Book III

1

WE have now spoken about the sterility of mules, and about those animals which are viviparous both externally and within themselves. The generation of the oviparous sanguinea is to a certain extent similar to that of the animals that walk, and all may be embraced in the same general statement; but in other respects there are differences in them both as compared with each other and with those that walk. All alike are generated from sexual union, the male emitting semen into the female. But among the ovipara (1) birds produce a perfect hard-shelled egg, unless it be injured by disease, and the eggs of birds are all two-coloured. (2) The cartilaginous fishes, as has been often said already, are oviparous internally but produce the young alive, the egg changing previously from one part of the uterus to another; and their egg is soft-shelled and of one colour. One of this class alone does not produce the young from the egg within itself, the so-called 'frog'; the reason of which must be stated later. (3) All other oviparous fishes produce an egg of one colour, but this is imperfect, for its growth is completed outside the mother's body by the same cause as are those eggs which are perfected within.

Concerning the uterus of these classes of animals, what differences there are among them and for what reasons, has been stated previously. For in some of the viviparous creatures it is high up near the hypozoma, in others low down by the pudenda; the former in the cartilaginous fishes, the latter in animals both internally and exter-

nally viviparous, such as man and horse and the rest; in the ovipara it is sometimes low, as in the oviparous fish, and sometimes high, as in birds.

Some embryos are formed in birds spontaneously, which are called wind-eggs and 'zephyria' by some; these occur in birds which are not given to flight nor rapine but which produce many young, for these birds have much residual matter, whereas in the birds of prey all such secretion is diverted to the wings and wing-feathers, while the body is small and dry and hot. (The secretion corresponding in hen-birds to catamenia, and the semen of the cock, are residues.) Since then both the wings and the semen are made from residual matter, nature cannot afford to spend much upon both. And for this same reason the birds of prey are neither given to treading much nor to laying many eggs, as are the heavy birds and those flying birds whose bodies are bulky, as the pigeon and so forth. For such residual matter is secreted largely in the heavy birds not given to flying, such as fowls, partridges, and so on, wherefore their males tread often and their females produce much material. Of such birds some lay many eggs at a time and some lay often; for instance, the fowl, the partridge, and the Libyan ostrich lay many eggs, while the pigeon family do not lay many but lay often. For these are between the birds of prey and the heavy ones; they are flyers like the former, but have bulky bodies like the latter; hence, because they are flyers and the residue is diverted that. way, they lay few eggs, but they lay often because of their having bulky bodies and their stomachs being hot and very active in concoction, and because moreover they can easily procure their food, whereas the birds of prey do so with difficulty.

Small birds also tread often and are very fertile, as are sometimes small plants, for what causes bodily growth in others turn in them to a seminal residuum. Hence the Adrianic fowls lay most eggs, for because of the smallness of their bodies the nutriment is used up in producing young. And other birds are more fertile than game-fowl, for their bodies are more fluid and bulkier, whereas those of game-fowl are leaner and drier, since a passionate spirit is found rather in

such bodies as the latter. Moreover the thinness and weakness of the legs contribute to making the former class of birds naturally inclined to tread and to be fertile, as we find also in the human species; for the nourishment which otherwise goes to the legs is turned in such into a seminal secretion, what Nature takes from the one place being added at the other. Birds of prey, on the contrary, have a strong walk and their legs are thick owing to their habits, so that for all these reasons they neither tread nor lay much. The kestrel is the most fertile; for this is nearly the only bird of prey which drinks, and its moisture, both innate and acquired, along with its heat is favourable to generative products. Even this bird does not lay very many eggs, but four at the outside.

The cuckoo, though not a bird of prey, lays few eggs, because it is of a cold nature, as is shown by the cowardice of the bird, whereas a generative animal should be hot and moist. That it is cowardly is plain, for it is pursued by all the birds and lays eggs in the nests of others.

The pigeon family are in the habit of laying two for the most part, for they neither lay one (no bird does except the cuckoo, and even that sometimes lays two) nor yet many, but they frequently produce two, or three at the most generally two, for this number lies between one and many.

It is plain from the facts that with the birds that lay many eggs the nutriment is diverted to the semen. For most trees, if they bear too much fruit, wither away after the crop when nutriment is not reserved for themselves, and this seems to be what happens to annuals, as leguminous plants, corn, and the like. For they consume all their nutriment to make seed, their kind being prolific. And some fowls after laying too much, so as even to lay two eggs in a day, have died after this. For both the birds the plants become exhausted, and this condition is an excess of secretion of residual matter. A similar condition is the cause of the later sterility of the lioness, for at the first birth she produces five or six, then in the next year four, and again three cubs, then the next number down to one, then none at

all, showing that the residue is being used up and the generative secretion is failing along with the advance of years.

We have now stated in which birds wind-eggs are found, and also what sort of birds lay many eggs or few, and for what reasons. And wind-eggs, as said before, come into being because while it is the material for generation that exists in the female of all animals, birds have no discharge of catamenia like viviparous sanguinea (for they occur in all these latter, more in some, less in others, and in some only enough in quantity just to mark the class). The same applies to fish as to birds, and so in them as in birds is found an embryonic formation without impregnation, but it is less obvious because their nature is colder. The secretion corresponding to the catamenia of vivipara is formed in birds at the appropriate season for the discharge of superfluous matter, and, because the region near the hypozoma is hot, it is perfected so far as size is concerned, but in birds and fishes alike it is imperfect for generation without the seminal fluid of the male; the cause of this has been previously given. Wind-eggs are not formed in the flying birds, for the same reason as prevents their laying many eggs; for the residual matter in birds of prey is small, and they need the male to give an impulse for the discharge of it. The wind-eggs are produced in greater numbers than the impregnated but smaller in size for one and the same reason; they are smaller in size because they are imperfect, and because they are smaller in size they are more in number. They are less pleasant for food because they are less concocted, for in all foods the concocted is more agreeable. It has been sufficiently observed, then, that neither birds' nor fishes' eggs are perfected for generation without the males. As for embryos being formed in fish also

(though in a less degree) without the males, the fact has been observed especially in river fish, for some are seen to have eggs from the first, as has been written in the Enquiries concerning them. And generally speaking in the case of birds even the impregnated eggs are not wont for the most part to attain their full growth unless the hen be trodden continually. The reason of this is that just as with women

intercourse with men draws down the secretion of the catamenia (for the uterus being heated attracts the moisture and the passages are opened), so this happens also with birds; the residual matter corresponding to the catamenia advances a little at a time, and is not discharged externally, because its amount is small and the uterus is high up by the hypozoma, but trickles together into the uterus itself. For as the embryo of the vivipara grows by means of the umbilical cord, so the egg grows through this matter flowing to it through the uterus. For when once the hens have been trodden, they all continue to have eggs almost without intermission, though very small ones. Hence some are wont to speak of wind-eggs as not coming into being independently but as mere relics from a previous impregnation. But this is a false view, for sufficient observations have been made of their arising without impregnation in chickens and goslings. Also the female partridges which are taken out to act as decoys, whether they have ever been impregnated or not, immediately on smelling the male and hearing his call, become filled with eggs in the latter case and lay them in the former. The reason why this happens is the same as in men and quadrupeds, for if their bodies chance to be in rut they emit semen at the mere sight of the female or at a slight touch. And such birds are of a lascivious and fertile nature, so that the impulse they need is but small when they are in this excited condition, and the secreting activity takes place quickly in them, wind-eggs forming in the unimpregnated and the eggs in those which have been impregnated growing and reaching perfection swiftly.

Among creatures that lay eggs externally birds produce their egg perfect, fish imperfect, but the eggs of the latter complete their growth outside as has been said before. The reason is that the fish kind is very fertile; now it is impossible for many eggs to reach completion within the mother and therefore they lay them outside. They are quickly discharged, for the uterus of externally oviparous fishes is near the generative passage. While the eggs of birds are two-coloured, those of all fish are one-coloured. The cause of the double colour may be seen from considering the power of each of the two parts, the white and the yolk. For the matter of the egg is secreted

from the blood [No bloodless animal lays eggs,] and that the blood is the material of the body has been often said already. The one part, then, of the egg is nearer the form of the animal coming into being, that is the hot part; the more earthy part gives the substance of the body and is further removed. Hence in all two-coloured eggs the animal receives the first principle of generation from the white (for the vital principle is in that which is hot), but the nutriment from the yolk. Now in animals of a hotter nature the part from which the first principle arises is separated off from the part from which comes the nutriment, the one being white and the other yellow, and the white and pure is always more than the yellow and earthy; but in the moister and less hot the yolk is more in quantity and more fluid. This is what we find in lake birds, for they are of a moister nature and are colder than the land birds, so that the so-called 'lecithus' or yolk in the eggs of such birds is large and less yellow because the white is less separated off from it. But when we come to the ovipara which are both of a cold nature and also moister (such is the fish kind) we find the white not separated at all because of the small size of the eggs and the quantity of the cold and earthy matter; therefore all fish eggs are of one colour, and white compared with yellow, yellow compared with white. Even the wind-eggs of birds have this distinction of colour, for they contain that out of which will come each of the two parts, alike that whence arises the principle of life and that whence comes the nutriment; only both these are imperfect and need the influence of the male in addition; for wind-eggs become fertile if impregnated by the male within a certain period. The difference in colour, however, is not due to any difference of sex, as if the white came from the male, the yolk from the female; both on the contrary come from the female, but the one is cold, the other hot. In all cases then where the hot part is considerable it is separated off, but where it is little it cannot be so; hence the eggs of such animals, as has been said, are of one colour. The semen of the male only puts them into form; and therefore at first the egg in birds appears white and small, but as it advances it is all yellow as more of the sanguineous material is continually mixed with it; finally as the

hot part is separated the white takes up a position all round it and equally distributed on all sides, as when a liquid boils; for the white is naturally liquid and contains in itself the vital heat; therefore it is separated off all round, but the yellow and earthy part is inside. And if we enclose many eggs together in a bladder or something of the kind and boil them over a fire so as not to make the movement of the heat quicker than the separation of the white and yolk in the eggs, then the same process takes place in the whole mass of the eggs as in a single egg, all the yellow part coming into the middle and the white surrounding it.

We have thus stated why some eggs are of one colour and others of two.

2

The principle of the male is separated off in eggs at the point where the egg is attached to the uterus, and the reason why the shape of two-coloured eggs is unsymmetrical, and not perfectly round but sharper at one end, is that the part of the white in which is contained this principle must differ from the rest. Therefore the egg is harder at this point than below, for it is necessary to shelter and protect this principle. And this is why the sharp end of the egg comes out of the hen later than the blunt end; for the part attached to the uterus comes out later, and the egg is attached at the point where is the said principle, and the principle is in the sharp end. The same is the case also in the seeds of plants; the principle of the seed is attached sometimes to the twig, sometimes to the husk, sometimes to the pericarp. This is plain in the leguminous plants, for where the two cotyledons of beans and of similar seeds are united, there is the seed attached to the parent plant, and there is the principle of the seed.

A difficulty may be raised about the growth of the egg; how is it derived from the uterus? For if animals derive their nutriment through the umbilical cord, through what do eggs derive it? They do not, like a scolex, acquire their growth by their own means. If there is anything by which they are attached to the uterus, what be-

comes of this when the egg is perfected? It does not come out with the egg as the cord does with animals; for when its egg is perfected the shell forms all round it. This problem is rightly raised, but it is not observed that the shell is at first only a soft membrane, and that it is only after the egg is perfected that it becomes hard and brittle; this is so nicely adjusted that it is still soft when it comes out (for otherwise it would cause pain in laying), but no sooner has it come out than it is fixed hard by cooling, the moisture quickly evaporating because there is but little of it, and the earthy part remaining. Now at first a certain part of this membrane at the sharp end of eggs resembles an umbilical cord, and projects like a pipe from them while they are still small. It is plainly visible in small aborted eggs, for if the bird be drenched with water or suddenly chilled in any other way and cast out the egg too soon, it appears still sanguineous and with a small tail like an umbilical cord running through it. As the egg becomes larger this is more twisted round and becomes smaller, and when the egg is perfected this end is the sharp end. Under this is the inner membrane which separates the white and the yolk from this. When the egg is perfected, the whole of it is set free, and naturally the umbilical cord does not appear, for it is now the extreme end of the egg itself.

The egg is discharged in the opposite way from the young of vivipara; the latter are born head-first, the part where is the first principle leading, but the egg is discharged as it were feet first; the reason of this being what has been stated, that the egg is attached to the uterus at the point where is the first principle.

The young bird is produced out of the egg by the mother's incubating and aiding the concoction, the creature developing out of part of the egg, and receiving growth and completion from the remaining part. For Nature not only places the material of the creature in the egg but also the nourishment sufficient for its growth; for since the mother bird cannot perfect her young within herself she produces the nourishment in the egg along with it. Whereas the nourishment, what is called milk, is produced for the young of vivipara in another

part, in the breasts, Nature does this for birds in the egg. The opposite, however, is the case to what people think and what is asserted by Alcmaeon of Crotona. For it is not the white that is the milk, but the yolk, for it is this that is the nourishment of the chick, whereas they think it is the white because of the similarity of colour.

The chick then, as has been said, comes into being by the incubation of the mother; yet if the temperature of the season is favourable, or if the place in which the eggs happen to lie is warm, the eggs are sufficiently concocted without incubation, both those of birds and those of oviparous quadrupeds. For these all lay their eggs upon the ground, where they are concocted by the heat in the earth. Such oviparous quadrupeds as do visit their eggs and incubate do so rather for the sake of protecting them than of incubation.

The eggs of these quadrupeds are formed in the same way as those of birds, for they are hard-shelled and two-coloured, and they are formed near the hypozoma as are those of birds, and in all other respects resemble them both internally and externally, so that the inquiry into their causes is the same for all. But whereas the eggs of quadrupeds are hatched out by the mere heat of the weather owing to their strength, those of birds are more exposed to destruction and need the mother-bird. Nature seems to wish to implant in animals a special sense of care for their young: in the inferior animals this lasts only to the moment of giving birth to the incompletely developed animal; in others it continues till they are perfect; in all that are more intelligent, during the bringing up of the young also. In those which have the greatest portion in intelligence we find familiarity and love shown also towards the young when perfected, as with men and some quadrupeds; with birds we find it till they have produced and brought up their young, and therefore if the hens do not incubate after laying they get into worse condition, as if deprived of something natural to them.

The young is perfected within the egg more quickly in sunshiny weather, the season aiding in the work, for concoction is a kind of heat. For the earth aids in the concoction by its heat, and the brood-

ing hen does the same, for she applies the heat that is within her. And it is in the hot season, as we should expect, that the eggs are more apt to be spoilt and the so-called 'uria' or rotten eggs are produced; for just as wines turn sour in the heats from the sediment rising (for this is the cause of their being spoilt), so is it with the yolk in eggs, for the sediment and yolk are the earthy part in each case, wherefore the wine becomes turbid when the sediment mixes with it, and the like applies to the eggs that are spoiling because of the yolk. It is natural then that such should be the case with the birds that lay many eggs, for it is not easy to give the fitting amount of heat to all, but (while some have too little) others have too much and this makes them turbid, as it were by putrefaction. But this happens none the less with the birds of prey though they lay few eggs, for often one of the two becomes rotten, and the third practically always, for being of a hot nature they make the moisture in the eggs to overboil so to say. For the nature of the white is opposed to that of the yolk; the yolk congeals in frosts but liquefies on heating, and therefore it liquefies on concoction in the earth or by reason of incubation, and becoming liquid serves as nutriment for the developing chick. If exposed to heat and roasted it does not become hard, because though earthy in nature it is only so in the same way as wax is; accordingly on heating too much the eggs become watery and rotten, [if they be not from a liquid residue]. The white on the contrary is not congealed by frost but rather liquefies (the reason of which has been stated before), but on exposure to heat becomes solid. Therefore being concocted in the development of the chick it is thickened. For it is from this that the young is formed (whereas the yolk turns to nutriment) and it is from this that the parts derive their growth as they are formed one after another. This is why the white and the yolk are separated by membranes, as being different in nature. The precise details of the relation of the parts to one another both at the beginning of generation and as the animals are forming, and also the details of the membranes and umbilical cords, must be learnt from what has been written in the Enquiries; for the present investigation it is sufficient to understand this much clearly, that, when the heart has been first

formed and the great blood-vessel has been marked off from it, two umbilical cords run from the vessel, the one to the membrane which encloses the yolk, the other to the membrane resembling a chorion which surrounds the whole embryo; this latter runs round on the inside of the membrane of the shell. Through the one of these the embryo receives the nutriment from the yolk, and the yolk becomes larger, for it becomes more liquid by heating. This is because the nourishment, being of a material character in its first form, must become liquid before it can be absorbed, just as it is with plants, and at first this embryo, whether in an egg or in the mother's uterus, lives the life of a plant, for it receives its first growth and nourishment by being attached to something else.

The second umbilical cord runs to the surrounding chorion. For we must understand that, in the case of animals developed in eggs, the chick has the same relation to the yolk as the embryo of the vivipara has to the mother so long as it is within the mother (for since the nourishment of the embryo of the ovipara is not completed within the mother, the embryo takes part of it away from her). So also the relation of the chick to the outermost membrane, the sanguineous one, is like that of the mammalian embryo to the uterus. At the same time the egg-shell surrounds both the yolk and the membrane analogous to the uterus, just as if it should be put round both the embryo itself and the whole of the mother, in the vivipara. This is so because the embryo must be in the uterus and attached to the mother. Now in the vivipara the uterus is within the mother, but in the ovipara it is the other way about, as if one should say that the mother was in the uterus, for that which comes from the mother, the nutriment, is the yolk. The reason is that the process of nourishment is not completed within the mother.

As the creature grows the umbilicus running the chorion collapses first, because it is here that the young is to come out; what is left of the yolk, and the umbilical cord running to the yolk, collapse later. For the young must have nourishment as soon as it is hatched; it is not nursed by the mother and cannot immediately procure its nour-

ishment for itself; therefore the yolk enters within it along with its umbilicus and the flesh grows round it.

This then is the manner in which animals produced from perfect eggs are hatched in all those, whether birds or quadrupeds, which lay the egg with a hard shell. These details are plainer in the larger creatures; in the smaller they are obscure because of the smallness of the masses concerned.

3

The class of fishes is also oviparous. Those among them which have the uterus low down lay an imperfect egg for the reason previously given,' but the so-called 'selache' or cartilaginous fishes produce a perfect egg within themselves but are externally viviparous except one which they call the 'frog'; this alone lays a perfect egg externally. The reason is the nature of its body, for its head is many times as large as the rest of the body and is spiny and very rough. This is also why it does not receive its young again within itself nor produce them alive to begin with, for as the size and roughness of the head prevents their entering so it would prevent their exit. And while the egg of the cartilaginous fishes is soft-shelled (for they cannot harden and dry its circumference, being colder than birds), the egg of the frog-fish alone is solid and firm to protect it outside, but those of the rest are of a moist and soft nature, for they are sheltered within and by the body of the mother.

The young are produced from the egg in the same way both with those externally perfected (the frog-fishes) and those internally, and the process in these eggs is partly similar to, partly different from that in birds' eggs. In the first place they have not the second umbilicus which runs to the chorion under the surrounding shell. The reason of this is that they have not the surrounding shell, for it is no use to them since the mother shelters them, and the shell is a protection to the eggs against external injury between laying and hatching out. Secondly, the process in these also begins on the surface of the egg but not where it is attached to the uterus, as in birds, for the

chick is developed from the sharp end and that is where the egg was attached. The reason is that the egg of birds is separated from the uterus before it is perfected, but in most though not all cartilaginous fishes the egg is still attached to the uterus when perfect. While the young develops upon the surface the egg is consumed by it just as in birds and the other animals detached from the uterus, and at last the umbilicus of the now perfect fish is left attached to the uterus. The like is the case with all those whose eggs are detached from the uterus, for in some of them the egg is so detached when it is perfect.

The question may be asked why the development of birds and cartilaginous fishes differs in this respect. The reason is that in birds the white and yolk are separate, but fish eggs are one-coloured, the corresponding matter being completely mixed, so that there is nothing to stop the first principle being at the opposite end, for the egg is of the same nature both at the point of attachment and at the opposite end, and it is easy to draw the nourishment from the uterus by passages running from this principle. This is plain in the eggs which are not detached, for in some of the cartilaginous fish the egg is not detached from the uterus, but is still connected with it as it comes downwards with a view to the production of the young alive; in these the young fish when perfected is still connected by the umbilicus to the uterus when the egg has been consumed. From this it is clear that previously also, while the egg was still round the young, the passages ran to the uterus. This happens as we have said in the 'smooth hound'.

In these respects and for the reasons given the development of cartilaginous fishes differs from that of birds, but otherwise it takes place in the same way. For they have the one umbilicus in like manner as that of birds connecting with the yolk,- only in these fishes it connects with the whole egg (for it is not divided into white and yolk but all one-coloured),- and get their nourishment from this, and as it is being consumed the flesh in like manner encroaches upon and grows round it.

Such is the process of development in those fish that produce a perfect egg within themselves but are externally viviparous.

4

Most of the other fish are externally oviparous, all laying an imperfect egg except the frog-fish; the reason of this exception has been previously stated, and the reason also why the others lay imperfect eggs. In these also the development from the egg runs on the same lines as that of the cartilaginous and internally oviparous fishes, except that the growth is quick and from small beginnings and the outside of the egg is harder. The growth of the egg is like that of a scolex, for those animals which produce a scolex give birth to a small thing at first and this grows by itself and not through any attachment to the parent. The reason is similar to that of the growth of yeast, for yeast also grows great from a small beginning as the more solid part liquefies and the liquid is aerated. This is effected in animals by the nature of the vital heat, in yeasts by the heat of the juice commingled with them. The eggs then grow of necessity through this cause (for they have in them superfluous yeasty matter), but also for the sake of a final cause, for it is impossible for them to attain their whole growth in the uterus because these animals have so many eggs. Therefore are they very small when set free and grow quickly, small because the uterus is narrow for the multitude of the eggs, and growing quickly that the race may not perish, as it would if much of the time required for the whole development were spent in this growth; even as it is most of those laid are destroyed before hatching. Hence the class of fish is prolific, for Nature makes up for the destruction by numbers. Some fish actually burst because of the size of the eggs, as the fish called 'belone', for its eggs are large instead of numerous, what Nature has taken away in number being added in size.

So much for the growth of such eggs and its reason.

5

A proof that these fish also are oviparous is the fact that even viviparous fish, such as the cartilaginous, are first internally oviparous, for hence it is plain that the whole class of fishes is oviparous. Where, however, both sexes exist and the eggs are produced in consequence of impregnation, the eggs do not arrive at completion unless the male sprinkle his milt upon them. Some erroneously assert that all fish are female except in the cartilaginous fishes, for they think that the females of fish differ from what are supposed to be males only in the same way as in those plants where the one bears fruit but the other is fruitless, as olive and oleaster, fig and caprifig. They think the like applies to fish except the cartilaginous, for they do not dispute the sexes in these. And yet there is no difference in the males of cartilaginous fishes and those belonging to the oviparous class in respect of the organs for the milt, and it is manifest that semen can be squeezed out of males of both classes at the right season. The female also has a uterus. But if the whole class were females and some of them unproductive (as with mules in the class of bushy-tailed animals), then not only should those which lay eggs have a uterus but also the others, only the uterus of the latter should be different from that of the former. But, as it is, some of them have organs for milt and others have a uterus, and this distinction obtains in all except two, the erythrinus and the channa, some of them having the milt organs, others a uterus. The difficulty which drives some thinkers to this conclusion is easily solved if we look at the facts. They say quite correctly that no animal which copulates produces many young, for of all those that generate from themselves perfect animals or perfect eggs none is prolific on the same scale as the oviparous fishes, for the number of eggs in these is enormous. But they had overlooked the fact that fish-eggs differ from those of birds in one circumstance. Birds and all oviparous quadrupeds, and any of the cartilaginous fish that are oviparous, produce a perfect egg, and it does not increase outside of them, whereas the eggs of fish are imperfect and do so complete their growth. Moreover the same thing applies to

cephalopods also and crustacea, yet these animals are actually seen copulating, for their union lasts a long time, and it is plain in these cases that the one is male and the other has a uterus. Finally, it would be strange if this distinction did not exist in the whole class, just as male and female in all the vivipara. The cause of the ignorance of those who make this statement is that the differences in the copulation and generation of various animals are of all kinds and not obvious, and so, speculating on a small induction, they think the same must hold good in all cases.

So also those who assert that conception in female fishes is caused by their swallowing the semen of the male have not observed certain points when they say this. For the males have their milt and the females their eggs at about the same time of year, and the nearer the female is to laying the more abundant and the more liquid is the milt formed in the male. And just as the increase of the milt in the male and of the roe in the female takes place at the same time, so is it also with their emission, for neither do the females lay all their eggs together, but gradually, nor do the males emit all the milt at once. All these facts are in accordance with reason. For just as the class of birds in some cases has eggs without impregnation, but few and seldom, impregnation being generally required, so we find the same thing, though to a less degree, in fish. But in both classes these spontaneous eggs are infertile unless the male, in those kinds where the male exists, shed his fluid upon them. Now in birds this must take place while the eggs are still within the mother, because they are perfect when discharged, but in fish, because the eggs are imperfect and complete their growth outside the mother in all cases, those outside are preserved by the sprinkling of the milt over them, even if they come into being by impregnation, and here it is that the milt of the males is used up. Therefore it comes down the ducts and diminishes in quantity at the same time as this happens to the eggs of the females, for the males always attend them, shedding their milt upon the eggs as they are laid. Thus then they are male and female, and all of them copulate (unless in any kind the distinction of sex

does not exist), and without the semen of the male no such animal comes into being.

What helps in the deception is also the fact that the union of such fishes is brief, so that it is not observed even by many of the fishermen, for none of them ever watches anything of the sort for the sake of knowledge. Nevertheless their copulation has been seen, for fish [when the tail part does not prevent it] copulate like the dolphins by throwing themselves alongside of one another. But the dolphins take longer to get free again, whereas such fishes do so quickly. Hence, not seeing this, but seeing the swallowing of the milt and the eggs, even the fishermen repeat the same simple tale, so much noised abroad, as Herodotus the storyteller, as if fish were conceived by the mother's swallowing the milt,- not considering that this is impossible. For the passage which enters by way of the mouth runs to the intestines, not to the uterus, and what goes into the intestines must be turned into nutriment, for it is concocted; the uterus, however, is plainly full of eggs, and from whence did they enter it?

6

A similar story is told also of the generation of birds. For there are some who say that the raven and the ibis unite at the mouth, and among quadrupeds that the weasel brings forth its young by the mouth; so say Anaxagoras and some of the other physicists, speaking too superficially and without consideration. Concerning the birds, they are deceived by a false reasoning, because the copulation of ravens is seldom seen, but they are often seen uniting with one another with their beaks, as do all the birds of the raven family; this is plain with domesticated jackdaws. Birds of the pigeon kind do the same, but, because they also plainly copulate, therefore they have not had the same legend told of them. But the raven family is not amorous, for they are birds that produce few young, though this bird also has been seen copulating before now. It is a strange thing, however, that these theorists do not ask themselves how the semen enters the uterus through the intestine, which always concocts whatever comes

into it, as the nutriment; and these birds have a uterus like others, and eggs are found them near the hypozoma. And the weasel has a uterus in like manner to the other quadrupeds; by what passage is the embryo to get from it to the mouth? But this opinion has arisen because the young of the weasel are very small like those of the other fissipeds, of which we shall speak later, and because they often carry the young about in their mouths.

Much deceived also are those who make a foolish statement about the trochus and the hyena. Many say that the hyena, and Herodorus the Heracleot says that the trochus, has two pudenda, those of the male and of the female, and that the trochus impregnates itself but the hyena mounts and is mounted in alternate years. This is untrue, for the hyena has been seen to have only one pudendum, there being no lack of opportunity for observation in some districts, but hyenas have under the tail a line like the pudendum of the female. Both male and female have such a mark, but the males are taken more frequently; this casual observation has given rise to this opinion. But enough has been said of this.

7

Touching the generation of fish, the question may be raised, why it is that in the cartilaginous fish neither the females are seen discharging their eggs nor the males their milt, whereas in the non-viviparous fishes this is seen in both sexes. The reason is that the whole cartilaginous class do not produce much semen, and further the females have their uterus near hypozoma. For the males and females of the one class of fish differ from the males and females of the other class in like manner, for the cartilaginous are less productive of semen. But in the oviparous fish, as the females lay their eggs on account of their number, so do the males shed their milt on account of its abundance. For they have more milt than just what is required for copulation, as Nature prefers to expend the milt in helping to perfect the eggs, when the female has deposited them, rather than in forming them at first. For as has been said both further back and in

our recent discussions, the eggs of birds are perfected internally but those of fish externally. The latter, indeed, resemble in a way those animals which produce a scolex, for the product discharged by them is still more imperfect than a fish's egg. It is the male that brings about the perfection of the egg both of birds and of fishes, only in the former internally, as they are perfected internally, and in the latter externally, because the egg is imperfect when deposited; but the result is the same in both cases.

In birds the wind-eggs become fertile, and those previously impregnated by one kind of cock change their nature to that of the later cock. And if the eggs be behindhand in growth, then, if the same cock treads the hen again after leaving off treading for a time, he causes them to increase quickly, not, however, at any period whatever of their development, but if the treading take place before the egg changes so far that the white begins to separate from the yolk. But in the eggs of fishes no such limit of time has been laid down, but the males shed their milt quickly upon them to preserve them. The reason is that these eggs are not two-coloured, and hence there is no such limit of time fixed with them as with those of birds. This fact is what we should expect, for by the time that the white and yolk are separated off from one another, the birds egg already contains the principle that comes from the male parent.... for the male contributes to this.

Wind-eggs, then, participate in generation so far as is possible for them. That they should be perfected into an animal is impossible, for an animal requires sense-perception; but the nutritive faculty of the soul is possessed by females as well as males, and indeed by all living things, as has been often said, wherefore the egg itself is perfect only as the embryo of a plant, but imperfect as that of an animal. If, then, there had been no male sex in the class of birds, the egg would have been produced as it is in some fishes, if indeed there is any kind of fish of such a nature as to generate without a male; but it has been said of them before that this has not yet been satisfactorily observed. But as it is both sexes exist in all birds, so that, considered as a plant,

the egg is perfect, but in so far as it is not a plant it is not perfect, nor does anything else result from it; for neither has it come into being simply like a real plant nor from copulation like an animal. Eggs, however, produced from copulation but already separated into white and yolk take after the first cock; for they already contain both principles, which is why they do not change again after the second impregnation.

8

The young are produced in the same way also by the cephalopoda, e.g. sepias and the like, and by the crustacea, e.g. carabi and their kindred, for these also lay eggs in consequence of copulation, and the male has often been seen uniting with the female. Therefore those who say that all fish are female and lay eggs without copulation are plainly speaking unscientifically from this point of view also. For it is a wonderful thing to suppose that the former animals lay eggs in consequence of copulation and that fish do not; if again they were unaware of this, it is a sign of ignorance. The union of all these creatures lasts a considerable time, as in insects, and naturally so, for they are bloodless and therefore of a cold nature.

In the sepias and calamaries or squids the eggs appear to be two, because the uterus is divided and appears double, but that of the poulps appears to be single. The reason is that the shape of the uterus in the poulp is round in form and spherical, the cleavage being obscure when it is filled with eggs. The uterus of the carabi is also bifid. All these animals also lay an imperfect egg for the same reason as fishes. In the carabi and their like the females produce their eggs so as to keep them attached to themselves, which is why the side-flaps of the females are larger than those of the males, to protect the eggs; the cephalopoda lay them away from themselves. The males of the cephalopoda sprinkle their milt over the females, as the male fish do over the eggs, and it becomes a sticky and glutinous mass, but in the carabi and their like nothing of the sort has been seen or can be naturally expected, for the egg is under the female and is hard-shelled.

Both these eggs and those of the cephalopoda grow after deposition like those of fishes.

The sepia while developing is attached to the egg by its front part, for here alone is it possible, because this animal alone has its front and back pointing in the same direction. For the position and attitude of the young while developing you must look at the Enquiries.

9

We have now spoken of the generation of other animals, those that walk, fly, and swim; it remains to speak of insects and testacea according to the plan laid down. Let us begin with the insects. It was observed previously that some of these are generated by copulation, others spontaneously, and besides this that they produce a scolex, and why this is so. For pretty much all creatures seem in a certain way to produce a scolex first, since the most imperfect embryo is of such a nature; and in all animals, even the viviparous and those that lay a perfect egg, the first embryo grows in size while still undifferentiated into parts; now such is the nature of the scolex. After this stage some of the ovipara produce the egg in a perfect condition, others in an imperfect, but it is perfected outside as has been often stated of fish. With animals internally viviparous the embryo becomes egg-like in a certain sense after its original formation, for the liquid is contained in a fine membrane, just as if we should take away the shell of the egg, wherefore they call the abortion of an embryo at that stage an 'efflux'.

Those insects which generate at all generate a scolex, and those which come into being spontaneously and not from copulation do so at first from a formation this nature. I say that the former generate a scolex, for we must put down caterpillars also and the product of spiders as a sort of scolex. And yet some even of these and many of the others may be thought to resemble eggs because of their round shape, but we must not judge by shapes nor yet by softness and hardness (for what is produced by some is hard), but by the fact that the whole of them is changed into the body of the creature and the

animal is not developed from a part of them. All these products that are of the nature of a scolex, after progressing and acquiring their full size, become a sort of egg, for the husk about them hardens and they are motionless during this period. This is plain in the scolex of bees and wasps and in caterpillars. The reason of this is that their nature, because of its imperfection, oviposits as it were before the right time, as if the scolex, while still growing in size, were a soft egg. Similar to this is also what happens with all other insects which come into being without copulation in wool and other such materials and in water. For all of them after the scolex stage become immovable and their integument dries round them, and after this the latter bursts and there comes forth as from an egg an animal perfected in its second metamorphosis, most of those which are not aquatic being winged.

Another point is quite natural, which may wondered at by many. Caterpillars at first take nourishment, but after this stage do so no longer, but what is called by some the chrysalis is motionless. The same applies to the scolex of wasps and bees, but after this comes into being the so-called nymph.... and have nothing of the kind. For an egg is also of such a nature that when it has reached perfection it grows no more in size, but at first it grows and receives nourishment until it is differentiated and becomes a perfect egg. Sometimes the scolex contains in itself the material from which it is nourished and obtains such an addition to its size, e.g. in bees and wasps; sometimes it gets its nourishment from outside itself, as caterpillars and some others.

It has thus been stated why such animals go through a double development and for what reason they become immovable again after moving. And some of them come into being by copulation, like birds and vivipara and most fishes, others spontaneously, like some plants.

10

There is much difficulty about the generation of bees. If it is really true that in the case of some fishes there is such a method of generation that they produce eggs without copulation, this may well happen also with bees, to judge from appearances. For they must (1) either bring the young brood from elsewhere, as some say, and if so the young must either be spontaneously generated or produced by some other animal, or (2) they must generate them themselves, or (3) they must bring some and generate others, for this also is maintained by some, who say that they bring the young of the drones only. Again, if they generate them it must be either with or without copulation; if the former, then either (1) each kind must generate its own kind, or (2) some one kind must generate the others, or (3) one kind must unite with another for the purpose (I mean for instance (1) that bees may be generated from the union of bees, drones from that of drones, and kings from that of kings, or (2) that all the others may be generated from one, as from what are called kings and leaders, or (3) from the union of drones and bees, for some say that the former are male, the latter female, while others say that the bees are male and the drones female). But all these views are impossible if we reason first upon the facts peculiar to bees and secondly upon those which apply more generally to other animals also.

For if they do not generate the young but bring them from elsewhere, then bees ought to come into being also, if the bees did not carry them off, in the places from which the old bees carry the germs. For why, if new bees come into existence when the germs are transported, should they not do so if the germs are left there? They ought to do so just as much, whether the germs are spontaneously generated in the flowers or whether some animal generates them. And if the germs were of some other animal, then that animal ought to be produced from them instead of bees. Again, that they should collect honey is reasonable, for it is their food, but it is strange that they should collect the young if they are neither their own offspring nor food. With what object should they do so? for all animals that

trouble themselves about the young labour for what appears to be their own offspring.

But, again, it is also unreasonable to suppose that the bees are female and the drones male, for Nature does not give weapons for fighting to any female, and while the drones are stingless all the bees have a sting. Nor is the opposite view reasonable, that the bees are male and the drones female, for no males are in the habit of working for their offspring, but as it is the bees do this. And generally, since the brood of the drones is found coming into being among them even if there is no mature drone present, but that of the bees is not so found without the presence of the kings (which is why some say that the young of the drones alone is brought in from outside), it is plain that they are not produced from copulation, either (1) of bee with bee or drone with drone or (2) of bees with drones. (That they should import the brood of the drones alone is impossible for the reasons already given, and besides it is unreasonable that a similar state of things should not prevail with all the three kinds if it prevails with one.) Then, again, it is also impossible that the bees themselves should be some of them male and some female, for in all kinds of animals the two sexes differ. Besides they would in that case generate their own kind, but as it is their brood is not found to come into being if the leaders are not among them, as men say. And an argument against both theories, that the young are generated by union of the bees with one another or with the drones, separately or with one another, is this: none of them has ever yet been seen copulating, whereas this would have often happened if the sexes had existed in them. It remains then, if they are generated by copulation at all, that the kings shall unite to generate them. But the drones are found to come into being even if no leaders are present, and it is not possible that the bees should either import their brood or themselves generate them by copulation. It remains then, as appears to be the case in certain fishes, that the bees should generate the drones without copulation, being indeed female in respect of generative power, but containing in themselves both sexes as plants do. Hence also they have the instrument of offence, for we ought not to call that female

in which the male sex is not separated. But if this is found to be the case with drones, if they come into being without copulation, then as it is necessary that the same account should be given of the bees and the kings and that they also should be generated without copulation. Now if the brood of the bees had been found to come into being among them without the presence of the kings, it would necessarily follow that the bees also are produced from bees themselves without copulation, but as it is, since those occupied with the tendance of these creatures deny this, it remains that the kings must generate both their own kind and the bees.

As bees are a peculiar and extraordinary kind of animal so also their generation appears to be peculiar. That bees should generate without copulation is a thing which may be paralleled in other animals, but that what they generate should not be of the same kind is peculiar to them, for the erythrinus generates an erythrinus and the channa a channa. The reason is that bees themselves are not generated like flies and similar creatures, but from a kind different indeed but akin to them, for they are produced from the leaders. Hence in a sort of way their generation is analogous. For the leaders resemble the drones in size and the bees in possessing a sting; so the bees are like them in this respect, and the drones are like them in size. For there must needs be some overlapping unless the same kind is always to be produced from each; but this is impossible, for at that rate the whole class would consist of leaders. The bees, then, are assimilated to them their power of generation, the drones in size; if the latter had had a sting also they would have been leaders, but as it is this much of the difficulty has been solved, for the leaders are like both kinds at once, like the bees in possessing a sting, like the drones in size.

But the leaders also must be generated from something. Since it is neither from the bees nor from the drones, it must be from their own kind. The grubs of the kings are produced last and are not many in number.

Thus what happens is this: the leaders generate their own kind but also another kind, that of the bees; the bees again generate another kind, the drones, but do not also generate their own kind, but this has been denied them. And since what is according to Nature is always in due order, therefore it is necessary that it should be denied to the drones even to generate another kind than themselves. This is just what we find happening, for though the drones are themselves generated, they generate nothing else, but the process reaches its limit in the third stage. And so beautifully is this arranged by Nature that the three kinds always continue in existence and none of them fails, though they do not all generate.

Another fact is also natural, that in fine seasons much honey is collected and many drones are produced but in rainy reasons a large brood of ordinary bees. For the wet causes more residual matter to be formed in the bodies of the leaders, the fine weather in that of the bees, for being smaller in size they need the fine weather more than the kings do. It is right also that the kings, being as it were made with a view to producing young, should remain within, freed from the labour of procuring necessaries, and also that they should be of a considerable size, their bodies being, as it were, constituted with a view to bearing young, and that the drones should be idle as having no weapon to fight for the food and because of the slowness of their bodies. But the bees are intermediate in size between the two other kinds, for this is useful for their work, and they are workers as having to support not only their young but also their fathers. And it agrees with our views that the bees attend upon their kings because they are their offspring (for if nothing of the sort had been the case the facts about their leadership would be unreasonable), and that, while they suffer the kings to do no work as being their parents, they punish the drones as their children, for it is nobler to punish one's children and those who have no work to perform. The fact that the leaders, being few, generate the bees in large numbers seems to be similar to what obtains in the generation of lions, which at first produce five, afterwards a smaller number each time at last one and thereafter none. So the leaders at first produce a number of workers, afterwards a few

of their own kind; thus the brood of the latter is smaller in number than that of the former, but where Nature has taken away from them in number she has made it up again in size.

Such appears to be the truth about the generation of bees, judging from theory and from what are believed to be the facts about them; the facts, however, have not yet been sufficiently grasped; if ever they are, then credit must be given rather to observation than to theories, and to theories only if what they affirm agrees with the observed facts.

A further indication that bees are produced without copulation is the fact that the brood appears small in the cells of the comb, whereas, whenever insects are generated by copulation, the parents remain united for a long time but produce quickly something of the nature of a scolex and of a considerable size.

Concerning the generation of animals akin to them, as hornets and wasps, the facts in all cases are similar to a certain extent, but are devoid of the extraordinary features which characterize bees; this we should expect, for they have nothing divine about them as the bees have. For the so-called 'mothers' generate the young and mould the first part of the combs, but they generate by copulation with one another, for their union has often been observed. As for all the differences of each of these kind from one another and from bees, they must be investigated with the aid of the illustrations to the Enquiries.

11

Having spoken of the generation of all insects, we must now speak of the testacea. Here also the facts of generation are partly like and partly unlike those in the other classes. And this is what might be expected. For compared with animals they resemble plants, compared with plants they resemble animals, so that in a sense they appear to come into being from semen, but in another sense not so, and in one way they are spontaneously generated but in another from their own kind, or some of them in the latter way, others in the

former. Because their nature answers to that of plants, therefore few or no kinds of testacea come into being on land, e.g. the snails and any others, few as they are, that resemble them; but in the sea and similar waters there are many of all kinds of forms. But the class of plants has but few and one may say practically no representatives in the sea and such places, all such growing on the land. For plants and testacea are analogous; and in proportion as liquid has more quickening power than solid, water than earth, so much does the nature of testacea differ from that of plants, since the object of testacea is to be in such a relation to water as plants are to earth, as if plants were, so to say, land-oysters, oysters water-plants.

For such a reason also the testacea in the water vary more in form than those on the land. For the nature of liquid is more plastic than that of earth and yet not much less material, and this is especially true of the inhabitants of the sea, for fresh water, though sweet and nutritious, is cold and less material. Wherefore animals having no blood and not of a hot nature are not produced in lakes nor in the fresher among brackish waters, but only exceptionally, but it is in estuaries and at the mouths of rivers that they come into being, as testacea and cephalopoda and crustacea, all these being bloodless and of a cold nature. For they seek at the same time the warmth of the sun and food; now the sea is not only water but much more material than fresh water and hot in its nature; it has a share in all the parts of the universe, water and air and earth, so that it also has a share in all living things which are produced in connexion with each of these elements. Plants may be assigned to land, the aquatic animals to water, the land animals to air, but variations of quantity and distance make a great and wonderful difference. The fourth class must not be sought in these regions, though there certainly ought to be some animal corresponding to the element of fire, for this is counted in as the fourth of the elementary bodies. But the form which fire assumes never appears to be peculiar to it, but it always exists in some other of the elements, for that which is ignited appears to be either air or smoke or earth. Such a kind of animal must be sought in the moon, for this appears to participate in the element removed in the third

degree from earth. The discussion of these things however belongs to another subject.

To return to testacea, some of them are formed spontaneously, some emit a sort of generative substance from themselves, but these also often come into being from a spontaneous formation. To understand this we must grasp the different methods of generation in plants; some of these are produced from seed, some from slips, planted out, some by budding off alongside, as the class of onions. In the last way produced mussels, for smaller ones are always growing off alongside the original, but the whelks, the purple-fish, and those which are said to 'spawn' emit masses of a liquid slime as if originated by something of a seminal nature. We must not, however, consider that anything of the sort is real semen, but that these creatures participate in the resemblance to plants in the manner stated above. Hence when once one such creature has been produced, then is produced a number of them. For all these creatures are liable to be even spontaneously generated, and so to be formed still more plentifully in proportion if some are already existing. For it is natural that each should have some superfluous residue attached to it from the original, and from this buds off each of the creatures growing alongside of it. Again, since the nutriment and its residue possess a like power, it is likely that the product of those testacea which 'spawn' should resemble the original formation, and so it is natural that a new animal of the same kind should come into being from this also.

All those which do not bud off or 'spawn' are spontaneously generated. Now all things formed in this way, whether in earth or water, manifestly come into being in connexion with putrefaction and an admixture of rain-water. For as the sweet is separated off into the matter which is forming, the residue of the mixture takes such a form. Nothing comes into being by putrefying, but by concocting; putrefaction and the thing putrefied is only a residue of that which is concocted. For nothing comes into being out of the whole of anything, any more than in the products of art; if it did art would have nothing to do, but as it is in the one case art removes the useless

material, in the other Nature does so. Animals and plants come into being in earth and in liquid because there is water in earth, and air in water, and in all air is vital heat so that in a sense all things are full of soul. Therefore living things form quickly whenever this air and vital heat are enclosed in anything. When they are so enclosed, the corporeal liquids being heated, there arises as it were a frothy bubble. Whether what is forming is to be more or less honourable in kind depends on the embracing of the psychical principle; this again depends on the medium in which the generation takes place and the material which is included. Now in the sea the earthy matter is present in large quantities, and consequently the testaceous animals are formed from a concretion of this kind, the earthy matter hardening round them and solidifying in the same manner as bones and horns (for these cannot be melted by fire), and the matter (or body) which contains the life being included within it.

The class of snails is the only class of such creatures that has been seen uniting, but it has never yet been sufficiently observed whether their generation is the result of the union or not.

It may be asked, if we wish to follow the right line of investigation, what it is in such animals the formation of which corresponds to the material principle. For in the females this is a residual secretion of the animal, potentially such as that from which it came, by imparting motion to which the principle derived from the male perfects the animal. But here what must be said to correspond to this, and whence comes or what is the moving principle which corresponds to the male? We must understand that even in animals which generate it is from the incoming nourishment that the heat in the animal makes the residue, the beginning of the conception, by secretion and concoction. The like is the case also in plants, except that in these (and also in some animals) there is no further need of the male principle, because they have it mingled with the female principle within themselves, whereas the residual secretion in most animals does need it. The nourishment again of some is earth and water, of others the more complicated combinations of these, so that what the

heat in animals produces from their nutriment, this does the heat of the warm season in the environment put together and combine by concoction out of the sea-water on the earth. And the portion of the psychical principle which is either included along with it or separated off in the air makes an embryo and puts motion into it. Now in plants which are spontaneously generated the method of formation is uniform; they arise from a part of something, and while some of it is the starting-point of the plant, some is the first nourishment of the young shoots.... Other animals are produced in the form of a scolex, not only those bloodless animals which are not generated from parents but even some sanguinea, as a kind of mullet and some other river fishes and also the eel kind. For all of these, though they have but little blood by nature, are nevertheless sanguinea, and have a heart with blood in it as the origin of the parts; and the so-called 'entrails of earth', in which comes into being the body of the eel, have the nature of a scolex.

Hence one might suppose, in connexion with the origin of men and quadrupeds, that, if ever they were really 'earth-born' as some say, they came into being in one of two ways; that either it was by the formation of a scolex at first or else it was out of eggs. For either they must have had in themselves the nutriment for growth (and such a conception is a scolex) or they must have got it from elsewhere, and that either from the mother or from part of the conception. If then the former is impossible (I mean that nourishment should flow to them from the earth as it does in animals from the mother), then they must have got it from some part of the conception, and such generation we say is from an egg.

It is plain then that, if there really was any such beginning of the generation of all animals, it is reasonable to suppose to have been one of these two, scolex or egg. But it is less reasonable to suppose that it was from eggs, for we do not see such generation occurring with any animal, but we do see the other both in the sanguinea above mentioned and in the bloodless animals. Such are some of the insects and such are the testacea which we are discussing; for they do

not develop out of a part of something (as do animals from eggs), and they grow like a scolex. For the scolex grows towards the upper part and the first principle, since in the lower part is the nourishment for the upper. And this resembles the development of animals from eggs, except that these latter consume the whole egg, whereas in the scolex, when the upper part has grown by taking up into itself part of the substance in the lower part, the lower part is then differentiated out of the rest. The reason is that in later life also the nourishment is absorbed by all animals in the part below the hypozoma.

That the scolex grows in this way is plain in the case of bees and the like, for at first the lower part is large in them and the upper is smaller. The details of growth in the testacea are similar. This is plain in the whorls of the turbinata, for always as the animal grows the whorls become larger towards the front and what is called the head of the creature.

We have now pretty well described the manner of the development of these and the other spontaneously generated animals. That all the testacea are formed spontaneously is clear from such facts as these. They come into being on the side of boats when the frothy mud putrefies. In many places where previously nothing of the kind existed, the so-called limnostrea, a kind of oyster, have come into being when the spot turned muddy through want of water; thus when a naval armament cast anchor at Rhodes a number of clay vessels were thrown out into the sea, and after some time, when mud had collected round them, oysters used to be found in them. Here is another proof that such animals do not emit any generative substance from themselves; when certain Chians carried some live oysters over from Pyrrha in Lesbos and placed them in narrow straits of the sea where tides clash, they became no more numerous as time passed, but increased greatly in size. The so-called eggs contribute to generation but are only a condition, like fat in the sanguinea, and therefore the oysters are savoury at these periods. A proof that this substance is not really eggs is the fact that such 'eggs' are always found in some testacea, as in pinnae, whelks, and purple-fish; only they are some-

times larger and sometimes smaller; in others as pectens, mussels, and the so-called limnostrea, they are not always present but only in the spring; as the season advances they dwindle and at last disappear altogether; the reason being that the spring is favourable to their being in good condition. In others again, as the ascidians, nothing of the sort is visible. (The details concerning these last, and the places in which they come into being, must be learnt from the Enquiry.)