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Anaxagoras' Theory of Change:  
a Response to Parmenides\*

Simplicius Phys. 163.18: "In the first book of his Physics, Anaxagoras plainly declares that coming-to-be and perishing are coming together and coming apart. This is what he writes: 'Coming-to-be and perishing are customarily believed in incorrectly by the Greeks, since nothing comes-to-be or perishes, but rather it is mingled together out of things that are, and again comes apart. Thus they would be correct to call coming-to-be being mingled together, and perishing coming apart.'"<sup>1</sup>

Empedocles: "When they [sc. the four roots--earth, water, air, fire] are mingled together to form a man and so come to light [??], or to form the race of wild beasts, or of plants, or of birds, then men speak of 'coming-to-be'; and when they come apart, then they speak of 'ill-fated death'. They are not right to call them so, but I myself comply with the customary belief."<sup>2</sup>

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These two fragments plainly make the same point, apart from the concession in Empedocles' last line. In addition, the verbal parallels are numerous: "coming-to-be" (γίνεσθαι); "mingling" (σμίσιγεται, μιγέντα); "coming apart" (διακρίνεται, ἀποκριθῶσι); "customary belief" (νομίζουσι, νόμος). Almost all commentators agree that both philosophers are presenting a similar solution to the same problem--the problem posed by the argument of Parmenides B 8.1-21, which culminates in the conclusion "Hence coming-to-be is extinguished, and perishing is unintelligible."<sup>3</sup> Both philosophers accept this conclusion, but argue that physical change can nevertheless be described without writing contradictions or nonsense, so long as it is interpreted as the "mingling together" and "coming apart" of "things that are" before, during and after the change. I shall take this as an agreed starting point.

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\*This paper is a revised and shortened version of a paper entitled "Anaxagoras and the Eleatics" which I presented to the University of Alberta's "Workshop" on the Eleatics, at Edmonton, Alberta, in November 1974.

The recurrence of so many of the same words in two such short passages may suggest that one writer had read the other before writing his version, in spite of the distance between their home towns (something like 800 nasty sea miles), and the figurative distance between their cultural milieus. But let us reserve judgment about that; it is possible that the common purpose of the two passages is sufficient to explain the echoes.

Assuming, then, that Anaxagoras was responding to Parmenides, I shall examine the nature of his response. I am aiming to show that the fragments and other evidence can and should be interpreted as belonging to a system whose main purpose is to provide an apparatus for explaining change without "coming to be" or "perishing". The system makes one assumption which was denied by Parmenides: that it is possible and legitimate to "set up two forms in the mind for naming" (Parmenides B 8.53).<sup>4</sup> That is to say, when sense perception distinguishes one thing as different in some way from another, according to Anaxagoras as opposed to Parmenides we can give an account of those two things, preserving their difference and duality, without breaking any epistemological rule. I am not sure whether Anaxagoras had, or even thought he had, any argument against Parmenides on this point; it may be that he simply contradicted Parmenides. Given this assumption, it was possible for Anaxagoras to introduce motion without any further assumptions (except Mind) since Parmenides, as it appears, had no argument against the possibility of motion except that it is impossible to distinguish any one thing from another at all, and therefore impossible to distinguish any place from any other.

I shall argue that we can understand Anaxagoras' theory of matter as a reasonable development from these first principles. Part of my motive in this paper is to argue against those who have written that Anaxagoras was responding not only to Parmenides, but also to Zeno.<sup>5</sup> The case for rejecting their thesis is fairly strong, I believe, but not conclusive. Since my interpretation of the theory of matter can stand independently of my case for dating Zeno after Anaxagoras, I have put the arguments about Zeno into an appendix.

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Perhaps I can make a start from the concept that has caused most trouble to those who try to explain Anaxagoras: rerum quam dicit homoiomerian, as Lucretius puts it, no doubt surprised and happy to find that it fits into a Latin hexameter. The abstract noun homoiomeria is attributed to Anaxagoras himself by Simplicius, Aetius, and other commentators, and it also turns up in the plural as a concrete noun, for which English historians use the version "homoiomerics".<sup>6</sup>

No word of this type occurs in the fragments.<sup>7</sup> The earliest attribution of anything comparable to Anaxagoras is in Aristotle, who says more than once:<sup>8</sup> "Anaxagoras made the homoiomere [neuter plural adjective--the homoiomerous things] elements." In one place<sup>9</sup> he explains this phrase: "for example, bone, flesh, marrow and the other things of which every part is synonymous with the whole." This is a familiar piece of Aristotelian terminology: he works with a three-tiered analysis of matter, of which the first consists of the simple bodies (earth, water, air and fire), the second the homoiomerous bodies, and the third physical organs like arms and hands. The criterion for distinguishing the first bodies from the second is that the first cannot be said to be made of the second, whereas the second are made of the first. The criterion for distinguishing the second from the third is that the third do not, whereas the second do, break up into parts synonymous with the whole. Parts of a face are not face or faces, but parts of blood and bone are blood and bone [a difficult borderline case is suggested by the unpleasant monster in the story that was made of lip]. Please observe in passing that the second criterion does not make any distinction between the first tier and the second: earth, water, air and fire are as homoiomerous as blood and bone.

Aristotle puts a determinate list of things into this second class. It includes animal tissues such as bone and blood, vegetable matter such as wood and bark, and minerals such as gold and iron.<sup>10</sup>

Now, does Aristotle mean only that Anaxagoras treats all the items on his (Aristotle's) list as elements?<sup>11</sup> Or does he mean that Anaxagoras used homoiomerity as a criterion in compiling his own list of elements?<sup>12</sup> Does the other evidence, with or without the support of Aristotle, warrant our attributing some principle of homoiomerity to Anaxagoras? If so, what part does this principle play in his theory?

Anaxagoras asks "How does hair come into being from what is not hair, or flesh from what is not flesh?"<sup>13</sup> I take it, along with everyone else, that this is what the grammar books call a "repudiating question". He means "hair could not come into being from what is not hair." We know from the fragment with which this paper began that there is no coming-to-be in the strict sense, but only "mingling together". Hair does not come into being; when someone's hair grows, it is because the existing hair gets more hair added to it. The additional hair is extracted from food, which contains hair.

This is what Lucretius says homoioomeria means in Anaxagoras:

"Bones grow out of tiny little bones, he says,  
and out of tiny little viscera  
viscera grow, and blood is made  
when many drops of blood congregate together,  
and he thinks gold dust can compose gold,  
and earth can grow out of little earths . . ."14

The same point is made in more detail by the sober Aetius,  
probably following Theophrastus:

"Anaxagoras . . . declared the principles of the things  
that are to be the homoiomerics. He thought it was  
quite unintelligible how a thing could come into being  
out of what is not or perish into what is not. Now we  
take food that is simple and of one form--bread, water--  
and out of it grow hair, vein, artery, flesh, nerves,  
bones, etc. Since that is what happens, we have to agree  
that in the food we take are all the things that are, and  
that everything grows from the things that are. In that  
food there are parts productive of blood, nerves, bones,  
etc.--theoretical parts, because we must not refer  
everything to sense perception, that bread and water pro-  
duce these things, but there are in them parts that are  
to be distinguished in theory [ λόγω θεωρητά ]. So from  
the fact that in food the parts are similar [ μερῶν..ὁμοία ]  
to the things that are produced, he called them 'homoio--  
meries' and declared that they are the principles of  
things that are."15

This is a different interpretation of the term homoio-  
mere from Aristotle's.<sup>16</sup> According to Aristotle's criterion,  
a substance is homoiomerous if parts of it have the same name  
as itself. According to the principle attributed to Anaxagoras  
by Aetius, a "homoiomery" is a part of something (especially  
food) that is like something else (especially biological  
tissue). Bread<sup>17</sup> is not, therefore, homoiomerous in Aris-  
totle's sense, at least in the present analysis. Indeed, as  
Cornford pointed out in his famous article, the requirement  
that bread should break down into parts that are not bread  
but bone, blood, flesh, etc., seems to mean that bread cannot  
be homoiomerous, in Aristotle's sense. And since Anaxagoras  
said "in everything there is a portion of everything",  
apparently meaning this as a generalization of statements  
like "there is blood, bone, flesh, etc., in bread", it appears  
that nothing can be homoiomerous in Aristotle's sense.

We can get out of this bind quite easily by bringing  
in a perfectly simple distinction. It is that things can be  
broken down into parts in more than one way. To put it into  
an Anaxagorean context, you can have ground beef (Anglice,  
"mince") or digested beef. It must be possible, if the theory  
is to work as an explanation of change without coming-to-be,  
that substances can be broken down non-homoiomerously, like

digested beef. But that does not mean that they cannot, on different occasions or within different limits, be broken down homoiomerously, like ground beef. It is perfectly obvious that the substances which Aristotle called "homoiomere" are, at least within limits, divisible in this way.

There is no reason why Anaxagoras should have denied the possibility of the homoiomerous type of decomposition. But does he need it at any crucial point in his theory of change, and is there any evidence that he made any use of it?

I cannot see that he had any need of it. He needed--and used--a concept that is very similar--so similar that it is easy to understand how the tradition may have become confused. From B 6 we know that "everything has a share of everything", and from B 3 that "of the small there is no least but always a lesser". Thus any part, however small, of any substance has all the same ingredients in it as any other part, however large--namely, all that there are. In this sense, then, all the parts of a substance, however small, are homoiomere--all alike.<sup>18</sup> Just as Aristotle's homoiomerous things break up into ever smaller parts that have all the same characteristics as each other and the whole, so Anaxagorean substances break up into ever smaller parts that have all the same ingredients.

But there is an essential difference, marked by the Anaxagorean principle "each thing is and was most evidently those things of which there is most in it" (B 12). This is what transforms Anaxagoras' theory into a theory of perceptible change. When we break down a quantity of a substance into parts, by whatever method, the parts always have all the same ingredients as each other and as the whole; but they do not always have them in the same proportions--and it is the proportions of the ingredients that determine what the thing is "most evidently".<sup>19</sup> A loaf of bread is bread, because what it has most of in it is bread, although it also has imperceptible portions of blood, bone, flesh, hair and everything else. The same is true of a slice of the loaf, and a crumb of the slice. But when the crumb is eaten and digested, it is mixed with the substances of the body: the bread that preponderated in the crumb is still there, but it no longer preponderates; the blood and bone and hair that were outweighed in the crumb join their like as they are digested, in regions where they preponderate. In the body, bread preponderates nowhere, although there is a fair amount of bread in it--which returns to preponderance, perhaps, when the body excretes or dies and fertilizes the ground which feeds the wheat which makes more bread.

The point is this: there are no least parts; within any given piece of any substance, there are smaller parts. But there is nothing in the system that requires that below

the level of perception the parts should all continue to be synonymous with each other and with the whole, since although the parts contain all the same ingredients, the preponderant ingredients, which determine what the part is called, may vary from part to part.<sup>20</sup>

So far I have used a biological example (the digestion of a piece of bread), which has a special feature that might lead to confusion. What normally alters the preponderance in this process is that the bread is mixed with other substances in the body. But there are other ways of altering the preponderance between part and part without any additions to or subtractions from the whole with which one starts-- simply by stirring the mixture, for example. On a large scale, this is just what happens at the beginning of Anaxagoras' cosmogony. All sorts of ingredients in the mixture, at first imperceptible "because of smallness" (i.e. because they do not preponderate anywhere), are separated out by the rotation started by mind until they do preponderate somewhere.

Now, given this distinction between Aristotelian homoiomereity, in which substances are divisible ad infinitum into parts that are synonymous with each other and with the whole, and an Anaxagorean principle which says that substances are divisible ad infinitum into parts that have the same ingredients as, but are not necessarily synonymous with, the whole and each other, we can come back to the question about the evidence. What evidence is there that Anaxagoras adopted the (Aristotelian) principle of homoiomereity and made use of it? G. B. Kerferd writes: "In fact the tradition that Anaxagoras held the [sc. Aristotelian] principle of Homoiomereity as part of his physical theory is just about as clear as one could possibly ask for."<sup>21</sup> On the contrary, I shall now have to claim that there is no evidence whatever that Anaxagoras held the Aristotelian principle, if there is anything in the distinction I have drawn above.

It would be tedious to review all the evidence claimed for their position by Kerferd and others who agree with him; it will be enough, I hope, to indicate the lines on which I propose to move in examining it.

Aristotle's evidence has been so thoroughly discussed by others that there is no need add anything.<sup>22</sup> I believe that all Aristotle says is that Anaxagoras made the homoiomere [sc. those substances that Aristotle refers to by this name] into elements, as opposed to others, including himself, who think they are reducible to simpler elements.

The doxographic tradition is more confused. Like modern commentators, the doxographers were not sure whether Aristotle's reports meant that the Aristotelian homoiomere

were elements for Anaxagoras, or also that these same elements were thought of by Anaxagoras as homoiomerous. They know of two senses in which the elements were homoiomerous: the sense that I have analysed above (things have parts whose ingredients are all the same), and another, slightly different sense, in that things have parts which are like whatever they change into. But to the best of my belief there is no passage in the doxographic tradition that attributes to Anaxagoras homoiomereity of precisely the Aristotelian kind, in which all the parts are synonymous with the whole.

There is one careful distinction to be added, however, in support of this claim. Anaxagoras' theory of nutrition is often described, as in the passage from Lucretius quoted above on p. , by saying that "bones grow out of tiny little bones", and so on. This is reasonably harmless. The same doctrine is put in different terms, by saying that bones are composed of (συνεστάναι and similar words) bits of bone. This is still correct, so long as it is interpreted as a thesis in the theory of growth. It means that things grow by the addition of portions of their like, which were latent in their food or their environment. The statement that bone is made up from small portions of bone is very like the statement that bone is analysable into parts that are bone (i.e. Aristotelian homoiomereity); but the former statement is not equivalent to the latter, does not entail the latter, and is not interpreted as the latter by any of the doxographers, to the best of my belief (if I am wrong in the last clause, I shall have to claim that the doxographer has made the same mistake as the modern commentators).

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We have taken as our starting point for explaining Anaxagoras the principle that there is no coming to be, but only mingling together of "things that are"; and we have seen how this principle works in accounting for perceptible change. When something like flesh grows, it does not come into being out of what is not flesh; the flesh that is there already grows by the addition of more flesh, portions of which are latent in food. This explanation can be generalized, as we have seen, to cover not merely growth by nutrition but other types of natural change as well. Hence the "things that are" include all the things that feature in natural change.

As a method of dealing with Parmenides, this theory is generally contrasted with that of Empedocles. Guthrie's version may be taken as typical:<sup>23</sup>

"The solution of Empedocles had been to suppose that there was only a strictly limited number of elemental substances which deserved to be called existent. The



rest, the world of 'mortal things' which we suppose to be real, consisted simply of mixtures of the four 'roots' in different proportions, which could be dissolved without infringing the rule of 'no becoming'. The condition laid down by Anaxagoras was stricter. On the Empedoclean theory, if it were possible to divide a piece of (say) flesh into small enough fragments, the elements would come to light and it would be flesh no longer. But Anaxagoras held that if this were even theoretically possible, then a definite substance, 'flesh', could perish. There was no reason for singling out certain forms of matter like earth or water as primary. Why should they be said to 'exist' more than others?"

But what about a man, or a city? If Anaxagoras' solution of the Parmenidean deadlock is to say that the hair that grows was in being, as hair, all the time, then are we to say that the man that is born and grows was in being, as a man, all the time? Somehow, because of the contrast with Empedocles, the commentators have always stressed the enormous number of kinds of being in Anaxagoras' system, but all of them, so far as I have observed, tacitly put a limit on the number. They assume, without noticing what they are omitting, that the list of beings will include all "the natural substances", in a sense in which a man or a horse is not a natural substance. Aristotle noticed the point, and confirms that Anaxagoras did indeed treat such items differently: even the Anaxagoreans, he says, do not make a face out of faces, "nor any other of the things that are given a shape by nature".<sup>24</sup>

I suggest that it is at this point in Anaxagoras' system that we find a role for the "seeds" mentioned in B 4 and by Aristotle, Theophrastus and Simplicius. We might take a hint from the first move in the physical argument in Epicurus' Letter to Herodotus: "Nothing comes to be out of nothing; for everything would come to be out of everything, with no need of seeds." At the beginning of B 4a<sup>25</sup> Anaxagoras says: "These things being so, it is right to think that there are, in all the things that are being put together, many things, of all kinds, and seeds of all things having forms of all kinds and colours and savours. And [sc. it is right to think that] men were composed and the other living creatures that have soul." And in B 4b: "Before these things were separated off, when all things were together, no colour at all was evident: for the mixture of all things prevented it--the mixture of the wet, the dry, the hot, the cold, the bright and the dark, much earth being in it too,<sup>26</sup> and seeds unlimited in number, in no way like each other; for not even of the other things is one like the other. These things being so, it is right to think that all things are in the whole."

The lists in these two passages can be (and have been) read in a number of different ways. I want to suggest that

there is some reason for thinking of the seeds as being at a higher level of organization than the "many things" or "the wet, the dry" etc. In the first list, the seeds have forms or shapes (ἰδέαι) of all kinds, which makes us think of Aristotle's "things that are given a shape by nature," quoted above.<sup>27</sup> In the second list, there seems to be some inference a fortiori (οὐδε γὰρ in 35.2) from the unlikeness of the "other things" (the wet, the cold, the dry, etc.?) to the unlikeness of the seeds, which might suggest that the seeds are less simple than the other things.

Anaxagoras rescues the natural substances that Aristotle calls "homoiomeric" from coming-to-be and perishing by supposing that they are always present but may be latent. He cannot do quite the same for what Aristotle calls "the things given a shape by nature", and so he comes as close to it as he can by speaking of "seeds". In the original mixture, when nothing was evident because of smallness, even if there were no men, there were the seeds of men. It is likely that Anaxagoras would think of this as still satisfying the Parmenidean requirement of no coming-to-be, since it was a common view that the seed, in biological generation, contains all the ingredients of the adult and grows to adulthood only by "like-to-like" addition.<sup>28</sup>

By a roundabout route I have come to the simplest of all interpretations of the "seeds" in B 4, by finding a role for seeds in an almost completely literal sense. The other fragments of Anaxagoras do not mention seeds; other ancient evidence on Anaxagoras' concept of seeds comes from a brief passage of Aristotle, Simplicius' comment on that, and a sentence of Theophrastus' Historia plantarum.<sup>29</sup> Aristotle, in an extremely well known and much discussed passage, contrasts Anaxagoras with Empedocles, saying that whereas the latter makes earth, water, air and fire the elements out of which all other bodies are made, Anaxagoras takes the contrary view and says the homoiomeric bodies are elements, whereas air and fire are "mixtures of these and of all the other seeds." Simplicius in his comment says "Anaxagoras called the homoiomeric bodies, like flesh, bone, etc. 'seeds'". Modern commentators have concluded from this evidence that Anaxagoras spoke of seeds of flesh, bone, etc., and of the hot, the cold, etc., and sometimes of earth, water, etc. They may be right to think that Anaxagoras had such a general theory of seeds, but I do not see any necessity for it in his system, and I do not think the evidence is strong enough to build on.

Immediately after mentioning seeds in B 4a, Anaxagoras continues with a description of the development of a cosmos: "These things being so . . . [it is right to think that] men were composed, and the other living creatures that have soul. And that by the men were built cities, and works have been

contrived, just as they are with us, and that there is a sun for them and a moon and the rest, as with us, and that the earth grows many things of all kinds for them, whose fruits they gather into their dwellings and use. Now these things have been said by me about the separating off, that it would be separated off not only with us, but also elsewhere." I agree with Fränkel<sup>30</sup> that this should not be interpreted as implying a commitment to "other worlds"--a later doctrine. It is something like a Gedankenexperiment. Given the initial conditions set out at the beginning of his book, Anaxagoras claims that it is only to be expected that things would turn out just as we see them to have turned out. The original mixture contained everything that now exists: it contained the whole mass of all the material stuffs of which the world is made, and seeds of all the structured things that exist in the world. Given a motive agent that can discriminate<sup>31</sup> all these things, it is only to be expected that just such a world will emerge as the one in which we live.

If this analysis is right, Anaxagoras' response to Parmenides' ban on coming-to-be is extremely simple--not at all the subtle and complex thing it has been made out to be. His chief tool is the concept of latency (quaedam latitandi copia, Lucretius I 875).<sup>32</sup> What men call "coming-to-be" is just the coming together of what was previously latent. This explains why it has proved so difficult to answer the question, what are the elements in Anaxagoras' system? As he says, there are things (χρῆματα) infinite in number (πλήθος)<sup>33</sup> in the original mixture (B 1), and one cannot know the "number of the things that are being separated off, either in theory or in fact" (B 7). We may allow that some things are obviously compounds, with identifiable components--for example, animals. In those cases, the components are permanent features of the mixture, and so is the principle of structure which is represented by the seed.<sup>34</sup> Exactly how he handled this relationship is a matter of guesswork. Perhaps there is flesh, bone, blood, etc., dispersed at large and not forming the seed of anything, while there is also flesh, bone, blood, etc. concentrated in seeds so as to give them their character by predominance--concentrated in the seeds of animals, which are bloody, fleshy, bony, etc. Seeds should not be simply reducible to such components, if the apparent coming-to-be of a man is to be explained in the standard way, avoiding offence to Parmenides, but they must contain them. I doubt whether earth, air, fire and water are special cases, as Aristotle implies: that is probably a mistake.<sup>35</sup> So if pressed with the question, "What were the ingredients of the original mixture?", Anaxagoras would probably reply that the list is infinite, but includes the hot, the cold, the wet, etc., earth, air, ether, etc., gold, iron, flint, etc., bark, leaf, root, flesh, blood, bone, etc., and seeds of fish, animals, men, etc. All these are "elementary" in the sense that they are irreducible, ungenerated and indestructible.

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Appendix

The relation between Anaxagoras and Zeno cannot be determined with certainty, I believe. I shall argue for three points, each of them inconclusive and together making at best a plausible case. The first point is purely chronological: there is no good external evidence for thinking that Anaxagoras wrote later than Zeno. The second point is that there is nothing in the wording or the content of Anaxagoras' philosophy that cannot be reasonably explained without the hypothesis that he was answering Zeno. The third is that what is often said to be a response to Zeno would be nothing but an ignoratio elenchi.

There is no need to do more than sketch the chronological arguments.<sup>36</sup> The best evidence for Zeno's date comes from Plato, who says he was about 25 years younger than Parmenides; and the dramatic setting of the Parmenides has Parmenides about sixty-five, Zeno nearly forty, and Socrates very young--perhaps about 450 B.C.<sup>37</sup> Others mention a floruit between 468 and 453.<sup>38</sup> Plato mentions that Zeno wrote his book when he was very young. So it seems likely that the book was written between about 470 and 460.

According to the famous "autobiography" of Socrates in the Phaedo, when he was young he was very much interested in natural philosophy but was disappointed with its result until he heard someone reading from a book by Anaxagoras which said that Mind organized everything in the world. The implication is that Socrates did not hear Anaxagoras in person. Anaxagoras is said to have come from Clazomenae to Athens at the time of Xerxes' invasion (480) when he was twenty--but he is also said to have begun to philosophize in Athens under the archonship of Kallias (456). These dates can be brought into harmony, as many editors do, by the device of emending "Kallias" to "Kalliades". The latter was archon in 480.

Guthrie<sup>39</sup> includes among the things that "may be said with confidence" that Anaxagoras' book was finished later than 467, the year of the fall of the meteorite at Aegospotami. There is a long tradition associating Anaxagoras with this event, it is true--but the tradition says that he predicted it. The likeliest interpretation of that legend is that it arose from Anaxagoras' famous theory that the sun, moon and stars are all stones: if there are heavy stones in the sky, perhaps they will fall one day. Guthrie says "the theory was suggested or appeared to be confirmed by the fall of a stone apparently from heaven."<sup>40</sup> It hardly needs arguing that empirical evidence is not a necessary precondition for Presocratic

theories. And the story of the prediction is explained much better if Anaxagoras' book preceded the meteorite.<sup>41</sup>

The later chronology of Anaxagoras' life is extremely confused.<sup>42</sup> I do not think there is any firm evidence that would tend to force us to abandon the thesis that his book was written before 467. If so, then the chronological arguments suggest that Zeno probably wrote after Anaxagoras.

There are two fragments of Anaxagoras that are said to constitute a reply to Zeno:<sup>43</sup>

"For of the small there is no least but always a lesser (for what is cannot not be)--but also of the large there is also a larger. And it is equal to the small in  $\pi\lambda\eta\theta\omicron\varsigma$ , but with respect to itself each thing is both great and small" (B 3).

"These things having been thus separated out, it is right to understand that all things are neither less nor more (since it is not possible that there be more than all), but all things are equal always" (B 5).

To take the second first: the allegation is that it is a deliberate echo of Zeno B 3: "If there are many, it must be that they are as many as they are and neither more nor less than themselves." Zeno's proposition, in its context, is one half of an antinomy which aims to prove, from the premiss "there are many", both "they are finite" and "they are infinite". From this contradiction, Zeno wants to deduce that the premiss "there are many" is false. Anaxagoras has no argument against this: the most he could be doing is contradicting Zeno by saying that "being neither more nor less than themselves" does not entail being finite. But the word "always" shows that he is making quite a different point, that the total of things does not change in time.<sup>44</sup> As I have shown earlier in this paper, this proposition is needed as part of Anaxagoras' answer to Parmenides, and there is no need whatever to erect a Zenonian target for him to fire at.

On the contrary, Zeno's argument in B 3 might well be aimed at Anaxagoras. The latter shows no sign of noticing that if things are as many as they are (which is entailed by "all things are equal always") then they are finite. So he asserts both "all things are equal" and "all things are infinite". Zeno could be looking for a contradiction in this.<sup>45</sup>

The first of Anaxagoras' fragments quoted above, B 3, is said to be connected with the Zenonian argument against plurality contained in B 1-2.<sup>46</sup> The conclusion of the antinomy in this argument is: "Thus if there are many, they must be both large and small--small so as to have no size, large

so as to be infinite."

To take the second arm first: Zeno argues that anything having size must be divisible into parts having size, "to say this once is to say it always", therefore anything having size must have an infinite number of parts having size, and therefore it must be infinitely large. So far as I can see, there is nothing in Anaxagoras that refers to this argument.

As to the first arm: Zeno argues that each of the alleged "many" must have no size, because otherwise it will be divisible and so not be a "one". Again, there appears to be nothing in Anaxagoras that takes note of this.

What Anaxagoras says can be wholly explained as part of his defence of his principles of latency and predominance. Change from A to B is possible, in his view, only if B is latent in A. So if A is so small that it contains nothing latent in it, it cannot change. Since he apparently wanted to set no limits to change, he had to maintain that there is nothing so small that it can contain nothing latent in it--that is, "there is no least, but always a lesser". Without this assumption, the "portions" of everything that are in everything could be eliminated simply by taking smaller and smaller pieces.

The theory of change depends on the proportions of the ingredients of a thing: the possibility of change depends on there being a relatively large and a relatively small. Any limits on the large and the small would limit the possibility of change. Hence for any given size, there must be a "larger", if latent things can be of any size and can cease to be latent.

When he says the large is "equal to the small in  $\mu\lambda\eta\theta\omicron\varsigma$ " he probably means that both the large and the small contain an equal number of ingredients--namely, all that there are. The same is said in B 6: "There are equal portions, in number, of the large and the small."

The last clause of B 3, "with respect to itself, each thing is both great and small" is a little puzzling. He has just been talking about comparative sizes--small and smaller, large and larger. One might expect him to say that with respect to itself each thing is neither large nor small. I suspect that what he means is that without comparisons a thing is whatever you like to call it--large or small. Large and small are entirely relative terms.<sup>47</sup>

Anaxagoras' theory of infinite divisibility--"of the small there is no least but always a lesser" (B 3)--is then a deduction from three propositions in his response to Parmenides:

- (1) There is no coming-to-be or perishing.
- (2) Nevertheless, a thing perceived as A can change into a thing perceived as B.
- (3) This is possible only if B is latent in A.

There is no reason to think that he was unable to work this out without a nudge from Zeno. On the contrary, if he did work it out after reading Zeno, then he either stupidly misunderstood or shamelessly ignored Zeno's whole point. For Zeno introduced the infinite divisibility of "what is" only to show that it leads to ridiculous and unacceptable consequences. If it is infinitely divisible into an infinite number of ultimate units, then it is impossible to give a non-contradictory account of these units (B 1-2). If it is infinitely divisible without any ultimate units, then you can never traverse it or give any non-contradictory account of its limits (the Dichotomy and the Achilles).<sup>48</sup> The Atomists and Aristotle tried to deal with this powerful attack on divisibility; not Anaxagoras.

## Anaxagoras' Theory of Change -- Notes

<sup>1</sup>Anaxagoras B 17. This seems an appropriate moment to defend the fragments of Anaxagoras quoted by Simplicius from the attack on their authenticity in the book by Gershenson and Greenberg. (Full references for all the modern literature cited are given in the Bibliography, pp. ).

These authors conclude that "the quotations from Anaxagoras to be found in Simplicius' commentaries . . . are useless as sources from which to reconstruct Anaxagoras' thought" (p. 358) on four grounds:

a) "The same 'quotations' appear differently in different places." But this is also true of Simplicius' quotations from Plato's Timaeus, which he certainly knew well. For example, Tm 51 e 6-52 d 1 is quoted by Simplicius in Ph. 224.30ff (call this A) and 539.14ff (B), with the following differences (according to Diels' apparatus and text):

52 a 2 οὔτε αὐτὸ εἰσδεχόμενον A: οὔτε [v.1. αὐτὸ]  
εἰς αὐτὸ εἰσδεχόμενον B  
a 8 αὐ A: αὐτὸ B  
b 1 γενέσθαι A: γένεσιν B  
c 1 ἐγερεθέντες A: διεγερεθέντες B  
c 2 λέγειν A: εἰπεῖν B  
c 4 τινὶ A: om. B  
c 6 ὡς ἕως ἂν τι A: ὡς ἕάν τι B  
c 7 ποτε A: om. B

Some of this text is quoted elsewhere by Simplicius, with different variations (e.g. 43.15ff omits ἄλλοθεν in 52 a 3). With all these variations, Simplicius preserves the sense perfectly; so why not also in the case of Anaxagoras?

b) "It is often impossible to tell where the 'quotations' begin or end" (p. 360). Agreed; but it is often reasonable to believe that one is right in the middle.

c) "The quotations are full of interpolations" (p. 363). This assertion is based only on the fact that Simplicius often interpolates remarks of his own in citations from Aristotle, for which we have a control, and on Gershenson's and Greenberg's disapproval of the content of some clauses in what Simplicius attributes to Anaxagoras.

d) "Simplicius did not have Anaxagoras' book" (p. 370). The case on this ground is very flimsy; one could make as strong a case against Simplicius' quotations from Empedocles. G. Strohmaier in CMG Suppl. Or. III (1970) p. 90, argues that Galen had a copy of Anaxagoras' book (I owe this reference to



Mr. Vivian Nutton). Simplicius claims confidently (Ph. 166.16) that he has ἀπὸ τῆς ἡ λέξις of Anaxagoras.

Of course we must always be cautious in accepting any alleged quotation as a genuine fragment of any Presocratic philosopher. We are always dealing with what is relatively reliable at best. In my view (and nearly everyone else's), Simplicius is a relatively reliable source for Anaxagoras.

<sup>2</sup>Empedocles B 9, from Plutarch adv. Coloten. The text is uncertain in three places. In the last line, the negative is a supplement, to correct the metre, suggested by Wyttendach and adopted by most subsequent editors. If it is wrong, the line means: "But they are right to call them so [sc. provided that they understand what they are doing], and I myself comply . . ."

<sup>3</sup>Aristotle Ph. 187 a 26 says Anaxagoras accepted the common opinion of the physikoi that nothing comes to be from nothing. Simplicius in his commentary (162.11ff) notes that Parmenides presented the arguments for this position, and goes straight on to say (162.26) "Anaxagoras accepted this as an axiom." He proceeds at once to give his outline of Anaxagoras' philosophy as an attempt to account for perceptible change while accepting this axiom.

Recently Professor Martin L. West has published a dissenting opinion (EGP&O p 219): "Why must we suppose that they [sc. Empedocles and Anaxagoras] are seeking an alternative answer to 'the problem posed by Parmenides'?" However, Mr. West's analysis of Parmenides, which follows, is so frivolous that it would be surprising if he thought anyone needed to compose an answer.

<sup>4</sup>For this reading of the line, see my "Notes on Parmenides", pp. 5-6.

<sup>5</sup>As Professor West puts it (p. 232), "we also find Zeno playing around with infinite divisibility." The arguments connecting Anaxagoras' position with Zeno, to which Mr. West airily alludes, are set out by Gigon, Raven and Calogero, among others.

<sup>6</sup>On these words, see Guthrie's note, HGPh II 325-6.

<sup>7</sup>Note Shorey's argument (CPhilol 1922, 350) that Plato Protag. 329 d-e tells against the use of any such term by

Anaxagoras himself. See also Mathewson, and Strohmaier pp. 89-90.

<sup>8</sup>Ph. III 4, 203 a 19; Metaph. I 3, 984 a 11; De caelo III 3, 302 a 28; GC I 1, 314 a 18.

<sup>9</sup>The last reference in the preceding note.

<sup>10</sup>See the list in Meteor. 388 a 13-20.

<sup>11</sup>So Guthrie II 326, and others.

<sup>12</sup>So Kerferd, in Mourelatos Pre-S p 498, and others.

<sup>13</sup>B 10. The actual words are, I think, less well authenticated than the Simplicius fragments, but the accuracy of the content is amply confirmed.

<sup>14</sup>Lucretius I 835-40. Lucretius, who is opposing the theory, spoils it by using bones (ossa), viscera and earths (terrae) as count nouns instead of mass nouns.

<sup>15</sup>Aetius I 3 5 = DK 59 A 46. Compare Theophrastus, cited by Simplicius Ph. 27.11 (in DK 59 A 41). Aetius differs from Lucretius in using homoiomeria to mean a part that is like that of which it is a component, whereas Lucretius uses it to refer to the principle that there are such parts.

<sup>16</sup>According to Cornford (A & F II, p. 316 n9), it is the "irresponsible conjecture of a doxographer."

<sup>17</sup>Bread, Aetius' example, is a bad one, because it is an artificial substance, and as such it is doubtful whether it would be included in Anaxagoras' elements. Substitute "flour".

<sup>18</sup>This may be an appropriate occasion to pay tribute to the late Arthur L. Peck, who did excellent work on Anaxagoras which is perhaps not as well known as it should be. His distinction between Aristotle's use of homoiomeres and the doctrine of Anaxagoras to which the name homoiomereia was attached is very close to mine: "The portions in anything

you care to choose are similar to the portions in any other thing, for there is a portion or part of everything in them all. What could be a more exact name for this doctrine than Homoiomereia, the similarity of parts, or, as Lucretius puts it, rerum homoeomeria? This has the advantage not only of fitting the doctrine exactly, but of being a clear echo of the famous phrase ἐν παντί παντός μοῖρα ἔνεστι " (CQ XXV 1931, p. 118). The difference is that Mr. Peck refers to the similarity of parts of different things, whereas I think the Aristotelian usage of the term homoiomeres probably led the doxographers to use cognate terms to refer to parts of the same thing.

Cyril Bailey (Gk. Atomists, p. 551) gets the essential point right--that homoiomereity of the Aristotelian type cannot help in an explanation of physical change--but his account of the theory is spoilt, in my view, by his interpretation of the "seeds" of fr. 4 as particles. It is important to realise that particles play no part in Anaxagoras' theory (Lanza's 1963 article is good on this point): with some justice, he makes of it a general criticism of the "studiosi anglosassoni").

Charles Mugler may also be right in his account of the concept of homoiomereity as applied to Anaxagoras (pp. 358-63 of the article cited in the bibliography), but his exposition leaves so many questions unanswered that I cannot be sure. I do feel sure, however, that much of the rest of his article is wrong--particularly his claim that Anaxagoras' prime target was Leucippus.

<sup>19</sup>I use the expression "break down into parts" deliberately as a cover-all. Gregory Vlastos makes use of a distinction very similar to mine (though more complicated, because of his theory of "powers" and "seeds"), but expresses it by distinguishing "division" from some other process of rearrangement (A & F II, pp. 338-39). But there is no evidence and no a priori reason, so far as I can see, why division, as well as rearrangement, should not result--at some stage, sometimes--in parts with different ingredients predominating. There is some evidence for this: at the end of B 12, Anaxagoras writes: "Mind is all alike, both the greater and the smaller." This implies that in other things the greater and the smaller are not all alike. The next sentence appears to say as much (or even more): ἕτερον δὲ οὐδὲν ἔστιν ὁμοίον οὐδενί.

(I owe this point to Mr. Malcolm Schofield.)

<sup>20</sup>Anaxagoras in the fragments says only that the preponderant ingredients determine what the thing is "most evidently". The Derveni papyrus, which recalls many Anaxagorean ideas, says "each thing is called from what predominates." (See Burkert, Et. Philos., p. 445.)

Mr. Colin Strang makes an essential point (A & F II, p. 361ff) in his distinction between "common and elemental substance". A piece of what is commonly called "gold" is so called because it has a predominance of pure, elemental gold in it. This is just plain common sense. When I drink a glass of water in Princeton, I still call it "water" (even if reluctantly), although it contains heaven knows what other ingredients. What is peculiar about Anaxagoras is that he denies that any pure substance (except Mind) can be wholly isolated from any other. It is sometimes said that this gives rise to an epistemological problem (what is water, if it never exists in a pure state?). If so, we should have to say that no non-chemist knows what he is talking about when he asks for a glass of water.

<sup>21</sup>In Mourelatos Pre-S, p. 498.

<sup>22</sup>See especially Peck and Mathewson.

<sup>23</sup>A & F II, p. 272.

<sup>24</sup>De caelo III 4, 302 b 25. It is worth noticing that this observation might be used, if we like, to turn the usual account of the history upside down. For example, Vlastos writes (in A & F II, p. 327): "No Ionian had ever said that earth had been 'in' the original matrix. Empedocles had said just that, precisely because he had endowed earth with Parmenidean being. Anaxagoras takes a long step in the same direction. He holds that earth, air, aether, as well as hair, flesh and every other substance are 'in' the primitive mixture, for they all have Parmenidean being." Could we not put it this way instead? Anaxagoras saved mortal men from Parmenidean non-being by making their components and their seeds into entities with Parmenidean being. But Empedocles went much further in the same direction, by claiming that these extravagantly varied Parmenidean beings could be reduced to just four? And the Atomists further still, by cutting out irreducible qualitative differences altogether? Is there anything in this line of thought?

I put this point in the form of a question, because I am not sure whether Empedocles wrote before Anaxagoras or vice versa, and whether either of them knew the work of the other at the time of writing. For an extensive discussion of the arguments, see O'Brien's 1968 article; he concludes that Empedocles wrote later than Anaxagoras, and was influenced by him. F. Solmsen now writes: "Reasons that have been communicated to me but are not yet in the public domain have strengthened my inclination to regard Anaxagoras as later than

Empedocles" (AGPh 1975, p. 123 n2). It will be interesting to learn more about this important leak.

<sup>25</sup>For the interpretation of this fragment, see especially Hermann Fränkel, WuF 284ff., and Gregory Vlastos in A & F II, 354-60.

DK prints consecutively as fr. 4 twenty lines that are never quoted consecutively by Simplicius. At Ph. 156.2ff., he quotes the first three lines, followed by the second paragraph; but this second paragraph is introduced by "φησί"--a hint that a new quotation is beginning. Taken as a whole, the evidence suggests that what DK prints as two paragraphs of fr. 4 is really two separate fragments; so following Fränkel, Lanza and others, I call them 4a and 4b. (Fränkel actually divides 4b into two as well.)

Fränkel interprets the whole of 4a as in the conditional mood. He first explains the omission of  $\hat{\alpha}\nu$  with the infinitives  $\sigma\upsilon\mu\pi\alpha\gamma\eta\tilde{\nu}\alpha\iota$  etc. as perhaps "ein Archaismus von Anaxagoras' Sprache" (p. 280). G. E. L. Owen is quoted as objecting to this interpretation (see A & F II, 360 n17, and 379 n28) that it cannot survive the indicative  $\chi\rho\omega\tilde{\nu}\tau\alpha\iota$  in DK II 34.14. But, as Fränkel himself seems to suggest (p. 281), his interpretation does not depend on the infinitives being potential. The whole construction is dependent on the opening phrase:  $\tau\acute{\omicron}\tilde{\upsilon}\tau\omega\tilde{\nu}\ \omicron\tilde{\upsilon}\tau\omega\varsigma\ \acute{\epsilon}\chi\acute{\omicron}\nu\tau\omega\tilde{\nu},\ \chi\rho\eta\ \delta\omicron\kappa\epsilon\tilde{\iota}\nu$ . The general sense is this: granted that the initial conditions are as we have described them, it is right to suppose (i.e. it is only what one would have expected) that . . . "men were composed . . . and there are cities built by the men . . . just as we see around us ( $\acute{\omega}\sigma\pi\epsilon\rho\ \pi\alpha\rho'\ \acute{\iota}\mu\tilde{\iota}\nu$ )." The potential optative in the last sentence follows quite naturally: given the initial conditions, the same would happen anywhere. There is no commitment to "other worlds" here.

<sup>26</sup>"There is no satisfactory explanation of the mention of earth in this connection, unless earth were one variety of seed" (Vlastos, in A & F II, 343 n17). It may be that earth is mentioned because of its connection with the growth of seeds. That is its role in B 4a (line 12 in DK).

<sup>27</sup>Vlastos in A & F II, 342 n7 points out that need not mean "shape", but may mean "form" in a quite general sense. True; on the other hand, Empedocles' use of the word, which Vlastos claims to be equally general, in the expression  $\pi\alpha\tilde{\nu}\tau\omicron\tilde{\iota}\alpha\iota\varsigma\ \acute{\iota}\delta\acute{\epsilon}\rho\sigma\iota\nu\ \acute{\alpha}\rho\eta\rho\acute{\omicron}\tau\alpha,\ \theta\acute{\alpha}\nu\mu\alpha\ \acute{\iota}\delta\acute{\epsilon}\sigma\theta\alpha\iota$  (B 35.17) is precisely to refer to the properties of complex organisms.

<sup>28</sup>See Vlastos in A & F II, 324-25, with the references to biological texts in his note 20.

<sup>29</sup>De caelo III 3, 302 a 28ff (DK A 43), Simplicius 603.7ff (not in DK) and Theophrastus HP III 1, 4 (DK A 117). There are some other passages, quoted by Lanza, Anassagora, A 111, A 113, A 117. Censorinus 6.6 and 6.8 (A 111) has a note about the role of animal seed in bringing about resemblances between parents and children. Theophrastus De causis plantarum I 5, 2 and Varro De re rustica I 40, 1 (both in A 117) report on seeds of plants carried imperceptibly in air or water. Irenaeus II 14, 2 (A 113) extends this idea to animal seed.

Perhaps a mite of confirmation for my interpretation may be found here: what was worth remembering about Anaxagoras was that he held a theory according to which the seeds of plants and animals are latent in air and water. (I am grateful to Mr. David Sider for drawing my attention to these passages.)

<sup>30</sup>See above, n. 25.

<sup>31</sup>The ambiguity of this word is of course deliberate.

<sup>32</sup>Not the same as potency, although it may be a forebear of it.

<sup>33</sup>In spite of Calogero's argument that  $\pi\lambda\eta\theta\omicron\varsigma$  may mean no more than "amount" or "quantity" (Storia p. 257), I think it means number here.

<sup>34</sup>This is not inconsistent with the reports that Anaxagoras spoke about the origin of living forms (Diogenes Laertius 2.9, Hippol. I 8, 12). They originated in the same sense as every other feature of the cosmos--by "separating out" of the original mixture.

<sup>35</sup>De caelo III 3, 302 a 28ff = DK A 43, quoted above. For an explanation of the mistake, see Vlastos in A & F II, 339-40.

<sup>36</sup>Because the evidence is such that however meticulously one examines it, it will never make a conclusive case. Perhaps the simplest argument is this: Anaxagoras wrote the

first prose treatise (Diogenes Laertius II 11); Zeno wrote in prose; therefore, Zeno wrote after Anaxagoras. Unfortunately, both the meaning and the truth of Diogenes' statement are uncertain.

<sup>37</sup>Parmenides 127 a-c.

<sup>38</sup>DK A 1-3.

<sup>39</sup>HGPh II 266.

<sup>40</sup>HGPh II 303.

<sup>41</sup>He wrote only one (Diogenes Laertius II 6) but apparently it filled more than one roll, since Simplicius refers to "the first of his Physica" (Ph. 155.26 and 163.19).

<sup>42</sup>See Davidson.

<sup>43</sup>See especially Raven in CQ 1954 and in KR, p. 370-71, Guthrie HGPh II 289ff., Calogero Storia 256ff. For a rebuttal, see Strang in A & F II, 366-67.

<sup>44</sup>This was pointed out by Strang, A & F II, 377 n13.

<sup>45</sup>But it is not necessary to think that Zeno had Anaxagoras in mind as a specific target. He was systematically looking for contradictions to be derived from "there are many", and it is not necessary to think that all the types of pluralism that he attacked were actually asserted by anyone.

<sup>46</sup>On this, see Strang, A & F II, 366-67.

<sup>47</sup>This conclusion is the same as Calogero's (Storia pp. 261ff) but I differ from him about many details.

<sup>48</sup>For this interpretation of Zeno, see G. E. L. Owen, in A & F II, ch. V, and my Two Studies, pp. 69-70, reprinted in Mourelatos PreS, pp. 360-61.

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