

CHAPTER VIII.

The Origin of Animal Forms—Difficulty of investigating the Subject—Theoretical Nature of the Subject—Theories of “Origin of Species”—Doctrine of “Special Creation”—Hypotheses of “Evolution”—Lamarck’s Theory of “Progressive Development”—Mr. Darwin’s Theory of “Natural Selection”—Examination of the Darwinian Hypothesis—Criticisms of and Objections to the Theory—Objections to the Theory of “Sexual Selection”—Tendency of Evolutionary Doctrines.

HAVING acquired some idea of the nature of “Species,” and bearing in mind the considerations which, in the preceding Chapter, were brought before us, the present may be deemed the most fitting stage for a brief review of the more important doctrines which in our day occupy the scientific mind, and which profess to elucidate the primary origin and successive development of the living forms which people our globe. Naturally enough, the human mind and imagination has not in any age rested content with the mere admission that living forms exist, and pass, in the course of that existence, through a series of changes more or less defined. On the contrary, the mere observation of these changes has led to the investigation of the relations of forms in the past, and with one another; and, in a perfectly natural sequence, has followed the endeavour to trace through its complicated series the progress of creation and development, and ultimately to arrive at a conception of the “beginning” itself.

The pursuit of a task, which from its nature is susceptible of little or no aid from the consideration of an unknown “past,” has necessitated the very close observation of an ascertainable “present.” And it is from the particular construction which may be put upon the probable derivation of the existing order of living forms, that the

respective theories of the origin of life and living beings derive their characteristic tenets and tendencies. We have already seen that the "species" forms the unit quantity of the organic series, and may therefore be held to represent in itself the entity peculiar to the whole series. Hence the theories which deal with the origin and relations of living beings, have directed their attention to the relations which exist between living "species" of animals and plants; since it is from modifications and variations in the development of individuals, that we may naturally argue respecting the relations of the larger groups which the collection and grouping together of individuals tend to form.

It may be well at this stage to remind the reader that we now enter upon the domain of theory and hypothesis; an assertion tantamount to the advice to be discriminating and cautious in our interpretation of the facts or experiments upon which the respective theories are based, and by which they are supported. Nor do I think that to remind the student of science, in all its aspects, that the search after truth is to be his only and constant aim, is a duty at all lying without my present province as a teacher of the principles of biology. The sacrifice of ascertained facts and convictions to preconceived notions and ideas, is a crime in an avowed truth-seeker, which, unfortunately for the advance of truth of all kinds, is but too common in these days; and one cannot escape the thought that the special odium attaching itself to any particular side or party, is the cause of more hindrance to the advance of scientific thought than can well be conceived. Nor must it be lost sight of that the conclusions to which the earnest thinker may be led, may be, and very often are, at variance with the preconceived ideas of even religion itself. And hence arise those much-to-be-deplored conflicts, from which neither party can be said to benefit, which frequently sow the germs of bitter enmity between minds that might and ought to be above the ordinary run of human passions, and which further tend to foster the very spirit of antagonism between science and

religion, which it is professedly the aim of both parties to avoid and extinguish. It is, in short, the old story of the fight between "orthodoxy" and "heterodoxy;" though we may account it a significant fact that the relative ideas involved in the use of these latter terms are susceptible of being very differently construed from the sense in which they are commonly used. Let plain truth and accuracy become the watchwords of a true system of "orthodoxy," and we shall then be able to discern who are the obstructives in the way of progress, scientific and social. These few considerations will not, I trust, be deemed unnecessary in entering upon the study of a field of thought, which, more than any other, has been, and still is, the scene of much unseemly strife and argument.

Two leading views or ideas would appear to have existed regarding the primitive origin of living forms, or "origin of species," as the subject-matter of the theories is now more commonly denominated. The first of these views is known as the "Doctrine of Special Creation;" whilst the second, termed the "Doctrine of Evolution," comprehends, under this single term, a number of more or less closely-allied theories.

The first-mentioned theory, depending upon and taking origin from the recognition of what has been termed "the Hebrew cosmogony," presents us with a very plain and easily-understood explanation of the "origin of species." This first hypothesis maintains that each species originally sprang from one or more parent-stocks, these "parent-species" being "specially created"—that is, produced by the operation of a supernatural creative power. The theory also is based upon the recognition of the immutable or unvarying nature of "species," and upon the supposition that each "species" was created within a certain area, termed its "specific centre;" and that from this "centre" the "species" subsequently radiated and dispersed itself in an area more or less wide, and according as external conditions were favourable or prejudicial to its extension.

As thus expressed, we have to bear in mind the follow-

ing points regarding this almost self-explanatory theory. Firstly, the operation of a creative power ; producing, secondly, the different distinct and generally immutable "species ;" thirdly, the distribution of these species from "specific centres ;" and, fourthly, the accounting for geographical separation of "species" by changes of geological or physical nature, operating subsequently to the creation of the species in their respective "specific centres."

The "theories of evolution" or "transmutation," as implied by the meaning of the term, maintain that the existing "species" of animals and plants have in all probability been *evolved* from, or are modifications of, pre-existing "species ;" or, to use the introductory words of Mr. Darwin himself, "that species undergo modification, and that the existing forms of life are the descendants by true generation of pre-existing forms." And carrying the process of analogy and argument still further, the evolutionist may hold that all the varied and existing forms of life may, by a similar process of evolution from pre-existing forms, have arisen or been produced from one, or from a few primæval forms. In other words, that existing species of animals and plants may have had common progenitors, in a few primitive and original forms of the simplest organisation.

The following passage, culled from Mr. Darwin's "Descent of Man," will give a preliminary idea of the supposed nature of the mode of origin and derivation of the highest form from pre-existing and lower forms :—"Man," according to Mr. Darwin, "is descended from a hairy quadruped, furnished with a tail and pointed ears, probably arboreal in its habits, and an inhabitant of the Old World. This creature, if its whole structure had been examined by a naturalist, would have been classed amongst the Quadrumana, as surely as would the common and still more ancient progenitor of the Old and New World monkeys. The Quadrumana and all the higher mammals are probably derived from an ancient marsupial animal, and this through a long line of diversified forms, either

from some reptile-like or some amphibian-like creature, and this again from some fish-like animal. In the dim obscurity of the past we can see that the early progenitor of all the Vertebrata must have been an aquatic animal, provided with branchiæ, with the two sexes united in the same individual, and with the most important organs of the body (such as the brain and heart) imperfectly developed. This animal seems to have been more like the larvæ of our existing marine Ascidians than any other known form."

We find, however, that the "theory of evolution" is by no means so recent as we might be led to think. On the contrary, it possesses a very considerable antiquity; and although, in the present day, we find that theory and fact approach more closely than before, yet the groundwork of the hypothesis was laid many years ago. Lamarck was probably the first who advocated the theory on truly philosophical grounds. This naturalist, in the beginning of the present century, announced his conviction that living forms or "species" were merely modifications of, or were descended from, pre-existing "species." And Lamarck further believed that the perpetuation of new forms so produced, was secured by the agency of physical or external conditions, by the effects of interbreeding, and by the results of the use or disuse of organs or parts. Such were the chief ideas involved in Lamarck's "Theory of Progressive Development." And although, since the days of Lamarck, evolutionists have seen reason to discard his more particular and peculiar views, yet the principle he asserts remains essentially the same—the theorists of to-day differing from him only in the recognition and maintenance of different means or agencies by which the primary process of the modification of "species" is brought about.

The "Darwinian hypothesis" forms the chief bulwark of Evolutionism in the present day. The theory promulgated by Mr. Darwin has acquired a fame far exceeding that which has attached to any previous hypothesis, and there are few educated persons who do not possess some

knowledge of the main ideas and principles involved in this theory.

In this hypothesis Mr. Darwin accounts for the modification of species, by primarily supposing the existence of certain primitive and common stocks or progenitors, and the development from these common stocks of "varieties." These "varieties" by perpetuation become first converted into "races," and from "races" into new and distinct "species." The agency by which this process of evolution—first of "varieties," then of "races," and finally of "species"—is accomplished, is that of "Natural Selection;" a process exemplified in the "artificial selection" exercised by man in mating together individuals of a species which possess any special variation from the "specific" type. In this way, man, by the "artificial selection" of particular individuals, perpetuates "varieties" to form "races;" and similarly, by "natural selection," nature may be supposed to select individuals which possess any peculiarities or variations, and thus cause these variations to be perpetuated, to form, firstly, "varieties," then "races," and finally distinct "species." The expression, "struggle for existence," has been brought into use to imply the conditions under which "natural selection" operates; those conditions consisting in the competition for food, and for the other necessities of existence. And hence this struggle for existence results in the "survival of the fittest;" the "fittest" forms being those in which peculiarities of form or habits exist, and which, therefore, transmit to their progeny those variations, from the perpetuation of which, "varieties," "races," and "species," are respectively evolved.

Latterly, Mr. Darwin has introduced into his theory another modifying influence, namely, that of "Sexual selection." The instincts of sex and of the sexual relations of forms, are by this second theory believed to exercise a powerful influence over the production of variations in form.

The primary points from which Mr. Darwin proceeds

to draw his conclusions, and upon which his hypothesis is based, are those, firstly, of the recognition of variations among the individuals of a "species," and of such variations being capable of transmission, so as to become perpetuated in "races."

We have already observed that there is an admitted tendency to variation and modification of the "specific type" among the individuals of most "species;" the general resemblance of the progeny to the parent exhibiting variation to such a degree, that in some cases the divergence amounts to a positive unlikeness. Such divergence generally tends to become perpetuated, although the limits of divergence, equally with the extent of perpetuation and with the causes of variation, are as yet comparatively undetermined. Concerning these points Mr. Darwin says—"The effects (of variations) on the offspring are either definite or indefinite. They may be considered as definite when all or nearly all the offspring of individuals exposed to certain conditions during several generations are modified in the same manner. It is extremely difficult to come to any conclusion in regard to the extent of the changes which have been thus definitely induced. There can, however, be little doubt about many slight changes,—such as size from the amount of food, colour from the nature of the food, thickness of the skin and hair from climate, etc. Each of the endless variations which we see in the plumage of our fowls must have had some efficient cause; and if the same cause were to act uniformly, during a long series of generations, on many individuals, all probably would be modified in the same manner. . . . Indefinite variability is a much more common result of changed conditions than definite variability, and has probably played a more important part in the formation of our domestic races. We see indefinite variability in the endless slight peculiarities which distinguish the individuals of the same species, and which cannot be accounted for by inheritance from either parent or from some more remote ancestor."

The proofs of such variations being capable of trans-

mission are at once numerous and well-ascertained, and we need not therefore take up space by repeating and proving here what every biologist, whether inclining to evolutionism or not, will readily admit. Mr. Darwin believes that a normal process of "true generation" or "inheritance" will, in ordinary cases, suffice for the transmission of variations to progeny.

The next point to which attention may be called, is the possibility of producing a "breed" in which the variations and peculiarities just alluded to will in turn be *perpetuated*. Examples in proof of this possibility are found in the process of "artificial selection," by means of which breeders of stock have succeeded in rendering permanent the variations or peculiarities found in different individuals of a species, and from "varieties" so constituted, new and distinct "races" have eventually been formed. And a chief point in the argument is held to be the fact that such artificially-selected "races" are distinguished by characters as distinct as those which distinguish and separate true "species."

Next in the chain of evidence come the links relating to the variability in turn of the "races." As "varieties" have been produced from "species," and perpetuated "races" from the mere "varieties," so it is assumed variations will arise among the races so produced. A lengthened period of time is demanded, no doubt, for the evolution of the new "species" from the "races;" and this demand for time has formed, as we shall have occasion to observe, one of the chief objections to Mr. Darwin's theory. But, even in the face of this objection, we may not only find, it is alleged, new "races" evolved from existing and previously modified "races," but these new "races" may evince differences in structure so remarkable and obvious as to resemble those which exist between ordinary and recognised "genera" and "species." Thus, from the single species of the Rock-Pigeon (*Columba livia*), have descended numerous breeds, these latter differing from each other in important points connected with size, form, habits, and colour; with the arrangement and num-

ber of feathers ; with the development of the "uropygium" or oil-gland ; and with the number of vertebræ or segments in the spine. Now, these characters are exactly those by which any ornithologist would distinguish between true "species." In other words, the characters which separate these derived breeds or "races," are similar to those which would, in ordinary instances, be distinctive of "species."

A curious and significant fact in regard to these derived "races," and one worthy of remembrance is, that occasionally we find in tame and "derived" pigeons, and in other forms, some characteristic and special markings peculiar to the Rock-Pigeon or original progenitor from which the various "races" have, as already remarked, been satisfactorily proved to spring. This perpetuation of "race-likeness," or "atavism," as it is called, is to be accounted one of the proofs of the transmission, even through many degrees of kinship, of the characters peculiar to the original and derivative "stock."

The arguments formerly so confidently believed in, with regard to the sterility of "hybrids," have previously been shown to be founded on insecure grounds, although admittedly this subject is one which requires further research. We have already seen that the fertility of such crossed and intermingled forms is, in all probability, destroyed through time.

Bearing in mind the foregoing and preliminary points in the theory, we now proceed to consider the more intimate aspects of "Natural Selection."

The next link is constituted by the statement, for the admission of which we are quite prepared—namely, that the high rate of increase of animals and plants inevitably tends to the production of more individuals than can possibly be provided for. "Hence," says Mr. Darwin, "as more individuals are produced than can possibly survive, there must in every case be a struggle for existence, either one individual with another of the same species, or with the individuals of distinct species, or with the physical conditions of life. It is the doctrine

of Malthus, applied with manifold force to the whole animal and vegetable kingdoms ; for, in this case, there can be no artificial increase of food, and no prudential restraint from marriage. Although some species may be now increasing, more or less rapidly, in numbers, all cannot do so, for the world would not hold them."

This progressive geometrical increase, then, is held to be a primary condition, influencing the existence and operation of the principle of "Natural Selection." The "struggle for existence" is thus recognised, and in the "struggle" those individuals of a "species" which possess any peculiarity or variation, will tend to be preserved in virtue of the process of "natural selection," over those individuals which do not possess such peculiarities, and which latter, therefore, fall in the "struggle ;" whilst the former, with their variability, are preserved, and perpetuate their peculiarities in their offspring.

Then, finally, this perpetuative process in time intensifies the peculiarities which the "favoured individuals" exhibit, and so the "varieties" become "favoured races," and the races tend to merge into distinct "species," sufficient or "infinite" time being allowed to the perpetuative progress. The difference between a stable "variety" and an ordinary "species" is thus to be considered as a difference only of degree, and one which, from being plainly perceptible, insensibly and eventually disappears.

Such, briefly stated, are the leading ideas in the theory of development by "natural selection." The data upon which the theory of "sexual selection" has more recently become supplementary, and in some degree subsidiary, to the former theory, are chiefly founded on the fact that peculiarities and variations in structure may be transmitted and perpetuated through the "sexual struggles" in which animals are well known to engage, and in which the males, which possess certain peculiarities, will tend to become progenitors before those destitute of such peculiarities or variations. Thus, those males which are the stronger and the better endowed with physical powers, may, in many instances gain pos-

session of the females ; whilst, in other cases, the females appear to literally "select" the males, being drawn towards the latter by their brilliancy of plumage, beauty of contour, peculiarity of odour, or excellence in voice. These distinctive points are in fact so many peculiarities, which will be naturally transmitted to the progeny, and so become intensified in the progress of perpetuation.

These ideas may serve to guide the reader in his personal examination and perusal of Mr. Darwin's works ; for to remain ignorant of the facts and theories therein expressed, would be to ignore the most fertile source of advance and progress in biological thought, which the present century, great as it is in power of research, has seen. However authorities high in worth and position may differ from the theory, and however deficient or erroneous many points may hereafter be proved to be, we must acknowledge that, by its aid, not only have many valuable biological principles been constructed or strengthened, but we also receive, through the facts and research incidental to the theory, many explanations of biological phenomena which formerly were either neglected or considered wholly inexplicable. Indeed, the influence of researches and thoughts such as those of Mr. Darwin, has stimulated and invigorated workers in all departments of natural science ; and, although we may differ from the ulterior views which the theory and its facts tend to support, we must still own and admire the earnest work and laborious research which have contributed so largely to our stores of knowledge. We would certainly prefer to support a scheme advocating the recognition of certain and defined laws, even though these necessitate the destruction of seemingly sound views, than to adhere to the opposite and other extreme of maintaining a system without regulation, or, at any rate, one, the regulation of which we must profess ourselves incompetent to explain.

As might be expected, the Darwinian theory has been subjected to many searching criticisms, with the general result of modifying several important features and

particulars. The chief arguments against the hypothesis of "natural selection" are founded on, or drawn from, the consideration of the following points:—

Firstly, that the theory of "Natural Selection," *per se*, is incompetent to account for the beginning or initiatory stages of the variations, upon the presence and ulterior transmission of which, the theory, as we have shown, principally depends. That these variations are subject to and regulated by certain determinable laws there can be no doubt, but of these laws Mr. Darwin's theory can give us no account. The mere *beginnings* of those stages of variation, which appear in course of their full development to be so fully accounted for, are thus left unexplained and undetermined.

Then, secondly, just as we perceive in individuals variations which are capable of transmission and of being perpetuated, so it may equally well be maintained that other kinds of variations and peculiarities exist, which latter, so far from tending to preserve and perpetuate the "species," would, on the contrary, conduce to its extermination. The existence of these unfavourable variations, and their effects, the theory of "Natural Selection" appears inadequate to explain.

Thirdly, the difficulty of proving that variations may occur in more than one individual of a "species" at one time, is supposed to found another objection to the favourable recognition of the theory. "Natural Selection," it is held, must require for the due perpetuation of variations, the existence, in a *number of individuals*, of the peculiarities to be transmitted. It is accordingly denied that specific peculiarities occur, either in such a number of individuals, or are so frequently exhibited, as to warrant the belief that the process of "selection" alone is competent to effect so great and ulterior changes in the form and constitution of the "species."

Fourthly, "Natural Selection" appears to take no cognisance of the facts that the progeny of many "species" includes normally sterile individuals, incapable of reproducing their like. Examples of such sexless forms are

seen in the so-called "neuters" of many insects, such as the Bees and Ants. The evolutionist would, probably, account for such peculiarities by supposing the existence of some primary cause or condition affecting the development in these forms of the reproductive organs; but, at the same time, this mere statement is quite inadequate to explain the production of such individuals from parents whose reproductive organs are fully and perfectly developed. The consideration of the ordinary law of inheritance, in virtue of which alone the process of "Natural Selection" is conceivable of operating, offers, in a case like the present, a grave objection to the theory.

Fifthly, naturalists are by no means agreed as to the limits by which the variability of "species" is confined. We have already seen that "Natural Selection" chiefly relies upon the "indefinite variability" of forms—that is, it maintains that there is no absolute limit to the extent of possible variation. Mr. Mivart, in his "Genesis of Species"—one of the most philosophic of the many works which oppose the Darwinian theory—states this objection thus:—"The opinion that species have definite though very different limits to their variability is still tenable." Every one must admit that every species is "variable" to a greater or less degree; but considerable difference exists as to the probable boundaries of such variability. Our utter ignorance of the laws which govern these variations is, as has been elsewhere pointed out, a chief reason for pronouncing a very guarded opinion on this head. But from a careful consideration of the facts which have already been brought to light, there appear grounds for the belief that a limit does exist to these variations; and the instances, in cases of variation, of "atavism," or "reversion" to the characters of the original "stock," seem to show the tendency of variability to become limited or diminished, and to give place to the original characters of the "species." Mr. Mivart cites as examples of this "atavism" or "reversion," the fact that "the feral rabbits of Porto Santo, Jamaica, and the Falkland Islands, have not yet so reverted in those several

localities. Nevertheless, a Porto Santo rabbit brought to England reverted in a manner the most striking, recovering the proper colour of its fur 'in rather less than four years?' (Darwin). Again, the white silk fowl, in our climate, 'reverts to the ordinary colour of the common fowl in its skin and bones, due care having been taken to prevent any cross' (Darwin). This reversion taking place in spite of careful selection is very remarkable. * * * These facts seem certainly to tell in favour of limited variability, while the cases of non-reversion do not contradict it, as it is not contended that all species have the same tendency to revert, but rather that their capacities in this respect, as well as for change, are different in different kinds, so that often reversion may only show itself at the end of very long periods indeed."

Sixthly, "Natural Selection" appears incompetent to explain the many instances of sudden development of "specific differences." We have seen that, in the view of Mr. Darwin's hypothesis, "Natural Selection" acts essentially and only through long periods of time, and tends to produce differences in species in a very gradual manner. In opposition to this opinion it is attempted to be shown that "specific differences" frequently become apparent at once, and suddenly; and in this view there must be some other and equally important and powerful cause than the slowly-operating one of "Natural Selection."

Mr. Mivart notices, in support of this objection to Mr. Darwin's theory, the sudden development in oysters removed from "the shores of England and placed in the Mediterranean," of a "mode of growth," and of "prominent diverging rays, *like those of the proper Mediterranean oyster.*" In this, and in many similar instances, therefore, "Natural Selection" appears incompetent to explain phenomena, which in themselves exhibit results, attainable, in virtue of Mr. Darwin's theory, only through a long course of years, and through innumerable stages of perpetuated variation.

In the seventh place, the absence of what are known

as "transitional forms" between species, affords an argument of considerable power against the evolutionist theories. "Certain fossil transitional forms are absent, which might have been expected to be present." The question before us is, therefore, one of *time*—the existence in time past of "intermediate forms," and the probability of the duration of past time, as insufficient for the purposes of the evolutionist.

Firstly, then, if existent species have descended from pre-existing forms by a process of modification of these latter, we might reasonably and naturally expect to find in the past or geological history of our earth, traces of intermediate organisms, which would connect existing forms with those species from which they were evolved. And these "transitional" forms would thus unite in themselves the structural peculiarities of the pre-existing and of the derived species. Does the study of fossil organisms, of palæontology, and of geological life and time, therefore reveal any such forms? Can the palæontologist, in other words, point to fossil organisms, which can be said to evince a transitional nature of this kind, or to form connecting or intermediate links in the graduated scale of structure, which the evolutionist necessarily proposes and requires? These queries must be answered in the negative, since the study of palæontology has not brought to light any organisms which cannot be referred to existing types of structure, and which therefore can be said to present in themselves the united characters of any two known species. But if the evolutionist theory be true, we should expect to find very many examples of such forms. The continuous and graduated structural chain which the evolutionist demands has, therefore, no existence in nature. The geological record reveals only forms separated from each other by boundaries and characters as sharply defined as those which mark the differences between existent species. The missing links which palæontology should supply are thus wanting; and even in the new and most recent life-periods, which include the fossil remains of those forms

at present existent, and of those species most nearly allied to them, we cannot detect any evidence of transitional forms connecting intermediately the forms of the present with those of the past.

It is, however, to be noted that very high authorities have attempted to demonstrate the existence of organisms which unite the characters of distinct "species" of animal forms; and which, therefore, may be supposed to exhibit that gradation of form consistent with the theory of the evolution of existing forms from pre-existing "species." Thus the extinct *Dinosaurian* (Reptilian) forms have been asserted to exhibit marks of identity with birds on the one hand, and with reptiles on the other; that, in short, the Dinosauria represent a group of transitional forms, exemplifying the gradual evolution of the bird-form from that of the reptile. As Mr. Mivart remarks, however, "the mass of palæontological evidence is indeed overwhelmingly against minute and gradual modification. It is true that when once an animal has obtained powers of flight its means of diffusion are indefinitely increased, and we might expect to find many relics of an aërial form and few of its antecedent state—with nascent wings just commencing their suspensory power. Yet had such a slow mode of origin, as Darwinians contend for, operated exclusively in all cases, it is absolutely incredible that birds, bats, and pterodactyles, should have left the remains they have, and yet not a single relic be preserved in any one instance of any of these different forms of wing in their incipient and relatively imperfect functional condition!

"Whenever the remains of bats have been found they have presented the exact type of existing forms, and there is as yet no indication of the conditions of an incipient elevation from the ground.

"The pterodactyles, again, though a numerous group, are all true and perfect pterodactyles, though surely *some* of the many incipient forms which, on the Darwinian theory, have existed, must have had a good chance of preservation."

Where forms approaching in nature to the intermediate exist therefore, they are themselves distinctly separated from the groups with which they are related, and the gaps between forms thus seemingly allied, are in this way left yawning as widely as before. The Dinosaur may be conceived, for example, to unite something of the bird with something of the reptile ; but we still require, for the purposes of "Natural Selection"—if not for the purposes of all other forms of the evolutionary theory—the existence of a multitude of forms representing the gradual and successive stages of modification between those rudely transitional organisms. We yet require to bridge over the immense space which intervenes between the Reptile and the Dinosaur, and then between the Dinosaur and the Bird. "Natural Selection" demands a host of graduated and transitional forms, which palæontology fails to furnish ; and the subject is further complicated for the Darwinian theory, if we consider that such transitional forms should, on all accounts, have had as good chance of preservation as the Dinosaur itself. And, as has been remarked, the preservation of the Dinosaur alone, and the absence of any intermediate forms, may be used as an argument in favour of the point already insisted upon—namely, the "sudden," instead of the "selective," and consequently gradual, origin of "species."

The question of time also offers a second aspect unfavourable to the theory of "Natural Selection" in particular and of "Evolution" in general. We have already seen that the evolutionist requires an immense period of time for the necessarily slow and gradual origin of new "species" through and from pre-existing forms. Physicists have accordingly seen reason to dispute the fact of the possibility of time past having been of duration sufficiently long for the purposes of the evolutionist. Time past for him must be practically infinite ; but the physicist holds that his demand is excessive, and inconsistent with the results of physical research.

Sir William Thomson's views are those which are

commonly quoted against this demand for time infinite. These views are founded on certain calculations recently made by the above-mentioned distinguished physicist, with the result of restricting time past to a period of duration overwhelmingly below that required for the modification of species according to the theory of "Natural Selection," and thus practically inadequate in every way for the operation of the "selective" process. No successful attempt at refutation of these views has as yet been made by Mr. Darwin or his supporters, and the argument thus derivable from the question of time is one of the most potent against the evolutionist's views.

Although the evolutionist may, therefore, cut down and limit the time required for specific change, yet by his own showing that change is of slow operation, and of very gradual progress. And he is therefore placed in the dilemma either of shortening the period of time he requires, or of hastening the "selective" process; either of which modifications will tend to powerfully militate against the validity of his theory.

Lastly, the theory of "Natural Selection" is proved to be at variance with certain facts observed in the geographical distribution of living forms. The distribution in space of nearly-allied "species," according to Mr. Darwin's theory, should evince a certain amount of near relation—that is, nearly-allied species should consistently be situated in approximate tracts or portions of this earth's surface. Now, a review of the distributional aspects of living beings shows us that, in many cases, species of closely-related nature are situated in widely-separated portions of the earth's surface, and under circumstances which otherwise militate against the application of this theory. No doubt geological and physical changes of very vast extent may be regarded as sufficient to account for the dispersion of these forms; but this very explanation tells somewhat against the operation of the "selective" process, requiring, as it does, the existence of comparatively undisturbed surroundings for the gradual development of those "minute, indefinite, and fortuitous vari-

ations," on which the progress of "Natural Selection" fundamentally depends.

Regarding the subsidiary theory of "Sexual Selection," which is supposed to supply certain wants or gaps in its companion hypothesis, many objections have in turn been entertained to its favourable reception. The presence of colour, sound, odour, in animal forms, as affording means for the perpetuation of variations by sexual selection, is not always satisfactorily explained on this footing. Thus, among the higher apes the males are adorned with brilliant colours, yet the weaker females appear to possess or exercise no power of "selection." Or amongst savages, as remarked by Mr. Wallace, their singing "is a more or less monotonous howling, and the females seldom sing at all. Savages certainly never choose their wives for fine voices, but for rude health, and strength, and physical beauty." "Sexual selection," he adds, "could not therefore have developed this wonderful power (of singing), which only comes into play among civilised people." The varied hues of many lower forms of life, such as are seen among shell-fish, must exist independently of the operation of "sexual selection." Since impregnation is effected in these cases "by the mere action of currents of water, and the least beautiful individual has fully as good a chance of becoming a parent as has the one which is the most favoured in beauty of form and colour." And so, in many similar instances, the doctrine of "sexual selection" can be shown to be inadequate to the explanation of most of the cases in which the conditions it requires to begin with are present in apparently full perfection.

Whilst thus the theories of the evolutionary origin of species endeavour each to reconcile to its particular ideas the probable causes and conditions which prompted and directed the existing order and relations of living forms, we observe that not one is exempt from objections, more or less grave, to its reception *in toto*. Yet from each we may derive a certain amount of information—from some a greater degree and from others a less degree; and, so far from such labours being discouraged, as is occasionally

inculcated upon us, it is clearly our duty to aid in all efforts which tend to the elucidation of the causes and means whereby this wondrous universe and its varied population have been derived, formed, and arranged. And, as a final thought, we must take into consideration the important fact, that future research will, if honestly pursued, tend either to the clear demonstration of truth, or to the exposure of inconsistency and error.