LITERATURE AND ART.

THE VARIATION OF ANIMALS AND PLANTS UNDER DOMESTICATION.*

THIS work is a continuation of the inquiry opened by Mr. Darwin in his volume on the "Origin of Species," in 1859. The publication of that book marked an era in the progress of biological science. There was, however, undoubtedly, a preparation for it in the scientific mind of the age. There had been for a century a convergence of the various lines of inductive investigation toward the grand problems presented by the living world, and this tendency had found expression in various speculations concerning the origin and progress of vital organization upon the globe. But while these hypotheses were generally regarded as crude and premature, and failed to command any considerable assent, the minds of thinkers were gradually brought to the conclusion that, however groundless and fantastic might be the notions hitherto broached, the subject of inquiry was, nevertheless, a legitimate one, and a solution of it, more or less complete, was held to be within the limits of possibility. The victories of science in the various fields of research; the growing conception of nature as involving a unity of plan, in which all the parts are mutually dependent, and reciprocally interpret each other, and the deep curiosity which inspires the human mind in relation to the wonderful secrets of life, all combined to create a kind of mental predisposition in favor of any new theory which, based upon real phenomena and dealing with actual causes, should help us on in this direction of thought.

Mr. Darwin proved to be the coming and expected man. He propounded an hypothesis in relation to the origin of the varieties of life upon earth conformed to the logical requirements of science, and although no such audacious contravention of current beliefs has been promulgated since the Copernican Astronomy, the favor it has met, both in and out of the scientific circles, has been quite extraordinary. His work has been translated into the principal European languages, and his eminent adherents are numerous among all the nations where science is cultivated. An illustration of this is furnished by the present volumes, which appear with the prefatory endorsement of the distinguished professor of botany in Harvard University, Mr. Asa Gray.

It is impossible in a short notice like the present either to make an analysis of the contents of these volumes, or to offer criticisms upon them. We can only briefly point out their relation to the first work, and to Mr. Darwin's general theory. And what is that theory? A theory is an explanation of something—an explanation of effects by assigning their true causes. There are hundreds of thousands of different kinds of animals and plants upon the earth, and hundreds of thousands more which formerly lived upon it, but which now only exist as fossil remains. The question to be answered is, what is the origin of this vast diversity of species? The old and still popular answer is that they were so created at first; that each species was stamped in the beginning with its fixed characters, which are perpetuated through an unvarying descent, so that species are immutable. To this Mr. Darwin replies "No! Species are mutable. Causes are in action which produce variation. These causes belong to the permanent economy

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of nature; they have acted in past times, and the present vast diversity of living forms is to be rationally explained only by the action of such causes."

The case as put by the Darwinians is briefly this: There is an undoubted tendency in nature to the persistence of animal and vegetable types by transmission of characters from parent to offspring. "Like begets like;" men are descended from men; elephants from elephants, and elms from elms. It is this law which maintains the existing order, and preserves the identity of species and varieties for long periods of time. But it is not an absolute law, or one which alone explains all the phenomena. It is modified and checked by the operation of another and equally important principle, namely, the tendency to variation. No child is precisely like either father or mother; no living being exactly repeats its progenitors. The tendency to diversity is universal; but it is so restrained and qualified by the law which perpetuates the type, that the modifications from generation to generation are very slight. The preservation of a species is an obvious and universal phenomenon of common observation; the variation of species is a slow and obscure affair of time; the former is familiar to all; the latter can only be traced out and estimated by cautious and skilful scientific inquiry.

The fact that there is a tendency in nature to variation, and that the new characters thus appearing are transmissible by inheritance, is incontestable. Numerous cases are on record of transmitted variations from typical characters in our own species. An outbreak or deviation occurs, and it is repeated, through descent, with or without interruption, for several generations. An individual, for example, appears with six toes, and this abnormal circumstance will reappear in his descendants and continue a trait of the family for several generations. Lambert, the "porcupine man," was covered with warty excrescences, which were periodically moulted, and all his six children and his male descendants to the fourth generation, exhibited the same peculiarities. Single locks of hair, differently colored from the rest, occasionally appear, and are transmitted in their exact situation. The hereditary character of individual traits and of numerous forms of disease is well known, and the transmission of the singularities just mentioned, which are examples of the tendency to variation, is but part of the general law of the descent of characters.

But modifications are not only transmissible, they are cumulative, and the whole philosophy of breeding rests upon this fact. By breeding, characteristics are preserved, so as to *give rise to varieties*. By combining parents of given traits, these traits are strengthened in the offspring, so that by starting from a given stock we work along divergent lines, and ultimately produce, for example, in one case a perfect draught horse, and in the other case a perfect race horse. The implication of "blood," "pedigree," and "ancestry," in race horses, by which it is explained that Eclipse was the sire of three hundred and thirty-four winners, is simply the preservation of special characters through inheritance.

Facts of this kind have been long known. Mr. Darwin merely gathers and systematizes a vast body of them as data for his new conclusions. Variations, the persistence of special varieties, and accumulated modifications being facts of nature of which we have absolute proof, the question arises to what extent do these agencies reach? Are causes and conditions which are competent to produce varieties, sufficient also to produce *species?* Time here comes into play as the great condition. So long as it was believed that the earth has been inhabited but six thousand years, no such conjecture was for a moment possible: special creations and permanence of characters formed the only hypothesis admissible. But when geology had proved that the duration of life upon earth could only be measured by incalculable periods of time, the case was altered, and it became possible to conceive that accumulated modification, extending through vast periods, might explain all the diversities in the kingdom of life. These factors of the problem, at all events, offered a possible solution, and brought it completely within the domain of rational inquiry.

But the question still remained: Do we know of any causes at work to give direction to the progressive variations—causes which can account for existing species, with their recognized characters? Granting that living beings are variable, how have they become determined to their present conditions?

It is here that Mr. Darwin's law of *natural selection* comes into play. The tendency to multiplication in the living world is confessedly out of all proportion to the means of subsistence; all seeds cannot grow to trees; all eggs cannot be developed into animals; by undisturbed increase, the herrings alone would soon fill the ocean. As there is not room for all, many must perish, and there hence arises a contest—a struggle for existence. But the issue of this struggle is not fortuitous; it is governed by law; the strongest must overcome the weakest and displace them. And to assert that the strong will overcome the weak and usurp their places, is simply to say that those will survive in whom certain characters are the most powerful—it is to say that those characters will be persistent, while others are transient. Now, if we admit, which seems unavoidable, that those will survive which are best fitted to their conditions, we have a winnowing, or selective process on the part of nature by which she secures the preservation of those creatures best suited to the circumstances in which they live, and by which the harmony of the existing order is maintained. This is Mr. Darwin's doctrine of natural selection. Mr. Herbert Spencer recognizes the principle, but objects to the phraseology. He calls it the *survival of the fittest*, which brings out more prominently the element of adaptation to circumstances and the determining force of surrounding conditions. Those will survive which are best fitted to the circumstances, and all changes of the environment, or the order of external influences, will be reproduced in the modifications of the living races.

Various examples are given by Mr. Darwin of the operation of natural selection. In Florida there is a common root upon which black pigs can feed unharmed, but which causes the hoofs to fall off when it is eaten by those of another color. So again, in certain places black sheep only are kept, as they can feed on a plant which quickly kills the white ones. White terriers are more liable to fatal distempers than those of other colors. Again, white animals and birds being more conspicuous, are more exposed to the hunter and the hawk than those of darker colors, just as white men are more exposed to sharks than negroes, when swimming in the sea. Certain plants and animals are more liable to disease, to parasites, and to destructive insects, than others. "The thin-shelled species of peas are attacked by birds much more than common peas. The thin-shelled walnut suffers greatly from the tom-tit. Certain varieties of the pear with soft bark are greatly injured by borers, while other kinds resist their attacks much better. The absence of down on the fruit makes a great difference in the ravages of the weevil; hence the nectarine suffers more than the peach."

It follows from the operation of the principle here illustrated, and which applies alike to the vegetable and animal kingdoms, that the surviving races upon earth are to be regarded as resultants of the action of natural agencies working through long periods in the manner stated. By suppressing certain individuals and preserving others, according to a plan, nature obliterates certain characters and perpetuates others. A seed, for example, with a harder shell, is protected while others are destroyed, while by the tendency to the transmission of its peculiar qualities a variety is produced, distinguished by these qualities. We are here dealing with real causes and effects, and the only question that can arise is as to the extent of these influences—it being easy to deny results which, from the nature of the case, require such long periods of time that the phenomena are necessarily excluded from direct observation. Many will admit that causes of this kind, operating within narrow limits may give origin to new varieties, but will deny their competency to produce a new species. This opens the question as to what constitutes a species, which we will not undertake to say, as there is no question in all natural history more unsettled than this. One thing is pretty certain, the old notion of a species as a division of living creatures sharply outlined in nature and

possessing immutable characters is abandoned as untenable by most leading naturalists, and with this abandonment the chief barrier to Darwin's doctrine—the assumed necessary limitation to the principle of variation—disappears. The causes which produce varieties find no obstacle in nature to the production of still further variation of characters in the lapse of time.

The principle of natural selection unquestionably plays an important part in the economy of nature, but what is to be the ultimate value which science will assign to it, it would be, perhaps, premature to say. Mr. Herbert Spencer is of opinion that, Mr. Darwin makes too much of it, and that, taken alone, or allowed the prominence given to it by its great expounder, it will be found inadequate as an explanation of organic diversities. But, whatever be its import, it opens a fruitful and promising field of inquiry, which Mr. Darwin has cultivated with great diligence and success. The general principle announced in his work on the origin of species in 1859, is elaborately worked out in one of its aspects in the present volumes, which are a perfect encyclopædia of all that is known on the great subject of hereditary descent in all the departments of life. In these volumes he considers the variation of animals and plants under domestication. In a future work he will complete the discussion by considering their variation in a state of nature.

It has been objected that the argument, as thus pursued, falls short of the main question—that the variations which may be produced in animals in domestication and under the hand of man—therefore in artificial conditions—give no valid data for inferring their variations in a state of nature. But while Mr. Darwin recognizes the necessity of an independent investigation of the variations which take place in a state of nature, his reply to the objection is just and cogent. The fact of variation under domestication settles the question of the plasticity of living organisms, or their capabilities of change—while in the larger view, man himself is to be regarded as but a part of nature's agencies for the accomplishment of her ends.

E. L. Y.