

united by some active power. But what is this power? It is the power, possessed by animals and vegetables, of assimilating the matter of their food; and is not this the same, or nearly connected with the same power which is the cause of reproduction?

## C H A P. III.

*Of Nutrition and Growth.*

**A**N animal body is a kind of internal mould, in which the nutritive matter is so assimilated to the whole, that, without changing the order or proportion of the parts, each part receives an augmentation. This increase of bulk has, by some philosophers, been called an expansion or unfolding of the parts; because they fancied they had accounted for the phenomenon, by telling us, that the form of an animal in embryo was the same as at full maturity, and that, therefore, it was easy to conceive how its parts should be proportionally unfolded and augmented by the addition of accessory matter.

But, how can we have a clear idea of this augmentation or expansion, if we consider not the bodies of animals, and each of their parts, as so many internal moulds which receive the accessory matter in the order that results from their position and structure? This expansion cannot be effected solely by an addition to the surfaces, but, on the contrary, by an intus-susception, or by penetrating the whole mass; for the size of

the part is augmented proportionally, without changing its form. Hence it is necessary, that the increasing matter must, in some manner or other, intimately penetrate the whole part in all its dimensions: It is equally necessary, that this penetration should be effected in a fixed order and proportion, so that no internal point receive more matter than another; otherwise some parts would be more quickly unfolded than others, which would entirely change their figure. What can thus regulate the accessory matter, and force it to arrive equally and proportionally to every internal point of the body, if we have not recourse to an internal mould?

The bodies of animals and of vegetables, therefore, consist of internal moulds, which uniformly preserve the same figure. But their masses may receive a proportional increase, by the expansion of the moulds in all their dimensions, both internal and external; and this expansion is effected by an intus-susception of an accessory and foreign matter, which intimately penetrates the whole, and assumes the same form and identity of substance with the matter of the moulds themselves.

But what is the nature of that matter which an animal, or a vegetable, assimilates to its own substance? What bestows on it that force and activity which enables it to penetrate the internal mould? If such a power exists, must it not be

be similar to that by which the mould itself is capable of being reproduced?

These three questions include the whole subject, and appear to depend on one another; for it is impossible to explain, in a satisfactory manner, the reproduction of animals or vegetables, if we have not a clear idea how the operation of nutrition is performed. Each question, therefore, demands a separate examination, that we may be enabled to compare their results.

The first, which regards the nature and qualities of the nutritive matter, is in part resolved by the preceding reasonings, and shall be clearly unfolded in the subsequent chapters. We shall show, that there are in Nature infinite numbers of living organic particles; that Nature produces them without any expence, because their existence is constant and invariable; that the causes of death disunite these particles only, but do not destroy them. Thus the matter assimilated by an animal or vegetable, is an organic matter of the same nature with that of the animal or vegetable, and, consequently, may augment the size without changing the figure or the qualities of the original moulds; because it has the same qualities and the same form with the matter of which the moulds themselves are composed. Of the quantity of aliment taken by an animal to support its life, and to maintain the vigour of its organs, and of the juices absorbed by the roots and leaves of a plant, a great part

part is rejected by transpiration, by secretions, and by other excretories; and a small portion only is retained for the nourishment and expansion of the parts. It is extremely probable, that, in the bodies of animals and of vegetables, a separation is made between the *brute* particles of the aliment and the organic; that the former are carried off by the methods just mentioned; that nothing but the organic particles remain; and that they are distributed, by means of some active power, to the different parts, in a proportion so exact, that neither more nor fewer are applied than answer the purposes of nutrition, and of an equal growth and expansion.

As to the second question, What is the nature of that active power, which enables the organic matter to penetrate and combine with the internal mould? It is apparent, from the preceding chapter, that powers exist in Nature, like that of gravity, which affect the most internal parts of matter, without having the smallest relation to its external qualities. These powers, as formerly observed, are beyond the reach of our senses; because their action is exerted upon the intimate structure of bodies. It is evident, therefore, that we can never obtain a clear idea of them, nor of their mode of acting. Their existence, however, is not less certain, than that, by means of them, most natural effects are produced, especially those of nutrition and expansion, which must be owing to a cause that penetrates the  
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most intimate recesses of the original moulds; for, in the same manner as gravity pervades the whole parts of matter, the power which pushes forward or attracts the organic particles of food, penetrates the internal parts of organized bodies; and, as these bodies have a certain form, which we have distinguished by the appellation of *internal moulds*, the organic particles, pushed on by the action of this penetrating force, must enter in an order relative to this form, and consequently cannot alter its figure, but only augment its bulk, and give rise to the growth and expansion of organized bodies: And if, in the organized body, thus expanded, there be some particles similar to the whole, both internally and externally, these parts will become the source of reproduction.

Let us now examine the third question, namely, Is it not by a similar power that the internal mould itself is reproduced? This power appears to be not only similar, but the very same with that which is the cause of expansion and reproduction; for, in an organized and expanded body, nothing farther is necessary for the reproduction of a new body similar to itself, than that it should contain some particle every way similar to the whole. This particle, at its first separation, will not present to our eyes a sensible figure by which we can compare it with the whole body. But, when separated from the body, and put in a situation to receive proper nourishment,  
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this similar particle will begin to expand and to exhibit the form of an entire and independent being, of the same species with that from which it was detached. Thus, a willow or a polypus, as they contain a larger proportion of particles similar to the whole, than most other substances, when cut into any indefinite number of pieces, each segment becomes a new body similar to the parent from which it was separated.

Now, in a body of which all the particles are similar to itself, the organization is the most simple, as has been remarked in the first chapter; for it is only a repetition of the same form, a congeries of figures, similarly organized. It is for this reason that the most simple bodies, the most imperfect species, are most easily and most abundantly reproduced. But, if an organized body contain only few particles similar to itself, as these alone are capable of a second expansion, its power of reproducing will be both more difficult, and more circumscribed as to the number produced. The organization of bodies of this last kind is also more complex, because it possesses fewer parts which are similar to the whole; and, therefore, the more perfectly a body is organized, its power of reproduction will be proportionally diminished.

In this manner we discover nourishment, growth, and propagation, to be effects of the same cause. Organized bodies are nourished by the particles of aliment which are similar to them; they

they grow or are expanded by absorbing those organic particles which correspond to their own nature; and they propagate, because they contain some organic particles similar to themselves. It only remains to examine whether these similar organic particles are extracted from the food, or have a primary and independent existence in the bodies themselves. If we suppose the latter, we recur to the infinity of similar parts or germs contained within each other, an hypothesis which we have already shown to be replete with difficulties and absurdities. We must, therefore, maintain, that the similar parts are extracted from the food; and, after what has been said on the subject, we hope to be able to explain the manner of their absorption, and how the more minute organic particles which compose them are united.

We formerly remarked, that the organic parts of food were separated from those which have no analogy to the animal or vegetable, by transpiration and other excretions. The first remain, and serve to expand and nourish the body: But these organic parts must be of very different species; and, as each part of the body receives only a proper number of those which correspond to it, the surplus, it is natural to imagine, will be returned from all parts of the body, and be collected in one or more reservoirs, where they will unite and form small organic bodies similar to the first, and which require nothing but proper

per circumstances for expanding and becoming new individuals of the same species; for, as all parts of the body send off organic particles similar to those of which themselves are composed, the result of their union must be the production of new organized bodies similar to the original. Hence we may conclude, that this is the reason why organized bodies, during the time of their growth and expansion, are seldom or never capable of reproducing; because the growing parts absorb the whole organic particles presented to them, and no surplus being sent from the different parts of the body, propagation becomes, of course, impracticable.

This account of nutrition, and of reproduction, will not, perhaps, be received by those philosophers who admit only a certain number of mechanical principles, and reject every thing as false which depends not upon them; and, as the explication now given of nutrition and reproduction has no connection with any of these principles, they will conclude that it deserves no credit. But I think very differently from these philosophers. In admitting only a few mechanical principles, they consider not how much they contract the bounds of philosophy, and how few phenomena can, by this narrow method of thinking, be fully explored.

The notion of explaining all the appearances in Nature upon the principles of mechanism, is, doubtless, a great exertion, and was first attempt-

ed by Des Cartes. But it is, at least, an untenable project; and, though it were otherwise, we are unable to put it in execution. These mechanical principles are, the extension of matter, its impenetrability, its motion, its external figure, its divisibility, the communication of motion by impulse, by the action of springs, &c. These ideas we have acquired by our senses, and we regard them as principles, because they are general and common to all matter. But are we certain that matter possesses no other qualities? Ought we not rather to believe that these qualities, which we assume for principles, are only modes of perception; and that, if the conformation of our senses were different, we would recognize qualities in matter very different from those above enumerated? It is presumptuous to deny every quality to matter but those we are acquainted with. Many general qualities, perhaps, remain to be discovered; and many may exist which will for ever elude human discernment. The cause of impulsion, of cohesion, or of any other mechanical principle, will always continue to be equally inscrutable as that of attraction, or of any other general quality. Hence it may be concluded, that mechanical principles are nothing else than general effects which experience has enabled us to remark in matter; and that, whenever we shall discover, either by reflection, by analogy, or by experience, a new general effect, it will become a new mechanical principle,

principle, which may be employed with equal advantage and certainty as any of those that are already known.

The defect of Aristotle's philosophy was the employing particular effects as causes; and that of Des Cartes consists in the rejection of every cause, but a few general effects. To use nothing as causes but general effects, to endeavour to augment the number of these, and to attempt to generalize particular effects, would constitute the most perfect principles of genuine philosophy.

In my theory of expansion and reproduction, I first admit the mechanical principles, then the penetrating force of gravity, and, from analogy and experience, I have concluded the existence of other penetrating forces peculiar to organized bodies. I have proved by facts, that matter has a strong tendency towards organization; and that there are in Nature an infinite number of organic particles. I have, therefore, only generalized particular observations, without advancing any thing contrary to mechanical principles, when that term is used in its proper sense, as denoting the general effects of Nature.

## CHAP. IV.

*Of the Generation of Animals.*

AS the organization of man, and of other animals, is the most perfect, and the most complex, the propagation of them is likewise most difficult, and the number of individuals is less abundant. I except here such animals as can be multiplied by a separation of their parts, or without the aid of generation, these having been sufficiently treated of in the preceding chapter\*.

But how will the theory delivered in the former chapter apply to the generation of men, and other animals, who are distinguished by sexes? We understand, from what has been said, how every individual may reproduce; but we cannot conceive how two individuals, the one a male, and the other a female, should uniformly produce a third.

Before replying to this objection, I must observe, that the writers on this subject have confined their ideas solely to the generation of men and of animals, without attending to the nature

\* Here the author gives an unnecessary recapitulation of Chap. III. to which the reader is referred.