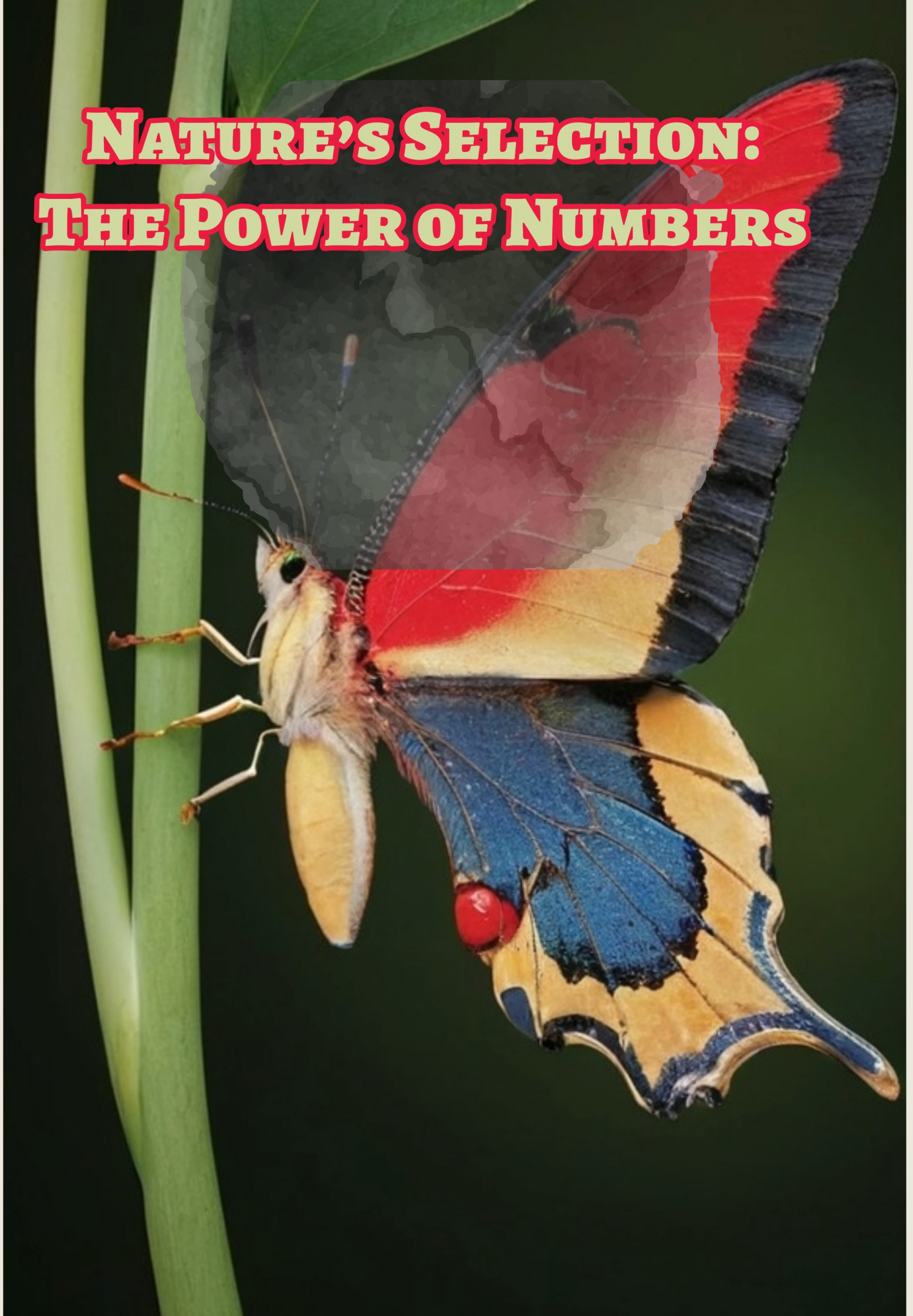
Nature's Selection:
The Power of Numbers

The facility with which man obtains new races, depends chiefly upon the number of individuals he can procure to select from. When hundreds of florists or breeders are all aiming at the same object, the work of change goes on rapidly. But a common species in nature contains a thousand-or a million-fold more individuals than any domestic race; and survival of the fittest must unerringly preserve all that vary in the right direction, not only in obvious characters but in minute details, not only in external but in internal organs; so that if the materials are sufficient for the needs of man, there can be no want of them to fulfil the grand purpose of keeping up a supply of modified organisms, exactly adapted to the changed conditions that are always occurring in the inorganic world. The Objection that there are Limits to Variation. Having now, I believe, fairly answered the chief objections of the Duke of Argyll, I proceed to notice one or two of those adduced in an able and argumentative essay on the "Origin of Species" in the North British Review for July. The writer first attempts to prove that there are strict limits to variation. When we begin to select variations in any one direction, the process is comparatively rapid, but after a considerable amount of change has been effected it becomes slower and slower, till at length its limits are reached and no care in breeding and selection can produce any further advance. The race-horse is chosen as an example. It is admitted that, with any ordinary lot of horses to begin with, careful selection would in a few years make a great improvement, and in a comparatively short time the standard of our best racers might be reached. But that standard has not for many years been materially raised, although unlimited wealth and energy are expended in the attempt. This is held to prove that there are definite limits to variation in any special direction, and that we have no reason to suppose that mere time, and the selective process being carried on by natural law, could make any material difference. But the writer does not perceive that this argument fails to meet the real question, which is, not whether indefinite and unlimited change in any or all directions is possible, but whether such differences as do occur in nature could have been produced by the accumulation of variations by selection. In the matter of speed, a limit of a definite kind as regards land animals does exist in nature. All the swiftest animals—deer, antelopes, hares, foxes, lions, leopards, horses, zebras, and many others, have reached very nearly the same degree of speed. Although the swiftest of each must have been for ages preserved, and the slowest must have perished, we have no reason to believe there is any advance of speed. The possible limit under existing conditions, and perhaps under possible terrestrial conditions, has been long ago reached. In cases, however, where this limit had not been so nearly reached as in the horse, we have been enabled to make a more marked advance and to produce a greater difference of form. The wild dog is an animal that hunts much in company, and trusts more to endurance than to speed. Man has produced the greyhound, which differs much more from the wolf or the dingo than the racer does from the wild Arabian. Domestic dogs, again, have varied more in size and in form than the whole family of Canidæ in a state of nature. No wild dog, fox, or wolf, is either so small as some of the smallest terriers and spaniels, or so large as the largest varieties of hound or Newfoundland dog. And, certainly, no two wild animals of the family differ so widely in form and proportions as the Chinese pug and the Italian greyhound, or the bulldog and the common greyhound. The known range of variation is, therefore, more than enough for the derivation of all the forms of Dogs, Wolves, and Foxes from a common ancestor. Again, it is objected that the Pouter or the Fan-tail pigeon cannot be further developed in the same direction. Variation seems to have reached its limits in these birds. But so it has in nature. The Fan-tail has not only more tail feathers than any of the three hundred and forty existing species of pigeons, but more than any of the eight thousand known species of birds.

There is, of course, some limit to the number of feathers of which a tail useful for flight can consist, and in the Fan-tail we have probably reached that limit. Many birds have the œsophagus or the skin of the neck more or less dilatable, but in no known bird is it so dilatable as in the Pouter pigeon. Here again the possible limit, compatible with a healthy existence, has probably been reached. In like manner the differences in the size and form of the beak in the various breeds of the domestic Pigeon, is greater than that between the extreme forms of beak in the various genera and sub-families of the whole Pigeon tribe. From these facts, and many others of the same nature, we may fairly infer, that if rigid selection were applied to any organ, we could in a comparatively short time produce a much greater amount of change than that which occurs between species and species in a state of nature, since the differences which we do produce are often comparable with those which exist between distinct genera or distinct families. The facts adduced by the writer of the article referred to, of the definite limits to variability in certain directions in domesticated animals, are, therefore, no objection whatever to the view, that all the modifications which exist in nature have been produced by the accumulation, by natural selection, of small and useful variations, since those very modifications have equally definite and very similar limits. Objection to the Argument from Classification. To another of this writer's objections—that by Professor Thomson's calculations the sun can only have existed in a solid state of years, and that therefore time would not suffice for the slow process of development of all living organisms—it is hardly necessary to reply, as it cannot be seriously contended, even if this calculation has claims to approximate accuracy, that the process of change and development may not have been sufficiently rapid to have occurred within that period. His objection to the Classification argument is, however, more plausible. The uncertainty of opinion among Naturalists as to which are species and which varieties, is one of very strong arguments that these two names cannot belong to things quite distinct in nature and origin. The Reviewer says that this argument is of no weight, because the works of man present exactly the same phenomena; and he instances patent inventions, and the excessive difficulty of determining whether they are new or old. I accept the analogy though it is a very imperfect one, and maintain that such as it is, it is all in favour of views. For are not all inventions of the same kind directly affiliated to a common ancestor? Are not improved Steam Engines or Clocks the lineal descendants of some existing Steam Engine or Clock? Is there ever a new Creation in Art or Science any more than in Nature? Did ever patentee absolutely originate any complete and entire invention, no portion of which was derived from anything that had been made or described before? It is therefore clear that the difficulty of distinguishing the various classes of inventions which claim to be new, is of the same nature as the difficulty of distinguishing varieties and species, because neither are absolute new creations, but both are alike descendants of pre-existing forms, from which and from each other they differ by varying and often imperceptible degrees. It appears, then, that however plausible this writer's objections may seem, whenever he descends from generalities to any specific statement, his supposed difficulties turn out to be in reality strongly confirmatory of view. The extraordinary misconception of the whole subject by popular writers and reviewers, is well shown by an article which appeared in the Times newspaper on "The Reign of Law." Alluding to the supposed economy of nature, in the adaptation of each species to its own place and its special use, the reviewer remarks: "To this universal law of the greatest economy, the law of natural selection stands in direct antagonism as the law of 'greatest possible waste' of time and of creative power. To conceive a duck with webbed feet and a spoonshaped bill, living by suction, to pass naturally into a gull with webbed feet and a knife-like bill, living on flesh, in the longest possible time and in the most laborious possible way, we may conceive it to pass from the one to the other state by natural selection.

The battle of life the ducks will have to fight will increase in peril continually as they cease (with the change of their bill) to be ducks, and attain a maximum of danger in the condition in which they begin to be gulls; and ages must elapse and whole generations must perish, and countless generations of the one species be created and sacrificed, to arrive at one single pair of the other." In this passage the theory of natural selection is so absurdly misrepresented that it would be amusing, did we not consider the misleading effect likely to be produced by this kind of teaching in so popular a journal. It is assumed that the duck and the gull are essential parts of nature, each well fitted for its place, and that if one had been produced from the other by a gradual metamorphosis, the intermediate forms would have been useless, unmeaning, and unfitted for any place, in the system of the universe. Now, this idea can only exist in a mind ignorant of the very foundation and essence of the theory of natural selection, which is, the preservation of useful variations only, or, as has been well expressed, in other words, the "survival of the fittest." Every intermediate form which could possibly have arisen during the transition from the duck to the gull, so far from having an unusually severe battle to fight for existence, or incurring any "maximum of danger," would necessarily have been as accurately adjusted to the rest of nature, and as well fitted to maintain and to enjoy its existence, as the duck or the gull actually are. If it were not so, it never could have been produced under the law of natural selection. Intermediate or generalized Forms of extinct Animals, an indication of Transmutation or Development. The misconception of this writer illustrates another point very frequently overlooked. It is an essential part of theory, that one existing animal has not been derived from any other existing animal, but that both are the descendants of a common ancestor, which was at once different from either, but, in essential characters, intermediate between them both. The illustration of the duck and the gull is therefore misleading; one of these birds has not been derived from the other, but both from a common ancestor. This is not a mere supposition invented to support the theory of natural selection, but is founded on a variety of indisputable facts. As we go back into past time, and meet with the fossil remains of more and more ancient races of extinct animals, we find that many of them actually are intermediate between distinct groups of existing animals. Professor Owen continually dwells on this fact: he says in his "Palæontology,": "A more generalized vertebrate structure is illustrated, in the extinct reptiles, by the affinities to ganoid fishes, shown by Ganocephala, Labyrinthodontia, and Icthyopterygia; by the affinities of the Pterosauria to Birds, and by the approximation of the Dinosauria to Mammals. (These have been recently shown by Professor Huxley to have more affinity to Birds.) It is manifested by the combination of modern crocodilian, chelonian, and lacertian characters in the Cryptodontia and the Dicnyodontia, and by the combined lacertian and crocodilian characters in the Thecodontia and Sauropterygia." In the same work he tells us that, "the Anoplotherium, in several important characters resembled the embryo Ruminant, but retained throughout life those marks of adhesion to a generalized mammalian type;"—and assures us that he has "never omitted a proper opportunity for impressing the results of observations showing the more generalized structures of extinct as compared with the more specialized forms of recent animals." Modern palæontologists have discovered hundreds of examples of these more generalized or ancestral types. In the time of Cuvier, the Ruminants and the Pachyderms were looked upon as two of the most distinct orders of animals; but it is now demonstrated that there once existed a variety of genera and species, connecting by almost imperceptible grades such widely different animals as the pig and the camel. Among living quadrupeds we can scarcely find a more isolated group than the genus Equus, comprising the horses, asses, and Zebras; but through many species of Paloplotherium, Hippotherium, and Hipparion, and numbers of extinct forms of Equus found in Europe, India, and America, an almost complete transition is established with the Eocene Anoplothorium and Paleotherium, which are also generalized or ancestral types of the Tapir and Rhinoceros.

The recent researches of M. Gaudry in Greece have furnished much new evidence of the same character. In the Miocene beds of Pikermi he has discovered the group of the Simocyonidæ intermediate between bears and wolves; the genus Hyænictis which connects the hyænas with the civets; the Ancylotherium, which is allied both to the extinct mastodon and to the living pangolin or scaly anteater; and the Helladotherium, which connects the now isolated giraffe with the deer and antelopes. Between reptiles and fishes an intermediate type has been found in the Archegosaurus of the Coal formation; while the Labyrinthodon of the Trias combined characters of the Batrachia with those of crocodiles, lizards, and ganoid fishes. Even birds, the most apparently isolated of all living forms, and the most rarely preserved in a fossil state, have been shown to possess undoubted affinities with reptiles; and in the Oolitic Archæopteryx, with its lengthened tail, feathered on each side, we have one of the connecting links from the side of birds; while Professor Huxley has recently shown that the entire order of Dinosaurians have remarkable affinities to birds, and that one of them, the Compsognathus, makes a nearer approach to bird organisation than does Archæopteryx to that of reptiles. Analogous facts to those occur in other classes of animals, as an example of which we have the authority of a distinguished paleontologist, M. Barande, quoted by for the statement, that although the Palæozoic Invertebrata can certainly be classed under existing groups, yet at this ancient period the groups were not so distinctly separated from each other as they are now; while tells us, that some of the fossil insects discovered in the Coal formation of America offer characters intermediate between those of existing orders. Agassiz, again, insists strongly that the more ancient animals resemble the embryonic forms of existing species; but as the embryos of distinct groups are known to resemble each other more than the adult animals (and in fact to be undistinguishable at a very early age), this is the same as saying that the ancient animals are exactly what, on Darwin's theory, the ancestors of existing animals ought to be; and this, it must be remembered, is the evidence of one of the strongest opponents of the theory of natural selection. Conclusion. I have thus endeavoured to meet fairly, and to answer plainly, a few of the most common objections to the theory of natural selection, and I have done so in every case by referring to admitted facts and to logical deductions from those facts. As an indication and general summary of the line of argument I have adopted, I here give a brief demonstration in a tabular form of the Origin of Species by means of Natural Selection, referring for the facts to works, and to the pages in this volume, where they are more or less fully treated. Among the most advanced students of man, there exists a wide difference of opinion on some of the most vital questions respecting his nature and origin. Anthropologists are now, indeed, pretty well agreed that man is not a recent introduction into the earth. All who have studied the question, now admit that his antiquity is very great; and that, though we have to some extent ascertained the minimum of time during which he must have existed, we have made no approximation towards determining that far greater period during which he may have, and probably has existed. We can with tolerable certainty affirm that man must have inhabited the earth a thousand centuries ago, but we cannot assert that he positively did not exist, or that there is any good evidence against his having existed, for a period of ten thousand centuries. We know positively, that he was contemporaneous with many now extinct animals, and has survived changes of the earth's surface fifty or a hundred times greater than any that have occurred during the historical period; but we cannot place any definite limit to the number of species he may have outlived, or to the amount of terrestrial change he may have witnessed. Wide differences of opinion as to Man's Origin. But while on this question of man's antiquity there is a very general agreement,—and all are waiting eagerly for fresh evidence to clear up those points which all admit to be full of doubt,—on other, and not less obscure and difficult questions, a considerable amount of dogmatism is exhibited; doctrines are put forward as established truths, no doubt or hesitation is admitted, and it seems to be supposed that no further evidence is required, or that any new facts can modify our convictions.

This is especially the case when we inquire,—Are the various forms under which man now exists primitive, or derived from preexisting forms; in other words, is man of one or many species? To this question we immediately obtain distinct answers diametrically opposed to each other: the one party positively maintaining, that man is a species and is essentially one— that all differences are but local and temporary variations, produced by the different physical and moral conditions by which he is surrounded; the other party maintaining with equal confidence, that man is a genus of many species, each of which is practically unchangeable, and has ever been as distinct, or even more distinct, than we now behold them. This difference of opinion is somewhat remarkable, when we consider that both parties are well acquainted with the subject; both use the same vast accumulation of facts; both reject those early traditions of mankind which profess to give an account of his origin; and both declare that they are seeking fearlessly after truth alone; yet each will persist in looking only at the portion of truth on his own side of the question, and at the error which is mingled with his opponent's doctrine. It is my wish to show how the two opposing views can be combined, so as to eliminate the error and retain the truth in each, and it is by means of Mr. Darwin's celebrated theory of "Natural Selection" that I hope to do this, and thus to harmonise the conflicting theories of modern anthropologists. Let us first see what each party has to say for itself. In favour of the unity of mankind it is argued, that there are no races without transitions to others; that every race exhibits within itself variations of colour, of hair, of feature, and of form, to such a degree as to bridge over, to a large extent, the gap that separates it from other races. It is asserted that no race is homogeneous; that there is a tendency to vary; that climate, food, and habits produce, and render permanent, physical peculiarities, which, though slight in the limited periods allowed to our observation, would, in the long ages during which the human race has existed, have sufficed to produce all the differences that now appear. It is further asserted that the advocates of the opposite theory do not agree among themselves; that some would make three, some five, some fifty or a hundred and fifty species of man; some would have had each species created in pairs, while others require nations to have at once sprung into existence, and that there is no stability or consistency in any doctrine but that of one primitive stock. The advocates of the original diversity of man, on the other hand, have much to say for themselves. They argue that proofs of change in man have never been brought forward except to the most trifling amount, while evidence of his permanence meets us everywhere. The Portuguese and Spaniards, settled for two or three centuries in South America, retain their chief physical, mental, and moral characteristics; the Dutch boers at the Cape, and the descendants of the early Dutch settlers in the Moluccas, have not lost the features or the colour of the Germanic races; the Jews, scattered over the world in the most diverse climates, retain the same characteristic lineaments everywhere; the Egyptian sculptures and paintings show us that, for at least years, the strongly contrasted features of the Negro and the Semitic races have remained altogether unchanged; while more recent discoveries prove, that the moundbuilders of the Mississippi valley, and the dwellers on Brazilian mountains, had, even in the very infancy of the human race, some traces of the same peculiar and characteristic type of cranial formation that now distinguishes them. If we endeavour to decide impartially on the merits of this difficult controversy, judging solely by the evidence that each party has brought forward, it certainly seems that the best of the argument is on the side of those who maintain the primitive diversity of man. Their opponents have not been able to refute the permanence of existing races as far back as we can trace them, and have failed to show, in a single case, that at any former epoch the well marked varieties of mankind approximated more closely than they do at the present day. At the same time this is but negative evidence. A condition of immobility for four or five thousand years, does not preclude an advance at an earlier epoch, and—if we can show that there are causes in nature which would check any further physical change when certain conditions were fulfilled—does not even render such an advance improbable, if there are any general arguments to be adduced in its favour.

Such a cause, I believe, does exist; and I shall now endeavour to point out its nature and its mode of operation. Outline of the Theory of Natural Selection. In order to make my argument intelligible, it is necessary for me to explain very briefly the theory of “Natural Selection” promulgated by and the power which it possesses of modifying the forms of animals and plants. The grand feature in the multiplication of organic life is, that close general resemblance is combined with more or less individual variation. The child resembles its parents or ancestors more or less closely in all its peculiarities, deformities, or beauties; it resembles them in general more than it does any other individuals; yet children of the same parents are not all alike, and it often happens that they differ very considerably from their parents and from each other. This is equally true, of man, of all animals, and of all plants. Moreover, it is found that individuals do not differ from their parents in certain particulars only, while in all others they are exact duplicates of them. They differ from them and from each other, in every particular: in form, in size, in colour; in the structure of internal as well as of external organs; in those subtle peculiarities which produce differences of constitution, as well as in those still more subtle ones which lead to modifications of mind and character. In other words, in every possible way, in every organ and in every function, individuals of the same stock vary. Now, health, strength, and long life, are the results of a harmony between the individual and the universe that surrounds it. Let us suppose that at any given moment this harmony is perfect. A certain animal is exactly fitted to secure its prey, to escape from its enemies, to resist the inclemencies of the seasons, and to rear a numerous and healthy offspring. But a change now takes place. A series of cold winters, for instance, come on, making food scarce, and bringing an immigration of some other animals to compete with the former inhabitants of the district. The new immigrant is swift of foot, and surpasses its rivals in the pursuit of game; the winter nights are colder, and require a thicker fur as a protection, and more nourishing food to keep up the heat of the system. Our supposed perfect animal is no longer in harmony with its universe; it is in danger of dying of cold or of starvation. But the animal varies in its offspring. Some of these are swifter than others—they still manage to catch food enough; some are hardier and more thickly furred—they manage in the cold nights to keep warm enough; the slow, the weak, and the thinly clad soon die off. Again and again, in each succeeding generation, the same thing takes place. By this natural process, which is so inevitable that it cannot be conceived not to act, those best adapted to live, live; those least adapted, die. It is sometimes said that we have no direct evidence of the action of this selecting power in nature. But it seems to me we have better evidence than even direct observation would be, because it is more universal, viz., the evidence of necessity. It must be so; for, as all wild animals increase in a geometrical ratio, while their actual numbers remain on the average stationary, it follows, that as many die annually as are born. If, therefore, we deny natural selection, it can only be by asserting that, in such a case as I have supposed, the strong, the healthy, the swift, the well clad, the well organised animals in every respect, have no advantage over,—do not on the average live longer than, the weak, the unhealthy, the slow, the ill-clad, and the imperfectly organised individuals; and this no sane man has yet been found hardy enough to assert. But this is not all; for the offspring on the average resemble their parents, and the selected portion of each succeeding generation will therefore be stronger, swifter, and more thickly furred than the last; and if this process goes on for thousands of generations, our animal will have again become thoroughly in harmony with the new conditions in which it is placed. But it will now be a different creature. It will be not only swifter and stronger, and more furry, it will also probably have changed in colour, in form, perhaps have acquired a longer tail, or differently shaped ears; for it is an ascertained fact, that when one part of an animal is modified, some other parts almost always change, as it were in sympathy with it.

calls this “correlation of growth,” and gives as instances, that hairless dogs have imperfect teeth; white cats, when blue-eyed, are deaf; small feet accompany short beaks in pigeons; and other equally interesting cases. Grant, therefore, the premises: That peculiarities of every kind are more or less hereditary. That the offspring of every animal vary more or less in all parts of their organization. That the universe in which these animals live, is not absolutely invariable;—none of which propositions can be denied; and then consider, that the animals in any country (those at least which are not dying out) must at each successive period be brought into harmony with the surrounding conditions; and we have all the elements for a change of form and structure in the animals, keeping exact pace with changes of whatever nature in the surrounding universe. Such changes must be slow, for the changes in the universe are very slow; but just as these slow changes become important, when we look at results after long periods of action, as we do when we perceive the alterations of the earth’s surface during geological epochs; so the parallel changes in animal form become more and more striking, in proportion as the time they have been going on is great; as we see when we compare our living animals with those which we disentomb from each successively older geological formation. This is, briefly, the theory of “natural selection,” which explains the changes in the organic world as being parallel with, and in part dependent on, those in the inorganic. What we now have to inquire is,—Can this theory be applied in any way to the question of the origin of the races of man? or is there anything in human nature that takes him out of the category of those organic existences, over whose successive mutations it has had such powerful sway? Different effects of Natural Selection on Animals and on Man. In order to answer these questions, we must consider why it is that “natural selection” acts so powerfully upon animals; and we shall, I believe, find, that its effect depends mainly upon their self-dependence and individual isolation. A slight injury, a temporary illness, will often end in death, because it leaves the individual powerless against its enemies. If an herbivorous animal is a little sick and has not fed well for a day or two, and the herd is then pursued by a beast of prey, our poor invalid inevitably falls a victim. So, in a carnivorous animal, the least deficiency of vigour prevents its capturing food, and it soon dies of starvation. There is, as a general rule, no mutual assistance between adults, which enables them to tide over a period of sickness. Neither is there any division of labour; each must fulfil all the conditions of its existence, and, therefore, “natural selection” keeps all up to a pretty uniform standard. But in man, as we now behold him, this is different. He is social and sympathetic. In the rudest tribes the sick are assisted, at least with food; less robust health and vigour than the average does not entail death. Neither does the want of perfect limbs, or other organs, produce the same effects as among animals. Some division of labour takes place; the swiftest hunt, the less active fish, or gather fruits; food is, to some extent, exchanged or divided. The action of natural selection is therefore checked; the weaker, the dwarfish, those of less active limbs, or less piercing eyesight, do not suffer the extreme penalty which falls upon animals so defective. In proportion as these physical characteristics become of less importance, mental and moral qualities will have increasing influence on the well-being of the race. Capacity for acting in concert for protection, and for the acquisition of food and shelter; sympathy, which leads all in turn to assist each other; the sense of right, which checks depredations upon our fellows; the smaller development of the combative and destructive propensities; self-restraint in present appetites; and that intelligent foresight which prepares for the future, are all qualities, that from their earliest appearance must have been for the benefit of each community, and would, therefore, have become the subjects of “natural selection.” For it is evident that such qualities would be for the well-being of man; would guard him against external enemies, against internal dissensions, and against the effects of inclement seasons and impending famine, more surely than could any merely physical modification.

Tribes in which such mental and moral qualities were predominant, would therefore have an advantage in the struggle for existence over other tribes in which they were less developed, would live and maintain their numbers, while the others would decrease and finally succumb. Again, when any slow changes of physical geography, or of climate, make it necessary for an animal to alter its food, its clothing, or its weapons, it can only do so by the occurrence of a corresponding change in its own bodily structure and internal organization. If a larger or more powerful beast is to be captured and devoured, as when a carnivorous animal which has hitherto preyed on antelopes is obliged from their decreasing numbers to attack buffaloes, it is only the strongest who can hold,—those with most powerful claws, and formidable canine teeth, that can struggle with and overcome such an animal. Natural selection immediately comes into play, and by its action these organs gradually become adapted to their new requirements. But man, under similar circumstances, does not require longer nails or teeth, greater bodily strength or swiftness. He makes sharper spears, or a better bow, or he constructs a cunning pitfall, or combines in a hunting party to circumvent his new prey. The capacities which enable him to do this are what he requires to be strengthened, and these will, therefore, be gradually modified by "natural selection," while the form and structure of his body will remain unchanged. So, when a glacial epoch comes on, some animals must acquire warmer fur, or a covering of fat, or else die of cold. Those best clothed by nature are, therefore, preserved by natural selection. Man, under the same circumstances, will make himself warmer clothing, and build better houses; and the necessity of doing this will react upon his mental organization and social condition—will advance them while his natural body remains naked as before. When the accustomed food of some animal becomes scarce or totally fails, it can only exist by becoming adapted to a new kind of food, a food perhaps less nourishing and less digestible. "Natural selection" will now act upon the stomach and intestines, and all their individual variations will be taken advantage of, to modify the race into harmony with its new food. In many cases, however, it is probable that this cannot be done. The internal organs may not vary quick enough, and then the animal will decrease in numbers, and finally become extinct. But man guards himself from such accidents by superintending and guiding the operations of nature. He plants the seed of his most agreeable food, and thus procures a supply, independent of the accidents of varying seasons or natural extinction. He domesticates animals, which serve him either to capture food or for food itself, and thus, changes of any great extent in his teeth or digestive organs are rendered unnecessary. Man, too, has everywhere the use of fire, and by its means can render palatable a variety of animal and vegetable substances, which he could hardly otherwise make use of; and thus obtains for himself a supply of food far more varied and abundant than that which any animal can command. Thus man, by the mere capacity of clothing himself, and making weapons and tools, has taken away from nature that power of slowly but permanently changing the external form and structure, in accordance with changes in the external world, which she exercises over all other animals. As the competing races by which they are surrounded, the climate, the vegetation, or the animals which serve them for food, are slowly changing, they must undergo a corresponding change in their structure, habits, and constitution, to keep them in harmony with the new conditions—to enable them to live and maintain their numbers. But man does this by means of his intellect alone, the variations of which enable him, with an unchanged body, still to keep in harmony with the changing universe. There is one point, however, in which nature will still act upon him as it does on animals, and, to some extent, modify his external characters. has shown, that the colour of the skin is correlated with constitutional peculiarities both in vegetables and animals, so that liability to certain diseases or freedom from them is often accompanied by marked external characters. Now, there is every reason to believe that this has acted, and, to some extent, may still continue to act, on man. In localities where certain diseases are prevalent, those individuals of savage races which were subject to them would rapidly die off; while those who were constitutionally free from the disease would survive, and form the progenitors of a new race.

These favoured individuals would probably be distinguished by peculiarities of colour, with which again peculiarities in the texture or the abundance of hair seem to be correlated, and thus may have been brought about those racial differences of colour, which seem to have no relation to mere temperature or other obvious peculiarities of climate. From the time, therefore, when the social and sympathetic feelings came into active operation, and the intellectual and moral faculties became fairly developed, man would cease to be influenced by "natural selection" in his physical form and structure. As an animal he would remain almost stationary, the changes of the surrounding universe ceasing to produce in him that powerful modifying effect which they exercise over other parts of the organic world. But from the moment that the form of his body became stationary, his mind would become subject to those very influences from which his body had escaped; every slight variation in his mental and moral nature which should enable him better to guard against adverse circumstances, and combine for mutual comfort and protection, would be preserved and accumulated; the better and higher specimens of our race would therefore increase and spread, the lower and more brutal would give way and successively die out, and that rapid advancement of mental organization would occur, which has raised the very lowest races of man so far above the brutes (although differing so little from some of them in physical structure), and, in conjunction with scarcely perceptible modifications of form, has developed the wonderful intellect of the European races. Influence of external Nature in the development of the Human Mind. But from the time when this mental and moral advance commenced, and man's physical character became fixed and almost immutable, a new series of causes would come into action, and take part in his mental growth. The diverse aspects of nature would now make themselves felt, and profoundly influence the character of the primitive man. When the power that had hitherto modified the body had its action transferred to the mind, then races would advance and become improved, merely by the harsh discipline of a sterile soil and inclement seasons. Under their influence, a hardier, a more provident, and a more social race would be developed, than in those regions where the earth produces a perennial supply of vegetable food, and where neither foresight nor ingenuity are required to prepare for the rigours of winter. And is it not the fact that in all ages, and in every quarter of the globe, the inhabitants of temperate have been superior to those of hotter countries? All the great invasions and displacements of races have been from North to South, rather than the reverse; and we have no record of there ever having existed, any more than there exists to-day, a solitary instance of an indigenous inter-tropical civilization. The Mexican civilization and government came from the North, and, as well as the Peruvian, was established, not in the rich tropical plains, but on the lofty and sterile plateaux of the Andes. The religion and civilization of Ceylon were introduced from North India; the successive conquerors of the Indian peninsula came from the North-west; the northern Mongols conquered the more Southern Chinese; and it was the bold and adventurous tribes of the North that overran and infused new life into Southern Europe. Extinction of Lower Races. It is the same great law of "the preservation of favoured races in the struggle for life," which leads to the inevitable extinction of all those low and mentally undeveloped populations with which Europeans come in contact. The red Indian in North America, and in Brazil; the Tasmanian, Australian, and New Zealander in the southern hemisphere, die out, not from any one special cause, but from the inevitable effects of an unequal mental and physical struggle. The intellectual and moral, as well as the physical, qualities of the European are superior; the same powers and capacities which have made him rise in a few centuries from the condition of the wandering savage with a scanty and stationary population, to his present state of culture and advancement, with a greater average longevity, a greater average strength, and a capacity of more rapid increase,—enable him when in contact with the savage man, to conquer in the struggle for existence, and to increase at his expense, just as the better adapted, increase at the expense of the less adapted varieties in the animal and vegetable kingdoms,—just as the weeds of Europe overrun North America and Australia, extinguishing native productions by the inherent vigour of their organization, and by their greater capacity for existence and multiplication.

The Origin of the Races of Man. If these views are correct; if in proportion as man's social, moral, and intellectual faculties became developed, his physical structure would cease to be affected by the operation of "natural selection," we have a most important clue to the origin of races. For it will follow, that those great modifications of structure and of external form, which resulted in the development of man out of some lower type of animal, must have occurred before his intellect had raised him above the condition of the brutes, at a period when he was gregarious, but scarcely social, with a mind perceptive but not reflective, ere any sense of right or feelings of sympathy had been developed in him. He would be still subject, like the rest of the organic world, to the action of "natural selection," which would retain his physical form and constitution in harmony with the surrounding universe. He was probably at a very early period a dominant race, spreading widely over the warmer regions of the earth as it then existed, and in agreement with what we see in the case of other dominant species, gradually becoming modified in accordance with local conditions. As he ranged farther from his original home, and became exposed to greater extremes of climate, to greater changes of food, and had to contend with new enemies, organic and inorganic, slight useful variations in his constitution would be selected and rendered permanent, and would, on the principle of "correlation of growth," be accompanied by corresponding external physical changes. Thus might have arisen those striking characteristics and special modifications which still distinguish the chief races of mankind. The red, black, yellow, or blushing white skin; the straight, the curly, the woolly hair; the scanty or abundant beard; the straight or oblique eyes; the various forms of the pelvis, the cranium, and other parts of the skeleton. But while these changes had been going on, his mental development had, from some unknown cause, greatly advanced, and had now reached that condition in which it began powerfully to influence his whole existence, and would therefore become subject to the irresistible action of "natural selection." This action would quickly give the ascendency to mind: speech would probably now be first developed, leading to a still further advance of the mental faculties; and from that moment man, as regards the form and structure of most parts of his body, would remain almost stationary. The art of making weapons, division of labour, anticipation of the future, restraint of the appetites, moral, social, and sympathetic feelings, would now have a preponderating influence on his well being, and would therefore be that part of his nature on which "natural selection" would most powerfully act; and we should thus have explained that wonderful persistence of mere physical characteristics, which is the stumbling-block of those who advocate the unity of mankind. We are now, therefore, enabled to harmonise the conflicting views of anthropologists on this subject. Man may have been, indeed I believe must have been, once a homogeneous race; but it was at a period of which we have as yet discovered no remains, at a period so remote in his history, that he had not yet acquired that wonderfully developed brain, the organ of the mind, which now, even in his lowest examples, raises him far above the highest brutes;—at a period when he had the form but hardly the nature of man, when he neither possessed human speech, nor those sympathetic and moral feelings which in a greater or less degree everywhere now distinguish the race. Just in proportion as these truly human faculties became developed in him, would his physical features become fixed and permanent, because the latter would be of less importance to his well being; he would be kept in harmony with the slowly changing universe around him, by an advance in mind, rather than by a change in body. If, therefore, we are of opinion that he was not really man till these higher faculties were fully developed, we may fairly assert that there were many originally distinct races of men; while, if we think that a being closely resembling us in form and structure, but with mental faculties scarcely raised above the brute, must still be considered to have been human, we are fully entitled to maintain the common origin of all mankind. The Bearing of these Views on the Antiquity of Man. These considerations, it will be seen, enable us to place the origin of man at a much more remote geological epoch than has yet been thought possible. He may even have lived in the Miocene or Eocene period, when not a single mammal was identical in form with any existing species.

For, in the long series of ages during which these primeval animals were being slowly changed into the species which now inhabit the earth, the power which acted to modify them would only affect the mental organization of man. His brain alone would have increased in size and complexity, and his cranium have undergone corresponding changes of form, while the whole structure of lower animals was being changed. This will enable us to understand how the fossil crania of Denise and Engis agree so closely with existing forms, although they undoubtedly existed in company with large mammalia now extinct. The Neanderthal skull may be a specimen of one of the lowest races then existing, just as the Australians are the lowest of our modern epoch. We have no reason to suppose that mind and brain and skull modification, could go on quicker than that of the other parts of the organization; and we must therefore look back very far in the past, to find man in that early condition in which his mind was not sufficiently developed, to remove his body from the modifying influence of external conditions and the cumulative action of "natural selection." I believe, therefore, that there is no à priori reason against our finding the remains of man or his works in the tertiary deposits. The absence of all such remains in the European beds of this age has little weight, because, as we go further back in time, it is natural to suppose that man's distribution over the surface of the earth was less universal than at present. Besides, Europe was in a great measure submerged during the tertiary epoch; and though its scattered islands may have been uninhabited by man, it by no means follows that he did not at the same time exist in warm or tropical continents. If geologists can point out to us the most extensive land in the warmer regions of the earth, which has not been submerged since Eocene or Miocene times, it is there that we may expect to find some traces of the very early progenitors of man. It is there that we may trace back the gradually decreasing brain of former races, till we come to a time when the body also begins materially to differ. Then we shall have reached the starting point of the human family. Before that period, he had not mind enough to preserve his body from change, and would, therefore, have been subject to the same comparatively rapid modifications of form as the other mammalia. Their Bearing on the Dignity and Supremacy of Man. If the views I have here endeavoured to sustain have any foundation, they give us a new argument for placing man apart, as not only the head and culminating point of the grand series of organic nature, but as in some degree a new and distinct order of being. From those infinitely remote ages, when the first rudiments of organic life appeared upon the earth, every plant, and every animal has been subject to one great law of physical change. As the earth has gone through its grand cycles of geological, climatal, and organic progress, every form of life has been subject to its irresistible action, and has been continually, but imperceptibly moulded into such new shapes as would preserve their harmony with the ever-changing universe. No living thing could escape this law of its being; none (except, perhaps, the simplest and most rudimentary organisms), could remain unchanged and live, amid the universal change around it. At length, however, there came into existence a being in whom that subtle force we term mind, became of greater importance than his mere bodily structure. Though with a naked and unprotected body, this gave him clothing against the varying inclemencies of the seasons. Though unable to compete with the deer in swiftness, or with the wild bull in strength, this gave him weapons with which to capture or overcome both. Though less capable than most other animals of living on the herbs and the fruits that unaided nature supplies, this wonderful faculty taught him to govern and direct nature to his own benefit, and make her produce food for him, when and where he pleased. From the moment when the first skin was used as a covering, when the first rude spear was formed to assist in the chase, when fire was first used to cook his food, when the first seed was sown or shoot planted, a grand revolution was effected in nature, a revolution which in all the previous ages of the earth's history had had no parallel, for a being had arisen who was no longer necessarily subject to change with the changing universe—a being who was in some degree superior to nature, inasmuch as he knew how to control and regulate her action, and could keep himself in harmony with her, not by a change in body, but by an advance of mind.

Here, then, we see the true grandeur and dignity of man. On this view of his special attributes, we may admit, that even those who claim for him a position as an order, a class, or a sub-kingdom by himself, have some show of reason on their side. He is, indeed, a being apart, since he is not influenced by the great laws which irresistibly modify all other organic beings. Nay more; this victory which he has gained for himself, gives him a directing influence over other existences. Man has not only escaped "natural selection" himself, but he is actually able to take away some of that power from nature which before his appearance she universally exercised. We can anticipate the time when the earth will produce only cultivated plants and domestic animals; when man's selection shall have supplanted "natural selection;" and when the ocean will be the only domain in which that power can be exerted, which for countless cycles of ages ruled supreme over all the earth. Their Bearing on the future Development of Man. We now find ourselves enabled to answer those who maintain, that if Mr. Darwin's theory of the Origin of Species is true, man too must change in form, and become developed into some other animal as different from his present self as he is from the Gorilla or the Chimpanzee; and who speculate on what this form is likely to be. But it is evident that such will not be the case; for no change of conditions is conceivable, which will render any important alteration of his form and organization so universally useful and necessary to him, as to give those possessing it always the best chance of surviving, and thus lead to the development of a new species, genus, or higher group of man. On the other hand, we know that far greater changes of conditions and of his entire environment have been undergone by man, than any other highly organized animal could survive unchanged, and have been met by mental, not corporeal adaptation. The difference of habits, of food, clothing, weapons, and enemies, between savage and civilized man, is enormous. Difference in bodily form and structure there is practically none, except a slightly increased size of brain, corresponding to his higher mental development. We have every reason to believe, then, that man may have existed and may continue to exist, through a series of geological periods which shall see all other forms of animal life again and again changed; while he himself remains unchanged, except in the two particulars already specified—the head and face, as immediately connected with the organ of the mind and as being the medium of expressing the most refined emotions of his nature,—and to a slight extent in colour, hair, and proportions, so far as they are correlated with constitutional resistance to disease. Summary. Briefly to recapitulate the argument;—in two distinct ways has man escaped the influence of those laws which have produced unceasing change in the animal world. By his superior intellect he is enabled to provide himself with clothing and weapons, and by cultivating the soil to obtain a constant supply of congenial food. This renders it unnecessary for his body, like those of the lower animals, to be modified in accordance with changing conditions—to gain a warmer natural covering, to acquire more powerful teeth or claws, or to become adapted to obtain and digest new kinds of food, as circumstances may require. By his superior sympathetic and moral feelings, he becomes fitted for the social state; he ceases to plunder the weak and helpless of his tribe; he shares the game which he has caught with less active or less fortunate hunters, or exchanges it for weapons which even the weak or the deformed can fashion; he saves the sick and wounded from death; and thus the power which leads to the rigid destruction of all animals who cannot in every respect help themselves, is prevented from acting on him. This power is "natural selection;" and, as by no other means can it be shown, that individual variations can ever become accumulated and rendered permanent so as to form well-marked races, it follows that the differences which now separate mankind from other animals, must have been produced before he became possessed of a human intellect or human sympathies. This view also renders possible, or even requires, the existence of man at a comparatively remote geological epoch. For, during the long periods in which other animals have been undergoing modification in their whole structure, to such an amount as to constitute distinct genera and families, man's body will have remained generically, or even specifically, the same, while his head and brain alone will have undergone modification equal to theirs.

We can thus understand how it is that, judging from the head and brain, Professor Owen places man in a distinct sub-class of mammalia, while as regards the bony structure of his body, there is the closest anatomical resemblance to the anthropoid apes, “every tooth, every bone, strictly homologous—which makes the determination of the difference between Homo and Pithecus the anatomist’s difficulty.” The present theory fully recognises and accounts for these facts; and we may perhaps claim as corroborative of its truth, that it neither requires us to depreciate the intellectual chasm which separates man from the apes, nor refuses full recognition of the striking resemblances to them, which exist in other parts of his structure. Conclusion. In concluding this brief sketch of a great subject, I would point out its bearing upon the future of the human race. If my conclusions are just, it must inevitably follow that the higher—the more intellectual and moral—must displace the lower and more degraded races; and the power of “natural selection,” still acting on his mental organization, must ever lead to the more perfect adaptation of man’s higher faculties to the conditions of surrounding nature, and to the exigencies of the social state. While his external form will probably ever remain unchanged, except in the development of that perfect beauty which results from a healthy and well organized body, refined and ennobled by the highest intellectual faculties and sympathetic emotions, his mental constitution may continue to advance and improve, till the world is again inhabited by a single nearly homogeneous race, no individual of which will be inferior to the noblest specimens of existing humanity. Our progress towards such a result is very slow, but it still seems to be a progress. We are just now living at an abnormal period of the world’s history, owing to the marvellous developments and vast practical results of science, having been given to societies too low morally and intellectually, to know how to make the best use of them, and to whom they have consequently been curses as well as blessings. Among civilized nations at the present day, it does not seem possible for natural selection to act in any way, so as to secure the permanent advancement of morality and intelligence; for it is indisputably the mediocre, if not the low, both as regards morality and intelligence, who succeed best in life and multiply fastest. Yet there is undoubtedly an advance—on the whole a steady and a permanent one—both in the influence on public opinion of a high morality, and in the general desire for intellectual elevation; and as I cannot impute this in any way to “survival of the fittest,” I am forced to conclude that it is due, to the inherent progressive power of those glorious qualities which raise us so immeasurably above our fellow animals, and at the same time afford us the surest proof that there are other and higher existences than ourselves, from whom these qualities may have been derived, and towards whom we may be ever tending. Throughout this volume I have endeavoured to show, that the known laws of variation, multiplication, and heredity, resulting in a “struggle for existence” and the “survival of the fittest,” have probably sufficed to produce all the varieties of structure, all the wonderful adaptations, all the beauty of form and of colour, that we see in the animal and vegetable kingdoms. To the best of my ability I have answered the most obvious and the most often repeated objections to this theory, and have, I hope, added to its general strength, by showing how colour—one of the strongholds of the advocates of special creation—may be, in almost all its modifications, accounted for by the combined influence of sexual selection and the need of protection. I have also endeavoured to show, how the same power which has modified animals has acted on man; and have, I believe, proved that, as soon as the human intellect became developed above a certain low stage, man’s body would cease to be materially affected by natural selection, because the development of his mental faculties would render important modifications of its form and structure unnecessary. It will, therefore, probably excite some surprise among my readers, to find that I do not consider that all nature can be explained on the principles of which I am so ardent an advocate; and that I am now myself going to state objections, and to place limits, to the power of “natural selection.”

I believe, however, that there are such limits; and that just as surely as we can trace the action of natural laws in the development of organic forms, and can clearly conceive that fuller knowledge would enable us to follow step by step the whole process of that development, so surely can we trace the action of some unknown higher law, beyond and independent of all those laws of which we have any knowledge. We can trace this action more or less distinctly in many phenomena, the two most important of which are—the origin of sensation or consciousness, and the development of man from the lower animals. I shall first consider the latter difficulty as more immediately connected with the subjects discussed in this volume. What Natural Selection can Not do. In considering the question of the development of man by known natural laws, we must ever bear in mind the first principle of "natural selection," no less than of the general theory of evolution, that all changes of form or structure, all increase in the size of an organ or in its complexity, all greater specialization or physiological division of labour, can only be brought about, in as much as it is for the good of the being so modified. himself has taken care to impress upon us, that "natural selection" has no power to produce absolute perfection but only relative perfection, no power to advance any being much beyond his follow beings, but only just so much beyond them as to enable it to survive them in the struggle for existence. Still less has it any power to produce modifications which are in any degree injurious to its possessor, and frequently uses the strong expression, that a single case of this kind would be fatal to his theory. If, therefore, we find in man any characters, which all the evidence we can obtain goes to show would have been actually injurious to him on their first appearance, they could not possibly have been produced by natural selection. Neither could any specially developed organ have been so produced if it had been merely useless to him, or if its use were not proportionate to its degree of development. Such cases as these would prove, that some other law, or some other power, than "natural selection" had been at work. But if, further, we could see that these very modifications, though hurtful or useless at the time when they first appeared, became in the highest degree useful at a much later period, and are now essential to the full moral and intellectual development of human nature, we should then infer the action of mind, foreseeing the future and preparing for it, just as surely as we do, when we see the breeder set himself to work with the determination to produce a definite improvement in some cultivated plant or domestic animal. I would further remark that this enquiry is as thoroughly scientific and legitimate as that into the origin of species itself. It is an attempt to solve the inverse problem, to deduce the existence of a new power of a definite character, in order to account for facts which according to the theory of natural selection ought not to happen. Such problems are well known to science, and the search after their solution has often led to the most brilliant results. In the case of man, there are facts of the nature above alluded to, and in calling attention to them, and in inferring a cause for them, I believe that I am as strictly within the bounds of scientific investigation as I have been in any other portion of my work. The Brain of the Savage shown to be Larger than he Needs it to be. Size of Brain an important Element of Mental Power.—The brain is universally admitted to be the organ of the mind; and it is almost as universally admitted, that size of brain is one of the most important of the elements which determine mental power or capacity. There seems to be no doubt that brains differ considerably in quality, as indicated by greater or less complexity of the convolutions, quantity of grey matter, and perhaps unknown peculiarities of organization; but this difference of quality seems merely to increase or diminish the influence of quantity, not to neutralize it. Thus, all the most eminent modern writers see an intimate connection between the diminished size of the brain in the lower races of mankind, and their intellectual inferiority. The collections of give the following as the average internal capacity of the cranium in the chief races:—Teutonic family, cubic inches; Esquimaux, cubic inches; Negroes, cubic inches; Australians and Tasmanians, cubic inches; Bushmen, cubic inches. These last numbers, however, are deduced from comparatively few specimens, and may be below the average, just as a small number of Finns and Cossacks give cubic inches, or considerably more than that of the German races.

It is evident, therefore, that the absolute bulk of the brain is not necessarily much less in savage than in civilised man, for Esquimaux skulls are known with a capacity of inches, or hardly less than the largest among Europeans. But what is still more extraordinary, the few remains yet known of pre-historic man do not indicate any material diminution in the size of the brain case. A Swiss skull of the stone age, found in the lake dwelling of Meilen, corresponded exactly to that of a Swiss youth of the present day. The celebrated Neanderthal skull had a larger circumference than the average, and its capacity, indicating actual mass of brain, is estimated to have been not less than cubic inches, or nearly the average of existing Australian crania. The Engis skull, perhaps the oldest known, and which, according to Sir John Lubbock, "there seems no doubt was really contemporary with the mammoth and the cave bear," is yet, according to Professor Huxley, "a fair average skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage." Of the cave men of Les Eyzies, who were undoubtedly contemporary with the reindeer in the South of France, Professor Paul Broca says (in a paper read before the Congress of Pre-historic Archæology in 1868)—"The great capacity of the brain, the development of the frontal region, the fine elliptical form of the anterior part of the profile of the skull, are incontestible characteristics of superiority, such as we are accustomed to meet with in civilised races;" yet the great breadth of the face, the enormous development of the ascending ramus of the lower jaw, the extent and roughness of the surfaces for the attachment of the muscles, especially of the masticators, and the extraordinary development of the ridge of the femur, indicate enormous muscular power, and the habits of a savage and brutal race. These facts might almost make us doubt whether the size of the brain is in any direct way an index of mental power, had we not the most conclusive evidence that it is so, in the fact that, whenever an adult male European has a skull less than nineteen inches in circumference, or has less than sixty-five cubic inches of brain, he is invariably idiotic. When we join with this the equally undisputed fact, that great men—those who combine acute perception with great reflective power, strong passions, and general energy of character, such as Napoleon, Cuvier, and O'Connell, have always heads far above the average size, we must feel satisfied that volume of brain is one, and perhaps the most important, measure of intellect; and this being the case, we cannot fail to be struck with the apparent anomaly, that many of the lowest savages should have as much brains as average Europeans. The idea is suggested of a surplusage of power; of an instrument beyond the needs of its possessor. Comparison of the Brains of Man and of Anthropoid Apes.—In order to discover if there is any foundation for this notion, let us compare the brain of man with that of animals. The adult male Orang-utan is quite as bulky as a small sized man, while the Gorilla is considerably above the average size of man, as estimated by bulk and weight; yet the former has a brain of only cubic inches, the latter, one of 30, or, in the largest specimen yet known, of cubic inches. We have seen that the average cranial capacity of the lowest savages is probably not less than five-sixths of that of the highest civilized races, while the brain of the anthropoid apes scarcely amounts to one-third of that of man, in both cases taking the average; or the proportions may be more clearly represented by the following figures—anthropoid apes; savages; civilized man. But do these figures at all approximately represent the relative intellect of the three groups? Is the savage really no farther removed from the philosopher, and so much removed from the ape, as these figures would indicate? In considering this question, we must not forget that the heads of savages vary in size, almost as much as those of civilized Europeans. Thus, while the largest Teutonic skull in collection is cubic inches, there is an Araucanian of an Esquimaux of, a Marquesan of, a Negro of, and even an Australian of cubic inches. We may, therefore, fairly compare the savage with the highest European on the one side, and with the Orang, Chimpanzee, or Gorilla, on the other, and see whether there is any relative proportion between brain and intellect. Range of intellectual power in Man.—First, let us consider what this wonderful instrument, the brain, is capable of in its higher developments.