Natural and Supernatural in Ancient Science

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All things are full of gods.

-Thales of Miletus

I. IN THE BEGINNING

Science is taken on what we might call 'the conventional view' to be a rejection of the supernatural in favor of strictly naturalistic explanations of phenomena. When in Hesiod (Greece's great seventh-or-eighth-century-BC poet), lightning is said to have been given to Zeus by Brontés, Steropés, and Argés (all names having to do with thunderstorms), who were born of Earth (Gaia) after she had lain with Heaven (Uranus), we are to understand that—however lightning existed before this—it came into the province of our world by a supernatural agency.¹ By contrast, when, writing a century or so later, the early philosopher Anaximander says that lightning and thunder "happen from wind,"² we are supposed to see an entirely naturalistic line of agency. Modern commentators are quick to point out the importance of this change as the signal move in the birth of science:

In a realm where mythology had provided divine beings as causes for the structure and events of the world, ... Anaximander offers elemental bodies and natural events In modern terms, Anaximander provides a kind of paradigm of explanation that sets the problems and the limits for a scientific understanding of the world.³

There is, however, a more profound reason to start natural philosophy with the Greeks rather than the older cultures, despite their many accomplishments. Although these older cultures had technical knowledge, keen observational skills, and vast resources of material and information,

¹ Hesiod, *Theogony* 138 f.

² H. Diels and W. Krantz, eds., *Die Fragmente der Vorsokratiker*, 6th ed. (Berlin: Weidmannsche Verlagsbuchhandlung, 1951) fragment A23.

³ D. Graham, *The Texts of Early Greek Philosophy* (Cambridge: Cambridge Univ. Press, 2010), p. 45-6.

they failed to create natural philosophy because they did not separate the natural world from the supernatural world.⁴

[In Anaximander, the] basic explanatory factors are no longer more or less anthropomorphic gods. Instead, the genesis of the cosmos is explained in terms of recognizable elements of nature—in other words, the approach is *naturalistic*.⁵

So far, the conventional wisdom seems conventional enough. But in recent years cracks have begun to show in it, and it is worth teasing out the ways in which some of the key elements of this account play out.

In the first instance, although many histories of science and of philosophy try to downplay the fact, the gods never really go away in ancient science (nor does mythology, for that matter, but that question moves us beyond the bounds of this paper).⁶ As David Sedley has shown, a great number of ancient philosophers, including many of the ones most likely to find their way into histories of the sciences, saw purposive divine agency at work in the cosmos. Many were creationists of one stripe or another.⁷ Even Anaximander, singled out in the above quotations as our first genuine naturalist, may well have thought there was a divine lawmaker behind the ‘paying of reparations’ that he claimed governed the regularities in nature,⁸ and we have two (closely related) sources that ascribe to him the idea that the stars are “gods.” One of these sources may even tie these stellar divinities back to Anaximander’s supposedly naturalistic “elemental body,” the so-called “unlimited”:

Anaximander said that the unlimited heavens are gods.⁹

⁴ A. Ede and L. Cormack, *A History of Science in Society* (2nd ed.), Toronto: Univ. of Toronto Press, 2012), p. 3.

⁵ K. Algra, “The Beginnings of Cosmology,” in *The Cambridge Companion to Early Greek Philosophy*, ed. A. A. Long (Cambridge: Cambridge Univ. Press, 1999), p. 48.

⁶ On mythology, see, e.g., L. Brisson, *Introduction à la philosophie du mythe, vol. I: Sauver les mythes* (Paris: J. Vrin, 1996) (English trans. by C. Tihanyi, *How Philosophers Saved Myths* [Chicago: Univ. of Chicago Press, 2004]); R. Buxton, ed. *From Myth to Reason?* (Oxford: Oxford Univ. Press, 1999); K. Morgan, *Myth and Philosophy from the Presocratics to Plato* (Cambridge: Cambridge Univ. Press, 2000); L. Taub, *Aetna and the Moon* (Eugene: Oregon State Univ. Press, 2000).

⁷ D. Sedley, *Creationism and its Critics in Antiquity* (Berkeley: Univ. of California Press, 2007).

⁸ Sedley, *Creationism and its Critics* (cit. n. 7), p. 6.

⁹ Stobaeus, *Anthology*, I.1.29b. All translations, unless otherwise noted, are my own.

Perhaps we should not read too much into the instance of *apeiron*, “unlimited,” here,¹⁰ but there is no denying the gods in this passage. However we may read it, it certainly complicates any account of Anaximander as the first pure naturalist, and it is perhaps unsurprising that this passage almost always goes unquoted and unacknowledged in modern commentary. Indeed, it is a core part of my argument in this paper that the imposition of a naturalism/supernaturalism divide in ancient science frequently relies on such selective blinkering.

Furthermore, the question of what we might even mean by using the loaded term “supernatural” raises its head. After all, if we define science as the domain of the natural and label one set of causal agents as by definition *beyond* that domain—*super* it, in the Latin—we are certainly setting up a clear demarcation, but at the nontrivial risk of begging the question. Or perhaps the gods are just part of the natural domain in the first place. If we try to refortify the natural/supernatural distinction by now arguing that the gods as causal agents do not, in point of fact, exist (or more cautiously, have never been proven to exist), we simultaneously close off a considerable portion of what we might otherwise want to accept as historical science, premodern as well as modern, since so very many historically posited causal entities turn out to be just as nonexistent: N-rays, phlogiston, psychic pneuma—the list is endless. A closely related question revolves around who gets to define the category of the natural in the first place: us or them? After all, as Geoffrey Lloyd has repeatedly pointed out, the idea of “the natural” itself has a history.¹¹

¹⁰ Not least because the word “unlimited” is replaced by the word “stars” in the second of the “heavens are gods” sources (Pseudo-Plutarch, I.7.12).

¹¹ G. E. R. Lloyd, *Magic, Reason, and Experience* (Indianapolis: Hackett, 1979); G. E. R. Lloyd, “The Invention of Nature,” in G. E. R. Lloyd, *Methods and Problems in Greek Science* (Cambridge: Cambridge Univ. Press, 1991) p. 417-434.

Many modern accounts tell us that the Presocratic philosophers (the loose grouping of early philosophers with whom Anaximander is usually categorized) were reacting against the mytho-poetic genealogies that populated the world with anthropomorphic deities, but when we try to chase this claim back to the ancient evidence itself, we find that that the idea of a reaction-against is very much a product of modern scholarship: the Presocratics themselves don't talk this way at all. There are a couple of potential exceptions, however, insofar as some of the Presocratics did single out Homer and Hesiod for criticism. Leaving the atomists aside for the moment, we find only three of these early philosophers explicitly critical of the poets. First, the sometimes-curmudgeonly early-fifth-century philosopher Heraclitus says in several places how one or the other of them was foolish (he adds that Homer should be thrashed), but he rarely gives us his explicit reasons, and so we cannot presume that naturalism was even part of what was at issue (and in the one instance where he fleshes out the objection, he tells us that Hesiod did not recognize that "the road up and the road down were one," for what that is worth).

The second explicit Presocratic reaction against Homer and Hesiod comes in Heraclitus' older contemporary Xenophanes, who mocks the traditional anthropomorphization of the gods by supposing that if horses had hands and could draw, then their gods would inevitably look like horses, and the gods of cows would look like cows. His motivation for this seems to have been that he thought Homer and Hesiod to have been impious for supposing that the gods had human foibles such as lust, jealousy, and a propensity for deception. It is significant that he nowhere objects to the idea of supernatural causation itself, but instead to a trivialization of the nobility and power of the gods. Indeed, Xenophanes' theology posits a supreme deity which, although it lacks human physical and emotional attributes, is explicitly said to have causal efficacy in the world:

Withdrawn from toil, he moves all things by the will of his mind.¹²

Elsewhere, we are also told that Xenophanes thought that god could “do everything he wishes,” and that god “sees and hears.”¹³ Thus, for all his bluster against the depiction of the gods in the great poets, Xenophanes’ objection has nothing to do with the primacy of naturalistic causation. Quite the opposite, in fact: it seems that he is arguing for an even more powerful and universal line of divine causation than Homer and Hesiod would allow.

Beyond Xenophanes and Heraclitus, the only other criticism of the poets we find in the (non-atomist) Presocratics is a cavil attributed to Thales about the date of the rising of the Pleiades.¹⁴ Thus far, the disagreement on naturalism between the Presocratics and the poets is clearly a later superposition on the evidence as we have it.

II. IMPERIUM

That the emphasis on naturalism at the birth of science may be barking up the wrong tree can further be shown by looking at how the sciences developed over the course of antiquity, and so I would like to jump ahead by a few hundred years, to the height of the Roman empire and the fully developed and very well attested natural philosophies of the early centuries AD, to see how divinity interacts with nature in the accounts that eventually grew out of those first philosophies. I hope to show that, not only was divinity immanent and active in nature in most accounts at this later date, but that it had been so all along.

If we look at the various philosophies on offer in imperial Rome, we find considerable overlap between a number of different schools on some of the most important

¹² Simplicius, *Phys.* 23.20. The verb for “move” here (*keradainei*) means to swing or brandish, as one might a sword, or to vibrate, as a bell; the poetic phrase “withdrawn from toil” (*apanenthe ponoio*) could either be meant to imply that the god himself needs make no effort to move things, or that he is far removed from the toils of this world in doing so. I tried to capture the ambiguity in the translation.

¹³ Pseudo-Aristotle, *On Melissus, Xenophanes, and Gorgias*, 977a35; Pseudo-Plutarch, *Miscellanies* 4.

¹⁴ Pliny, *NH* 18.213.

questions.¹⁵ This tendency has often been referred to (sometimes with disapproval) as the period's *eclecticism*. In the past couple of decades, however, scholars have increasingly begun to see this eclecticism less as the dabbling of dilettantes and more as a sophisticated shared intellectual background among the educated classes at Rome.¹⁶ There are, of course, exceptions, people who disagreed rather sharply on what the fundamental makeup of the world was (the atomist Epicureans), and those who were radically sceptical of the possibility of obtaining knowledge about the world at all (Pyrrhonians). We will return to these presently.

What we see with the remaining schools, Stoics, Aristotelians, and many Platonists, is a good deal of overlap on the broad strokes of how the world is composed, and this consensus is so widespread that often it is impossible to tell which (if any) school a particular scientific author has an affiliation with. Many Roman-era authors in fact betray no particular school affiliation but instead a general agreement on the standard philosophical and theological tropes of the age, coupled with their own individual elaboration of finer points when relevant. So the first-century-AD encyclopedist Pliny the Elder begins his *Natural History* with a paean to a cosmic divinity that might have come from the pen of almost any educated Roman:

The world, *this* (according to whatever other name you want to call the heavens by which everything is embraced round), is rightly believed to be a god, eternal, immeasurable, never born nor ever perishing. ... It is sacred, eternal, immeasurable, everything in everything. Indeed it is itself the everything, finite but as though infinite, certain in all things but as though

¹⁵ I have argued this point at length in D. Lehoux, *What Did the Romans Know?* (Chicago: Univ. of Chicago Press, 2012), esp. ch. 8.

¹⁶ J. M. Dillon and A. A. Long, eds., *The Question of Eclecticism* (Berkeley: Univ. of California Press, 1988); D. Sedley "Philosophical Allegiance in the Greco-Roman World," in *Philosophia Togata*, ed. M. Griffin and J. Barnes (Oxford: Oxford Univ. Press, 1989) p. 97-119; A. A. Long, "Roman Philosophy," in *The Cambridge Companion to Greek and Roman Philosophy*, ed. D. Sedley (Cambridge: Cambridge Univ. Press, 2003) p. 184-210; C. Gill, "The School in the Roman Imperial Period," in *The Cambridge Companion to the Stoics*, ed. B. Inwood (Cambridge: Cambridge Univ. Press, 2003) p. 33-58; Lehoux, *What Did the Romans Know?* (cit. n. 15).

uncertain, the whole within and without encompassed in itself, both the product of the nature of things, and the nature of things itself.¹⁷

This is not to impute every detail of this account to every Roman, and indeed even within what I have elsewhere called the ‘concentric’ schools of Stoicism, Aristotelianism, and middle Platonism there is considerable room for fine tuning, but any educated Roman would immediately recognize the assertions and motivations at play in this passage, and (again, with the exceptions of Epicureans and Pyrrhonists), would have found much to agree on. What is particularly striking for our present purposes is the emphasis on the rationality and the divinity of the cosmos as a whole.

We find this point emphasized again and again in Roman sources: Cicero, an Academic sceptic, finds something very like it “most compelling” at the conclusion of his *On the Nature of the Gods*; the greatest physician and polymath of his own day, Galen, sees a purposive divine agency behind the flawless design of human and animal bodies; Seneca, the author of an extended treatise on physics that has been the subject of considerable scholarly attention in recent years,¹⁸ again sees divine rationality as central to how the world works and is held together; Manilius, the great Augustan astrological author, sees knowledge of the heavens passed down to the first astronomers by god himself in what appears to be an act of divine revelation; Ptolemy fits the science of harmonics into a causal hierarchy with god as a cause of being at the top, and his fellow (and possibly contemporary) harmonic theorist Aristides Quintilianus goes so far as to say that the harmonies we perceive in nature were devised and created by a rational and unified divinity. At the outset to his *Almagest*, Ptolemy

¹⁷ Pliny, *NH* II.i.1-2.

¹⁸ See e.g., F. R. Berno, *Lo specchio, il vizio, e la virtù* (Bologna: Patron Editore, 2003); B. Inwood, *Reading Seneca* (Oxford: Oxford Univ. Press, 2005); H. M. Hine, “Rome, the Cosmos, and the Emperor in Seneca’s *Natural Questions*,” *Journal of Roman Studies*, 2006, 96: 42-72; H. M. Hine, “Seneca’s *Naturales Quaestiones* 1960-2005 (Part 1),” *Lustrum*, 2009, 51: 253-329; H. M. Hine, “Seneca’s *Naturales Quaestiones* 1960-2005 (Part 2),” *Lustrum*, 2010, 52: 7-160; H. M. Hine, *Lucius Annaeus Seneca: Natural Questions* (Chicago: Univ. of Chicago Press, 2010); Lehoux, *What Did the Romans Know?* (cit. n. 15); G. Williams, *The Cosmic Viewpoint* (Oxford: Oxford Univ. Press, 2012).

says that “the first cause of the first motion of the universe ... can be thought of as an invisible and motionless deity,” gesturing back, one suspects, to Aristotle’s account of the prime mover.

What we also find pervasively sown throughout Roman science is, as I have argued at length elsewhere, a conception of nature as lawlike, which conception frequently finds itself rooted in the idea of god as divine lawmaker and ruler of the cosmos. So when Vergil says that “nature has always imposed laws and edicts” to create natural regularity,¹⁹ we *could* try to make the case that the active verb “imposing” is merely metaphorical language, but the problem is that such talk is ubiquitous in accounts of the lawlikeness of nature in antiquity, and its ubiquity should make us wonder whether there isn’t more to it than mere metaphor. More importantly, in the (not infrequent) instances where we find the details fleshed out explicitly, we see the deliberate invocation of active divinity and we are forced to recognize that divine governance is in fact the underlying explanation, in a wide range of Roman philosophers, for nature’s regularity.

Divinities are frequently said to ‘govern’ or ‘rule’ over the world actively. Thus

Cicero:

So I perceive that it has been the opinion of the wisest that law has not been invented by the minds of men nor is it some kind of decree made by peoples, but something eternal, which rules the whole cosmos by the wisdom of its commands and prohibitions. Thus they say that this first and final law is the mind of god, compelling or forbidding everything by means of reason.²⁰

Or Seneca, where we see both creation and maintenance:

Nor did [the ancients] believe that Jupiter throws lightning-bolts with his hand, like the one we worship on the Capitol and in other temples. They recognize the same Jupiter as we do, the ruler and guardian of the universe, the mind and breath of the cosmos, the master and the craftsman of this creation, for whom every name will be appropriate. ... You wish to call him

¹⁹ *Georg.* I.60-1.

²⁰ *Leg.* II.8.

nature? You will not be wrong: he it is from whom everything is born, by whose breath we live. You wish to call him the cosmos? You are not mistaken: for he himself is all that you see, contained in his own parts, sustaining both himself and his creation.²¹

This latter passage is doubly interesting, as Seneca begins it with his assertion (repeated several times in the *Natural Questions*) that the ancients didn't really believe the silly stories about the gods that had been bandied about by the poets (to which we might add the rather surprising observation that we don't, in fact, have much evidence that he was wrong).²² We see Jupiter called "nature" and "cosmos," and are told that his role is as sustainer, container, genitor, master, mind, and breath of the cosmos, its ruler and guardian.

The gods are frequently characterized as running the cosmos "for the best" and this for the simple reason that they care about us and about the world as a whole. Thus in Cicero's *On the Nature of the Gods*, the Stoic character Balbus sees divine providence behind the clever construction of the cosmos throughout, from the stars on high down to the lowliest plants and animals on earth. Galen, in his great paean to the divine and beneficent goddess Nature, gives a this utterly charming proof:

Let me tell you what I felt the first time I saw an elephant.... In the place where other animals have a nose, the elephant has a narrow, free-swinging part, so long that it touches the ground. When I first saw this, I thought it superfluous and useless, but when I saw the animal using it like a hand, it no longer seemed so.... The elephant handles everything with the end of this part, folding it around what it receives, even the smallest coins, which it gives to its riders by stretching up to them its proboscis—for that is what they call the part of which we are speaking.... Now, since the animal performs the most useful actions with it, the part itself is shown to be useful, and Nature to be skilful.... And when the elephant died and I dissected the channels leading from the apertures up to the root of the part ... I admired the skill of Nature more than ever. When I also learned that in crossing a river or lake so deep that its entire body is submerged, the animal raises its proboscis high

²¹ *NQ* II.45. Translation modified slightly from Hine, *Natural Questions* (cit. n. 18).

²² For my argument that poetic genealogical accounts may well have been seen by contemporaries as fiction rather than being taken to be literal explanations of the creation of the world, see D. Lehoux, "Creation Myths and Epistemic Boundaries," *Spontaneous Generations*, 2009, 3: 28-34; D. Lehoux, *Ancient Science* (New York: Wiley, forthcoming). Compare also P. Veyne, *Les Grecs, ont-ils cru à leurs mythes?* (Paris: Éditions du Seuil, 1983) (English trans. by P. Wissing, *Did the Greeks Believe in Their Myths?* [Chicago: Univ. of Chicago Press, 1988]).

and breathes through it, I perceived that Nature is provident not only because she constructed excellently all parts of its body but also because she taught the animal to use them.²³

One could go on and on in this vein, but the point is abundantly clear: if the conventional wisdom of the birth of naturalism is right, then it has a lot of explaining to do for why and how all this divinity crept so widely and pervasively back into accounts of nature just a few hundred years later.

III. DEMARCATION

Creationist accounts—and here I follow David Sedley²⁴ in using the term ‘creationist’ in its broadest possible sense to refer to any account where the cosmos was made or shaped by some kind of superhuman agency—creationist accounts obviously present a straightforward challenge to the conventional wisdom, but one that is also perhaps all-too-easily circumvented, as the defender of naturalism can simply fall back on the definition of science as non-supernaturally causal. If it’s creationist, the argument would run, then it’s not science. Indeed, a similar tack will be straightforwardly applicable to worlds that are seen as “governed by” divinity, and ultimately to virtually any theological interaction with natural philosophy, and so we should perhaps outline our reasons for not trusting such a move in the first instance.

We have already seen an impressive list of ancient authors who invoke divinities in nature in one way or another: Ptolemy, Galen, Aristotle, Plato, Pliny, Cicero, Seneca, as well as a number of Presocratics (I made the case for something going on in Anaximander above, but we could also even more straightforwardly add Thales, Anaxagoras, Anaximenes, Heraclitus, Empedocles, Diogenes of Apollonia, all the Pythagoreans, Parmenides—himself

²³ Galen, *De usu partium*, XVII.i, M. T. May trans.

²⁴ D. Sedley, *Creationism and its Critics* (cit. n. 7).

possibly even a priest of Apollo,²⁵ and others). Even Democritus did not deny the gods, and in fact the only Presocratics I can find who may have done so are the otherwise unknown “Hippo” mentioned as *atheos*, “atheist,” in Simplicius, and also possibly Prodicus of Cos.²⁶

Among these, we find some, like Anaxagoras, Empedocles, Plato, and possibly others, who account for the existence of the world as we see it by supposing that it was created or shaped from preexisting matter by the action of a divinity. If the matter from which the cosmos is formed is sometimes said, as in Plato, to have been preexisting, that does not entirely ‘naturalize’ the account, at least insofar as divine agency is still responsible for the shape and characteristics of the world. A supernatural entity of one sort or another is clearly mucking about in the system, and ‘the natural order’ itself is seen to be non-self-starting. The chain of natural physical causation, that is, is seen as insufficient to explain its own beginning.

If we try now to use the natural/supernatural boundary distinction as the demarcation criterion for what will count as science, then clearly Plato, Empedocles, and Anaxagoras are going to fall onto the non-science side. Some scholars may be happy with this exclusion, but then we have to find some way of telling the story of the history of the early sciences that excludes or marginalizes both the author of the profoundly influential *Timaeus*, and the inventor of the famous four-element theory of physics. Earth, air, water, and fire, after all, occur nowhere together as a group before Empedocles. In biology, Empedocles also offers us the earliest version of something like a theory of evolution through natural selection, which, because he did not think the increasing organization of

²⁵ We have a single inscription from Parmenides’ home town of Elea that mentions him by name. It reads: “Parmenides, son of Pyres. Priest of Apollo the Healer, natural philosopher.” For commentary, see Lehoux, *Ancient Science* (cit. n. 22); publication of the inscription is in P. Ebner, “An Ancient Medical Centre Identified at Velia,” *Illustrated London News*, Aug. 31, 1963: 306-7. Note that in Ebner, 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.

²⁶ Simplicius, *Phys.* 23.24. On Prodicus, see D. Graham, *The Texts of Early Greek Philosophy* (cit. n. 3), p. 861.

matter over time to have been self-starting, was ultimately guided by a divine force. Attempts to scrub the divinity from this account have been made in the past, but the increasingly evident, prominent strain of mysticism and religious imagery that is emerging in Empedocles is no longer possible to ignore.

If we were to disbar these influential thinkers from science on these grounds, what then do we do with those who do not offer creationist accounts as such, but who instead see divinity as immanent in the cosmos in some way? Is the role of a governing or guiding nature any less of a supernatural intervention than that of a creator? Indeed, the lines between creation and governance are often very blurry, and it is difficult to tell with some authors whether some form of creationism may not be lurking in the background. So in Galen, Nature is said to be skillful and provident, actively designing anatomical structures, but we have no idea whether this is meant as a full-blown creationist account or whether something subtler is afoot. In those who stick to divine governance and deny creationism explicitly, we find their reasons are not because there is something teleologically suspicious about divine creators, but because their physics simply demands an eternally existent—and therefore uncreated—cosmos. So the Stoics argue that the universe periodically burns up as the moisture in it is consumed by the stars (a purely physical reaction) only to be reborn as order reimposes itself and the causal chain of cosmos-formation begins again. In their strictly deterministic physics, where identical causes have identical effects, where the cosmos unfolds in a rigorously predictable way, it would seem that divinity is not needed to kick-start the system. Nevertheless, they see god everywhere and the cosmos itself becomes a huge, divine, rational, and providential divinity.

Looking beyond creationism and divine governance, we find a third model, a little different from either, where some divine force gets called upon when the explanatory chain

of physical causation seems to need an originary push of some sort, but neither creationism nor divine governance is explicitly used to describe it. So Aristotle in the *Physics* posits an entirely naturalistic chain of causation for everything in the heavens and on earth, except that he can't find a way to have the stars be eternally self-moving. Since they are neither alive nor divided into parts, and since he cannot accept that they move according to their own wills (for then they could stop of their own accord too), he needs some external cause to account for stellar motion. In fact, he believes that he needs an actor *external to the whole system* to make it work.²⁷ This is no mere side-problem affecting only one part of the cosmos, however. It is, after all, the eternal motion of the stars that keeps the four elements down here on earth from settling out into a stagnant heap with earth at the center surrounded by concentric and unmoving spheres of water, air and fire. Left to their own devices, where earth and water move to the center of the cosmos, air and fire away from it, that is what the natural motions of the four elements would give us. It is only the constant stirring of the four sublunar elements by means of the whirling of the heavens that prevents this from happening, and the constant whirling of the heavens is what needs a boost of some sort from outside to keep it going. The entire dynamic of the cosmos, from the earth on up, then, needs some kind of external cause.

Here is where things start to get a little more esoteric. Because the first mover cannot itself be moved, Aristotle starts to employ increasingly abstract and philosophically technical considerations in order to describe its role. What we end up with is a first mover that is eternal, completely unified and without parts, without magnitude, and external to the cosmos as a whole. Finally, when he fleshes out the characteristics of the first mover in the

²⁷ *Physics* VIII 254b32 f.; see also *Cael.* 300b22; *MA* 699a12; *Metaph.* A.

Metaphysics,²⁸ we find Aristotle at long last calling it what one has suspected it of being all along: it is *divine*.

We have already seen Ptolemy toeing something like this line in the *Harmonics* and the *Almagest*. This is all well and good, but if we found the exclusion of the creationists on the grounds of supernaturalism even a little worrying, we should be very concerned at this point, for we now have some of the biggest names in early science unabashedly touting divine causation in the cosmos, not just coincidentally or metaphorically, but deeply and centrally. What, we might ask, would the history of ancient, medieval, and even Early Modern science look like without Aristotle, Galen, and Ptolemy?

Clearly, the line from naturalism to science is not nearly as simple and straightforward as the conventional-wisdom account would have it.

IV. CLEARER INSTANCES OF NATURALISM?

There are, however, two places in ancient science where naturalism in our sense seems to be more clearly and explicitly on the table and it will be worth looking at these before too hastily concluding that naturalism is a complete non-starter as an issue in ancient science and philosophy. These are in Epicurean atomism, where the gods are explicitly said to be disinterested in (or possibly even incapable of) interacting with the cosmos, and the Hippocratic text *The Sacred Disease*, where the author rails against quacks and incantation-healers in favour of what has often been championed as a purely naturalistic aetiology for the (now merely “so-called”) “sacred” disease.

A fairly typical reading of *The Sacred Disease* (*SD*) can be found in Jouanna’s (otherwise very good) *Hippocrates*. In it, Jouanna reads *SD* together with the opening of

²⁸ *Metaph.* 1074b1 f.

another Hippocratic text, *Diseases of Girls (DG)*, as offering an entirely naturalistic account of an ailment that probably (though possibly not exclusively) maps onto the disease we now know as epilepsy. The author of *DG* (we have no idea if he was the same author as that of *SD*) says that those who make offerings to Artemis for relief of the seizures that sometimes attack girls at the onset of puberty are “deceived.” Jouanna comments:

The opposition between physicians and soothsayers hinted at here is radical. The seers believe in the divine origin of the disease and attribute it to the virginal Artemis. Furthermore, once the crisis is passed, they recommend that offerings be made to the goddess to thank her and to appease her, thereby preventing a recurrence of the attack. As against this advice, the Hippocratic author makes his own recommendation: *unencumbered by taboos of morality or religion*, he urges the girl to marry as soon as possible in order that the obstacle preventing the blood from draining out be removed. The attack of the physician on the soothsayers, *whom he accuses of misleading the patient and her family*, is brief but vehement, and gives us a sense of how bitter the rivalry between physicians and soothsayers at the patient’s bedside must have been.²⁹

There are two aspects of this reading I am trying to draw out in the italics. First is just how strange the phrase “unencumbered by taboos of morality” is in this context. After all, what the physician is offering us as a “naturalistic” explanation, is that the girl’s menstrual blood needs to be prevented from blocking itself up in the diaphragm. The cure for this is marriage and pregnancy as quickly as possible after the onset of her first menses (the same recommendation is offered elsewhere in the Hippocratic corpus as a means of preventing the womb from wandering around the body and suffocating the girl: the frequent application of the husband’s semen keeps the womb from drying out and then going in search of moisture elsewhere in her body).³⁰ Far from being unencumbered, this is in fact a *spectacular* instance of the “naturalization” of cultural norms, where (male) Greeks were quite happy to find justification *in nature* for their common—and we would now say quite objectionable—

²⁹ J. Jouanna, *Hippocrates*, trans. M. B. DeBevoise (Baltimore, Johns Hopkins Univ. Press, 1999), p. 183. Emphasis mine.

³⁰ *Diseases of Women I*.

cultural practice of marrying their female children off as young as twelve or fourteen years old, usually to much older men.

The second aspect of this passage is that Jouanna's claim that the author of *DG* accuses the soothsayers of (apparently deliberately) misleading the women³¹ reads more into the passage than may be warranted, and a more careful reading takes some of the wind out of the sails of Jouanna's larger argument about the bitterness of the rivalry at the bedside.

Here is what the text of *DG* actually says:

When the girl regains her reason it is to Artemis that the women dedicate many offerings ... on the recommendation of the soothsayers, but they are deceived.³²

Notice what is not said here: the author does not say that the soothsayers mislead, but only that (some) people in the story are misled. The participle for "being misled" is indeed feminine,³³ and so would seem to apply primarily to the women, but it is a not-uncommon feature of Greek adjectival expressions that they agree in number and gender with the most important actors in a sentence even when they apply to all. Everyone in this sentence, the soothsayers *and* the women, seem to be the deceived parties. If we decline to read a deliberate conspiracy to mislead on the part of the soothsayers into this passage, then what we have is not an accusation of villainy, but a much more passive assertion that the correct explanation is the one our author offers. That is to say, without bringing considerably more evidence to bear on this passage, it is impossible to read some great physician-soothsayer bedside rivalry into this passage.

³¹ Perhaps he is following Lloyd, *Magic, Reason, and Experience* (cit. n. 11), p. 29, although Lloyd's position developed into something more nuanced in later works.

³² *Diseases of Girls I*, trans. modified from DeBevoise, who translates *exapateōmenai* as "completely deceived"—certainly this is a possible reading, but the extra force implied by "completely" is not necessarily inherent in the Greek, and for the sake of the present discussion it is perhaps best left as an open question.

³³ There are variations in the spelling across MSS, but they do all seem to agree on the feminine ending.

When we do cast around for outside evidence of the relationships between physicians and Greek religious practice, many scholars have been finding quite the opposite of rivalry. The cults of Asclepius and other healing deities, for example, see their rise and spread in concert with that of Hippocratic medicine, and there is increasing evidence that the two were seen to work together fruitfully throughout Greek antiquity. We now know that physicians had ritual responsibilities within Athenian cult practice, for example, and we have numerous dedications within Asclepian shrines that come from both doctors and their grateful (or hopeful) patients. So Nutton:

All this suggests that notions of hostility between human and divine healers have been much exaggerated. The author of *Sacred Disease*, far from denying the gods any role in healing, professes his own high notion of piety towards them. He approves of the types of purification offered by most shrines, whereby the divinity washes away the stains, faults, and impieties of everyday life. He even appears to concede the propriety of making a dedication to a god if one's condition were the result of some divine punishment ... although, of course, his investigation into epilepsy and mania has convinced him that these conditions have a purely natural cause.³⁴

This is a radically different reading of the argument in *SD* than we find in many authors, but a very sensible one when we take off the blinkers of our own prejudice, where science and rationality must be purely naturalistic. If we allow the author of *SD* his own terms and categories then he is in a position not unlike that of a modern physician faced with an anti-vaccinationist: there is an assertion that one group of people (“quacks and magicians,” but never in *SD* “religious people”) misunderstands the evidence, but nowhere an outright denial by the physician of the overarching premise (religious efficacy in the Hippocratic instance, comparable perhaps to our modern physician’s recognition that some drugs on the market are inefficacious or overly risky, just not the commoner vaccines). Indeed, I would, in light of *SD*’s conclusion even go so far as to soften Nutton’s apparent conclusion that the sacred

³⁴ V. Nutton, *Ancient Medicine* (New York: Routledge, 2004), p. 111-113.

disease is said to have a “purely” natural cause (though to be fair, I suspect that given his argument throughout his chapter Nutton did not mean it in our current sense). Here is how the author of *SD* words it:

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.³⁵

All are divine, and all human. That there is a natural cause to the sacred disease is not to deny divinity or divine agency in medicine, just to argue that we know what physical conditions in the body cause or bring on this particular disease, and that we can then try and physically counteract them to cure the patient. Nowhere—nowhere—is there a denial of the gods in medicine, as Nutton so forcefully shows.³⁶

Turning now to the other candidates for “pure” naturalism, the Epicurean atomists, we find that, finally, a good case can be made. (A caveat: what follows cannot be taken to straightforwardly apply to earlier forms of atomism [Democritus and Leucippus] where our evidence is more murky.³⁷ For present purposes I will stick to where the evidence is clear, which is to say, with Epicurus and Lucretius.) For the Epicureans, the cosmos was both infinite and eternal. They argued that all observable matter, all observable processes including life itself, could be accounted for by the interactions of invisible little particles called, from their indivisibility, *atoms*. These atoms whizzed around at inconceivable speed in an unlimited void, and their interactions were entirely due to collision and rebound (we’ll qualify the “entirely” momentarily, but for now it makes the point).

³⁵ [Hippocrates] *Sacred Disease*, xxi.

³⁶ V. Nutton, *Ancient Medicine* (cit. n. 34). One could further point to the roles of prayer in other Hippocratic texts such as *Regimen IV*, to the praise of the creator in one of our most impressive Hippocratic anatomical texts, *The Heart*, or to the assertion that all of nature is “set in order” by god in *Regimen I*, among many other passages.

³⁷ For what it is worth, Democritus does espouse praying for “lucky” images in one fragment (Sextus Empiricus, *Adversus mathematicos*, ix.19-24.).

There were several aspects to Epicureanism that made it a radical outlier to the other Hellenistic/Roman schools which, as was remarked earlier, found much to agree on. One is the acceptance of an infinite cosmos. Most (if not all) other schools seem to have settled on a finite spherical cosmos, ending at the sphere of the fixed stars. Another radical aspect of Epicureanism was its claim that there was continuous void in the cosmos. No other school outside of some medical theorists and a (related) handful of mechanists and post-Aristotelians seems to have thought void could possibly exist within the cosmos, and even those believed only in tiny “microvoids” (analogous, perhaps, to the little holes in sponges) that accounted for compressibility of some materials as well as air and steam pressure within mechanical devices.³⁸ The other widespread objection to Epicureanism, however, was considerably more serious. It was theological, and it plays directly into the current question about naturalism.

The Epicureans argued that it would be beneath the dignity of the gods to concern themselves with the petty affairs of mortals, and so they set up a theology that saw the gods living in perfect bliss in the interstices between the many worlds scattered throughout the infinite void of the universe. These gods paid no attention whatsoever to our lives or to our prayers and entreaties for help. Although they always insisted that the gods existed, Epicureans simultaneously denied that the gods cared in any way about us, or that they ever interacted in the running of the world. Indeed, if Lucretius is to be believed, it is precisely the fear of divine retribution and meddling that Epicureanism was meant to cure. So far, the Epicurean cosmos appears to cleave to the ideal of those who would seek a “pure” naturalism in antiquity.

³⁸ See S. Berryman, *The Mechanical Hypothesis in Ancient Greek Philosophy* (Cambridge: Cambridge Univ. Press, 1999); D. Lehoux, “All Voids Large and Small,” *Apeiron*, 1999, 32: 1-36.

Why, we might then ask, do the gods need to exist at all, if they never interact with the world, never answer our prayers, never show themselves in any way? After all, for the vast majority of ancient thinkers the proof of the existence of the gods was to be found in the natural order and beneficence of the cosmos.³⁹ If the order of the cosmos had nothing to do with divinities (and indeed was not seen as beneficent at all in Epicureanism), how could we prove that the gods existed in the first place? The Epicurean answer was more of an assertion than a proof, but it seems to have been sincere for all that: the gods stood as moral exemplars for us to follow. Their perfect happiness and untroubledness was something we could emulate down here on earth as *the* ethical ideal.

Now, I said earlier that there was a qualification to be made to the word “entirely” in my assertion that the interactions of Epicurean atoms were “entirely” due to collision and rebound. This is not quite true. In Lucretius, we find a very interesting argument that seems to stem from the (not always clear) Epicurean argument for falling bodies. In most other ancient physics, where the universe is finite and spherical and the earth sits at the center, falling bodies are not a problem at all: they simply move naturally toward the center of the cosmos. But in the infinite and therefore center-less Epicurean cosmos this will not work. The solution seems to have been to assert the primacy of a single direction called “down,” toward which all atoms in the universe move naturally unless they are otherwise impeded or pushed. This presents a problem for Lucretius, insofar as there is no reason for atoms to interact if they are all simply falling at the same speed and in the same direction. All we have is an infinite shower in parallel, and therefore non-interacting, trajectories. Lucretius’s solution—and it likely goes back to Epicurus—is to posit an (occasional? one-time?) random *swerve* to the trajectory of an atom, which causes it to incline in a different direction *for no*

³⁹ An excellent recent study of this is C. Ando, *The Matter of the Gods* (Berkeley: Univ. of California Press, 2008).

reason whatsoever and thus begin a chain-reaction of atomic collisions in atoms that would otherwise have just kept falling.⁴⁰ That the swerve is said to be “uncaused” we have from Cicero’s *De fato*, and the implication seems to be that, for Epicureans as for so many others, physical causation is not enough to explain all that we see in the universe. But where other schools brought in some form of divine agency as a solution, the Epicureans opted instead for randomness.

That this is a pretty serious compromise can be seen from how radically it breaks from the physicality of the rest of Epicurean physics, as well as from the widespread contemporary belief that physics should employ no uncaused motions (indeed in the most widespread physics of the Lucretius’s day, Stoicism, the universe was just the opposite of random: it was instead completely deterministic, all actions strictly fated).

Nevertheless, the Epicureans seem to have put a priority on natural explanations, and the swerve is certainly not what *we* would call supernatural, but it could well be argued that, as an uncaused motion, contemporaries would have seen it as at least *non*-natural, which may be an interesting complication in light of the question of this volume: is non-natural causation any more naturalistic than supernatural causation?

V. INSCRUTABILITY

Part of what drives that last question is my worry about a word that gets bandied about, almost invariably, in the common-wisdom accounts of naturalism that I have been challenging in this chapter. That word is *anthropomorphic*. Commentator after commentator who wants to see naturalism at the heart of the birth of philosophy and of science says that

⁴⁰ On the import of the phrase *sponte sua* in describing the swerve’s motion, see M. R. Johnson, “Nature, Spontaneity, and Voluntary Action in Lucretius,” in *Lucretius: Poetry, Philosophy, Science*, ed. D. Lehoux, A. D. Morrison, and A. Sharrock (Oxford: Oxford Univ. Press), p. 99-130.

what is being denied in ancient philosophy are the causal roles of *anthropomorphic* deities. we have already seen Algra deploy this qualification in the opening section of this chapter, but it is not difficult to find other instances:

These “theologians” were presumably, like Hesiod, prepared to invoke divine, probably anthropomorphic, agents in their accounts. Such agents are notably absent from early Ionian cosmology.⁴¹

There are two characteristic features of the Homeric-Hesiodic world-view that are of leading significance for a study of the ‘origins of science.’ These two features are connected, though one of them is very obvious and one rather less so. The obvious feature, overwhelmingly so to a modern reader, is the *centrality of anthropomorphic gods* [emphasis in original] (especially the Olympian gods) in the world. The less obvious feature is the *finitude* and the *vagueness about the limits* ... of the world.⁴²

Prior to science, ... when they attempted to explain their world, it was in terms of myths and anthropomorphic gods.⁴³

Why should anthropomorphism be an issue so consistently? No-one really elaborates, but I suspect that the problem has much to do with a quiet worry on the part of modern commentators with the fact of many of the theological commitments we have now seen on the part of ancient authors, and with a perfectly legitimate attempt to deal with what may well be a serious theological distinction. What I mean to say is that for all that I have tried to problematize and qualify naturalism, there is still an important point to be made that the gods of the philosophers are—universally, it would seem—not the same as the gods we think of when we think of Greek mythology. What I think anthropomorphism is meant to flag is just this distinction, but in a qualified way. No-one today would have much riding on what kinds of pictures any particular Greek may or may not have painted of his or her gods, which is to say that the issue is not one of idolatry or some such, but is instead more akin to

⁴¹ J. Warren, *Presocratics* (Berkeley: Univ. of California Press, 2007), p. 24.

⁴² E. Hussey, “The Beginnings of Science and Philosophy in Archaic Greece,” in *A Companion to Ancient Philosophy*, ed. M. L. Gill and P. Pellegrin (Oxford: Blackwell, 2006), p. 3.

⁴³ A. Gregory, *Eureka! The Birth of Science* (Duxford: Icon Books, 2001), p. 1.

what Xenophanes was worried about: the philosophers did not, it seems, believe the gods acted capriciously. This is surely correct, so far as it goes, and is, I suspect, the intuition at the heart of the universal modern emphasis on the rejection of anthropomorphism.

"I think you should be more explicit here in step two."

Fig. 1: Sidney Harris on method.

Where this point becomes interesting is when we try to open it out and ask what it is about capriciousness that is so objectionable. After all, when the agent is seen as a real one (as in dogs and humans) otherwise capricious action is not inherently or necessarily seen as un-natural. Indeed, much of 20th century biology, psychology, and behavioural science has been dedicated to disenchanting and naturalizing apparent capriciousness by reducing it to what we believe to be understandable and qualifiable (if normally hidden) structural, evolutionary, or acquired motivations. Of course, the wills of the gods are not subject to such reduction (nor to double-blinded empirical study) and so their capriciousness remains a kind of “pure” capriciousness, which is to say that their wills remain inscrutable, unpredictable, and, from where we stand, apparently random. If such capricious gods are allowed to interfere in the cosmos, then we end up in the situation of the old Sidney Harris cartoon where a miraculous occurrence shows up as a crucial step in an otherwise sound proof (see fig. 1). The universe becomes unpredictably arbitrary in ways no naturalist should be willing to bear.

If I am right in unpacking the anthropomorphism qualification in this way, then something interesting has happened to our story. Where the ancient philosophers who invoke divinities do so, nearly universally, to account for nature’s regularity, complexity, and beauty, but the one school we have found to be pure naturalists, the Epicureans, are the one school who allow for just this kind of capriciousness—the random, uncaused swerve—in the cosmos. It may not be a personalized kind of capriciousness (just the opposite), but for all that it is exactly the kind of explanation that “pure naturalism”—if such a thing even exists—was designed to avoid.