

CHAPTER 2

Early Greek Science

Traditionally, books on the history of ancient science would start with this chapter, on the birth of Greek science among the early philosophers and the Hippocratics. Increasingly, though, historians of ancient science have come to realize the importance and sophistication of Mesopotamian intellectual traditions not only in their own right, but also because of the great debt that classical science would (particularly at a little later period) owe to Mesopotamia. The choice of how to order the sections in a book like this, then, becomes a difficult one. The problem can be framed something like this: in Mesopotamia, divinatory and medical practices and research imposed deliberate and careful order on the data sets they were collecting, and some subdisciplines of divination (astronomy, for example) became highly mathematized and rigourously observational, as we have seen. This material is interesting in and of itself, but it is also important for how it would radically influence the development of Greek science. That being said, the intellectual projects that would eventually give us what we now call the Greek sciences had their own more-or-less independent beginnings, some time around the sixth century BC. And although Mesopotamian ideas began to trickle in soon after this period, the real flood had to wait until the second century BC, four centuries or so after the Greeks first began writing about what we now call philosophy and medicine. This means that from the sixth to second centuries, there are two more-or-less independent story lines to keep track of: one for Mesopotamia, and quite a different one for Greece. This chapter is the beginning of the Greek story line, and we will continue it in the next chapter with a closer look at Hippocratic medicine.

The most common version of the Greek story goes something like this:¹ Once upon a time, people believed that the world was full of gods. Natural processes like thunder and lightning were explained by recourse to divine actions. They were seen as the ineffable will of unobservable beings. Earthquakes were caused by Poseidon, angry at some transgression. Epilepsy was possession, disease was punishment. The sky at night was painted full of heroes and monsters. Then one day, something changed: a small group of Greeks, first in Ionia (the Aegean coast of modern-day Turkey) and then spreading out from there, began to insist that the old explanations would no longer do. Instead they looked for a new kind of explanation, one that involved only *natural* entities and processes rather than *supernatural* ones. Epilepsy was now caused by a surplus of cerebral phlegm overflowing into the veins that normally carry air up into the brain. Earthquakes were caused by subterranean winds, rumbling around in openings deep underground. No more gods acting out whims, just natural forces acting according to natural processes. No more gods giving birth to the world or simply creating the things in it, but instead natural forces of generation and destruction interacting with matter. Experience, tangible and testable, thus replaced speculation and superstition as ways of understanding—of knowing—the world. Science, in short, was born.²

Recent scholarship has begun to ask serious questions about a number of assumptions made in this standard story, and this chapter will build on that work. I will argue that ‘naturalism’ does not supplant or replace myth at all, and that the two traditions frequently intertwine throughout their long and complex history. But first, we need to be clear on why the myth-to-science narrative has been so attractive.

In general, two kinds of (closely related) historical evidence have been adduced to support the standard interpretation of what the early Greek philosophers and physicians were doing. One involves a blanket comparison of philosophical theories and explanations

¹ Short passages of this section appeared in Lehoux, 2010.

² For versions of this story, see, e.g., Graham, 2006; Gregory, 2001; Algra, 1999; French, 1994; Longrigg, 1993; Lindberg, 1992. Sedley, 2007, offers a useful corrective to key parts of the story, but still separates genealogical accounts from naturalistic ones.

with those of Hesiod and Homer (and so contrasts philosophical explanations with mythical accounts). The other involves looking at specific passages in polemical texts where physicians and philosophers argue that what they are doing is new and novel. One of the standard sources for this ‘new-and-novel’ argument is the Hippocratic text *On the Sacred Disease*. There the author says:

I do not believe that what is called “the sacred disease” is any more divine or sacred than any other disease, but instead that it has a nature and a cause, and that people call it sacred through inexperience and wonderment at its uniqueness....

My own opinion is that the first to call this disease sacred were men like those we now know as *Magi*, faith-healers, charlatans, and quacks, men who try to look very pious and particularly knowledgeable. They hid their lack of skill and inability to treat the ailment by suggesting that the disease is ‘sacred.’ ...

By these phrases and tricks, they pretend to be especially knowledgeable and they deceive men, prescribing rituals and purifications and talking especially about divine visitation and spirits. But to me their words seem not pious (as they think), but particularly impious, denying the existence of the gods. Their ‘piety’ and ‘sacredness’ are really impiety and unholiness, as I shall show.³

The author of this treatise—we don’t know his name—goes on to argue that the sacred disease (a term covering symptoms we would now probably diagnose as epilepsy) has a perfectly natural cause. The impiety that this author sees in the magicians and faith-healers lies in their claim to be able to constrain the course of a disease that they say is divine, as though they could control the gods themselves. Moreover, the use of purification assumes the patient to be unclean, where the supposed cause of the disease is the presence or action of a god, which should imply the very opposite of uncleanness. These latter two arguments form an important part of the author’s case against the ‘quacks,’ and they show that he takes the idea of gods very seriously, even if he thinks they have no more role in the aetiology of this disease than they do in any other, more mundane, disease.

When he does outline the aetiology of the sacred disease, the author uses descriptions of the disease and bodily ‘constitutions’ of patients (more on this in the next

³ [Hippocrates] *On the Sacred Disease*, 1-3.

chapter), reports of when and where they have seizures, and the comparative anatomy of goats' brains to argue that the real culprit is a surplus of phlegm in the brain, caused when the passages for the discharge of phlegm from the brain get blocked up. The phlegm then backs up into the veins that he thinks normally bring air to the brain, causing all the phenomena of seizures: falling, convulsions, loss of voice, foaming at the mouth, etc. As strange as this causal story may look to us, it is at least limited to natural entities and structures. The cause of the disease has to do with the cooling powers of phlegm, the physical layout of structures in the body, and the disruption of the natural processes in those structures. Further influences include weather and the seasons (cold or damp weather being productive of more phlegm), the age of the patient, and the patient's natural bodily constitution (phlegmatic people are especially susceptible, unsurprisingly). Although the author calls the winds and the sun 'divine,' he still denies that they can be manipulated by ritual entreaty as the 'witch-doctors' seem to think. Instead, the author of the *Sacred Disease* sees the cure to that disease (and he does think there is a cure) to lie in the manipulation of the same observable entities and qualities as brought the ailment on in the first place. Rather than stopping the wind, the physician seeks to moderate its cold and damp effects on the body, or to find ways to drain the excesses of phlegm before it becomes a problem in the brain. So far, it seems, the case for naturalism is strong. But before we turn to why that conclusion may be hasty, let us look also at the more general case for the myth-to-science narrative, that says that the kinds of causes invoked in Hippocratic and early philosophical texts really are substantially different from those invoked in mythological texts.

In the mythologically rich poetry of Homer and Hesiod, the gods—Zeus, Hera, Athena, and their kin—often act and interfere in the universe, whether this is to cause illness or madness in individuals, to impose their (sometimes questionable) will on humans, or more broadly to bring about the creation of the Cosmos, the earth, and the people and other creatures who live on it. Two aspects are generally cited: the gods are (roughly)

anthropomorphic, and the origins of the Cosmos and of people are usually talked about in *genealogical* terms, as the products of reproductive acts. A sample from Hesiod should give the general flavour:

Verily, at first Chaos came to be, and next wide-bosomed Earth, the ever-sure foundation of all.... From Chaos came forth Erebus and black Night; but of Night were born Aether and Day, whom she conceived and bore from union in love with Erebus. And Earth bore starry Heaven, equal to herself, to cover her on every side, and to be an ever-sure abiding-place for the blessed gods. And she brought forth long Hills, graceful haunts of the goddess-Nymphs who dwell among the glens of the hills.. She bore also the fruitless deep with its raging swell, Pontus, without union of love. But afterwards she lay with Heaven and bore deep-swirling Ocean...

And again she bore the Cyclopes, overbearing in spirit, Brontes, and Steropes and stubborn-hearted Arges, who gave Zeus the thunder and made the thunderbolt...⁴

Just as Zeus is here said to wield the thunderbolt, so he is elsewhere called the “cloud-driver” and Poseidon the “earth-shaker,” which is taken to mean that Poseidon caused earthquakes and Zeus thunder and wind. Men seem to have been begotten from various of these divine and semi-divine unions, and women sent down to earth as punishment for their theft of fire from Zeus.

Clearly this material is working with a very different general account of causation than what we saw in the *Sacred Disease*, even if the author of the *Sacred Disease* does not say anything about the origins of the earth or sky specifically. That being said, there is still the important question of whether this kind of comparison is really of apples to apples—can we assume that Hesiod is even intending to offer an *explanation* in the same way as the *Sacred Disease* is, or is he trying to do something entirely different (writing poetry, or telling stories, perhaps)?⁵ We will return to this question after a more detailed look at philosophical accounts of causation more generally.

⁴ Hesiod, *Theogony*, 116 f. Evelyn-White, trans., with minor modifications.

⁵ On genre, see Taub, 2008. On Hesiod and cosmology, see Clay, 2003.

I. IN THE BEGINNING, ACCORDING TO THE GREEKS

The naturalistic account traditionally begins with the semi-legendary Thales. I say semi-legendary here because we don't have anything extant from Thales' own pen, and although we have a few fragments of his thinking as quoted in later authors, there is also a perpetual problem in the fact that he tended to be a magnet for fantastic stories, like that he successfully predicted a solar eclipse in 585 BC—a feat that would have been impossible for another three centuries even for the most sophisticated of ancient astronomers (who were not even Greek, but Mesopotamian).⁶ Likewise he is said to have made a fortune by cornering the olive presses after he used astronomy to predict that the coming harvest would be particularly bountiful. As for his actual philosophy, we have to rely on later authors as reporters of what he said and thought. This presents no small difficulty—imagine trying to recreate Sigmund Freud's work (or for that matter Einstein's) based only on what a couple of dozen later people have said about it in a sentence or two each. Moreover the problem is not limited to Thales, but some version of it applies to most of the wide-ranging group of thinkers known today as the early Greek philosophers (often called presocratics). I do not want to suggest we should totally despair of painting something like a reasonable picture of what these philosophers were doing, but that we should always pay very close attention to how and why our sources for their thought are representing them in a particular way.

Writing in the third century BC, Aristotle portrayed an important earlier group of thinkers from Ionia as 'physicists,' by which he meant 'students of the natural world' very generally. On Aristotle's account these earlier philosophers had been concerned with just the

⁶ See Neugebauer, 1975, p. 604. One might contrast Panchenko, 1994, but the consensus emerging from that paper seems to be that if Thales did predict an eclipse it was more-or-less a coincidence that the prediction was successful. This would mean that the sagacity usually ascribed to Thales for this achievement is still more the stuff of legend than of fact, whatever the actual status of the eclipse itself.

same project as Aristotle himself, which included determining the fundamental underlying *stuff* of which all things were made up.

Most of the earliest philosophers thought that the principles of all things were material, for they say that the element and principle of all things is this: that of which all things that exist *are*, and from which they first come to be, and into which they are finally dissolved; that whose substance remains although the attributes change. Because of this they think that nothing is created nor destroyed since something of this nature always remains. ...

Thales, the founder of this kind of philosophy, says the principle is water, which is why he said the earth rests on water, perhaps taking the idea from the observation that the food of all things is moist, and that heat itself is generated from and lives on moisture (and that from which things are generated is the principle of all things). He got the idea from there, and also from the fact that the seeds of everything have a moist nature, and water is the principle of moist things.⁷

As with all philosophical prose, it is worth taking the time to unpack this account carefully.

Aristotle is offering us a characterization of “most of the earliest philosophers,” a generalized account that he is, as we see in the first sentence, taking a few liberties with—liberties that may or may not be justified, may or may not alter the meanings of important statements, and it is just here that we need to tread very carefully. “They say,” he tells us, “that the element and principle of all things is ... [something].” We know from another passage in Aristotle himself that Thales could not have actually called this something a “principle,” *arché*, since a later philosopher, Anaximander, “was the first to use that word” in a physical sense (see below). The original meaning of *arché* seems to have had some of the wide semantic range of the English “first,” in the sense that the word came to mean “beginning” “origin,” or “(political) power” (held by the one who is first among the people). Nor could Thales have used “element,” *stoicheion*, since in Thales’ day that Greek word had not yet come to have its later physical sense (we are told by two later sources that such a use was due to Plato in the fourth century BC). In its original form the word *stoicheion* seems to have come from a verb meaning “to arrange things [like soldiers] in an ordered line,” from which the noun emerged with such varied meanings as “the shadow of a sundial” (which

⁷ Aristotle, *Metaphysics*, I.3-5

moves across a graded line) and “syllable” (as the minimal units that get strung together to make up a word).

Nevertheless, what Aristotle means by using such “modern” terminology to describe his predecessor’s idea seems clear enough, in that he specifies that by principle and element he means “that of which all things that exist *are*, and from which they first come to be, and into which they are finally dissolved,” a description that seems on the face of it to mean that they are looking for some kind of material stuff that underlies the things we see in the universe, and that survives as they change form and shape. Here again, he reverts to his own particular terminology: “that whose *substance* remains although the *attributes* change.” What, the question seems to be, is a stick made up of really, if it can be burned, or it can rot, or it can be eaten by bugs, and what stuff remains behind as it undergoes all these changes (as indeed in what stuff did it originate, as it grew from the earth and water and sunlight)?

Thales’ response, says Aristotle, was that the real underlying substance of all things was water “which is why he said the earth rests on water, perhaps taking the idea from the observation that the food of all things is moist.” Did Thales really say everything was made from water in so many words, or is that a very big extrapolation from another statement of his that the earth rests on water? Aristotle is more than a little unclear here. We might further worry from the fact that in the very next breath, Aristotle goes on to speculate whether water might have also been the principle for the earliest poets, who made Ocean a “parent of creation” and who said that the gods swore their oaths on the river Styx—what the poets seem to be saying is a long way from what Aristotle is saying. Aristotle ends this discussion uncertain of whether the poets’ story really stands as an account of *nature* in the sense he has been discussing, but the fact that he was willing to stretch the poets even this far is worth noting. Finally, we might also point out that the great Greco-Roman physician

Galen, writing in the second century AD, complains to his reader that he is unable to find any direct textual evidence from Thales that says that “water is the only element.”⁸

Galen aside, most Greeks themselves certainly saw no problems with reading both their poets and their early philosophers as working to explain the universe in this mould, and a long-lived tradition developed that saw the early Greek philosophers as materialists who sought the ultimate origin of all things in some elemental substance or substances, and who saw the variability in physical objects as differences in the surface properties of some persistent and unchanging underlying stuff. So for Thales, the principle was said to be water, and he was supposed to have said that all things were full of gods. Aristotle took this to mean that ‘soul,’ which may have been a principle of motion for Thales, was mixed in with all things. Thales was also supposed by others to have made a number of foundational geometrical discoveries, such as that the angles in the base of an isosceles triangle are equal, and that a circle is cut exactly in half by its diameter. But in antiquity it was the discourse about the origins, principles, and arrangements of existent things (including living things) that was seen as fundamentally characterizing what would later be called ‘the inquiry concerning nature,’ which was universally taken to be the project Thales had begun.⁹

Our knowledge of the history of philosophy from Thales to Socrates has been very largely shaped by Plato (Aristotle’s teacher) as well as by Aristotle himself.¹⁰ The tradition of reading the early Greek philosophers that was initiated by Plato and Aristotle held that Thales’ project of explaining the physical makeup of the universe was continued by a series of subsequent philosophers, each offering different fundamental substances, and each adding new subjects, new questions, and new answers to the inquiry into nature. So, gradually, new aspects of astronomical inquiry came on board, new physical concerns, new accounts of human origins, new observations, new criteria for argument.

⁸ Galen, *Commentary on Hippocrates’ On the Nature of Man*, 15.69K.

⁹ A good discussion is in Laks, 2006, chapter 1.

¹⁰ See e.g., Warren, 2007, p. 3.

Anaximander, sometimes said to be a student of Thales (although that claim is likely just apocryphal), said that the principle of things was something called ‘the unlimited’ (*to apeiron*, in Greek). Here is how the Philosopher Simplicius put it in his sixth century AD commentary on Aristotle’s *Physics*:

Of those who say that it is one, moving, and unlimited, Anaximander the Milesian, son of Praxiades and student and follower of Thales, said that the principle and element of things is “the unlimited” (he was the first to use the word, “principle”). He said it is not water nor any other of the so-called elements, but a separate unlimited nature, from which all the heavens and the worlds in them come to be. And the things from which what exists comes to be are also the things into which they are destroyed according to necessity, for “they give justice and repay injustice to one another according to the ordering of time” (he is speaking in rather poetic terms). It is clear that he himself observed the changing of the four elements into one another and he thought it incorrect to make one of them the underlying substance, but something else besides these.¹¹

The unlimited, then, underlies all coming-to-be in the Cosmos. The Cosmos comes out of it (materially, one thinks, though Simplicius does not say it in so many words), and change in the Cosmos is presented as a process of generation of one thing and destruction of another, which is how Simplicius understands the sentence about “repaying injustice” in the quotation above. Simplicius also seems to claim that what would later come to be known as the ‘four elements’ of Greek physics (earth, air, water, and fire) were already known to Anaximander as a closed group. But we should also keep in mind who Simplicius was writing for. His project was not to collect together verbatim quotations from earlier philosophers to hand down to posterity. He was instead concerned with teaching an new, important, and coherent set of doctrines called Neoplatonism to his students. The overarching project was to claim that the philosophies of Plato and Aristotle could be integrated (though with a marked preference for Plato) into one theological and philosophical system.

¹¹ Simplicius, *Commentary on Aristotle’s Physics*, 24.13.

We find more information about some of Anaximander's other interests and ideas in a passage from an anonymous writer of intellectual history:

Anaximander, an associate of Thales, says that the unlimited contains the whole cause of all generation and destruction. He says that from it the heavens were separated, and in general all worlds, which are unlimited in number. He proved that destruction, and generation long before it, have come about for an unlimited time, all in cycles. He says that the earth is in the shape of a cylinder such that its depth is a third of its breadth. He says also that at the generation of the Cosmos, something productive of heat and cold separated from the eternal, and a kind of sphere of this flame surrounded the air that encircles the earth, like bark on a tree. This sphere breaking apart and then becoming closed up in circles produced the sun, the moon, and the stars. He further says that people were generated from other kinds of animals, for other animals quickly learn to get food for themselves, and only people require long nursing—such a being could not preserve itself in the beginning.¹²

Again, the unlimited is the source from which the heavens and the worlds in it were separated. We see the earth described as a definite shape (cylindrical) and we are offered an account of the formation of the sun, moon, and stars. The mechanism seems to be some kind of natural process of fiery encrustation around a primeval earth that was ultimately unstable, and broke apart into separate heavenly circles. We also see here an interesting account of the generation of the human species from other animals. The argument is a good one: since humans are so helpless from birth, they could not have first emerged just as they are or they would never have survived. We need instead to presume someone or something is already there to take care of them until maturity, at least for the first generation, which must be some kind of animal different from humans (insofar as these other animals had been able to take care of themselves from birth). Humans, then, came to be from something different in kind from themselves. We are told by another source that the parent animal was “like a fish” from which humans burst once they were full grown. Note that this is not a theory of evolution so much as a theory of change; the origin of *one* species, we might say.

¹² Pseudo-Plutarch, *Miscellanies*, 2.

Particularly interesting is Anaximander's argument for how the earth can sit still in the middle of the Cosmos, all the stars whirling around it, and not fall out of place even though it has nothing holding it up. The earth, he says, has no reason to go in one direction rather than any other (since it sits in the middle of the heavens), therefore it does not move.

Anaximander's follower, Anaximenes,¹³ rejected the vague "unlimited" in favour of *air* as the principle of all things. As it is condensed and rarefied, air changes and appears different, becoming hotter or colder, more solid or less. Plutarch uses as one analogy the way that our breath will feel hot if puffed out through a wide open mouth, but cold when condensed and blown between pursed lips. As Simplicius explained Anaximenes' physics:

Anaximenes of Miletus, son of Eurystratus and a companion of Anaximander, said (like Anaximander) that the underlying nature is one and unlimited, but not indefinite as Anaximander had said; instead he said it is definite, being air. It differs in rarity and density according to how things are constituted. Being rarefied it is fire, being condensed it is wind and then cloud and eventually water and earth and even stones and everything else made up of these.¹⁴

Hippolytus, Bishop of Rome in the early third century AD, added that Anaximenes also held that the earth rests on air, and that the motions of the planets are due to the motions of the air containing them. The heavenly bodies do not go beneath the earth, as many think, but rotate around it, "like a felt hat spins about on our head."¹⁵ That the earth can rest on air is due to its broad flatness and, as Aristotle had earlier pointed out, it is difficult to move a wide, flat object face-on into the wind. The explicit use of density and rarity as explanatory categories is a new and important addition in Anaximenes, and it offers us a physics by which different objects can be made up of the same underlying stuff and still have very different properties.

These three philosophers, Thales, Anaximander, and Anaximenes, all hailed from the city of Miletus, and are generally seen in the Greek tradition as very closely associated with

¹³ The reader may wish to consult the 'Hint for keeping the "Anaxes" straight' in the foreword to this book.

¹⁴ Simplicius, *Commentary on Aristotle's Physics*, 24.26.

¹⁵ Hippolytus, *Refutation of All Heresies*, I.vii.

each other. Not all early philosophers, however, can be so easily grouped together. At about the same time as Anaximenes was working (around the middle of the sixth century BC) Pythagoras left his home on the island of Samos (not far from Miletus) and moved to the Greek colony of Croton, just east of the toe in Italy's boot, and founded a school that would be very widely influential on later philosophy. The style of thinking that emerged from the school of Pythagoras was very different, much more mathematically and religiously oriented than what we know of the Milesians, and we will return to look at it later in the chapter.

Also working in a very different style, and also working in the late sixth and early-to-mid fifth century BC, Heraclitus (from Ionia) and Parmenides (from Greek-speaking southern Italy) are generally seen as marking distinctive breaks from Milesian interests, although some ancient accounts did still try to make Heraclitus out to be a one-element theorist with fire as the base of all things. For both Heraclitus and Parmenides we also have considerably more text than we have for their predecessors on which to base our understanding. In the case of Heraclitus, though, his deliberately obscure style makes it a difficult project to try and outline anything like a consistent doctrine for him, such that even in antiquity commentators were frequently puzzled. Nevertheless, we can see important and influential ideas in many of his fragments, and he never fails to be thought-provoking and original.

That he emphasized some kind of rational principle (Greek: *logos*) governing the universe is widely reported.

This *logos* being true always men fail to understand it, both before they have heard it as well when first they have heard it, for although everything happens according to this *logos*, it is as though they are inexperienced even when they experience words and deeds like I set out, distinguishing each thing according to nature and saying how it is.¹⁶

The word *logos*, though, can also mean simply 'account' and so it may be ambiguous here whether Heraclitus is only just saying that his account of things is true and that few can

¹⁶ Sextus Empiricus, *Adversus mathematicos*, 7.132. Translation indebted to Warren, 2007.

understand him, although the Greek tradition generally saw him as saying considerably more than that, as implying that rationality underlies the Cosmos in some way. There is also ambiguity in the force of the ‘always’: does it apply to the truth of the *logos* or to the misunderstanding? Both? That Heraclitus was fond of word-play is abundantly clear from many of his fragments, as also his love of bringing two apparently contradictory truths into confrontation:

Opposition unites, and the most beautiful harmony comes from things pulling away from each other and everything happens because of strife.¹⁷

Donkeys prefer garbage to gold.¹⁸

The road up and down: one and the same.¹⁹

Changing it rests.²⁰

Things taken together: the complete and the incomplete, coming together and separation, consonant and dissonant; from all things one and from one all things.²¹

We step and do not step into the same rivers. We are and we are not.²²

Another source gives the most famous formulation of this last fragment, even if it is a paraphrase of Heraclitus rather than a quotation: “According to Heraclitus, it is not possible to step into the same river twice ... because of the degree and speed of change it scatters and brings together ... it forms and dissolves, comes and goes.”²³ That an emphasis on change is a central core to Heraclitus’ physics seems clear from this as well as a number of other fragments. The use of fire as a metaphor or as a primary element seems related: “Everything is an exchange for fire and fire for all things, just as goods for gold and gold for goods.”²⁴ Or,

¹⁷ Aristotle, *Nicomachean Ethics*, 1155b4.

¹⁸ Aristotle, *Nicomachean Ethics*, 1176a7.

¹⁹ Hippolytus, *Refutation of All Heresies*, 9.10.4.

²⁰ Plotinus, 4.8.1.

²¹ Pseudo-Aristotle, *De mundo*, 396b20

²² Heraclitus, *Homeric Questions*, 24.

²³ Plutarch, *On the E at Delphi*, 392b.

²⁴ Plutarch, *On the E at Delphi*, 338d-e.

more perplexingly: “Fire lives the death of earth and air lives the death of fire, water lives the death of air, and earth the death of water.”²⁵

The various themes of change, rationality, and the centrality of fire all come together in a very important fragment preserved by the second-century Christian theologian Clement of Alexandria: “This order (Greek: *cosmos*), the same for all, no god nor man made but has been always, and is, and will be, ever-living fire, kindling in measures and going out in measures.”²⁶ Here the use of the Greek word *cosmos*, which would eventually come to mean what we think of when we hear the word, is playing instead on its older, original meanings of *order*, *decoration*, or *government*. It is hard to doubt, though, that Heraclitus is gesturing at the whole universe when he is talking of the order that no man or god made. So also, perhaps, when he says “the most beautiful order (*cosmos*) is a pile swept up randomly.”²⁷ That the word finally comes to mean Cosmos in Pythagoras or Parmenides (sources disagree about when exactly) is an interesting window into how the universe itself was being conceived by sixth-century philosophers (Heraclitus included) to enable the shift in meaning.²⁸

Heraclitus was also a sharp critic of his predecessors (Homer, Hesiod, Pythagoras) and, like the philosopher Xenophanes before him, of traditional Greek religion; that, at least, is the story according to a number of later Christian writers, themselves strong opponents of Greek religious practices. Although he had theological interests of his own, Heraclitus is reported to have railed against the practice of animal sacrifice as being contrary to religious purity, and as rooted in a misunderstanding of the true nature of the gods and heroes. Praying to statues, he added memorably, is as pointless as talking to houses. His own theology seems to have involved rethinking the traditional gods. “One,” he said, “the only wise thing, is unwilling and willing to be called by the name of Zeus.”²⁹ Again, the

²⁵ Maximus of Tyre, 41.4.

²⁶ Clement of Alexandria, *Miscellanies*, 5.103.6.

²⁷ Theophrastus, *Metaphysics*, 15.

²⁸ On the many changing meanings of *cosmos*, see Horky, 2019.

²⁹ Clement of Alexandria, *Miscellany*, 5.115.1.

juxtaposition of opposites is noteworthy. So, too, “god is day, night, winter, summer, war, peace, satisfaction, hunger.”³⁰ Divinity is also central to true understanding: “Human nature does not have true understanding, but divine does.”³¹ Just when we think we are coming to grips with his lofty theological ideals, though, we read in Plutarch that Heraclitus also said that souls can smell things when they are in Hades, whatever that statement might have meant.³²

Parmenides, who lived well into the fifth century (Plato could write a dialogue that just plausibly had a young Socrates debating an older Parmenides), also broke from earlier philosophy in many ways. Like some of his predecessors (Xenophanes, and perhaps also Anaxagoras) he composed his philosophical treatise as a poem, choosing the traditional epic form, which is to say he wrote very much in the old style of Homer and Hesiod. He opens the poem by describing a journey he took with the daughters of the sun, to the distant realm of a goddess who for the rest of the poem enlightens him with the truth about “what is.” Her revelation to the narrator is divided into two parts, *The Way of Truth* and *The Way of Opinion* (notice in “way” the continued metaphor of a journey). *The Way of Opinion* offers a cosmology that describes the Cosmos as we see it and accounts for its origins, but this cosmology is only an opinion—not the truth. Indeed, *The Way of Opinion* is usually seen not as a concession to earlier cosmologies, but as a pointed criticism of the whole project. Some have even suggested that Parmenides was taking Anaximenes and company to task for thinking in the same mode as Hesiod had before them.³³ The real truth, by contrast, does not allow for a cosmology at all. The reasons why are frankly shocking. Nothing, the goddess proves to the narrator, can possibly change. What-is *is*, and this means that it cannot have come to be, nor can it cease to be. Change, in short, is impossible. As the goddess begins her speech to the narrator:

³⁰ Hippolytus, *Refutation of All Heresies*, 9.10.8.

³¹ Origen, *Against Celsus*, 6.12.

³² Plutarch, *On the Face that Appears in the Orb of the Moon*, 943c.

³³ See e.g., Graham, 2006, p. 156; Warren, 2007.

Come, and I shall tell you the only roads of inquiry there are for thinking (and you listen and pass on the story [*mythos*]). The first, that it is and that it cannot not be—that is the path of Persuasion, for it attends on truth. The second, that it is not and that it is necessary that it not be—that I say to you is an utterly unlearnable route, for you could not know what is not.³⁴

“It is and it cannot not be” is the central proposition here, and it implies, as the goddess goes on to explain, the impossibility of change:

Nor was it, nor will it be, since now it is all together, one, continuous—for what genesis would you seek for it? In what way did it grow? From where? I shall not allow you to say or think “from what is not,” for “it is not” is neither sayable nor thinkable.... Nor shall strength of trust permit something to come to be from an existing thing other than itself. For this reason Justice has not, relaxing her bonds, allowed either coming to be or dissolution... For if it came to be, it *is* not, nor (is it) if it ever is going to be. Thus coming to be is extinguished, and perishing unheard of.³⁵

Or to put it slightly differently: if what is has come to be, then it has come to be from what is not. But what is not cannot be, therefore what is cannot come to be from what is not, therefore what is cannot come to be. As she further explores what “it is” means, the goddess shows further that what-is is indivisible and complete, uniform, “like a well-rounded sphere, in every direction equal from the centre.”³⁶

The conclusions here are often seen as a radical prioritization of reason over the senses, where what we can show with thought is taken as the truth, and what seems to be the case to the senses is confined to opinion or seeming. The idea that what is cannot not be and cannot come from what is not, gained widespread currency in Greek philosophy, being used for example by the author of the Hippocratic work *Regimen I* to prove that there is no such thing as death, since life cannot come to be from what is not-life nor can not-life come to be from what is life.³⁷

Parmenides’ goddess now accordingly turns to the *Way of Opinion*, offering the narrator a cosmology of the more traditional philosophical type, not as an account of what

³⁴ Quoted in both Simplicius, *Commentary on Aristotle’s Physics*, 116, 25 and Proclus, *Timaeus*, I.345, 18

³⁵ Simplicius, *Commentary on Aristotle’s Physics*, 144 f.

³⁶ Simplicius, *Commentary on Aristotle’s Physics*, 146.

³⁷ *Regimen I*, iv.

really is (that we have already been given in the *Way of Truth*), but perhaps as a way of beating the Cosmologists at their own game. She sets up a dichotomy of “light” (or fire) and “night.” The details are obscure, and not nearly as much of this part of the poem was preserved for us by later authors, but there seems to have been some discussion of how the earth, sun, moon, and the Cosmos as a whole came to be. In this account, the goddess plays an active role in “steering” and mediating the interactions of night and fire, and somehow out of these come male and female, and the generative power that comes of their difference.

The primary conclusion with which Parmenides would later be associated, though, is his assertion of the impossibility of change. Several followers would develop the idea further, most notably Zeno of Elea and Melissus of Samos (whose fame as a hardline monist made it even into contemporary medical debates, as we shall see). Zeno famously argued, building on Parmenides, that motion is impossible. He offered four paradoxes, not all of which are well understood, but one example should give the flavour. Imagine, said Zeno, a race between the hero Achilles and a tortoise. If we allow the tortoise a head start, then Achilles can never catch up with him to pass, no matter how speedy Achilles is. The reason is this: if Achilles, beginning from the starting line, does not start running until the tortoise gets to some point *A*, ahead of him, then by the time Achilles gets to point *A* himself, the tortoise will have moved on a little, to point *B*. By the time Achilles gets to point *B*, the tortoise will have again moved on to *C*, and so on, with Achilles never able to actually catch the tortoise in order to pass, since to catch the tortoise would involve completing an infinite series of movements forward. Another paradox of Zeno’s asks of a flying arrow whether it is, at any particular slice of time we want to pick, actually moving (imagine a freeze-frame photo of the arrow: is the arrow moving in the picture?). But if it is not moving in even one such instant, then it is not moving across all instants, and so is not moving at all.

II. PHILOSOPHY AND ITS PUBLIC

One might think a simple experiment would disprove Zeno. But this would miss the important challenges that Zeno is posing to our theories of space and time. How can we think we understand space and time until we can explain away such paradoxes? Nevertheless, some thinkers were willing to turn away from this style of thinking in favour of an emphasis on what is knowable by observation. We see this tack taken by the Hippocratic author of a lecture called *The Nature of Man*, delivered in the context of a public medical debate (and it is notable that the lecture itself is preserved in its entirety, rather than, as has been the case for the other early Greek philosophers, only in quotations from other authors). The author begins:

Whoever is used to hearing talk about ‘the nature of man’ beyond its usefulness to medicine will not find my account helpful. For I do not say that man is wholly air, or fire, or water, or earth, or anything else that is not clearly present in people. Whoever wants to do so can talk that way, and I leave them to it, but it does seem to me that people who say such things don’t have real knowledge.... One speaker says that the one and only thing is air, another that it’s fire, still another water, and another earth, and each fills out his argument with evidence and proofs that amount to nothing. For whenever an idea is the same but the arguments are not, it is clear that the speakers don’t know what they are talking about. You can see this very easily by listening when they debate each other: the same debaters stand in front of the same audience, and the same man never wins the argument three times in a row. Instead now one, now the other wins, or else the one with the sharpest tongue in front of the crowd. Rather it would rightly be the case that someone saying they have true knowledge to offer about the issue should be victorious in his argument always, if, that is, he really does have knowledge and demonstrates it correctly. No, such men seem to me to overthrow themselves by their very words in these debates, on account of their stupidity, and they construct the argument of Melissus.³⁸

The fact that Melissus, a follower of Parmenides, is being used as a by-word for overly clever arguments on monism is striking here. So also is his inclusion in a medical debate. Thus far, our early philosophers have been represented as arguing about the nature of matter, about how the world came to be, about what is, about what the gods are, but none of this has had any obvious practical application. Here we see a physician situating debates about the

³⁸ [Hippocrates] *The Nature of Man*, I.1-28.

makeup of the human body (and by extension on how to treat illness) within the context of early Greek philosophy, which shows how widespread these debates were in the mid-to-late fifth century BC when this text was written. The second striking feature of this passage is that it presents itself as though it were the transcript of a speech made before an audience, referring even to such speeches as parts of public competition, with winners and losers being judged. For the first time, we see a performance context to philosophical debates, and a competition among participants for superiority. Broader trends in Greek culture become relevant here. We know that from the earliest historical period forward, there was in the Greek-speaking world a strong tradition of public rhetorical performances of one sort or another. Hymns and epics were recited before audiences long before they were written down. By the sixth and fifth centuries BC, political developments in powerful city-states like Athens, Corinth, Miletus, and Syracuse meant that the ability to argue publicly—and to win those arguments—became an important skill in the management of the state as well as in the furthering of political careers and social agendas.³⁹ By the fifth century there also emerged a loosely grouped movement, whose practitioners are known as *sophists*, that was concerned with publicly debating and teaching ethics and social issues, as well as sometimes mathematics, music, astronomy, and other topics.⁴⁰ Greek audiences thus developed a taste for virtuoso performances in debates, whatever the topic, and so public contests on a range of subjects eventually came into something of a vogue. Physicians, sophists, and philosophers alike used this forum of public debate not only to entertain, educate, or persuade, but also to promote their own theories over those of their rivals and so attract paying patients or students. We should note, though, that some physicians emphatically distinguished what they did from what philosophers were doing, although other sources tell us that Hippocrates' own teacher was a Philosopher (Democritus) or else a sophist (either Gorgias or Herodicus, who was reported also to have discovered the effects of regimen on

³⁹ Detienne, 1967; Lloyd, 1972, 1979; Asper, 2004.

⁴⁰ A good introduction is Barney, 2006.

health).⁴¹ Similarly some philosophers (Plato most famously) tried to distance what they did from what the sophists were doing, on the grounds that the philosopher was supposedly searching for truth and the sophist only for money or for victory, having no concern with whether their argument was true or not. That being said, however, many of Plato's contemporaries could see no difference between a Socrates (the quintessential philosopher) and a Hippias or a Gorgias (both sophists), whatever Plato may have wanted people to think. Modern scholarship is also increasingly emphasizing the important overlaps between philosophical and sophistic practices, practitioners, audiences, interests, and methods. It is clear that sophists could weigh in on medical debates, and that physicians and philosophers could find themselves engaged in arguments with sophists. So, too, we see Hippocratic works like *On the Art* and *On Breaths* that are so tightly bound up with known sophistic techniques as to defy us to find a sharp distinction between physician and sophist. Indeed, it has been argued that *On Breaths* was deeply influenced by a speech, called the *Encomium of Helen*, by the sophist Gorgias, and some scholars have held that *On the Art* was actually written by the sophist Protagoras.⁴² Plutarch also tells us that the sophist Antiphon set up a clinic, early in his career, at which he claimed to be able to cure the sick by talking to them. Although the words used by Plutarch for "the sick" and "sufferers" can be construed—as also in English—to refer to mental pain as well as physical, it is not at all clear from the account that the pains should be seen as strictly mental, and Plutarch in any case compares Antiphon's treatment by means of words to the physician's treatment by means of medical *therapeia*.⁴³

We can also get a window into the place of philosophers, physicians, and sophists in Greek society from the way they are portrayed on the Greek stage. Not only does the way in

⁴¹ For criticism of philosophers, see e.g., [Hippocrates] *Ancient Medicine*, xx. For the question of Hippocrates' teacher, see e.g., Soranus, *Life of Hippocrates*, 2. That Herodicus was considered to be a sophist, see Plato *Protagoras*, 316d-e.

⁴² Jouanna, 1992, p. 82; Lloyd, 1979, p. 88.

⁴³ Plutarch, *Lives of the Sophists*, 833C.

which they figure as characters in comedies, for example, point to a certain cultural prominence, but also the important interactions we see between philosophical themes and many of the themes of Greek drama reveals the significance of the cultural product they were providing.

In some of Plato's dialogues, we also get a picture of Athens during the same period where intellectual 'celebrities' come through town from time to time and give public performances of their works, as well as engaging in (open?) dialogues with small groups of interested fellow-thinkers (although this particular picture raises the question of to what extent the Platonic dialogue was a literary convention and to what extent it was a historical report of actual philosophic practice). In Plato's *Phaedo*, the character of Socrates says that in his youth he heard someone publicly reading from the philosopher Anaxagoras, a reading by which Socrates himself was sufficiently inspired to seek out Anaxagoras' books in order to read more for himself:

I once heard someone reading from a book by, he said, Anaxagoras, and saying that Mind is what orders and causes everything. I was thrilled by this cause, and in a way it seemed right to me that Mind should be the cause of everything. And I thought that, if that is how things are, then Mind would arrange the ordered whole and situate each thing such as would be best... Thinking about this, I was glad that I had found Anaxagoras, a teacher of the cause of what exists, so amenable to my own way of thinking. (I hoped) that he would first say whether the earth was flat or round and then expand on the cause and necessity of it, saying what was better and that it should be so. And if he said it was in the middle (of the Cosmos) he would explain how it was better that it should be in the middle. If he showed me these things, I was ready never to look for another kind of cause again. Moreover, I was ready to learn in the same way about the sun and the moon and the other planets, their relative speeds and their stations and whatever else they do, and why what each one does or has done to it is the best.⁴⁴

Socrates then tells us that he sought out some books, but Anaxagoras unfortunately let him down in the end. We can, however, see in the list of things Socrates had hoped to learn from Anaxagoras a survey of some of the topics that were occupying philosophers of the day, with descriptions of the natural world prominent among them.

⁴⁴ Plato, *Phaedo* 96b8-98a5. I owe the example to Warren, 2007, p. 12 f.

We might also note that, like public debates, the public reading of texts could be expected to draw an audience and even, as with Socrates, potential purchasers of books. In the Athens of Socrates' day, all citizens were expected to have at least a minimal level of literacy (enough to read decrees and laws on public display, e.g.), although the class of 'citizens' made up only a small portion of Athenian society (citizenship excluded women, foreigners, and slaves, for example). The actual purchasing of books was also not for everyone (we are told that Anaxagoras' book cost one drachma, about the same as the daily wage for a skilled labourer), and so readings and debates were the most common forms of dissemination of texts and arguments and reached a much larger audience. They also likely supplemented the incomes of those philosophers and doctors who could not simply fall back on inherited wealth. We see in some sources (Plato, notably) a distaste for those who had to rely on charging fees for teaching, just as we sometimes see aristocratic politicians mock their opponents who needed to actually work for a living.⁴⁵

III. INTELLIGENT CAUSE OR RANDOM ACTS, MINDLESS?

In the passage from Plato just quoted, Socrates mentions a new kind of cause that we have not yet seen: Mind, introduced by Anaxagoras of Clazomenae in the fifth century. Among the philosophers we have seen so far, the question of change, where we have any evidence for it, has been handled either by denying change is possible (Parmenides and his followers), or by assuming that matter is itself somehow active, and that the differences we see between different things in the Cosmos can be explained by changes in the qualities or properties of an underlying element, or else by the interactions between different kinds of stuff, between one element or quality and another. We see both the self-movement and property-alteration

⁴⁵ See Lloyd and Sivin, 2002.

of fundamental elements in the two-element theory put forth by the Hippocratic author of

Regimen I:

Man and all other living things are constituted of two things, different in powers but unified in action: fire and water. Their pairing is sufficient for themselves and for everything else, but each separately is sufficient neither for itself nor for anything else. The power that each of them has is this: fire can move all things always, and water can nourish all things always. ...

The qualities attached to each of them are thus: to fire the hot and dry, to water the cold and moist. But also from each other, fire has the moist from water (for there is moisture in fire) and water has the dry from fire (for there is dryness in water). Being constituted thus, they separate off from each other many forms of diverse kinds, of seeds and of living things, none the same as the others, neither in appearance nor in power.⁴⁶

Here fire and water are clearly meant to be self-sufficient as causes of motion and change.

What we see in Anaxagoras is the introduction of an active, causal force that is *external* to matter itself, and acts on that matter to produce change. As Simplicius later explained it:

Mind is unlimited and independent and mixed with nothing, but exists alone by itself. For if it were not by itself but were mixed with something else, it would partake of all things if it were mixed with anything. For there is a part of everything in everything, as I said earlier. Furthermore, the mixed-together parts would block it, such that it could not rule things nor be alone by itself. For it is the lightest and purest of all things and it has all knowledge about all things and it has the greatest power. Whatever has soul, whether large or small, Mind rules over.

And Mind governed the whole rotation, so that it rotated in the beginning. At first it began to rotate in a small area, and then it rotated more widely, and it will rotate wider still. Mind knew everything that was mixing together and separating and being distinguished. Mind set in order everything that was going to be, everything that was, everything that now is, and everything that will be, and also the rotation in which the stars now rotate, and the sun and the moon and the air and aether, separated. The rotation itself made them separate.⁴⁷

That Anaxagoras thought this cosmology to be of great importance can be seen from his reputed response to a man who asked what reason one might have for preferring life, with all its hardships, to nonexistence. Anaxagoras supposedly replied that sufficient reason to choose life was in order “to observe the sky and the order of the entire Cosmos.”⁴⁸

⁴⁶ *Regimen I*, iii-iv.

⁴⁷ Simplicius, *Commentary on Aristotle's Physics* 156.

⁴⁸ Aristotle, *EE*, 1216a11.

Anaxagoras also introduced a novel theory of matter, likely in order to deal with Parmenidean objections to change. In response to the argument that nothing can come to be from what is not, Anaxagoras reasoned that things could still come to be from what they *already were*, which is the point of the statement above, that “there is a part of everything in everything.” As one Byzantine commentator put it:

Anaxagoras discovered the old idea that nothing can come from what is not. He dismissed coming-to-be, introducing separation instead of coming-to-be. For he fancied that things were mixed with each other and that growing was separation. So in the genitals there are hair, nails, veins, arteries, tendons, and bones, which happen to be invisible because of their smallness. As they grow they separate, bit by bit. For how, he said, could hair come to be from not-hair, or flesh from not-flesh?⁴⁹

So there is a little bit of everything in everything, and change or growth happen as certain parts are separated out from the mixture. Furthermore, the individual parts are infinitely divisible, with no smallest ultimate unit. In some sources, we see attention paid to pairs of opposite qualities (the hot, the cold, the wet, the dry, the light, and the dark, and more) as well as to certain “seeds” in everything, although how we should understand these in conjunction with the everything-in-everything statements is still debated. We are also told by one source that a portion of Mind is contained in some mixtures, perhaps to account for living things, or perhaps this is another way of understanding the statement we saw above, that Mind ‘governs’ whatever has soul.

The idea that there is some kind of active force governing matter would be profoundly influential, persisting through many thinkers to the end of antiquity and beyond. It had its critics, as we shall see, but they were never more than a minority voice. We have seen hints in the direction of some kind of (purposive) governance in many of Anaxagoras’ predecessors, from Anaximander’s “repaying injustice” to Thales’ things-full-of-gods and Heraclitus’ Zeus, though none of these was as fully fleshed out as Anaxagoras’ Mind, existing independent of matter and acting on it as an intelligent agent. So also in Anaxagoras’

⁴⁹ Scholium on Gregory of Nazianzus, in *Patrologia graeca*, vol. xxxvi, col. 911b.

contemporary Empedocles we find Love and Strife as active, divine forces. We will see in later chapters how these ideas were developed by Plato and Aristotle, and how they formed an important core to later ancient philosophies of nature, most fully developed in the Stoics and Galen.

But at least one group of thinkers expressly—and very radically—rejected active governance in nature, arguing instead that they could account for the phenomena of the Cosmos using only brute matter. In order to do so, though, they had to make a case for a very tricky idea indeed: the existence of nonexistence. According to Simplicius,

Leucippus of Elea or Miletus (both are associated with him) shares something with Parmenides, although he does not follow the same road as Parmenides and Xenophanes with regard to existence, but instead, it seems, the opposite one. For they supposed everything to be one and unmoving and ungenerated and finite, and did not admit the possibility of inquiring into what is not. Leucippus on the other hand supposed unlimited and ever-moving elements, the atoms, and an unlimited number of shapes among them because one shape is no more likely than another, and seeing that genesis and change are unending among what is. Moreover, there is no more reason for what is to exist than [for] what is not [to exist], and both are similarly causes of what comes to be.

The idea here is that there are two fundamental kinds of existents: atoms, and the void (or “emptiness” or “not-being” as it is called in the Greek). We moderns have surprisingly little trouble with the idea of the existence of void space, as though nothingness were just another thing that can occupy space, but most Greeks were genuinely bothered by the contradictions inherent in talking about *nothing* as though it could exist. We also have the advantage of a relative familiarity with empty space, being told from childhood that the universe is full of it, in addition to the ubiquity of vacuum flasks and vacuum seals of various kinds. (But of course none of these is really a *perfect* nothingness like the atomists were conceptualizing—their void was utterly absolute in a way that does not correspond to anything in the modern physical universe.)

But historically speaking, humans’ first real experience with even approximate vacuum did not occur until the invention of the air pump in the middle 1600’s CE, and so for

the Greeks the possibility of the existence of void had to be taken on faith or inferred from other evidence, and it is far from an obvious idea. Where we are happy to have forces and fields, virtual particles, zero-point energy, and what we can think of as certain ‘properties’ like space-time curvature permeating even the purest vacuums we can imagine existing in our universe, for the atomists this only-relatively-empty space would not satisfy the requirements of their atomic physics, which needed a *genuinely* empty and property-less place into and through which atoms could move. The things that we actually see in the Cosmos are then produced by the atoms coming together and temporarily entangling themselves with each other, not, it would seem, randomly, but according to some kind of lawlike “necessity.” Quoting from a lost work of Aristotle, Simplicius explains the theory of Democritus (Leucippus’ more famous and prolific successor) thus:

[The atoms] struggle and are carried about in the void because of dissimilarity and the other differences already discussed, and being carried about they crash into and entangle each other in a mesh where they touch and stay near each other without any kind of truly unified entity coming to be from them, for it is completely ridiculous that two or more things should ever become one. He alleges that the entities stay together for a while, those that are fitted into and intertwined with each other, for some of them are jagged, some hooked, some hollow, some arched, and others have unreckonable other differences. He thinks they cling to each other and hang together until some stronger necessity comes to them from outside and shakes them and scatters them about.⁵⁰

We note in this description a couple of deliberately political analogies: the atoms “struggle” which in Greek is a word describing the political chaos of revolts and revolutions, and also Democritus “alleges,” in a courtroom sense, that the bodies are of particular shapes.

The ubiquity of all this crashing and dissolution, though, creates real problems for the question of why anything should cohere to produce recognizable macroscopic entities at all. Why, for example, do we find an ocean full of relatively homogenous water under a blanket of relatively homogenous air rather than a random jumble of all kinds of things everywhere? To solve the question, Democritus seems to have looked to the way that

⁵⁰ Simplicius, *Commentary on Aristotle's On the Heavens*, 295.10 f.

pebbles come together on a beach as a model, and argued that things that are like each other have some kind of tendency to group together. This idea coincidentally helped to explain a phenomenon most unpromising for atomism (as it would be for any mechanistic universe): how magnets should attract iron if all motion is caused by atoms crashing into each other. The solution, we are told, was to suppose that magnets and iron are made of the same kinds of atoms and so would be attracted to each other, since like things are attracted to like things. As to why magnets should be more attractive to iron than iron was to other pieces of iron, one later commentator tells us that Democritus claimed the magnet to have more void between its atoms, thus making its atoms “more mobile.”⁵¹

As to the qualities that we perceive in the universe, heat, cold, colour, and so on, Democritus argued that these were not real properties of atoms, but emerged somehow from the interactions of atoms with our senses. Atoms possessed only what he called “shape,” “orientation,” and “order.” As Aristotle later explained it, using letters of the alphabet as examples: A is different from N in its shape, Z is different from N in its orientation (it is turned ninety degrees), and AN different from NA in their order.⁵² Democritus is frequently quoted as saying: “By convention sweet, by convention bitter, by convention hot, by convention cold, by convention colour; in reality: atoms and void.”⁵³ However, this creates a tension in Democritus between the senses as always deceptive about what really is, and the use of the senses in order to gather the evidence necessary to determine how the universe is made up, a tension that is not easily resolved in our sources.

But, in spite of a lack of purposive causation in the Cosmos, atomism still finds itself deeply concerned with human morality. The later version of atomism formulated by Epicurus in the following century would make ethics absolutely central to the atomist project. Although the specific ethical import of Democritean atomism is less clear from our sources,

⁵¹ Alexander of Aphrodisias, *Problems and Solutions*, II.23.

⁵² Aristotle, *Metaphysics*, 985b18.

⁵³ Sextus Empiricus *Adversus mathematicos*, VII.135, e.g.

it is abundantly clear that Democritus did have a strong moral agenda, as can be seen from repeated references to his emphasis on moderation and piety, and to the importance of avoiding evil words and deeds. So also, the Epicureans would develop a theology that distanced the gods from the mundane world. It is more difficult to see how Democritus dealt with the gods, although there are some hints here and there in his references to the divine inspiration of poets and in Epicurean criticisms of Democritean theology, which they thought conceded too much to traditional conceptions of the gods, where the gods could approve or disapprove of certain actions, help or hinder people, and so on.⁵⁴

IV. DIVINE NATURES

Looking back over the specific elemental theories described in the authors above, we see that four entities commonly tend to get singled out for special attention, and these would eventually become the four traditional elements of Greek philosophy. So the author of *The Nature of Man* listed these four—and only these four—as candidates for monism: all is air, all is fire, all is water, or all is earth. The first thinker we know of to close off the set of elements to just these four seems to have been the Sicilian mystical philosopher and poet Empedocles, who wrote on physics and theology, and likely also on medicine, some time just before the Hippocratic *Nature of Man* was written (and Empedocles is targeted by name another Hippocratic work, *On Ancient Medicine*). A larger-than-life figure, Empedocles seems to have been thought of by many as a wonder-worker, and the story goes that he ended his time on earth by leaping into the active crater of Mount Etna in order to prove that he was a god. The connection of early philosophy and physics with not just theology but even with contemporary Greek mystery religions has been the subject of some interesting scholarly work, and Empedocles is one of the main foci of these studies.⁵⁵ There has even been some

⁵⁴ See Taylor, 1999; Broadie, 1999.

⁵⁵ See e.g., Laks and Most, 1997; Kahn, 2001; Bernabé, 2002; Betegh, 2004; Sedley, 2007.

speculation that the kind of religio-magical medicine associated with Empedocles was the direct target of the Hippocratic *Sacred Disease*.⁵⁶

There is some debate about whether Empedocles wrote one poem or two. Certainly the extant fragments we have of his work cover a very wide range, from physics to religious purifications to accounts of his past lives as “a boy and a girl and a shrub and a bird and a fish.”⁵⁷ A recently discovered papyrus fragment may lean us toward the idea of a single poem, and in any case there is no reason to suppose that the different subjects could not have formed part of a consistent whole, with the account of reincarnation, purification, and salvation forming a central part of the account of the makeup of the Cosmos and the genesis of humans.

That Empedocles takes Parmenides’ arguments about change very seriously can be seen from the attention he gives to the idea that things cannot come to be from what is not, although he interprets this stricture differently from Parmenides, choosing instead to argue for change as a shuffling of constituent parts (the four “roots,” as he calls earth, air, water, and fire) under the influence of two opposed forces, Love and Strife. As in Anaxagoras, change is thus re-thought, not as a coming to be from what is not, but as an alteration in the mixture of what already is.

From what is not, coming to be is impossible; and the destruction of what is can never be accomplished and is unthinkable. For it will always be there, whichever way one may push it.⁵⁸

I shall tell a double tale: at one time growth, becoming one alone from many, at another separation again, becoming many from one: fire and water and earth and unending height of air, and wretched Strife apart from them, alike in every way, and Love among them, equal in both length and breadth.... In Love we come together in one Cosmos; in Strife it dissolved, many out of one, from which all things that were and are and will be hereafter: trees came forth and men and women, beasts and birds and water-dwelling fish and aëon-living gods, greatest in honour.⁵⁹

⁵⁶ See Nutton, 65.

⁵⁷ Diogenes Laertius, VIII.77.

⁵⁸ Pseudo-Aristotle, *On Melissus, Xenophanes, and Gorgias*, 975b1.

⁵⁹ Simplicius, *Commentary on Aristotle’s Physics* 157, 25, continued by P. Strasboug 1665-6, a(i)-a(ii), which we now know followed directly. See Martin and Primavesi, 1999.

That there is some great cosmic cycle in which sometimes Love, sometimes Strife dominates, the roots coming together and separating in turn, seems clear from this last passage, as also from another:

In turn they prevail as the cycle goes around, and decay into each other and grow according to the lot of fate. For these things exist, moving through each other and becoming men and the tribes of other beasts, sometimes coming together by Love in one Cosmos, sometimes again being borne apart from each other by the hostility of Strife.... They never stop completely exchanging, and in this way they are always unmoved according to a cycle.⁶⁰

Empedocles also offers a memorable account of the generation of people and animals. As part of its great cycle, the Cosmos moves through a period where various limbs and organs exist by themselves independently of whole animals or people. The various bodily parts crash into each other making random combinations, some of which work better than others.

This is clear in the bulk of mortal limbs, sometimes coming together by Love, all limbs in one, those that happened to have found bodies in the peak of thriving life; sometimes again broken up by evil discords they wander, each apart, at the margins of life.⁶¹

Many heads without necks came forth, and naked arms stumbled about bereaved of shoulders, and eyes wandered alone lacking foreheads.⁶²

Many with two faces and two chests came forth, man-faced ox-things, and then again there sprang up ox-headed man-things, in one case mixed from men, in another of female form, decorated with dark limbs.⁶³

As one later commentator understood it, there were four stages in this account of the development of humans and animals. The first stage was where these limbs were all separated, individually generated from earth and water. Next the limbs begin to unite, creating “phantom-shapes.” Third, whole forms came together, and lastly living things finally come to be generated from each other rather than from the mixing of pre-existing limbs and forms.⁶⁴

⁶⁰ Simplicius, *Commentary on Aristotle's Physics* 33, 18.

⁶¹ Simplicius, *Commentary on Aristotle's Physics* 1124, 9.

⁶² Simplicius, *Commentary on Aristotle's On the Heavens*, 586, 29.

⁶³ Aelian, *On the Nature of Animals*, XVI.29.

⁶⁴ Pseudo-Plutarch, *Opinions of the Philosophers*, 908D.

We also see in Empedocles a number of ethical concerns, not only in the moral overtones carried by the names Love and Strife, but also in an explicit injunction against religious impurity caused by killing (“staining one’s limbs with blood”) or swearing false oaths. The consequences of impurity were that the soul would wander for 30,000 years away from the gods, incarnating as all manner of beasts: fish, animals, and birds. The second-century AD philosopher Sextus Empiricus tells us that the incarnation of these souls in animals meant that Empedocles preached a strict vegetarianism, lest children eat their reincarnated parents, or parents their future children, “deaf to their cries.”⁶⁵

But if religious concerns (and pretensions) are scattered throughout the work and the various accounts of Empedocles, they pale in comparison with those surrounding the life, teachings, and later the cult of his predecessor, Pythagoras of Samos. Pythagoras was in antiquity famous as the founder of an innovative and profoundly influential mathematico-philosophico-theological school.

Isolating Pythagoras himself from developments in philosophy after his death has proved a very difficult scholarly task, as he and his followers were for a long time fiercely secretive, and later Greek writers had some tendency to ascribe all the best ideas of Greek philosophy to Pythagoras or his early followers, up to and including forging texts to make their case. Our sources also often have a tendency to refer to what “Pythagoreans” believe, rather than what Pythagoras himself said, and in many ways it may be safer to follow their lead in talking of “Pythagorean philosophy” rather than Pythagoras’ philosophy. But even here problems arise in that, a century or so after the master’s death, what appear to be Pythagorean ideas become so seamlessly integrated into much of Plato’s work that it becomes difficult to disentangle Pythagoreanism and Platonism afterwards. Furthermore, different authors emphasize different aspects of the school, such that it becomes the fountainhead of mathematical philosophy for Plato, whereas Pythagoras himself seems to

⁶⁵ Sextus Empiricus, *Adversus mathematicos*, IX.129.

have been seen as primarily a religious figure before this.⁶⁶ Indeed, more than any of the thinkers we have seen so far, the life of Pythagoras attracted a great number of fantastic stories. A short excerpt from the third-century-AD doxographer Diogenes Laertius should give the flavour:

There is a story that once when he was undressed his thigh was seen to be made of gold, and there was a frequent report that when he was crossing the river Nessus people heard it call him by name.... He brought geometry to perfection ... and discovered the musical intervals on the monochord, and he also did not neglect medicine. Apollodorus the calculator says that he performed a sacrifice when he discovered that in a right triangle the hypoteneuse squared is equal to the squares of the other sides [together].⁶⁷

Others tell us that Pythagoras was worshipped as the god Apollo by his followers, and that new recruits to the school had to listen to him teach from behind a curtain, being allowed into the inner circle only after five years. We are told that he once journeyed to the underworld, where (among other things) he saw Homer and Hesiod being tortured for what they said about the gods. He is supposed to have studied with all the important sages, both in the Greek world and abroad (Egypt, Palestine, and Babylon, including with Zoroaster himself). He was once seen in two different cities at once.

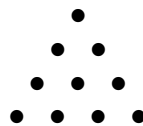
But even the plausible-looking bits of such accounts may be unreliable. Pythagoras was later to be famous for his mathematics, but there is actually very little direct early evidence that mathematics was a particular interest or skill of his. Still, many modern scholars think that, on balance of the indirect and/or later evidence, he must have done at least some mathematical work. Likewise, he would later come to be associated with a complex cosmology (likely actually invented by a later follower, Philolaus) involving a spherical earth where those who live on the opposite side to us have their up and down reversed. The earth, on this account, orbits a central fire (distinct from the sun) with a counter-earth always on exactly the other side, and the sun, moon and planets were gods,

⁶⁶ Kahn, 2001, p.12 f.

⁶⁷ Diogenes Laertius, VIII.11-12.

farther out still. These played a wonderful music as they moved around, audible to the properly initiated.

This idea of this cosmic harmony was part of a complex and thoroughgoing mathematization of the Cosmos that would, from Plato onwards, be forever associated with the Pythagorean school. Legend has it—and we know it is a legend, since the physics is wrong—that Pythagoras had been walking past a blacksmith’s shop one day when he heard the hammers ringing out different musical notes. When he weighed the hammers he found (and this is the impossible part) that the hammers that produced an octave were weighted in the ratio of 2:1 (the lower note produced by a hammer twice as heavy as the higher), and the musical intervals known as a fourth and a fifth were produced by weights in the ratio of 4:3 and 3:2 (we will return to these ratios in more detail in chapter XX). But the digits generating these ratios, 1, 2, 3, and 4, have the property that they collectively represent the number 10, when written in their characteristic Pythagorean representation, as dots making up a special equilateral triangle called the *tetractys*, whose significance to the school is shown in their use of it as the sacred object on which they swore oaths:



In total, 10 dots, making 10 a ‘triangular number’ (the next triangular number is 15, as any billiards player knows). The top two rows in this figure give us the ratio of the musical octave, 2:1; the middle two rows the fifth, 3:2, and the bottom two rows give us the fourth, 4:3 (and this relationship is radially symmetrical such that it does not matter which vertex one starts at). Aristotle frames their reverence of the number 10 this way:

The so-called Pythagoreans engaged in mathematics, and were the first to investigate this field. Developing it among themselves, they believed the principles of mathematics to be the principles of all things. And since of these principles number is the first by nature, and they thought they saw in numbers—more than in fire and earth and water—many similarities with things that are and things that are coming to be, such that the property of

one number is 'justice,' of another 'soul' and 'mind,' of still another 'time,' and more or less similarly for the others. Since they saw that the properties and ratios of harmonies are in numbers and moreover it seemed that the complete nature of other things can be modelled by numbers, and numbers were the first things in all nature, they took the elements of numbers to be the elements of all things, and the whole Cosmos to be harmony and number.... For example, since the number 10 is held to be complete and to contain the whole nature of numbers, they said that there were 10 bodies that move in the heavens. There being only nine visible bodies [earth, sun, moon, five planets, and the sphere of the fixed stars], they added a tenth, the counter-earth, for this reason.⁶⁸

For Pythagoreans, each line of the tetractys represented different fundamental attributes or principles of the Cosmos. A later musical theorist, Aristides Quintilianus, lists them thus (although we should note that there are variations in the details between different authors, as well as across time):

The ancients reckoned one to be the principle and the efficient cause of the concordance of the Cosmos, because everything comes to be, held together by the harmony of one. They make two out to be matter, being the first number to show contrariety. They call three the whole, containing two ends and a middle. Four they call solid since, beginning with a point and increasing the dimensions one by one, the fourth figure they come to is a solid.... They say that five is perception, for obvious reasons, and six was perfection of body, being derived by multiplication of the first odd and the first even number, and for this reason it was also called by them marriage [here it is helpful to know that the ancients did not consider one to be a number; it was instead the foundation of all numbers]. Seven was chastity, for it is the only one of the first ten numbers that is neither attainable by multiplication from other numbers, nor can it so produce another number under ten. Eight was material body, for it is produced by cubing the first number. Nine they called music, since it is the first to be made up of the numbers comprising the three concordant ratios (two, three and four make nine).... Ten they call first concord.⁶⁹

In this way, Pythagoreans took the relationships exhibited by numbers with each other, and found ways to map those numbers and relationships onto the Cosmos as a whole. What may look to the modern reader like fanciful thinking here (seven is chastity, e.g.) was not seen by these investigators as different in kind from the determination of the numbers that governed musical harmonies, such as the octave being represented by 2:1, which is in fact correct

⁶⁸ Aristotle, *Metaphysics*, 985b23 f.

⁶⁹ Aristides Quintilianus, III.6.

(pressing a guitar or violin string at exactly the halfway point along its length, for example, produces a note exactly one octave higher than the open string).

A final notable characteristic of the Pythagorean school is its relative sexual egalitarianism, unusual for Ancient Greece. Women were full participants in the school as early as Pythagoras' own wife, Theano, and their daughters, all of whom are said to have contributed to the early development of the school.

V. WHAT IS NEW AND NOVEL?

For all the theological concerns that tie into early natural philosophy, it has long been taken for granted by historians of science, medicine, and philosophy, that these early Greek thinkers broke radically with older mythical traditions of thought to introduce a new kind of cause, natural rather than supernatural, in their explanations of phenomena. In doing so, these revolutionary thinkers simultaneously gave birth to a whole new way of thinking about the Cosmos. No longer, the story goes, would philosophers and physicians accept explanations that invoked personalized gods and demons as causes in the universe. Indeed, this naturalistic move has been seen by many as *the defining moment* in the birth of the sciences (or, to speak a little more cautiously, of a rationalist or scientific mentality). Over the last couple of decades this picture of Early Greek science has come under increasing fire from several quarters, but the question is an extremely tricky one, not least because the Greeks themselves seem to talk at times as though a shift to naturalistic causes is exactly what they thought they were up to. We have already seen the famous passage from the Hippocratic text *On the Sacred Disease*, where the author distinguishes his own theory from those of the witch-doctors, magicians, and quacks, although we saw that close attention to the Hippocratic author's language showed that he was worried not about the religiosity inherent in his competitors' theories, but about the impiety of their view of the gods. He also never

denied that the sacred disease was sacred—it is “as sacred as other diseases”—but he did go to some lengths to offer an explanation of the disease that relied only on entities, structures, and processes in the human body. So also we are told by the great arch-sceptic Sextus Empiricus that Democritus, like some of his predecessors, thought that some combination of (a) people’s ignorance of what really causes things to happen, and (b) their observation of certain atomic ‘images’ led people to invent divine or mythological causes:

Democritus says that images come to people, some of which are beneficent and some of which are maleficent (which is why he prayed to have lucky images), and these images are great and monstrous, and they are hard, though not impossible, to destroy. Being visible and uttering sounds, they signify the future to people. For this reason the ancients, seeing their appearance, supposed god to exist (god being nothing more than these images with an indestructible nature).... And there are some who suppose that we came to the idea of gods from puzzling events in the Cosmos, which appears to be the opinion of Democritus, for he says that ancient people, when they saw events in the heavens such as thunder and lightning-bolts, the movements of the stars and eclipses of the sun and moon, they were frightened, thinking the gods to be the causes of these things.⁷⁰

This passage poses a number of difficulties for the modern reader. For if Sextus is representing him accurately, Democritus seems to believe that the images, whatever they are exactly, can predict the future, thus following on a common Greek belief in omens. But he also seems to think there is some point in *praying* for one kind of image rather than another, which would seem to indicate some room for divine action in the world. How this should work exactly, though, remains opaque. Nevertheless, the claim at the end of the quotation above, that says that early people thought the gods caused certain heavenly phenomena, is worth noting, for it links two themes that we know to be important from later atomism: fear, and a belief in divine causation. That Democritus felt himself to be offering some kind of alternative explanation seems clear, but how we make that position agree with his other references to divinity remains a difficult problem.

⁷⁰ Sextus Empiricus, *Adversus mathematicos*, ix.19-24.

Other early Greek philosophers were centrally concerned with divinity. If we take their pronouncements on the gods seriously, it seems impossible to think of Pythagoras, Empedocles, or Heraclitus, for example, as naturalists in any strict sense. Similarly Parmenides not only has his truth offered as a revelation from a goddess, but he also situates his entire account in the narrator's mythical journey to the goddess herself. The poem also uses religious imagery that has been associated with the cults of Apollo and Helios,⁷¹ and the association of Parmenides with the cult of Apollo is further strengthened by the only inscription we have found from Parmenides' home town of Elea that mentions the philosopher by name. It reads:

Parmenides, son of Pyres. Priest [or "descendant"—the Greek could mean either] of Apollo the Healer, natural philosopher.⁷²

Finally, the uses of divinity and divine imagery in the poem should not be dismissed lightly. If, for example, we were to say that Parmenides' use of religious imagery, divine revelation, and mythical journey can be excused as merely poetic convention, we may have to also excuse Homer and Hesiod's gods on the same grounds, which would mean that they were saying nothing concrete about divine causation after all. So, too, we should pay attention to the uses of myth in so many other ancient philosophers—for myth is by no means confined to Parmenides—which are not so easily dismissible as mere convention.⁷³

We also see that appeals to divinity and divine causation could go hand-in-hand with naturalistic approaches to the world. As the author of the Hippocratic work *Regimen IV* put it:

Praying is good but it is also necessary, when calling on the gods, to lend a hand yourself.⁷⁴

⁷¹ See e.g., Steele, 2002.

⁷² Ebner, 1963 (note that in the publication illustrations 2 and 4 are inadvertently switched. The photograph of the Parmenides inscription actually appears as figure 4, but its text and caption under fig. 2). The Greek reads: Παρμενείδης Πύρητος Οὐλιάδης φυσικός.

⁷³ See e.g., Morgan, 2000; Brisson, 1996.

⁷⁴ *Regimen IV*, lxxvii.

He continues on a little later give his readers advice not only on the medical treatment to employ in a particular case, but also on which gods—by name—one should pray to, and he even fine-tunes that advice for two different scenarios. So, too, the author of the Hippocratic work *Decorum* credits *all* healing to the gods and says that it is through medicine that we come to know the gods most clearly.⁷⁵ Scholars are now coming to realize the extent to which the histories of Hippocratic medicine, theology, and religious healing are intertwined, and the one by no means replaces the others. Indeed, there is considerable evidence that the spread of Hippocratic medicine and the spread of the cult of the god Asclepius were closely linked.⁷⁶ Hippocrates himself is said to have claimed direct descent from one of the two sons of Asclepius mentioned in Homer's *Iliad*. Not only does divinity figure in the Hippocratic corpus more than is often acknowledged, but also we find inscriptions, statues, and dedications to physicians in temples of Asclepius, as well as inscriptions recording sacrifices to Asclepius by physicians, strongly suggesting what Vivian Nutton has called “a considerable degree of cooperation” between doctors and healing shrines.⁷⁷ Methods of healing, too, could overlap between the two.⁷⁸ We saw at the beginning of this chapter that the author of *The Sacred Disease* claimed that the sacred disease was *no more divine* than any other disease, which some have been tempted to see as a veiled dismissal of divinity, but such a reading would be too hasty, for as the author says in his conclusion to the work,

The disease that they call ‘sacred’ comes about from the same causes as the other diseases: from ingestions and evacuations, and from cold, the sun, and the changing winds that never rest. These things are divine, so that it is not necessary to think this disease should be set apart as more divine than the rest. Instead all are divine, and all are human.⁷⁹

⁷⁵ [Hippocrates] *Decorum*, vi.

⁷⁶ See e.g., Gorrini, 2005; Nutton, 2004, chapter 7; Horstmanshoff, 2004; Edelstein and Edelstein, 1945. For a different reading of this evidence, see Wickkiser, 2008. See also Marx-Wolf, 2010, who brings Nutton's 2004 argument to bear on Wickkiser's thesis.

⁷⁷ See Nutton, 2004, p. 111. For Nutton's full argument see his chapter 7 especially.

⁷⁸ Lloyd, 2003; Jouanna, 1992; Edelstein and Edelstein, 1945.

⁷⁹ [Hippocrates] *Sacred Disease*, xxi.

All diseases are divine, all are caused by divine things, all likewise human, says our author. This is a remarkable and challenging claim, and the question now becomes how to understand it. Perhaps the author of another Hippocratic work can shed light on the idea:

The gods set all of nature in order. Things arranged by people never remain constant, neither in staying up nor in falling down, but whatever was arranged by the gods always remains, staying up.⁸⁰

The Greek verb used by the author of this passage for what the gods do when they “set all of nature in order” is the same verb as Anaxagoras is reported to have used for what Mind did when it set the Cosmos in order. And we have seen that several of the early philosophers felt the need to introduce active causes in the universe, causes that guided or underpinned the interactions and changes of material entities in the Cosmos, causes with names like “Mind,” “*logos*,” “Zeus,” “Love,” and “Strife,” and that seem to have been explicitly or implicitly thought of as divine—indeed, David Sedley has aptly described such accounts as “creationist.”⁸¹

Finally, we should remember that mythological accounts, even when they do seem to be ascribing divine causes to certain events, should not be taken as ascribing divine causes to *all* events. It did not take Thales to teach the Greeks that to travel from Athens to Corinth one needed to do more than just pray and wait to be teleported. Clearly people have been consciously working with and manipulating natural causes (in harnessing animal power, for example, and in designing harnesses, ploughs, carts, and wheels) from time immemorial, and it is very difficult to see how they could have inserted divine causes at every stage to make sense of *everything*. Thales’ predecessors did not get better ships and better sails by waiting for them to fall from the sky. To be sure, this does not preclude a belief in divine inspiration or the occasional divine intervention, but then beliefs in those things did not go away after these philosophers either. Not only did Socrates, for example, have a little *daemon* who talked to him and guided his decisions, but much of later natural philosophy was driven by a desire

⁸⁰ [Hippocrates] *Regimen I*, xi.

⁸¹ Sedley, 2007.

to uncover the wonders revealed in nature by a divine creator. It should be noted, though, that this teleology was tied with a self-consciously ‘sophisticated’ theology, and was repeatedly contrasted with the superstition of ignorant people. It is precisely here that we need to be careful, for a belief that there is a divine cause underlying or responsible for nature as we see it, is not the same thing as a belief that one might be turned into a cow by a jealous Hera, and philosophers not infrequently stressed how elevated and enlightened their brand of piety was. What we as historians need to do is to be careful not to take ancient criticisms of ‘superstition’ as though they were ancient criticisms of piety, divinity, mythology, or religion themselves. There is a lovely passage from Plutarch that makes the distinction very clear. Speaking of the great fifth-century Athenian statesman Pericles, who was said to have been a friend of Anaxagoras, Plutarch says:

This was not the only benefit Pericles got from his conversations with Anaxagoras, but he also seems to have overcome superstition, that which wonder about heavenly phenomena produces in those who are ignorant of their causes and who are addled and confused about divine things because of their inexperience. Natural philosophy (ὁ φυσικὸς λόγος), setting us free from this, produces a steadfast piety together with good hopes in place of fearful and festering superstition.⁸²

Here fear and superstition are linked, and knowledge of true causes frees one from both, not by eliminating divinities outright, but by teaching the truth about them such that the inquirer is led from the knowledge of the causes of heavenly phenomena to a “steadfast piety,” and (by implication) to a state of clarity about divine things.

There is much that is new in early Greek philosophy and Hippocratic medicine, and much that is closely related to contemporary and earlier literature, theology, ethics, and cultural history. We should not overstress the novelty, but neither should we deny that there is something very interesting going on in the debates among the different philosophers and physicians, debates about how the things we see in the world came to be, about how those things are constituted, about how or whether change can happen. The Greeks would forever

⁸² Plutarch, *Life of Pericles*, VI.

see this set of questions as related, as new, and as important. In arguing in this chapter that the idea of a pure ‘naturalism’ has been overstated by modern scholars, I hope I have not been seen to argue that there is anything derivative or uninteresting in early Greek philosophy, but instead that their individual projects are richly connected with much of what is happening in a wider Greek intellectual culture, and that these interconnections are central to understanding the wide range of the early philosophers’ interests and their very remarkable ideas about nature.

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