Episode One Hundred Twenty - Letter to Herodotus 09 - Epicurus' Rejection of Infinite Divisibility

Post by “Cassius” of April 30, 2022 at 9:46 AM

Welcome to Episode One Hundred Twenty of Lucretius Today.

This is a podcast dedicated to the poet Lucretius, who wrote "On The Nature of Things," the only complete presentation of Epicurean philosophy left to us from the ancient world.

I am your host Cassius, and together with our panelists from the EpicureanFriends.com forum, we'll walk you through the ancient Epicurean texts, and we'll discuss how Epicurean philosophy can apply to you today. We encourage you to study Epicurus for yourself, and we suggest the best place to start is the book "Epicurus and His Philosophy" by Canadian professor Norman DeWitt.

If you find the Epicurean worldview attractive, we invite you to join us in the study of Epicurus at EpicureanFriends.com, where you will find a discussion thread for each of our podcast episodes and many other topics.

Today we continue our review of Epicurus' letter to Herodotus, and we move further into fundamental physics and discuss issues related to the question of whether matter can be infinitely divided.

Now let's join Joshua reading today's text:

Bailey

Moreover, we must not either suppose that every size exists among the atoms, in order that the evidence of phenomena may not contradict us, but we must suppose that there are some variations of size. For if this be the case, we can give a better account of what occurs in our feelings and sensations.

[56] But the existence of atoms of every size is not required to explain the differences of qualities in things, and at the same time some atoms would be bound to come within our ken and be visible; but this is never seen to be the case, nor is it possible to imagine how an atom could become visible.

Besides this we must not suppose that in a limited body there can be infinite parts or parts of every degree of smallness. Therefore, we must not only do away with division into smaller and smaller parts to infinity, in order that we may not make all things weak, and so in the

composition of aggregate bodies be compelled to crush and squander the things that exist into the non-existent, but we must not either suppose that in limited bodies there is a possibility of continuing to infinity in passing even to smaller and smaller parts.

[57] For if once one says that there are infinite parts in a body or parts of any degree of smallness, it is not possible to conceive how this should be, and indeed how could the body any longer be limited in size? (For it is obvious that these infinite particles must be of some size or other; and however small they may be, the size of the body too would be infinite.) And again, since the limited body has an extreme point, which is distinguishable, even though not perceptible by itself, you cannot conceive that the succeeding point to it is not similar in character, or that if you go on in this way from one point to another, it should be possible for you to proceed to infinity marking such points in your mind.

[58] We must notice also that the least thing in sensation is neither exactly like that which admits of progression from one part to another, nor again is it in every respect wholly unlike it, but it has a certain affinity with such bodies, yet cannot be divided into parts. But when on the analogy of this resemblance we think to divide off parts of it, one on the one side and another on the other, it must needs be that another point like the first meets our view. And we look at these points in succession starting from the first, not within the limits of the same point nor in contact part with part, but yet by means of their own proper characteristics measuring the size of bodies, more in a greater body and fewer in a smaller.

[59] Now we must suppose that the least part in the atom too bears the same relation to the whole; for though in smallness it is obvious that it exceeds that which is seen by sensation, yet it has the same relations. For indeed we have already declared on the ground of its relation to sensible bodies that the atom has size, only we placed it far below them in smallness. Further, we must consider these least indivisible points as boundary-marks, providing in themselves as primary units the measure of size for the atoms, both for the smaller and the greater, in our contemplation of these unseen bodies by means of thought. For the affinity which the least parts of the atom have to the homogeneous parts of sensible things is sufficient to justify our conclusion to this extent: but that they should ever come together as bodies with motion is quite impossible.

HICKS

Again, you should not suppose that the atoms have any and every size, lest you be contradicted by facts; but differences of size must be admitted; for this addition renders the facts of feeling and sensation easier of explanation.

[56] But to attribute any and every magnitude to the atoms does not help to explain the differences of quality in things; moreover, in that case atoms large enough to be seen ought to have reached us, which is never observed to occur; nor can we conceive how its occurrence

should be possible, i. e. that an atom should become visible. "Besides, you must not suppose that there are parts unlimited in number, be they ever so small, in any finite body. Hence not only must we reject as impossible subdivision ad infinitum into smaller and smaller parts, lest we make all things too weak and, in our conceptions of the aggregates, be driven to pulverize the things that exist, i. e. the atoms, and annihilate them; but in dealing with finite things we must also reject as impossible the progression ad infinitum by less and less increments.

[57] For when once we have said that an infinite number of particles, however small, are contained in anything, it is not possible to conceive how it could any longer be limited or finite in size. For clearly our infinite number of particles must have some size; and then, of whatever size they were, the aggregate they made would be infinite. And, in the next place, since what is finite has an extremity which is distinguishable, even if it is not by itself observable, it is not possible to avoid thinking of another such extremity next to this. Nor can we help thinking that in this way, by proceeding forward from one to the next in order, it is possible by such a progression to arrive in thought at infinity.

[58] We must consider the minimum perceptible by sense as not corresponding to that which is capable of being traversed, i.e. is extended, nor again as utterly unlike it, but as having something in common with the things capable of being traversed, though it is without distinction of parts. But when from the illusion created by this common property we think we shall distinguish something in the minimum, one part on one side and another part on the other side, it must be another minimum equal to the first which catches our eye. In fact, we see these minima one after another, beginning with the first, and not as occupying the same space; nor do we see them touch one another's parts with their parts, but we see that by virtue of their own peculiar character (i.e. as being unit indivisibles) they afford a means of measuring magnitudes: there are more of them, if the magnitude measured is greater; fewer of them, if the magnitude measured is less.

[59] We must recognize that this analogy also holds of the minimum in the atom; it is only in minuteness that it differs from that which is observed by sense, but it follows the same analogy. On the analogy of things within our experience we have declared that the atom has magnitude; and this, small as it is, we have merely reproduced on a larger scale. And further, the least and simplest things must be regarded as extremities of lengths, furnishing from themselves as units the means of measuring lengths, whether greater or less, the mental vision being employed, since direct observation is impossible. For the community which exists between them and the unchangeable parts (i.e. the minimal parts of area or surface) is sufficient to justify the conclusion so far as this goes. But it is not possible that these minima of the atom should group themselves together through the possession of motion.

YONGE

Hence these somethings capable of being diversely arranged must be indestructible, exempt from change, but possessed each of its own distinctive mass and configuration. This must remain.

[55] "For in the case of changes of configuration within our experience the figure is supposed to be inherent when other qualities are stripped off, but the qualities are not supposed, like the shape which is left behind, to inhere in the subject of change, but to vanish altogether from the body. Thus, then, what is left behind is sufficient to account for the differences in composite bodies, since something at least must necessarily be left remaining and be immune from annihilation. "Again, you should not suppose that the atoms have any and every size, lest you be contradicted by facts; but differences of size must be admitted; for this addition renders the facts of feeling and sensation easier of explanation.

[56] But to attribute any and every magnitude to the atoms does not help to explain the differences of quality in things; moreover, in that case atoms large enough to be seen ought to have reached us, which is never observed to occur; nor can we conceive how its occurrence should be possible, i. e. that an atom should become visible. "Besides, you must not suppose that there are parts unlimited in number, be they ever so small, in any finite body. Hence not only must we reject as impossible subdivision ad infinitum into smaller and smaller parts, lest we make all things too weak and, in our conceptions of the aggregates, be driven to pulverize the things that exist, i. e. the atoms, and annihilate them; but in dealing with finite things we must also reject as impossible the progression ad infinitum by less and less increments.

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Post by “Cassius” of April 30, 2022 at 9:54 AM

The podcast subject next up is on the indivisibility of the atom. This has lots of implications that are not necessarily discussed in this section of the text, so if anyone has issues that we should be sure to include, please add them to this thread.

Post by “Joshua” of May 1, 2022 at 8:52 AM

https://scholarship.claremont.edu/cgi/viewcontent.cgi?article=1316&context=jhm

I recall reading this article some time back, some parts of it may be worth discussing.

Post by “Joshua” of May 1, 2022 at 9:00 AM

Also: Torquatus section on Mathematics and Geometry (very brief):

> Quote
>
> [72] Was he the man to spend his time in conning poets as I and Triarius do on your advice, when they afford no substantial benefit, and all the enjoyment they give is

> childish in kind, or was he the man to waste himself, like Plato, upon music, geometry, mathematics and astronomy, which not only start from false assumptions and so cannot be true, but if they were true would not aid us one whit towards living a more agreeable, that is a better life? Was he, I ask, the man to pursue those arts and thrust behind him the art of living, an art of such moment, so laborious too, and correspondingly rich in fruit? Epicurus then is not uneducated, but those persons are uninstructed who think that subjects which it is disgraceful to a boy not to have learned, are to be learned through life into old age!

And;

Infinite mathematical detail at the subatomic scale;

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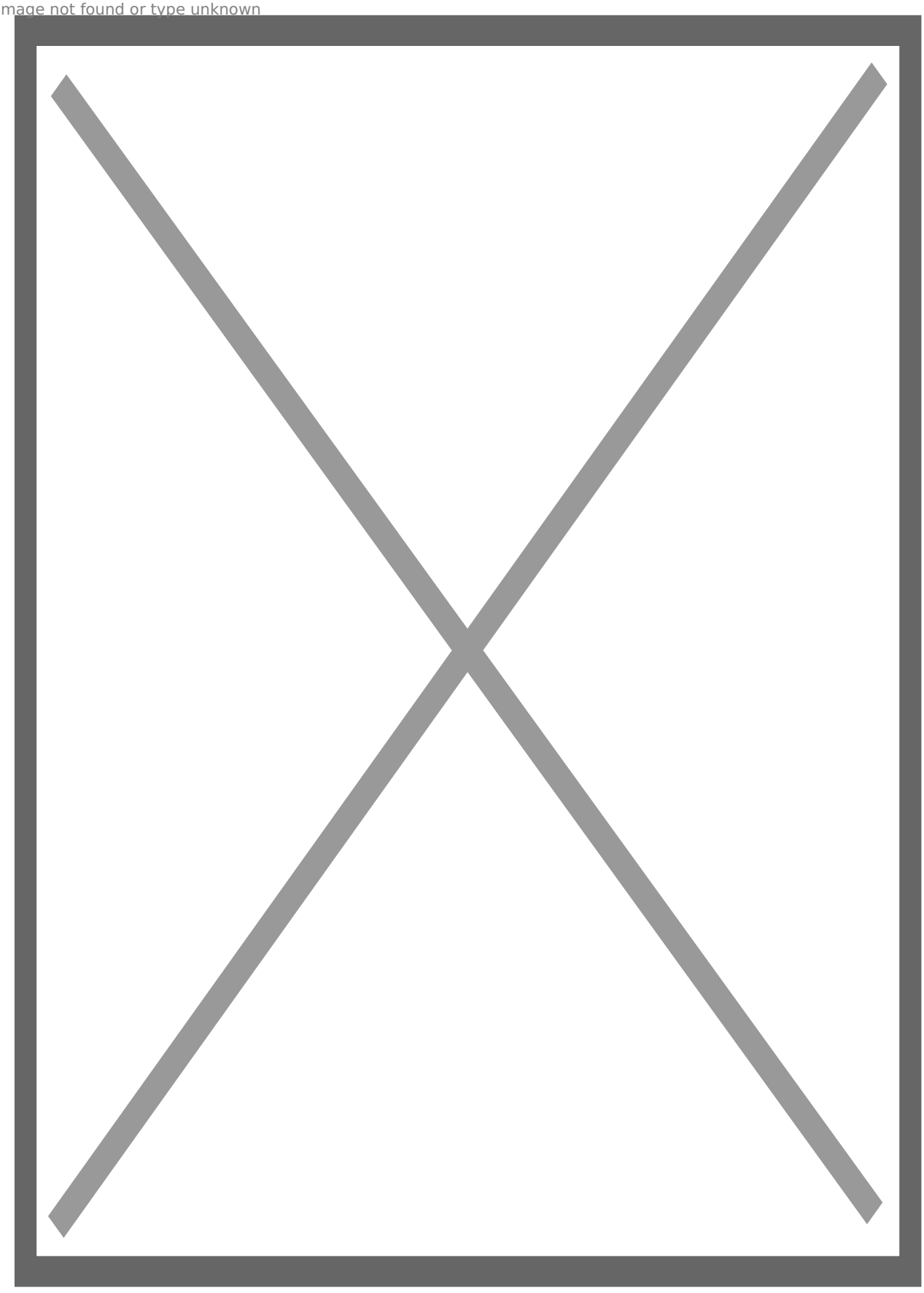

https://www.epicureanfriends.com/thread/2490-episode-one-hundred-twenty-letter-to-herodotus-09-epicurus-rejection-of-infinite/

Fractal - Wikipedia
en.wikipedia.org

Post by “Cassius” of May 1, 2022 at 11:20 AM

More links:

Wikipedia: Infinite Divisibility: https://en.wikipedia.org/wiki/Infinite_divisibility

Wikipedia: Zeno's Paradoxes: https://en.wikipedia.org/wiki/Zeno%27s_paradoxes

Zeno's paradoxes are a set of philosophical problems generally thought to have been devised by Greek philosopher Zeno of Elea (c. 490–430 BC) to support Parmenides' doctrine that contrary to the evidence of one's senses, the belief in plurality and change is mistaken, and in particular that motion is nothing but an illusion. It is usually assumed, based on Plato's *Parmenides* (128a–d), that Zeno took on the project of creating these paradoxes because other philosophers had created paradoxes against Parmenides' view. Thus Plato has Zeno say the purpose of the paradoxes "is to show that their hypothesis that existences are many, if properly followed up, leads to still more absurd results than the hypothesis that they are one."[1] Plato has Socrates claim that Zeno and Parmenides were essentially arguing exactly the same point.[2] Some of Zeno's nine surviving paradoxes (preserved in Aristotle's *Physics*[3][4] and Simplicius's commentary thereon) are essentially equivalent to one another. Aristotle offered a refutation of some of them.[3] Three of the strongest and most famous—that of Achilles and the tortoise, the Dichotomy argument, and that of an arrow in flight—are presented in detail below.

Zeno's arguments are perhaps the first examples of a method of proof called *reductio ad absurdum*, also known as proof by contradiction. They are also credited as a source of the dialectic method used by Socrates.[5] Some mathematicians and historians, such as Carl Boyer, hold that Zeno's paradoxes are simply mathematical problems, for which modern calculus provides a mathematical solution.[6] Some philosophers, however, say that Zeno's paradoxes and their variations (see Thomson's lamp) remain relevant metaphysical problems.[7][8][9] The origins of the paradoxes are somewhat unclear. Diogenes Laërtius, a fourth source for information about Zeno and his teachings, citing Favorinus, says that Zeno's teacher Parmenides was the first to introduce the paradox of Achilles and the tortoise. But in a later passage, Laërtius attributes the origin of the paradox to Zeno, explaining that Favorinus disagrees.[10]

Post by “Joshua” of May 1, 2022 at 12:25 PM

More adventures of the tortoise and the hare:

"Draw!" *[literally, "Draw your weapon!] educe; from educere, to draw or to lead--second person singular present active imperative: and telum; dart, javeline, projectile--accusative singular*

"Pew!" *Latin "v" pronounced "u", "oo"*

"Haha! I am the swiftest of all! *celerrimus; superlative of celer, "swift", so "swiftest": omnium; from omnia, all things--genitive plural: sum, I am*

"Slow and steady..." *adverbs, both are vocative and singular*

This is my translation; feel free to educate me! (late Middle English: from Latin educat- 'led out', from the verb educare, related to educere 'lead out')

Post by "Cassius" of May 1, 2022 at 12:29 PM

> Quote from Cassius
>
> Some mathematicians and historians, such as Carl Boyer, hold that Zeno's paradoxes are simply mathematical problems, for which modern calculus provides a mathematical solution.[6] Some philosophers, however, say that Zeno's paradoxes and their variations (see Thomson's lamp) remain relevant metaphysical problems

We just finished recording the podcast and this statement from Wikipedia stands out for me. We did our best to make the issues understandable and relevant, and this quote gets to the issue of why I think Epicurus thought the subject was important: We aren't simply discussing

"mathematical problems" - we're illustrating that some very compelling arguments can be drawn up on many issues that would make you doubt your ability to control your life and be confident in reasoning based on the senses. Two other quotes come to mind:

This one I included in the podcast at the end:

[500] And if reason is unable to unravel the cause, why those things which close at hand were square, are seen round from a distance, still it is better through lack of reasoning to be at fault in accounting for the causes of either shape, rather than to let things clear seen slip abroad from your grasp, and to assail the grounds of belief, and to pluck up the whole foundations on which life and existence rest. For not only would all reasoning fall away; life itself too would collapse straightway, unless you chose to trust the senses, and avoid headlong spots and all other things of this kind which must be shunned, and to make for what is opposite to these. Know, then, that all this is but an empty store of words, which has been drawn up and arrayed against the senses. (Bailey)

This one I didn't include but also seems relevant from Book One:

[102] But still I fear your caution will dispute the maxims I lay down, who all your life have trembled at the poets' frightful tales. Alas! I could even now invent such dreams as would pervert the steadiest rules of reason, and make your fortunes tremble to the bottom. No wonder! But if Men were once convinced that death was the sure end of all their pains, they might with reason, then, resist the force of all Religion, and contemn the threats of poets. Now, we have no sense, no power, to strive against prejudice, because we fear a scene of endless torments after death. (Brown)

Post by “Cassius” of May 6, 2022 at 9:21 AM

Episode 120 of the Lucretius Today Podcast is now available. Today we continue in the Letter to Herodotus to discuss the issue of infinite divisibility of atoms. Please let us know any comments or questions you have in the thread below, and please be sure to subscribe to the podcast on your telephone or other podcast aggregator.

https://www.spreaker.com/episode/49689039

Post by “SimonC” of June 21, 2022 at 8:04 AM

I'm partway through the episode, but regarding Zeno's motivation: I've understood that he was trying to come up with a rational argument for the teachings of Parmenides, who claimed that all things are one and therefore the perception of change or movement must be an illusion.

But Parmenides claimed to have come by this knowledge through mystical revelation. This would put Zeno in the same category as Anselm of Canterbury, trying to come up with post hoc justification of an essentially religious belief. No wonder that it is not very convincing.

The status of mathematics is interesting to think about. I wonder if it is possible to figure out that, for example, the sum of an infinite series can be finite purely a priori. When Zeno's contemporaries knew that he was wrong, I suspect they knew this from their sensory experience, not from spotting an error in his mathematics.

Post by “Cassius” of June 21, 2022 at 8:45 AM

If you come up with some good summary observations, be sure to post them. This issue - that mathematics is a model but not reality itself - can be stated all sorts of ways but it is difficult for a lot of people to grasp, and new ways to make the issue more clear are always welcome.

Post by “Martin” of June 22, 2022 at 5:59 AM

> Quote
>
> "I wonder if it is possible to figure out that, for example, the sum of an infinite series can be finite purely a priori."

In mathematics, series means the sum of a sequence. Therefore, I assume you mean ".. the sum of an infinite sequence can be finite purely a priori."

There is an easy proof that the infinite geometric series 1 + r + r*r + r*r*r + ... is 1/(1 - r) for r<1. This is finite for all cases r<1. (With r as the ratio of the speed of the tortoise to the speed of Achilles and multiplied by the head start, 1/(1 - r) solves Zeno's paradox. Zeno formulates the paradox such that he arbitrarily limits the consideration to the interval before Achilles reaches the tortoise.)

For r equal to or greater than 1, the sum of the infinite geometric sequence 1, r, r*r, r*r*r + ... is infinite.