Of things that exist, some exist by nature, some from other causes. 'By nature' the animals and their parts exist, and the plants and the simple bodies (earth, fire, air, water)-for we say that these and the like exist 'by nature'.

All the things mentioned present a feature in which they differ from things which are not constituted by nature. Each of them has within itself a principle of motion and of stationariness (in respect of place, or of growth and decrease, or by way of alteration). On the other hand, a bed and a coat and anything else of that sort, qua receiving these designations i.e. in so far as they are products of art-have no innate impulse to change. But in so far as they happen to be composed of stone or of earth or of a mixture of the two, they do have such an impulse, and just to that extent which seems to indicate that nature is a source or cause of being moved and of being at rest in that to which it belongs primarily, in virtue of itself and not in virtue of a concomitant attribute.

I say 'not in virtue of a concomitant attribute', because (for instance) a man who is a doctor might cure himself. Nevertheless it is not in so far as he is a patient that he possesses the art of medicine: it merely has happened that the same man is doctor and patient-and that is why these attributes are not always found together. So it is with all other
artificial products. None of them has in itself the source of its own production. But while in some cases (for instance houses and the other products of manual labour) that principle is in something else external to the thing, in others those which may cause a change in themselves in virtue of a concomitant attribute—it lies in the things themselves (but not in virtue of what they are).

‘Nature’ then is what has been stated. Things ‘have a nature’ which have a principle of this kind. Each of them is a substance; for it is a subject, and nature always implies a subject in which it inheres.

The term 'according to nature' is applied to all these things and also to the attributes which belong to them in virtue of what they are, for instance the property of fire to be carried upwards—which is not a 'nature' nor 'has a nature' but is 'by nature' or 'according to nature'.

What nature is, then, and the meaning of the terms ‘by nature’ and ‘according to nature’, has been stated. That nature exists, it would be absurd to try to prove; for it is obvious that there are many things of this kind, and to prove what is obvious by what is not is the mark of a man who is unable to distinguish what is self-evident from what is not. (This state of mind is clearly possible. A man blind from birth might reason about colours. Presumably therefore such persons must be talking about words without any thought to correspond.)

Some identify the nature or substance of a natural object with that immediate constituent of it which taken by itself is without arrangement, e.g. the wood is the 'nature' of the bed, and the bronze the 'nature' of the statue.

As an indication of this Antiphon points out that if you planted a bed and the rotting wood acquired the power of sending up a shoot, it would not be a bed that would come up, but wood—which shows that the arrangement in accordance with the rules of the art is merely an incidental attribute, whereas the real nature is the other, which, further, persists continuously through the process of making.

But if the material of each of these objects has itself the same relation to something else, say bronze (or gold) to water, bones (or wood) to earth and so on, that (they say) would be their nature and essence. Consequently some assert earth, others fire or air or water or some or all of these, to be the nature of the things that are. For whatever any one of them supposed to have this character—whether one thing or more than one thing—this or these he declared to be the whole of substance, all else being its affections, states, or dispositions. Every such thing they held to be eternal (for it could not pass into anything else), but other things to come into being and cease to be times without number.

This then is one account of 'nature', namely that it is the immediate material substratum of things which have in themselves a principle of motion or change.

Another account is that ‘nature’ is the shape or form which is specified in the definition of the thing.

For the word 'nature' is applied to what is according to nature and the natural in the same way as 'art' is applied to what is artistic or a work of art. We should not say in the latter case that there is anything artistic about a thing, if it is a bed only potentially, not yet having the form of a bed; nor should we call it a work of art. The same is true of natural compounds. What is potentially flesh or bone has not yet its own ‘nature’, and does not exist until it receives the form specified in the definition, which we name in defining what flesh or bone is. Thus in the second sense of ‘nature’ it would
be the shape or form (not separable except in statement) of things which have in themselves a source of motion. (The combination of the two, e.g. man, is not 'nature' but 'by nature' or 'natural'.)

The form indeed is 'nature' rather than the matter; for a thing is more properly said to be what it is when it has attained to fulfilment than when it exists potentially. Again man is born from man, but not bed from bed. That is why people say that the figure is not the nature of a bed, but the wood is—if the bed sprouted not a bed but wood would come up. But even if the figure is art, then on the same principle the shape of man is his nature. For man is born from man.

We also speak of a thing's nature as being exhibited in the process of growth by which its nature is attained. The 'nature' in this sense is not like 'doctoring', which leads not to the art of doctoring but to health. Doctoring must start from the art, not lead to it. But it is not in this way that nature (in the one sense) is related to nature (in the other). What grows qua growing grows from something into something. Into what then does it grow? Not into that from which it arose but into that to which it tends. The shape then is nature.

'Shape' and 'nature', it should be added, are in two senses. For the privation too is in a way form. But whether in unqualified coming to be there is privation, i.e. a contrary to what comes to be, we must consider later.

**Part 2**

We have distinguished, then, the different ways in which the term 'nature' is used.

The next point to consider is how the mathematician differs from the physicist. Obviously physical bodies contain surfaces and volumes, lines and points, and these are the subject-matter of mathematics.

Further, is astronomy different from physics or a department of it? It seems absurd that the physicist should be supposed to know the nature of sun or moon, but not to know any of their essential attributes, particularly as the writers on physics obviously do discuss their shape also and whether the earth and the world are spherical or not.

Now the mathematician, though he too treats of these things, nevertheless does not treat of them as the limits of a physical body; nor does he consider the attributes indicated as the attributes of such bodies. That is why he separates them; for in thought they are separable from motion, and it makes no difference, nor does any falsity result, if they are separated. The holders of the theory of Forms do the same, though they are not aware of it; for they separate the objects of physics, which are less separable than those of mathematics. This becomes plain if one tries to state in each of the two cases the definitions of the things and of their attributes. 'Odd' and 'even', 'straight' and 'curved', and likewise 'number', 'line', and 'figure', do not involve motion; not so 'flesh' and 'bone' and 'man'-these are defined like 'snub nose', not like 'curved'.

Similar evidence is supplied by the more physical of the branches of mathematics, such as optics, harmonics, and astronomy. These are in a way the converse of geometry. While geometry investigates physical lines but not qua physical, optics investigates mathematical lines, but qua physical, not qua mathematical.

Since 'nature' has two senses, the form and the matter, we must investigate its objects as we would the essence of snubness. That is, such things are neither independent of matter nor can be defined in terms of matter only. Here too
indeed one might raise a difficulty. Since there are two natures, with which is the physicist concerned? Or should he investigate the combination of the two? But if the combination of the two, then also each severally. Does it belong then to the same or to different sciences to know each severally?

If we look at the ancients, physics would to be concerned with the matter. (It was only very slightly that Empedocles and Democritus touched on the forms and the essence.)

But if on the other hand art imitates nature, and it is the part of the same discipline to know the form and the matter up to a point (e.g. the doctor has a knowledge of health and also of bile and phlegm, in which health is realized, and the builder both of the form of the house and of the matter, namely that it is bricks and beams, and so forth): if this is so, it would be the part of physics also to know nature in both its senses.

Again, ‘that for the sake of which’, or the end, belongs to the same department of knowledge as the means. But the nature is the end or 'that for the sake of which'. For if a thing undergoes a continuous change and there is a stage which is last, this stage is the end or 'that for the sake of which'. (That is why the poet was carried away into making an absurd statement when he said 'he has the end for the sake of which he was born'. For not every stage that is last claims to be an end, but only that which is best.)

For the arts make their material (some simply 'make' it, others make it serviceable), and we use everything as if it was there for our sake. (We also are in a sense an end. 'That for the sake of which' has two senses: the distinction is made in our work On Philosophy.) The arts, therefore, which govern the matter and have knowledge are two, namely the art which uses the product and the art which directs the production of it. That is why the using art also is in a sense directive; but it differs in that it knows the form, whereas the art which is directive as being concerned with production knows the matter. For the helmsman knows and prescribes what sort of form a helm should have, the other from what wood it should be made and by means of what operations. In the products of art, however, we make the material with a view to the function, whereas in the products of nature the matter is there all along.

Again, matter is a relative term: to each form there corresponds a special matter. How far then must the physicist know the form or essence? Up to a point, perhaps, as the doctor must know sinew or the smith bronze (i.e. until he understands the purpose of each): and the physicist is concerned only with things whose forms are separable indeed, but do not exist apart from matter. Man is begotten by man and by the sun as well. The mode of existence and essence of the separable it is the business of the primary type of philosophy to define.

Part 3

Now that we have established these distinctions, we must proceed to consider causes, their character and number. Knowledge is the object of our inquiry, and men do not think they know a thing till they have grasped the 'why' of (which is to grasp its primary cause). So clearly we too must do this as regards both coming to be and passing away and every kind of physical change, in order that, knowing their principles, we may try to refer to these principles each of our problems.

In one sense, then, (1) that out of which a thing comes to be and which persists, is called 'cause', e.g. the bronze of the statue, the silver of the bowl, and the genera of which the bronze and the silver are species.
In another sense (2) the form or the archetype, i.e. the statement of the essence, and its genera, are called 'causes' (e.g. of the octave the relation of 2:1, and generally number), and the parts in the definition.

Again (3) the primary source of the change or coming to rest; e.g. the man who gave advice is a cause, the father is cause of the child, and generally what makes of what is made and what causes change of what is changed.

Again (4) in the sense of end or 'that for the sake of which' a thing is done, e.g. health is the cause of walking about. ('Why is he walking about?' we say. 'To be healthy', and, having said that, we think we have assigned the cause.) The same is true also of all the intermediate steps which are brought about through the action of something else as means towards the end, e.g. reduction of flesh, purging, drugs, or surgical instruments are means towards health. All these things are 'for the sake of' the end, though they differ from one another in that some are activities, others instruments.

This then perhaps exhausts the number of ways in which the term 'cause' is used.

As the word has several senses, it follows that there are several causes of the same thing not merely in virtue of a concomitant attribute), e.g. both the art of the sculptor and the bronze are causes of the statue. These are causes of the statue qua statue, not in virtue of anything else that it may be-only not in the same way, the one being the material cause, the other the cause whence the motion comes. Some things cause each other reciprocally, e.g. hard work causes fitness and vice versa, but again not in the same way, but the one as end, the other as the origin of change. Further the same thing is the cause of contrary results. For that which by its presence brings about one result is sometimes blamed for bringing about the contrary by its absence. Thus we ascribe the wreck of a ship to the absence of the pilot whose presence was the cause of its safety.

All the causes now mentioned fall into four familiar divisions. The letters are the causes of syllables, the material of artificial products, fire, &c., of bodies, the parts of the whole, and the premisses of the conclusion, in the sense of 'that from which'. Of these pairs the one set are causes in the sense of substratum, e.g. the parts, the other set in the sense of essence-the whole and the combination and the form. But the seed and the doctor and the adviser, and generally the maker, are all sources whence the change or stationariness originates, while the others are causes in the sense of the end or the good of the rest; for 'that for the sake of which' means what is best and the end of the things that lead up to it. (Whether we say the 'good itself or the 'apparent good' makes no difference.)

Such then is the number and nature of the kinds of cause.

Now the modes of causation are many, though when brought under heads they too can be reduced in number. For 'cause' is used in many senses and even within the same kind one may be prior to another (e.g. the doctor and the expert are causes of health, the relation 2:1 and number of the octave), and always what is inclusive to what is particular. Another mode of causation is the incidental and its genera, e.g. in one way 'Polycitus', in another 'sculptor' is the cause of a statue, because 'being Polycitus' and 'sculptor' are incidentally conjoined. Also the classes in which the incidental attribute is included; thus 'a man' could be said to be the cause of a statue or, generally, 'a living creature'. An incidental attribute too may be more or less remote, e.g. suppose that 'a pale man' or 'a musical man' were said to be the cause of the statue.

All causes, both proper and incidental, may be spoken of either as potential or as actual; e.g. the cause of a house being
built is either 'house-builder' or 'house-builder building'.

Similar distinctions can be made in the things of which the causes are causes, e.g. of 'this statue' or of 'statue' or of 'image' generally, of 'this bronze' or of 'bronze' or of 'material' generally. So too with the incidental attributes. Again we may use a complex expression for either and say, e.g. neither 'Polyclitus' nor 'sculptor' but 'Polyclitus, sculptor'.

All these various uses, however, come to six in number, under each of which again the usage is twofold. Cause means either what is particular or a genus, or an incidental attribute or a genus of that, and these either as a complex or each by itself; and all six either as actual or as potential. The difference is this much, that causes which are actually at work and particular exist and cease to exist simultaneously with their effect, e.g. this healing person with this being-healed person and that house-building man with that being-built house; but this is not always true of potential causes–the house and the housebuilder do not pass away simultaneously.

In investigating the cause of each thing it is always necessary to seek what is most precise (as also in other things): thus man builds because he is a builder, and a builder builds in virtue of his art of building. This last cause then is prior: and so generally.

Further, generic effects should be assigned to generic causes, particular effects to particular causes, e.g. statue to sculptor, this statue to this sculptor; and powers are relative to possible effects, actually operating causes to things which are actually being effected.

This must suffice for our account of the number of causes and the modes of causation.

On the Parts of Animals, Book I

Part 1

Every systematic science, the humblest and the noblest alike, seems to admit of two distinct kinds of proficiency; one of which may be properly called scientific knowledge of the subject, while the other is a kind of educational acquaintance with it. For an educated man should be able to form a fair off-hand judgement as to the goodness or badness of the method used by a professor in his exposition. To be educated is in fact to be able to do this; and even the man of universal education we deem to be such in virtue of his having this ability. It will, however, of course, be understood that we only ascribe universal education to one who in his own individual person is thus critical in all or nearly all branches of knowledge, and not to one who has a like ability merely in some special subject. For it is possible for a man to have this competence in some one branch of knowledge without having it in all.

It is plain then that, as in other sciences, so in that which inquires into nature, there must be certain canons, by reference to which a hearer shall be able to criticize the method of a professed exposition, quite independently of the question whether the statements made be true or false. Ought we, for instance (to give an illustration of what I mean), to begin by discussing each separate species-man, lion, ox, and the like-taking each kind in hand inde- pendently of the rest, or ought we rather to deal first with the attributes which they have in common in virtue of some common element of their nature, and proceed from this as a basis for the consideration of them separately? For genera that are quite distinct yet oftentimes present many identical phenomena, sleep, for instance, respiration, growth, decay, death, and other
similar affections and conditions, which may be passed over for the present, as we are not yet prepared to treat of them with clearness and precision. Now it is plain that if we deal with each species independently of the rest, we shall frequently be obliged to repeat the same statements over and over again; for horse and dog and man present, each and all, every one of the phenomena just enumerated. A discussion therefore of the attributes of each such species separately would necessarily involve frequent repetitions as to characters, themselves identical but recurring in animals specifically distinct. (Very possibly also there may be other characters which, though they present specific differences, yet come under one and the same category. For instance, flying, swimming, walking, creeping, are plainly specifically distinct, but yet are all forms of animal progression.) We must, then, have some clear understanding as to the manner in which our investigation is to be conducted; whether, I mean, we are first to deal with the common or generic characters, and afterwards to take into consideration special peculiarities; or whether we are to start straight off with the ultimate species. For as yet no definite rule has been laid down in this matter. So also there is a like uncertainty as to another point now to be mentioned. Ought the writer who deals with the works of nature to follow the plan adopted by the mathematicians in their astronomical demonstrations, and after considering the phenomena presented by animals, and their several parts, proceed subsequently to treat of the causes and the reason why; or ought he to follow some other method? And when these questions are answered, there yet remains another. The causes concerned in the generation of the works of nature are, as we see, more than one. There is the final cause and there is the motor cause. Now we must decide which of these two causes comes first, which second. Plainly, however, that cause is the first which we call the final one. For this is the Reason, and the Reason forms the starting-point, alike in the works of art and in works of nature. For consider how the physician or how the builder sets about his work. He starts by forming for himself a definite picture, in the one case perceptible to mind, in the other to sense, of his end—the physician of health, the builder of a house—and this he holds forward as the reason and explanation of each subsequent step that he takes, and of his acting in this or that way as the case may be. Now in the works of nature the good end and the final cause is still more dominant than in works of art such as these, nor is necessity a factor with the same significance in them all; though almost all writers, while they try to refer their origin to this cause, do so without distinguishing the various senses in which the term necessity is used. For there is absolute necessity, manifested in eternal phenomena; and there is hypothetical necessity, manifested in everything that is generated by nature as in everything that is produced by art, be it a house or what it may. For if a house or other such final object is to be realized, it is necessary that such and such material shall exist; and it is necessary that first this then that shall be produced, and first this and then that set in motion, and so on in continuous succession, until the end and final result is reached, for the sake of which each prior thing is produced and exists. As with these productions of art, so also is it with the productions of nature. The mode of necessity, however, and the mode of ratiocination are different in natural science from what they are in the theoretical sciences; of which we have spoken elsewhere. For in the latter the starting-point is that which is; in the former that which is to be. For it is that which is yet to be—health, let us say, or a man—that, owing to its being of such and such characters, necessitates the pre-existence or previous production of this and that antecedent; and not this or that antecedent which, because it exists or has been generated, makes it necessary that health or a man is in, or shall come into, existence. Nor is it possible to track back the series of necessary antecedents to a starting-point, of which you can say that, existing itself from eternity, it has determined their existence as its consequent. These however again, are matters that have been dealt with in another treatise. There too it was stated in what cases absolute and hypothetical necessity exist; in what cases also the proposition expressing hypothetical necessity is simply convertible, and what cause it is that determines this convertibility.

Another matter which must not be passed over without consideration is, whether the proper subject of our exposition is that with which the ancient writers concerned themselves, namely, what is the process of formation of each animal; or
whether it is not rather, what are the characters of a given creature when formed. For there is no small difference
between these two views. The best course appears to be that we should follow the method already mentioned, and
begin with the phenomena presented by each group of animals, and, when this is done, proceed afterwards to state the
causes of those phenomena, and to deal with their evolution. For elsewhere, as for instance in house building, this is the
true sequence. The plan of the house, or the house, has this and that form; and because it has this and that form,
therefore is its construction carried out in this or that manner. For the process of evolution is for the sake of the thing
finally evolved, and not this for the sake of the process. Empedocles, then, was in error when he said that many of the
characters presented by animals were merely the results of incidental occurrences during their development; for
instance, that the backbone was divided as it is into vertebrae, because it happened to be broken owing to the contorted
position of the foetus in the womb. In so saying he overlooked the fact that propagation implies a creative seed endowed
with certain formative properties. Secondly, he neglected another fact, namely, that the parent animal pre-exists, not
only in idea, but actually in time. For man is generated from man; and thus it is the possession of certain characters by
the parent that determines the development of like characters in the child. The same statement holds good also for the
operations of art, and even for those which are apparently spontaneous. For the same result as is produced by art may
occur spontaneously. Spontaneity, for instance, may bring about the restoration of health. The products of art, however,
require the pre-existence of an efficient cause homogeneous with themselves, such as the statuary's art, which must
necessarily precede the statue; for this cannot possibly be produced spontaneously. Art indeed consists in the
conception of the result to be produced before its realization in the material. As with spontaneity, so with chance; for this
also produces the same result as art, and by the same process.

The fittest mode, then, of treatment is to say, a man has such and such parts, because the conception of a man includes
their presence, and because they are necessary conditions of his existence, or, if we cannot quite say this, which would
be best of all, then the next thing to it, namely, that it is either quite impossible for him to exist without them, or, at any
rate, that it is better for him that they should be there; and their existence involves the existence of other antecedents.
Thus we should say, because man is an animal with such and such characters, therefore is the process of his
development necessarily such as it is; and therefore is it accomplished in such and such an order, this part being formed
first, that next, and so on in succession; and after a like fashion should we explain the evolution of all other works of
nature.

Now that with which the ancient writers, who first philosophized about Nature, busied themselves, was the material
principle and the material cause. They inquired what this is, and what its character; how the universe is generated out of
it, and by what motor influence, whether, for instance, by antagonism or friendship, whether by intelligence or
spontaneous action, the substratum of matter being assumed to have certain inseparable properties; fire, for instance, to
have a hot nature, earth a cold one; the former to be light, the latter heavy. For even the genesis of the universe is thus
explained by them. After a like fashion do they deal also with the development of plants and of animals. They say, for
instance, that the water contained in the body causes by its currents the formation of the stomach and the other
receptacles of food or of excretion; and that the breath by its passage breaks open the outlets of the nostrils; air and
water being the materials of which bodies are made; for all represent nature as composed of such or similar substances.

But if men and animals and their several parts are natural phenomena, then the natural philosopher must take into
consideration not merely the ultimate substances of which they are made, but also flesh, bone, blood, and all other
homogeneous parts; not only these, but also the heterogeneous parts, such as face, hand, foot; and must examine how
each of these comes to be what it is, and in virtue of what force. For to say what are the ultimate substances out of
which an animal is formed, to state, for instance, that it is made of fire or earth, is no more sufficient than would be a
similar account in the case of a couch or the like. For we should not be content with saying that the couch was made of
bronze or wood or whatever it might be, but should try to describe its design or mode of composition in preference to the
material; or, if we did deal with the material, it would at any rate be with the concretion of material and form. For a couch
is such and such a form embodied in this or that matter, or such and such a matter with this or that form; so that its
shape and structure must be included in our description. For the formal nature is of greater importance than the material
nature.

Does, then, configuration and colour constitute the essence of the various animals and of their several parts? For if so,
what Democritus says will be strictly correct. For such appears to have been his notion. At any rate he says that it is
evident to every one what form it is that makes the man, seeing that he is recognizable by his shape and colour. And yet
a dead body has exactly the same configuration as a living one; but for all that is not a man. So also no hand of bronze
or wood or constituted in any but the appropriate way can possibly be a hand in more than name. For like a physician in
a painting, or like a flute in a sculpture, in spite of its name it will be unable to do the office which that name implies.
Precisely in the same way no part of a dead body, such I mean as its eye or its hand, is really an eye or a hand. To say,
then, that shape and colour constitute the animal is an inadequate statement, and is much the same as if a woodcarver
were to insist that the hand he had cut out was really a hand. Yet the physiologists, when they give an account of the
development and causes of the animal form, speak very much like such a craftsman. What, however, I would ask, are
the forces by which the hand or the body was fashioned into its shape? The woodcarver will perhaps say, by the axe or
the auger; the physiologist, by air and by earth. Of these two answers the artificer's is the better, but it is nevertheless
insufficient. For it is not enough for him to say that by the stroke of his tool this part was formed into a concavity, that into
a flat surface; but he must state the reasons why he struck his blow in such a way as to effect this, and what his final
object was; namely, that the piece of wood should develop eventually into this or that shape. It is plain, then, that the
teaching of the old physiologists is inadequate, and that the true method is to state what the definitive characters are
that distinguish the animal as a whole; to explain what it is both in substance and in form, and to deal after the same
fashion with its several organs; in fact, to proceed in exactly the same way as we should do, were we giving a complete
description of a couch.

If now this something that constitutes the form of the living being be the soul, or part of the soul, or something that
without the soul cannot exist; as would seem to be the case, seeing at any rate that when the soul departs, what is left is
no longer a living animal, and that none of the parts remain what they were before, excepting in mere configuration, like
the animals that in the fable are turned into stone; if, I say, this be so, then it will come within the province of the natural
philosopher to inform himself concerning the soul, and to treat of it, either in its entirety, or, at any rate, of that part of it
which constitutes the essential character of an animal; and it will be his duty to say what this soul or this part of a soul is;
and to discuss the attributes that attach to this essential character, especially as nature is spoken of in two senses, and
the nature of a thing is either its matter or its essence; nature as essence including both the motor cause and the final
cause. Now it is in the latter of these two senses that either the whole soul or some part of it constitutes the nature of an
animal; and inasmuch as it is the presence of the soul that enables matter to constitute the animal nature, much more
than it is the presence of matter which so enables the soul, the inquirer into nature is bound on every ground to treat of
the soul rather than of the matter. For though the wood of which they are made constitutes the couch and the tripod, it
only does so because it is capable of receiving such and such a form.

What has been said suggests the question, whether it is the whole soul or only some part of it, the consideration of
which comes within the province of natural science. Now if it be of the whole soul that this should treat, then there is no
place for any other philosophy beside it. For as it belongs in all cases to one and the same science to deal with
correlated subjects—one and the same science, for instance, deals with sensation and with the objects of sense—and
therefore the intelligent soul and the objects of intellect, being correlated, must belong to one and the same science, it
follows that natural science will have to include the whole universe in its province. But perhaps it is not the whole soul,
nor all its parts collectively, that constitutes the source of motion; but there may be one part, identical with that in plants,
which is the source of growth, another, namely the sensory part, which is the source of change of quality, while still
another, and this not the intellectual part, is the source of locomotion. I say not the intellectual part; for other animals
than man have the power of locomotion, but in none but him is there intellect. Thus then it is plain that it is not of the
whole soul that we have to treat. For it is not the whole soul that constitutes the animal nature, but only some part or
parts of it. Moreover, it is impossible that any abstraction can form a subject of natural science, seeing that everything
that Nature makes is means to an end. For just as human creations are the products of art, so living objects are manifest
in the products of an analogous cause or principle, not external but internal, derived like the hot and the cold from the
environing universe. And that the heaven, if it had an origin, was evolved and is maintained by such a cause, there is
therefore even more reason to believe, than that mortal animals so originated. For order and definiteness are much
more plainly manifest in the celestial bodies than in our own frame; while change and chance are characteristic of the
perishable things of earth. Yet there are some who, while they allow that every animal exists and was generated by
nature, nevertheless hold that the heaven was constructed to be what it is by chance and spontaneity; the heaven, in
which not the faintest sign of haphazard or of disorder is discernible! Again, whenever there is plainly some final end, to
which a motion tends should nothing stand in the way, we always say that such final end is the aim or purpose of the
motion; and from this it is evident that there must be a something or other really existing, corresponding to what we call
by the name of Nature. For a given germ does not give rise to any chance living being, nor spring from any chance one;
but each germ springs from a definite parent and gives rise to a definite progeny. And thus it is the germ that is the ruling
influence and fabricator of the offspring. For these it is by nature, the offspring being at any rate that which in nature will
spring from it. At the same time the offspring is anterior to the germ; for germ and perfected progeny are related as the
developmental process and the result. Anterior, however, to both germ and product is the organism from which the germ
was derived. For every germ implies two organisms, the parent and the progeny. For germ or seed is both the seed of
the organism from which it came, of the horse, for instance, from which it was derived, and the seed of the organism that
will eventually arise from it, of the mule, for example, which is developed from the seed of the horse. The same seed
then is the seed both of the horse and of the mule, though in different ways as here set forth. Moreover, the seed is
potentially that which will spring from it, and the relation of potentiality to actuality we know.

There are then two causes, namely, necessity and the final end. For many things are produced, simply as the results of
necessity. It may, however, be asked, of what mode of necessity are we speaking when we say this. For it can be of
neither of those two modes which are set forth in the philosophical treatises. There is, however, the third mode, in such
things at any rate as are generated. For instance, we say that food is necessary; because an animal cannot possibly do
without it. This third mode is what may be called hypothetical necessity. Here is another example of it. If a piece of wood
is to be split with an axe, the axe must of necessity be hard; and, if hard, must of necessity be made of bronze or iron.
Now exactly in the same way the body, which like the axe is an instrument—for both the body as a whole and its several
parts individually have definite operations for which they are made—just in the same way, I say, the body, if it is to do its
work, must of necessity be of such and such a character, and made of such and such materials.

It is plain then that there are two modes of causation, and that both of these must, so far as possible, be taken into
account in explaining the works of nature, or that at any rate an attempt must be made to include them both; and that those who fail in this tell us in reality nothing about nature. For primary cause constitutes the nature of an animal much more than does its matter. There are indeed passages in which even Empedocles hits upon this, and following the guidance of fact, finds himself constrained to speak of the ratio (olugos) as constituting the essence and real nature of things. Such, for instance, is the case when he explains what is a bone. For he does not merely describe its material, and say it is this one element, or those two or three elements, or a compound of all the elements, but states the ratio (olugos) of their combination. As with a bone, so manifestly is it with the flesh and all other similar parts.

The reason why our predecessors failed in hitting upon this method of treatment was, that they were not in possession of the notion of essence, nor of any definition of substance. The first who came near it was Democritus, and he was far from adopting it as a necessary method in natural science, but was merely brought to it, spite of himself, by constraint of facts. In the time of Socrates a nearer approach was made to the method. But at this period men gave up inquiring into the works of nature, and philosophers diverted their attention to political science and to the virtues which benefit mankind.

Of the method itself the following is an example. In dealing with respiration we must show that it takes place for such or such a final object; and we must also show that this and that part of the process is necessitated by this and that other stage of it. By necessity we shall sometimes mean hypothetical necessity, the necessity, that is, that the requisite antecedants shall be there, if the final end is to be reached; and sometimes absolute necessity, such necessity as that which connects substances and their inherent properties and characters. For the alternate discharge and re-entrance of heat and the inflow of air are necessary if we are to live. Here we have at once a necessity in the former of the two senses. But the alternation of heat and refrigeration produces of necessity an alternate admission and discharge of the outer air, and this is a necessity of the second kind.

In the foregoing we have an example of the method which we must adopt, and also an example of the kind of phenomena, the causes of which we have to investigate.