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Epicurus' Scientific Method

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I concede right away that Epicurus was not interested in scientific discovery for its own sake. But I claim that he did have a method by which he developed his conclusions about nature and that this method qualifies as a scientific method. As I shall try to show, his method consists in deducing what is non-apparent (ἄδηλον) from the phenomena. This procedure was, I propose, derived by Epicurus from the early atomists, who developed it in opposition to Parmenides' method of deducing what there is from "it is".

I shall first offer a brief summary of Epicurus' method of investigation and I shall then illustrate it by analyzing a section of argument from the Letter to Herodotus, starting with Epicurus' first deduction about what is non-apparent (that nothing comes to be from non-being) and ending with the deduction that there is void (Her. 38-40)

Epicurus proposes two rules of investigation. These rules are stated in a short procedural note which is prefixed by Epicurus to the summary of his physical doctrines in the Letter to Herodotus (37-38). The two rules state the two conditions which must be satisfied if an investigation is to occur; they jointly form an answer to the problem posed by Plato in the Meno. The first rule is the requirement for initial concepts; the second is the requirement for observation conducted in accordance with one's perceptions and feelings. Concepts are needed to serve as objects by reference to which proposals are judged. Observation is needed to provide evidence ("signs", σημεῖα) for what is not manifest. Diogenes Laertius (10.33) illustrates the first requirement by noting that we must have a concept of a horse (or an ox) to begin with in order to be able to judge, by proposing an answer, whether the thing in the distance is a horse (or an ox). The second requirement may be

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exemplified by the appearance of a thing in the distance; this appearance is evidence of what is as yet unknown. The investigation gets underway when a general notion is added to what is observed.

The examples which have just been cited illustrate only one of two types of investigation, - conjecture about what will appear. The other type of investigation is the investigation of what does not appear at all, or technically what is "non-apparent" (ἄδηλον). This is the type of investigation conducted by the student of nature and illustrated by Epicurus throughout the Letter to Herodotus and the Letter to Pythocles. What is non-apparent is investigated like an appearance for the future by the addition of a general notion to an observation. However, it differs in the method of verification. Whereas an expectation of a future appearance is verified by the manifestation of what was expected and falsified by its non-manifestation, an opinion about what is non-apparent is verified by its logical compatibility with what is observed and is falsified by its logical incompatibility with what is observed (Sextus Empiricus, adversus mathematicos, 7.211-216) In Epicurus' terminology, what is proposed concerning the non-apparent is "in agreement with" (σύμφωνον, Pyth. 86) or "in disagreement with" (διαφωνεῖ, Pyth 93; also "in conflict with", μαχόμενον, Pyth. 90, 96) the "phenomena" (φαινόμενα, Pyth. 90, etc; also "manifestations", ἐναργήματα, Pyth. 93, 96). Further, what is expected to appear (το προσμένον; the active form casts the expected thing as that which is itself expecting to be manifest) is confirmed by ἐπιμαρτύρησις - direct witnessing -, and is disconfirmed by οὐκ ἐπιμαρτύρησις . . . . no direct witnessing -; and what is non-apparent is confirmed by οὐκ ἀντιμαρτύρησις , - no counter-witnessing -, and is disconfirmed by ἀντιμαρτύρησις, - counterwitnessing. The component -μαρτύρησις indicates in each case that confirmation or disconfirmation belongs to a phenomenon or phenomena. According to this system of verification, a "sign" of what is expected to appear is not a proof of it, while there are signs of what is non-apparent which serve as proof.

Epicurus was notorious in ancient times for holding that all "perceptions" ("phenomena", "perceptibles","presentations") are "true" (Usener 247, etc.) This way of speaking is not strictly accurate; the commentators are loose in their use of "true", as they also are when discussing . . Stoic doctrine . . . . What Epicurus himself says (Her. 50-52) is that truth and falsehood consist in an opinion added to an appearance; truth and falsehood occur, Epicurus explains, when an opinion is confirmed or disconfirmed. Strictly, then, the Epicurean position should be expressed by saying that all perceptions (phenomena, perceptibles, presentations) equally verify an opinion. That this was in fact Epicurus' view has been denied by modern interpreters of Epicurus. There is general agreement that Epicurus did distinguish between reliable and unreliable perceptions, selecting the "near view"

or the "clear view" bypreference to the rest of perception as a standard of truth. This is, I think, quite mistaken. What has been termed the "near" or "clear" perception is simply the appearance that matches an expectation, no matter what the expectation. A standard example used by the ancients to illustrate Epicurus' method of verification for expectations is the round and square tower (Sextus Empiricus, adv. math. 7.208-9; cf Lucretius 4.353-363, Diogenes Laertius 10.34). It appears round from a distance and square from closeby. Is the perception of a square tower true or reliable, and the perception of a round tower not true or reliable? Not at all, as Sextus carefully explains (see also Lucretius 4.379ff). If upon seeing a round tower I form the opinion that when I will be twenty yards from the tower I will see a square tower, and subsequently at twenty yards away I see a square tower, my opinion is proved true. It has been confirmed by a near view, which has replaced a distant and less distinct view, but the confirmation has nothing to do with the intrinsic properties of the appearance but is due entirely to the fact that the appearance matches the expectation. If I had previously seen a dark object on the horizon and had ventured the opinion that upon coming a little closer I would see a round tower, and if I had then seen a round tower, my opinion would have been equally true. As Lucretius explains in connection with sight, perception does not present the "nature of things" (4.385). It makes no sense to demand from perception confirmation of whether the round tower is <u>really</u> a round tower; what is perceived as a round tower <u>is</u> a round tower, and if one would know the underlying nature of what is perceived, one must go to reason, - reason relying to be sure entirely on perception. Perception can confirm only an <u>expectation</u> of what will be perceived. Displaying exactly what is presently experience, each perception is as clear, as Plutarch says (<u>adversus Colotem</u> 1121a), as another.

The position of the Epicurean investigator is indeed similar to that of the prisoner in Plato's cave. That poses a serious difficulty for the validity of Epicurus' conclusions about what is non-apparent; but this difficulty should not obscure the fact that Epicurus does propose taking <u>all</u> phenomena alike as evidence of what is non-apparent. More will be said about this difficulty in connection with Democritus.

The scientist, then, will use as signs of what is non-apparent observations gathered in accordance with present appearances. These observations are phenomena, and all phenomena and only phenomena serve as signs. There is some question about the place of "feelings" (πάθη), which Epicurus mentions together with the perceptions as a standard of observation, in Epicurus' method. Diogenes (10.34) identifies the feelings as pleasure and pain, and says that they are a criterion of choice and avoidance (that is, of action). Diogenes' report is unlikely to be the whole truth; for in his procedural note Epicurus does assign to the feelings a role in the cognition of future occurrences and of what is non-apparent, and he mentions them

three times again in the Letter to Herodotus (twice in connection with the nature of the soul) together with the perceptions as a standard of investigation. I suggest that the "feelings" are the sensations which accompany all perceptions. They complement the perceptions in that they are reports of one's internal condition, whereas the perceptions are directed towards what is external to the percipient. As Epicurus views perception, the two standards have exactly the same truth value.

Epicurus distinguishes between scientific discoveries that are single explanations, that is, explanations not admitting of an alternative, and those that are one of a number of equally valid explanations. Plural explanations occur when more than one explanation agrees with the phenomena. Single explanations are those obtained by the falsification of the contradictory. The basic doctrines of Epicurus' physics are single explanations, as Epicurus points out (Pyth. 86, Her. 78 ff)

To turn now to Epicurus' physical doctrines, these may be divided into (a) the basic doctrines, presented by Epicurus in sections 38 to 44 of the Letter to Herodotus and summarized by him (Her. 45) as a "sufficient outline" of the nature of things, and (b) the elaboration of these doctrines. Epicurus' basic doctrines, as sketched by him in Her. 38 - 44, are: (1) nothing comes to be from non-being; (2) nothing is destroyed into non-being; (3) "the all" (το πᾶν) was always such as it now is, and always will be such; (4) the all is bodies and void; (5) bodies are, some of them combinations, and, for the rest, atomic and unchanging components of the combinations; (6) the all is infinite; (7) the all is infinite both in the number of bodies and in the size of the void; (8) the atoms have incomprehensibly many shapes, but not infinite shapes; (9) the atoms move continuously, without there being a beginning of motion. These conclusions form, I think, four main divisions, the first dealing with generation and destruction and, in sum, the uniformity of what there is (1, 2, 3), the second with the division of what there is (4, 5), the third with the shape of what there is (6, 7, 8), and the fourth with the movement of what there is (9); but I am obviously anticipating. What I propose is that Epicurus argues from the phenomena to an underlying reality which balances, feature for feature, Parmenides' being, and that through his series of deductions he moves from the acceptance of perceptible change to the conclusion, which Lucretius supplies as the conclusion of (9) (at 2.294-307), that perceptibles are ever the same.

But let's turn to a detailed examination. First, Epicurus offers the opinion "nothing comes to be from non-being", with the proof "for everything would come to be from everything without requiring seeds" (Her. 38). That is all the explanation that Epicurus provides. Fortunately, Lucretius presents detailed arguments. He has six in all,

the first of which is an elaboration of Epicurus' solitary proof. They are (1.159-214): if something were to come to be (I shall also use the translation "be generated") from non-being (Lucretius' nil must be translated as "non-being"), (1) everything would come to be from everything, (2) everything would come to be at every time, (3) everything would grow within every period of time, (4) plants and animals would thrive without having definite kinds of nourishment, (5) men would grow to super-human size, having super-human strength, and living a super-human lifetime, (6) all the produce of the fields would improve greatly without our toil. Proofs (4) - (6) may be regarded as special cases of the general proofs: (4) everything would be nourished from everything; (5) everything would grow to every extent; and (6) everything would improve in every place.

Lucretius makes clear by the use of the word genus and his examples that "everything" refers to kinds. He also amply demonstrates by his examples and the plain statement, in connection with his third proof, that "none of this is manifest (manifestum for ἐναργές)" that the opinion "nothing comes to be from non-being" is verified by the so-called "counterwitnessing" of the contradictory by the phenomena. The signs of the non-apparent fact that nothing comes to be from non-being are: (1) there are things which come to be from definite things (not from all things); (2) there are things which come to be at definite times (not at all times); etc. To take some of Lucretius' examples: (1) men do not come to be from the sea, nor fishes from the earth, nor birds from the sky; and (2) the rose comes to be in the springtime.

What precisely is the question about what is non-apparent that Epicurus undertakes to answer? To the perception, something is generated from what it is not; something has come to be which was not there before. But can we say the same about the non-apparent origin of the generated thing? Is something generated not only in its perceived aspect but also in its non-apparent nature from what it is not; to put it another way, is something generated in every respect from what it is not? That would be to be generated from non-being. That this is the way that Epicurus formulates the question is, I think, confirmed by Lucretius' elaboration of Epicurus' second opinion, that nothing is destroyed into non-being. Epicurus states this opinion by saying no more than "and if that which disappears were destroyed into non-being, all things would perish, there not being [things] into which they would be dissolved" (Her. 39). One of the ways in which Lucretius presents the possibility of a thing being destroyed into non-being is to say "if a thing were mortal in all its parts" (1.217), similarly he considers what would happen if old age "utterly destroyed, consuming all its matter" each thing that it eliminates (1.225-6). As destruction into non-being is the complete destruction of a thing ("complete" encompassing the non-apparent nature of the

thing), so generation from non-being is the complete generation of a thing. Indeed Epicurus tells us this much by adding, in the case of generation, "not requiring seeds", and in the case of destruction, "there not being [things] into which it would be dissolved". The seeds are to generation as the remnants of dissolution are to destruction: the seeds are the ungenerated starting-point of generation which make it false to say that a thing, considered in its entirety, is generated from what it is not, and the remnants of dissolution are the undestroyed end product of destruction which make it false to say that a thing, considered in its entirety, is destroyed into what it is not.

In his first two opinions, then, Epicurus places a limit upon generation and destruction. Though to the perception something is generated from what it is not and is destroyed into what it is not, an examination of the whole nature of what is generated and what is destroyed reveals that a thing is not generated from what it is not and is not destroyed into what it is not. With respect to its ultimate constituents, as recognized by reason, a thing that is generated is <u>not</u> generated and a thing that is destroyed is <u>not</u> destroyed. Epicurus' two opinions are paradoxical; what saves them from being self-contradictory, given the reality of phenomena, is that Epicurus is considering the underlying, non-apparent nature of the phenomena.

It is commonly said that "nothing is generated from non-being" and nothing is destroyed into non-being" are Eleatic principles, and that Epicurus took his first two opinions from the Eleatics. I don't think that the two principles are at all Eleatic as Epicurus sees them. Rather, if we look closely, I think it will appear that Epicurus' conclusions on generation and destruction are developed in a manner that is opposed to the way in which the Eleatics derived their conclusions. To examine only generation, Parmenides had argued on the assumption "it is" that it is not generated. Epicurus by contrast argues on the assumption that things are generated that nothing is generated from non-being. According to our text of Parmenides, Parmenides argued for his conclusion by supposing in addition that if it were generated, it would be generated from non-being. This claim follows indeed upon the assumption "it is"; for being would not be generated at all if it were generated from non-being. Parmenides accepts on the basis of his initial assumption what Epicurus argues against. Epicurus has no quarrel with Parmenides' logic, he might well admit that if "it is", it would be generated from non-being. As it is, Epicurus uses an initial assumption that leads him to the opposite view.
To press the comparison further, Parmenides argues, first, that since it would be generated from non-being, but non-being is inconceivable, it is not generated. For Epicurus, who sets out with the assumption that the phenomena are real, non-being is not at all inconceivable; hence Parmenides' argument will not do for him. Parmenides argues, secondly, that even supposing that it would start from "nothing", there would be no need for it to be generated at this time rather than at that time (I shall not defend this interpretation, which is

widely accepted, except by reference to the corresponding Epicurean argument). At this point, I think, the opposition between the Epicurean and the Parmenidean arguments on generation becomes conspicuous. Epicurus, as supplemented by Lucretius, replaces Parmenides' "nothing" by "everything" and Parmenides' "no time" by "every time". If something were generated from non-being, this is the Epicurean argument, everything would be generated from everything (the unstated assumption being that there would be no reason why anything should be generated from this rather than that), and further, since everything would be generated from everything, everything would be generated at every time (for there would be no reason why a thing would be generated at this time rather than that). Epicurus uses the principle of sufficient reason as though he had directly modeled his argument on Parmenides; but since he starts with the assumption that there are generated things, the use of the principle yields him results which are opposed to those of Parmenides.

Consider now Epicurus' third opinion: "the all (το πᾶν) was always such as it is now and always will be such" (Her. 39). Epicurus provides a proof which is likely corrupt as it stands in the text. The text reads: "for there is nothing into which it changes; for there is nothing besides the all which by entering into it would make the change". Lucretius omits this third opinion, but he indicates elsewhere (2.303-7, and 5.361-63 = 3.816-18) that there are two complementary possibilities, change by loss to something else, and change by acquisition from something else. Epicurus' text is easily emended to provide two complementary explanations rather than one explanation subordinate to another. In either case, however, the conclusion follows upon the first two opinions and the concept of "all". Since there is nothing apart from "all" that there is, and since, as just demonstrated, nothing is generated from non-being and nothing is destroyed into non-being, what is "all" is unchanging in time. Epicurus is not denying change in general (far from it), but rather change in the sum total of what there is.

In Epicurus' third opinion, the "all" has replaced Parmenides' "being" as that which is unchanging. Epicurus uses the ordinary concept of "all" as that which indeed has "nothing" outside it to provide a subject of changelessness; he makes no assumption about "being" and whether there is something (this would be "non-being") apart from "being". Epicurus' first two deductions have provided him with his first conclusion on changelessness, - the persistence in time of what there is. This changelessness will be filled out in the deductions that follow by further conclusions on changelessness, ending with the conclusion that the motions in the "all" are ever the same. This finally elaborated changeless "all" is, I think, Epicurus' answer to Parmenides' "being".

After showing that the "all" is unchanging, Epicurus continues his series of deductions by showing that the "all" is bodies and void (Her. 39-40; I accept the addition of "bodies and void", or better "bodies and touchless nature" (see Pyth 86) in the first sentence of this section). That there are bodies, Epicurus claims, is attested directly by perception. That there is void is a conclusion obtained by calculation, as Epicurus indicates; to be precise, the existence of void is proved by calculating the nature of perceptible bodies. Epicurus offers two proofs of the existence of void: first, if there were no void, bodies would not have anywhere to be; and secondly, if there were no void, bodies would not have anywhere to move through as they are observed to move. What I have called "void" is presented by Epicurus under three different names, the "empty" (or "void" proper, κένον), "space" (or "room", χώρα), and "touchless nature" (ἀναφης φύσις). These names correspond to different aspects of the same thing (compare Sextus Empiricus, adversus mathematicos 10.2), and under each of these aspects, the void contrasts with body (viewed as fully bodily): it is "empty" as opposed to "full"; it has room for another as opposed to not having room; and it can neither touch nor be touched, as opposed to being able to touch and be touched (see Lucretius 1.304, also 1.434). The void (as I call it) is non-body.

Epicurus proceeds by taking the existence of bodies as known directly by perception and then considering whether these existents, - perceptible bodies -, are entirely bodily or whether they are in part non-bodily. If they are in part non-body, it must be concluded that what exists is both body (now fully body) and non-body. Epicurus' procedure is the same as that which he used in his earlier investigation of generation and destruction. There he took generation and destruction to be immediately known by perception, and he inquired whether what is generated is generated in its entirety or whether there are ungenerated primary elements of generation, and similarly for destruction; and he concluded that generated things are not generated in their entirety, and likewise for destruction. Now he takes the existents of perception, - bodies -, and asks the question, - which makes sense only insofar as it concerns the non-apparent nature of these presumed existents -, whether what exists is in part what does not exist. His answer will be that what exists (bodies) is in part what exists (what is fully body) and in part what does not exist (non-body). In this, Epicurus limits the existence of bodies as before he limited generation and destruction.

Epicurus' analysis of the void offers for the first time in his series of deductions an opportunity to compare his method of argument directly with that of the early atomists. For Aristotle presents a number of arguments for the existence of void (Phys. 213b); since Aristotle singles out Leucippus and Democritus as proponents of the void just before presenting these arguments, the

arguments may be assigned to the early atomists themselves. Fortunately too, Lucretius presents three detailed arguments of the existence of the void (1.335-369), the first two of which, - the argument from perceived motion and the argument from the perceived absorption of one body by another, - form parallels to Aristotle's arguments. I shall focus here on the argument from motion. Concerning the argument from absorption, I shall say only that I think that Lucretius' argument covers the three proofs that Aristotle adds to the argument from motion, and that the Epicurean and the early atomist arguments on absorption are alike deductions from the perceived activity of bodies.

As for the argument from motion (which is, to be precise, an argument from locomotion, as Aristotle states), Lucretius presents this version: there is void; for otherwise things could in no way move, for "that which is the office of body, to obstruct and be in the way, would be present for all things at all times" with the consequence that nothing would be able to move forward (since nothing would start to yield); but as it is, many things are observed to move in many ways. (1.334 ff). Lucretius does not provide an argument in support of his claim that body would "obstruct all things at all times". Aristotle on the other hand does supply an argument showing why a body may not yield to another body. As far as I can see, there is no reason why Lucretius might not have accepted that support into his argument.

Aristotle's presentation of the argument is in summary: locomotion would not be, if there were not void, for what is full is unable to receive anything (for supposing that the full were to receive something, the smallest would receive the largest). Aristotle ends by attributing the argument (which he introduced as an argument used by the proponents of the void) to Melissus. In Aristotle's words, "Melissus indeed shows from this that the all (το πᾶν) is unmoving; for if it will move, it is necessary (he says) that there is void, and void is not something that is."

Aristotle is surely being imprecise in attributing the atomist argument to Melissus. For the atomists' argument depends on the assumption that there are bodies, and Melissus rejected the existence of body as of plurality. Aristotle indeed gives an accurate representation of Melissus' thought just after making the claim that Melissus used the same argument as the atomists, and this explanatory addition shows, I think, the grounds on which Aristotle made the attribution. Both the atomists and Melissus deduce the impossibility of locomotion from fullness, and this general similarity is sufficient for Aristotle to assign to Melissus the argument used by the atomists.

The similarity recognized by Aristotle conceals, I think, a fundamental difference between the argument of Melissus and that of the early atomists. Melissus argues on the assumption "it is"; the atomists argue on the assumption "bodies are". Correspondingly,

the "empty" of Melissus' argument is that which is empty of being; the "empty" of the atomists' argument is that which is empty of body. Melissus is forced by his assumption to suppose, first of all, that if it were to move, it would move into that which is empty of being (or equivalently, into non-being), and subsequently that if it ... would move into non-being, it would move into nothing and hence would not move at all. The atomists, who substitute bodily existence for Melissus' being, need not suppose that movement is movement into non-being, for while they have assigned existence to the things that they assume to move, - bodies -, they have not commited themselves to supposing that only bodies exist. Quite the contrary: the atomists argue that what is, - bodies -, move into that which is, - non-body- , and conclude in this way that what is, is bodies and non-body.

It should be noted that the bodies of the atomists' argument are not already atoms. To assume that they are atoms would be to presuppose the very thing that the argument is intended to show, - that there is void; for atoms are bodies separated by the void. From where, then, did the atomists take the assumption of bodily existence? I suggest that they took it from the phenomena, just as they took the assumption of bodily movement, by which they prove the existence of non-body, from the phenomena; - that is, that they argued in the same way as Epicurus, deducing what is non-apparent from the phenomena. What is the alternative? - That the atomists took from Parmenides thirr notion of being, as is traditionally suggested? Surely not. For quite apart from the question of whether Parmenides' being is bodily or not, the Parmenidean assumption "it is" would commit the atomists to holding that non-being is not. The atomists claimed that "being (το ὄν) is no more than non-being (το μη ὄν)", identifying "being" with body and "non-being" with void. How did they justify this claim? Not, I think, by taking over anything of Parmenides' being, but, as I see it, by using the opposed method of deducing what there is from the phenomena.

So far, then, in the analysis of Epicurus' deductions there has been some indication that not only Epicurus, but also the predecessors from whom he took his basic doctrines (with certain modifications appearing later on in the series of deductions), developed the atomic doctrine by deduction from the phenomena. The examination needs to be continued through the rest of Epicurus' and the early atomists' theories for further testing. That's not feasible now. However, a few words may be said in conclusion concerning Democritus' views on knowledge. Democritus is attested to have held that "the truth is in φαίνεσθαι" (Generation and Corruption, 315a), "what is true is the phenomenon" (On the Soul 404a), and (as one of a number of diverse thinkers) that "what appears in accordance with perception is necessarily true" (Metaphysics 1009b), further that knowledge by the senses is

covered in darkness and unauthentic (σκοτίη, B 11), that sweet, bitter, and so forth, are "by convention" whereas "in truth there are atoms and void" (B 9), and further that man is "separated from the truth" (B 6) and that "either nothing is true or what is true is non-apparent to us" (Metaphysics 1009b). The clue to how these varied testimonies may be reconciled is provided, I think, by Sextus' report that while Democritus in his book Confirmations promised to assign the power of proof to the perceptions, he is nonetheless found to condemn them (B 9), along with the excerpt from Galen in which Democritus has the senses accuse the mind: "Miserable mind who after taking the proofs from us overthrow us; our fall is your overthrow" (B 125). Democritus' attested faith in the senses and his rejection of them, and his despair of discovering the truth together with the claim that truly there are atoms and void have, I think, this explanation: Democritus initiates his investigation into what there is by assuming the phenomena to be real; subsequently, the theory deduced from the phenomena shows that the phenomena are not real, and by overthrowing the phenomena destroys itself. Epicurus begins in the same way by assuming the phenomena to be real, but in contrast to Democritus continues to defend the reality of the phenoma, in spite of the atomic theory.