

which stares us in the face when we attempt to compare one type with another, even within the limits of the same class—as the whale with the sheep, for instance, and this latter with the beaver or the tiger—is alone sufficient to prevent a present acceptance of the development theory. Between the highest apes and Man, it is true, much closer structural relations are shown to exist; and great weight is attached to this by the followers of Darwin's school. But admitting the full force of these relations, the gulf required to be bridged over is equally great: a dumb and stationary brute-intellect on the one side—speech, reason, and progress, on the other. We may yet say, in the words of Jean Paul, if not in the exact sense in which he used them, “*Der Mensch ist der grosse Gedankenstrich im Buche der Natur.*”

E. J. C.

On the Origin of Species, or the Causes of the Phenomena of Organic Nature: A Course of Lectures to Working Men. By Thomas H. Huxley, F.R.S., F.L.S., Professor of Natural History in the Jermyn St. School of Mines. London: Published. New York: Reprinted; D. Appleton & Co., 443 & 445 Broadway—1863.

This is a publication from the notes of the Short-hand writer, the lectures having been delivered extemporaneously, and the author having had no leisure for their revision, beyond the correction of any important error in a matter of fact. The work has been much read, and has attracted much attention, which is only natural and reasonable considering the varied and accurate knowledge, the high reputation and undoubted talents of its distinguished author, as well as the extraordinary interest excited by Darwin's book, in which the hypothesis was proposed, but although anything coming from Professor Huxley must deserve careful consideration, and is in fact only too likely to be hastily accepted on his authority, the present publication involves such grave questions affecting the very foundations of our scientific inquiries, that we are not disposed to content ourselves with saying that it is an able work deserving of candid examination, but feel bound to enter a little upon the argument, and to express our reasons for not assenting to the hypothesis defended.

There might at the outset be a question raised whether Professor Huxley exercised a wise discretion in the choice of a subject to bring before such an audience as he was to address. He selected a subject

very interesting to himself; a controversial subject upon which he entertained a very strong opinion, which he was glad of any opportunity of defending; a subject which is at this time engaging much of the attention of the scientific world, and exciting the curiosity of the public, so as to promise as much popularity as any which could be chosen; but a subject involving the most obscure and difficult questions connected with natural science, and therefore least adapted for those whose ordinary employments prevent their giving much time to such pursuits, and who cannot be presumed to possess the preliminary knowledge requisite for any useful judgment on the points at issue. It may be that Professor Huxley calculated on an audience very different in character from that which he was nominally addressing; it may be that he relied on his clear and forcible style of address to remove the difficulties in his way, and that himself, holding his views to be true and useful, he slighted the uneasiness or alarm which it creates in the minds of many, but there are numbers to whom it will appear very questionable whether he would not better have fulfilled his official duty by offering instruction respecting the established principles and interesting facts of natural science, rather than speculative views on the most recondite question his science afforded.

It would be useless, however, to press this objection now, and although there are undoubtedly fitnesses of things, in respect to times and places for propounding opinions, the mischief which it is possible to do by their violation is temporary and transient whilst we may rely on the great general law that, whatever may appear at the moment or to the partial view of individuals, discussion must ultimately promote the cause of truth.

Another preliminary observation is, we think, called for before we endeavour to estimate the force of Prof. Huxley's argument. He has more than once insisted on the origin of species being an inquiry essential to their scientific study, and there being before the public no hypothesis on the subject, entitled to the least attention, except the Darwinian, and he takes this to be a presumption in its favour, entitling it, at least for the present, to guide the course of inquiry on the subject. Now it appears to us that the preliminary inquiry is, whether there exist in nature any forms of fixed character, varying only within certain limits, and through an indefinite succession of generations remaining continually the same; or whether organic structures are subject to gradual modification, so as after a certain succession of generations to be found very materially different from

their original condition, and to be accounted different species. If our inquiries lead us to the former conclusion, every species in nature has come into existence at some time and place, and it is an important inquiry how long each can be proved by good evidence to have existed, and within what geographical limits it has been confined; but there is scarcely any place for inquiry respecting the act of creation since it is not easy to perceive how it could be effected by the operation of second causes, and if we can conceive of such causes they are out of the field of natural science, and if ever determined it must be by other means than the observation of nature and the study of the relations between differing structures. If, on the other hand, we conclude that such distinctions, as properly mark species, are liable to change with the progress of time, and can produce good evidence that even any one distinct species has been derived from any other in the course of ages, then it may be reasonable to admit the possibility of all varying forms having been derived from one primitive germ, and the manner in which such changes have been effected, the causes upon which they depend, become subjects of intense interest, and furnish the most important inquiries in which a naturalist can be engaged. But it seems to us most unreasonable, to expect that the believer in the immutability of species should want a theory as to their origin. He sees throughout nature the abundant evidence of the operation of an intelligent designing mind, the great first cause of all things. He sees every species adapted to its condition and enabled to supply its wants, and the conception of a creative act, as the expression of an almighty volition, is sufficient to account to him for the existing order of things—objects may have been created simultaneously or successively,; all in one place on the earth's surface, or in various localities; but as long as they are acknowledged to be essentially distinct objects, and to have no natural tendency to intermix and modify each other, they admit of no inquiry into the nature of the modifying causes, and consequently of no theory of the formation of species. It is quite true that we recognise a common plan of structure in a variety of objects; on examination this plan is found to consist in a certain arrangement of elementary organs, which, in some form, are always present, whilst the characteristics of species seem to be really found in the tendencies to comparative development of certain parts, which, in all of the same genus tribe or sub-kingdom, are at least rudimentally present, bearing to each other certain common rela-

tions. The truest notion of a species may perhaps be that of a group of developmental tendencies, fixed in the nature of things and only liable to modification by external causes within certain limits. Since those differences of plan or degree of development which mark genera, tribes and sub-kingdoms are without doubt at least as constant as those which distinguish species, it follows that these larger groups are natural and real associations of objects as much as species themselves, and that in determining them we find out, and invent names to express, something existing, and it is a great mistake to represent classification as a mere human contrivance of which there may be many varieties equally well founded. A classification which may serve some purposes may be founded upon any observed resemblances and differences amongst objects; but a true natural classification is the interpretation of the great plan of the Creator, expressing real affinities amongst organised beings, and pointing out their natural relationships whether direct or analogical, that is, whether consisting in conformity to a common type, or in a correspondent position as to mode of development and plan of life in respect to different types.

The believers in the transmutation of species will naturally enough regard the case of different organisms, resembling each other in many important particulars, and approaching each other more or less nearly, as favouring their notion of a common origin of all organic structures, and as illustrating different stages of progress or the influence of different circumstances, but the facts are equally accounted for by admitting a certain plan of creation. They are in truth much better accounted for, since the regularity with which we may generally observe each type to display an equal number of analogous variations, affords proof of a great plan running throughout nature, and excludes the idea of the differences of species depending on such influences as incidental special development in one of the offspring of a creature, giving that one advantages in the struggle for existence which are transmitted to its descendants.

We deduce from these considerations that it is not the business of the philosophical inquirer to form some theory respecting the origin of the various species of organised beings, unless he has first observed in them such signs of fluctuation and of being modified by causes, of which he can estimate the operation, as to turn his thoughts in that direction. So long as species are regarded by him as fixed and constant forms, he is not as a naturalist concerned with their origin, but

only with their mutual relations as parts of the great system of the universe.

Lut us now turn to Mr. Huxley's mode of dealing with the subject before us, and we shall first quote a passage containing his statement of the principles upon which such inquiries as that proposed must be conducted (Lecture VI., p. 130, American edition.)

"I stated to you in substance, if not in words, that wherever there are complex masses of phenomena to be inquired into, whether they be phenomena of the affairs of daily life, or whether they belong to the more abstruse and difficult problems laid before the philosopher, our course of proceeding in unravelling that complex chain of phenomena with a view to get at its cause, is always the same; in all cases we must invent a hypothesis; we must place before ourselves some more or less likely supposition respecting that cause; and then, having assumed a hypothesis, having supposed a cause for the phenomena in question, we must endeavour, on the one hand, to demonstrate our hypothesis, or, on the other, to upset and reject it altogether by testing it in three ways. We must, in the first place, be prepared to prove that the supposed causes of the phenomena exist in nature; that they are what the logicians call *vera causa*—true causes;—in the next place, we should be prepared to show that the assumed causes of the phenomena are competent to produce such phenomena as those which we wish to explain by them; and in the last place, we ought to be able to show that no other known causes are competent to produce these phenomena. If we can succeed in satisfying these three conditions, we shall have demonstrated our hypothesis; or rather I ought to say, we shall have proved it as far as certainty is possible for us; for, after all, there is no one of our surest convictions which may not be upset, or at any rate modified by a further accession of knowledge."

We make no objection to these principles, but, as already indicated, we consider it as requiring proof that the phenomena of species are such as demand any investigation of their cause, or easily admit the supposition of any second cause. We pass on to Professor Huxley's concise statement of the Darwinian hypothesis (Lect. VI., p. 131, Am. Ed.)

"What is Mr. Darwin's hypothesis? As I apprehend it—for I have put it into a shape more convenient for common purposes than I could find *verbatim* in his book—as I apprehend it, I say, it is, that all the phenomena of organic nature, past and present, result from, or are caused by, the inter-action of those properties of organic matter, which we have called **ATAVISM** and **VARIABILITY**, with the **CONDITIONS OF EXISTENCE**; or in other words,—given the existence of organic matter, its tendency to transmit its properties, and its tendency occasionally to vary; and, lastly, given the conditions of existence by which organic matter is surrounded—that these put together are the causes of the Present and of the Past conditions of **ORGANIC NATURE**."

Accepting this as a clear and accurate summary, we shall find that the points requiring to be carefully examined are the proper meaning and natural limits of Atavism and Variability, and we must recollect that the existence of these tendencies is equally admitted by both parties. The question is whether, in connection with the external conditions of existence, they are fully sufficient to account for all the phenomena of species, genera and higher groups amongst organized bodies, or whether the modifications they produce are subservient to certain determinate inherent tendencies of development, descending from the first created organisms and constituting the great plan of creation which, as we learn to interpret it, we express by the kingdoms, sub-kingdoms, classes, tribes, genera, and species. Now this question is identical with that of the permanence or mutability of species, which is therefore, we apprehend, the real subject of controversy. Granting their mutability, we do not pretend to adduce more probable influences for their modification than those assigned by Mr. Darwin, and all who maintain their permanence believe the cases of variation brought forward to be confined to varieties and races, and to affect characters which are not essential to the species. It is easy to assume that the existence of certain structural resemblances implies a common origin, but such resemblances form an essential part of the notion of a plan of creation in which every position is occupied and in which the utmost variety is produced by special adaptations of various types. They are as well accounted for on the one scheme as on the other—unless indeed we recognise in the regularity of corresponding variations of different types, the impossibility of what may be termed accidental causes of variation, such as are supposed in Darwin's hypothesis, having any place.

It seems to us beyond all reasonable question that what is absolutely required before we can admit the possibility of the transmutation theory, is the production of at least one clear instance of descendants of a common parent, having by the joint action of variability and atavism become so distinct in structure as to be fairly accounted separate species. This we do not believe to have been done. We know, however, that the want of any definition of a species in which both parties can agree, and the power of requiring indefinite periods of time to accomplish the supposed changes, will prevent this test being of much value for convincing opponents. We must therefore be content with enquiring what we really know of atavism and varia-

bility, and what proof can be brought forward of the tendency of long periods of time, to change the characters of species.

Atavism is but a name for the general law that the offspring resemble the parents. The resemblance is not a complete and exact one, but it is real and certain, and we believe it to include all the particulars which characterise the species. There is a certain amount of variation arising partly from assignable, partly from unknown causes, the nature and extent of which is learned by experience. In cases of a sexual reproduction, whether naturally occurring by gemmation or fissure, or artificially produced by section with replacement of parts, the variation is almost nothing. In reproduction by the fertilised ovum a regular series of changes is passed through before reaching the complete condition of the organism, and this condition is not an exact copy in every particular of the parents, for they themselves differ in some points; there are variations in the influence of each parent upon the offspring; there are effects of such causes as temperature, food, atmospheric conditions, and superinduced habits on the development of the germ; and there are internal causes not to be estimated by us which, within seemingly narrow limits, affect development so as to produce slight deviations from a precise pattern. Again it is observed that existing varieties in parents are most commonly transmitted to the offspring, if found alike in both parents very generally; if only occurring in one parent, much less uniformly, yet the peculiarity frequently occurring. When by selective breeding a variety is kept up through successive generations, it becomes a permanent variety or race which may either have become insulated by its position or may be studiously kept up on account of its beauty or utility, but if the causes which maintain the variety are removed the offspring gradually return to the more normal specific types. The advocate of the Darwinian hypothesis believes that no real difference can be recognised between species and varieties; that there are no determinate inherent tendencies of development limiting the action of causes of variation, and that new species are produced, as some also become extinct, in the ordinary course of nature. We ask, has he proved by sufficient examples that varieties tend to recede more and more from the specific type and do not tend to return to it; that species are capable of mixing by the production of *fertile* intermediate forms which thus in reality become new species, or that palæontological facts encourage the idea, that species are transmuted, of course very

gradually, through a lengthened period of time? The transmission through several generations of the monstrosity of a sixth finger, has no more to do with specific distinctions than the transmission of a particular cast of features, complexion, tendency to certain diseases or any similar instance of atavism acting in subservience to the more marked tendencies which constitute species. The history of the otter breed of sheep exemplifies the formation and preservation of races, but affords no argument for their breaking through the natural boundaries of species. The case of the varieties of pigeons is a very interesting one, and the more so because the leading varieties seem to exhibit the same tendencies of development which distinguish the larger really distinct groups and prevail throughout nature; but so long as it is generally agreed that all the varieties have sprung from *columba livia*, and it is reasonably supposed that if not under the care of man they would gradually fall back into that species, instances of partial return being frequent; and so long as the difficulty remains, which is candidly acknowledged by Prof. Huxley, respecting the general if not universal infertility of hybrids between species, we cannot admit that the phenomena of the races of domestic pigeons afford any evidence whatever against the natural and real separation of species. Races which are habitually under the care of man, being cherished and kept in favourable circumstances to suit his purpose, may well illustrate the extent to which variations may be carried, but are least of all to be alleged as examples of the formation of distinct types of structure, the very fact of the peculiarities occurring in such circumstances being a warning to us against attributing to them any specific importance.

We have such clear evidence of the antiquity of various existing species both of animals and plants, which plainly appear to be now what they were many centuries ago, that the presumption is against the influence of time in modifying organised structures. Direct evidence on the subject can only be derived from palæontological studies, and the defenders of the Darwinian hypothesis have been forward to claim the facts of the palæontology as favouring their views. The following passage from Mr. Huxley shows how they proceed: (Lect. VI., p. 136—140, Am. Ed.)

“If you regard the whole series of stratified rocks—that enormous thickness of sixty or seventy thousand feet that I have mentioned before, constituting the only record we have of a most prodigious lapse of time, that time being, in all probability, but a fraction of that of which we have no record;—if you observe

in these successive strata of rocks successive groups of animals arising and dying out, a constant succession, giving you the same kind of impression, as you travel from one group of strata to another, as you would have in travelling from one country to another;—when you find this constant succession of forms, their traces obliterated except to the man of science,—when you look at this wonderful history, and ask what it means, it is only a paltering with words if you are offered the reply,—“They were so created.”

But if, on the other hand, you look on all forms of organized beings as the results of the gradual modification of a primitive type, the facts receive a meaning, and you see that these older conditions are the necessary predecessors of the present. Viewed in this light the facts of palæontology receive a meaning—upon any other hypothesis, I am unable to see, in the slightest degree, what knowledge or signification we are to draw out of them. Again, note as bearing upon the same point, the singular likeness which obtains between the successive Faunæ and Floræ, whose remains are preserved on the rocks: you never find any great and enormous difference between the immediately successive Faunæ and Floræ, unless you have reason to believe there has also been a great lapse of time or a great change of conditions. The animals, for instance, of the newest tertiary rocks, in any part of the world, are always, and without exception, found to be closely allied with those which now live in that part of the world. For example, in Europe, Asia, and Africa, the large mammals are at present rhinoceroses, hippopotamuses, elephants, lions, tigers, oxen, horses, &c.; and if you examine the newest tertiary deposits, which contain the animals and plants which immediately preceded those which now exist in the same country, you do not find gigantic specimens of ant-eaters and kangaroos, but you find rhinoceroses, elephants, lions, tigers, &c.,—of different species to those now living,—but still their close allies. If you turn to South America, where, at the present day, we have great sloths and armadilloes and creatures of that kind, what do you find in the newest tertiaries? You find the great sloth-like creature, the *Megatherium*, and the great armadillo, the *Glyptodon*, and so on. And if you go to Australia you find the same law holds good, namely, that that condition of organic nature which has preceded the one which now exists, presents differences perhaps of species, and of genera, but that the great types of organic structure are the same as those which now flourish.

What meaning has this fact upon any other hypothesis or supposition than one of successive modification? But if the population of the world, in any age, is the result of the gradual modification of the forms which peopled it in the preceding age,—if that has been the case, it is intelligible enough; because we may expect that the creature that results from the modification of an elephantine mammal shall be something like an elephant, and the creature which is produced by the modification of an armadillo-like mammal shall be like an armadillo. Upon that supposition, I say, the facts are intelligible; upon any other, that I am aware of, they are not.

So far, the facts of palæontology are consistent with almost any form of the doctrine of progressive modification; they would not be absolutely inconsistent with the wild speculations of De Maillet, or with the less objectionable hypothesis of Lamarck. But Mr. Darwin's views have one peculiar merit; and that

is, that they are perfectly consistent with an array of facts which are utterly inconsistent with and fatal to, any other hypothesis of progressive modification, which has yet been advanced. It is one remarkable peculiarity of Mr. Darwin's hypothesis that it involves no necessary progression or incessant modification, and that it is perfectly consistent with the persistence for any length of time of a given primitive stock, contemporaneously with its modifications. To return to the case of the domestic breeds of pigeons, for example; you have the Dovecot pigeon, which closely resembles the Rock pigeon, from which they all started, existing at the same time with the others. And if species are developed in the same way in nature, a primitive stock and its modifications may, occasionally, all find the conditions fitted for their existence; and though they come into competition, to a certain extent, with one another, the derivative species may not necessarily extirpate the primitive one, or *vice versa*.

Now palæontology shows us many facts which are perfectly harmonious with these observed effects of the process by which Mr. Darwin supposes species to have originated, but which appear to me to be totally inconsistent with any other hypothesis which has been proposed. There are some groups of animals and plants, in the fossil world, which have been said to belong to "persistent types," because they have persisted, with very little change indeed, through a very great range of time, while everything about them has changed largely. There are families of fishes whose type of construction has persisted all the way from the carboniferous rock right up to the cretaceous; and others which have lasted through almost the whole range of the secondary rocks, and from the lias to the older tertiaries. It is something stupendous this—to consider a genus lasting without essential modifications through all this enormous lapse of time while almost everything else was changed and modified."

Mr. Huxley calls it paltering with words to say of the succession of organisms revealed by an examination of the earth's strata, that they were so created, meaning that this is all we know of their origin. We confess to a different feeling. There may be a grand scheme of successive creations, suited to changes, taking place in the physical condition of the globe, as well as a scheme of successive changes in mode and degree of development of organs derived from the primitive living element. Which of these schemes is most conformable to known facts must be determined by observation, but if the origin of life be at all referred to a direct exertion of the will of a supreme intelligence, we cannot see that the former scheme is less antecedently probable than the latter; and even if it be referred to the operation of chemical laws, laws of nature do not imply any powers, inherent in matter, but are only our expressions of the observed uniformity of a class of results from causes—and really only direct our attention to the mode of operation of the great first cause of all things. Mr. Huxley thus describes an objection to Darwin's hypothesis which we think he hardly

treats fairly: "Well, after all," he supposes the objector to say, "you see Mr. Darwin's explanation of the 'origin of species' is not good for much, because, in the long run, he admits that he does not know how organic matter began to exist. But if you admit any special creation for the first particle of organic matter, you may just as well admit it for all the rest; five hundred or five thousand distinct creations are just as intelligible, and just as little difficult to understand, as one." Now, if such an objection were ever used as an argument against learning as much as we can of the order of Nature and mutual derivation of organized beings, it is as little worth as Mr. Huxley represents it; but if, as we apprehend, it was only meant to show that the Darwinian hypothesis relieves us from no fancied difficulty about the idea of creation, and that there is in truth no rational presumption in favour of the creation only of the first and simplest organisms, rather than the creation of numerous forms of living beings, and as often as a wise regard to other changes might require, then we must think the objection a sound one leaving us open to draw whatever truths we can from the study of nature, but convincing us that we are not driven to seek an origin of species in second causes, and that there is no strong reasonable presumption that such might be found.

We cannot at all perceive why, the prevalence of certain sections of the animal kingdom in particular regions of the globe being an admitted fact in respect to the present state of things, it should not be admitted as equally suitable in any former state—or why the present existence of the armadillo where an armadillo-like animal formerly existed should be admitted as any proof that the one is descended from the other without distinct evidence of gradual changes. But perhaps the best thing we can do with this palæontological argument will be to bring under the reader's notice, in immediate connection with Prof. Huxley's reasoning, the sentiments on the same subject of one of the greatest living authorities, and who cannot possibly, from his known opinions on the subject, be supposed to be prejudiced in favour of old-fashioned doctrines. We shall quote from a note to the second chapter of the first part of Agassiz's treatise on the Acalephæ in his contributions to the Natural History of the United States, (Vol. III., p. 90, Note 1,) the sentiments of this eminent palæontologist respecting Darwin's geological arguments.

"It seems generally admitted, that the work of Darwin is particularly remarkable for the fairness with which he presents the facts adverse to his views. It

may be so; but I confess that it has made a very different impression upon me. I have been more forcibly struck with his inability to perceive when the facts are fatal to his argument, than with anything else in the whole work. His chapter on the Geological Record, in particular, appears to me to be, from beginning to end, a series of illogical deductions and misrepresentations of the modern results of Geology and Palæontology. I do not intend to argue here, one by one, the questions he has discussed. Such arguments end too often in special pleading; and any one familiar with the subject may readily perceive where the truth lies, by confronting his assertions with the geological record itself. But, since the question at issue is chiefly to be settled by palæontological evidence, and I have devoted the greater part of my life to the special study of the fossils, I wish to record my protest against his mode of treating this part of the subject. Not only does Darwin never perceive when the facts are fatal to his views, but, when he has succeeded by an ingenious circumlocution in overleaping the facts, he would have us believe that he has lessened their importance, or changed their meaning. He would thus have us believe that there have been periods during which all that had taken place during other periods were destroyed; and this solely to explain the absence of intermediate forms between the fossils found in successive deposits, for the origin of which he looks to those missing links, whilst every recent progress in Geology shows more and more fully how gradual and successive all the deposits have been which form the crust of our earth.—He would have us believe that entire faunæ have disappeared before those were preserved, the remains of which are found in the lowest fossiliferous strata; when we find everywhere non-fossiliferous strata below those that contain the oldest fossils now known. It is true, he explains their absence by the supposition that they were too delicate to be preserved; but any animals from which Crinoids, Brachiopods, Cephalopods, and Trilobites could arise, must have been similar enough to them to have left, at least, traces of their presence in the lowest non-fossiliferous rocks, had they ever existed at all.—He would have us believe that the oldest organisms that existed were simple cells, or something like the lowest living beings now in existence: when such highly organized animals as Trilobites and Orthoceratites are amongst the oldest known.—He would have us believe that these lowest first-born became extinct, in consequence of the gradual advantage some of their more favored descendants gained over the majority of their predecessors; when there exist now, and have existed at all periods in past times, as large a proportion of more simply organized beings, as of more favored types; and when such types as *Lingula* were among the lowest Silurian fossils, and are alive at the present day.—He would have us believe that each new species originated in consequence of some slight change in those that preceded; when every geological formation teems with types that did not exist before.—He would have us believe that animals and plants became gradually more and more numerous; when most species appear in myriads of individuals, in the first bed in which they are found.—He would have us believe that animals disappear gradually; when they are as common in the uppermost bed in which they occur, as in the lowest, or any intermediate bed. Species appear suddenly and disappear suddenly in successive strata. That is the fact proclaimed by Palæontology;

they neither increase successively in number, nor do they gradually dwindle down; none of the fossil remains thus far observed show signs of a gradual improvement or of a slow decay.—He would have us believe that geological deposits took place during periods of subsidence; when it can be proved that the whole continent of North America is formed of beds which were deposited during a series of successive upheavals. I quote North America in preference to any other part of the world, because the evidence is so complete here that it can be overlooked only by those who may mistake subsidence for the general shrinking of the earth's surface, in consequence of the cooling of its mass. In this part of the globe, fossils are as common along the successive shores of the rising deposits of the Silurian system, as anywhere along our beaches: and each of these successive shores extends from the Atlantic States to the foot of the Rocky Mountains. The evidence goes even further; each of these successive sets of beds of the Silurian system contains peculiar fossils, neither found in the beds above nor in the beds below, and between them there are no intermediate forms. And yet Darwin affirms that "the littoral and sub-littoral deposits are continually worn away, as soon as they are brought up by the slow and gradual rising of the land within the grinding action of the coast waves."—(*Origin of Species*, p. 290).—He would also have us believe that the most perfect organs of the body of animals are the product of gradual improvement; when eyes as perfect as those of the Trilobites are preserved with the remains of these oldest animals.—He would have us believe that it required millions of years to effect any one of these changes; when far more extraordinary transformations are daily going on, under our eyes, in the shortest periods of time, during the growth of animals.—He would have us believe that animals acquire their instincts gradually; when even those that never see their parents, perform at birth the same acts, in the same way, as their progenitors.—He would have us believe that the geographical distribution of animals is the result of accidental transfers; when most species are so narrowly confined within the limits of their natural range, that even slight changes in their external relations may cause their death. And all these, and many other calls upon our credulity, are coolly made in the face of an amount of precise information, readily accessible, which would overwhelm any one who does not place his opinions above the records of an age eminently characterized for its industry; and during which, that information was laboriously accumulated by crowds of faithful laborers.

Professor Huxley argues from the existence of rudimentary organs, such as "the splint-like bones in the leg of the horse, which correspond with bones which belong to certain toes and fingers in the human hand and foot;" the rudimentary cutting teeth on the upper jaw of the young calf; the teeth of the foetal whale which are never used and come to nothing, and other similar instances; contending that such facts are entirely unaccountable and inexplicable except on Mr. Darwin's hypothesis, according to which the whalebone whale descended from a whale with teeth, the horse from an animal with several toes,

the ruminant from an animal furnished with cutting teeth in its upper jaw. We have already referred to this subject, and we need only say now that the facts can be generalised in at least two distinct ways, the one followed by Darwin, in which imperfectly developed organs are regarded as indicating their partial suppressions by accidental variety, and the view previously taken that in forming a perfect creation in which every position should be suitably filled, and the greatest possible amount of life and enjoyment be produced; the almighty and all-wise intelligence used a plan, according to which the required variety depended not on so many altogether different types of structure, but on changes in the comparative development of parts in structures belonging to one type, the common relationship giving unity to the whole, and harmonising the various parts into one grand system. According to this view certain elements of structure belonging to one organic type would receive their fullest development in one form, and in others would be gradually reduced until they existed only imperfectly or rudimentally, so as in many instances not to be observable without investigation or only to become observable under peculiar circumstances. We account the latter view the most antecedently probable because it best explains the analogies as well as affinities observable in nature; because it is most consistent with the uniformity and completeness of the design which seems to us to pervade creation, and is more readily conceived as the result of ordinary intelligence. But it would be enough, as an answer to Prof. Huxley's argument, merely to shew that there is a way of viewing the occurrence of imperfectly developed organs, which is reasonable and consistent in itself, and by no means requires or favours the Darwinian hypothesis.

On the whole, it must be acknowledged that the cases of the phenomena exhibited by species, suggested by Darwin, have a real existence in Nature. Proceeding to the second test, we deny that they are, so far as we yet know, competent to give rise to all the phenomena; since, besides the admitted difficulty about sterility of hybrids, it has not been proved that the tendency to variation ever passes the boundaries imposed by predominating developmental tendencies which constitute species, and it is not proved that any degrees of variation entitled to be called specific have arisen within our knowledge, or that time, however long the period attained, tends to increase the extent of variation. We cannot affirm that the contradictory of these propositions is absolutely proved, but it seems to us in each case to be more

probable. As to the third test, the hypothesis being the only one which can explain the phenomena, we cannot understand upon what ground Prof. Huxley believes that "the alternative is Darwinian or nothing." The opponents of the new hypothesis may not profess to explain the origin of species by tracing them to second causes, but they insist that they are not called upon to do so. They find, as they think, organised nature made up of permanently distinct structures, amidst their differences bearing numerous and striking relations to each other, and together forming a connected whole displaying one grand plan, and presenting an inconceivable variety of different combinations of organs, all working out, by varying means, a common end and together filling creation with order, harmony, beauty, forming one grand and beneficent system.

If it were a legitimate aim of philosophy to prevent the thought of Deity from arising from the contemplation of his works, we should have made a step in advance in adopting Darwin's hypothesis which makes all the variety in nature the result of fixed physical laws, and limits the direct operation of the Divine volition to the production of the first organised element. Even so however a creative act is required, and if for one creature why not for a million? If for one condition of external nature, why not for any number of such conditions which may succeed one another on the earth's surface? The scheme of a creation of numerous species which may reproduce themselves with a certain limited variation is not essentially unphilosophical, and so long as we believe in the real distinctness of species is the most probable explanation of what we see. If the transmutation of species can be definitely established the case will be altered, and we may apply ourselves with advantage to the study of the law of modification. Our limited space forbids, at present, the fuller expression of our views on this interesting subject, but differing as we do from Messrs. Darwin and Huxley and other eminent naturalists, we readily receive the speculations which have engaged their minds as worthy of candid consideration, and only desire that they may be so considered as to promote sound knowledge, just views, and practical utility.

W. H.
