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MR. CHARLES DARWIN'S NEW BOOK.

The Variation of Animals and Plants under Domestication. By Charles Darwin, M.A. F.R.S. &c. 2 vols. London: John Murray. 1868.

When Mr. Darwin first startled the philosophical world by his speculations upon the "origin of species," he confessed to a hurried performance that he might anticipate others advancing upon the same road. His object was attained. The views he propounded have been ever since associated with his name, and he has been the centre round which debaters have fought and theorisers have revolved. Many, with the hasty credulity which ever marks superficial thought, accepted Mr. Darwin's hypotheses as facts, and hence the dogmatism which has marked the utterances of those who have actually outrun Mr. Darwin himself. Indeed he has greatly suffered from the ignorant and eager zeal of converts. With the conviction of new truth suggested, Mr. Darwin felt the responsibility attaching to unproven theories, and declared in his first book that he would "soon publish the facts on which the conclusions given in it were founded." The present volumes are a part fulfilment of that promise, and we learn with great sorrow that "the great delay in publishing this first work has been caused by continued ill-health." An impartial view of Mr. Darwin's position and self-imposed task will suggest the best rebuke to his impatient and incompetent disciples. Their master is in no hurry. He feels too strongly the necessity of taking every step with the utmost caution—of finding solid material to rest upon as he advances. Here are two large volumes, full of facts and observations, as the result of his careful labour, and, if we understand his wishes, they are now placed before the world as corroborations of previous deductions, not as authorities for final judgments. There are here, of course, corollaries and speculations; but in disclosing the experimental processes through which he has forced his own mind, Mr. Darwin puts into the hands of all the means of testing the validity and truth of his own methods and opinions.

An admission is made which will help some to a clearer understanding of his theory of "natural selection." Mr. Darwin calls the term a bad one; Mr. Herbert Spencer's expression, the "survival of the fittest," he greatly prefers. Still there is real justification for the first. Chemists speak of *elective* affinity, as if substances exercised conscious choice in combining. There is no such conscious choice in unorganised—there is none in organised—beings; but the terms *elective affinity* and *natural selection* convey no erroneous impressions to those familiar with scientific study. Thus, he says, "The term is so far a good one, as it brings into connection the production of domestic races by man's power of selection, and the natural preservation of varieties and species in a state of nature. For brevity sake, I sometimes speak of natural selection as an intelligent power, in the same way as astronomers speak of the attraction of gravity as ruling the movements of the planets, or as agriculturists speak of man making domestic races by his power of selection." In both cases selection "does nothing without variability," a phenomenon depending upon the action of circumstances upon organisms. In the same frank manner Mr. Darwin explains his personification of nature. He means by nature "only the aggregate action and product of many natural laws, and by laws only the ascertained sequence of events":—

> In the chapter devoted to natural selection I shall show from experiment and from a multitude of facts, that the greatest amount of life can be supported on each spot by great diversification or divergence in the structure and constitution of its inhabitants. We shall, also, see that the continued production of new forms through natural selection, which implies that each new variety has some advantage over others, almost inevitably leads to the extermination of the older and less improved forms. These latter are almost necessarily intermediate in structure as well as in descent between the last-produced forms and their original parent species. Now, if we suppose a species to produce two or more varieties, and these in the course of time to produce other varieties, the principle of good being derived from diversification of structure will generally lead to the preservation of the most divergent varieties; thus the lesser differences characteristic of varieties come to be augmented into the greater differences characteristic of species, and, by the extermination of the older intermediate forms, new species come to be distinctly defined objects. Thus also we shall see how it is that organic beings can be classed by what is called a natural method in distinct groups—species under genera, and genera under families.

It may surprise some to hear Mr. Darwin say that there is no innate or necessary tendency in each being to its own advancement in the scale of organisation. But surprise will cease when it is seen that natural selection "acts exclusively through the preservation of profitable modifications of structure." The law of the survival of the fittest must be held under the knowledge of probabilities thus stated—that, "as the conditions of life in each area generally become more and more complex, from the increasing number of different forms which inhabit it, and from most of these forms acquiring a more and more perfect structure, we may confidently believe that on the whole organisation advances." For his proofs of these statements, Mr. Darwin asks us to read carefully his present work, the first only of a series of evidential books which he considers it incumbent upon himself to produce. In a note we are reminded that the fact of variation under domestication is not accepted by M. Pouchet and those who think with him as in any sense illustrative of the natural modification of species. Mr. Darwin sees no force in M. Pouchet's arguments, and in a second work will proceed, after treating of the variation of organisms in a state of nature, of the struggle for existence, and the principle of natural selection, to discuss the difficulties which stand in the way of his theory. "These difficulties may be classed under the following heads: the apparent impossibility in some cases of a very simple organ graduating by small steps into a highly perfect organ; the marvellous facts of instinct; the whole question of hybridity; and, lastly, the absence at the present time and in our geological formations of innumerable links connecting all allied species." With continued frankness, Mr. Darwin states his conviction that some of these difficulties are explicable on the theory of natural selection, and are otherwise inexplicable. We commend to general attention, and to the special notice of those who are prone to exercise the *odium theologicum* against scientific students like Mr. Darwin, the following passage:—

> In scientific investigations it is permitted to invent any hypothesis, and if it explains various large and independent classes of facts it rises to the rank of a well-grounded theory. The undulations of the ether and even its existence are hypothetical, yet every one admits the undulatory theory of light. The principle of natural selection may be looked at as a mere hypothesis, but rendered in some degree probable by what we positively know of the variability of organic beings in a state of nature,—by what we positively know of the struggle for existence, and the consequent almost inevitable preservation of favourable variations,—from the analogical formation of domestic races. Now this hypothesis may be tested,—and this seems to me the only fair and legitimate manner of considering the whole question—by trying whether it explains several large and independent classes of facts; such as the geological succession of organic beings, their distribution in past and present times, and their mutual affinities and homologies. If the principal of natural selection does explain these and other large bodies of facts, it ought to be received. On the ordinary view of each species having been independently created, we gain no scientific explanation of any one of these facts. We can only say that it has so pleased the Creator to command that the past and present inhabitants of the world should appear in a certain order and in certain areas; that He has impressed on them the most extraordinary resemblances, and has classed them in groups subordinate to groups. But by such statements we gain no new knowledge; we do not connect together facts and laws; we explain nothing.

In another work—which we hope Mr. Darwin may have both life and health to complete—he will try the principle of natural selection by seeing how far it will give just explanations of the classes of facts under consideration:—

> It was the consideration of these facts which first led me to take up the present subject. When I visited, during the voyage of H.M.S. Beagle, the Galapagos Archipelago, situated in the Pacific Ocean about 500 miles from the shore of South America, I found myself surrounded by peculiar species of birds, reptiles, and plants, existing nowhere else in the world. Yet they nearly all bore an American stamp. In the song of the mocking thrush, in the harsh cry of the carrion hawk, in the great candlestick-like opuntias, I clearly perceived the neighbourhood of America, though the islands were separated by so many miles of ocean from the mainland, and differed much from it in their geological constitution and climate. Still more surprising was the fact that most of the inhabitants of each separate island in this small archipelago were specifically different, though most closely related to each other. The archipelago, with its innumerable craters and bare streams of lava, appeared to be of recent origin; and thus I fancied myself brought near to the very act of creation. I often asked myself how these many peculiar animals and plants had been produced: the simplest answer seemed to be that the inhabitants of the several islands had descended from each other, undergoing modification in the course of their descent; and that all the inhabitants of the archipelago had descended from those of the nearest land, namely America, whence colonists would naturally have been derived. But it long remained to me an inexplicable problem how the necessary degree of modification could have been effected, and it would have thus remained for ever, had I not studied domestic productions, and thus acquired a just idea of the power of selection. As soon as I had fully realised this idea, I saw, on reading Malthus on Population, that natural selection was the inevitable result of the rapid increase of all organic beings; for I was prepared to appreciate the struggle for existence by having long studied the habits of animals.

As Mr. Darwin justly says, to exhume with one's own hands the bones of extinct quadrupeds brings the whole question of the succession of species right before us. Such work also forces generalisations upon us which it were madness to resist. There are visible links connecting past and present inhabitants of the world. Affinities of the "most singular and complex" kind enable us to place group under group, and these affinities appeal to science for explanation. To what other teacher can they appeal? "How inexplicable," exclaims Mr. Darwin, "is the similar pattern of the hand of a man, the foot of a dog, the wing of a bat, the flipper of a seal, on the doctrine of independent acts of creation; how simply explained on the principle of the natural selection of successive slight variations in the diverging descendants from a single progenitor! So it is, if we look to the structure of an individual animal or plant, when we see the fore and hind limbs, the skull and vertebræ, the jaws and legs of a crab, the petals, stamens, and pistils of a flower, built on the same type or pattern." Mr. Darwin lays stress upon the changes which time has forced upon all organic beings. Certain organs have become useless—the retention of such parts in a rudimentary and useless condition is therefore explained on the theory of descent:—

> On the principle of modifications being inherited at the same age in the child, at which each successive variation first appeared in the parent, we shall see why rudimentary parts and organs are generally well developed in the individual at a very early age. On the same principle of inheritance at corresponding ages, and on the principle of variations not generally supervening at a very early period of embryonic growth (and both these principles can be shown to be probable from direct evidence), that most wonderful fact in the whole round of natural history—namely, the similarity of members of the same great class in their embryonic condition—the embryo, for instance, of a mammal, bird, reptile, and fish being barely distinguishable—becomes simply intelligible.

It is claimed that the theory of independent creations explains none of the facts here investigated. But it is admitted that the first origin of life on this earth, as well as the continued life of each individual, is quite beyond the scope of science. What more can be asked of Mr. Darwin? Nothing; yet he gives more, in the admission that he cares not to emphasise "the greater simplicity of the view of a few forms, or of only one form, having been originally created, instead of innumerable miraculous creations having been necessary at innumerable periods; though this more simple view accords well with Maupertuis's philosophical axiom of 'least action.'" It accords equally well, we may add, with the idea started, we think, by a theologian of no heretical notions, of the *parsimony of divine action*. The expressions mean one and the same thing, but the mere manner of a statement is with many a great matter.

We shall now give, in a few extracts, illustrations of the proofs offered by Mr. Darwin of the truth of his present theory. A lengthy and deeply-interesting section treats of dogs—their originals, the differences of breeds, and means of modification. We can only give a paragraph from the very full discussion of the last-named topic:—

> As changes in domestic breeds which take place so slowly as not to be noticed at any one period, whether due to the selection of individual variations or of differences resulting from crosses, are most important in understanding the origin of our domestic productions, and likewise in throwing indirect light on the changes effected under nature, I will give in detail such cases as I have been able to collect. Lawrence, who paid particular attention to the history of the foxhound, writing in 1829, says that between eighty and ninety years before "an entirely new foxhound was raised through the breeder's art," the ears of the old southern hound being reduced, the bone and bulk lightened, the waist increased in length, and the stature somewhat added to. It is believed that this was effected by a cross with the greyhound. With respect to this latter dog, Youatt, who is generally cautious in his statements, says that the greyhound within the last fifty years, that is before the commencement of the present century, "assumed a somewhat different character from that which he once possessed. He is now distinguished by a beautiful symmetry of form, of which he could not once boast, and he has even superior speed to that which he formerly exhibited. He is no longer used to struggle with dogs, but contends with his fellows over a shorter and speedier course." An able writer believes that our English greyhounds are the descendants, progressively improved, of the large rough greyhounds which existed in Scotland so early as the third century. A cross at some former period with the Italian greyhound has been suspected; but this seems hardly probable, considering the feebleness of this latter breed. Lord Orford, as is well known, crossed his famous greyhounds, which failed in courage, with a bulldog—this breed being chosen from being deficient in the power of scent; "after the sixth or seventh generation," says Youatt, "there was not a vestige of the form of the bulldog, but his courage and indomitable perseverance remained." Youatt infers, from a comparison of an old picture of King Charles's spaniels with the living dog, that "the breed of the present day is materially altered for the worse:" the muzzle has become shorter, the forehead more prominent, and the eyes larger: the changes in this case have probably been due to simple selection. The setter, as this author remarks in another place, "is evidently the large spaniel improved to his present peculiar size and beauty, and taught another way of marking his game. If the form of the dog were not sufficiently satisfactory on this point we might have recourse to history:" he then refers to a document dated 1685 bearing on this subject, and adds that the pure Irish setter shows no signs of a cross with the pointer, which some authors suspect has been the case with the English setter. Another writer remarks that, if the mastiff and English bulldog had formerly been

as distinct as they are at the present time (*i.e.* 1823), so accurate an observer as the poet Gay (who was the author of "Rural Sports" in 1711) would have spoken in his Fable of the Bull and the Bulldog, and not of the Bull and the Mastiff. There can be no doubt that the fancy bulldogs of the present day, now that they are not used for bull-baiting, have become greatly reduced in size, without any express intention on the part of the breeder. Our pointers are certainly descended from a Spanish breed, as even their names, Don, Ponto, Carlos, &c. would show: it is said that they were not known in England before the revolution in 1688; but the breed since its introduction has been much modified, for Mr. Borrow, who is a sportsman and knows Spain intimately well, informs me that he has not seen in that country any breed "corresponding in figure with the English pointer; but there are genuine pointers near Xeres which have been imported by English gentlemen." A nearly parallel case is offered by the Newfoundland dog, which was certainly brought into England from that country, but which has since been so much modified that, as several writers have observed, it does not now closely resemble any existing native dog in Newfoundland. These several cases of slow and gradual changes in our English dogs possess some interest; for though the changes have generally, but not invariably, been caused by one or two crosses with a distinct breed, yet we may feel sure, from the well-known extreme variability of crossed breeds, that rigorous and long-continued selection must have been practised, in order to improve them in a definite manner. As soon as any strain or family became slightly improved or better adapted to altered circumstances, it would tend to supplant the older and less improved strains. For instance, as soon as the old foxhound was improved by a cross with the greyhound or by simple selection, and assumed its present character—and the change was probably required by the increased fleetness of our hunters—it rapidly spread throughout the country, and is now everywhere nearly uniform. But the process of improvement is still going on, for every one tries to improve his strain by occasionally procuring dogs from the best kennels. Through this process of gradual substitution the old English hound has been lost; and so it has been with the old Irish greyhound, and apparently with the old English bulldog. But the extinction of former breeds is apparently aided by another cause; for whenever a breed is kept in scanty numbers, as at present with the bloodhound, it is reared with difficulty, and this apparently is due to the evil effects of long-continued close interbreeding. As several breeds of the dog have been slightly but sensibly modified within so short a period as the last one or two centuries, by the selection of the best individual dogs, modified in many cases by crosses with other breeds; and as we shall hereafter see that the breeding of dogs was attended to in ancient times, as it still is by savages, we may conclude that we have in selection, even if only occasionally practised, a potent means of modification.

Cats afford a less reliable sphere of speculation; but all that can be learned of and from their history is interesting:—

The domestic cat has run wild in several countries, and everywhere assumes, as far as can be judged by the short recorded descriptions, a uniform character. Near Maldonado, in La Plata, I shot one which seemed perfectly wild; it was carefully examined by Mr. Waterhouse, who found nothing remarkable in it, excepting its great size. In New Zealand, according to Dieffenbach, the feral cats assume a streaky grey colour like that of wild cats; and this is the case with the half-wild cats of the Scotch Highlands. We have seen that distant countries possess distinct domestic races of the cat. The differences may be in part due to descent from several aboriginal species or at least to crosses with them. In some cases, as in Paraguay, Mombas, and Antigua, the differences seem due to the direct action of different conditions of life. In other cases some slight effect may possibly be attributed to natural selection, as cats in many cases have largely to support themselves and to escape diverse dangers. But man, owing to the difficulty of pairing cats, has done nothing by methodical selection; and probably very little by unintentional selection; though in each litter he generally saves the prettiest, and values most a good breed of mouse or rat catchers. Those cats which have a strong tendency to prowl after game generally get destroyed by traps. As cats are so much petted, a breed bearing the same relation to other cats that lapdogs bear to larger dogs would have been much valued; and if selection could have been applied we should certainly have had many breeds in each long-civilised country, for there is plenty of variability to work upon. We see in this country considerable diversity in size, some in the proportions of the body, and extreme variability in colour. I have only lately attended to this subject, but have already heard of some singular cases of variation, one of a cat born in the West Indies toothless, and remaining so all its life. Mr. Tegetmeier has shown me the skull of a female cat with its canines so much developed that they protruded uncovered beyond the lips; the tooth with the fang being .95, and the part projecting from the gum .6 of an inch in length. I have heard of a family of six-toed cats. The tail varies greatly in length; I have seen a cat which always carried its tail flat on its back when pleased. The ears vary in shape, and certain strains in England inherit a pencil-like tuft of hairs, above a quarter of an inch in length, on the tips of their ears; and this same peculiarity, according to Mr. Blyth, characterises some cats in India. The great variability in the length of the tail, and the lynx-like tufts of hairs on the ears are apparently analogous to differences in certain wild species of the genus. A much more important difference, according to Daubenton, is that the intestines of domestic cats are wider, and a third longer, than in wild cats of the same size; and this apparently has been caused by their less strictly carnivorous diet.

Of the horse Mr. Darwin seems to speak confidently as the descendant of one wild species. Geological discovery has found the horse buried in tertiary strata; his history is, therefore, far beyond the reach of human grasp. As Mr. Darwin says, it is lost in antiquity. What can we know of the horse whose remains lie imbedded in Swiss lake-dwellings? The tendency in the horse to become striped is elaborately discussed. It is shown that this is not a small or local matter, but that some animals of the species exhibit a disposition to become striped over a large part of their bodies; "and, as we know that stripes readily pass into spots and cloudy marks in the varieties of the domestic cat and in several feline species—even the cubs of the uniformly-coloured lion being spotted with dark marks on a lighter ground, we may suspect that the dappling of the horse, which has been noticed by some authors with surprise, is a modification or vestige of a tendency to become striped." We are asked to believe that the horse was originally dun, striped, nearly akin to the zebra or quagga, and that the stripes in all the other breeds result from ancient crosses with this one primitive dun:—

With respect to the primitive colour of the horse having been dun, Colonel Hamilton Smith has collected a large body of evidence, showing that this tint was common in the East as far back as the time of Alexander, and that the wild horses of Western Asia and Eastern Europe now are, or recently were, of various shades of dun. It seems that not very long ago, a wild breed of dun-coloured horses with a spinal stripe was preserved in the royal parks in Prussia. I hear from Hungary that the inhabitants of that country look at the duns with the spinal stripe as the aboriginal stock, and so it is in Norway. Dun-coloured ponies are not rare in the mountainous parts of Devonshire, Wales, and Scotland, where the aboriginal breed would have had the best chance of being preserved. In South America, in the time of Azara, when the horse had been feral for about 250 years, 90 out of 100 horses were "bai-chatans," and the remaining ten were 'zains," and not more than one in 2,000 black. Zain is generally translated as dark without any white; but as Azara speaks of mules being "zain-clair," I suspect that zain must have meant dun-coloured. In some parts of the world feral horses show a strong tendency to become roans. In the following chapters on the pigeon we shall see that in pure breeds of various colours, when a blue bird is occasionally produced, certain black marks invariably appear on the wings and tail; so, again, when variously-coloured breeds are crossed, blue birds with the same black marks are frequently produced. We shall further see that these facts are explained by, and afford strong evidence in favour of, the view that all the breeds are descended from the rock-pigeon, or *Columba livia*, which is thus coloured and marked. But the appearance of the stripes on the various breeds of the horse, when of a dun colour, does not afford nearly such good evidence of their descent from a single primitive stock as in the case of the pigeon; because no certainly wild horse is known as a standard of comparison; because the stripes when they do appear are variable in character; because there is far from sufficient evidence of the appearance of the stripes from the crossing of distinct breeds; and, lastly, because all the species of the genus equus have the spinal stripe, and several have shoulder and leg stripes. Nevertheless the similarity in the most distinct breeds in their general range of colour, in their dappling, and in the occasional appearance, especally in duns, of leg stripes and of double or triple shoulder stripes, taken together, indicate the probability of the descent of all the existing races from a single dun-coloured, more or less striped, primitive stock, to which our horses still occasionally revert.

After discussing pigs, cattle, sheep, and rabbits, Mr. Darwin treats at great length and minuteness of pigeons. These familiar, beautiful, and immensely modified birds are his great resource in this work. Indeed, their changes under domestication seem to be endless. If the expression be permissible, the pigeon tribe exhibits illimitable elasticity of character, indestructible adaptableness to circumstance. Man may, with skill and patience, breed any sort of pigeon he pleases. And all our known varieties come from the Columba livia, or rock pigeon; tumbler, pouter, jacobin, runt, horseman, carrier, fantail, bald pate, trumpeter, and what not. The following is a summary of physical differences:—

The beak, together with the bones of the face, differ remarkably in length, breadth, shape, and curvature. The skull differs in shape, and greatly in the angle formed by the union of the premaxillary, nasal, and maxillo-jugal bones. The curvature of the lower jaw and the reflexion of its upper margin, as well as the gape of the mouth, differ in a highly remarkable manner. The tongue varies much in length, both independently and in correlation with the length of the beak. The development of the naked wattled skin over the nostrils and round the eyes varies in an extreme degree. The eyelids and the external orifices of the nostrils vary in length, and are to a certain extent correlated with the degree of development of the wattle. The size and form of the œsophagus and crop, and their capacity for inflation, differ immensely. The length of the neck varies. With the varying shape of the body the breadth and number of the ribs, the presence of processes, the number of the sacral vertebræ, and the length of the sternum, all vary. The number and size of the coccygeal vertebræ vary apparently in correlation with the increased size of the tail. The size and shape of the perforations in the sternum, and the size and divergence of the arms of the furcula, differ. The oil-gland varies in development, and is sometimes quite aborted. The direction and length of certain feathers have been much modified, as in the hood of the Jacobin and the frill of the Turbit. The wing and tail feathers generally vary in length together, but sometimes independently of each other and the size of the body. The number and position of the tail feathers vary to an unparalleled degree. The primary and secondary wing feathers occasionally vary in number, apparently in correlation with the length of the wing. The length of the leg and the size of the feet, and, in connection with the latter, the number of the scutellæ, all vary. A web of skin sometimes connects the bases of the two inner toes, and almost invariably the two outer toes when the feet are feathered. The size of the body differs greatly; a runt has been known to weigh more than five times as much as a short-faced tumbler. The eggs differ in size and shape. According to Parmentier, some races use much straw in building their nests, and others use little; but I cannot hear of any recent corroboration of this statement. The length of time required for hatching the eggs is uniform in all the breeds. The period at which the characteristic plumage of some breeds is acquired, and at which certain changes of colour supervene, differs. The degree to which the young birds are clothed with down when first hatched is different, and is correlated in a singular manner with the future colour of the plumage. The manner of flight, and certain inherited movements, such as clapping the wings, tumbling either in the air or on the ground, and the manner of courting the female, present the most singular differences. In disposition the several races differ. Some races are very silent; others coo in a highly peculiar manner.

Here is a historical epitome of the formation of races:—

That circumstances have been eminently favourable for the modification of the pigeon through variation and selection will now be shown. The earliest records, as has been pointed out to me by Professor Lepsius, of pigeons in a domesticated condition, occurs in the fifth Egyptian dynasty, about 3000 B.C.; but Mr. Birch, of the British Museum, informs me that the pigeon appears in a bill of fare in the previous dynasty. Domestic pigeons are mentioned in Genesis, Leviticus, and Isaiah. In the time of the Romans, as we hear from Pliny, immense prices were given for pigeons; "nay, they are come to this pass, that they can reckon up their pedigree and race." In India, about the year 1600, pigeons were much valued by Akber Khan; 20,000 birds were carried about with the court, and the merchants brought valuable collections. "The monarchs of Iran and Turan sent him some very rare breeds. His Majesty," says the courtly historian, "by crossing the breeds, which method was never practiced before, has improved them astonishingly." Akber Khan possessed 17 distinct kinds, eight of which were valuable for beauty alone. At about this same period of 1600 the Dutch, according to Aldrovandi, were as eager about pigeons as the Romans had formerly been. The breeds which were kept during the 15th century in Europe and in India apparently differed from each other. Tavernier, in his travels in 1677, speaks, as does Chardin in 1735, of the vast number of pigeon-houses in Persia; and the former remarks that, as Christians were not permitted to keep pigeons, some of the vulgar actually turned Mahometans for this sole purpose. The Emperor of Morocco had his favourite keeper of pigeons, as is mentioned in Moore's treatise, published 1737. In England, from the time of Willughby in 1678 to the present day, as well as in Germany and in France, numerous treatises have been published on the pigeon. In India, about a hundred years ago, a Persian treatise was written; and the writer thought it no light affair, for he begins with a solemn invocation, "in the name of God, the gracious and merciful." Many large towns in Europe and the United States now have their societies of devoted pigeon fanciers; at present there are three such societies in London. In India, as I hear from Mr. Blyth, the inhabitants of Delhi and of some other great cities are eager fanciers. Mr. Layard informs me that most of the known breeds are kept in Ceylon. In China, according to Mr. Swinhoe of Amoy, and Dr. Lockhart of Shanghai, carriers, fantails, tumblers, and other varieties are reared with care, especially by the bonzes or priests. The Chinese fasten a kind of whistle to the tail-feathers of their pigeons, and as the flock wheels through the air they produce a sweet sound. In Egypt the late Abbas Pasha was a great fancier of fantails. Many pigeons are kept at Cairo and Constantinople, and these have lately been imported by native merchants, as I hear from Sir W. Elliot, into Southern India, and sold at high prices. The foregoing statements show in how many countries, and during how long a period, many men have been passionately devoted to the breeding of pigeons.

Intensely interesting is the section devoted to the "Manner of the formation of the chief races." We give one or two short passages from it.

As long as pigeons are kept semi-domesticated in dovecots in their native country, without any care in selecting and matching them, they are liable to little more variation than the wild *C. livia*, namely, in the wings becoming chequered with black, in the croup being blue or white, and in the size of the body. When, however, dovecot pigeons are transported into diversified countries, such as Sierra Leone, the Malay archipelago, and Madeira (where the wild *C. livia* is not known to exist), they are exposed to new conditions of life; and apparently in consequence they vary in a somewhat greater degree. When closely confined, either for the pleasure of watching them, or to prevent their straying, they must be exposed, even under their native climate, to considerably different conditions; for they cannot obtain their natural diversity of food; and, what is probably more important, they are abundantly fed, whilst debarred from taking much exercise. Under these circumstances we might expect to find, from the analogy of all other domesticated animals, a greater amount of individual variability than with the wild pigeon; and this is the case. The want of exercise apparently tends to reduce the size of the feet and organs of flight; and then, from the law of correlation of growth, the beak apparently becomes affected. From what we now see occasionally taking place in our aviaries, we may conclude that sudden variations or sports, such as the appearance of a crest of feathers on the head, of feathered feet, of a new shade of colour, of an additional feather in the tail or wing, would occur at rare intervals during the many centuries which have elapsed since the pigeon was first domesticated. At the present day such "sports" are generally rejected as blemishes; and there is so much mystery in the breeding of pigeons that, if a valuable sport did occur, its history would often be concealed.* * Hence, after a long course of domestication, we might expect to see in the pigeon much individual variability, and occasional sudden variations, as well as slight modifications from the lessened use of certain parts, together with the effects of correlation of growth. But without selec-

tion all this would produce only a trifling or no result; for without such aid differences of all kinds would, from the the two following causes, soon disappear. In a healthy and vigorous lot of pigeons many more young birds are killed for food or die than are reared to maturity; so that an individual having any peculiar character, if not selected, would run a good chance of being destroyed; and if not destroyed, the peculiarity in question would almost certainly be obliterated by free intercrossing. It might, however, occasionally happen that the same variation repeatedly occurred, owing to the action of peculiar and uniform conditions of life, and in this case it would prevail independently of selection. But when selection is brought into play all is changed; for this is the foundation-stone in the formation of new races; and with the pigeon circumstances, as we have already seen, are eminently favourable for selection. When a bird presenting some conspicuous variation has been preserved, and its offspring have been selected, carefully matched, and again propagated, and so onwards during successive generations, the principle is so obvious that nothing more need be said about it. This may be called methodical selection, for the breeder has a distinct object in view, namely, to preserve some character which has actually appeared, or to create some improvement already pictured in his mind. Another form of selection has hardly been noticed by those authors who have discussed this subject, but is even more important. This form may be called unconscious selection, for the breeder selects his birds unconsciously, unintentionally, and without method, yet he surely though slowly produces a great result. I refer to the effects which follow from each fancier at first procuring and afterwards rearing as good birds as he can, according to his skill, and according to the standard of excellence at each successive period. He does not wish permanently to modify the breed; he does not look to the distant future, or speculate on the final result of the slow accumulation during many generations of successive slight changes; he is content if he possesses a good stock, and more than content if he can beat his rivals. The fancier in the time of Aldrovandi, when in the year 1600 he admired his own jacobins, pouters, or carriers, never reflected what their descendants in the year 1860 would become; he would have been astonished could he have seen our jacobins, our improved English carriers, and our pouters; he would probably have denied that they were the descendants of his own once admired stock, and he would perhaps not have valued them, for no other reason, as was written in 1765, "than because they were not like what used to be thought good when he was in the fancy." No one will attribute the lengthened beak of the carrier, the shortened beak of the short-faced tumbler, the lengthened leg of the pouter, the more perfectly enclosed hood of the jacobin, &c.—changes effected since the time of Aldrovandi, or even since a much later period—to the direct and immediate action of the conditions of life. For these several races have been modified in various and even in directly opposite ways, though kept under the same climate and treated in all respects in as nearly uniform a manner as possible. Each slight change in the length or shortness of the beak, in the length of leg, &c. has no doubt been indirectly and remotely caused by some change in the conditions to which the bird has been subjected, but we must attribute the final result, as is manifest in those cases of which we have any historical record, to the continued selection and accumulation of many slight successive variations.* * In the foregoing cases we have supposed that a sudden variation, conspicuous enough to catch a fancier's eye, first appeared; but even this degree of abruptness in the process of variation is not necessary for the formation of a new breed. When the same kind of pigeon has been kept pure, and has been bred during a long period by two or more fanciers, slight differences in the strain can often be recognised. Thus I have seen first-rate jacobins in one man's possession which certainly differed slightly in several characters from those kept by another. I possessed some excellent barbs descended from a pair which had won a prize, and another lot descended from a stock formerly kept by that famous fancier Sir John Sebright, and these plainly differed in the form of the beak; but the differences were so slight that they could hardly be described by words. Again, the common English and Dutch tumbler differ in a somewhat greater degree, both in length of beak and shape of head. What first caused these slight differences cannot be explained any more than why one man has a long nose and another a short one. In the strains long kept distinct by different fanciers, such differences are so common that they cannot be accounted for by the accident of the birds first chosen for breeding having been originally as different as they now are. The explanation no doubt lies in selection of a slightly different nature having been applied in each case; for no two fanciers have exactly the same taste, and consequently no two, in choosing and carefully matching their birds, prefer or select exactly the same. As each man naturally admires his own birds, he goes on continually exaggerating by selection whatever slight peculiarities they may possess. This will more especially happen with fanciers living in different countries, who do not compare their stocks and aim at a common standard of perfection. Thus, when a mere strain has once been formed, unconscious selection steadily tends to augment the amount of difference, and thus converts the strain into a sub-breed, and this ultimately into a well-marked breed or race. The principle of correlation of growth should never be lost sight of. Most pigeons have small feet, apparently caused by their lessened use, and from correlation, as it would appear, their beaks have likewise become reduced in length. The beak is a conspicuous organ, and, as soon as it had thus become perceptibly shortened, fanciers would almost certainly strive to reduce it still more by the continued selection of birds with the shortest beaks; whilst at the same time other fanciers, as we know has actually been the case, would, in other sub-breeds, strive to increase its length. With the increased length of the beak, the tongue would become greatly lengthened, as would the eyelids with the increased development of the eye-wattles; with the reduced or increased size of the feet the number of the scutellæ would vary; with the length of the wing the number of the primary wing-feathers would differ; and with the increased length of the body in the pouter the number of the sacral vertebræ would be augmented. These important and correlated differences of structure do not invariably characterise any breed; but if they had been attended to and selected with as much care as the more conspicuous external differences, there can hardly be a doubt that they would have been rendered constant. Fanciers could assuredly have made a race of tumblers with nine instead of ten primary wing feathers, seeing how often the number nine appears without any wish on their part, and indeed in the case of the white-winged varieties in opposition to their wish. In a similar manner if the vertebræ had been visible and had been attended to by fanciers, assuredly an additional number might easily have been fixed in the pouter. If these latter characters had once been rendered constant we should never have suspected that they had at first been highly variable, or that they had arisen from correlation, in the one case with the shortness of the wings, and in the other case with the length of the body.

Enough has been said and transcribed to explain the character and value of Mr. Darwin's new book. As a study of physical science it is a masterpiece, and will be referred to as such by all who value purely scientific methods. The central idea of the book, as of Mr. Darwin's previous work, we leave to the continued, and probably endless, discussion it will receive in all quarters. Fierce followers of Mr. Darwin will be alternately elated and disappointed with his materials. This is natural enough in the case of a conscientious experimenter. He is himself the subject of ever varying feelings. Hence the patience he exhibits; hence the fine and admirable modesty which marks his deliverances. That he has added much to the defence of the theory of the "survival of the fittest" is certain. It is here, as Mr. Darwin thinks, exemplified in the domestication of races. We shall await with great curiosity his prosecution of the subject into the sphere of pure and untouched nature. If it can be shown that the struggle for existence in that sphere does what human influence accomplishes out of it, a positive advance will have been made in scientific research. A step onward will have been made. The *destruction of the least fitting* explains the disappearance of forms between extremes of the most opposite appearances, and forces the acceptance of the idea of the development of new species. That these results have occurred, and do still occur, in the natural history of animals and plants under domestication it is the object of Mr. Darwin to show in the volumes we have so imperfectly but willingly noticed.

LITERATURE.

The Power of Movement in Plants. By CHARLES DARWIN, LL.D., F.R.S., assisted by FRANCIS DARWIN. With Illustrations. (London: John Murray.)

THE unceasing industry of Mr. Darwin, his perseverance in making observations, and the care he takes in preparing them for publication, and so placing them at the disposal of other students, deserves the warmest recognition of those who are competent to appreciate such valuable and self-denying labours. Even those who cannot accept all the conclusions deduced by the great naturalist from his observations, who are able to estimate their value and importance, will be anxious to acknowledge their indebtedness; for no one, we feel assured, can venture to question the good faith and sincerity of purpose with which the observations are made, or the care which is always taken to ensure accuracy of statement in presenting them to the public. We therefore feel sure that almost every naturalist will hail with thankfulness the present volume, which has a positive and undoubted value for every student of nature. Its chief object, as stated in the introduction, with much modesty, "is to describe and connect together several large classes of movement common to almost all plants." For the most commonly prevalent movement, Mr. Darwin has coined the word "circumnutation." From the evidence adduced, it seems probable that every growing part of every plant indulges in the movement so designated. The great sweeps made by the stems of twining plants, and by the tendrils of other climbers, are reasonably supposed to result from a mere increase in the amplitude of the ordinary movement of circumnutation. Plants, the leaves of which "sleep" at night, when their blades assume a vertical position, presumably owe this protective movement to modified circumnutation, and employ it to protect their upper surfaces from being chilled through radiation. Everyone who has watched the development of plants raised from seeds, must be aware of the almost invariable arched condition of the hypocotyl as it lifts the cotyledons above the surface. But probably very few are aware of the great force which plants at this early stage of their existence are able to exert, and what obstacles to their appearance above the soil they are able to overcome. Mr. Darwin mentions that he ascer-

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MR. CHARLES DARWIN'S NEW BOOK.

Variation of Animals and Plants under Domestication. By Charles Darwin, M.A. F.R.S. &c. 2 vols. London: John Murray. 1868.

When Mr. Darwin first startled the philosophical world by his speculations upon the "origin of species," he confessed to a hurried performance that he might anticipate others advancing upon the same road. His object was attained. The views he propounded have been ever since associated with his name, and he has been the centre round which debaters have fought and theorisers have revolved. Many, with the hasty credulity which ever marks superficial thought, accepted Mr. Darwin's hypotheses as facts, and hence the dogmatism which has marked the utterances of those who have actually outrun Mr. Darwin himself. Indeed he has greatly suffered from the ignorant and eager zeal of converts. With the conviction of new truth suggested, Mr. Darwin felt the responsibility attaching to unproven theories, and declared in his first book that he would "soon publish the facts on which the conclusions given in it were founded." The present volumes are a part fulfilment of that promise, and we learn with great sorrow that "the great delay in publishing this first work has been caused by continued ill-health." As impartial view of Mr. Darwin's position and self-imposed task will suggest the best rebuke to his impatient and incompetent theorists. Their master is in no hurry. He feels too strongly the necessity of taking every step with the utmost caution—of finding solid material to rest upon as he advances. Here are two large volumes, full of facts and observations, as the result of his careful labour, and, if we understand his wishes, they are now placed before the world as corroborations of certain deductions, not as authorities for final judgment. There are here, of course, corollaries and conclusions; but in dismissing the experimental proposition which he has forced his own mind, Mr. Darwin puts into the hands of all the means of testing the validity and truth of his own methods and results.

Some explanation is made which will help some to a better understanding of his theory of "natural selection." Mr. Darwin calls the term a bad one; Mr. Herbert Spencer's expression, the "survival of the fittest," is greatly preferred. Still there is real need for the first. Chemists speak of "elective affinities," and instances exceeding correct choice in the case of human beings. There is no such conscious choice in nature, but there is in many cases a process closely analogous to it. Thus, he says, "The facts so far as we now go, seem to bring into connection the production of domestic races by man's power of selection, and the natural preservation of variation and species in a state of nature. For brevity sake, I sometimes speak of natural selection as an intelligent power, in the same way as astronomers speak of the attraction of gravity as ruling the movements of the planets, or as agriculturists speak of man making domestic races by the power of selection." In both cases "there is something without variability," a phenomenon depending upon the action of circumstances which is, in the same frank manner Mr. Darwin uses, a personification of nature. He considers "not only the aggregate action and product of many natural laws, but by laws only the results of events."

Having thus introduced to natural selection I shall show how it arises from a multitude of facts, that the principle can be supported on each spot by the most overwhelming evidence, and the structures and habits of the inhabitants. We shall, also, see that the production of new forms through natural selection depends entirely upon that each new variety has some advantage over others, since inevitably leads to the extermination of the older and less improved forms. These principles will be illustrated by the structure as [illegible] the last-produced forms and [illegible] species. Now, if we suppose a species [illegible] variations, and these in the course [illegible] the principle of good being [illegible] of structure will generally [illegible] of the most divergent varieties; [illegible] characteristic of varieties come to be [illegible] the greater difference characteristic [illegible] by the extermination of the older [illegible] species come to be distinctly [illegible] also we shall see how it is that [illegible] be classed by what is called a natural [illegible] groups—species under genera, and [illegible]

[illegible] some to hear Mr. Darwin say [illegible] chance or necessary tendency in [illegible] advancement in the scale of [illegible] surprise will cease when it is [illegible] selection" for exclusively through [illegible] profitable modifications of struc[illegible] the survival of the fittest must [illegible] knowledge of probabilities thus [illegible] the conditions of life in each area [illegible] more and more complex, from the [illegible] of different forms which inhabit [illegible] of these forms acquiring a more [illegible] structure, we may confidently be[illegible] of the whole organisation advances."

For his proofs of these statements, Mr. Darwin asks us to read carefully his present work, the first only of a series of evidential books which he considers it incumbent upon himself to produce. In a note we are reminded that the fact of variation under domestication is not accepted by M. Pouchet and those who think with him as in any sense illustrative of the natural modification of species. Mr. Darwin sees no force in M. Pouchet's arguments, and in a second work will proceed, after treating of the variation of organisms in a state of nature, of the struggle for existence, and the principle of natural selection, to discuss the difficulties which stand in the way of his theory. These difficulties may be classed under the following heads: the apparent impossibility in some cases of a very simple organ graduating by small steps into a highly perfect organ; the marvellous facts of instinct; the whole question of hybridity; and, lastly, the absence of the present time and in our geological formations of innumerable links connecting all allied species." With continued frankness, Mr. Darwin states his conviction that some of these difficulties are explicable on the theory of natural selection, and are otherwise inexplicable. We commend to general attention, and to the special notice of those who are prone to exercise the *odium theologicum* against scientific students like Mr. Darwin, the following passage:—

"In scientific investigations it is permitted to invent any hypothesis, and if it explains various large and independent classes of facts it rises to the high grade of well-grounded theory. The undulations of the ether and even its existence are hypothetical, yet every one admits the undulatory theory of light. The principle of natural selection may be looked at as a mere hypothesis, but rendered in some degree probable by what we positively know of the variability of organic beings in a state of nature,—by what we positively know of the struggle for existence, and the consequent almost inevitable preservation of favourable variations,—from the analogical formation of domestic races. Now this hypothesis may be tested,—and this seems to me the only fair and legitimate manner of considering the whole question—by trying whether it explains several large and independent classes of facts; such as the geological succession of organic beings, their distribution in past and present times, and their mutual affinities and homologies. If the principal of natural selection does explain these and other large bodies of facts, it ought to be received. On the ordinary view of each species having been independently created, we gain no scientific explanation of any one of these facts. We can only say that it has so pleased the Creator to command that the past and present inhabitants of the world should appear in a certain order and in certain areas; that He has impressed on them the most extraordinary resemblances, and has classed them in groups subordinate to groups. But by such statements we gain no new knowledge; we do not connect together facts and laws; we explain nothing."

In another work—which we hope Mr. Darwin may have both life and health to complete—he will try the principle of natural selection by seeing how far it will give just explanations of the classes of facts under consideration:—

It was the consideration of these facts which first led me to take up the present subject. When I visited, during the voyage of H.M.S. Beagle, the Galapagos Archipelago, situated in the Pacific Ocean about 500 miles from the shore of South America, I found myself surrounded by peculiar species of birds, reptiles, and plants, existing nowhere else in the world. Yet they nearly all bore an American stamp. In the song of the mocking thrush, in the harsh cry of the carrion hawk, in the great candlestick-like opuntias, I could everywhere recognise the neighbourhood of America, though the islands were separated by so many miles of ocean from the mainland, and differed much from it in their geological constitution and climate. Still more surprising was the fact that most of the inhabitants of each separate island in this small archipelago were specifically different, though most closely related to each other. The islands of this archipelago, with its innumerable craters and lava streams of lava, appeared to be of recent origin; and thus I fancied myself brought near to the very act of creation. I often asked myself how these many peculiar animals and plants had been produced: the simplest answer seemed to be that the inhabitants of the several islands had descended from each other, undergoing modification in the course of their descent; and that all the inhabitants of the archipelago had descended from those of the nearest land, namely America, whence colonists would naturally have been derived. But it long remained to me an inexplicable problem how the necessary degree of modification could have been effected, and it would have long remained for ever, had I not studied domestic productions, and thus acquired a just idea of the power of selection. As soon as I had fully realised this idea, I saw, on reading Malthus on Population, that natural selection was the inevitable result of the rapid increase of all organic beings; for I was prepared to appreciate the struggle for existence by having long studied the habits of animals.

As Mr. Darwin justly says, to exhume with one's own hands the bones of extinct quadrupeds brings the whole question of the succession of species more before us. Such work also forces great questions upon us which it were madness to resist. There are visible links connecting past and present inhabitants of the world. Affinities of the "most singular and complex" kind enable us to place group under group, and these affinities appeal to science for explanation. To what other teacher can they appeal? "How inexplicable," exclaims Mr. Darwin, "is the similar pattern of the hand of a man, the foot of a dog, the wing of a bat, the flipper of a seal, on the doctrine of independent acts of creation; how simply explained on the principle of the natural selection of successive slight variations in the diverging descendants from a single progenitor! So it is, if we look to the structure of an individual animal or plant, when we see the fore and hind limbs, the skull and vertebræ, the jaws and legs of a crab, the petals, stamens, and pistils of a flower, built on the same type or pattern." Mr. Darwin lays stress upon the changes which time has forced upon all organic beings. Certain organs have become useless—the retention of such parts in a rudimentary and useless condition is therefore explained on the theory of descent:—

On the principle of modifications being inherited at the same age in the child, at which each successive variation first appeared in the parent, we shall see why rudimentary parts and organs are generally well developed in the individual at a very early age. On this same principle of inheritance at corresponding ages, and on the principle of variations not generally supervening at a very early period of embryonic growth (and both these principles can be shown to be probable from direct evidence), that most wonderful fact in the whole round of natural history—namely, the similarity of members of the same great class in their embryonic condition—the embryo, for instance, of a mammal, bird, reptile, and fish being barely distinguishable—becomes simply intelligible.

It is claimed that the theory of independent creations explains none of the facts here investigated. But it is admitted that the first origin of life on this earth, as well as the continued life of each individual, is quite beyond the scope of science. What more can be asked of Mr. Darwin? Nothing; yet he gives more, in the admission that he cares not to emphasise "the greater simplicity of the view of a few forms, or of only one form, having been originally created, instead of many independent creations having been necessary at innumerable periods; though this more simple view accords well with Maupertuis's philosophical axiom of 'least action.'" It accords equally well, we may add, with the idea started, we think, by a theologian of no heretical notions, of the *parsimony of divine action*. The expressions mean one and the same thing, but the mere manner of a statement is with many a great matter.

We shall now give, in a few extracts, illustrations of the proofs offered by Mr. Darwin of the truth of his present theory. A lengthy and deeply-interesting section treats of dogs—their originals, the differences of breeds, and means of modification. We can only give a paragraph from the very full discussion of the last-named topic:—

As changes in domestic breeds which take place so slowly as not to be noticed at any one period, whether due to the selection of individual variations or of differences resulting from crosses, are most important in understanding the origin of our domestic productions, and likewise in throwing indirect light on the changes effected under nature, I will give in detail such cases as I have been able to collect. Lawrence, who paid particular attention to the history of the foxhound, writing in 1829, says that between eighty and ninety years before "an entirely new foxhound was raised through the breeder's art," the ears of the old southern hound being reduced, the bone and bulk lightened, the waist increased in length, and the stature somewhat added to. It is believed that this was affected by a cross with the greyhound. With respect to this latter dog, Youatt, who is generally cautious in his statements, says that the greyhound within the last fifty years, that is before the commencement of the present century, "assumed a somewhat different character from that which he once possessed. He is now distinguished by a beautiful symmetry of form, of which he could not once boast, and he has even superior speed to that which he formerly exhibited. He is no longer used to struggle with deer, but contends with his fellows over a shorter and speedier course." An able writer believes that our English greyhounds are the descendants, progressively improved, of the large rough greyhounds which existed in Scotland so early as the third century. A cross at some former period with the Italian greyhound has been suspected; but this seems hardly probable, considering the tenderness of this latter breed. Lord Orford, as is well known, crossed his famous greyhounds, which failed in courage, with a bulldog—this breed being chosen from being deficient in the power of scent; "after the sixth or seventh cross," says Youatt, "there was not a vestige of the form of the bulldog, but his courage and indomitable perseverance remained." Youatt infers, from a comparison of an old picture of King Charles's spaniels with the living dog, that "the breed of the present day is materially altered for the worse" the muzzle has become shorter, the forehead more prominent, and the eyes larger: the changes in this case have probably been due to simple selection. The writer, as this author remarks in another place, is evidently the large spaniel improved to his present peculiar size and beauty, and taught another way of marking his game. If the form of the dog were not sufficiently satisfactory on this point we might have recourse to history; he then refers to a document dated 1685 bearing on this subject, and adds that the gun-to Irish setter shows no signs of a cross with the pointer, which some authors suspect has been the case with the English setter. Another writer remarks that if the mastiff and English bulldog had formerly been

as distinct as they are at the present time (c. 1859) an accurate an observer as the poet Gay (who was the author of "a Rural Sports" in 1711) would have spoken of his Fable of the Bull and the Bulldog, and not of the Bull and the Mastiff. There can be no doubt that the fancy bulldogs of the present day, now that they are not used for bull-baiting, have become greatly reduced in size, without any express intention on the part of the breeder. Our pointers are certainly descended from a Spanish breed, as even their names, 'Don, Foeto, Carlos, &c. would show. It is said that they were not known in England before the revolution in 1688; but the breed since its introduction has been much modified, for Mr. Borrow, who is a sportsman and knows pointers intimately well, informs me that he has not seen in that country any dog corresponding in figure with the English pointer; but there are genuine pointers near Xeres which have been imported by English gentlemen." A nearly parallel case is offered by the Newfoundland dog, which was certainly brought into England from that country, but which has since been so much modified that, as several writers have observed, it does not now closely resemble any existing native dog in Newfoundland. These several cases of slow and gradual changes in our English dogs possess some interest; for though the changes have generally, but not invariably, been caused by one or two crosses with a distinct breed, yet we may feel sure, from the well-known extreme variability of ground breeds, that rigorous and long-continued selection must have been practised, in order to improve them in a definite manner. As soon as any strain or family became slightly improved or better adapted to altered circumstances, it would tend to supplant the older and less improved strains. For instance, as soon as the old foxhound was improved by a cross with the greyhound or by simple selection, and assumed its present character—and this was probably rapidly required by the increased fleetness of our hunters—it would rapidly spread throughout the country, and is now everywhere nearly uniform. But the process of improvement is still going on, for every one tries to improve his strain by occasionally procuring dogs from the best kennels. Though this process of gradual substitution and modification has been long carried on it has not been with the old Irish greyhound, and apparently with the old English bulldog. But the extinction of former breeds is apparently aided by another cause; for whenever a breed is kept in scanty numbers, as at present with the bloodhound, it is reared with difficulty, and this apparently is due to the effects of long-continued close interbreeding. As several breeds of the dog have been slightly but sensibly modified within so short a period as the last one or two centuries, by the selection of the best individual dogs, modified in many cases by crosses with other breeds; and as we shall hereafter see that the breeding of dogs was attended to in ancient times, as it still is by savages, we may conclude that we have in selection, even if only occasionally practised, a potent means of modification.

Cats afford a less reliable sphere of speculation; but all that can be learned of and from their history is interesting:—

The domestic cat has run wild in several countries, and everywhere assumes, as far as can be judged by the short recorded descriptions, a uniform character. Near Maldonado, in La Plata, I shot one which differed perfectly wild; it was carefully examined by Mr. Waterhouse, who found nothing remarkable in it, excepting its great size. In New Zealand, according to Dieffenbach, the feral cats assume a streaky grey colour like that of wild cats; and this is the case with the half-wild cats of the Scotch Highlands. We have seen that distant countries possess distinct domestic races of the cat. The differences may be in part due to descent from several aboriginal species of the genus crosses with them. In some cases, as in Paraguay, Mombas, and Antigua, the differences seem due to the direct action of different conditions of life. In other cases some slight effect may possibly be attributed to natural selection, as cats in many countries have largely to support themselves and to escape diverse dangers. But mice, owing to the difficulty of pairing cats, has done nothing by methodical selection; and probably very little by unintentional selection; though in each litter he generally saves the prettiest, and values most a good breed of mouse or rat catchers. Those cats which have a strong tendency to prowl after game generally get destroyed by traps. As cats are so much petted, a breed bearing the same relation to other cats that lapdogs bear to larger dogs would have been much valued; and if selection could have been applied we should certainly have had many breeds in each long-civilised country, for there is plenty of variability to work upon. We see in this country considerable diversity in size, some in the proportions of the body, and extreme variability in colour. I have only lately attended to this subject, but have already heard of some singular cases of variation, one of a cat born in the West Indies stoutheless, and remaining so all its life. Mr. Tegetmeier has shown me the skull of a female cat with its canines so much developed that the projecting protruded uncovered beyond the lips; the tooth with the fang and root filling the part projecting from the gum ·6 of an inch in length. I have heard of a family of six-toed cats. The tail varies greatly in length; I have seen a cat which always carried its tail flat on its back when pleased. The ears vary in shape, and certain strains in England inherit a pencil-like tuft of hairs, above a short one of an inch in length, on the tips of their ears; and this same peculiarity, according to Mr. Blyth, characterises some cats in India. The extreme variability in the length of the tail, and the lynx-like tufts of hairs on the ears are apparently analogous to differences in certain wild species of the genus. A much more important difference, according to Daubenton, is that the intestines of domestic cats are wider, and a third longer, than in wild cats of the same size; and this apparently has been caused by their less strictly carnivorous diet.

Of the horse Mr. Darwin seems to speak confidently as the descendant of one wild species. Geological discovery has found the horse buried in tertiary strata; his history is, therefore, far beyond the reach of human grasp. As Mr. Darwin says, it is lost in antiquity. What can we know of the horse whose remains lie imbedded in Swiss lake-dwellings? The tendency in the horse to become striped is elaborately discussed, as is shown that this is not a small or local matter, but that some animals of the species exhibit a disposition to become striped over a large part of their bodies; and as we know that stripes readily pass into spots and closely marks in the varieties of the domestic cat and in several feline species—even the rule of the half-formly-coloured lion being spotted with dark marks on a lighter ground, we may suspect that the dappling of the horse, which has been noticed by some authors with surprise, is a modification or vestige of a tendency to become striped." We are asked to believe that the horse was originally dun, striped, nearly akin to the zebra or quagga, and that the stripes in all the other breeds result from ancient crosses with this one primitive dun;—

With respect to the primitive colour of the horse having been dun, Colonel Hamilton Smith has collected a large body of evidence, showing that this tint was common in the East as far back as the time of Alexander, and that the wild horses of Western Asia and Eastern Europe now are, or recently were, of various shades of dun. It seems clear not only that a wild breed of dun-coloured horses with a spinal stripe does exist in the royal parks in Prussia. I hear from Hungary that the semi-wild tants of that country look as the dun with the spinal stripe to the aboriginal stock, and so it is in Norway. Dun-coloured ponies are not rare in the mountainous parts of Devonshire, Wales, and Scotland, where the aboriginal breed would have existed the best chance of being preserved. In South America, in the times of Azara, when the horse had been feral for about 250 years, 90 per cent. of horses were "bai-chatanos," and the remaining ten were "zains," and not more than one in 2,000 black. Zain is generally translated as dark without any white; but as Azara speaks of mules being "zain-clair," I suspect that zain must have meant dun-coloured. In some parts of the world feral horses show a strong tendency to become roans. In the following chapters on the pigeon we shall see that in pure breeds of various colours, when a blue bird is occasionally produced, certain black marks invariably appear on the wings and tail; so, again, when variously-coloured breeds are crossed, blue birds with the same black marks are frequently produced. We shall further see that these facts are excellent evidence afford strong evidence in favour of the view that all the breeds are descended from the rock-pigeon, or *Columba livia*, which is thus coloured and marked. But the appearance of the stripes on the various breeds of the horse, when of a dun colour, does not afford nearly such good evidence of their descent from a single primitive stock as in the case of the pigeon; because no certainly wild horse is known as a standard of comparison; because the stripes when they do appear are variable in character; because there is far from sufficient evidence of the appearance of the stripes from the crossing of distinct breeds; and, lastly, because all the species of the genus equus have the spinal stripe, and several have shoulder and leg stripes. Nevertheless the similarity in the most distinct breeds in their general range of colour, in their dappling, and in the occasional appearance, especially in duns, of leg stripes and of double or triple shoulder stripes, taken together, indicate the probability of the descent of all the existing races from a single dun-coloured, more or less striped, primitive stock, to which our horses still occasionally revert.

After discussing pigs, cattle, sheep, and rabbits, Mr. Darwin treats at great length and minuteness of pigeons. These familiar, beautiful, and immensely modified birds are his great resource in this work. Indeed, their changes under domestication seem to be endless. If the expression be permissible, the pigeon tribe exhibits illimitable elasticity of character, indestructible adaptableness to circumstance. Man may, with skill and patience, breed any sort of pigeon he pleases. And all our known varieties come from the Columba livia, or rock pigeon; tumbler, pouter, jacobin, runt, horseman, carrier, fantail, bald pate, trumpeter, and what not. The following is a summary of physical differences:—

The beak, together with the bones of the face, differ remarkably in length, breadth, shape, and curvature. The skull differs in shape, and greatly in the angle formed by the union of the premaxillary, nasal, and maxillo-jugal bones. The curvature of the lower jaw and the relaxation of its upper margin, as well as the gape of the mouth, differ in a highly remarkable manner. The tongue varies much in length, both independently and in correlation with the length of the beak. The development of the naked wattled skin over the nostrils and round the eyes varies in an extreme degree. The eyelids and their external ornaments vary in length, and are to a certain extent correlated with the degree of development of the wattle. The size and form of the œsophagus and crop, and their capacity for inflation, differ immensely. The length of the neck varies. With the varying shape of the body the breadth and number of the ribs, the presence of processes, the number of the sacral vertebræ, and the length of the sternum, all vary. The number and size of the occipital vertebræ vary apparently in correlation with the increased size of the tail. The size and shape of the perforations in the sternum, and the size and divergence of the arms of the furcula, differ. The oil-gland varies in development, and is sometimes quite aborted. The direction and length of certain feathers have been much modified, as in the hood of the Jacobin and the frill of the Turbit. The wing and tail feathers generally vary in length together, but sometimes independently of each other and the size of the body. The number and position of the tail feathers vary to an unparalleled degree. The primary and secondary wing feathers occasionally vary in number, apparently in correlation with the length of the wing. The length of the leg and the size of the feet, and, in connection with the latter, the number of the scutellæ, all vary. A web of skin sometimes connects the bases of the two inner toes, and almost invariably the two outer toes when the feet are feathered. The size of the body differs greatly; a runt has been known to weigh more than five times as much as a short-faced tumbler. The eggs differ in size and shape. According to Parmentier, some races use much straw in building their nests, and others use little; but I cannot hear of any recent corroboration of this statement. The length of time required for hatching the eggs is uniform in all the breeds. So the period at which the characteristic plumage of some breeds is acquired, and at which certain changes of colour appearance, differs. The degree to which the young birds are clothed with down when hatched is different, and is correlated in a singular manner with the future colour of the plumage. The manner of flight, and certain inherited movements, such as clapping the wings, tumbling either in the air or on the ground, and the manner of pouring the female, present the most singular differences. In disposition the several races differ. Some races are very silent; others coo in a highly peculiar manner.

Here is a historical epitome of the formation of races:—

That circumstances have been eminently favourable for the modification of the pigeon through variation and selection will now be shown. The earliest records, as has been pointed out to me by Professor Lepsius, of pigeons in a domesticated condition, occurs in the fifth Egyptian dynasty, about 3000 B.C.; but Mr. Birch, of the British Museum, informs me that the pigeon appears in a bill of fare in the previous dynasty. Domestic pigeons are mentioned in Genesis, Leviticus, and Isaiah. In the time of the Romans, as we learn from Pliny, immense prices were given for pigeons; "nay, they are arrived to this pass, that they can reckon up their pedigree and race." In fact, about the year 1600, pigeons were much valued by Akbar Khan; 20,000 birds were carried about with the camp, and of the best sorts thousands brought valuable collections. The monarchs of Persia, Turan, sent him some very rare breeds. The Emperor Baber, the founder of the family of Timur, by crossing the breeds which he loved produced breeds before, has improved them astonishingly. Akbar Khan possessed 37 distinct breeds, some of which were valuable for beauty alone. At about the same period of 1600 the Dutch, according to Aldrovandi, were as much about pigeons as the Romans had formerly been. The breeds which were kept during the 16th century in Europe and in India apparently differed much from each other. Tavernier, in his travels in 1657, speaks, as does Chardin, in 1735, of the vast number of pigeon-houses in Persia; and the former remarks that, as Christians were not permitted to keep pigeons, some of the vulgar actually turned Mahometans for this sole purpose. The Emperor of Morocco had his favourite breeds of pigeons, as is mentioned in Moore's Journal, published in 1738. In England, from the time of Willughby in 1676 to the present day, as well as in Germany and in France, numerous treatises have been published on the pigeon. In India, about a hundred years ago, a Persian treatise was written, and the writer thought it no light affair, for he began with a solemn invocation, "In the name of God, the merciful, the merciful." Many large towns in Europe and the United States now have their societies or devoted pigeon fanciers, and at present there are three such societies in London. In India, as I hear from Mr. Blyth, the inhabitants of Delhi and of some other great cities are eager fanciers. Mr. Layard informs me that most of the known breeds are kept in Ceylon. In China, according to Mr. Swinhoe of Amoy, and Dr. Lockhart of Shanghai, carriers, fantails, tumblers, and other varieties are reared with their feathers chiefly by the boxes or priests. The Chinese fasten a block of wood to the tail feathers of their pigeons, and as the flock wheels through the air they produce a sweet sound. In Egypt the late Abbas Pasha was a great fancier of fantails. Many pigeons are kept at Cairo and Constantinople, and these have lately been imported by amateurs. In Persia, Turkey, Russia, Italy, Spain, Portugal, India, and south of the Equator, pigeons are kept. The fact is, that wherever man has settled, and has advanced in civilisation, and has shown in how many countless, and during how many a period, man's pen has been assiduously devoted to the breeding of pigeons.

Intensely interesting is the section devoted to the "Manner of the formation of the chief races." We give one or two short passages from it.

As long as pigeons are kept under domestication or taken in their native country, without any care in selecting and restricting them, they are liable to little more variation than the wild *C. livia*, namely, in the wings being chequered with black, in the croup being blue or white, and in the size of the body. But when pigeons are transported into different countries, as into Sierra Leone, the Malay archipelago, and Madeira, where the wild *C. livia* is not known to exist), they are exposed to new conditions of life; and apparently in some cases they vary in a somewhat greater degree. When closely confined, either for the purpose of retaining them, or to prevent their straying, they must be exposed, under their native climate, to considerably different conditions; for they cannot obtain their natural diversity of food; and, what is probably more important, they are plentifully fed, whilst debarred from taking much exercise. Under these circumstances we might expect to find, from the analogy of all other domesticated animals, a greater amount of individual variability than in the wild pigeon; and this is the case. The want of exercise apparently tends to reduce the size of the feet and organs of flight; and then, from the law of correlation of growth, the beak apparently becomes affected. From what we now see occasionally taking place in our aviaries, we may conclude that sudden reversions of form, such as the appearance of a crest of feathers in the Polish fowl, the feet, of a new shade of colour, or an additional feather in the tail or wing, would occur at rare intervals during the many centuries which have elapsed since the pigeon was first domesticated. At the present day such "sports" are generally rejected as blemishes; and there is so much mystery in the breeding of pigeons that, if a valuable sport did occur, its history would often be unknown. Hence, after a long course of domestication, we might expect to see in the pigeon much individual variability, and occasional sudden variations, as well as slight modifications from the blended use of certain parts, together with the effects of correlation of growth. But without selec-

tion all this would produce only a trifling or no result; for without such aid differences of all kinds would, from the two following causes, soon disappear. In a [illegible] and [illegible] lot of pigeons many more young birds are killed or die than are reared to maturity; so that an individual having any peculiar character, if not selected, would run a good chance of being destroyed; and if not destroyed, the peculiarity in question would almost certainly be obliterated by free intercrossing. It might, however, occasionally happen that the same variation repeatedly occurred, owing to the action of peculiar and uniform conditions of life, and in this case it would prevail independently of selection. But when selection is brought into play all is changed; for this is the foundation-stone in the formation of new races; and with the pigeon circumstances, as we have already seen, are eminently favourable for selection. When a bird presenting some conspicuous variation has been preserved, and its offspring have been selected, carefully matched, and again propagated, and so onwards during successive generations, the principle is so obvious that nothing more need be said about it. This may be called methodical selection, for the breeder has a distinct object in view, namely, to preserve some character which has actually appeared, or to create some improvement already pictured in his mind. Another form of selection has hardly been noticed by those authors who have discussed this subject, but is even more important. This form may be called unconscious selection, for the breeder selects his birds unconsciously, unintentionally, and without method, yet he surely though slowly produces a great result. I refer to the effects which follow from each fancier at first procuring and afterwards rearing as good birds as he can according to his skill, and according to the standard of excellence at each successive period. He does not wish permanently to modify the breed; he does not look to the distant future, or speculate on the final result of the slow accumulation during many generations of successive slight changes; he is content if he possesses a good stock, and more than content if he can beat his rivals. The fancier in the time of Aldrovandi, when in the year 1600 he admired his own jacobins, pouters, or carriers, never reflected what their descendants in the year 1860 would become; he would have been astonished could he have seen our jacobins, our improved English carriers, and our pouters; he would probably have denied that they were the descendants of his own once admired stock, and he would perhaps not have valued them, for no other reason, as was written in 1765, "than because they were not like what used to be thought good when he was in the fancy." No one will attribute the lengthened beak of the carrier, the shortened beak of the short-faced tumbler, the lengthened leg of the pouter, the more perfectly enclosed hood of the jacobin, &c.—changes effected since the time of Aldrovandi, or even since a much later period—to the direct and immediate action of the conditions of life. For these several races have been modified in various and even in directly opposite ways, though kept under the same climate and treated in all respects in as nearly uniform a manner as possible. Each slight change in the length or shortness of the beak, in the length of leg, &c. has no doubt been indirectly and remotely caused by some change in the conditions to which the bird has been subjected, but we must attribute the final result, as is manifest in those cases of which we have any historical record, to the continued selection and accumulation of many slight successive variations.* * In the foregoing cases we have supposed that a sudden variation, conspicuous enough to catch a fancier's eye, first appeared; but even this degree of abruptness in the process of variation is not necessary for the formation of a new breed. When the same kind of pigeon has been kept pure, and has been bred during a long period by two or more fanciers, slight differences in the strain can often be recognised. Thus I have seen first-rate jacobins in one man's possession which certainly differed slightly in several characters from those kept by another. I possessed some excellent barbs descended from a pair which had won a prize, and another lot descended from a stock formerly kept by that famous fancier Sir John Sebright, and these plainly differed in the form of the beak; but the differences were so slight that they could hardly be described by words. Again, the common English and Dutch tumbler differ in a somewhat greater degree, both in length of beak and shape of head. What first caused these slight differences cannot be explained any more than why one man has a long nose and another a short one. In the strains long kept distinct by different fanciers, such differences are so common that they cannot be accounted for by the accident of the birds first chosen for breeding having been originally as different as they now are. The explanation no doubt lies in selection of a slightly different nature having been applied in each case; for no two fanciers have exactly the same taste, and consequently no two, in choosing and carefully matching their birds, prefer or select exactly the same. As each man naturally admires his own birds, he goes on continually exaggerating by selection whatever slight peculiarities they may possess. This will more especially happen with fanciers living in different countries, who do not compare their stocks and aim at a common standard of perfection. Thus, when a mere strain has once been formed, unconscious selection steadily tends to augment the amount of difference, and thus converts the strain into a sub-breed, and this ultimately into a well-marked breed or race. The principle of correlation of growth should never be lost sight of. Most pigeons have small feet, apparently caused by their lessened use, and from correlation, as it would appear, their beaks have likewise become reduced in length. The beak is a conspicuous organ, and, as soon as it had thus become perceptibly shortened, fanciers would almost certainly strive to reduce it still more by the continued selection of birds with the shortest beaks; whilst at the same time other fanciers, as we know has actually been the case, would, in other sub-breeds, strive to increase its length. With the increased length of the beak, the tongue would become greatly lengthened, as would the eyelids with the increased development of the eye-wattles; with the reduced or increased size of the feet the number of the scutellæ would vary; with the length of the wing the number of the primary wing-feathers would differ; and with the increased length of the body in the pouter the number of the sacral vertebræ would be augmented. These important and correlated differences of structure do not invariably characterise any breed; but if they had been attended to and selected with as much care as the more conspicuous external differences, there can hardly be a doubt that they would have been rendered constant. Fanciers could assuredly have made a race of tumblers with nine instead of ten primary wing feathers, seeing how often the number nine appears without any wish on their part, and indeed in the case of the white-winged varieties in opposition to their wish. In a similar manner if the vertebræ had been visible and had been attended to by fanciers, assuredly an additional number might easily have been fixed in the pouter. If these latter characters had once been rendered constant we should never have suspected that they had at first been highly variable, or that they had arisen from correlation, in the one case with the shortness of the wings, and in the other case with the length of the body.

Enough has been said and transcribed to explain the character and value of Mr. Darwin's new book. As a study of physical science it is a masterpiece, and will be referred to as such by all who value purely scientific methods. The central idea of the book, as of Mr. Darwin's previous work, we leave to the continued, and probably endless, discussion it will receive in all quarters. Fierce followers of Mr. Darwin will be alternately elated and disappointed with his materials. This is natural enough in the case of a conscientious experimenter. He is himself the subject of ever varying feelings. Hence the patience he exhibits; hence the fine and admirable modesty which marks his deliverances. That he has added much to the defence of the theory of the "survival of the fittest" is certain. It is here, as Mr. Darwin thinks, exemplified in the domestication of races. We shall await with great curiosity his prosecution of the subject into the sphere of pure and untouched nature. If it can be shown that the struggle for existence in that sphere does what human influence accomplishes out of it, a positive advance will have been made in scientific research. A step onward will have been made. The *destruction of the least fitting* explains the disappearance of forms between extremes of the most opposite appearances, and forces the acceptance of the idea of the development of new species. That these results have occurred, and do still occur, in the natural history of animals and plants under domestication it is the object of Mr. Darwin to show in the volumes we have so imperfectly but willingly noticed.

Midland Counties Herald

LITERATURE.

The Power of Movement in Plants. By CHARLES DARWIN, LL.D., F.R.S., assisted by FRANCIS DARWIN. With Illustrations. (London: John Murray.)

THE unceasing industry of Mr. Darwin, his perseverance in making observations, and the care he takes in preparing them for publication, and so placing them at the disposal of other students, deserves the warmest recognition of those who are competent to appreciate such valuable and self-denying labours. Even those who cannot accept all the conclusions deduced by the great naturalist from his observations, who are able to estimate their value and importance, will be anxious to acknowledge their indebtedness; for no one, we feel assured, can venture to question the good faith and sincerity of purpose with which the observations are made, or the care which is always taken to ensure accuracy of statement in presenting them to the public. We therefore feel sure that almost every naturalist will hail with thankfulness the present volume, which has a positive and undoubted value for every student of nature. Its chief object, as stated in the introduction, with much modesty, "is to describe and connect together several large classes of movement common to almost all plants." For the most commonly prevalent movement, Mr. Darwin has coined the word "circumnutation." From the evidence adduced, it seems probable that every growing part of every plant indulges in the movement so designated. The great sweeps made by the stems of twining plants, and by the tendrils of other climbers, are reasonably supposed to result from a mere increase in the amplitude of the ordinary movement of circumnutation. Plants, the leaves of which "sleep" at night, when their blades assume a vertical position, presumably owe this protective movement to modified circumnutation, and employ it to protect their upper surfaces from being chilled through radiation. Everyone who has watched the development of plants raised from seeds, must be aware of the almost invariable arched condition of the hypocotyl as it lifts the cotyledons above the surface. But probably very few are aware of the great force which plants at this early stage of their existence are able to exert, and what obstacles to their appearance above the soil they are able to overcome. Mr. Darwin mentions that he ascertained that the epicotyl (plumule) of a common bean grew upward with a force sufficient to lift a thin plate of zinc loaded with a weight of twelve ounces. Two more ounces were added, and the fourteen ounces were lifted up a little and then the tender shoot yielded and bent to one side. In all the germinating seeds observed by Mr. Darwin, the first change noticed was the protrusion of the radicle, which immediately bent downwards. As soon as the tip of the radicle protruded from the seed coats, it began to circumnutate, and the whole growing part continued to do so as long as the observations continued. The tip of the radicle also seems to be endowed with a selective power which enables it to alter the direction of its movement when it comes in contact with any substance too hard for it to penetrate, and to follow the line of least resistance. The observations on this point are both numerous and important. Many other points were satisfactorily investigated, and definite conclusions of much importance arrived at. According to Mr. Darwin's usual practice, the details of his observations are printed in smaller type than the conclusions arrived at, which the general reader will find to contain the gist of this interesting book.

AL RECORD. [APRIL 25, 1860.

GEOLOGICAL SOCIETY OF DUBLIN.

A GENERAL meeting of the society was held on Wednesday evening in the Museum Building, Trinity College. The chair was taken at eight o'clock by the Rev. Professor Haughton, President of the Society.

George Smith, Esq., of College-green, was elected a member of the society.

The President read his paper on the "Comparison of Modern Theories of the Origin of Species." After explaining the opinions of ancient philosophers on this interesting subject, he said the sciences of geology and political economy are mainly answerable for the revival of these exploded and forgotten fancies—geology, in supplying the lost history of organic life, which could never be studied profoundly from the creatures living at any given time; and political economy, in furnishing, from its mean and sordid motives, a Malthusian force supposed to be sufficient to supply the wants of previous theories. One of the earliest speculators on the origin of the diversified forms of life we see around us, and class as varieties, species, and genera, was Buffon, who published in 1766 his theory of the derivation of all mammal forms, by Degradation, from fifteen primary and perfect types, and nine special or isolated species. Some of the classes given by Buffon are as old as the time of Moses, who defines with some approach to accuracy, the class Ruminantia, distinguishing it from Pachydermata and Rodentia, in his classification of human breeding on domestic animals to be capable of production in ten or twenty years, he denies the right of his adversaries to appeal to the unaltered condition of the ass, the ostrich, or the cat, for three thousand years as a proof that specific forms balance round central types, and have no tendency to depart indefinitely from them. He continues the progress made to develop the subject:—Lamarck is the father of the Progressionists, and of the many who quote his name as an authority in support of their system, or express their disapproval of his doctrine, few have taken the trouble to understand his theory or to trace it to its origin. It is apparently founded on the confusion of species, like that of Buffon; but there is in reality an *arriere pense*, like an unseen presence, which corrupts his reasoning and discloses the motive force of his entire system. This hidden spring of action and theorising is a profound, and, as many think, a well-founded, contempt for humanity, which pervade his writings as thoroughly as it does the Voyage to the Houyhnhnms. Lamarck was too quick-witted and acute an observer, however deficient he may have been as a reasoner, to have believed his own theory, the mainspring of which is the desire to degrade man into an intelligent baboon or yahoo—what difference is there in a name? In his desire to do so he overlooks every fact at variance with his foregone conclusion, and writes of mankind with a virulence, which, though devoid of the wit of Swift, springs from the same profound and unalterable conviction of the worthlessness of the creature he describes. Lamarck's contempt for his species is again shewn in the strange list of resemblance he selects for his comparison between man and the chimpanzee, a comparison fully as degrading as Swift's mock imitation of a naturalist's description of a yahoo. Lamarck's theory consists in the assertion of six laws in number, which he dignifies with the title of laws of nature. Lamarck's theory is essentially one of Progression, and is totally opposed to that of Buffon, which is one of Degradation, yet it is remarkable that they both rest upon the same foundation—the assumed non-reality of species. Like his successors in the progression theory, Lamarck spent his life in the establishment of the reality of species, and it is a humiliating reflection that, at the close of it, he believed himself to have lived under a delusion. What must we think of the principles that guide the speculations of naturalists when we find minds like those of Buffon and Lamarck drawing opposite conclusions from the same premises. It matters little in this question whether the premises be true or false, whether species be truly distinct or not; our surprise at the logic of the naturalists is natural, and must border on a courteous contempt. The English revival of Lamarckianism, or progress in organic life, by Mr. Darwin, does not contain a single idea in advance of those contained in Lamarck's six laws which he explains. I propose to test this strange theory by a corresponding theory of the mineralogical succession of igneous rocks, which opens up a fertile field of speculation hitherto unwrought. The igneous rocks of the Palæozoic period contain abundance of felspars, whose principal constituent is potash; the Mesozoic igneous rocks abound in soda, replacing potash; and in the Tertiary period soda itself gives way to lime and magnesia. Viewed in the light of the Lamarckian philosophers, here is a distinct indication that soda and lime are only allotropic conditions of potash. We may read the history of their formation in the crust of the globe, if we will only open our eyes and see it written. I may add, by the way, that this theory of the origin of lime is more intelligible