Book IV

1

WE have thus spoken of the generation of animals both generally and separately in all the different classes. But, since male and female are distinct in the most perfect of them, and since we say that the sexes are first principles of all living things whether animals or plants, only in some of them the sexes are separated and in others not, therefore we must speak first of the origin of the sexes in the latter. For while the animal is still imperfect in its kind the distinction is already made between male and female.

It is disputed, however, whether the embryo is male or female, as the case may be, even before the distinction is plain to our senses, and further whether it is thus differentiated within the mother or even earlier. It is said by some, as by Anaxagoras and other of the physicists, that this antithesis exists from the beginning in the germs or seeds; for the germ, they say, comes from the male while the female only provides the place in which it is to be developed, and the male is from the right, the female from the left testis, and so also that the male embryo is in the right of the uterus, the female in the left. Others, as Empedocles, say that the differentiation takes place in the uterus; for he says that if the uterus is hot or cold what enters it becomes male or female, the cause of the heat or cold being the flow of the catamenia, according as it is colder or hotter, more 'antique' or more 'recent'. Democritus of Abdera also says that the differentiation of sex takes place within the mother; that however it

is not because of heat and cold that one embryo becomes female and another male, but that it depends on the question which parent it is whose semen prevails,- not the whole of the semen, but that which has come from the part by which male and female differ from one another. This is a better theory, for certainly Empedocles has made a rather light-hearted assumption in thinking that the difference between them is due only to cold and heat, when he saw that there was a great difference in the whole of the sexual parts, the difference in fact between the male pudenda and the uterus. For suppose two animals already moulded in embryo, the one having all the parts of the female, the other those of the male; suppose them then to be put into the uterus as into an oven, the former when the oven is hot, the latter when it is cold; then on the view of Empedocles that which has no uterus will be female and that which has will be male. But this is impossible. Thus the theory of Democritus would be the better of the two, at least as far as this goes, for he seeks for the origin of this difference and tries to set it forth; whether he does so well or not is another question.

Again, if heat and cold were the cause of the difference of the parts, this ought to have been stated by those who maintain the view of Empedocles; for to explain the origin of male and female is practically the same thing as to explain this, which is the manifest difference between them. And it is no small matter, starting from temperature as a principle, to collect the cause of the origin of these parts, as if it were a necessary consequence for this part which they call the uterus to be formed in the embryo under the influence of cold but not under that of heat. The same applies also to the parts which serve for intercourse, since these also differ in the way stated previously.

Moreover male and female twins are often found together in the same part of the uterus; this we have observed sufficiently by dissection in all the vivipara, both land animals and fish. Now if Empedocles had not seen this it was only natural for him to fall into error in assigning this cause of his; but if he had seen it it is strange that he should still think the heat or cold of the uterus to be the cause,

since on his theory both these twins would have become either male or female, but as it is we do not see this to be the fact.

Again he says that the parts of the embryo are 'sundered', some being in the male and some in the female parent, which is why they desire intercourse with one another. If so it is necessary that the sexual parts like the rest should be separated from one another, already existing as masses of a certain size, and that they should come into being in the embryo on account of uniting with one another, not on account of cooling or heating of the semen. But perhaps it would take too long to discuss thoroughly such a cause as this which is stated by Empedocles, for its whole character seems to be fanciful. If, however, the facts about semen are such as we have actually stated, if it does not come from the whole of the body of the male parent and if the secretion of the male does not give any material at all to the embryo, then we must make a stand against both Empedocles and Democritus and any one else who argues on the same lines. For then it is not possible that the body of the embryo should exist 'sundered', part in the female parent and part in the male, as Empedocles says in the words: 'But the nature of the limbs hath been sundered, part in the man's...'; nor yet that a whole embryo is drawn off from each parent and the combination of the two becomes male or female according as one part prevails over another.

And, to take a more general view, though it is better to say that the one part makes the embryo female by prevailing through some superiority than to assign nothing but heat as the cause without any reflection, yet, as the form of the pudendum also varies along with the uterus from that of the father, we need an explanation of the fact that both these parts go along with each other. If it is because they are near each other, then each of the other parts also ought to go with them, for one of the prevailing parts is always near another part where the struggle is not yet decided; thus the offspring would be not only female or male but also like its mother or father respectively in all other details.

Besides, it is absurd to suppose that these parts should come into being as something isolated, without the body as a whole having changed along with them. Take first and foremost the blood-vessels, round which the whole mass of the flesh lies as round a framework. It is not reasonable that these should become of a certain quality because of the uterus, but rather that the uterus should do so on account of them. For though it is true that each is a receptacle of blood of some kind, still the system of the vessels is prior to the other; the moving principle must needs always be prior to that which it moves, and it is because it is itself of a certain quality that it is the cause of the development. The difference, then, of these parts as compared with each other in the two sexes is only a concomitant result; not this but something else must be held to be the first principle and the cause of the development of an embryo as male or female; this is so even if no semen is secreted by either male or female, but the embryo is formed in any way you please.

The same argument as that with which we meet Empedocles and Democritus will serve against those who say that the male comes from the right and the female from the left. If the male contributes no material to the embryo, there can be nothing in this view. If, as they say, he does contribute something of the sort, we must confront them in the same way as we did the theory of Empedocles, which accounts for the difference between male and female by the heat and cold of the uterus. They make the same mistake as he does, when they account for the difference by their 'right and left', though they see that the sexes differ actually by the whole of the sexual parts; for what reason then is the body of the uterus to exist in those embryos which come from the left and not in those from the right? For if an embryo have come from the left but has not acquired this part, it will be a female without a uterus, and so too there is nothing to stop another from being a male with a uterus! Besides as has been said before, a female embryo has been observed in the right part of the uterus, a male in the left, or again both at once in the same part, and this not only once but several times.

Some again, persuaded of the truth of a view resembling that of these philosophers, say that if a man copulates with the right or left testis tied up the result is male or female offspring respectively; so at least Leophanes asserted. And some say that the same happens in the case of those who have one or other testis excised, not speaking truth but vaticinating what will happen from probabilities and jumping at the conclusion that it is so before seeing that it proves to be so. Moreover, they know not that these parts of animals contribute nothing to the production of one sex rather than the other; a proof of this is that many animals in which the distinction of sex exists, and which produce both male and female offspring, nevertheless have no testes, as the footless animals; I mean the classes of fish and of serpents.

To suppose, then, either that heat and cold are the causes of male and female, or that the different sexes come from the right and left, is not altogether unreasonable in itself; for the right of the body is hotter than the left, and the concocted semen is hotter than the unconcocted; again, the thickened is concocted, and the more thickened is more fertile. Yet to put it in this way is to seek for the cause from too remote a starting-point; we must draw near the immediate causes in so far as it is possible for us.

We have, then, previously spoken elsewhere of both the body as a whole and its parts, explaining what each part is and for what reason it exists. But (1) the male and female are distinguished by a certain capacity and incapacity. (For the male is that which can concoct the blood into semen and which can form and secrete and discharge a semen carrying with it the principle of form- by 'principle' I do not mean a material principle out of which comes into being an offspring resembling the parent, but I mean the first moving cause, whether it have power to act as such in the thing itself or in something else- but the female is that which receives semen, indeed, but cannot form it for itself or secrete or discharge it.) And (2) all concoction works by means of heat. Therefore the males of animals must needs be hotter than the females. For it is by reason of cold and incapacity that the

female is more abundant in blood in certain parts of her anatomy, and this abundance is an evidence of the exact opposite of what some suppose, thinking that the female is hotter than the male for this reason, i.e. the discharge of the catamenia. It is true that blood is hot, and that which has more of it is hotter than that which has less. But they assume that this discharge occurs through excess of blood and of heat, as if it could be taken for granted that all blood is equally blood if only it be liquid and sanguineous in colour, and as if it might not become less in quantity but purer in quality in those who assimilate nourishment properly. In fact they look upon this residual discharge in the same light as that of the intestines, when they think that a greater amount of it is a sign of a hotter nature, whereas the truth is just the opposite. For consider the production of fruit; the nutriment in its first stage is abundant, but the useful product derived from it is small, indeed the final result is nothing at all compared to the quantity in the first stage. So is it with the body; the various parts receive and work up the nutriment, from the whole of which the final result is quite small. This is blood in some animals, in some its analogue. Now since (1) the one sex is able and the other is unable to reduce the residual secretion to a pure form, and (2) every capacity or power in an organism has a certain corresponding organ, whether the faculty produces the desired results in a lower degree or in a higher degree, and the two sexes correspond in this manner (the terms 'able' and 'unable' being used in more senses than one)- therefore it is necessary that both female and male should have organs. Accordingly the one has the uterus, the other the male organs.

Again, Nature gives both the faculty and the organ to each individual at the same time, for it is better so. Hence each region comes into being along with the secretions and the faculties, as e.g. the faculty of sight is not perfected without the eye, nor the eye without the faculty of sight; and so too the intestine and bladder come into being along with the faculty of forming the excreta. And since that from which an organ comes into being and that by which it is increased are the same (i.e. the nutriment), each of the parts will be made out of such a material and such residual matter as it is able to receive.

In the second place, again, it is formed, as we say, in a certain sense, out of its opposite. Thirdly, we must understand besides this that, if it is true that when a thing perishes it becomes the opposite of what it was, it is necessary also that what is not under the sway of that which made it must change into its opposite. After these premisses it will perhaps be now clearer for what reason one embryo becomes female and another male. For when the first principle does not bear sway and cannot concoct the nourishment through lack of heat nor bring it into its proper form, but is defeated in this respect, then must needs the material which it works on change into its opposite. Now the female is opposite to the male, and that in so far as the one is female and the other male. And since it differs in its faculty, its organ also is different, so that the embryo changes into this state. And as one part of first-rate importance changes, the whole system of the animal differs greatly in form along with it. This may be seen in the case of eunuchs, who, though mutilated in one part alone, depart so much from their original appearance and approximate closely to the female form. The reason of this is that some of the parts are principles, and when a principle is moved or affected needs must many of the parts that go along with it change with it.

If then (1) the male quality or essence is a principle and a cause, and (2) the male is such in virtue of a certain capacity and the female is such in virtue of an incapacity, and (3) the essence or definition of the capacity and of the incapacity is ability or inability to concoct the nourishment in its ultimate stage, this being called blood in the sanguinea and the analogue of blood in the other animals, and (4) the cause of this capacity is in the first principle and in the part which contains the principle of natural heat- therefore a heart must be formed in the sanguinea (and the resulting animal will be either male or female), and in the other kinds which possess the sexes must be formed that which is analogous to the heart.

This, then, is the first principle and cause of male and female, and this is the part of the body in which it resides. But the animal becomes definitely female or male by the time when it possesses also

the parts by which the female differs from the male, for it is not in virtue of any part you please that it is male or female, any more than it is able to see or hear by possessing any part you please.

To recapitulate, we say that the semen, which is the foundation of the embryo, is the ultimate secretion of the nutriment. By ultimate I mean that which is carried to every part of the body, and this is also the reason why the offspring is like the parent. For it makes no difference whether we say that the semen comes from all the parts or goes to all of them, but the latter is the better. But the semen of the male differs from the corresponding secretion of the female in that it contains a principle within itself of such a kind as to set up movements also in the embryo and to concoct thoroughly the ultimate nourishment, whereas the secretion of the female contains material alone. If, then, the male element prevails it draws the female element into itself, but if it is prevailed over it changes into the opposite or is destroyed. But the female is opposite to the male, and is female because of its inability to concoct and of the coldness of the sanguineous nutriment. And Nature assigns to each of the secretions the part fitted to receive it. But the semen is a secretion, and this in the hotter animals with blood, i.e. the males, is moderate in quantity, wherefore the recipient parts of this secretion in males are only passages. But the females, owing to inability to concoct, have a great quantity of blood, for it cannot be worked up into semen. Therefore they must also have a part to receive this, and this part must be unlike the passages of the male and of a considerable size. This is why the uterus is of such a nature, this being the part by which the female differs from the male.

2

We have thus stated for what reason the one becomes female and the other male. Observed facts confirm what we have said. For more females are produced by the young and by those verging on old age than by those in the prime of life; in the former the vital heat is not yet perfect, in the latter it is failing. And those of a moister and more

feminine state of body are more wont to beget females, and a liquid semen causes this more than a thicker; now all these characteristics come of deficiency in natural heat.

Again, more males are born if copulation takes place when north than when south winds are blowing. For in the latter case the animals produce more secretion, and too much secretion is harder to concoct; hence the semen of the males is more liquid, and so is the discharge of the catamenia.

Also the fact that the catamenia occur in the course of nature rather when the month is waning is due to the same causes. For this time of the month is colder and moister because of the waning and failure of the moon; as the sun makes winter and summer in the year as a whole, so does the moon in the month. This is not due to the turning of the moon, but it grows warmer as the light increases and colder as it wanes.

The shepherds also say that it not only makes a difference in the production of males and females if copulation takes place during northern or southerly winds, but even if the animals while copulating look towards the south or north; so small a thing will sometimes turn the scale and cause cold or heat, and these again influence generation.

The male and female, then, are distinguished generally, as compared with one another in connexion with the production of male and female offspring, for the causes stated. However, they also need a certain correspondence with one another to produce at all, for all things that come into being as products of art or of Nature exist in virtue of a certain ratio. Now if the hot preponderates too much it dries up the liquid; if it is very deficient it does not solidify it; for the artistic or natural product we need the due mean between the extremes. Otherwise it will be as in cooking; too much fire burns the meat, too little does not cook it, and in either case the process is a failure. So also there is need of due proportion in the mixture of the male and female elements. And for this cause it often happens to many of both sexes that they do not generate with one another, but

if divorced and remarried to others do generate; and these oppositions show themselves sometimes in youth, sometimes in advanced age, alike as concerns fertility or infertility, and as concerns generation of male or female offspring.

One country also differs from another in these respects, and one water from another, for the same reasons. For the nourishment and the medical condition of the body are of such or such a kind because of the tempering of the surrounding air and of the food entering the body, especially the water; for men consume more of this than of anything else, and this enters as nourishment into all food, even solids. Hence hard waters cause infertility, and cold waters the birth of females.

3

The same causes must be held responsible for the following groups of facts. (1) Some children resemble their parents, while others do not; some being like the father and others like the mother, both in the body as a whole and in each part, male and female offspring resembling father and mother respectively rather than the other way about. (2) They resemble their parents more than remoter ancestors, and resemble those ancestors more than any chance individual. (3) Some, though resembling none of their relations, yet do at any rate resemble a human being, but others are not even like a human being but a monstrosity. For even he who does not resemble his parents is already in a certain sense a monstrosity; for in these cases Nature has in a way departed from the type. The first departure indeed is that the offspring should become female instead of male; this, however, is a natural necessity. (For the class of animals divided into sexes must be preserved, and as it is possible for the male sometimes not to prevail over the female in the mixture of the two elements, either through youth or age or some other such cause, it is necessary that animals should produce female young). And the monstrosity, though not necessary in regard of a final cause and an end, yet is necessary accidentally. As for the origin of it, we must look at it

in this way. If the generative secretion in the catamenia is properly concocted, the movement imparted by the male will make the form of the embryo in the likeness of itself. (Whether we say that it is the semen or this movement that makes each of the parts grow, makes no difference; nor again whether we say that it 'makes them grow' or 'forms them from the beginning', for the formula of the movement is the same in either case.) Thus if this movement prevail, it will make the embryo male and not female, like the father and not like the mother; if it prevail not, the embryo is deficient in that faculty in which it has not prevailed. By 'each faculty' I mean this. That which generates is not only male but also a particular male, e.g. Coriscus or Socrates, and it is not only Coriscus but also a man. In this way some of the characteristics of the father are more near to him, others more remote from him considered simply as a parent and not in reference to his accidental qualities (as for instance if the parent is a scholar or the neighbour of some particular person). Now the peculiar and individual has always more force in generation than the more general and wider characteristics. Coriscus is both a man and an animal, but his manhood is nearer to his individual existence than is his animalhood. In generation both the individual and the class are operative, but the individual is the more so of the two, for this is the only true existence. And the offspring is produced indeed of a certain quality, but also as an individual, and this latter is the true existence. Therefore it is from the forces of all such existences that the efficient movements come which exist in the semen; potentially from remoter ancestors but in a higher degree and more nearly from the individual (and by the individual I mean e.g. Coriscus or Socrates). Now since everything changes not into anything haphazard but into its opposite, therefore also that which is not prevailed over in generation must change and become the opposite, in respect of that particular force in which the paternal and efficient or moving element has not prevailed. If then it has not prevailed in so far as it is male, the offspring becomes female; if in so far as it is Coriscus or Socrates, the offspring does not resemble the father but the mother. For as 'father' and 'mother' are opposed as general terms, so also

the individual father is opposed to the individual mother. The like applies also to the forces that come next in order, for the offspring always changes rather into the likeness of the nearer ancestor than the more remote, both in the paternal and in the maternal line.

Some of the movements exist in the semen actually, others potentially; actually, those of the father and the general type, as man and animal; potentially those of the female and the remoter ancestors. Thus the male and efficient principle, if it lose its own nature, changes to its opposites, but the movements which form the embryo change into those nearly connected with them; for instance, if the movement of the male parent be resolved, it changes by a very slight difference into that of his father, and in the next instance into that of his grandfather; and in this way not only in the male but also in the female line the movement of the female parent changes into that of her mother, and, if not into this, then into that of her grandmother; and similarly also with the more remote ancestors.

Naturally then it is most likely that the characteristics of 'male' and of the individual father will go together, whether they prevail or are prevailed over. For the difference between them is small so that there is no difficulty in both concurring, for Socrates is an individual man with certain characters. Hence for the most part the male offspring resemble the father, and the female the mother. For in the latter case the loss of both characters takes place at once, and the change is into the two opposites; now is opposed to male, and the individual mother to the individual father.

But if the movement coming from the male principle prevails while that coming from the individual Socrates does not, or vice versa, then the result is that male children are produced resembling the mother and female children resembling the father.

If again the movements be resolved, if the male character remain but the movement coming from the individual Socrates be resolved into that of the father of Socrates, the result will be a male child resembling its grandfather or some other of its more remote ancestors in the male line on the same principle. If the male principle be pre-

vailed over, the child will be female and resembling most probably its mother, but, if the movement coming from the mother also be resolved, it will resemble its mother's mother or the resemblance will be to some other of its more remote ancestors in the female line on the same principle.

The same applies also to the separate parts, for often some of these take after the father, and others after the mother, and yet others after some of the remoter ancestors. For, as has been often said already, some of the movements which form the parts exist in the semen actually and others potentially. We must grasp certain fundamental general principles, not only that just mentioned (that some of the movements exist potentially and others actually), but also two others, that if a character be prevailed over it changes into its opposite, and, if it be resolved, is resolved into the movement next allied to it- if less, into that which is near, if more, into that which is further removed. Finally, the movements are so confused together that there is no resemblance to any of the family or kindred, but the only character that remains is that common to the race, i.e. it is a human being. The reason of this is that this is closely knit up with the individual characteristics; 'human being' is the general term, while Socrates, the father, and the mother, whoever she may be, are individuals.

The reason why the movements are resolved is this. The agent is itself acted upon by that on which it acts; thus that which cuts is blunted by that which is cut by it, that which heats is cooled by that which is heated by it, and in general the moving or efficient cause (except in the case of the first cause of all) does itself receive some motion in return; e.g. what pushes is itself in a way pushed again and what crushes is itself crushed again. Sometimes it is altogether more acted upon than is the thing on which it acts, so that what is heating or cooling something else is itself cooled or heated; sometimes having produced no effect, sometimes less than it has itself received. (This question has been treated in the special discussion of action and reaction, where it is laid down in what classes of things action and reaction exist.) Now that which is acted on escapes and is not

mastered by the semen, either through deficiency of power in the concocting and moving agent or because what should be concocted and formed into distinct parts is too cold and in too great quantity. Thus the moving agent, mastering it in one part but not in another, makes the embryo in formation to be multiform, as happens with athletes because they eat so much. For owing to the quantity of their food their nature is not able to master it all, so as to increase and arrange their form symmetrically; therefore their limbs develop irregularly, sometimes indeed almost so much that no one of them resembles what it was before. Similar to this is also the disease known as satyrism, in which the face appears like that of a satyr owing to a quantity of unconcocted humour or wind being diverted into parts of the face.

We have thus discussed the cause of all these phenomena, (1) female and male offspring are produced, (2) why some are similar to their parents, female to female and male to male, and others the other way about, females being similar to the father and males to the mother, and in general why some are like their ancestors while others are like none of them, and all this as concerns both the body as a whole and each of the parts separately. Different accounts, however, have been given of these phenomena by some of the nature-philosophers; I mean why children are like or unlike their parents. They give two versions of the reason. Some say that the child is more like that parent of the two from whom comes more semen, this applying equally both to the body as a whole and to the separate parts, on the assumption that semen comes from each part of both parents; if an equal part comes from each, then, they say, the child is like neither. But if this is false, if semen does not come off from the whole body of the parents, it is clear that the reason assigned cannot be the cause of likeness and unlikeness. Moreover, they are hard put to it to explain how it is that a female child can be like the father and a male like the mother. For (1) those who assign the same cause of sex as Empedocles or Democritus say what is on other grounds impossible, and (2) those who say that it is determined by the greater or smaller amount of semen coming the male or female parent, and that this

is why one child is male and another female, cannot show how the female is to resemble the father and the male the mother, for it is impossible that more should come from both at once. Again, for what reason is a child generally like its ancestors, even the more remote? None of the semen has come from them at any rate.

But those who account for the similarity in the manner which remains to be discussed, explain this point better, as well as the others. For there are some who say that the semen, though one, is as it were a common mixture (panspermia) of many elements; just as, if one should mix many juices in one liquid and then take some from it, it would be possible to take, not an equal quantity always from each juice, but sometimes more of one and sometimes more of another, sometimes some of one and none at all of another, so they say it is with the generative fluid, which is a mixture of many elements, for the offspring resembles that parent from which it has derived most. Though this theory is obscure and in many ways fictitious, it aims at what is better expressed by saying that what is called 'panspermia' exists potentially, not actually; it cannot exist actually, but it can do so potentially. Also, if we assign only one sort of cause, it is not easy to explain all the phenomena, (1) the distinction of sex, (2) why the female is often like the father and the male like the mother, and again (3) the resemblance to remoter ancestors, and further (4) the reason why the offspring is sometimes unlike any of these but still a human being, but sometimes, (5) proceeding further on these lines, appears finally to be not even a human being but only some kind of animal, what is called a monstrosity.

For, following what has been said, it remains to give the reason for such monsters. If the movements imparted by the semen are resolved and the material contributed by the mother is not controlled by them, at last there remains the most general substratum, that is to say the animal. Then people say that the child has the head of a ram or a bull, and so on with other animals, as that a calf has the head of a child or a sheep that of an ox. All these monsters result from the causes stated above, but they are none of the things they are said to

be; there is only some similarity, such as may arise even where there is no defect of growth. Hence often jesters compare some one who is not beautiful to a 'goat breathing fire', or again to a 'ram butting', and a certain physiognomist reduced all faces to those of two or three animals, and his arguments often prevailed on people.

That, however, it is impossible for such a monstrosity to come into existence- I mean one animal in another- is shown by the great difference in the period of gestation between man, sheep, dog, and ox, it being impossible for each to be developed except in its proper time.

This is the description of some of the monsters talked about; others are such because certain parts of their form are multiplied so that they are born with many feet or many heads.

The account of the cause of monstrosities is very close and similar in a way to that of the cause of animals being born defective in any part, for monstrosity is also a kind of deficiency.

4

Democritus said that monstrosities arose because two emissions of seminal fluid met together, the one succeeding the other at an interval of time; that the later entering into the uterus reinforced the earlier so that the parts of the embryo grow together and get confused with one another. But in birds, he says, since copulation takes place quickly, both the eggs and their colour always cross one another. But if it is the fact, as it manifestly is, that several young are produced from one emission of semen and a single act of intercourse, it is better not to desert the short road to go a long way about, for in such cases it is absolutely necessary that this should occur when the semen is not separated but all enters the female at once.

If, then, we must attribute the cause to the semen of the male, this will be the way we shall have to state it, but we must rather by all means suppose that the cause lies in the material contributed by the female and in the embryo as it is forming. Hence also such mon-

strosities appear very rarely in animals producing only one young one, more frequently in those producing many, most of all in birds and among birds in the common fowl. For this bird produces many young, not only because it lays often like the pigeon family, but also because it has many embryos at once and copulates all the year round. Therefore it produces many double eggs, for the embryos grow together because they are near one another, as often happens with many fruits. In such double eggs, when the yolks are separated by the membrane, two separate chickens are produced with nothing abnormal about them; when the yolks are continuous, with no division between them, the chickens produced are monstrous, having one body and head but four legs and four wings; this is because the upper parts are formed earlier from the white, their nourishment being drawn from the yolk, whereas the lower part comes into being later and its nourishment is one and indivisible.

A snake has also been observed with two heads for the same reason, this class also being oviparous and producing many young. Monstrosities, however, are rarer among them owing to the shape of the uterus, for by reason of its length the numerous eggs are set in a line.

Nothing of the kind occurs with bees and wasps, because their brood is in separate cells. But in the fowl the opposite is the case, whereby it is plain that we must hold the cause of such phenomena to lie in the material. So, too, monstrosities are commoner in other animals if they produce many young. Hence they are less common in man, for he produces for the most part only one young one and that perfect; even in man monstrosities occur more often in regions where the women give birth to more than one at a time, as in Egypt. And they are commoner in sheep and goats, since they produce more young. Still more does this apply to the fissipeds, for such animals produce many young and imperfect, as the dog, the young of these creatures being generally blind. Why this happens and why they produce many young must be stated later, but in them Nature has made an advance towards the production of monstrosities in that what they generate, being imperfect, is so far unlike the par-

ent; now monstrosities also belong to the class of things unlike the parent. Therefore this accident also often invades animals of such a nature. So, too, it is in these that the so-called 'metachoera' are most frequent, and the condition of these also is in a way monstrous, since both deficiency and excess are monstrous. For the monstrosity belongs to the class of things contrary to Nature, not any and every kind of Nature, but Nature in her usual operations; nothing can happen contrary to Nature considered as eternal and necessary, but we speak of things being contrary to her in those cases where things generally happen in a certain way but may also happen in another way. In fact, even in the case of monstrosities, whenever things occur contrary indeed to the established order but still always in a certain way and not at random, the result seems to be less of a monstrosity because even that which is contrary to Nature is in a certain sense according to Nature, whenever, that is, the formal nature has not mastered the material nature. Therefore they do not call such things monstrosities any more than in the other cases where a phenomenon occurs habitually, as in fruits; for instance, there is a vine which some call 'capneos'; if this bear black grapes they do not judge it a monstrosity because it is in the habit of doing this very often. The reason is that it is in its nature intermediate between white and black; thus the change is not a violent one nor, so to say, contrary to Nature; at least, is it not a change into another nature. But in animals producing many young not only do the same phenomena occur, but also the numerous embryos hinder one another from becoming perfect and interfere with the generative motions imparted by the semen.

A difficulty may be raised concerning (1) the production of many young and the multiplication of the parts in a single young one, and (2) the production of few young or only one and the deficiency of the parts. Sometimes animals are born with too many toes, sometimes with one alone, and so on with the other parts, for they may be multiplied or they may be absent. Again, they may have the generative parts doubled, the one being male, the other female; this is known in men and especially in goats. For what are called 'tragaenae' are such because they have both male and female generative

parts; there is a case also of a goat being born with a horn upon its leg. Changes and deficiencies are found also in the internal parts, animals either not possessing some at all, or possessing them in a rudimentary condition, or too numerous or in the wrong place. No animal, indeed, has ever been born without a heart, but they are born without a spleen or with two spleens or with one kidney; there is no case again of total absence of the liver, but there are cases of its being incomplete. And all these phenomena have been seen in animals perfect and alive. Animals also which naturally have a gall-bladder are found without one; others are found to have more than one. Cases are known, too, of the organs changing places, the liver being on the left, the spleen on the right. These phenomena have been observed, as stated above, in animals whose growth is perfected; at the time of birth great confusion of every kind has been found. Those deficiency which only depart a little from Nature commonly live; not so those which depart further, when the unnatural condition is in the parts which are sovereign over life.

The question then about all these cases is this. Are we to suppose that a single cause is responsible for the production of a single young one and for the deficiency of the parts, and another but still a single cause for the production of many young and the multiplication of parts, or not?

In the first place it seems only reasonable to wonder why some animals produce many young, others only one. For it is the largest animals that produce one, e.g. the elephant, camel, horse, and the other solid-hoofed ungulates; of these some are larger than all other animals, while the others are of a remarkable size. But the dog, the wolf, and practically all the fissipeds, produce many, even the small members of the class, as the mouse family. The cloven-footed animals again produce few, except the pig, which belongs to those that produce many. This certainly seems surprising, for we should expect the large animals to be able to generate more young and to secrete more semen. But precisely what we wonder at is the reason for not wondering; it is just because of their size that they do not produce

many young, for the nutriment is expended in such animals upon increasing the body. But in the smaller animals Nature takes away from the size and adds the excess so gained to the seminal secretion. Moreover, more semen must needs be used in generation by the larger animal, and little by the smaller. Therefore many small ones may be produced together, but it is hard for many large ones to be so, and to those intermediate in size Nature has assigned the intermediate number. We have formerly given the reason why some animals are large, some smaller, and some between the two, and speaking generally, with regard to the number of young produced, the solid-hoofed produce one, the cloven-footed few, the many-toed many. (The reason of this is that, generally speaking, their sizes correspond to this difference.) It is not so, however, in all cases; for it is the largeness and smallness of the body that is cause of few or many young being born, not the fact that the kind of animal has one, two, or many toes. A proof of this is that the elephant is the largest of animals and yet is many-toed, and the camel, the next largest, is cloven-footed. And not only in animals that walk but also in those that fly or swim the large ones produce few, the small many, for the same reason. In like manner also it is not the largest plants that bear most fruit.

We have explained then why some animals naturally produce many young, some but few, and some only one; in the difficulty now stated we may rather be surprised with reason at those which produce many, since such animals are often seen to conceive from a single copulation. Whether the semen of the male contributes to the material of the embryo by itself becoming a part of it and mixing with the semen of the female, or whether, as we say, it does not act in this way but brings together and fashions the material within the female and the generative secretion as the fig-juice does the liquid substance of milk, what is the reason why it does not form a single animal of considerable size? For certainly in the parallel case the fig-juice is not separated if it has to curdle a large quantity of milk, but the more the milk and the more the fig-juice put into it, so much the greater is the curdled mass. Now it is no use to say that the several regions of the uterus attract the semen and therefore more young than one are

formed, because the regions are many and the cotyledons are more than one. For two embryos are often formed in the same region of the uterus, and they may be seen lying in a row in animals that produce many, when the uterus is filled with the embryos. (This is plain from the dissections.) Rather the truth is this. As animals complete their growth there are certain limits to their size, both upwards and downwards, beyond which they cannot go, but it is in the space between these limits that they exceed or fall short of one another in size, and it is within these limits that one man (or any other animal) is larger or smaller than another. So also the generative material from which each animal is formed is not without a quantitative limit in both directions, nor can it be formed from any quantity you please. Whenever then an animal, for the cause assigned, discharges more of the female secretion than is needed for beginning the existence of a single animal, it is not possible that only one should be formed out of all this, but a number limited by the appropriate size in each case; nor will the semen of the male, or the power residing in the semen, form anything either more or less than what is according to Nature. In like manner, if the male emits more semen than is necessary, or more powers in different parts of the semen as it is divided, however much it is it will not make anything greater; on the contrary it will dry up the material of the female and destroy it. So fire also does not continue to make water hotter in proportion as it is itself increased, but there is a fixed limit to the heat of which water is capable; if that is once reached and the fire is then increased, the water no longer gets hotter but rather evaporates and at last disappears and is dried up. Now since it appears that the secretion of the female and that from the male need to stand in some proportionate relation to one another (I mean in animals of which the male emits semen), what happens in those that produce many young is this: from the very first the semen emitted by the male has power, being divided, to form several embryos, and the material contributed by the female is so much that several can be formed out of it. (The parallel of curdling milk, which we spoke of before, is no longer in point here, for what is formed by the heat of the semen is not only of a certain

quantity but also of a certain quality, whereas with fig-juice and rennet quantity alone is concerned.) This then is just the reason why in such animals the embryos formed are numerous and do not all unite into one whole; it is because an embryo is not formed out of any quantity you please, but whether there is too much or too little, in either case there will be no result, for there is a limit set alike to the power of the heat which acts on the material and to the material so acted upon.

On the same principle many embryos are not formed, though the secretion is much, in the large animals which produce only one young one, for in them also both the material and that which works upon it are of a certain quantity. So then they do not secrete such material in too great quantity for the reason previously stated, and what they do secrete is naturally just enough for one embryo alone to be formed from it. If ever too much is secreted, then twins are born. Hence such cases seem to be more portentous, because they are contrary to the general and customary rule.

Man belongs to all three classes, for he produces one only and sometimes many or few, though naturally he almost always produces one. Because of the moisture and heat of his body he may produce many [for semen is naturally fluid and hot], but because of his size he produces few or one. On account of this it results that in man alone among animals the period of gestation is irregular; whereas the period is fixed in the rest, there are several periods in man, for children are born at seven months and at ten months and at the times between, for even those of eight months do live though less often than the rest. The reason may be gathered from what has just been said, and the question has been discussed in the Problems. Let this explanation suffice for these points.

The cause why the parts may be multiplied contrary to Nature is the same as the cause of the birth of twins. For the reason exists already in the embryo, whenever it aggregates more material at any point of itself than is required by the nature of the part. The result is then that either one of its parts is larger than the others, as a finger or

hand or foot or any of the other extremities or limbs; or again if the embryo is cleft there may come into being more than one such part, as eddies do in rivers; as the water in these is carried along with a certain motion, if it dash against anything two systems or eddies come into being out of one, each retaining the same motion; the same thing happens also with the embryos. The abnormal parts generally are attached near those they resemble, but sometimes at a distance because of the movement- taking place in the embryo, and especially because of the excess of material returning to that place whence it was taken away while retaining the form of that part whence it arose as a superfluity.

In certain cases we find a double set of generative organs [one male and the other female]. When such duplication occurs the one is always functional but not the other, because it is always insufficiently supplied with nourishment as being contrary to Nature; it is attached like a growth (for such growths also receive nourishment though they are a later development than the body proper and contrary to Nature.) If the formative power prevails, both are similar; if it is altogether vanquished, both are similar; but if it prevail here and be vanquished there, then the one is female and the other male. (For whether we consider the reason why the whole animal is male or female, or why the parts are so, makes no difference.)

When we meet with deficiency in such parts, e.g. an extremity or one of the other members, we must assume the same cause as when the embryo is altogether aborted (abortion of embryos happens frequently).

Outgrowths differ from the production of many young in the manner stated before; monsters differ from these in that most of them are due to embryos growing together. Some however are also of the following kind, when the monstrosity affects greater and more sovereign parts, as for instance some monsters have two spleens or more than two kidneys. Further, the parts may migrate, the movements which form the embryo being diverted and the material changing its place. We must decide whether the monstrous animal is one or

is composed of several grown together by considering the vital principle; thus, if the heart is a part of such a kind then that which has one heart will be one animal, the multiplied parts being mere outgrowths, but those which have more than one heart will be two animals grown together through their embryos having been confused.

It also often happens even in many animals that do not seem to be defective and whose growth is now complete, that some of their passages may have grown together or others may have been diverted from the normal course. Thus in some women before now the os uteri has remained closed, so that when the time for the catamenia has arrived pain has attacked them, till either the passage has burst open of its own accord or the physicians have removed the impediment; some such cases have ended in death if the rupture has been made too violently or if it has been impossible to make it at all. In some boys on the other hand the end of the penis has not coincided with the end of the passage where the urine is voided, but the passage has ended below, so that they crouch sitting to void it, and if the testes are drawn up they appear from a distance to have both male and female generative organs. The passage of the solid food also has been closed before now in sheep and some other animals; there was a cow in Perinthus which passed fine matter, as if it were sifted, through the bladder, and when the anus was cut open it quickly closed up again nor could they succeed in keeping it open.

We have now spoken of the production of few and many young, and of the outgrowth of superfluous parts or of their deficiency, and also of monstrosities.

5

Superfoetation does not occur at all in some animals but does in others; of the former some are able to bring the later formed embryo to birth, while others can only do so sometimes. The reason why it does not occur in some is that they produce only one young one, for it is not found in solid-hoofed animals and those larger than these, as owing to their size the secretion of the female is all used up for the

one embryo. For all these have large bodies, and when an animal is large its foetus is large in proportion, e.g. the foetus of the elephant is as big as a calf. But superfoetation occurs in those which produce many young because the production of more than one at a birth is itself a sort of superfoetation, one being added to another. Of these all that are large, as man, bring to birth the later embryo, if the second impregnation takes place soon after the first, for such an event has been observed before now. The reason is that given above, for even in a single act of intercourse the semen discharged is more than enough for one embryo, and this being divided causes more than one child to be born, the one of which is later than the other. But when the embryo has already grown to some size and it so happens that copulation occurs again, superfoetation sometimes takes place, but rarely, since the uterus generally closes in women during the period of gestation. If this ever happens (for this also has occurred) the mother cannot bring the second embryo to perfection, but it is cast out in a state like what are called abortions. For just as, in those animals that bear only one, all the secretion of the female is converted to the first formed embryo because of its size, so it is here also; the only difference is that in the former case this happens at once, in the latter when the foetus has attained to some size, for then they are in the same state as those that bear only one. In like manner, since man naturally would produce many young, and since the size of the uterus and the quantity of the female secretion are both greater than is necessary for one embryo, only not so much so as to bring to birth a second, therefore women and mares are the only animals which admit the male during gestation, the former for the reason stated, and mares both because of the barrenness of their nature and because their uterus is of superfluous size, too large for one but too small to allow a second embryo to be brought to perfection by superfoetation. And the mare is naturally inclined to sexual intercourse because she is in the same case as the barren among women; these latter are barren because they have no monthly discharge (which corresponds to the act of intercourse in males) and mares have exceedingly little. And in all the vivipara the barren females are

so inclined, because they resemble the males when the semen has collected in the testes but is not being got rid of. For the discharge of the catamenia is in females a sort of emission of semen, they being unconcocted semen as has been said before. Hence it is that those women also who are incontinent in regard to such intercourse cease from their passion for it when they have borne many children, for, the seminal secretion being then drained off, they no longer desire this intercourse. And among birds the hens are less disposed that way than the cocks, because the uterus of the hen-bird is up near the hypozoma; but with the cock-birds it is the other way, for their testes are drawn up within them, so that, if any kind of such birds has much semen naturally, it is always in need of this intercourse. In females then it encourages copulation to have the uterus low down, but in males to have the testes drawn up.

It has been now stated why superfoetation is not found in some animals at all, why it is found in others which sometimes bring the later embryos to birth and sometimes not, and why some such animals are inclined to sexual intercourse while others are not.

Some of those animals in which superfoetation occurs can bring the embryos to birth even if a long time elapses between the two impregnations, if their kind is spermatic, if their body is not of a large size, and if they bear many young. For because they bear many their uterus is spacious, because they are spermatic the generative discharge is copious, and because the body is not large but the discharge is excessive and in greater measure than is required for the nourishment wanted for the embryo, therefore they can not only form animals but also bring them to birth later on. Further, the uterus in such animals does not close up during gestation because there is a quantity of the residual discharge left over. This has happened before now even in women, for in some of them the discharge continues during all the time of pregnancy. In women, however, this is contrary to Nature, so that the embryo suffers, but in such animals it is according to Nature, for their body is so formed from the beginning, as with hares. For superfoetation occurs in these animals, since

they are not large and they bear many young (for they have many toes and the many-toed animals bear many), and they are spermatic. This is shown by their hairiness, for the quantity of their hair is excessive, these animals alone having hair under the feet and within the jaws. Now hairiness is a sign of abundance of residual matter, wherefore among men also the hairy are given to sexual intercourse and have much semen rather than the smooth. In the hare it often happens that some of the embryos are imperfect while others of its young are produced perfect.

6

Some of the vivipara produce their young imperfect, others perfect; the one-hoofed and cloven-footed perfect, most of the many-toed imperfect. The reason of this is that the one-hoofed produce one young one, and the cloven-footed either one or two generally speaking; now it is easy to bring the few to perfection. All the many-toed animals that bear their young imperfect give birth to many. Hence, though they are able to nourish the embryos while newly formed, their bodies are unable to complete the process when the embryos have grown and acquired some size. So they produce them imperfect, like those animals which generate a scolex, for some of them when born are scarcely brought into form at all, as the fox, bear, and lion, and some of the rest in like manner; and nearly all of them are blind, as not only the animals mentioned but also the dog, wolf, and jackal. The pig alone produces both many and perfect young, and thus here alone we find any overlapping; it produces many as do the many-toed animals, but is cloven-footed or solid-hoofed (for there certainly are solid-hoofed swine). They bear, then, many young because the nutriment which would otherwise go to increase their size is diverted to the generative secretion (for considered as a solid-hoofed animal the pig is not a large one), and also it is more often cloven-hoofed, striving as it were with the nature of the solid-hoofed animals. For this reason it produces sometimes only one, sometimes two, but generally many, and brings them to perfection

before birth because of the good condition of its body, being like a rich soil- which has sufficient and abundant nutriment for plants.

The young of some birds also are hatched imperfect, that is to say blind; this applies to all small birds which lay many eggs, as crows and rooks, jays, sparrows, swallows, and to all those which lay few eggs without producing abundant nourishment along with the young, as ring-doves, turtle-doves, and pigeons. Hence if the eyes of swallows while still young be put out they recover their sight again, for the birds are still developing, not yet developed, when the injury is inflicted, so that the eyes grow and sprout afresh. And in general the production of young before they are perfect is owing to inability to continue nourishing them, and they are born imperfect because they are born too soon. This is plain also with seven-months children, for since they are not perfected it often happens that even the passages, e.g. of the ears and nostrils, are not yet opened in some of them at birth, but only open later as they are growing, and many such infants survive.

In man males are more often born defective than females, but in the other animals this is not the case. The reason is that in man the male is much superior to the female in natural heat, and so the male foetus moves about more than the female, and on account of moving is more liable to injury, for what is young is easily injured since it is weak. For this same reason also the female foetus is not perfected equally with the male in man (but they are so in the other animals, for in them the female is not later in developing than the male). For while within the mother the female takes longer in developing, but after birth everything is perfected more quickly in females than in males; I mean, for instance, puberty, the prime of life, and old age. For females are weaker and colder in nature, and we must look upon the female character as being a sort of natural deficiency. Accordingly while it is within the mother it develops slowly because of its coldness (for development is concoction, and it is heat that concocts, and what is hotter is easily concocted); but after birth it quickly arrives at maturity and old age on account of its weakness,

for all inferior things come sooner to their perfection or end, and as this is true of works of art so it is of what is formed by Nature. For the reason just given also twins are less likely to survive in man if one be male and one female, but this is not at all so in the other animals; for in man it is contrary to Nature that they should run an equal course, as their development does not take place in equal periods, but the male must needs be too late or the female too early; in the other animals, however, it is not contrary to Nature. A difference is also found between man and the other animals in respect of gestation, for animals are in better bodily condition most of the time, whereas in most women gestation is attended with discomfort. Their way of life is partly responsible for this, for being sedentary they are full of more residual matter; among nations where the women live a laborious life gestation is not equally conspicuous and those who are accustomed to work bear children easily both there and elsewhere; for work consumes the residual matter, but those who are sedentary have a great deal of it in them because not only is there no monthly discharge during pregnancy but also they do no work; therefore their travail is painful. But work exercises them so that they can hold their breath, upon which depends the ease or difficulty of child-birth. These circumstances then, as we have said, contribute to cause the difference between women and the other animals in this state, but the most important thing is this: in some animals the discharge corresponding to the catamenia is but small, and in some not visible at all, but in women it is greater than in any other animal, so that when this discharge ceases owing to pregnancy they are troubled (for if they are not pregnant they are afflicted with ailments whenever the catamenia do not occur); and they are more troubled as a rule at the beginning of pregnancy, for the embryo is able indeed to stop the catamenia but is too small at first to consume any quantity of the secretion; later on it takes up some of it and so alleviates the mother. In the other animals, on the contrary, the residual matter is but small and so corresponds with the growth of the foetus, and as the secretions which hinder nourishment are being consumed by the foetus the mother is in better bodily condition than usual. The same holds

good also with aquatic animals and birds. If it ever happens that the body of the mother is no longer in good condition when the foetus is now becoming large, the reason is that its growth needs more nourishment than the residual matter supplies. (In some few women it happens that the body is in a better state during pregnancy; these are women in whose body the residual matter is small so that it is all used up along with the nourishment that goes to the foetus.)

7

We must also speak of what is known as mola uteri, which occurs rarely in women but still is found sometimes during pregnancy. For they produce what is called a mola; it has happened before now to a woman, after she had had intercourse with her husband and supposed she had conceived, that at first the size of her belly increased and everything else happened accordingly, but yet when the time for birth came on, she neither bore a child nor was her size reduced, but she continued thus for three or four years until dysentery came on, endangering her life, and she produced a lump of flesh which is called mola. Moreover this condition may continue till old age and death. Such masses when expelled from the body become so hard that they can hardly be cut through even by iron. Concerning the cause of this phenomenon we have spoken in the Problems; the same thing happens to the embryo in the womb as to meats half cooked in roasting, and it is not due to heat, as some say, but rather to the weakness of the maternal heat. (For their nature seems to be incapable, and unable to perfect or to put the last touches to the process of generation. Hence it is that the mola remains in them till old age or at any rate for a long time, for in its nature it is neither perfect nor altogether a foreign body.) It is want of concoction that is the reason of its hardness, as with half-cooked meat, for this half-dressing of meat is also a sort of want of concoction.

A difficulty is raised as to why this does not occur in other animals, unless indeed it does occur and has entirely escaped observation. We must suppose the reason to be that woman alone among animals is

subject to troubles of the uterus, and alone has a superfluous amount of catamenia and is unable to concoct them; when, then, the embryo has been formed of a liquid hard to concoct, then comes the so-called mola into being, and this happens naturally in women alone or at any rate more than in other animals.

8

Milk is formed in the females of all internally viviparous animals, becoming useful for the time of birth. For Nature has made it for the sake of the nourishment of animals after birth, so that it may neither fail at this time at all nor yet be at all superfluous; this is just what we find happening, unless anything chance contrary to Nature. In the other animals the period of gestation does not vary, and so the milk is concocted in time to suit this moment, but in man, since there are several times of birth, it must be ready at the first of these; hence in women the milk is useless before the seventh month and only then becomes useful. That it is only concocted at the last stages is what we should expect to happen also as being due to a necessary cause. For at first such residual matter when secreted is used up for the development of the embryo; now the nutritious part in all things is the sweetest and the most concocted, and thus when all such elements are removed what remains must become of necessity bitter and ill-flavoured. As the embryo is perfecting, the residual matter left over increases in quantity because the part consumed by the embryo is less; it is also sweeter since the easily concocted part is less drawn away from it. For it is no longer expended on moulding the embryo but only on slightly increasing its growth, it being now fixed because it has reached perfection (for in a sense there is a perfection even of an embryo). Therefore it comes forth from the mother and changes its mode of development, as now possessing what belongs to it; and no longer takes that which does not belong to it; and it is at this season that the milk becomes useful.

The milk collects in the upper part of the body and the breasts because of the original plan of the organism. For the part above

the hypozoma is the sovereign part of the animal, while that below is concerned with nourishment and residual matter, in order that all animals which move about may contain within themselves nourishment enough to make them independent when they move from one place to another. From this upper part also is produced the generative secretion for the reason mentioned in the opening of our discussion. But both the secretion of the male and the catamenia of the female are of a sanguineous nature, and the first principle of this blood and of the blood-vessels is the heart, and the heart is in this part of the body. Therefore it is here that the change of such a secretion must first become plain. This is why the voice changes in both sexes when they begin to bear seed (for the first principle of the voice resides there, and is itself changed when its moving cause changes).

At the same time the parts about the breasts are raised visibly even in males but still more in females, for the region of the breasts becomes empty and spongy in them because so much material is drained away below. This is so not only in women but also in those animals which have the mammae low down.

This change in the voice and the parts about the mammae is plain even in other creatures to those who have experience of each kind of animal, but is most remarkable in man. The reason is that in man the production of secretion is greatest in both sexes in proportion to their size as compared with other animals; I mean that of the catamenia in women and the emission of semen in men. When, therefore, the embryo no longer takes up the secretion in question but yet prevents its being discharged from the mother, it is necessary that the residual matter should collect in all those empty parts which are set upon the same passages. And such is the position of the mammae in each kind of animals for both causes; it is so both for the sake of what is best and of necessity.

It is here, then, that the nourishment in animals is now formed and becomes thoroughly concocted. As for the cause of concoction, we may take that already given, or we may take the opposite, for it

is a reasonable view also that the embryo being larger takes more nourishment, so that less is left over about this time, and the less is concocted more quickly.

That milk has the same nature as the secretion from which each animal is formed is plain, and has been stated previously. For the material which nourishes is the same as that from which Nature forms the animal in generation. Now this is the sanguineous liquid in the sanguinea, and milk is blood concocted (not corrupted; Empedocles either mistook the fact or made a bad metaphor when he composed the line: 'On the tenth day of the eighth month the milk comes into being, a white pus', for putrefaction and concoction are opposite things, and pus is a kind of putrefaction but milk is concocted). While women are suckling children the catamenia do not occur according to Nature, nor do they conceive; if they do conceive, the milk dries up. This is because the nature of the milk and of the catamenia is the same, and Nature cannot be so productive as to supply both at once; if the secretion is diverted in the one direction it must needs cease in the other, unless some violence is done contrary to the general rule. But this is as much as to say that it is contrary to Nature, for in all cases where it is not impossible for things to be otherwise than they generally are but where they may so happen, still what is the general rule is what is 'according to Nature'.

The time also at which the young animal is born has been well arranged. For when the nourishment coming through the umbilical cord is no longer sufficient for the foetus because of its size, then at the same time the milk becomes useful for the nourishment of the newly-born animal, and the blood-vessels round which the so-called umbilical cord lies as a coat collapse as the nourishment is no longer passing through it; for these reasons it is at that time also that the young animal enters into the world.

9

The natural birth of all animals is head-foremost, because the parts above the umbilical cord are larger than those below. The body then, being suspended from the cord as in a balance, inclines towards the heavy end, and the larger parts are the heavier.

10

The period of gestation is, as a matter of fact, determined generally in each animal in proportion to the length of its life. This we should expect, for it is reasonable that the development of the long-lived animals should take a longer time. Yet this is not the cause of it, but the periods only correspond accidentally for the most part; for though the larger and more perfect sanguinea do live a long time, yet the larger are not all longer-lived. Man lives a longer time than any animal of which we have any credible experience except the elephant, and yet the human kind is smaller than that of the bushy-tailed animals and many others. The real cause of long life in any animal is its being tempered in a manner resembling the environing air, along with certain other circumstances of its nature, of which we will speak later; but the cause of the time of gestation is the size of the offspring. For it is not easy for large masses to arrive at their perfection in a small time, whether they be animals or, one may say, anything else whatever. That is why horses and animals akin to them, though living a shorter time than man, yet carry their young longer; for the time in the former is a year, but in the latter ten months at the outside. For the same reason also the time is long in elephants; they carry their young two years on account of their excessive size.

We find, as we might expect, that in all animals the time of gestation and development and the length of life aims at being measured by naturally complete periods. By a natural period I mean, e.g. a day and night, a month, a year, and the greater times measured by these, and also the periods of the moon, that is to say, the full moon and her disappearance and the halves of the times between these, for it is

by these that the moon's orbit fits in with that of the sun [the month being a period common to both].

The moon is a first principle because of her connexion with the sun and her participation in his light, being as it were a second smaller sun, and therefore she contributes to all generation and development. For heat and cold varying within certain limits make things to come into being and after this to perish, and it is the motions of the sun and moon that fix the limit both of the beginning and of the end of these processes. Just as we see the sea and all bodies of water settling and changing according to the movement or rest of the winds, and the air and winds again according to the course of the sun and moon, so also the things which grow out of these or are in these must needs follow suit. For it is reasonable that the periods of the less important should follow those of the more important. For in a sense a wind, too, has a life and birth and death.

As for the revolutions of the sun and moon, they may perhaps depend on other principles. It is the aim, then, of Nature to measure the coming into being and the end of animals by the measure of these higher periods, but she does not bring this to pass accurately because matter cannot be easily brought under rule and because there are many principles which hinder generation and decay from being according to Nature, and often cause things to fall out contrary to Nature.

We have now spoken of the nourishment of animals within the mother and of their birth into the world, both of each kind separately and of all in common.