *physis*, the men have no desire to have intercourse; also they indulge constantly in horse-riding. The women have fat and moist flesh, which means the womb cannot absorb the seed: 'Because of these necessary causes (ὑπὸ τούτων τῶν ἀναγκέων), fecundity (πολύγονον) is absent from the Scythian race' (21.3). The author continues with this miserable catalogue of Scythian traits; we then hear about the Scythians suffering from the female disease, the Anaries (ch. 22).

It is interesting that this passage in *Airs* on Scythian lack of *polygonia* was noted and discussed by Heinimann, but Heinimann did not notice the Herodotean interest in the same matter.²⁷ Heinimann combined *Airs* ch. 21 with a passage in Aristotle, *Gen. Anim.* (iv, 770a34f.), where Egyptian

²⁵ καὶ κως τοῦ θείου ἢ προνοίῃ, ὥσπερ καὶ οἰκός ἐστι, ἐοῦσα σοφῇ, ὅσα μὲν [γὰρ] ψυχὴν τε δειλὰ καὶ ἐδωδιμα, ταῦτα μὲν πάντα πολύγονα πεποίηκε, ἵνα μὴ ἐπιλίπη κατεσθιόμενα, ὅσα δὲ σκέτλια καὶ ἀνιηρά, ὀλιγόγονα.

²⁶ On conventional chronology; *polygonos* occurs in Aesch. *Suppl.* 692, of plants.

²⁷ Heinimann (1945), 22–3, suggesting that Egyptians in *Airs* also were *polygonos*; also briefly pp. 198–9.

women are mentioned as prolific (*polygonos*), and speculated that both derived from Ionian *historie*. The implication that Egypt featured in this way in the lost part of *Airs* is certainly strong. But such a suggestion about Ionian *historie* is impossibly vague: Heinimann seems to imply a long distant source, since he also mentioned the possible derivation of schematic geography from Hecataeus. Indeed he contrasted nearby the doctor's 'scientific' thinking²⁸ and Herodotus' supposedly archaic idea that the ends of the earth had the most beautiful objects (iii 106). But the omission of Herodotus in the discussion of *polygonia* in any case undermines his suggestion. What we can see from other Greek discussions enables us to refine the picture and make some suggestions about Herodotus' intellectual affiliations and milieu.

Prolific birth or its opposite was a subject of interest to some of the most serious thinkers on the subject of generation in the second half of the fifth century (contrast the slightly patronizing tone one senses in Heinimann's use of 'Ionian *historie*'). Thus the author of *On the Nature of the Child*, dated by its most recent editor to c. 420, turns in ch. 31 to the cause of multiple births and how twins can result from one act of intercourse (answer: the womb has a number of pockets). Animals who produce large litters are mentioned, both wild and domestic; the dog, pig and 'other animals which produce two or more offspring from one act of intercourse' are produced as evidence that twins are, in fact, born from one act of intercourse (31.2). This was clearly an issue of importance, though we may note that the Hippocratic author concentrates on the physical cause of multiple births, not the significance of this in the wider scheme of animal survival, as does Herodotus.

The antecedents of this view are problematic and complex, but it is clear that the Hippocratic writer was not the first to discuss this. He seems to be using 'an account which is definitely ascribed to Democritus in the tradition', though as a recent commentator admits, the same explanation might have been used by Anaxagoras or by Diogenes, since its elements are pre-Democritean.²⁹ Thus according to Aelian (DK 68, A 151): 'Democritus says that the sow and the bitch are prolific and he adds the explanation that they have many uteri and places to receive the seed' (then follows more on the seed itself). Empedocles also had an explanation for twins or triplets, again apparently for the biological process itself

²⁸ Heinimann (1945) 22; 'Der naturwissenschaftlichdenkende Arzt', p. 23.

²⁹ See Lonie (1981), 63 (both quotations); 252–5 for further discussion. Cf. Diller (1934), 45 and esp. n. 78, on Hdt. iii 108 (also iv 29) and Democritus to show that the questions asked by Democritus in A 150a–155 were older: concerned with Democritus' *Aitia*, he seems to see Herodotus as evidence for Ionian origin of aetiological literature.

(DK 31, A 81: superabundance of sperm and its division). Democritus' view lies closest to that of *Nature of the Child*.³⁰

Herodotus obviously approaches the question of prolific birth from a different angle: he does not give us a general biological theory for *how* it occurs, the physical, internal mechanism, that is, which would apply to all animals. Indeed he seems rather uninterested in the general mechanics of the process. But two elements of his account are crucial: firstly, he does give lengthy (and gruesome) biological detail for the hare, and the lion, as well as the snakes, so he does not gloss over precise details of animal biology altogether; secondly, he asks, indeed he begins with, the question why some animals have *polygonia*, others have *oligogonia*.

Both are brought together neatly in the Pseudo-Aristotelian *Problemata*, always a fascinating treasure-trove for what are to us wildly improbable questions of a pseudo-scientific nature:

Why are some living creatures prolific, like the sow, the bitch and the hare, but others, like man and the lion not? Is it that the former have many wombs and places which the sperm hastens to fill and into which it is divided, while the latter are the opposite?³¹

What is remarkable is both that this is precisely the question Herodotus asks, or rather, the question to which he offers an answer; and that the author covers some of the same examples: the lion and the hare, Herodotus' main examples apart from the Arabian flying snakes and the vipers, feature here as prime suspects.³² It would seem then, from this combination of ancient discussions that Herodotus' few paragraphs should also belong in the thick of discussions of late fifth-century speculation about prolific and unprolific animals. But where exactly does his account stand?

Any degree of certainty is, of course, impossible. But there are inter-

³⁰ Democritus' dates: he said himself he was 40 years older than Anaxagoras; he had a long life, born perhaps c. 470 or 460 (see D.L. ix 41); at any rate he will have coincided with several natural philosophers; Jouanna sees him as contemporary with Hippocrates. Cf. also *Regimen*. I 30 on twins; ch. 31 on cause of superfetation in women (here 'Ετρίονα).

³¹ *Probl.* 10, 14. 892a38–b3. Cf. also Arist. *Gen. Anim.* iv 4. 771b27 ff. (uterus with different sections), and 771a14 ff. generally for elaborate discussion of whether there is a single cause for 'monotokia', 'polytokia'.

³² Later, Aristotle is still trying to combat the idea that the lioness gives birth only once: *HA* vi 31, 579b2–4; he declares that the idea about the lioness losing the uterus 'is nonsense' (ἀπώδης), and invented to explain the scarcity of lions (cf. Herodotus vii 126 on lions in Europe?). The vipers' methods reappear in Arist. *On marvellous things heard*, ch. 165, 846b18–22, where it is cited as an example of revenge by the young on the mother (with the Atreids in mind? – cf. Clytemnestra's dream, Aesch. *Choeph.* 523–50). For what it is worth, the long discussion in Arist. *Gen. Anim.* has a rather different range of both examples and categories.

esting respects in which Herodotus stands out. If we can take the question and answer of the *Problemata* and Democritus as the fragment stands, we receive a biological explanation involving the physical character of the womb which has no place in Herodotus. Herodotus' gruesome account of the fate of the lioness explains her single conception by the lion cub's use of his sharp claws in the womb: this explanation involves the behaviour of the unborn rather than the nature of the womb; it is also quite different from the generalist explanation given in *Airs*, which simply invoked moistness. The same can be said of Herodotus' details about the snakes. We can perhaps simply guess that Herodotus was aware of other discussions about animal birth-rates that simply have not survived. For the hare and the lion were certainly classic examples for the question for the later author of the *Problemata*.

In fact it is probably significant that this Herodotean description of the lion's birth pangs seems to correspond neatly with the medical view that the pains of giving birth were produced by the infant struggling to emerge. This description, implying a passive uterus, has been seen as 'the most explicit expression of the notion that a parturient's pains were due to blows from her rambunctious infant as it forced its way out from the maternal womb',³³ though its presence in a complex passage of this kind should make one wary of taking it simply as a reflection of popular misconceptions about lions.

From the presence of the topic in Democritus, *Airs* (however disappointing), as well as *Nat. Child*, one would guess easily that here Herodotus was touching an issue of the latter half of the fifth century and a contemporary one, and certainly not merely harking back to some very much earlier account of 'Ionian historie', perhaps Hecataeus.³⁴ To assume that this kind of detail in Herodotus' *Histories* must go back always to some earlier source implicitly misrepresents the nature of contemporary debates about biology and animal reproduction.

But what makes this even more probable is the presence in his description of the hare as a high producer, of an extraordinarily technical and unusual word: ἐπικυϊσεται, meaning superfetation, or the capacity of an animal to become pregnant again when it is already pregnant. The hare, a timid animal, is especially *polygonos*, for, 'it alone of all wild animals can be doubly pregnant' (ἐπικυϊσεται μόνον πάντων θηρίων), (108.3). This

³³ Hanson (1991), 90; also 94; she mentions Aesop's fable (257 Perry) – though not wider intellectual context, and points out similar ideas about the human baby forcing its way out in *Nature of the Child*.

³⁴ Pherecydes of Syros, DK 7, A8, is added tentatively by Lonie (1981, 255): 'an early example in mythic form, of the belief that multiple birth is determined by the structure of the uterus': but the fragment in its present form is unhelpful.

verb occurs in Herodotus, in the late Hippocratic treatise *Superfetation* 1, where the Greek title is ἐπικύησις, and in the discussion on the subject in Aristotle's *Generation of Animals*.³⁵ The Hippocratic treatise discusses superfetation in women, and assumes the presence of a two-horned uterus for the purpose. Superfetation is also discussed in *On Regimen* 1 31.³⁶ Herodotus is thus *au fait* with one of the most technical terms in the discussions relating to prolific births (to which superfetation is obviously relevant). One can easily assume that the term so attested in later Hippocratic works was current in medical circles earlier.³⁷ From the way Herodotus insists that the hare is the only one 'of all wild animals', he may also be aware of ideas that domestic animals, or even humans were capable of this (perhaps also of ideas that multiple births as such were results of superfetation). This might imply that he was on the whole closer here to Hippocratic-related ideas, or at least detailed, quite technical discussion on this issue, possibly in the more medical writing, than to Democritean ideas.³⁸ Certainly the type of explanation provided by *Airs* was also quite different (though no more 'rational' or scientific than Herodotus'). It is worth contrasting the easy comparison made by Heinimann between *Airs* on *oligogonia* in Scythia and (selectively) Herodotus' declaration that the furthest parts of the world have the most beautiful things, not necessarily the place with the best climate – in which Heinimann says that the doctor attempts a rational solution to the problems of differences, Herodotus stands closer to an archaic way of thinking.³⁹ This is a fairly conventional view, but untrue, as we have seen, to all of Herodotus' text.

There is yet another strand: the form of the question. The *Problemata* asked the question why some animals were prolific, others not, and answered it narrowly in the physical sense, via the nature of the womb (this

³⁵ *Gen. Anim.* iv 5. 773a33–774b4; cf. Arist. *HA* vi 33 (579b–580a) on hares: accepts superfetation without discussion or much explanation.

³⁶ Ἐπικύησις; superfetation also occurs in the case at *Epid.* v 11. There is a problem whether multiple birth could be regarded as the result of superfetation: for Lonie (1981), comm. on 31.2 (p. 256), the author of *Nat. Child.* in his insistence that twins are conceived from a single act of copulation, implies that others thought multiple births were result of superfetation; Aristotle 'regarded multiple birth as a kind of "superfetation", whether there was one act of copulation or not' (*Gen. Anim.* iv 5. 773b6–7).

³⁷ For possibility of earlier material in *Superfetation*, see Thivel (1981), 94–7; and Lienau (1973), 37–42, 66f.; and generally on superfetation, Hanson (1994), 161–2, and Lienau (above). On the general possibility of older practice/knowledge within the gynaecological treatises, Hanson (1991).

³⁸ Cf. Arist. *Gen. Anim.* iv 5.774 a (c. 32 ff.), for example, for a quite different set of explanations for the hare's prolific nature (physical, e.g. hairiness).

³⁹ Heinimann (1945), 24: 'Es ist kein Zweifel, daß Herodot mit dieser Auffassung der archaischen Denkweise nähersteht, die jeden Geschöpf seine ἀρετή zuweist, während der Arzt von πάντ. [*Airs*] nach einer rationaleren Lösung des Problems der Verschiedenheit sucht.'

sounds rather Democritean).⁴⁰ It is significant that Herodotus is effectively addressing the same question: more exactly, he provides an answer to the same question, which is on a quite different level: 'The god's foresight is wise, as is likely, for it has ensured that those animals which are cowardly and edible are all prolific, while all those which are savage and troublesome, have few progeny' (108.2). Herodotus, then, is interested in the grand overall plan of animal survival, though he also goes on to give some biological detail. There is a wider pattern here, by which animals which tend to be a prey for others, and especially the hare, have numerous offspring. The idea that an equilibrium is maintained in nature, in the world of animals, is new (whether it is ultimately Herodotean or Protagorean – for which see below), and is later developed by Aristotle into the idea that nature itself keeps the balance.⁴¹

Finally, there is a possible and fascinating connection with Protagoras. Characteristically the relevant evidence occurs in a context notoriously hard to evaluate, within the myth told by Protagoras in Plato's *Protagoras*. Here, before we reach Prometheus' and Zeus' gifts for the preservation of humankind, Epimetheus apportions various 'powers' to the animals, strength or speed, size, ability to fly or burrow in the ground, and so on, the wherewithal to survive (320d7 ff.):

καὶ τοῖς μὲν ὀλιγογονίαν προσήψε, τοῖς δ' ἀναλίσκομένοις ὑπὸ τούτων πολυγονίαν, σωτηρίαν τῷ γένει πορίζων.

And some he made have very few young (*oligogonia*), while those who were their prey were very prolific (*polygonia*), and in this way the race was preserved. (321b5–6)

The similarity with Herodotus' opening statement is striking, but it is hardly a verbatim record of the sophist himself. Besides, Protagoras is better known for his theories about human society than the animal kingdom. It is generally assumed that Protagoras was not much interested in 'natural philosophy', though Cicero did remark that Prodicus, Thrasy-machus and Protagoras wrote 'even about nature' (*etiam de natura rerum: De Orat.* 3.32. 127–8).⁴² Protagoras may, then, have had something to say on natural philosophy, but the evidence, inadequate though it is,

⁴⁰ So does Aristotle, asking whether there is a *single* cause.

⁴¹ See Demont (1994a).

⁴² Cf. Guthrie (1971), 46, sceptical, on natural philosophy among sophists: the interest in 'nature' is merely for the further aim of being able to answer all questions. Eupolis ridiculed Protagoras for 'pretending an interest in the heavens but eating what came out of the ground' (DK A11), but Guthrie thinks this has as little value as Aristophanes' calling Socrates and Prodicus 'meteorosophists'; Kerferd (1981a) is more positive. See below for other sophists.

suggests that the intricacies of nature were far from the centre of his vision. This is borne out by Plato's portrayal of his aims – Protagoras is concerned with political and moral questions, not arithmetic, astronomy, geometry and *mousike*, he says, looking at Hippias who was discoursing on just those areas.⁴³

The Protagorean link (to use a neutral term) was noticed by Nestle long ago, and he devoted some time to the implications.⁴⁴ He thought that the most likely solution was that both Herodotus and Plato derived the idea about *pronoia* from Protagoras' work, Περὶ τῆς ἐν ἀρχῇ καταστάσεως, usually translated as 'On the Original State of Man' (D.L. ix. 55), partly on the grounds that it was improbable that Plato and Protagoras had relied on Herodotus.⁴⁵ This is not unlikely, though it is unclear how far that really helps in understanding Herodotus here. For even if the source were certain, one would then like to know what Herodotus had done with the 'source'. But there are other problems here. For on present understanding of Protagoras, and his scepticism about the divine, it seems most improbable that Protagoras had been keen to stress divine *pronoia*, indeed even in the Platonic version of the myth, there is no mention of *pronoia* itself, though the elements of the myth effectively denote it. Surely Herodotus' stress on the god and on foresight was his own and not Protagoras'.⁴⁶ Nor can there be a single source. Nestle, for example, did not discuss the full context, the details about snakes, hares and lions; nor the lively controversy about *polygonia* and *oligogonia* visible in Hippocratic texts and Democritus, not to mention the later writers (which underlines the danger of concentrating only upon certain prominent thinkers). It also highlights the fact that whatever ideas Herodotus may have accepted from Protagoras about the general distribution of the animal kingdom, he was absorbed also in some of the biological detail: his main examples recur, after all, in the list in the *Problemata*; he knows a highly technical medical term which was presumably current in medical discussion at the

⁴³ *Protag.* 315c5–7; 318c. For an analysis of the rest of the myth and importance of Protagoras' division between the gifts of Epimetheus, Prometheus and Zeus, see Demont (1994a).

⁴⁴ Nestle (1908), 16–18; also Kerferd (1981a), 150: the prolific v. strong animals contrast fits with myth in *Protag.*; Herodotus either drew on Protagoras, or on 'the source used by Protagoras'. Cf. Demont (1994a), undecided, but stresses plausibly the originality and coherence of Herodotus' whole section (pp. 149–50 surveys other views on the relation of Herodotus and Protagoras).

⁴⁵ Demont (1994a) stresses intertextuality and Plato's play on Herodotus' text. Stein, commentary on iii 108.2, concentrating on issue of providential divinity, suggested Anaxagoras as a possible source for Herodotus, but did not note Protagoras.

⁴⁶ For Protagoras' agnosticism and current consensus that he would not have attributed such matters to the gods: Guthrie (1971); C. W. Müller (1967); *contra*, Morrison (1941), 14–16, who connects Protagoras with Herodotus.

time he was writing, earlier than its first occurrence in our Hippocratic texts.⁴⁷

The simplest solution – given the evidence, it can only be tentative – is that Herodotus was himself not only familiar with the current discussions of the day, but using them in his own way to create something of his own. Hence the Protagorean echo, but no obvious single source. His idea, for instance, that this is the result of divine *pronoia* may be his contribution to the controversy, especially if Protagoras was unlikely to stress this. Equipped with the examples of biology, he yet concentrates upon the grand pattern of existence and survival between species, and sees it as part of a divine ordering. He seems to share certain lines of interest and knowledge with natural philosophers and medical experts, but offers his own slant.

The flying snakes also look like a Herodotean contribution – and it was the behaviour of the flying snakes and vipers which triggered off the whole discussion. After all, the hare and the lion were amongst the examples in the *Problemata*. But there was nothing there so exotic as the Arabian flying snakes who threatened to engulf the country had they not been blessed with such self-destructive tendencies (109.1–2)! Somehow this example did not enter the later technical literature on generation: the viper did, but not the winged snakes (note 32). Herodotus does not emphasize that this is his own theory as he sometimes does, but it looks like a Herodotean contribution to the *mélange*.

We seem to have here, then, a section which at first glance belongs to the category of Herodotean wonders, originating in or embellished by fantastic travellers' tales or merchants' yarns, but which turns out to be a reflection on the workings of nature and divine providence through the habits of animal procreation. It is a fascinating combination of schematic ordering of the exotic margins, biological knowledge and theory which belongs in the centre of late fifth-century discussion about procreation and prolific animals: an example, also, where 'wonders' obviously form part of a serious enquiry into nature as well as material simply to entrance the audience. The intellectual connections are too complex, too various, to sort out a neat genealogy of knowledge: Protagoras, Democritus or one of his predecessors, Hippocratic doctors all have something to say on this issue. But so does Herodotus, and why should a genealogy of knowledge be neat in any case? He seems well aware of the general issue of animal survival. He is asking the same questions, he seeks a general explanation for these natural phenomena and while his own approach looks more

⁴⁷ *Regimen* is dated to end of the fifth or early fourth century by Jouanna (1992). Perhaps similar problems hold for Demont's discussion (1994a) of Herodotus and Protagoras.

akin to the medical writers or Protagoras, he was creating a picture and an argument that could not be attributed to anyone but himself.

There are other areas where Herodotus treats subjects we know were dealt with by natural philosophers, subjects which could be classed as wonders, where we can also see this intermeshing of interests between groups who might later be placed in separate disciplines. Even with our fragmentary evidence for the *physiologoi*, there is an interesting cluster of common interests around the topics of growth, reproduction, and the effect of hot and cold upon these animals.

Take, for example, the effect of cold on animals. Herodotus is quite certain that the area beyond the Ister cannot be overrun with bees, as the Thracians think, because bees are intolerant of the cold (v 10) – a question that recurs in later writings on animals.⁴⁸ The cold of Scythia affects other animals, and he explains which ones can bear it, which cannot; he points out that there are no asses or mules either (iv 28.4).⁴⁹ Having stressed the extreme cold, he offers his own opinion about the hornless cattle:

It seems to me (δοκέει δέ μοι) that it is because of this that the hornless oxen do not grow horns; a verse in Homer's *Odyssey* supports my opinion (μαρτυρεῖ δέ μοι τῇ γνώμῃ): 'Libya too, where horns grow quickly on the heads of lambs', and it expresses correctly (ὀρθῶς) that horns grow rapidly in warm countries. But in countries with severe cold, either cattle do not grow horns, or they grow them with difficulty. So it is because of the cold that this happens. (iv 29–30.1)

The passage is striking. It is introduced with a personal opinion, a Homeric passage is added in support, though it is not a particularly conclusive one, as a *marturion* of the opposite phenomenon that in warm countries the opposite holds true, again with a hint of personal opinion, then again the importance of the cold is affirmed in restraining horn-growth. Why does this issue arouse such a detailed and personal argument from Herodotus? And where does it come from?

Herodotus' theories about hornless cattle do not stand in a vacuum, for the cause of horn growth was a matter of concern to those thinkers interested in *physis*, linked as it was to the fundamentals of explaining birth and growth. Democritus discussed the growth of horn – with a different explanation involving *ikmas* (humour), the nature of the skull, and the cold outside the skull which hardens the excrescences into horn, Empedocles had views on the related matter of the growth of nails, created

⁴⁸ Cf. *Gen. Anim.* iii 10. 759a8–761a2 on the 'puzzle' of bee-generation. Note Herodotus' language: argument from likelihood, first person, combination of animals and humans.

⁴⁹ This absence returns, crucially, in the great Persian invasion where it is a *thauma*, no less, 'because of the cold', iv 129.

when tendons are hardened by cold,⁵⁰ and *On the Nature of the Child* tried to explain the growth of hair.⁵¹ *Airs, Waters, Places* also mentioned briefly the hornless cattle, taking the same line as Herodotus, that the lack of horns is caused by the cold (ch. 18.3 J: 'they do not have horns because of the cold').

Perhaps Herodotus' text bears no relation to these other views, and we should simply take Herodotus on his own account.⁵² But this does not really explain why he is so insistent on the importance of cold, and it is reminiscent of those other passages where one suspects a controversy not entirely explained in the text: 'It seems to me', he says, 'that the type of hornless oxen do not grow horns because of this... It is because of the cold that this happens'. He seems to be presenting a theory of his own, or contradicting some other view held by others, or both. A clue may be offered by the way he moves immediately, with slight apology, to the different issue of why there should be no mules in Elis (30.1–2): the absence of mules, he insists, is not because of the cold 'or any other clear cause' (30.1). Mules were another topic we know was discussed by *physiologoi*, though admittedly they tried to explain the sterility of the mule. Alcmaeon's explanation had involved the cold (again the cold as a fundamental cause), and also the thinness of the semen (DK 24, B 3), Empedocles had another explanation (DK 31, B 92, A 82). Herodotus is discussing the absence of mules, but the whole section seems to be based on some sort of relationship to issues which were matters of controversy amongst the *physiologoi*. He moves easily from hornless cattle in Scythia to the absence of mules in Elis by a train of association – the cold, animals and animal growth – which is surely made ready by the fact that, in both subjects, he is dealing with problems which are being debated (with singular disagreement) by certain *physiologoi* as well. We seem to be within a circle of interrelated issues which Herodotus enters with his views on Scythian cold.

The growth of horns and related substances recurs suggestively in Herodotus and again in later discussions about animals. A great many horned

⁵⁰ DK 68, A 153–5, with excellent discussion by Lonie (1981), 198–200; DK 31, A 78.

⁵¹ Ch. 20, through porosity of the outer skin. The author is particularly concerned with baldness and eunuchs. On this, see Lonie (1981), commentary on *Nat. Child.* ad loc., pp. 198–200; also Longrigg (1993), 95; cf. Lonie (1981), 200: 'Taken together, these passages imply precisely the same explanation of the growth of hair as Democritus gave for the growth of horn; this is the explanation which is implied by [*Nat. Child.*] ch. 20 and possibly by the account of nails in ch. 19'; but cf. p. 63 against influence of a single philosopher: it could have come from Empedocles via Anaxagoras or Diogenes, or via Democritus.

⁵² Pohlenz used this discussion of horn-growth to argue that Hdt. iv 29 was the source of *Airs* ch. 18: see Heinemann (1945), 173.

animals appear in his Libyan *logos* – not surprisingly if horns grow because of the heat. The preponderance of horned Libyan animals exactly fits his remarks about hornless cattle in Scythia. We find asses (ὄνοι) with horns (iv 191.4), and a little later, asses which 'are not those with horns' (192.1), also snakes with horns (192.2), and the strange oxen with horns turned backwards, the ὀπισθονόμοι βόες (iv 183.2). It seems unlikely to be a coincidence that Libya can offer so many horned animals. The distinction between Scythia and Libya in terms of horn growth reappears in Aristotle's *History of Animals*, where rams with horns in Libya contrast with those without in the Pontus⁵³ – we are back again to the Libya–Scythia axis we looked at before (chapter 2). It does not matter whether there really are more horned animals in Libya, something no ancient writer was in a position to verify: surely the observer/enquirer noticed more horns precisely because of the idea that heat generates horn growth.

Perhaps a similar idea is behind the assertion about the hair growth of human Egyptians in the notorious section on the skulls at the battlefield of Pelusium, mentioned before (chapter 2). Egyptians, he said, were least prone to baldness of any men, and the cause of this is that they have strong skulls, because they shave their heads, and the bone is thickened (παχύνεται τὸ ὀστέον) by the sun (iii 12.2–3) – the sun again with its prolific effect now on human hair and skulls as well as animal horns. It is not entirely clear why *thick* skulls help hair growth; in any case the observer could hardly discern luxuriant hair if heads were shaved. But perhaps the association of thought is that hair, bone and horns all benefit from the sun. Of course there is also a wider application to humans: the same basic theories are applied as much to human procreation as to the animal world. As we saw, the Libyans themselves were thought to be prolific, just as Egyptians were, and Egyptian women in one later Hippocratic essay are thought likely to have premature births.⁵⁴

There are also hints that Herodotus knew something about the growth of plants and ideas about why some plants might grow in one place rather than another, another area where information about wonders might mesh with the pursuit of the workings of nature. We recall how the mysterious

⁵³ *Hist. Anim.* vii (viii), 606a18–21.

⁵⁴ See *On the Seven-months child*, a late work (CMG I 2,1 Grensemann, 122, 11–15) where a parallel is made with Egyptian women – because of the 'polyphilia' of the land and the heat of the περὶοχή (enclosure). For modern interpretations of prolificity, see ch. 3, n. 31. Cf. also David Hume, 'Of the populousness of ancient nations', in *Essays Moral, Political and Literary*, ed. E. F. Miller (Indianapolis, 1985), 378 n. 1: 'Columella says [*On Agriculture*], lib. iii cap. 8 that in AEGYPT and AFRICA the bearing of twins was frequent, and even customary; *gemini partus familiares, ac paene solennes sunt*.' He adds that this is not the case nowadays: 'On the contrary, we are apt to suppose the northern nations more prolific ...'

substance *ikmas* was invoked by other writers⁵⁵ as a way of explaining why silphium could only grow in Libya. Herodotus also occasionally points out that a plant grows 'spontaneously' (*automatos*) in certain places, in such a way as to suggest that he may be partaking in the language of scientific, medical or physiological discussion. Thus he offers this description of 'sillikypria', of a millet-like plant in India, of cannabis, and of roses in the garden of Midas.⁵⁶

The descriptions of the food and diet of Egypt, of the Ister and all those other Scythian rivers, of Arabian spices and Indian exotica, all could be construed as part of an interest in the wonders of nature as well as an appetite for marvels in their own right. And Herodotus will interrupt his main narrative at some of the most crucial junctures to give his audience a short lecture on some such wonder: just after the narrative of the battle of Marathon and before the Spartans arrive belatedly at the scene of devastation, he explains about the bitumen well near Susa (vi 119). At a momentous point in the invasion of Xerxes as Xerxes enters Thessaly, we have the long 'digression' about the nature of early Thessaly, the rivers and the effect of what must have been an earthquake (vii 128–30). In his attention to the wonders of nature, Herodotus seems to partake of a circle of enquiries which are visible also in the *physiologi* where marvels are a clue in the investigation of nature.

Medicine, natural philosophy and 'science'

So far, then, we can see Herodotus' *Histories* delving into questions of natural science, particularly into natural wonders, questions of growth and procreation, which were matters of interest both to those conventionally known as *physiologi*, and to the early medical writers. The doctors of course focus on the human species, but the same natural processes as well as the same questions are often applied to man and animals, and the categories are often taken from the more abstract philosophers. In looking at Herodotus' forays into the natural world, particularly into prolific birth, it is extraordinarily difficult to separate rigidly borrowing from *physiologi* or from medicine, or common interests, to disentangle any one strand entirely from the rest. If this was a period in which these different areas were either not entirely separated or in the process of

⁵⁵ *Dis. IV* ch. 34: see ch. 2, pp. 49–50.

⁵⁶ ii 94.1, τὰ σιλλικύπρια ... τὰ ἐν Ἑλλήσι αὐτόματα ἄγρια φύεται (castor-oil plant); iii 100, millet-like plant; iv 74, cannabis (wild and cultivated); viii 138.2, roses (an example which occurs in the medical work); also for salt forming spontaneously, iv 53.3; he makes other observations of 'wild' plants (ἄγρια). He knows, like everyone else, of silphium: iv 169.2, 192.3.

attempting to distinguish themselves, it may be useful to outline something of this interaction, and of the attempts to separate or define the different fields of enquiry, before returning to Herodotus' conception of his 'enquiry' as a way towards understanding this pre-disciplinary world.

The interaction between doctors, *physiologoi* and 'philosophy' and the development of Greek science in the latter part of the fifth century, has been thoroughly studied by scholars of Greek science, the intense interaction of ideas and intellectual debts, and also the incipient rivalry between developing *technai*.⁵⁷

It is particularly in the realm of the problem of the nature of man, what he consists of, how he comes to be (generation, embryology) that the community of interests and questions – as well as controversies – between the theories of certain natural philosophers and the Hippocratic works is most striking. The problems in disentangling the possible lines of influence or borrowing between the one or other group illustrate the difficulties in separating them too strictly.

The belief that man is composed of several humours is a particularly apt example.⁵⁸ For the author of *Ancient Medicine*, health is caused by a 'coction of the humours' (e.g. ch. 19); for the author of *On the Nature of Man*, the humours are blood, yellow bile, black bile, and phlegm, and these humours cause either health or illness (and one predominates during each season).⁵⁹ The idea of four humours, which eventually became most popular, bears obvious relation to Empedocles' theories about man which involved four constituents, and some influence from Empedocles has been accepted here.⁶⁰ Yet the origin and development of this influential idea seem to have grown out of fundamental ideas and divisions of the world in earlier thinkers: not simply Empedocles' idea that man is made of four elements, earth, air, fire and water, but ideas conventional to Presocratic philosophy like the importance of opposites, the theory (of Alcmaeon's) that health is the result of equilibrium (*isonomia*), are all involved.⁶¹ The medical writers may have taken over these ideas and assumptions about the world and adapted their own (probably very early) recognition of the existence of humours to a model of four *constituent* humours which could

⁵⁷ On this interaction and overlap see esp.: G. E. R. Lloyd (1966), (1979), (1987); Jones (1946), esp. section 1; Jouanna (1992), 366–403 – less inclined than some to see all the influence coming from 'philosophy'; Edelstein (1952); Longrigg (1963), and (1993) (though he tends to separate the two rather categorically). On role of concepts and theory in observation, cf. also Lloyd (as above), Mansfeld (1980a), who stresses the debt of medicine to theory; Joly (1966); Bourgey (1953); Diller (1932).

⁵⁸ See also ch. 2, on 'Libya and the humours'.

⁵⁹ Cf. a further variation in *Diseases IV* (e.g. ch. 32: phlegm, blood, bile and water).

⁶⁰ See Jouanna's edition of *Nat. Man*, CMG (1975), 43 ff.; Longrigg (1993), 85 ff.

⁶¹ See e.g. Lonie (1981), 54 ff.

only have been developed through the lens of earlier philosophical theory. In other words, 'the philosopher provides the categories within which the medical scientist can order his experience'.⁶²

Yet of course there was a wide spectrum of theories about man. The author of *On the Nature of Man* opens his work by objecting to what is essentially a position taken by philosophical monists, but probably also by many who regarded themselves as doctors. The atmosphere of intellectual interaction and debate is vividly illustrated here. *On the Nature of Man* begins with a full-scale attack on 'those who talk about the nature of man' ('Ὅστις μὲν οὖν εἰώθεν ἀκούειν λεγόντων ἀμφὶ τῆς φύσεως τῆς ἀνθρωπίνης: literally, 'Whoever is used to listening to people who speak about the nature of man'), who go further than that which pertains to medicine, and who talk in terms of a single ingredient, those for instance, who declare that 'man is all air, or fire, or water, or earth' (ch. 1.1 J).⁶³ This is an obvious attack on the kind of theories used by earlier Greek *physiologoi* who saw a single principle as the basis of the world. But it is not an attack merely on long-past theories, nor simply on 'philosophers' as a separate group: the author could be aiming his polemic at Diogenes of Apollonia, for instance, a contemporary of the latter half of the fifth century who believed in air as the governing principle, declared it to be a god and thought it an agent of thought.⁶⁴ Diogenes may well have been a doctor himself,⁶⁵ and certainly had an interest in relevant human biology, a reminder, if so, that a doctor in the second half of the fifth century could well look very like an earlier Ionian monist. Or he could be attacking Hippon of Samos who, similarly, revived the idea that water was the first principle. He too was active in the latter part of the fifth century, satirized by Cratinos (DK 38, A 2), and had interests in biology and causes of illness. Or others of whom we know nothing. The debate here seems to be a live one between contemporaries or near contemporaries.⁶⁶ After this initial attack, the author turns explicitly to doctors and declares what 'the constituents of man' actually are; not simply phlegm, he insists, nor bile or

⁶² Lonie (1981), 61; cf. also Mansfeld (1980a).

⁶³ For the view that *akouein* here and elsewhere may mean 'to read', that is, to read a text oneself, or to listen to a slave read, see Schenkeveld (1992a), 137f.: his suggestion that a live lecture is not necessarily implied by the word is plausible, but there is other evidence for this period for live lectures, and the opening paragraphs of this essay seem most easily understood in terms of live debates: see further, ch. 8 below.

⁶⁴ See Jouanna (1965); Longrigg (1993), 86 ff. further on the Melissos, Diogenes, *Nat. Man* relations.

⁶⁵ Jouanna (1992), 375–6 for clear presentation of the problem, and Diogenes' biology and medical competence (NB esp. DK 64, A 4 and A 19). Diller assumes this, (1932), 38–9 (from the presence of medical forms in his work); Longrigg (1993), 76 ff., and n. 101 (p. 238) on the evidence.

⁶⁶ Cf. G. E. R. Lloyd (1979), 92–5 on background to attack by *Nat. Man*.

any single substance (ch. 2), and presents his idea that man is composed of more than one quality or *dynamis*, developing the famous theory of the four humours which eventually became the one most widely accepted.

It is striking that the only individuals named in these earlier medical texts are thinkers who are not usually considered 'doctors' in any sense. The opening paragraph of *Nature of Man* (ch. 1) makes one of the rare mentions in the Corpus to a specific thinker: these mistaken theories, he declares scornfully, manage only to 'establish the theory (*logos*) of Melissos'. This reference to the Eleatic Melissos, incidentally also a famous Samian general, evidently needed no further explanation.⁶⁷ To this audience, listening to a debate about the nature of man from a 'doctor', the theory of Melissos was known and vivid, not a separate sphere of Greek intellectual enquiry – no more separate than the monistic theories also being attacked here.⁶⁸

Similar implications arise from *Ancient Medicine*, sometimes thought to have been by Hippocrates himself.⁶⁹ The author opens with an attack on 'those who have assumed a postulate (*hypothesis*) as a basis for their discussion – heat, cold, moisture, dryness, or anything else they might fancy' (ch. 1.1 J). This attack on 'hypotheses' has attracted particular attention because it is the earliest use of the word itself before Plato; there has been much debate on which thinkers could be meant, and who was guilty of basing their theory of disease upon these opposites (below). But on a general level, the type of theory under attack is again reminiscent of philosophical speculation on the first principle and it is sometimes thought that the author is attacking the input of philosophical theory into medicine. It might seem on one level, perhaps, to be a segment of a debate between philosophy, so named, and medicine,⁷⁰ or an attack on the

⁶⁷ General: Plut. *Per.* 26 ff. Other allusions in *Nat. Man* to Melissos: see Jouanna (1965), and Longrigg (1993), 87–8.

⁶⁸ It is partly for this reason that *Nat. Man* seems to me to belong easily in the late fifth century; not 400 BC, as is often suggested on the grounds that it is attributed to Polybus, Hippocrates' son-in-law – which is a very conservative use of chronology. (Lonie 1981, 55, accepts c. 400; Jouanna in ed. of *Nat. Man* (pp. 59–61) puts it 410–400.)

⁶⁹ Littré and Gomperz attributed it to Hippocrates, largely on the basis of the resemblance of ch. 20 to *Phaedr.* 270c–d (with its tricky use of τοῦ δλου (universe or merely 'the whole?') attributed to Hippocrates' view), but this is much disputed; against, see (e.g.), Jones (1946), 16 ff. (he dated *Anc. Med.* to between 430 and 400); Jouanna, *Hippocrate* 16–19.

⁷⁰ See e.g. Longrigg (1963): including discussion on whether Anaxagoras is influenced by *Anc. Med.* or vice versa: he believes the former; cf. Longrigg (1993); Jones (1946), 44–7, on connections with other philosophers (incl. Pythagoreanism); Jones, Introduction to Loeb, p. 5 takes it as an attack on philosophical theory. Cf. more nuanced discussion by Jouanna (1992), 366–403, esp. 379 ff.; Jouanna, Budé edn of *Anc. Med.*

growing influence of philosophy. The author mentions Empedocles by name: on the necessity of knowing what the nature of man is, he says,

τείνει δὲ [τε – J] αὐτοῖσιν ὁ λόγος ἐς φιλοσοφίην, καθάπερ Ἐμπεδοκλῆς ἢ ἄλλοι οἱ περὶ φύσιος γεγράφασιν ἐξ ἀρχῆς ὃ τί ἐστὶν ἄνθρωπος, καὶ ὅπως ἐγένετο πρῶτον καὶ ὁπόθεν συνεπάγη.

But the question they raise is one for philosophy, it is the province of Empedocles or those others who have written on *physis* (nature), what man is from the beginning, how he came into being at the first, and from what he was constructed. (*Ancient Medicine*, ch. 20.1 J)

Here we glimpse an explicit separation of medicine from 'philosophy', which seems in this context to denote natural philosophy, the province of Empedocles and 'others who write about *physis*', in their attainment of knowledge. But it may be read as an attempt by the author to differentiate himself from others, rather than a statement of clear and widely accepted divisions between thinkers. It is perhaps part of a strategy to separate medicine, to stake out a corner of the intellectual field and guard it from encroachment, and thus to claim that medicine is a *techne* in its own right.⁷¹

The distinction is not actually that clear cut, even here. For the same chapter had begun with an attack on both doctors and philosophers (actually called 'sophists') for the same kinds of faults. This again implies (as we saw was a plausible background to *On the Nature of Man*) that doctors at this period were sometimes engaged in intellectual enquiry very similar even to self-styled philosophers. Thus *Anc. Med.* ch. 20 begins:

Λέγουσι δὲ τινες ἰητροὶ καὶ σοφισταὶ ὥς οὐκ εἴη δυνατόν ἰητρικὴν εἶδέναι ὅστις μὴ οἶδεν ὃ τί ἐστὶν ἄνθρωπος.

Certain doctors and sophists say that no one can know medicine who does not know what man is. (ch. 20.1 J)

The author totally disagrees. We have his outburst about Empedocles (above), then further mockery:

ἐγὼ δὲ τοῦτο μὲν ὅσα τινὲς εἴρηται ἢ σοφιστῇ ἢ ἰητρῷ ἢ γέγραπται περὶ φύσιος ἥσσαν νομίζω τῇ ἰητρικῇ τέχνῃ προσήκειν ἢ τῇ γραφικῇ.

But I think that everything that has been said either by a sophist or a doctor, or that has been written about nature, belongs less to the medical art than to the art of painting. (*Anc. Med.* ch. 20.2 J)

⁷¹ See esp. G. E. R. Lloyd (1979) on development of *techne*; Jouanna (1992), 398–403 on insistence on autonomy of medicine.

Here both the *sophistai* and the doctors and anyone who talks about *physis* are dismissed as woefully irrelevant; *sophistes* here seems to denote 'philosopher' in the widest sense (i.e. *sophos*), rather than the narrower group known since Plato as 'sophists'. He adds immediately that knowledge 'about *physis*' can only be obtained through the medical art; then states what the doctor *should* know 'about *physis*' to be a decent doctor.

It has been argued that the main and immediate focus of attack in *Ancient Medicine* is Philolaos of Croton rather than Empedocles.⁷² But in the opening chapters the author seems to have a wider target and his opposition is directed to a range of people, 'doctors', as well as *sophistai*, perhaps in fact a large number who laid much emphasis on the 'hypotheses' (heat, cold, dryness, moisture) rather than a single individual.⁷³ Jouanna points out that the object of scorn is reminiscent of the kind of 'enquiries into nature' conducted by Socrates as he says in the *Phaedo*, in his earliest youth.⁷⁴ One has the impression that a large range of thinkers are delving into the question of the nature of man, and Herodotus was among them with his extensive curiosity about the whole of the known world – to its limits. Even the ambiguity of Hippocrates' statement, as reported by Plato, that one cannot understand the human body without a knowledge of 'the nature of the whole' (τῆς τοῦ ὅλου φύσεως) – the whole universe or the whole man? – may be expressive of the range of areas which could be thought relevant to medicine.⁷⁵

On the Sacred Disease created its radical theory about the natural causes of epilepsy with the help of a theory about the centrality of the brain, a belief held by Alcmaeon and by Diogenes,⁷⁶ and not universally accepted; and another about the importance of air in the veins. Alcmaeon had a theory about disease. Diogenes, we recall, parodied in the *Clouds*

⁷² G. E. R. Lloyd (1963). Note that he concentrated on finding specific *medical* theories in medically based writers, which fitted the bill, though admitting that a wider target was possible. Part of the problem is that *Anc. Med.* talks of the 4 opposites while most medical theories are more complex.

⁷³ Jones (1946), 47–8 points out that such objectionable views may be found in *Generation and Diseases IV*, plus *Affectations*, *Diseases I*, and in Dexippus, Philolaos and Petron: 'It is quite likely that the author ... had no single individual in mind, but was combating all thinkers who attached undue weight to the effect of the four traditional opposites on bodily health' (p. 48). Cf. G. E. R. Lloyd (1963). One might also suggest as targets *Breaths* or *Nat. Man*, or the views they represented. Cf. Longrigg (1963), 152, on *Anc. Med.*, who may overstate the clarity of the distinction between medicine and philosophy. Similarly Longrigg (1993): cf. 46, of fifth-century developments, 'for its influence upon philosophy here medicine itself had a very heavy price to pay'.

⁷⁴ Jouanna (1992), 366–403; on Socrates' remark, p. 402.

⁷⁵ Plato, *Phaedrus*, 270c–d: cf. n. 10 above.

⁷⁶ Diogenes, DK 64, A 19 (= Theophr. *De Sensibus* 39 ff.), on Diogenes' theory of health; Longrigg (1963), 153–4; Alcmaeon, DK 24, A5; cf. A 10.

(227 ff.), had re-emphasized the importance of air. He saw air as crucial to intelligence and therefore to thought, declared that air needed to mix with the blood. Birds, who might otherwise be the cleverest of all, had flesh too dense to benefit from the thought-provoking nature of air.⁷⁷

If Diogenes of Apollonia may have been a doctor (n. 65 above), and the confusion on this question may be significant, the Hippocratic work *On Breaths* also laid stress on air, here as one of the causes of disease. Again, this is a work long thought to have been written by a sophist rather than by a doctor, though its medical provenance and milieu is now more readily accepted.⁷⁸ But it could be an example of precisely the type of discussion about the nature of man and his health that is attacked by *Ancient Medicine* (that is, a doctor who talks about *physis* without proper attention to the truly important facts the author of *Ancient Medicine* thinks necessary for the art). Anaxagoras had a theory about the cause of acute disease (bile); his speculation about the nature of matter involved as fundamental elements things such as flesh, bone and nails.⁷⁹ Empedocles may have been a doctor himself; he believed at any rate that he could heal, though we have to admit that his healing had decided mystical properties.⁸⁰

Democritus seems to have written works on clearly medical subjects, if we can trust the list of titles of his works preserved in Diogenes Laertius: *Prognosis*, *On Regimen*, and *Medical Opinion* (Πρόγνωσις; Περὶ διαίτης ἢ Διαιτητικόν, Ἱητρικὴ γνώμη).⁸¹ At any rate certain fragments attributed to him overlap significantly with the matters of concern to the Hippocratic texts: for instance the nature of the seed in the womb (B 148), the causes of the senses.⁸² Specific Democritean influence has been discerned in certain Hippocratic works, most notably *Generation/Nat. Child*, and closely allied, *Diseases IV*⁸³ (see previous section, pp. 143–4). It is certainly

⁷⁷ DK 64, A 19 again; see also n. 7 above for general discussions on Diogenes.

⁷⁸ Cf. Longrigg (1963), 153 for a good example of its dismissal; also Jones' ed. (Loeb), vol. II, pp. 221–5; *contra*, Jouanna (1992), 109 ff., esp. 116 ff., and (1984b).

⁷⁹ DK 59, A 105 (*de Partib. Animal.* D2 677a5): for similarities between Anaxagoras and *Anc. Med.*, Vlastos (1955), 67 n. 2; Jones (1946); Longrigg (1963) (cf. n. 70 above); Jouanna (1992), 373–5, generally, on Anaxagoras' biological interests and relation to cosmology.

⁸⁰ DK 31, B 112; cf. B 111; Diller (1932), 37; it is often doubted that Empedocles wrote a separate medical work (e.g. Longrigg 1993, 69) but see DK 31, A1 and A2 for work on medicine, with Jouanna (1992), 371–3, and A3 for Galen's classification of Empedocles among 'the doctors from Italy'.

⁸¹ DK 68, B 26 b, c, d. Accepted by (e.g.) Jouanna (1992, 378–9). Other titles attest to his general interest in the nature of man. Cf. Stückelberger (1984).

⁸² Theophrastus, *On the Senses* 49–50 (cited by Barnes (1987b), 257–8); DK 68, A 135. Cf. A 143 (*Ar. Gen. An.*) on creation of male and female children.

⁸³ See esp. Lonie (1981), 62–70, and commentary; Stückelberger (1984); Longrigg (1993).

possible that Hippocrates himself and Democritus were contemporaries.⁸⁴ But the difficulties of separating, for instance, the various affiliations, lines of influence, between Presocratic philosophers and the theory of embryology in *Nat. Child* (chs. 12–31), or on the botany of plants (chs. 22–7, 33–4) tends to indicate not a neat and tidy division of specialities, but a community of contemporary interest and debate, theory and counter-theory, in which *physiologos*, 'scientist', 'doctor', *sophistes*, were not always easy to disentangle. Of course our information is often fragmentary. Yet even with the state of our evidence, the complexity of interaction between 'philosophers', *physiologoi*, and medical works is striking and important. In one attempt to isolate various lines of influence in one particular area, Lonie concluded: 'Much of the material of the botanical theory is the common intellectual property of the age: to disentangle its separate elements would be rather like attempting to disentangle the separate influences upon a contemporary writer of the Freudian school. The botanical theory, like the genetic and embryological theory, bears witness to lively and complex contemporary discussion.'⁸⁵ Jouanna's recent study puts a strong case for seeing a spectrum of medically inclined philosophers and doctors with more or less philosophical (i.e. cosmological) tendencies and methods even within the Hippocratic Corpus itself.⁸⁶

It would be unwise to deny any differentiation between Hippocratic writers and other *physiologoi*. Some Hippocratic writers are in the process of trying to define and determine the separateness of medicine from the general enquiry into nature – though in part that need for definition may have been the more acute precisely because there often might not seem to be any great difference in theory. The detailed observation of symptoms and discussion of prognosis by the Hippocratic school (e.g. in *Epidemics*) were peculiar to the medical treatment of disease – though even there observations were to some extent formed via certain abstract assumptions (see n. 57 above). But in some areas of enquiry, it is clearer that the very structures, basic concepts and assumptions about *physis* were at work in medical arguments, and these do not always lie so distant from the concerns of the *physiologoi* themselves. Some doctors looked like *physiologoi*, others (*Anc. Med.*) rejected that model or posed as rejecting it, and vice versa. This muddies the water, but offers a plausibly complex picture of intellectual interaction in the second half of the fifth century. The intel-

⁸⁴ Jouanna (1992), 378–9.

⁸⁵ Lonie (1981), 69.

⁸⁶ (1992), 379 ff. esp. 386–7, eloquent against attempts to find origin of (all) ideas on embryology and related subjects in philosophy.

lectual circle which knew of certain theories about nature or medicine may have been wider than the immediately obvious practitioners.

Finally we should add that some sophists ('sophists' as designated by modern scholars) were interested in physical problems and there were occasional overlaps with the interests of natural philosophers (as also of sophists and medical writers, as the more rhetorical of the essays clearly imply). Galen was able to list works with the title *περὶ φύσεως* or 'On Nature', by Melissos, Parmenides, Empedocles, Alcmaeon, Gorgias, Prodicus, 'and all the others' – though they surely treated the topic very differently.⁸⁷ Certain sophists did touch on areas of natural philosophy, though our sources tend to dwell on their other theories, and the subject of 'nature' may have been for some merely part of the general knowledge necessary for a polymath. Prodicus, for instance, had a theory about phlegm, and if we can accept any of these titles wrote a work, according to Galen, *On the Nature of Man*,⁸⁸ as well as *On Nature*; the *Clouds* even called him a *μετεωροσοφιστής*, a 'meteo-sophist' (v. 360). Hippias answers questions on 'nature' and 'meteorology', and knew about astronomy,⁸⁹ while Gorgias discussed problems of vision (*Men.* 76cf.); and Antiphon's *Truth* dealt, among other things, with topics of biology and meteorology.⁹⁰ We have mentioned the possibility that Protagoras had an interest in the study of nature (above, p. 147), though Plato makes Protagoras set himself aloof from this and from the kinds of subjects that Hippias taught (*Protag.* 318e). Some well-known sophists, then, delved into these areas, but it should be admitted that these forays into nature seem from our evidence to be just that – forays – amidst many more dominant interests in politics, ethics and rhetoric.

Historie and the Histories

Where, then, does this leave Herodotus? This chapter has tried to show how some elements in the *Histories* bear unmistakable similarity to contemporary 'science' of the mid and late fifth century, and that in some cases Herodotus' own discussion should be seen more readily as part of

⁸⁷ DK 24 (Alkmaion), A 2. (Heinimann (1945), however, seems to take it that the title *Peri Physeos* is a late fifth-century creation).

⁸⁸ G. E. R. Lloyd (1979), 87, n. 146 gives refs.; Guthrie (1971), 277 (ambivalent on Prodicus).

⁸⁹ *Protag.* 315c5–7, 318e1–5; *Hipp. Mai.* 285c1–d2.

⁹⁰ *Frgs.* 22–39. G. E. R. Lloyd (1979), 87, n. 146 collects further evidence for sophists' discussion of physical problems; (1987), 92–5 (with notes) on the 'permeability' of the categories of sophist and natural philosopher; Kerferd (1981a); Guthrie (1971), 46, is more sceptical.

that complex of questions. He is not, of course, interested in or informed about the more abstract philosophical arguments of the Presocratics, in questions about the first principle, for instance, or the nature of the stars, the balancing principles of Empedocles, the nature of being, or the details of the internal workings of matter. He is unmistakably drawn to the observable world. But he sometimes covers the very subjects that are discussed by *physiologoi* and self-styled doctors. Had we fuller evidence on the *physiologoi* – and most particularly on Democritus – we might be able to say much more; we have concentrated on only a few areas where there is good external evidence, and perhaps to contemporaries many more elements of his ethnography and geographical enquiries would have seemed part of that world – for instance the lengthy description of the fauna and flora of Egypt (e.g. II 65–76, 92–7). To regard his remarks on the natural world as the result of earlier 'sources', implying that he borrowed unquestioningly from another source, does not do justice either to the nature of the language and concepts he uses for it, or to the manner in which he presents these views as his own. He seems to wish to imply that he is contributing to a matter discussed by others. While that is by no means proof that he is being original, we should probably also accept that his own enquiries involving the natural world were influenced by some of these ideas and questions discussed by the *physiologoi* or actually part of the same milieu.

Yet as we have seen, it is hard – indeed unwise – to specify that one particular method was peculiar to the *physiologoi* or to the early medical writers. We may not be doing justice to the fluidity of boundaries and expansiveness in the quest for knowledge, the absence of disciplinary limits, in this period. The interlocking of methods and ideas is striking, sometimes most striking where the medical writer is particularly anxious to distance himself from the *physiologoi* and maintain the distinct identity of medicine (*On the Nature of Man*). Even some of the thinkers conventionally labelled sophists shared an interest in the workings of nature; Socrates also professed to a youthful, but passing enthusiasm, for the 'enquiry into nature'.

This implies that in this period (broadly to the end of the fifth century), certain questions concerning the natural world, from cosmology and astronomy to the intricate observable details of the animal world, were more widely discussed by a wider range of thinkers than study of the *physiologoi* alone might imply; and perhaps that in this period where separate fields of enquiry are either not separated or in the process of defining themselves, that the enquiry into nature seemed to lie in the general realm of the *sophos*, that is, it was to some extent common property to the prominent thinkers of the time. We saw above how contemporary sources

fail entirely to use our own (conventional) categories: and how *sophistai* may refer to a vague group who seem to have ideas about nature and talk about medicine and the nature of man. We shall need to return to this (last chapter); let us concentrate here upon the character of this enquiry into the nature of the world, and the resonances of Herodotus' description of his own work as *historie*.

Herodotus' *Histories* might also, in this predisciplinary age, be considered part of this enterprise. His *Histories* do not cover the nature of the Nile because it was an element of the older Ionian *historie*, but because it was a fascinating subject of contemporary Ionian and non-Ionian *historie*, and a topic that everyone who considered himself *sophos* in the area of nature should have an opinion on. Similarly, perhaps, with the widely discussed questions concerning reproduction and growth in the animal world, and the whole mass of world geography, the attempt to find out what he could for the furthest parts of the world until all information gave out completely. As often pointed out, his *historie* encompassed all subjects of enquiry.

The 'wonders of nature' seem to belong here too, though it is probably impossible to draw a line between those wonders which can be discussed as a serious part of scientific enquiry, like the Nile's summer flooding, and wonders which cater to a popular love of the sensational, the fantastic, and might be wheeled out simply to entertain a general credulous audience (compare the Arabian sheep whose fat tails are carried on miniature trolleys, III 113). One would like to know how far Herodotus' 'enquiries' about the remote areas, and marvellous 'facts' and life and nature on the margins, were meant to contribute to an earlier version of the later pseudo-genre of the study of nature represented by the Aristotelian *On Marvellous things heard*. After all, the vipers' horrible birth is mentioned in this latter work, along with the length of time for which the elephant carries her young, the behaviour of camels in Arabia, and the ability of Ligurian women to bear children while they are actually at work.⁹¹ One of the greatest natural wonders and 'paradoxes' of all, the summer flooding of the Nile, could be explained by natural processes – in effect natural laws – which were universally applicable.⁹²

What is clear, is that Herodotus calls Hecataeus a *logopoios* along with Aesop (II 143.1; V 36.2; II 134.3) – rather than a sophist or a *sophos* or any other possibility – and that his use of *historie* of his own work suggests that he wished to present it in a different light. Here we treat an area very

⁹¹ All prefaced by *λεγέται* or similar distancing device. Refs.: vipers, ch. 165 (846b); elephants, ch. 177 (847b); camels, ch. 2 (830b); Ligurians, ch. 91 (837b).

⁹² On Herodotus' quest for uniformity in nature, Corcella (1984), 74–84, and p. 139 above.

extensively discussed.⁹³ The etymological link of *historie* with οἶδα, 'know' and thence seeing, is obviously of some relevance. Another stimulating approach is to connect Herodotus' *historie* with the *histor*, which shares the same root. The figure of the *histor*, who appears in the *Iliad* (e.g. xviii 501, shield of Achilles), the mediator and arbitrator of the archaic period, would, through the philological link, convey Herodotus as the *histor* who sees, hears, and arbitrates⁹⁴ – thus fitting with Herodotus' liking for settling controversies, judging between two stories. Yet while this is suggestive, and the root meaning must retain some force, it tends to interpret Herodotus in the light of a remote archaic world (perhaps up to 300 years before). Etymology can perhaps only take us so far (compare an interpretation of the institution of the British Parliament via the French *parler*) and there is a danger of missing any contemporary resonances. When Herodotus famously opens his work by saying he is giving a demonstration of his enquiries, he is the first extant writer to use the word *historie*,⁹⁵ and with this placing one would suppose a deliberate emphasis. In the few other places where it occurs, method is at stake (ii 99.1; ii 118.1; 119.3; vii 96.1).⁹⁶ When he stands aside in Book ii (ch. 99) and makes his rather formal statement that 'Up to this point what has been said is the product of my own sight (*opsis*) and judgement (*gnome*) and enquiry' (*historie*), but from now on he is repeating what he has heard of Egyptian traditions, he is not using the language of the archaic mediator. Nor is he using *historie* about his enquiries about the past, which in this case are still to come – *historie* here clearly refers to his enquiries into the

⁹³ Discussions of *historie*: esp. Snell (1924), 59–71; Jacoby (1913), 396; Sauge (1992); Connor (1993b); Immerwahr (1966), 315 (stressing all-embracing conception of *historie* in Herodotus); Weber (1976); cf. Christ (1994); Evans (1968), stressing fairness of the *histor*; Erbse (1956) on Herodotus' first sentence; and further works below.

⁹⁴ See most recently, e.g., Connor (1993b), who looks at the *histor* in later Greek sources, but the burden of his interpretation still lies in the archaic *histor*; Sauge (1992), with my review, *CR* 45 (1995b), 456–7; Lateiner (1989), 84. A problem with the archaic '*histor*' is that it has other associations also: cf. *Od.* xxi 26 (compound denoting skill), *Hom. Hymn* 32.2; also *Il.* xvi 695, *Bacchyl.* 9.44 (all cited by Connor).

⁹⁵ Note, however, Heraclitus: B 35 (χρή γὰρ εὖ μάλα πολλῶν ἱστορίας φιλοσόφους ἀνδρας εἶναι καθ' Ἡράκλειτον). Diels-Kranz lists DK 22, B 129, on Pythagoras' *historie* among fragments of dubious authenticity. Xenophanes (DK 21, B 18) speaks of 'searching/discovering' (cf. ἐξευρήσει, DK 22, B 18); Parmenides' word for enquiry is the related (and older) word δίζησις (DK 28, B 2: B 6, 1–3; B 7, 2; B 8, 6), used also by Heraclitus (B 101), and Herodotus (e.g. i 95.1, ἐτιδίζηται).

⁹⁶ vii 96.1 is sometimes seen, unnecessarily, as approaching our word 'history'. For use of the verb: of Herodotus' enquiries, ii 19.3 *bis* (Nile), ii 29.1 (Nile sources), ii 34.1, ii 44.5, ii 113.1 (Helen), iv 192.3 (Libya); by various tyrants or kings, i 24.7, i 56.1 and 2 (Croesus), iii 50.3, 51.1 *bis* (Periander); by others, i 61.2, i 122.1, iii 77.2 *bis*; cf. also vii 195 (Greeks). Almost all of Herodotus' own 'enquiries' (self-styled) concern present geography: but the priests' enquiries (ii 118.1, 119.3) and ii 113.1 concern the Trojan war, ii 44.5 concerns Heracles.

land, river, nature of Egypt and its people, not its history.⁹⁷ Rather, he is distinguishing precisely his own enquiries and sources of knowledge in exactly the language that was favoured by the early Hippocratic writers and no doubt other contemporaries – the distinction between what you can deduce from *gnome*, and what you can tell by experience, and via concepts used by the natural philosophers (for which, see next chapter). A revealing comparison can be made with the notorious section in *On the Nature of the Child* (ch. 13) where the author lays great emphasis on the fact that he actually *saw* a six-day embryo – the age is probably provided by the woman's testimony, the embryo by the fact that she terminated a pregnancy – and that he has evidence that what he says is true. Quite what he can have seen, and how far he saw what he thought he ought to see, are moot points: but the intense emphasis on the doctor's own personal autopsy, his experience and his own inferences from that, are most striking, and his argument makes careful distinctions between what he saw, his opinion, and *historion*, evidence which is seen.⁹⁸

If we look carefully at the writers who actually use *historie* of their own activity, it seems to be part of the vocabulary of 'scientific' activity of the latter part of the fifth century and early fourth century (I use 'scientific' here in its weak sense, as denoting the attempt to find out the truth about the world without resorting to divine or supernatural explanations). We may then press this later contemporary milieu far more forcefully than any earlier association.⁹⁹ In one of the earliest Hippocratic treatises, *On Ancient Medicine*, which we discussed above, the author declares in characteristically dogmatic fashion that it is quite impossible to understand

⁹⁷ Indeed most of his refs. to *historie* in Book ii are not about sifting stories and traditions, *pace* Connor (1993b). See previous note.

⁹⁸ See on this Lonie (1981), Commentary ad loc., 158 ff.; and Lonie (1977), who notes the unusual emphasis on sight; interestingly, he connects this with the term *historion*, meaning 'evidence (which is seen)' (commentary p. 163). See also Hanson (1987), esp. 596–9 on the problem of theory and observation here and in other cases (pregnancies). A clearer example of the distinction between experience and *gnome* in *Art*, ch. 11, amidst much play on sight, *gnome*, hearing: where the doctor cannot use *opsis*, or *akoe*, he tries *logismos* – theory (see further below, ch. 6, pp. 200–11).

⁹⁹ Gould implies this, but sees the phenomenon more as one which stretches from Herodotus back over a century before: (1989), 11, 'Perhaps, by using the word *historie* Herodotus aligns himself, perhaps deliberately, with a tradition of positivist thinking and rational analysis of available data which had been created in Ionia over the past century.' For *historie* as expression of rational enquiry, natural science: Gould 10–11, who presses implications of rational analysis etc. (I would reinforce even more the contemporary and late fifth-century relevance); A. Lloyd (1990), 215–16 ('as a scientific enquiry with a clear awareness of problems of evidence and a determination, where possible, to solve them'); Cf. A. Lloyd (1975), *Introduction*, esp. 81–4 on *historie* (stressing *historie* as usually oral enquiry, and scientific overtones). On *historie* and its later development into 'history', Hornblower (1987), 8–12.

the nature of man by any other means than by medicine – 'impossible, I say, to understand this *historie* (enquiry), what man is, by what causes he is made, and similar matters, accurately' (λέγω δὲ ταύτην τὴν ἱστορίην εἰδέναι, ἄνθρωπος τί ἐστὶ καὶ δι' οἷας αἰτίας γίνεται καὶ τὰλλα ἀκριβέως; ch. 20.2 J). Even more striking is the opening of *Art* (ch. 1.1 J), for which there is an interesting ambiguity about whether the author was a doctor or a sophist (or both): he opens by objecting to 'those who make an art (*techne*) of criticizing the arts, who consider that they are making a display of their own *historie*' – their own enquiry, their own knowledge.¹⁰⁰ Socrates' reminiscence about his early interests in nature refers to that subject as 'that branch of knowledge (*sophia*) which they call enquiry about nature' (ταύτης τῆς σοφίας ἦν δὴ καλοῦσι περὶ φύσεως ἱστορίαν, *Phaedo* 96a7–8). Despite his hints at Anaxagoras in the following paragraphs, he seems also to refer more widely to the whole 'branch' of philosophical enquiry belonging clearly to the *physiologoi* but not confined to them. A fragment of Euripides also refers to the happiness of life devoted to 'historia' into 'the ageless order of nature' (fr. 910 N²). Moreover, none of these remarks imply an intimate or necessary relationship between *historie* and a resort to visual evidence.¹⁰¹

These descriptions are clearly not all absolutely contemporary with Herodotus and scholars have expressed doubts as to their relevance,¹⁰² but this is the evidence we have, and as our only contemporary evidence, it suggests unequivocally that *historie* was a term which in Herodotus' time and even later, was intimately paired with the enquiry into nature, the nature of man. In all our fifth-century (and also early fourth-century) evidence apart from Herodotus, it is a term used to express the enquiry of the natural philosopher, the doctor, those seeking after the truth about the nature of the world in whatever manner they pursued this. Thus even if we believed that natural science took its cue from Herodotus, as the earlier writer, we would then have to explain why this could occur. These methods might range from highly theoretical speculation to the use of

¹⁰⁰ For further comparison with Herodotus' opening sentence, see ch. 7 below.

¹⁰¹ A link stressed e.g. by Hartog (1988), 265; or Lonie (1981), 163 on '*historion*'. For what it is worth, Proclus speaks of Hippias' discovery of the quadratrix curve in terms of enquiry (ἱστορήσεν): *Commentary on the First Book of Euclid's Elements*, p. 356, cited, Kerferd (1981a), 48.

¹⁰² Connor (1993b) sees the Presocratics as problematic because of our dependence on later sources; and *Anc. Med.* and *Art* as too late to be relevant (see esp. p. 4 n. 3). Sauge (1992) astonishingly omits the late fifth-century instances: see e.g. p. 306. Democritus perhaps discussed *historie* among his many lost works: D. L. has a title Περί ἱστορίας in the list of his works (DK 68, A 33; cf. B 299, but doubted by DK); stressing lack of disciplinary divisions, Gould (1989, 10) mentioned Democritus, but treating Democritus simply as Herodotus' successor, did not press the implications.

visual evidence, experience, empirical evidence, or logical proof: *historie* here is clearly not confined to the process of using personal experience, visible evidence; it can equally involve theoretical argument; nor is it necessarily related to enquiry about the past.¹⁰³ And as we shall see (chapter 6) Herodotus himself shares some of the methods and vocabulary of certain natural philosophers and doctors. Moreover, while Connor makes an interesting connection between the *histor* and Herodotus' penchant for controversy, conflicting views and competing stories, and links the latter with the model of the mediating arbitrator,¹⁰⁴ controversy is as central to the conflicting and antithetical arguments of intellectual debate in the late fifth century as it was in the archaic world of early dispute settlement – and probably considerably more refined. This would tend to confirm the idea that when Herodotus talked of his work as *historie* he was deliberately setting it within the milieu of the philosophical and proto-scientific enquiries of his time: a signal to his audience, perhaps, that he was not merely a *logopoios*.¹⁰⁵ The concept of an 'early Ionian *historie*', of the sixth and early fifth century, and which called itself *historie*, is, I would suggest, an entirely modern one. For Herodotus' audience, the word *historie* would have contemporary resonances; it made contemporary claims that his work belonged in the world of scientific enquiry, whether it be into nature, or the nature of man, or as in Herodotus, the nature of the conflict between Greeks and barbarians in the widest possible interpretation of that conflict.

¹⁰³ Not just personal experience or witnessing, as von Fritz took it (1936, 315), building on the meaning of *histor* (*historie* 'meant knowledge of all sorts which was not based on speculation, demonstration, intuition, practice or the like but on personal experience. It meant all that a man could tell, because he had been a ἱστωρ, a personal witness', or had knowledge from other witnesses). Cf. Lateiner (1989), 225, who perhaps assumes *historie* is enquiry into past actions; pp. 83–4: '*Apodexis histories*,... for Herodotus means serving as a *histor*: to see, report, compare and arbitrate among contending claims of truthfulness'; Lateiner (1986), on the other hand, stresses *historie* as empirical research of the type visible in the medical writers keen to use visual evidence (e.g. pp. 5, 10, 17).

¹⁰⁴ Connor (1993b).

¹⁰⁵ If it is significant that *historie* becomes less frequent in the *Histories*, as Connor (1993b) stresses, then that would reinforce this suggestion.