# SPECIES IN OUR DOMESTICATED ANIMALS AND CULTIVATED PLANTS.

MR DARWIN'S book on the Origin of Species has met with more attention, and excited a greater degree of interest, than usually falls to the lot of works devoted to difficult and abstruse departments of natural history. To the majority of readers it will possess the attraction of novelty, and the numerous facts stated are highly interesting in themselves, independently of the theory they are brought forward to support. An air of candour and moderation pervades the work; old opinions are treated with consideration and respect; and the considerations which seem opposed to or subversive of the views advocated, are weighed with an appearance of impartiality which well becomes a searcher for truth. The extensive knowledge and philosophical cast of mind possessed by the author, fit him well for an inquiry of this nature; and if he has failed, as he seems to us to have failed, in establishing the results aimed at, it is not so much from any deficiency in the advocate, as from the inherent weakness of the cause itself.

The full discussion of a philosophical question of this nature would scarcely be appropriate to the pages of this Journal. There are several points of view, however, in which questions are raised of the highest interest both to the agriculturist and breeder of domestic animals. From the variability of the species both in the animals and plants which have been longest subject to the influence of man, some of Mr Darwin's most plausible arguments are derived. Many of the facts, too, stated in regard to them, especially on hybridism and other particulars, are interesting and important, and deserve to be generally known. With some of these we propose to make our readers acquainted; but it will not be considered out of place, to enter, previously, on a short consideration of the principles or theory which Mr Darwin seeks to establish, and to assign some of the reasons by which we are led to regard his views as inadmissible.

Before we are in a condition to appreciate his notions as to the nature and origin of species, it is necessary that we should have a distinct conception of the ideas that formerly prevailed, or rather which still prevail, on these subjects. The points at issue depend very much on the meaning we attach to the word *species*. Different authors have given different definitions, but all of them agree in certain essential points. It may be regarded as an assemblage of individuals possessed of similar forms and properties, derived from an original stock, and created originally distinct from all other forms of existence. It includes, therefore, the idea of independent existence and original creation. It also implies fixity or permanence in the forms thus created, admitting, indeed, of variation, within certain limits, from the influence of external and accidental causes, but transmitting from generation to generation the original character and features, essentially unimpaired, so that the identity of the same form of being can be at all times recognised. Thus we regard, in the vegetable kingdom, an oak-tree and a palm-tree as distinct species; in the animal, a horse and an elephant, an eagle and a salmon, as specifically distinct; and, to give one instance more, a cockchaffer and an oyster. We think that these have derived the strongly-marked features of distinction which characterise them, from the creative act to which all vegetable and animal life is admitted to have at first owed its existence; that these distinctive features will be retained, so far at least as to preserve the identity of the different species, as long as they continue to exist; that their form and properties are, under no possible combination of circumstances, interchangeable,—that a horse, for example, can never become an elephant, much less an eagle or a salmon, and that a palm-tree can never become an oak-tree, much less the member of a different class or kingdom, and be converted into a mollusc or an insect.

This original and permanent distinction of specific forms is the basis on which all classification in natural history has proceeded; and, advancing a step further, we come to the arrangement which suggested to Linnæus the principles of his nomenclature, which has been of such incalculable advantage to the science. We find that certain species bear obvious marks of being nearly related to each other; that is to say, they possess many properties in common, agreeing in general structure, appearance, and habits, and presenting only such differences as constitute species. These cognate species are associated together in one group, and this group is called a *genus*. To this group Linnæus gave a name, and that name is prefixed to the designation appropriate to each of the different species. Each object in natural history has, therefore, two names: one of a somewhat general nature, indicating the genus; another of more individual application, denoting the species. Thus the mammiferous animals to which the horse belongs, are readily distinguishable from others of their class, by having a solid undivided hoof. All the different kinds, while differing materially from one another in other respects, agree in this character, as well as in others. They are associated, therefore, in one generic group, to which the name *Equus* is applied; and the various species has each its distinctive appellation subjoined. Thus the horse is *Equus Caballus;* the ass, *E. Asinus;* the zebra, *E. Zebra*, and so on. The scientific name, therefore, not only serves to denote the individual species, but, to a certain extent, indicates their connection and natural affinities.

But this principle of classification may obviously be carried further. The resemblances so often seen between genera may be seized upon as a bond of connection, and these grouped together in *families;* these again, on more general characters, into *orders* or *classes.* The latter is usually the last step in the gradation, and includes all natural objects moulded after a peculiar type or basis of organisation, and living under certain physical conditions; thus we speak of the class of birds, fishes, quadrupeds, &c.

Now, it is not alleged by naturalists who adhere to the long-received views on this subject, that all these divisions are clearly indicated in nature, or mark the plan that she has followed in her operations. They merely denote certain relations and resemblances between natural objects, which may be conveniently seized upon to bring things of like nature into proximity, and thus facilitate our acquaintance with their properties. Accordingly almost every systematist takes different views as to the nature and extent of these groups, and adjusts them in different order. They must all, therefore—with *one* exception—be regarded as conventional and arbitrary, and the line of demarcation between conterminous groups will be continually shifting.

The exception to this artificial division just alluded to, consists of species; these are maintained by all, save the naturalists of the new school, to have a definite existence. But while the essential stability of species is regarded as an axiom, it is admitted that they diverge into a great number of *varieties.* Without taking into account the sexual and individual variations—for there are never two individuals of the same species in every respect alike—varieties are continually observed of a very marked and decided character. Nay, these varieties may assume a permanent form, and become perpetuated by cultivation, just as the varieties of the cereal grains and culinary vegetables have been made to become separate and durable races. This liability to variation, which is readily admitted to be so great in some instances that it is difficult or impossible to say which is a species and which a variety, is the mainstay of Mr Darwin's argument; and the instances, many of them very familiar ones, which he brings forward, prove the tendency quite conclusively in regard to many species. We shall mention only one at present, reverting to the subject afterwards—namely, that of the primrose and cowslip, *Primula vulgaris* and *P. veris.* "These plants," says Mr Darwin, "differ considerably in appearance; they have a different flavour and emit a different odour; they flower at slightly different periods; they grow in somewhat different stations; they ascend mountains to different heights; they have different geographical ranges; and, lastly, according to very numerous experiments made during several years by that most careful observer, Gärtner, they can be crossed only with much difficulty. We could hardly wish for better evidence of the two forms being specifically distinct. On the other hand, they are united by many intermediate links, and it is doubtful whether these links are hybrids; and there is, as it seems to me, an overwhelming amount of experimental evidence, showing that they descend from common parents, and consequently must be ranked as varieties."—(P. 49.)

Now, this variability in many species has been always admitted by naturalists, and, indeed, is too obvious to be for a moment denied. Even much greater latitude in this respect than has hitherto been allowed may be safely conceded, or rather is a necessary result from the array of facts which our author has accumulated. It will be afterwards seen what explanation can be given of this circumstance, and it will appear that it is not, upon the whole, inconsistent with the idea that species are distinct and independent creations, and that their natural tendency is to retain their original structure and attributes without essential change.

These few remarks will be sufficient, we trust, to show in what light naturalists of the Linnæan and Cuvierian school regard the nature and origin of species; fewer words will suffice to enunciate Mr Darwin's views on the subject. He is of opinion that species do not exist in nature; that what we have been accustomed to call such have really no independent existence, nor were they originally created distinct, but have been produced, by modification, from some different and it may be extinct type of form. Species, therefore, do not differ essentially from varieties; and what we call species, so far from being original creations, are in the continual course of production under the various agencies which affect the condition of animal and vegetable life. These agencies, and the mode in which they operate in effecting the marvellous results assigned to them, it is the principal object of the work to describe and explain. According to this theory, then, to revert to the examples formerly given, an oak and a palm-tree originate, by means of certain formative processes, from the same original stock; a horse and an elephant, an eagle and a salmon, a cockchaffer and an oyster, are merely modified forms of the same original nature. In order to account for these startling transmutations, an indefinite duration of time is required, during which there is a vast succession of transitional links, arising from a gradual accumulation of minute differences, made available for further change by a principle of what is called Natural Selection, which is Mr Darwin's substitute for the frequent intervention of creative agency.

These views are by no means new, although the facts adduced in their support, in many cases, are so, as well as part of the machinery by which the results are attempted to be wrought out. Lamarck's opinions are well known to naturalists, and amount to this—that the production of a new organ in an animal body is the result of a new want which comes to be felt. This gives rise to a new movement, and the continued urgency of the desire, or *appetence* (a power somewhat analogous to Mr Darwin's Natural Selection), at last leads to the formation of the organ fitted to fulfil that desire. A snail, for example, *wishes* to examine the objects on its path, and this exertion of its will, continually operating, determines the nervous and other animal fluids towards the head; and these reiterated efforts cause two horns or tentacula to spring forth! A bird wishes to have the power of swimming, and the continued effort in stretching the toes, at last produces a membrane between them, and a web-foot is the result! Waders (*Grallæ*) do not wish to swim, but *stand* in the water, and they stretch their legs to keep their bodies from submersion, till they become so long as to save them that trouble! In the same manner we can account for the long neck of the giraffe, in its continual efforts to reach the boughs of the mimosa hanging far over head. How the birds escaped drowning, or the quadruped starvation, while the process of adaptation was going on, we are not informed. If this doctrine were sound, we need not despair of the long-wished-for faculty of flying; we have only to entertain a sufficiently long and ardent *appetence* for this accomplishment, and wings will come in due course! Similar notions have been propagated by the author of *Vestiges of the Natural History of Creation*, as well as by Geoffroy St Hilaire, and some others.

If, according to our author, so-called species be in a continual process of change and transfusion into other forms, we might expect to find an immense series of intermediate varieties retaining so many of the characters of the form they have left, and assuming those of the form to which they are tending. There should be a fine gradation of links, exclusive of the idea of strongly-marked and prominently distinctive features. Yet we everywhere find species of such peculiar characters, that, in our systematic arrangements, they stand insulated and alone, owning scarcely any connection or alliance with others of their race, and showing no transitional links whatever. This fact is visible, not only in living nature, but also, and in a still more marked manner, in the case of fossil remains. Mr Darwin admits this to be one of the difficulties in the way of his theory, and his attempted explanation is by no means satisfactory. "The main cause, however," he says, "of innumerable intermediate links not now occurring everywhere throughout nature depends on the process of natural selection, through which new varieties continually take the places of and exterminate their parent-forms. But, just in proportion as this process of extermination has acted on an enormous scale, so must the number of intermediate varieties, which have formerly existed on the earth, be truly enormous. Why then is not every geological formation and every stratum full of such intermediate links? Geology, assuredly, does not reveal any such finely graduated organic chain, and this, perhaps, is the most obvious and gravest objection which can be urged against my theory. The explanation lies, as I believe, in the extreme imperfection of the geological record."—(P. 280.)

This last observation leads us to make a remark on the manner in which Mr Darwin treats geological evidence as bearing on the question at issue. An entire chapter is devoted to the consideration of the imperfections of the geological record. According to that record, whole groups of beings are found to have been introduced suddenly, precisely as we may expect them to have been if a new series had been at once originated, to people a new platform of the earth's surface. Such facts require to be explained away, and our author's invariable resource in such cases is, that the geological evidence is imperfect. Had it been more complete, we are led to believe, the relics of intermediate forms would have abounded, and we should have been able to pass along the stepping-stones by which one supposed species became another. Doubtless, it cannot be for a moment supposed that vestiges of all the creatures formerly existing are to be found in stratified rocks; all traces of many must have inevitably been obliterated. The wonder is that so many have been preserved, and in so perfect a state—so many, in fact, that we are warranted to conclude that they afford a fair representation both of the zoology and botany of the earth in primeval times. But, because some may be presumed to be wanting, are we at liberty to conjecture that such kinds must have existed as it suits our theories to pre-suppose? Are we to derive support for our views from the fact that there is no evidence to support them? The evidence may be said to be merely negative, but, in such a case as this, it must be regarded as conclusive. Mr Darwin virtually says, the geological evidence in this, and in some other instances, is against me; but it would have been otherwise, if the evidence had been different from what it is. What notions may not be advocated on such grounds? The logical and legitimate mode of using such evidence, is to learn the lesson that it teaches us in its existing form—not what it might teach us, under imaginary modifications. Hence, we frequently find Mr Darwin making such statements as the following: "If my theory be true, it is indisputable that before the lowest silurian stratum was deposited long periods elapsed, as long as, or probably far longer than, the whole interval from the silurian age to the present day; and that, during these vast, yet quite unknown periods of time, the world swarmed with living creatures. To the question why we do not find records of these vast primordial periods, I can give no satisfactory answer."—(P. 307.) If it were to be inferred that, although the lower silurian rocks of the south of Scotland are for the most part unfossiliferous, animal and vegetable life yet abounded in the periods when they were deposited, the reasoning would be thought inadmissible; and in such a case as this, we have no resource but to accept of the alternative to which Mr Darwin alludes in the beginning of the previous extract.

What do historical records teach us regarding the permanency of specific forms? Do they lead us to believe that they have undergone a change during the period to which they extend? We are well aware how trifling in point of duration that period is in the estimation of some modern geologists, who affirm, on data which we believe to be utterly erroneous, that the denudation of the Weald (a comparatively late formation of the Cretaceous system) required a period of 306,662,400 years; or, taking Mr Darwin's modification, say 300,000,000 years! But what do historical records testify, as far as they go, or rather, we should say, what information do we derive from the positive evidence within our reach? It most decidedly confirms the idea that species are essentially permanent. We know that the ibis, and other animals preserved in Egypt, are identical with those now living; we can recognise in the most ancient sculptured figures, existing species. Now these have remained unchanged throughout the whole historic period; and it would not be unwarrantable to suppose that they would continue unchanged, at least for an equal length of time to come. Here, then, we have what may be called the evidence of experience—not the experience of an individual, which comprehends a mere point of time, but the accumulated experience of our race—as to the fixity of species, showing that, as far as our observation extends, there are species which do not vary, and show no tendency to vary. Agassiz gives us reason to believe, that the same species of animals which form coral reefs have continued unchanged for above 30,000 years.

Before adverting further to the theory here advanced, it will perhaps be more satisfactory to our readers to notice some of the curious facts bearing on agricultural subjects recorded in this work, and this we shall do by regarding them, in a great measure, simply as facts, without much reference to the use the author makes of them.

It is a curious circumstance, and one that has often excited surprise, that we are unacquainted with the parent stocks and native sites of many of the plants and animals with which we have been longest familiar, and which have been most useful to us. Nearly all the cereal grains are in this case, many of the plants in our flower and kitchen gardens, the dog, and some other domesticated animals. The probable reason of this has long since been given, and we find it thus stated in a work published thirty years ago:—"That some of these plants were produced in the regions first inhabited by mankind, we have every reason to believe, and the warrant of something like obscure tradition; but our ignorance of the first habitats of these plants is the less to be wondered at, when we consider that it is more than probable that culture and the arts of man have so infinitely changed the form, improved the nature, and obscured the original species, that it is no longer traceable in any existent state."* Such facts are easily made to fall in with Mr Darwin's theory, and probably, indeed, have been the means of suggesting it. The first chapter of his work is devoted to variation under domestication, and it is certainly very remarkable the power we possess in changing the forms and other properties both of animals and plants. It seems as if certain species of both had been put into our hands, endowed with such a singular flexibility of constitution that we may, with proper care, convert them to any purpose subservient to our comfort or enjoyment. But we have no reason to suppose that all kinds would be equally pliable; some bid defiance to all human control—the beautiful quagga, for instance, so nearly allied to the horse, has never yet been thoroughly tamed. Mr Darwin admits that some animals and plants withstand domestication or cultivation, and vary very slightly, perhaps hardly more than in a state of nature. The ass has varied very little under domestication; the guinea-fowl has always retained some of its original wildness, and has scarcely varied at all; the peacock, goose, and some other animals, have also deviated very little from their original form and properties.

The tendency to variation which so many kinds exhibit, is no doubt owing, in a considerable degree, to the comparatively artificial conditions of life under which they are placed, such as the nature of the food, action of heat, light, moisture, &c. During the present spring, for example, sheep have been very generally fed on oil-cake, beans, and corn, in many cases without receiving hay or straw, and without a blade of fresh grass. Such food is very unnatural in the case of sheep, and there can be little doubt that, if continued, it would produce, in successive generations, great changes in the constitution and qualities of these animals. The tendency to change once induced, further alterations become comparatively easy, the organisation gains increased flexibility, and, as Mr Darwin remarks, there is no case on record of a variable being ceasing to be variable under cultivation. Our oldest cultivated plants, such as wheat, still often yield new varieties; our oldest domesticated animals are still capable of rapid improvement or modification. The circumstances, however, which act with still greater momentum than those above referred to, are connected with the laws of reproduction, of growth, and of inheritance. Habit has also a decided influence, especially on animals; "for instance," says Mr Darwin, "I find in the domestic duck that the bones of the wing weigh less and the bones of the leg more, in proportion to the whole skeleton, than do the same bones in the wild-duck; and I presume that this change may be safely attributed to the domestic duck flying much less, and walking more, than its wild parent. The great and inherited development of the

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* *Journal of a Naturalist*, p. 37.

udders in goats and cows in countries where they are habitually milked, in comparison with the state of these organs in other countries, is another instance of the effect of use. Not a single domestic animal can be named which has not, in some country, drooping ears; and the view suggested by some authors, that the drooping is due to the disuse of the muscles of the ear, from the animals not being much alarmed by danger, seems probable."—(P. 11.) The use and disuse of certain parts are thus seen to exercise a modifying influence in domesticated animals, and the same thing may be observed in free nature. It is the normal character of insects to be organised for flight; many ground-feeding beetles do not require to use their wings, and although the rudiments of these organs exist, the wing-cases are soldered together at the dorsal suture, so that flight, from disuse, becomes organically impossible. So it is supposed to be with some of the larger ground-feeding birds. Having little occasion to use their wings, they became at length functionally obsolete, as in the case of the apteryx and ostrich. In regard to the latter, Mr Darwin remarks, "It indeed inhabits continents and is exposed to danger from which it cannot escape by flight, but by kicking it can defend itself from enemies, as well as any of the smaller quadrupeds. We may imagine that the early progenitor of the ostrich had habits like those of a bustard, and that as natural selection increased in successive generations the size and weight of the body, its legs were used more and its wings less, until they became incapable of flight."—(P. 135.) The case of the ostrich, it may be remarked by the way, must be rather a difficult one to deal with according to the theory of progressive development. Natural selection (an expression which we shall explain more fully hereafter) always acts exclusively, we are told, for the welfare of the species or individual. Can we conceive anything more useful to this bird than the means of escaping from its pursuers by flight? While running it plies its stumps of wings with the utmost vigour, and, according to the theory, they should gain expansion and development by the exercise; nothing can more strongly indicate Lamark's *appetence;* but they have been stationary for as long a period backward as Egyptian records carry us. Yet the absence of wings, in several analogous species, has no doubt been a great evil to them, and the principal cause of their extermination. This has been the case with the dinornis and the dido, and the divi of New Holland will in all probability soon follow them. The penguins feed exclusively on fish and marine animals; their wings are converted into fins or paddles, which are most effective in the water, and serve as imperfect fore-legs on the land. This is an example of an admirable adaptation of structure to the mode of life; but there are multitudes of other birds, frequenting the same element and living on the same kind of food, which have no such adaptation. How can we account for natural selection, always striving for the good of the species, not having wrought out a similar structure in others? Why should results so different arise under circumstances so similar?

It may be often observed, particularly in our domesticated animals, that when a change is effected, from whatever cause, on one organ or system of organs, a change also takes place in a certain other organ or parts of the system which do not seem necessarily connected or dependent on each other. This has been called correlation of growth. Its influence is very considerable, and although somewhat obscure, it is very important that it should be understood by breeders. While endeavouring to alter one part of an animal to bring it nearer to their standard of excellence, they may be unconsciously altering another which makes it deviate as far from it. Many curious examples might be given of the operation of this law. Long limbs, for example, in a horse, are almost always believed to be accompanied by an elongated head. Some instances of correlation are quite whimsical. Mr Darwin gives the following—cats with blue eyes are invariably deaf, those with tortoise-shell colours, females. White sheep and pigs are differently affected from coloured individuals by certain vegetable poisons. Hairless dogs have imperfect teeth; long-haired and coarse-haired animals are apt to have long or many horns; pigeons with feathered feet have skin between their outer toes; pigeons with short beaks have small feet, and those with long beaks large feet. Hence, if man goes on selecting, and thus augmenting, any peculiarity, he will almost certainly unconsciously modify other parts of the structure, owing to the mysterious laws of correlation of growth.

Of course, variations which are not inherited are not of much importance, either to the breeder, or in a physiological point of view. But by far the greater number of deviations in structure are strictly inheritable, and on this fact the whole practice of rearing improved breeds of plants and animals is founded. Perhaps the most remarkable instance of inheritable variation is to be found in domestic pigeons; to this, accordingly, our author directs particular attention. "The diversity of the breeds is something astonishing. Compare the English carrier and the short-faced tumbler, and see the wonderful difference in their beaks, entailing corresponding differences in their skulls. The carrier, more especially the male bird, is also remarkable from the wonderful development of the carunculated skin about the head, and this is accompanied by greatly elongated eyelids, very large external orifices to the nostrils, and a wide gape of mouth. The short-faced tumbler has a beak in outline almost like that of a finch, and the common tumbler has the singular inherited habit of flying to a great height in a compact flock, and tumbling in the air head over heels. The runt is a bird of great size, with long massive beak and large feet; some of the sub-breeds of runts have very long necks, others very long wings and tails, others singularly short tails. The barb is allied to the carrier, but, instead of a very long beak, he has a very short and very broad one. The pouter has a much elongated body, wings, and legs; and its enormously developed crop, which it glories in inflating, may well excite astonishment, and even laughter. The turbit has a very short and conical beak, with a line of reversed feathers down the breast; and it has the habit of continually expanding slightly the upper part of the œsophagus. The Jacobin has the feathers so much reversed along the back of the neck that they form a hood, and it has, proportionally to its size, much elongated wing and tail feathers. The trumpeter and laugher, as their names express, utter a very different coo from the other breeds. The fantail has thirty or even forty tail feathers, instead of twelve or fourteen, the normal number in all members of the great pigeon family; and these feathers are kept expanded, and are carried so erect that in good birds the head and tail touch; the oil-gland is quite aborted. Several other less distinct breeds might be specified."—(P. 21.)

These differences do not exhaust the limits of variation; it extends to the skeleton, the number of vertebræ, shape and size of the eggs, &c., in so much, our author thinks, that at least a score of pigeons might be chosen, which, if shown to an ornithologist, and he were told that they were wild birds, would certainly be ranked by him as well-defined species. Yet all these, it seems to be admitted on all hands, are descended from the rock-pigeon (*Columba livia*), as their common progenitor. With all this accumulation of divergencies, however, it may be observed that the most superficial observer would at once determine them to be pigeons; they could never be mistaken for transformed bantams or partridges; and this virtually amounts to a recognition of a basis for specific distinctions. An experienced naturalist can often determine when he has a species before him by what may be called a kind of natural instinct; the *tout ensemble*, the *facies*, or indefinable aggregation of characters, strike the eye and convey this conviction, when it may be difficult, or almost impossible, to describe the numerous minute and almost inappreciable details which combine in producing it. Amid all the diversity above specified, some of the original marks of the rock-pigeon are still frequently retained, such as the dark bar near the end of the tail, and the two black bars on the wings; and, when left to themselves, they show a tendency to revert to the parent stock.

And this leads us to say a word on the subject of reversion, which must always form a great if not insuperable objection to such views as those of Mr Darwin. When the agencies which have been most instrumental in causing variation in plants and animals are removed—when man's occasion for certain forms, artificially produced, have ceased, and he neglects them—they show a decided tendency to return to their original forms and condition.

This fact is well known to all, and is usually called *running wild.* It seems to indicate that their departure from their primitive character is only temporary—that it has been caused by the pressure of external circumstances—and that the irregularity thereby occasioned has an inherent tendency to correct itself. It looks as if the course of nature had been checked or perverted, but that it hastens again to flow in its old channels. It seems as if there were an order in nature which it is intended to keep up, and that things are not to be left in a continual flux, tending we know not whither, and becoming we know not what. A fact so inconvenient for him, Mr Darwin has difficulty in disposing of; he seems inclined both to admit and deny it. "As our varieties," he says, "certainly do occasionally revert in some of their characters to ancestral forms, it seems to me not improbable that, if we could succeed in naturalising, or were to cultivate, during many generations, the several races, for instance, of the cabbage, in very poor soil—in which case, however, some effect would have to be attributed to the direct action of the poor soil—that they would to a large extent, or even wholly, revert to the wild aboriginal stock."—(P. 15.) Again he says, "There is a tendency in the young of each successive generation (of pigeons) to produce the long-lost character, and this tendency, from unknown causes, sometimes prevails." —(P. 166.) After these admissions we would hardly expect him to assert that he has in vain endeavoured to discover on what decisive facts reversion is maintained, so as to countenance the argument that no deductions can be drawn from domestic races to species in a state of nature.

The origin of our domestic dogs is a subject which has given rise to much diversity of opinion, and it is one which probably must ever remain vague. The influence of man in the production of variety has in this instance reached its maximum; no animal is so thoroughly artificial. It has been seen in the case of the domestic pigeon what an immense number and widely divergent forms have sprung from a common progenitor; in this instance, the diversities are at least as great, the instincts and propensities much more varied and strongly pronounced. The genus to which dogs belong (*canis*) has a very wide distribution; it is almost, in fact, cosmopolitan. It is highly probable, therefore, that different species have been tamed and domesticated in different parts of the world. We may safely admit a multiple parentage, or at least two or three different progenitors; and this, along with the plasticity of their nature, lending itself so readily to human artifices, accounts sufficiently for the existence of so many distinct races. Their instincts, too, or what may be called their mental endowments and dispositions, are as transmissible by inheritance as their outer configuration. Young pointers will sometimes point, and even back other dogs the very first time they are taken out: retrieving is certainly in some degree inherited by retrievers; and a tendency to run round, instead of at, a flock of sheep by shepherd-dogs. "How strongly these domestic instincts, habits, and dispositions are inherited, and how curiously they become mingled, is well shown when different breeds of dogs are crossed. Thus it is known that a cross with a bull-dog has affected for many generations the courage and obstinacy of greyhounds; and a cross with a greyhound has given to a whole family of shepherd-dogs a tendency to hunt hares. These domestic instincts, when thus tested by crossing, resemble natural instincts, which in a like manner become curiously blended together, and for a long period exhibit traces of the instincts of either parent—for example, Le Roy describes a dog whose great-grandfather was a wolf, and this dog showed a trace of its wild parentage only in one way, by not coming in a straight line to his master when called."—(P. 214.)

It is perhaps impossible to determine whether our domestic cattle have descended from one or several wild species. Mr Blyth, a great authority on such subjects, infers from the habits, voice, constitution, and other peculiarities of the Indian humped cattle, that they are descended from a different aboriginal stock from our European cattle. Many competent judges are of opinion that these latter have had more than one wild parent. It seems very probable that the white cattle preserved in certain places, and which are often spoken of as the wild state of our ordinary cattle, are themselves a derivative breed. With regard to the horse, Mr Darwin is inclined, though with some hesitation, to believe that all the races have descended from one stock. With respect to sheep and goats, he confesses himself unable to form any opinion. The latter seem to have a robust and inflexible constitution, something like that of the ass, and probably have not changed much from their original condition, there being little inducement to experiment on them, as all the advantages that could be expected from their most improved form could be more readily obtained from other species. For the endlessly varied races of domestic fowls, Mr Blyth is disposed to look for only one progenitor, and that he finds in the wild Indian Fowl (*Gallus bankiva*). Although the breeds of ducks and rabbits differ considerably, even in structure, no one seems to doubt that they are descended from the common wild duck and rabbit. Much diversity in the breeds of some of these animals appears to have prevailed as far back as history enables us to trace them; it would appear, from Egyptian monuments, that some of the oldest closely resemble, or are perhaps identical with, those still existing. Mr Horner's researches have made it highly probable that man, sufficiently civilised to have manufactured pottery, existed in the valley of the Nile thirteeen or fourteen thousand years ago: if this be the case, he had plenty of time to subjugate wild animals, and employ all the ordinary means of making them subservient to his wants.

With so many instances of variability before us, especially in our domesticated animals and cultivated plants, it becomes an interesting point of inquiry, at what period of life the causes of variability begin to act—whether during the early or late period of development of the embryo, or at the instant of conception? Geoffroy St Hilaire's experiments show that unnatural treatment of the embryo causes monstrosities; and monstrosities cannot be separated by any clear line of distinction from varieties. "I am strongly inclined to suspect," says Mr Darwin, "that the most frequent cause of variability may be attributed to the male and female reproductive elements having been affected prior to the act of conception. Several reasons make me believe this; but the chief one is the remarkable effect which confinement or cultivation has on the function of the reproductive system—this system appearing to be far more susceptible than any other part of the organisation to any change in the conditions of life. Nothing is more easy than to tame an animal, and few things more difficult than to get it to breed freely under confinement, even in many cases where the male and female unite. How many animals there are which will not breed, though living long under not very close confinement in their native country! This is generally attributed to vitiated instincts; but how many cultivated plants display the utmost vigour, and yet rarely or never seed! . . . Carnivorous animals, even from the tropics, breed in this country pretty freely under confinement, with the exception of the plantigrades or bear family; whereas carnivorous birds, with the rarest exceptions, hardly ever lay fertile eggs. Many exotic plants have pollen utterly worthless, in the same exact condition as in the most sterile hybrids. When, on the one hand, we see domesticated animals and plants, though often weak and sickly, yet breeding quite freely under confinement; and when, on the other hand, we see individuals, though taken young from a state of nature, perfectly tamed, long-lived, and healthy (of which I could give numerous instances), yet having their productive system so seriously affected as to fail in acting, we need not be surprised at this system, when it does act under confinement, acting not quite regularly, and producing offspring not perfectly like their parents."—(P. 8.)

Among the interesting observations and facts recorded in this volume, are some of importance to farmers and gardeners on the fertilising of plants by the agency of insects. The tubes of the corollas of the common red and incarnate clovers (*Tripolium pratense* and *incarnatum*) do not appear at a hasty glance to differ much in length; yet the hive-bee can easily suck the nectar out of the incarnate clover, but not out of the common red clover. The hive-bee accordingly visits the former; and these visits, it appears from experiments recently made, are necessary for the fertilisation of the plant. The common red clover is visited by humble-bees alone, and Mr Darwin thinks that if the whole genus of humble-bees become extinct or very rare in Britain, the red clover would also become very rare, or wholly disappear. The number of humble-bees in any district depends in a great degree on the number of field-mice, which destroy their combs and nests; and Mr H. Newman, who has long attended to the habits of humble-bees, believes that more than two-thirds of them are thus destroyed all over England. Now, the number of mice is largely dependent, as every one knows, on the number of cats; and Mr Newman says, "Near villages and small towns I have found the nests of humble-bees more numerous than elsewhere, which I attribute to the number of cats that destroy the mice." "Hence," says Mr Darwin, "it is quite credible that the presence of a feline animal in large numbers in a district, might determine, through the intervention, first of mice and then of bees, the frequency of certain flowers in that district!" Doubtless, the relations of natural objects are often singularly complicated, and when we affect one, others, which seem to have the most remote or no connection at all with it, may be affected also. But in the case in question, Mr Darwin overlooks the fact that both the clovers referred to are frequented by butterflies, which have a much longer proboscis than bees, and also by certain day-flying moths (such as *Plusia gamma* and its allies); and as fertilisation in these clovers seems to depend on the corolla being moved, and the pollen thus pushed on to the stigmatic surface, their comparatively tranquil visits may suffice for this purpose as well as the bustling activity of the restless bees. Humble-bees seem also indispensable to the fertilisation of the violet (*Viola tricolor*), and Mr Darwin dreads a similar fate for it, if these insects should be destroyed. The existence of natural objects has seldom, however, been left to so uncertain contingencies. When one mode of propagation fails, another frequently comes into operation, and the violet would increase from offshoots, even if it scarcely ever ripened a seed; just as mice, especially field-mice, would be kept in check by rapacious birds and weasels, even if cats were to fail throughout the land.

We are often surprised at the comparatively small number of plants and animals we find in nature, although they are so amazingly productive, in many cases, in seeds, ova, and young. Just in proportion to their prolificacy in this respect is the number of their enemies, and their liability to be destroyed; provision is made for an immense loss, if that can be called loss which is often the means of supporting others. The number of ova in fishes is sometimes prodigious; so of seeds in many plants. But this is no test of the abundance of the mature animal or plant. The condor lays a couple of eggs, the ostrich a score, and yet in the same country the condor may be the more numerous of the two; the Fulmar petrel lays but one egg, yet it is believed to be the most numerous bird in the world. We are not aware how much the mud of ponds is sometimes charged with seeds. Mr Darwin, on one occasion, took three table-spoonfuls of mud from three different points, beneath water, on the edge of a little pool; this mud, when dried, weighed only 6¾ ounces. He kept it covered up in his study for six months, pulling up and counting each plant as it grew; the plants were of many kinds, and were altogether 537 in number; and yet the viscid mud was all contained in a breakfast cup! The destruction of seedlings is equally striking. On a piece of ground three feet long and two wide, dug and cleared, and where there could be no choking from other plants, he marked all the seedlings of our native plants as they came up, and out of the 357, no less than 295 were destroyed, chiefly by slugs and insects. Seeds, ova, and seedlings, are thus seen to have other purposes to fulfil, in the economy of nature, besides continuing their kind.

A little better acquaintance with the geographical distribution of Batrachians (frogs, toads, newts) would lead us to deprive St Patrick of the merit of having preserved Ireland from their unwelcome presence. They have never been found on any of the many islands with which the great oceans are studded. The simple reason seems to be that their spawn is immediately killed by salt-water, and their migration to sea-girt land is thus prevented. But there is nothing in an insular locality to prevent them flourishing; on the contrary, they have been introduced into Madeira, the Azores, Mauritius, and have multiplied so as to become a nuisance.

It has just been seen that the ova of frogs and allied reptiles perish in sea-water; the power of seeds to resist its action is a matter that has an important influence on the distribution of plants. Experiments have shown, that out of 87 kinds, 64 germinated after an immersion of 28 days, and a few survived an immersion of 137 days. Eighteen out of 98 seeds have been found to float in salt-water 42 days, and then to be capable of germination; a sufficient length of time to admit of transportation to a considerable distance by means of oceanic currents.

Such are a few of the important facts with which Mr Darwin's work abounds; but our space will not admit of our adverting to them further, as we should wish, before concluding, to say a few words more on his theory, and the objections which may be urged against it.

In our domesticated animals and cultivated plants, the changes they have undergone have been chiefly brought about by the intervention of man. He has ingeniously availed himself of individual varieties, and gradually accumulated these, even though originally very trifling, till the result was found to answer the end he had in view. He had the power of selection; could employ it methodically; and he has done this so effectually, that the agriculturist can not only modify the character of his flock, but change it altogether.

It is the magician's wand, by means of which he may summon into life whatever form and mould he pleases. "It would seem," says Lord Somerville, speaking of breeders of sheep, "as if they had chalked out upon a wall a form perfect in itself, and then had given it existence." We all know what marvellous results have been brought about by skilful breeding, and this is owing to what Mr Darwin calls "Man's power of selection;" perhaps it had better been called "artificial selection," in contradistinction to the other kind of selection about to be referred to.

This is "Natural Selection." It is a power supposed to be inherent in plants and animals, by which they are enabled to avail themselves of variations useful to themselves; to select these for their own good; and to accumulate them in such a way that their original forms may be entirely lost and new forms assumed. It is, in Mr Darwin's own words, the preservation of favourable variations, and the rejection of injurious variations. It is analogous to man's power of selection, but far more powerful in its operation; for, while man can act only on external and visible characters, nature can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life. Man selects only for his own good; nature only for that of the being which she tends.

The main object of Mr Darwin's work is to illustrate and establish this supposed principle of natural selection. It is his substitute for creative agency, at least as far as concerns the appearance and character of the present objects in nature. Its operation is complex and unceasing, but so gradual, that the results appear only after the lapse of a vast period of time. In the "struggle for life," which all natural objects are supposed unceasingly to be engaged in, those who turn to best account the faculty of selection gain a prepotency over others, and these gradually become extinct, being pushed from the stage of life by their more powerful compeers. But into the further exposition of this theory we cannot here enter.

Difficulties in admitting it occur at every step. Some of the most formidable of these the author tries to dispose of, in most cases, we think, unsuccessfully. We have no doubt that he has endeavoured, and imagines himself to have succeeded, in weighing the evidence impartially. In such cases, this may be regarded as next to impossible. We start with a favourite theory, and we cannot help seeing in a stronger light facts that seem to favour than such as are opposed to it; indeed, in looking out for the former, we are apt to overlook the latter altogether, and when we do see them we can scarcely avoid withholding from them their due importance. We become at length the partisans of our own views; our pride is enlisted in maintaining them; and what began in a search for truth may unconsciously end in a struggle for victory. Even if true, Mr Darwin's theory would scarcely admit of full proof; human experience is too limited in duration to bring it to an adequate test.

Besides general objections, special ones continually suggest themselves; we shall mention one with which we have been struck. It is an essential condition in natural selection, that it acts only for the good of the individual; it cannot produce any modification in any one species exclusively for the good of another species (p. 200); if it could be shown to be otherwise, it is admitted that this would be fatal to the theory (p. 199). Now, take the case of several different kinds of plants which throw out their flowers very early in spring, long before the leaves make their appearance. The most common examples in our climate are colt's foot (*Tussilago farfara*), butterbur (*Petasites vulgaris*), the hazel, willow, and some other amentiferous or catkin-bearing plants. It must have struck the most careless observer that some special purpose must be served by this remarkable deviation from the prevailing rule. Leaves are in most cases necessary to the growth and maturation of the flower; but here they do not appear till after the blossom and the accompanying reproductive organs have performed their functions. Natural selection, which is supposed to have brought them to do this, can scarcely, we should think, be regarded as having promoted solely the good of the plants by such an arrangement. In the bleak weather of February and early March these heralds of the spring almost excite our pity, standing out naked and alone, without protection from their own foliage or that of others, and unfolding their corollas to the fitful gleams of sunshine, too often alternating with chilling showers and sleety blasts. What can be the reason of this early appearance,

> . . . Ere a leaf is on the bush,
> In the time before the thrush
> Has a thought about a nest—

an appearance brought about, we cannot doubt, for some special purpose, but which we can in no light regard as exclusively for the good of these individual plants? We have always looked upon it as a beautiful ordination for the support of early insects, when no other food was accessible to them. They are frequented by bees, beetles, &c.; and on a patch of a few square yards, consisting of the two first plants mentioned above, we have counted thirty different species of insects. Would natural selection have led to such a result? And are we not to believe, in like manner, that many forms of beauty and variety have been produced solely to please the eye of man—others to minister to his wants—others to mitigate or cure the maladies to which he is subject—and that without any reference to the individual good of the plants or animals? If we do not regard nature in this light, we deprive it of half of its charms, and reduce it to a blind mechanism, of whose operations we can avail ourselves only by fortunate accident, when the interest of the plant or animal happens to coincide with our own. What are we to make of those very peculiar organs and functions which are confined to certain animals, such as the electrical apparatus of fishes, the luminous reservoirs of insects, &c.? How did these properties become transmitted to them by progenitors which did not possess them, and why do they not descend by inheritance to others in which they are wanting? Such questions may be asked without end, and no satisfactory reply can be given.

The very beauty and order of the plan on which the Creator has framed his works, are, by this theory, made the ground of repudiating his intervention in the operations of nature. One grand idea may be said to pervade the scheme of animal structure, another that of plants. The variety we witness is produced not by departing altogether from that scheme, but by modifying it. In every department nature works with few materials, but these can be infinitely diversified. "Nature," says Milne Edwards, "is prodigal in variety, but niggard in innovation." By gradual steps she advances from one form to another; she makes no leaps, according to the Linnæan maxim, no abrupt transition from one type of form to another. She proceeds,—

> By due gradation, nature's sacred law.

Every new evolution of creative power has a retrospective reference to what went before, and a prospective one to what has to come. And it is the manifestation of this grand idea—this adherence to a certain unity of design under so many different forms, that has given rise to the notion that one form virtually evolves another, and that natural objects, as we now see them, are essentially self-created. If we admit an original act of creation in which the whole series originated, this view cannot be considered as either atheistic or infidel; but it virtually banishes the Creator from the world He has made, and represents him as exercising no continuous or regulating control over the works of his hand.

We cannot be too cautious in attempting to test the truth of scientific results by the statements of Scripture; the frequent endeavours to do so by well-meaning but not very judicious men have given rise to a mass of the most worthless literature in our language. It is not the object of Scripture to give us precise information on such points, and its statements on the one hand, and those of science on the other, may be regarded as two parallel geometrical lines, which, if properly considered, can never come into collision, because they can never meet. It is impossible, however, not to be struck in the present case with the complete antagonism of the Mosaic account of the creation of animals and plants to the views we have been considering. One of the most prominent features in that account is, that *each was created after its kind.*

Advantages will arise from the statement and advocacy of these opinions, by leading us to consider natural objects from different points of view, to exercise diligently our powers of observation, and to accumulate facts. They should lead us, among other things, to give greater latitude to our definitions of species, to make them more comprehensive, so as to embrace a greater amount of individual variations than they now do. Many of our naturalists seem to have a most indistinct notion of what a species is, even according to the Linnæan sense. We find some of them placing before them a specimen of a bird, for example, and minutely describing that as the description of a species. Instead of being so, it is the description of an individual. A specific description must be somewhat general, so as to include all individual variations (except the most extreme), and can only be properly drawn up from the comparison of numerous individuals. A German naturalist makes no fewer than a dozen species out of the common oak; and even in the most recent works on British botany, the sessile and pedunculated varieties stand as species.

Mr Darwin extends his doctrine as far as it will go, consistently with the idea that creative power has been exerted at all. He inclines to the opinion that all animals have descended from four or five progenitors; which is nearly saying, in other words, that mammals, birds, fishes, reptiles, and articulate animals, have each been derived from a separate original form. Plants he conceives to be derived from an equal or lesser number. Analogy, however, he thinks, would rather countenance the belief that all animals and plants have descended from one prototype.

Throughout the work scarcely any allusion is made to man, although in regard to all physical attributes he must be regarded as a subject of Zoology. It was probably felt that it would be difficult to deal with him in such a way as not to neutralise the more plausible parts of the theory. The difficulty, however, must be fairly faced, and it is not easy to see how it can be got over. Man is either an original creation, or he is descended from some animal form previously existing. If the former, then he is an example of creative power being exerted at a comparatively late period, for it was but of yesterday, in a geological sense, that he entered on the stage of life. In this light also he is an example of a species, an independent existence not derived from other beings, and thus refutes the assertion that species do not exist. If descended from some animal, where are his progenitors and prototype? Through what gradations of form has he passed till natural selection completed thus far her exertions in his favour, and made him what he is? According to the theory, these exertions must be continued, and what will man, considered as an animal, ultimately become? He is now on the threshold merely of his physical existence, and though so superior to the animals around him, he must go on improving under the impulse of this blind energy, working always for his good, till he become as superior to his present self as he is now to other creatures. A considerable leap must have been made to him from his nearest allies, for if palæontology be looked to for intermediate or transitional forms, she gives no sign. We shall be referred, it may be supposed, to quadrumanous animals as his more immediate progenitors; and,—humbling thought to the "paragon of animals!"—baboons, apes, and ouran-outangs will be pointed out to us as our nearest existing kindred, and we may say to them, as Coleridge said to the ass, "I hail thee, brother!"

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## NOTES, CHIEFLY AGRICULTURAL, TAKEN DURING A TOUR IN BELGIUM, HOLLAND, AND ON THE RHINE.

BY ROBERT SCOTT BURN.

No. V.

WE finished our last paper with a description of the Agricultural School and Reformatory at Ruysselade near Bruges, to which locality we had conducted our readers. We now propose to take them to Ghent, from thence a brief excursion into the Pay de Waes, where the spade-culture, *par excellence*, is chiefly carried out; and afterwards through the immense plain known as the Campine, in which most striking examples will be met with of what painstaking industry can do in wresting fertility from the sad sterility which is the normal characteristic of that wild district. From Ruysselade the traveller should direct his steps to the Bloemandael station, booking from thence by railway to Ghent or Gand, the fare in second class being 2 francs, and in the first class 2 francs 80 centimes—the time occupied in the journey being one hour and a half. A richer condition of the crops and a more highly finished state of the land will be observed to exist in the district through which the railway journey is made, from Bloemandael to Ghent, than was noticeable in the district from Ostend to Bruges. In great part of the latter, for some distance inland from the dunes at Ostend, Polder land exists; and, as we have observed in our last paper, the districts in which this kind of land is found do not display, by any means, the best of culture, but are, in fact, far behind the districts farther inland, where the true Flemish husbandry is met with in all its perfection. If the time of the traveller permitted, a walk through the district between Bloemandael and Ghent would be repaid by the opportunities afforded of examining more closely the peculiarities of culture, and especially the points connected with the feeding of cattle. In nothing, indeed, is Flemish farming so