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Pythagoras and the Greek West

'THE Greek West' is a convenient name for what came to be called in antiquity 'Great Greece' (*Magna Graecia*): the area of Greek settlement in the Western Mediterranean, above all in Sicily and southern Italy. Most of the Greek cities there had been founded in the last half of the seventh century, but they received fresh waves of emigrants from old Greece throughout the sixth, especially from Ionia after the Persian conquest.

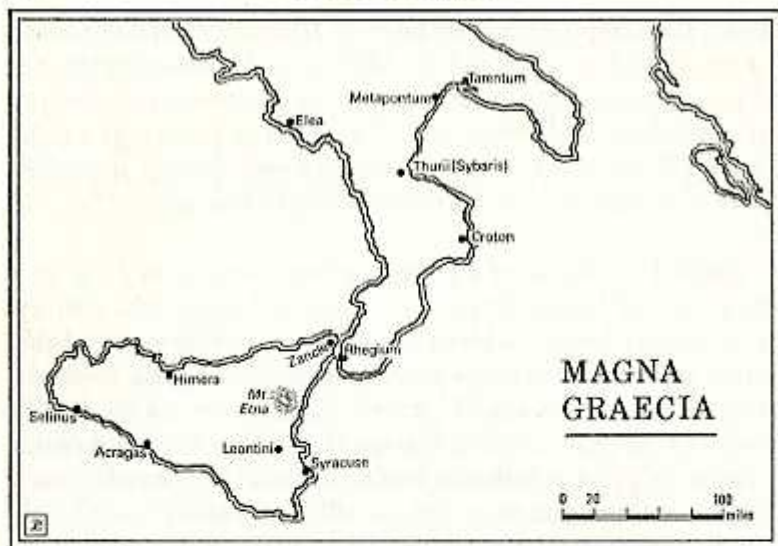
These young and often very prosperous Greek cities in the West were to the older Greek world at this time something of what America was to Europe in the nineteenth century A.D., an underdeveloped region offering the prospect of new opportunities and wealth. The Greek settlers dispossessed or treated with the native tribes and acquired large tracts of rich agricultural land. Some of the new cities were also well placed to be markets and entrepôts for some of the most lucrative trade in the Mediterranean. The wealth amassed was conspicuously consumed, as may still be seen from the ruins of Acragas and Selinus in Sicily, with their extravagant use of space and their great temples, enormous by the standards of old Greece. On the Italian mainland, the city of Sybaris became a byword for luxury before it was destroyed, about 510, by its neighbour and rival, Croton.

Culturally, the West was probably still rather provincial at the end of the sixth century. In the visual arts, at least, there seems to be a dependence on the Greek mainland. In literature, there had early been one great name, Stesichorus of Himera, but towards 500 we hear only of two citizens of Rhegium in Italy: Theagenes, who produced allegorical interpretations of Homer in

which the various gods were taken to represent such constituents of the world as appeared in Milesian-style cosmologies; and Ibycus, a graceful lyric poet, whose fragments reveal some interest in cosmology and astronomy. The leading personage of this chapter, Pythagoras, was not born in Great Greece; he arrived there as a migrant from his native island of Samos.

Around the figure of Pythagoras there very soon grew up a great mass of legend. Even towards the end of the fifth century, when history begins to be written in earnest, there was probably rather little surviving in the way of reliable information about the facts of his life, his teachings, and the activities of his sect or school in the cities of Great Greece. The school itself had ceased to exist, its political activities having made it so unpopular that it was broken up, and its members killed or exiled, around 450. While it had existed its members had been bound not to reveal, or even commit to writing, the doctrines of their master. Even of the political activities themselves there was little public record. In the absence of reliable information, real or pretended Pythagoreans repeatedly fostered exaggerated and miraculous accounts. Such was the magic of the name of Pythagoras in later centuries that there repeatedly appeared persons who wished to be regarded as his followers and labelled themselves 'Pythagoreans'. Such people would project their own ideas back upon their hero, so adding to the mass of misinformation.

For these reasons, the study of Pythagoras involves the close examination of the various sources of information, and accounts of his activity will vary widely according to the value placed on each by different scholars. There is no space in this book for a discussion of the sources. The account of Pythagoras that follows will in general assume that the only testimony that can be admitted as *prima facie* trustworthy is that of authors earlier than the mid-fourth century, together with that of the teachings known as the 'Pythagorean *akousmata*' of which our knowledge derives from a work by Aristotle which is now lost. In the mid-fourth century there begin debates about the true nature of Pythagoras' teaching



and new 'interpretations' are offered which have greatly confused all the subsequent tradition. The principles just enunciated mean that a generally sceptical attitude will be taken towards all those sources which purport to give precise and detailed accounts of Pythagoras' doctrines, which in turn means that the contribution of Pythagoras and his earliest disciples to the intellectual life of their time cannot be determined with any certainty. Disappointing as this conclusion is, it is the only justifiable one, and was very likely that of Aristotle.

Some outward facts in Pythagoras' life can be given with fair certainty. He was born on Samos before the middle of the sixth century, the son of a gem-engraver. He acquired a reputation in Ionia as a polymath, and eventually migrated to Croton in Italy. The date of this migration cannot well be later than 520, and the most likely occasion for it is given by the political turmoils in Samos in the years after 525. In Croton Pythagoras founded a society the like of which had not been seen before in Greece. Political clubs, whose members helped one another to obtain office, and generally acted as a *bloc* in politics, were probably

already common, as they certainly were in fifth-century Athens. But the Pythagoreans, though they too acquired by their solidarity and their beliefs great political strength, were linked together primarily by their adherence to the rule of life and the doctrines of their master. Pythagoras himself died around the turn of the century; the Pythagorean brotherhoods in Croton and other cities of Great Greece continued to flourish, and often dominated political life, until they provoked violent reaction and their own eventual destruction.

The contemporary testimony about Pythagoras consists of two or three fragments of Heraclitus, and one of Xenophanes. Heraclitus is forthright:

Much learning does not teach understanding; if it did, it would have taught Hesiod and Pythagoras, and again Xenophanes and Hecataeus (fr. 40);

[Pythagoras was] the pioneer of swindles (fr. 81);

Pythagoras, son of Mnesarchus, of all men practised inquiry the most, and making a selection [sc. from the results of his inquiries] he composed as his own a system of 'wisdom', a collection of much knowledge, a low deception (fr. 129).

The last of these may be spurious; in any case, Heraclitus saw in Pythagoras only a polymath who had not merely missed the truth but gone in for deliberate deception. Xenophanes was equally hostile, to judge by the satirical tone in which he relates his story (DK 21 B 7). Herodotus, writing in the second half of the fifth century, also follows at one place (1v 95) a source which saw Pythagoras as a trickster who imposed upon the credulous. Heraclitus, Xenophanes, and their contemporary the geographer and historian Hecataeus were all in the Milesian tradition of free and rational inquiry and discussion. Pythagoras, it is clear, was something quite different. This is confirmed by the little that is reliably known of his sect. Some testimony, it is true, presents the early Pythagorean school as a centre of astronomical and mathematical research, in the same way as Plato's Academy was intended to be, but the more reliable tradition suggests that

Pythagoras and his followers were opposed in principle and in practice to free discussion and speculation, at least on fundamental questions. The words of the master had absolute authority.

It is reasonable, then, to ask why Pythagoras should occupy any space in a history of early Greek philosophy. No very confident answer can be given to this question; but it is possible, though by no means proved, that some of the ideas Pythagoras expounded may have influenced intellectual life in the Greek West at a time when it was about to produce some remarkable thinkers.

The best attested part of Pythagoras' teaching is that which concerned the souls of men and their destiny. The soul is a unity which is immortal; it is rational and responsible for its actions. Its fate is determined by those actions, as it lives through successive incarnations in human bodies or those of other animals or plants. By keeping itself pure, that is, free from the pollution of the bodily passions which beset it in these incarnations, it can eventually rise to its true or proper god-like state. But if it sins, it is punished and purified by prolonged suffering in more miserable incarnations. In other words, the soul is not at home in the body and must be kept apart from it as far as possible. These ideas are quite foreign to Greek tradition, and there has been much debate about their origins. In recent years, a good case has been made out for deriving them from the shamanism of tribes inhabiting the steppes of Asia. There are clear traces of shamanistic practices among the Thracians and the Scythians, from whom they would easily be transmitted to Greece.

From these beliefs it follows that the proper rule of life is asceticism. The Pythagorean societies in Great Greece were presumably communities who tried to follow this rule, but how strictly and logically this was done is not certain. For instance, it is not clear whether they abstained from all food which involved the taking of animal and vegetable life or not. The precepts which have survived under the name of *akousmata* appear to be genuinely Pythagorean, and these are largely taboo-prohibitions such

as 'Do not stir the fire with a dagger', 'Do not look into a looking-glass with a lamp beside you', and the like. The procreation of children, and therefore marriage, was enjoined as a duty.

The Pythagoreans, though enemies of the body, did not withdraw from the everyday world. On the contrary, it is certain that they took part in the politics of their cities, and often a dominant part. The soul that abstains from the pleasures of the senses must be provided with other and worthier ways of using its time and energy, and political activity was one of these. It is clear that the energy and solidarity of the Pythagoreans made them a formidable political force, and it seems likely that they exercised their power with considerable austerity, which would account for the violent reactions against them in later years.

The other activities of the early Pythagoreans are covered in uncertainty. There is certainly a suggestion in the early sources that Pythagoras himself, if not his followers, claimed to exercise magical or miraculous powers, based on his acquisition of such supernatural knowledge and skills as are accessible to the initiated shaman. What is more doubtful is whether purely intellectual activity had any place in early Pythagorean life, and in particular the study of mathematics and astronomy. The earliest evidence on this point derives from the mid-fourth century, and is under suspicion of being a Platonising interpretation. Aristotle, it is true, knew of a group which he refers to as 'the people called Pythagoreans', who worked in Italy and held that numbers and their properties were the key to the structure of the universe. Unfortunately, this group, whatever its relation to the early Pythagorean school, is likely to belong to the second half of the fifth century.

The direct evidence being of doubtful value, it is necessary to look at the indirect indications given by what is known otherwise of the history of particular studies in Greece at this time.

In the history of mathematics there is a gap in our knowledge between the highest level reached by Babylonian arithmetic, algebra, and geometry before 1000 B.C. and the emergence of Greek arithmetic and geometry as intellectual disciplines in their

own right. The gap is not one of time, since Babylonian mathematics remained essentially the same for hundreds of years, and was still in being under Persian rule in the fifth century, to the last half of which belong the first certain achievements of Greek mathematics. The first mathematician known to us as an individual is Hippocrates of Chios* who composed an 'Elements of Geometry' at some time in the last decades of the fifth century. With this work, if not before, geometry became a system of abstract thought. Of the development of arithmetic less is known, but it must have reached the same kind of stage about the same time. The gap between Babylonian and Greek mathematics is that between the accumulation of rules for the solution of concrete problems and the further step to a self-contained abstract system. This further step the Babylonians, to our knowledge, never took.

There are therefore two main problems: that of the transmission, if any, of Babylonian knowledge to Greece, and that of the origins of pure mathematics in Greece. There is no overwhelming necessity to include the early Pythagoreans under either head. All that can be said is that they were well posted, in time and space, to be influential in the development of mathematics in Greece, and that a number of small indications, each of little value separately, converge to suggest that they were so. It was precisely in the lifetime of Pythagoras that the importance of numbers and proportions for the structure of things was beginning to be realised. Signs of this appear in Heraclitus, who as has been seen was feeling his way towards the concept of 'structure', and who certainly thought proportions important. A polymath of this time, such as Pythagoras, would discover that numbers and proportions were of importance in several apparently unconnected branches of experience: in music, metallurgy, the visual arts and medicine. In music, the connection between musical intervals and arithmetical ratios was probably known, though the stories directly linking Pythagoras with the discovery must be considered legend. In metallurgy, the formulae for producing various alloys

*Not to be confused with his contemporary namesake, the great medical man Hippocrates of Cos.

were of course known to those who produced those alloys, and Heraclitus seems to have paid attention to them. In sculpture, and the visual arts generally, it is precisely in the late sixth and early fifth century that the decisive steps are taken towards a realistic rendering of the human body and other natural objects, an enterprise impossible without an awareness of the vital importance of proportions between lengths. In medicine, the periodicity observable in certain diseases deeply impressed the earliest Greek medical men, and, in general, cycles in human and animal life began to be noticed. Here again Heraclitus may be adduced, if in fixing the length of a 'Great Year' he reasoned by analogy from the cycle of human reproduction. All these sources of interest in numbers and proportions reappear in those thinkers of the Greek West in the early fifth century about whom anything is known, notably Alcmaeon, Parmenides and Empedocles, who will be discussed later in this chapter. Given these facts, it may be significant that mathematical studies would fit well with the Pythagorean way of life, and that Aristotle's 'Pythagoreans', who were certainly interested in (indeed, obsessed by) numbers, claimed to be followers of Pythagoras, and this in Italy at a time not long after the breaking up of the original school. There is perhaps a relic of early Pythagorean number-lore in the mysterious *tetraktus* or 'four-some', esoterically associated with the Delphic oracle, musical harmony, and the Sirens. All these considerations suggest that numbers, at least, if not geometry, played some part in the teachings of Pythagoras and the activities of his school. But there is no important advance in mathematics that can with any certainty at all be attributed to them, not even 'Pythagoras' theorem'; it seems likely that their number-lore was more number-mysticism than arithmetic, but that they stimulated even so an interest in numbers for their own sake and an awareness of their importance in the structure of things.

With astronomy the case is similar. A great deal is known of the Babylonian achievements. The Babylonians named many individual fixed stars and constellations, distinguished the five

planets known in antiquity* as 'wanderers' relative to the fixed stars, and made some progress with the study of the motions of sun, moon and planets. They recognised the cardinal fact that all seven of these bodies have apparent paths confined to a small band of the heavens, occupied by the twelve constellations of the zodiac, which they distinguished and named. For computing the motions of the sun and moon, which particularly interested them, they contrived simple mathematical methods of fair accuracy.

Various indications suggest that some of this knowledge percolated to Greece *via* Ionia in the sixth century. Astronomy was not a principal interest of the Milesians or Heraclitus, whose concern was with the wider issues of cosmology, but Thales and Anaximander were perhaps involved in the transmission of knowledge. In the Greek West, before 450, there occurs the first Greek contribution to astronomy: a fragment of Parmenides (fr. 15, cf. fr. 14) shows that the reflection of the sun's light by the moon was known to him, and it is therefore probable that the cause of lunar eclipses was also. This in turn would be likely to suggest the true cause of solar eclipses and the key fact of the sphericity of the earth, but this can only be conjecture. The arguments for bringing in the early Pythagoreans to help to bridge the gap between Babylonia and fifth-century Great Greece are analogous to those in the case of mathematics, and so is the most reasonable conclusion: that the Pythagoreans attached special importance to the heavenly bodies, particularly the seven 'wanderers', and that this stimulated investigation by others outside the Pythagorean circle. Again, we have some scraps of relevant Pythagorean lore: the sun and moon were 'the isles of the blest', the planets were 'the hounds of Persephone', the Pleiades 'the lyre of the Muses', and the Great and Little Bears were 'the hands of Rhea'—descriptions which hint at esoteric doctrine which was intended to be meditated rather than discussed or criticised, but which might still serve to stimulate interest in the things described.

*

* Mercury, Venus, Mars, Jupiter, Saturn.

(sun + moon)

The theoretical study of music goes naturally with mathematics. It has already been said that the connection had probably been made by the time of Pythagoras, and may have contributed to his number-mysticism. There are also stray hints of a connection between music and the heavenly bodies being alleged by the early Pythagoreans.

In these fields, therefore, it is probable that the early Pythagoreans held certain doctrines derived from the strange mind of Pythagoras, but made no contribution to the advance of thought or knowledge except indirectly by provoking the investigations of others. Some light on the Pythagorean attitude to knowledge can perhaps be derived from the fragments of Empedocles of Acragas in Sicily, a unique figure whose poems cannot be dated much if at all later than 450.

Unlike any other Presocratic thinker of whom we have substantial knowledge (except perhaps Parmenides), he both belongs to the tradition of cosmological speculation subject to rational criticism and puts himself outside it. He was indisputably the author of two poems, both of which were read and admired until late in antiquity and of which there remain many fragments. In one poem—later given the title 'On Nature'—there is a cosmology which can be seen as an attempt to carry on the Milesian tradition in spite of the arguments which had been put forward by Parmenides against all cosmologies. This is how the cosmology of Empedocles will be treated in Chapter Seven, together with other enterprises of the same kind. In the other poem, later known as the 'Purifications', there is an account of the fate of the individual soul, its fall from a state of innocence by surrender to 'the temptations of Strife', its punishment by successive incarnations in which it feels itself a homeless exile, and the way to its eventual reinstatement in divine bliss. All this is manifestly close to Pythagorean teaching, as are many of the details, and there is no hint of any cosmology, laws of nature, or analysis of all things into indestructible elements; in the 'Purifications' the order of the universe is a purely moral one, the soul is a unitary, free and

responsible agent, and no hint is given that it can be analysed into components other than itself. It is extremely difficult to construct any framework of ideas into which the statements of both poems can be simultaneously fitted, and in this sense there is a discrepancy between them, even if there is no formal contradiction.

In the face of this discrepancy, it is possible to suppose that Empedocles at some time experienced a 'conversion', which caused him to reject cosmology of the Milesian kind for Pythagorean doctrines of the soul, or *vice versa*. Such a conversion is possible, but there is no independent evidence for it. Alternatively, there may be some way of showing that the discrepancy does not matter. If this possibility is to be explored, it is necessary to look more carefully at the two poems, and not merely at the propositions they advance but also the attitude that they imply towards those propositions.

It is not irrelevant to begin by pointing out the originality of Empedocles *as a poet*. He writes in hexameters, the metre of the Homeric epic and of Hesiod, and yet he creates a completely individual style which owes little to either. His style alone is enough to guarantee the unity of authorship of the two poems; it is rich, brilliant, declamatory and takes every kind of subject-matter in its stride with equal ease, from the torments of the fallen soul to the mechanism of respiration. It is a way of writing that has its dangers; if the poet is too self-indulgent it will quickly become unbearably hollow and noisy. So far as can be judged, Empedocles avoided such dangers by sticking closely to his subject-matter and not running on to too great length. This style conceals like a mask the attitude of Empedocles to his subject-matter. Only in one or two fragments of the 'Purifications' does some private emotion seem to be discernible. In the cosmological poem, it often seems as though Empedocles were writing simply in order to display his poetic gifts on a difficult subject.

Something further, however, can be learnt by looking at the forms into which the two poems are cast. The cosmological poem is addressed to Empedocles' young friend Pausanias, and has the

form of instruction given to him about the nature of the world. This didactic form was not new in Greek literature, but it had not, so far as is known, been used for conveying cosmology before. Among the introductory and concluding remarks are some which are also novel in a Presocratic context. Pausanias is urged not to reveal what he is about to be told, and finally a series of truly remarkable promises is made to him:

If you press them [these teachings] firmly in a shrewd mind, and contemplate them in a well-disposed mood, making this your undisturbed exercise, then all these teachings will surely remain with you so long as you live, and you will acquire besides from them much further knowledge; for these teachings grow of themselves to be part of the individual character, according to the natural disposition of each recipient. But if you go after other things, such as there are in thousands in human life, wretched things that blunt the concern for thought, then after some time these teachings will all at once desert you, in their desire to regain their own kindred. For you must know that everything has thought, and a share of intelligence (fr. 110).

You shall learn all the medicines that keep off illness and old age; for you alone will I perform all this. You shall still the untiring winds, that rush over the earth and blow to ruin the tilled fields; and then again you shall if you wish change about and bring on winds again; you shall give men an opportune drought instead of dark rain, and streams of rain from heaven to nourish the trees instead of drought in summer; and you shall bring back from Hades the life of a dead man (fr. 111).

These words, and their didactic context, show clearly that the purposes of Empedocles in expounding his cosmology are widely different from those of any Ionian thinker. Pausanias is not expected to discuss critically in public what he is told, but to hold it fast and contemplate it as received truth, without even divulging it to others. It is true that there is room for further discoveries, but the foundations may not be challenged. This is Pythagorean practice, not Milesian. A further similarity with Pythagoreanism is given by the suggestion that the contemplation of the truths accepted is itself a kind of purification of the soul, an escape from

the useless external cares of mankind. Even more strangely different from Ionian ways of thinking is the promise of practical results in fr. 111. This is not the first prophecy of the fruits of applied science, for the cosmological ideas of the poem could not possibly justify such presumptuous confidence. Pausanias is promised control of the weather, of illness, old age and death—in other words he will become a magician. In making the promise, Empedocles is claiming, most explicitly by saying 'for you alone will I perform all this', that he himself is a person of occult powers. Here the shamanistic sides of Pythagoreanism seem to be close at hand; what is startling is to find the purposes of initiation subserved by a superficially rational cosmology, which is here treated as a magical object, the contemplation of which helps the soul to detach itself from external concerns.

From this point of view the discrepancy between the cosmological poem and the 'Purifications' becomes less important, and further elucidation is provided by some other remarks. 'You shall learn,' Empedocles promises Pausanias, 'to the extent that mortal thought has bestirred itself' (fr. 2); that is, the cosmology is the product of the latest research, but a contrast is implied with some kind of higher knowledge, hinted at in the preceding lines, which is not accessible to mortal thought at all. Elsewhere, he invokes the Muse to tell him 'what it is fitting for short-lived men to learn' (fr. 3). It seems possible, then, that the 'Purifications' represents a higher kind of truth, not accessible to rational thought, and which supersedes, rather than contradicts, the cosmology.

The fragments of the 'Purifications' themselves give some support to this view. In order to proclaim truths not accessible to men, Empedocles would have to be a divine being, which is precisely what he claims in the opening lines of the poem:

Friends, who inhabit the upper town in the great city on the honey-coloured hill of Acragas, and practise a good rule of life, respectfully sheltering guests and abstaining from wickedness, hail to you! I go about among you all, an immortal god, no longer a mortal man, receiving due honours, crowned with triumphal headbands and heaped with green garlands . . . (fr. 112, part).

We expect divine revelations after this beginning. They are to be made to a group of 'friends', who clearly are not the whole citizen body of Acragas, but, from the description, a small community of a Pythagorean kind in the city. Empedocles' claims are backed by his gifts of healing and prophecy, for which he is famous:

... When I come to splendid cities, the men and women revere me, and follow me in thousands to ask me the way to their own benefit, some desiring prophecies, while others inquire to hear helpful words for all kinds of diseases, being long pierced by severe pains (fr. 112, part).

The revelations that follow are largely in agreement with what is known of Pythagorean teaching, though the restrictions on animal food may be stricter and more logical than those of Pythagoras himself. Pythagoras is eulogised, without being named, as a man of surpassing wisdom, but there is no suggestion that he is the sole authority.

The attitude of Empedocles towards the study of nature suggests that Pythagoras and his original disciples also may very well have used cosmology for magical purposes. It is interesting that the same combination of shamanistic magic, esoteric doctrines about the after-life, political activity and the study of nature is to be found in the Taoists of ancient China, who provide many suggestive parallels to what is known of the Pythagoreans.

Empedocles is one of three thinkers of the Greek West who are at least partly independent of Pythagoras and who all seem to belong to the first half of the fifth century. The other two are Parmenides of Elea, a philosopher of extreme originality and power, whose greatest achievements will be considered in the next chapter, and Alcmaeon of Croton, a lesser but interesting figure, who will now be considered in connection with the development of medical and biological thought in the West at this time.

From Herodotus (III 131) we learn that, around 500, the medical men of Croton, the adopted city of Pythagoras, were the

best in the Greek world. 'Of things in human life, what displays most wisdom? Medicine' was a piece of Pythagorean lore. The connections between asceticism, physical training and bodily health have always been obvious. In the half-century that followed, whether under Pythagorean influence or not can hardly be decided, speculative theories about the more striking phenomena of human and animal physiology began to be advanced. From the reports we have about Parmenides, Empedocles and Alcmaeon, some of these developments can be reconstructed; they are also illuminated by some of the late fifth-century medical writings which were largely influenced by them.

The single most important idea of this period in biology and medicine was that of a 'due mixture' (*krasis*) of component forces as the necessary and sufficient condition for the proper functioning of any organism. This concept clearly has some kinship with the *harmonîē* of Heraclitus; it explains orderly functioning by the existence of an internal structure which is complex but, in principle, mathematically determinable, and which somehow incorporates and reconciles naturally opposed forces. The concept of *krasis* was immensely influential in the theory of disease of later Greek and early modern writers. In Alcmaeon it is already found as the basis of an analogy between medicine and politics, between the animal body and the body politic. (This analogy too is perhaps implicit in Heraclitus fr. 114.) In the animal body, according to Alcmaeon, the 'powers' which are compounded are the familiar 'opposites': hot-cold, wet-dry, and perhaps others, for instance sweet-bitter. These are conceived of as agents of change acting upon their environment; they are all necessary in the body, but somehow are subject to a system of checks and balances so that their action is confined within their proper limits. This system is the *krasis*. In the city, the 'powers' are the various factions and interests, most obviously rich and poor. If, in either case, the delicate balance is disturbed, the action of some 'powers' will be excessive, and will impede the vital functions necessary for survival; in the animal body, these are especially digestion and respiration.

Though the precise mechanism of *krasis* was necessarily left vague, the concept rightly had great influence. It appears in Parmenides and Empedocles as well as in Alcmaeon, the interest of Empedocles in the due proportions of mixtures in various organic systems being particularly clear.

In these three thinkers there is also found a new interest in some of the obviously important functions of the living organism: nutrition, respiration, reproduction, and perception. The volume of information is greatest for the problems concerned with reproduction. The most obvious problem about animal reproduction is how it manages to produce new individuals which are recognisably of the same species as their parents and furthermore inherit particular personal characteristics of their parents or remoter ancestors. It is natural to postulate something that carries what would now be called 'genetic information', and that is contributed by both parents; this is called '*sperma*' by the thinkers in question. Then one must ask such questions as: how is the *sperma* formed in the body? what determines the sex of the child, and in general what it inherits from each parent? Theories of some detail about these further questions were already being discussed in Great Greece before 450. For digestion, the basic model seems to have been that of cooking, in which the action of heat in particular separated useful from useless ingredients of food, and produced a *krasis* among the useful ones. Of the mechanism of respiration there is an elaborate account in Empedocles (fr. 100) using the analogy of the behaviour of water in a simple device used for transferring small amounts of water from vessel to vessel. And on sense-perception there are again reports (esp. DK 28 A 46, 31 A 86) of theories advanced by Parmenides and Empedocles, of small sophistication even by Aristotle's standards, but interesting as the first attempts on a difficult problem. This is not the place for further details of the various hypotheses, nor for other more general ideas such as that apparently due to Alcmaeon, of the importance of the brain for the general regulation of bodily functions. Alcmaeon also appears as the father of an idea, which may perhaps be older, that there is an

intrinsic connection between eternity and motion in a circle. The fixed stars, and the species of animals, both go through unending circles, and individual men die 'because they cannot join the beginning to the end'. It is possible that Pythagoras taught some doctrine of eternal cyclic recurrence.

There was, then, in Great Greece at this time a continuing and fruitful debate on basic questions of biology and medicine. Man, and the animal kingdom, are for the first time fully a subject for science, or at least the *bodily* aspects of men and animals are. It is natural to connect this with the Pythagorean concept of the soul, as something totally alien to the body, and having no necessary connection with it. If what was of value in man was not human at all, but an exiled divinity, this would facilitate and justify the detached inspection of the facts of human physiology, as just another part of cosmology.

Indeed, if any formula could ever sum up the intellectual development of a period of years, then the years from around 530 to around 450, in Greece, might be brought under the formula 'the detachment of the soul from the body'. At least it seems to be suggestive of interesting connections between many important developments of the time. It can be applied literally to the teachings of Pythagoras and of others, including those grouped under the vague heading of 'Orphics'. But in Heraclitus too this detachment of the divine soul from the 'natural' body has already proceeded some distance. More widely, there is the emergence, both in Heraclitus and in the West, of a concept of 'reason' or 'reasoned argument' as the proper way to truth, with a corresponding depreciation or even denial of the evidence of the senses; here again, the reasoning part of man is in effect partly detached from the bodily sensations which surround it. Correspondingly, the object of the best kind of knowledge is refined from a physical presence or force to a *structure*, and the branch of the study of 'structure in itself' which is pure mathematics shows signs of appearing. It is only superficially in contradiction with this that, at the same time, the human body becomes as never before an object of study. In a parallel way, in the visual arts, the human

body and other things are rendered with a naturalness never before achieved, and this is done by a consciousness of the importance of structure in the form of proportions. Naturally, this 'formula' is to be taken as a means for grouping suggestively some of the thoughts that were 'in the air', not as a magic key to everything that was happening at this period. But the most profound expression of thought in these years has still to be considered: the philosophy of Parmenides of Elea, which is the subject of the next chapter.