and move by their own powers. In the corruption, the fermentation, or rather in the reſolution of animal or vegetable ſubſtances, we find real animals capable of propagating their ſpecies, though they were not themſelves produced in this manner. Theſe varieties are, perhaps, more extenſive than we imagine. Though it be right to generalize our ideas, to aſſemble the effects of Nature under one point of view, and to claſs her productions; yet numberleſs ſhades, and even degrees, in the great ſcale of being, will always eſcape our obſervation.

CHAP. X.

On the Formation of the Fœtus.

FROM the experiments of Verheyen, who found the ſemen of the bull in the uterus of a cow, and from thoſe of Ruyſch, Fallopius, and Leeuwenhoek, who diſcovered male ſemen in the uteri of women and many other animals, it ſeems to be a point fully aſcertained, that the ſemen of the male enters into the uterus of the female. It is probable, that, during the time of coition, the oriſice of the uterus opens for the reception of the ſeminal fluid: But, though this ſhould not happen, the active and prolific part of the ſemen may penetrate the membranes and ſubſtance of the uterus itſelf; for, as the ſeminal liquor, as formerly remarked, is almoſt entirely compoſed of organic particles, which are very active, and extremely minute, they may paſs with the utmoſt facility through the membranes and ſubſtance of the uterus.

What proves that the active part of this fluid may paſs through the pores and ſubſtance of the uterus, is the ſudden change it undergoes immediately after conception. The menſes are obſtructed,

obſtructed, the uterus becomes flaccid, ſwells, and appears to be inflated. All theſe changes muſt be effected by an active external cauſe, by the penetration of part of the ſeminal fluid into the ſubſtance of the uterus. This penetration is not confined to the ſurface; it extends through all the veſſels and parts of which the uterus is compoſed, like that penetration by which nutrition, and the expanſion of the body, is produced.

We ſhall the more eaſily believe this to be the caſe, when we reflect, that, during the time of geſtation, the uterus not only augments in ſize, but even in its quantity of matter, and that it poſſeſſes a ſpecies of life, or rather of vegetation, which continues till the child be delivered. If the uterus were only a ſac, a reſervoir for receiving the ſemen and retaining the fœtus, it would extend and diminiſh in thickneſs, in proportion as the fœtus grows larger. But the augmentation of the uterus is not a ſimple extenſion or dilatation of its parts. It not only extends as the fœtus enlarges, but it acquires, at the ſame time, an additional thickneſs and ſolidity; or, in other words, both its ſize and quantity of matter are greatly increaſed. This augmentation is a real growth or increaſe of ſubſtance, ſimilar to the expanſion of the body in young animals, which could not be effected but by an intimate penetration of organic particles analogous to the ſubſtance of thoſe parts. As this expanſion

expanſion of the uterus never happens but after impregnation, the ſeminal liquor muſt be the cauſe by which it is produced; for the uterus is conſiderably augmented before the fœtus has acquired bulk enough to dilate it by preſſing againſt its internal ſurface.

It appears, from my own experiments, to be equally certain, that the female has a ſeminal fluid, which begins to be formed in the teſticles, and is brought to maturity in the glandulous bodies. This fluid perpetually diſtils through the ſmall apertures in the extremities of theſe bodies, and, like that of the male, enters the uterus by two different ways, either through the apertures at the extremities of the horns of the uterus, or by piercing through the ſubſtance of the uterus itſelf.

Theſe two ſeminal fluids are extracts from all parts of the body; and a mixture of them is all that is neceſſary for the formation of a certain number of males and females. The more any animal abounds in this ſeminal fluid, or the more it abounds in organic particles, the number of young is the greater, as may be remarked in the ſmaller animals; and the number of young diminiſhes in proportion as the organic particles are leſs abundant, as is the caſe with the larger animals.

But, before taking any farther notice of other animals, we ſhall examine with attention the formation of the human fœtus. In mankind, as well as in the larger ſpecies of animals, the

quantity of organic particles in the male and female ſemen is not great, and, accordingly, they very ſeldom produce above one fœtus at a time. This fœtus is either a male or a female, according as the number of organic particles predominates in the male or in the female fluid; and the child reſembles the father or the mother moſt, according to the proportional quantities of male or female organic particles in the mixture of the two liquors.

I conceive, therefore, that the ſeminal fluids, both of the male and of the female, are equally active, and equally neceſſary for the purpoſes of propagation: And this, I think, is fully proved by my experiments; for I found in both fluids the ſame moving bodies; I diſcovered that the male fluid enters the uterus, where it meets with the fluid of the female; that theſe two fluids are perfectly analogous; and that they are compoſed of parts not only ſimilar in their form, but in their action and movements *. Now, I imagine, that, by the mixture of the two fluids, the activity of the organic particles proper to each is ſtopped; that the action of the one counterbalances the action of the other; that each organic particle, by ceaſing to move, remains fixed in the place which correſponds to its nature; and that this place can be no other than that which it formerly occupied in the body of the animal from which it was extracted. Thus all the organic particles which were detached from the head

* See chap. vi.

 of

of the animal, will arrange themſelves in a ſimilar order in the head of the fœtus. Thoſe which proceeded from the backbone, will diſpoſe themſelves in an order correſponding to the ſtructure and poſition of the vertebræ. In the ſame manner, the organic particles which had been detached from any part of the body, will naturally aſſume the ſame poſition, and arrange themſelves in the ſame order that they obſerved before they were ſeparated from that part. Of courſe, theſe particles will neceſſarily form a ſmall organized body, entirely ſimilar to the animal from which they originally proceeded.

It is worthy of remark, that this mixture of the organic particles of both ſexes contains particles which are ſimilar, and particles which are diſſimilar. The ſimilar particles are thoſe which have been detached from all the parts that are common to the two ſexes. The diſſimilar particles are thoſe which have been ſeparated from the parts that diſtinguiſh the two ſexes. In this mixture, therefore, there is a double portion of particles deſtined for the formation of the head, the heart, and ſuch parts as are common to both ſexes; while there are no more than what are neceſſary for the production of the ſexual parts. Now, the ſimilar particles may act upon each other without producing any diſorder; and they may unite in the ſame manner as if they had proceeded from the ſame body. But the diſſimilar particles cannot act upon each other, nor form any intimate union, becauſe they have no analogy or relation: Hence

 theſe

theſe particles will preſerve their original nature without any mixture, and fix their poſition, without the neceſſity of being penetrated by others. Thus the particles which proceed from the ſexual parts will be firſt fixed, and thoſe that are common to the two ſexes, whether they belong to the male or to the female, will then fix indiſcriminately, and form an organized body, which, in its ſexual parts, will perfectly reſemble the father, if it be a male, and the mother, if it be a female, but which, in the other parts, may reſemble either or both.

If what I have advanced be properly underſtood, we ſhall, perhaps, be able to obviate an objection to the ſyſtem of Ariſtotle, and which might alſo be urged againſt the doctrine which I am now eſtabliſhing. The objection is, Why is not every individual, both male and female, endowed with the faculty of producing an animal of its own ſex? I am aware of the difficulty of ſolving this queſtion, which I have ſlightly mentioned in the fifth chapter, and ſhall now proceed farther to illuſtrate.

From what is delivered in the firſt four chapters, and from the experiments I have related, it is apparent, that reproduction is effected by the aſſemblage and union of the organic particles, detached from every part of the animal or vegetable body, in one or ſeveral common reſervoirs; that theſe particles are the ſame which ſerve for the nutrition and expanſion of the body;

body; and that both effects are produced by the ſame matter, and by the ſame laws. I think I have eſtabliſhed this point by ſo many facts and reaſonings, that it is impoſſible to entertain a doubt concerning its truth. But I allow, that the queſtion may be put, Why every ſeparate animal and vegetable produces not its own likeneſs, ſince every individual detaches from all its parts, and collects, in a common reſervoir, the organic particles neceſſary for the formation of a ſmall organized body? Why is not this organized body formed? and why, in moſt animals, is a mixture of the fluids of both ſexes neceſſary? If I were to reply, that, in all the vegetable tribes, in all thoſe animals that multiply by cuttings, and in the vine-fretters, which produce without any ſexual commerce, the general intention of Nature ſeems to be, that each individual ſhould multiply its own ſpecies, and that reproduction by the intervention of ſexes is only an exception to this general law; it might, with propriety, be rejoined, that the exception is perhaps more univerſal than the rule itſelf. To maintain that all individuals would have the faculty of reproducing, if they were endowed with proper organs, and if they contained the matter neceſſary for nouriſhing the embryo, is not removing the difficulty: For, in females, all theſe circumſtances concur; and yet the influence of the male is indiſpenſible to the production either of a female or of a male fœtus.

But, we come nearer a ſolution of the queſtion, when we maintain, that, though the fluid in the teſticles and ſeminal veſſels of the male contain all the organic particles neceſſary for the formation of a male fœtus, yet theſe particles cannot receive any local eſtabliſhment or arrangement of parts, becauſe a conſtant circulation of them goes on by means of abſorption, and by the perpetual ſucceſſion of new ſupplies from all parts of the body; and that, as the ſame circulation of the organic particles takes place in the female, neither of them can poſſibly multiply without the aſſiſtance of the other; becauſe, in the mixture of the male and female fluids, the different organic particles of which they conſiſt have a greater affinity to each other than they have to the body of the female where the mixture happens. But, though this explication were admitted, why, it may ſtill be aſked, does not the ordinary mode of generation correſpond with it? For, upon this ſuppoſition, each individual would produce, and, like ſnails, mutually impregnate one another, every individual receiving the organic particles furniſhed by the other, which, without being injured by any foreign power, would unite ſolely by the affinity between the particles themſelves. If there were no other cauſe by which the organic particles could be united, perhaps this mode of generation would be the moſt ſimple. But it is contrary to the analogy of Nature.

Few

Few animals are endowed, like ſnails, with both ſexes; and, therefore, if this mode of propagating were the moſt ſimple, it would be more generally employed by Nature. This ſolution, of courſe, amounts to no more than a gratuitous ſuppoſition, that males produce not, ſolely becauſe they have not organs proper for containing and nouriſhing a fœtus.

It may be ſtill farther ſuppoſed, that the activity of the organic particles in the ſemen of each individual requires to be counterbalanced by the force or action of thoſe of the other individual, in order to reduce them to a fixed ſtate, or equilibrium, without which the formation of the fœtus cannot be effected; and that the motion of the organic particles of the female cannot be counterbalanced by any other cauſe than a contrary action in the organic particles received from the male. But this anſwer is too general to be void of obſcurity. However, when we attend to all the phænomena, it may, perhaps, admit of ſome illuſtration. The mixture of the two ſeminal fluids produces not only a male or female fœtus, but other organized bodies, which are endowed with the faculty of growth or expanſion. The placenta, the membranes, &c. are produced at the ſame time, if not ſooner, than the fœtus. There are, therefore, in the ſeminal fluid of the male or female, or in the mixture of both, organic particles not only ſuited to the production of the fœtus, but of the

placenta and membranes. Since there are no parts either in the male or female bodies from which they could be detached, whence do theſe particles proceed? It muſt be admitted, that the organic ſeminal particles of each ſex being equally active, uniformly produce organized bodies every time that they can fix themſelves, by their mutual action upon one another; that, of the particles deſtined to produce a male, thoſe peculiar to the male ſex will fix firſt, and form the ſexual parts; that the particles common to both ſexes may afterwards fix themſelves indifferently, in order to form the reſt of the body; and that the placenta and membranes are produced by the exceſs of organic particles which have not been employed in the formation of the fœtus. If, as we have ſuppoſed, the fœtus be a male, all the organic particles peculiar to the female ſex, which have not been employed, as alſo the ſuperfluous particles of both individuals which have not entered into the compoſition of the fœtus, and which cannot be leſs than one half of the whole, remain for the formation of the membranes and placenta. If the fœtus be a female, the ſame quantity of ſuperfluous organic particles ſtill remain, and are occupied in forming the placenta and membranes.

But it may be ſaid, that the membranes and placenta, upon this ſuppoſition, ought to become another fœtus, which would be a male, if the firſt was a female, and a female, if the firſt was a male;

a male; becauſe the firſt fœtus conſumed only the organic particles peculiar to the ſex of one individual, and the half of thoſe particles which were common to both ſexes; and, of courſe, the ſexual particles of the other individual, and the other half of the common particles, remain ſtill unexhauſted. To this I reply, that the firſt union of the organic particles prevents a ſecond, at leaſt under the ſame form; and that the fœtus, being firſt formed, exerts an external force, which deſtroys the natural arrangement of the other organic particles, and throws them into that order which is neceſſary for the formation of the placenta and membranes.

From the experiments and obſervations formerly made, it is apparent, that all animated beings contain an amazing quantity of living organic particles. The life of an animal or vegetable ſeems to be nothing elſe than a reſult of all the particular *lives* (if the expreſſion be admiſſible) of each of theſe active particles, whoſe life is primitive, and perhaps indiſtructible. Theſe living particles we have found in every animal and vegetable ſubſtance; and we are certain that all theſe particles are equally neceſſary to the nutrition, and, conſequently, to the reproduction of animals and vegetables. That the union of a certain number of theſe particles, therefore, ſhould produce an animated being, it is not difficult to conceive. As each particle is animated, a whole, or any aſſemblage of them,

muſt be endowed with life. Theſe living organic particles being common to all animated beings, they are capable of forming particular ſpecies of animals or of vegetables, according to the peculiar arrangement they aſſume. Now, this arrangement depends entirely on the form of the individuals which furniſh the organic particles. If they are furniſhed by an animal, they arrange themſelves under the form peculiar to its ſpecies, exactly agreeable to that arrangement they obſerved when they nouriſhed or expanded the animal itſelf. But, does not this regular arrangement ſuppoſe the neceſſity of ſome baſe or centre, round which the particles aſſemble in order to unite and form a fœtus? This baſis is furniſhed by the particles which form the ſexual parts. I ſhall illuſtrate this point.

As long as the organic particles of either ſex remain alone, their activity produces no effect, becauſe it is not oppoſed by any reſiſtance or reaction from particles of a different kind. But, when the male and female liquors are blended, the particles detached from the ſexual parts, being of a different kind, ſerve as a baſe to fix the activity of the other particles.

Upon this ſuppoſition, that the organic particles which, in the mixture of the two fluids, repreſent the ſexual parts of the male, can alone ſerve as a baſis to the particles which proceed from all parts of the female; and that thoſe proceeding from all parts of the male can only be

be fixed by the particles which are detached from the ſexual parts of the female; we may conclude, that the ſexual parts of the male fœtus are formed by the organic particles of the father, and the reſt of its body by the organic particles of the female; and, on the contrary, that the female fœtus derives nothing but its ſex from the mother, and the reſt of its body from the father. Boys, therefore, except in the parts which diſtinguiſh their ſex, ought to reſemble the mother more than the father, and girls ſhould reſemble the father more than the mother.

Conſidering generation by ſexes under this light, we ſhould conclude it to be the moſt common manner of reproduction, as it is in reality. Beings of the moſt perfect organization, as animals, whoſe bodies make a whole that is incapable of diviſion, and whoſe powers are all concentrated into one point, cannot be reproduced in any other way; becauſe they contain only particles that are perfectly ſimilar, and cannot be united but by means of different particles furniſhed by another individual. But vegetables, which are leſs perfect in their organization, and which can be divided without deſtruction, are capable of being reproduced in different ways: 1. Becauſe they contain diſſimilar particles; 2. Becauſe the form of theſe bodies is leſs fixed and determined than that of an animal, different parts may ſupply the functions of each other,

and vary according to circumſtances: The roots of a tree, when expoſed to the air, puſh out branches and leaves; and thus the organic particles of vegetables obtain a local eſtabliſhment, become fixed, and produce individuals in many different ways.

The ſame phænomenon is exhibited in animals whoſe organization is leſs perfect, as in the freſh water polypus, and others, which are capable of reproducing by the diviſion of their parts. Theſe organized bodies, inſtead of ſingle animals, may be conſidered as bundles of organized beings united by a common membrane, as trees are compoſed of an infinite number of minute trees*. The vine-fretters, which propagate individually, likewiſe contain diſſimilar particles; becauſe, after producing their young, they change into barren flies. Snails mutually communicate diſſimilar particles to each other; and, therefore, each individual is fruitful. Thus, in every mode of generation with which we are acquainted, we find, that the neceſſary union of the organic particles cannot be effected but by the admixture of different particles, to ſerve as a common baſis, and to fix or deſtroy their activity.

According to this general idea of ſexes, we may ſuppoſe, that the diſtinction of ſex extends through all Nature; for *ſex*, in this ſenſe, is nothing but that part of bodies which furniſhes

* See chap. ii.

organic

organic particles of a different kind from thoſe of the common parts, and which ſerve as a baſis for their union. But it is, perhaps, uſeleſs to reaſon on a queſtion which can be ſolved at once, by ſaying, that, as God has created ſexes, animals muſt neceſſarily be produced by their intervention. We are not in a condition, as I formerly remarked, to explain *why* things exiſt; we are unable to explain *why* Nature almoſt univerſally employs ſexes for the reproduction of animals, or *why* ſexes exiſt. We ought, therefore, to content ourſelves with reaſoning concerning things as they are. If we attempt to riſe higher, we loſe ourſelves in the regions of fancy, and forget the narrow limits of our capacity.

Leaving, therefore, all further ſubtleties, I ſhall adhere to nothing that is not founded on facts and obſervation. I find that the reproduction of bodies is effected in many different modes: But, at the ſame time, I clearly perceive, that animals and vegetables are reproduced by the union of the organic particles detached from all parts of their bodies. I am certain that theſe active organic particles exiſt in the ſeeds of vegetables, and in the ſeminal fluids of animals, both male and female; and have no doubt that every ſpecies of reproduction is accompliſhed by the union and admixture of theſe particles. It is equally unqueſtionable, that, in the generation of man, and other animals, the organic

particles

particles of the male and female mix at the time of conception; becauſe we often ſee children who reſemble both father and mother: And, what confirms this theory is, that all the particles common to the two ſexes mix together promiſcuouſly, but that the particles peculiar to the ſexes never mix; for we daily perceive children with eyes reſembling thoſe of the father, while their mouth and front reſemble thoſe of the mother. But we never ſee any ſuch mixture of reſemblances in the ſexual parts; we never find, in the ſame individual, the teſticles of the father and the vagina of the mother.

The formation of the fœtus, therefore, is effected by the mixture of the organic particles of both ſexes; and this mixture fixes or gives a local eſtabliſhment to the particles, becauſe it is made according to the laws of affinity which take place between the different parts, and which determine the particles to arrange themſelves in the ſame order they obſerved when they exiſted in the individuals who furniſhed them. The particles which proceed from the head, for example, cannot, according to theſe laws, take up their ſtation in the legs, or in any other part but the head of the fœtus. All the particles are in motion when they firſt unite; and this motion muſt be round the point or centre of union. This baſis or central point, which is neceſſary to the union of the particles, and which, by its reaction and inertia, fixes and deſtroys their activity,

tivity, is probably the firſt aſſemblage of particles that proceed from the ſexual parts, becauſe they are the only particles in the mixture which differ from thoſe common to both ſexes.

I imagine, therefore, that, in the mixture of the two fluids, the organic particles which come from the ſexual parts of the male fix themſelves firſt, and cannot unite with thoſe which proceed from the ſexual parts of the female, becauſe they are of a different nature, and have leſs affinity to each other than the particles that come from the eye, the arm, or any other part of the female. Round this centre, or point of union, the other organic particles ſucceſſively arrange themſelves in the ſame order they formerly exiſted in the body from which they were derived; and, according as the particles of the one or of the other individual moſt abound, or are nearer this central point, they enter in greater or leſs quantities into the compoſition of the new being, which, in this manner, is formed in the middle of a homogeneous fluid; at the ſame time, veſſels begin to ſhoot, which increaſe in proportion to the growth of the fœtus, and furniſh it with proper nouriſhment. Theſe veſſels, which have a peculiar ſpecies of organization, are probably formed by the exceſs of the organic particles that have not been admitted into the compoſition of the fœtus; for, as theſe particles are both active, and furniſhed with a baſe or point of union from the organic particles peculiar

liar to the ſexual parts of the other individual, they muſt arrange themſelves in the form of an organized body, but not in the form of another fœtus; becauſe their poſition with reſpect to each other has been changed by the different movements of the particles which entered into the compoſition of the firſt fœtus. From the union of theſe ſuperabundant particles, therefore, an irregular body muſt ariſe, which will reſemble the fœtus in nothing but its growth and expanſion, becauſe, though this body be compoſed of the ſame organic active particles with the fœtus, their poſition and form muſt be different, as they were thrown aſide from the centre or point of union, which ſerved as a baſis for the formation of the fœtus.

When the quantity of ſeminal fluid of both individuals is great, or, rather, when theſe liquors abound with organic particles, different centres of attraction are formed in different parts of the mixture; and, in that caſe, by a mechaniſm ſimilar to what has been mentioned above, ſeveral fœtuſes are formed, ſome of them males, and others females, according as the particles of the one ſex or of the other are the moſt active. But, from the ſame centre of attraction, two fœtuſes can never originate; becauſe two centres are requiſite for this purpoſe. Beſides, if this arrangement were to happen, no particles would be left for the formation of the placenta and membranes; becauſe they would all be employed in conſtituting the ſecond

ſecond fœtus, which would neceſſarily be a female, if the other was a male. All that could happen in a caſe of this kind would be, that ſome of the particles common to both individuals, being equally attracted by the firſt centre of union, muſt arrive there at the ſame time, and produce a monſter, or a fœtus with ſuperfluous parts; or, if ſome of the common particles ſhould fix at too great a diſtance from the centre, or be conſtrained by the attraction of the ſecond, round which the placenta is formed, a monſter, defective in ſome part, would be the conſequence.

That the organic particles peculiar to the ſexual parts ſerve for a baſis or centre of union to the other particles of which the embryo is formed, I pretend not to demonſtrate: But as they are the only particles which differ from the reſt, it is more natural to imagine that they ſhould anſwer this purpoſe than thoſe which are common to both individuals.

I formerly detected the errors of thoſe who maintained, that the heart, or the blood, were firſt formed. The whole is formed at the ſame time. We learn from actual obſervation, that the chicken exiſts in the egg before incubation. The head, the back-bone, and even the appendages which form the placenta, are all diſtinguiſhable. I have opened a great number of eggs, both before and after incubation, and I am convinced, from the evidence of my own eyes, that the whole chicken exiſts, in the middle of the

cicatrice, the moment the egg iſſues from the body of the hen. The heat communicated to it by incubation, expands the parts only, by putting the fluids in motion. But we have never been able to determine, with certainty, what parts of the fœtus are firſt fixed, at the moment of its formation.

I have always maintained, that the organic particles were fixed, and that they united in conſequence of their motion being ſuſpended. Of the truth of this fact I am fully convinced; for, if the male and female ſemen be ſeparately examined, we find in both a great number of moving particles; but, when theſe fluids are mixed, the motion of the particles is totally deſtroyed, and a certain degree of heat is neceſſary to renew their activity; for the chicken, which exiſts in the centre of the cicatrice, has no motion before incubation; and, even 24 hours, or two days afterwards, when we begin to perceive it without the microſcope, it has not the ſmalleſt appearance of motion. During the firſt two or three days, the fœtus is only a ſmall white mucilaginous maſs, which gradually acquires conſiſtence and magnitude. But this progreſs is exceedingly ſlow, and has no reſemblance to the rapid movements of the organic particles in the ſeminal fluid. Beſides, I maintained, not without reaſon, that the motion of the organic particles was entirely deſtroyed; for, if eggs be kept without expoſing them to the degree of heat

heat that is neceſſary for the expanſion of the chicken, the embryo, though completely formed, will remain without any motion, and the organic particles of which it is compoſed will continue fixed, without being able to give life and motion to the embryo which was formed by their union. Thus, after the motion of the organic particles is ſtopped, and after they have united in ſuch a manner as to form a fœtus, ſome external cauſe is ſtill neceſſary to give them life and motion. This cauſe, or agent, is heat, which, by rarifying the fluids, obliges them to circulate: This circulation makes all the organs act; and nothing farther is neceſſary for the growth and expanſion of the parts than the continuation of this heat.

Before the action of this external heat, there is not the ſmalleſt appearance of blood; and I never could perceive any change of colour in the veſſels till about 24 hours after incubation. In the veſſels of the placenta, which communicate with the body of the fœtus, the blood firſt appears. But it would ſeem that this blood loſes its red colour, as it approaches the body of the animal; for the chicken is entirely white; and during the firſt, ſecond, and third days after incubation, we can with difficulty perceive a few red particles near the animal's body, but which ſeem not to make any part of it, though theſe red particles are deſtined for the formation of the heart. Thus the formation of blood is an effect produced by the motion communicated

to the fluids by heat; and even this blood is formed without the body of the animal, the whole ſubſtance of which conſiſts of a white mucilage.

The fœtus, as well as the placenta, receive the nouriſhment that is neceſſary for their expanſion by a ſpecies of abſorption; and they aſſimilate the organic particles of the liquor in which they ſwim: For, it is an equal impropriety to ſay that the placenta nouriſhes the animal, as that the animal nouriſhes the placenta. If the placenta nouriſhes the fœtus, the former would diminiſh in proportion to the growth of the latter, which by no means happens; for both augment together. I have indeed obſerved, that, in eggs, the placenta at firſt grows much more in proportion than the fœtus, and, conſequently, it may nouriſh the animal; or, rather, it conveys nouriſhment to the chick by means of abſorption.

What we have ſaid concerning the chicken, admits of an eaſy application to the human fœtus, which is formed by the union of the organic particles of the two ſexes. The membranes and placenta are produced by the ſuperabundant particles that enter not into the compoſition of the fœtus, which is now incloſed in a double membrane, containing alſo a quantity of fluid. This fluid is at firſt, perhaps, nothing but a portion of the ſeminal liquors of the father and mother; and, as the fœtus is not thrown out of the uterus, it enjoys, from the moment of its formation,

tion, as much external heat as is ſufficient for its expanſion. This heat communicates motion to the fluids; it gives play to all the organs; and the blood is formed in the placenta, and in the body of the fœtus, ſolely by the motion excited by the heat. We might even maintain, that the formation of the blood in a child is as independent of the mother, as that which ariſes in the egg is independent of the hen that covers it, or of the furnace which heats it.

It is certain that the fœtus, the membranes, and the placenta, are all nouriſhed and expanded by abſorption; for, at firſt, the ſac that contains the whole product of generation does not adhere to the uterus: And we have ſeen, from the experiments of De Graaff upon female rabbits, that he made the globules which contained the fœtuſes roll about in the uterus. They could receive no nouriſhment, therefore, but by abſorbing the fluids that conſtantly bedew the uterus, to which they afterwards begin to adhere by means of a mucilage that gradually gives origin to ſmall blood veſſels, as ſhall afterwards be more fully explained.

But, to return to the formation of the fœtus, concerning which we have to make ſeveral remarks, both as to its ſituation, and to the different circumſtances that may prevent or alter the mode of its production.

In the human ſpecies, the ſemen of the male enters into the uterus, the cavity of which is

 conſi-

conſiderable; and when it meets with a ſufficient quantity of female ſemen, the two inſtantly mix, and the organic particles unite and form the fœtus. The whole is, perhaps, performed in a moment, eſpecially if the two fluids be in an active ſtate. The cavity of the uterus is the proper place for the formation of the fœtus; becauſe the ſemen of the male has an eaſier admiſſion into the uterus than into the Fallopian tubes or ovarium; and, as the uterus has only a ſmall aperture, which is always ſhut, except when opened by the ardor of love, the materials of generation remain there in ſafety, unleſs they be diſturbed by ſome rare and accidental circumſtance. But, as the male fluid moiſtens the vagina, before it penetrates the uterus, and, as the organic particles are exceedingly active, it may penetrate as far as the Fallopian tubes and ovarium. In the ſame manner, as the female fluid is already perfected in the glandulous bodies of the teſticles, from which it diſtills and moiſtens the Fallopian tubes, before it deſcends into the uterus; and, as it may eſcape through the lacunæ round the neck of the uterus, it is not impoſſible that the mixture of the two liquors may take place in all theſe different places. Fœtuſes, therefore, may frequently be formed in the vagina, and inſtantly fall out of it, having nothing proper for their retention. They may alſo be ſometimes formed in the Fallopian

lopian tubes; but inſtances of this kind muſt be rare.

Anatomiſts mention, that fœtuſes have been found, not only in the Fallopian tubes, but likewiſe in the ovaria. M. Theroude *, a ſurgeon in Paris, ſhowed to the academy a rude maſs which he found in the right ovarium of a girl of 18 years of age. Two open fiſſures, garniſhed with hair like eye-lids, were perceived in this maſs. Above theſe eye-lids was a kind of front, with a black line in place of eye-brows. Immediately above the front, there were ſeveral hairs collected into two ſeparate pencils, one of them about ſeven inches long, and the other three. Below the angle of the eye, two large, hard, white, dentes molares appeared, together with their gums: Theſe teeth were about three lines long, and about a line diſtant from each other. Several other teeth appeared, ſituated at different diſtances. In the ſame volume †, M Mery is reported to have found in the ovarium of a woman an upper jaw-bone, with ſeveral teeth in it, ſo perfect that they appeared to be at leaſt of ten years growth. In the Medical Journal, publiſhed by the Abbe de la Roque ‡, we have the hiſtory of a woman, who died of her ninth child, which had been formed *in* or *near* one of the ovaria; for, from the deſcription, it is not clear whether the child was within the

* See Mem. de l'Acad. des Sciences, tom. ii. p. 91.
† P. 244. ‡ January 1683.

 ovarium,

ovarium, or adjacent to it only. This fœtus was about an inch thick, and completely formed. In the Philoſophical Tranſactions, examples are recorded of teeth, hair, and bones being found in the ovaria of women. If all theſe facts can be credited, the ſeminal liquor of the male muſt be ſuppoſed ſometimes, though rarely, to mount up to the ovaria. But there are many conſiderations which render this point extremely doubtful: 1. The facts which ſeem to ſupport it are few: 2. The only inſtance of a perfect fœtus found in the ovarium, is narrated in a very ſuſpicious manner by M. Littre. Neither is it impoſſible that the ſeminal fluid of the female alone may ſometimes produce organized maſſes, as moles, ciſts full of hair, of bones, or of fleſh. Beſides, if we are to believe anatomiſts, fœtuſes may be formed in the teſticles of men as well as in thoſe of women; for, we are told by a ſurgeon, in the 2d volume of the hiſtory of the old academy *, that he found a fœtus, with its membranes, in which the head, the feet, the eyes, the bones and cartilages, were diſtinguiſhable, in the ſcrotum of a man. Were all theſe facts equally worthy of credit, we muſt neceſſarily adopt one of the two following hypotheſes; either that the ſeminal fluid of each ſex can produce nothing without being mixed with the other; or, that either of the fluids alone is capable of producing irregularly organized maſſes. If we maintain the former

* Page 298.

mer hypotheſis, to explain the facts above related, we ſhall be obliged to admit, that the male fluid ſometimes aſcends to the ovarium, and by mixing there with the female fluid, forms organized bodies; and alſo, that the female fluid, by being copiouſly effuſed in the vagina, may, in the time of coition, penetrate as far as the ſcrotum of the male, in the ſame manner as the venereal virus often reaches that part; and, conſequently, that an organized body may be formed in the ſcrotum by a mixture of the male and female fluids. If the other hypotheſis, which is the moſt probable, be adopted, namely, that the ſeminal fluid of each individual may ſeparately produce organized maſſes, then all theſe oſſeous, fleſhy, and hairy bodies, which ſometimes appear in the ovaria of females, and in the ſcrotum of males, may derive their origin from the ſeminal fluid of the individual in which they are found. But it is needleſs to ſpeculate farther concerning facts which ſeem to be more uncertain than inexplicable; for I am inclined to think, that the ſeminal fluid of each individual may ſingly produce ſomething; and that young girls, for example, may produce moles, without any intercourſe with the male, in the ſame manner as hens lays eggs without the intervention of the cock. I might ſupport this opinion with obſervations equally credible as thoſe we have juſt now quoted. M. de la Saone, a phyſician and anatomiſt, publiſhed a treatiſe on this ſubject, in which

which he aſſures us, that nuns, though ſtrictly cloiſtered, ſometimes produce moles: And why ſhould this be impoſſible, ſince hens produce eggs without any communication with the cock, and ſince we find, in the cicatrices of theſe eggs, inſtead of a chicken, a mole with its appendages? The analogy here is ſufficiently ſtrong to make us at leaſt ſuſpend a raſh determination. Whatever be in this, it is certain, that a mixture of the two fluids is neceſſary for the formation of a fœtus, and that this mixture cannot be properly effected but in the uterus, or in the Fallopian tubes, where anatomiſts have ſometimes diſcovered fœtuſes: And it is natural to imagine, that thoſe which have been found in the cavity of the abdomen, have eſcaped by the extremity of the tube, or by ſome accidental rupture of the uterus; and that they never fall into the abdomen from the ovarium, becauſe I think it next to impoſſible that the ſeminal fluid ſhould aſcend ſo far. Leeuwenhoek has computed the motion of his pretended ſpermatic animals to be four or five inches in 40 minutes; ſo that, if the whole fluid moved at this rate, in an hour or two the animalcules might proceed from the vagina into the uterus, from the uterus into the Fallopian tubes, and from the Fallopian tubes into the ovaria. But how is it poſſible to conceive, that the organic particles, whoſe motion ceaſes whenever they are deprived of the fluid part of the ſemen, ſhould arrive at the ovarium, unleſs

unleſs they were accompanied with the liquor in which they ſwim? The moving particles cannot give a progreſſive motion to the fluid which contains them. Thus, whatever activity may be aſcribed to theſe organic particles, we cannot conceive how they ſhould arrive at the ovarium, and there form a fœtus, unleſs, by ſome unknown power, the fluid be abſorbed by the ovarium, a ſuppoſition which is not only gratuitous, but contrary to probability.

The difficulty attending this ſuppoſition confirms the opinion, that the male fluid enters the uterus, either by its orifice, or by penetrating its ſubſtance. The female fluid may likewiſe find its way into the uterus, either by the aperture at the extremity of the Fallopian tubes, or by penetrating the ſubſtance of the tubes and uterus. M. Weitbrech, an able anatomiſt of the Academy of Peterſburg, has clearly proved that the ſeminal fluid can penetrate through the ſubſtance of the uterus: ‘Res omni attentione digniſſima,’ ſays he, ‘oblata mihi eſt in utero fœminæ alicu-
‘jus a me diſſectæ; erat uterus ea magnitudi-
‘ne qua eſſe ſolet in virginibus, tubæque ambæ
‘apertæ quidem ad in greſſum uteri, ita ut ex
‘hoc in illas cum ſpecillo facile poſſem tranſire
‘ac flatum injicere, ſed in tubarum extremo nul-
‘la dabatur apertura, nullus aditus; fimbriarum
‘enim ne veſtigium quidem aderat, ſed loco il-
‘larum bulbus aliquis pyriformis materia ſubal-
‘bida fluida turgens, in cujus medio fibra plana
‘nervea,

'nervea, cicatriculæ æmula, apparebat, quæ 'ſub ligamentuli ſpecie uſque ad ovarii involu-'cra protendebatur.

'Dices, eadem a Regnero de Graaff jam 'olim notata. Equidem non negaverim illuſ-'trem hunc profeſſorem, in libro ſuo de organis 'mulieribus, non modo ſimilem tubam deline-'aſſe, Tab. xix. fig. 3. ſed et monuiſſe 'tubas "quamvis, ſecundum ordinariam naturæ diſ-"poſitionem, in extremitate ſua notabilem ſem-"per coarctationem habeant, præter naturam "tamen aliquando claudi;' verum enimvero, 'cum non meminerit auctor an id in utraque 'tuba ita deprehenderit, an in virgine, an ſtatus 'iſte præternaturalis ſterilitatem inducat, an 'vero conceptio nihilominus fieri poſſit, an a 'principio vitæ talis ſtructura ſuam originem 'ducat, ſive an tractu temporis ita degenerare 'tubæ poſſint, facile perſpicimus multa nobis 'relicta eſſe problemata, quæ, utcumque ſoluta, 'multum negotii faceſcant in exemplo noſtro. 'Erat enim hæc fœmina maritata, viginti qua-'tuor annos nata, quæ filium pepererat quem 'vidi ipſe, octo jam annos natum. Dic igitur 'tubas ab incunabulis clauſas ſterilitatem indu-'cere: Quare hæc noſtra fœmina peperit? 'Dic concepiſſe tubis clauſis: Quomodo ovu-'lum ingredi tubam potuit? Dic coaluiſſe tubas 'poſt partum: Quomodo id noſti? quomodo 'adeo evaneſcere in utroque latere fimbriæ poſ-'ſunt, tanquam nunquam adfuiſſent? Si qui-

'dem ex ovario ad tubas alia daretur via, præ-'ter illarum orificium, unico greſſu omnes ſu-'perarentur difficultates; ſed fictiones intellec-'tum quidem adjuvant, rei veritatem non de-'monſtrant; præſtat igitur ignorationem fateri, 'quam ſpeculationibus indulgere*.' Theſe difficulties, which occurred to this acute obſerver, are inſurmountable, according to the egg-ſyſtem. But the fact he records is alone ſufficient to demonſtrate, that the female fluid may penetrate the ſubſtance of the uterus; and it is not to be doubted that the male fluid is capable of entering it in the ſame manner. The change which the male fluid produces in the uterus, and the ſpecies of vegetation or expanſion which it occaſions in that viſcus, is ſufficient to demonſtrate the truth of the fact. Beſides, the fluid which iſſues through the lacunæ of De Graaff being of the ſame nature with that of the glandulous bodies, it is evident that this liquor proceeds from the ovaria; and yet there are no veſſels through which it could paſs. We muſt therefore conclude, that it penetrates through the ſpongy ſubſtance of the parts, and that it not only enters the uterus, but may even iſſue out of it, when the parts are irritated.

But, though this penetration ſhould be regarded as impoſſible, it cannot be denied, that the female fluid, which diſtills from the glandu-

* See Comm. Acad. Petropol. vol. iv. pag. 261. and 262.

lous

lous bodies of the ovaria, may fall into the uterus, by entering the apertures at the extremities of the Fallopian tubes, as the male fluid enters by the orifice of the uterus itſelf; and, conſequently, that the fœtus may be formed in the cavity of the uterus, by the mixture of the two fluids, in the manner already explained.

CHAP. XI.

Of the Expanſion, Growth, and Delivery of the Fœtus, &c.

IN the expanſion of the fœtus, two different ſpecies of growth are diſtinguiſhable: The firſt, which immediately ſucceeds the formation of the fœtus, is not uniform in all the parts of the animal. The nearer the fœtus approaches to maturity, the growth of the parts is more proportional; and it is not till after the birth, that all the parts grow nearly in an equable manner. We muſt not imagine, that the fœtus, at the time of its formation, has the exact figure of an adult. The ſmall embryo, it is true, contains all the parts eſſential to a man; but they differ in their ſucceſſive expanſion.

In an organized body, like that of an animal, ſome parts may be ſuppoſed to be more eſſential than others; and though none of them are uſeleſs or ſuperfluous, yet there are ſome to which others ſeem to owe their growth and diſpoſition. Some parts may be conſidered as fundamental, without which the animal could not exiſt, and others as only ſuperficial and acceſſory. The latter