

## ARTICLE II.

## DARWINISM.

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MR. DARWIN had been long known to the scientific world before he propounded the theories which have now made his name familiar in every household. He was distinguished as a naturalist as well by the extent, variety, and accuracy of his observations as by the singular fairness of his statement of them. The most widely known among his many scientific works are probably his "Journal of Researches: Voyage of the Beagle," his investigations of the Orchids, and of the facts concerning climbing plants; the last accomplished during the author's confinement in a sick room. The first of these works has a more than technical interest, because the author compares the fauna and flora of many and diverse lands evidently with a mind already under the influence of those speculations which afterwards took form in the theory of "Natural Selection," and also because he recounts his experiences with the Fuegians and others of the lowest types of the human race. Of these experiences he makes large use in his "Descent of Man," and they have also afforded strong points to the assailants of his theory. His researches upon the Orchids have also served as the basis for opposite arguments. In both cases the faithfulness of his observations has been unquestioned; the controversy is on the inferences to be deduced from them.

The series of works, however, by which Mr. Darwin is most generally known are those in which he propounds, supports, and expands those theories which bear his name. The first of this series is entitled "The Origin of Species"

(in one volume) and has had a wide circulation. Its fifth carefully revised edition, published in this country, contains the most exact presentation of the author's views. This book promised a successor in which the facts on which the theory rested should be more fully presented. After a considerable delay this appeared, under the title of "Animals and Plants under Domestication," in two volumes. In this, besides presenting such facts as he had proposed to bring forward, the author also broached a new and remarkable theory called "Pangenesis," designed to be supplementary of his main hypothesis, of which more hereafter. These works, but especially the earlier one, excited a wide and profound interest. One point, however, was still left in some uncertainty: whether the author would extend his theory to include the origin of man, and if he did this in regard to man as an animal, whether he would also include under the operations of the same theory his higher intellectual and moral nature. Mr. Darwin's disciples were somewhat divided about the matter. All possibility of doubt has been finally removed by the publication of his two volumes on "The Descent of Man," in which the broadest ground is frankly taken of the derivation of man's whole nature from lower and still lower animal forms, until at last all organisms are ultimately derived by the simple process of "Natural Selection," or (as it is otherwise called) "the survival of the fittest," from one common source. In the case of man, Mr. Darwin traces back the probable line of the chain as far as some creature resembling "the larvae of marine Ascidians."

It is scarcely more than one quarter of this last work that is immediately concerned with the subject of its title; the remaining volume and a half being occupied with the development of a fresh supplementary hypothesis, entitled "Sexual Selection." The former supplementary hypothesis, although considered by its author as important to the completeness of his main theory, is yet one which he is willing to have set aside by those who still adhere to "Natural Selection"; the latter he makes essential as being, in all the higher forms of

life, an important co-operating agency in the change of hereditary structures.

The theory of Darwin is to be distinguished from the theory of evolution, as one special hypothesis is to be distinguished from a vastly more general one in which it is included. If Darwinism were proved true, it would of course establish, so far as the forms of life on this earth are concerned, the theory of evolution; but if Darwinism were proved false, evolution would have lost nothing but the discomfiture of one — and just now, perhaps, the most popular one — of the supposable theories of its *modus operandi*. Among the most able and zealous opponents of Darwinism are to be reckoned some of the strongest supporters of evolution. It is impossible, therefore, to discuss the Darwinian theory without saying something on the general subject of evolution, and it should be kept in mind that, on the one hand, while arguments in favor of Darwinism all go to establish evolution, those in favor of evolution generally do but afford standing ground for, and do not enter on the proof of, Darwinism; and, on the other hand, arguments against evolution are equally conclusive against Darwinism, while those against Darwinism specifically, scarcely affect the more general subject of evolution.

Mr. Darwin's main theory may be thus stated: every plant as well as animal transmits to its offspring a general likeness to itself; along with the general likeness thus inherited, each individual has also slight differences which may be of any kind and tending in any direction (the causes of these variations being scarcely at all understood, Mr. Darwin frequently speaks of them as "accidental," although fully believing them to be under the control of laws not yet discovered); all plants and animals tending to increase in number in geometrical progression, while the total vegetable and animal population of the world (apart from man and his agency) remains nearly stationary, there arises among them all a severe struggle for existence; in this struggle those individuals will survive and transmit offspring which are best adapted to the conditions of life in which they are placed, that is, "the fittest will sur-

vive"; if now there come about any change in the conditions of life, either from a change in the earth itself, or from the spread of any species into a different part of the earth, the slight variations among the offspring of any plant or animal will determine which individuals will be most likely to survive, and so again among their offspring, until these "slight individual differences" have been gradually accumulated into races, species, genera, etc., etc.; at the same time a portion of the offspring continuing ordinarily under unchanged conditions, will continue itself unchanged, and thus, for the most part, the old species will in some localities be continued along with the new under other conditions; theoretically, such a process should present every possible gradation of plant and animal from the lowest to the highest, but practically so small a part of their remains is preserved, and of that part science has as yet examined only such a minute fraction, that the absence of the connecting links is sufficiently explained; the time during which organic life has existed upon our globe is practically infinite.

Mr. Darwin by no means denies that other causes, such, e.g. as outward circumstances of heat and cold, etc., may have had a direct effect in the modification of species; but these he considers as altogether secondary, the main law by which all diversities of plants and animals have been produced being natural selection, or the survival of the fittest.

It will be observed that the theory rests upon a number of data, some of which will be universally admitted, while others are more or less seriously questioned by scientific men. It may be well in advance to call attention to two points as those in which the theory stands most in need of evidence — first, the extent to which the accumulation of differences is possible, and secondly, the length of time required for the purpose; while the absence of remains of intermediate forms will doubtless be considered as a further point which requires a fuller explanation. To these points we shall recur.

The reception accorded to this and to Mr. Darwin's other hypotheses has been various. Among those exclusively devo-

ted to natural science, "Natural Selection" has awakened universal attention. Perhaps by the larger, certainly by the more demonstrative, portion of them it has been fully accepted, and in Germany more fully than anywhere else, and it has called forth an already considerable literature in its defence and support. By others, and those among men entitled to speak confidently upon such a subject, it is more or less completely rejected. By Mr. Wallace, who was himself an independent originator of the same theory, and by others, its general truth is fully admitted, but its applicability to man is denied. Some distinguished men of science, as Huxley, accept it ardently, but with the reserve that certain facts—such as the infertility of hybrids—which now militate against the theory shall hereafter receive an explanation. It is probably accepted by all naturalists as explaining more satisfactorily than had previously been done the variation within narrow limits of species under changed conditions of life; but this can hardly be called an acceptance of the theory, since it does not at all reach to the dimensions of the subject with which Mr. Darwin has undertaken to grapple. Among men devoted to other branches of science there has been less occasion for an expression of opinion; but, on mathematical and astronomical grounds, Sir W. Thompson has undertaken to show that the demands it makes upon time are quite inadmissible.

With the general public it has had what may be called "an immense run." Theories of evolution or of transmutation of species in various forms have always obtained a transient popularity on their first enunciation, as undertaking to bring some of the most obscure problems of the world under the operation of familiar causes, and as definitely extending the region of LAW over what it was supposed must in some unknown way lie within its boundaries. None of these theories have rested upon so large a portion of known truth, none have been worked out in connection with such an immense observation of facts, and none have found an advocate whose candor so won upon our confidence; while

his command of style fixed our attention, and his own untiring earnestness enlisted our sympathy. When to this is added the open adhesion to, and strenuous advocacy of, the theory by several men already well-known in their successful attempts to popularize the teachings of other branches of science, it is not to be wondered at that Darwinism should have almost at once occupied the public ear, without regard to the evidence on which it rests or the real cogency of the arguments by which it is sustained. So far as the reception of a theory by those competent to pronounce upon it is to be regarded as a test of its truth, it is evident that this test has in this case only very lately begun to be applied. The sifting of the evidence, argument upon the proper inferences to be drawn from it, the questioning of the force of its analogies, the weighing of objections, are processes which are not to be accomplished in a moment, nor to be satisfactorily concluded by the application of a very few minds. What is to be the ultimate issue yet remains to be seen, and it is by no means inconceivable that another ten years may see the Darwinian theories considered as insufficient to include within their generalizations the broader domain of observation. This has already repeatedly occurred with the more or less similar theories that have preceded them, as those of Lamarck and of the author of the *Vestiges of Creation*.

There is one feature of the discussion, as hitherto conducted, which cannot be left quite unnoticed — the absence of any reference to the scriptures by the disputants on either side. We must rejoice that doctrinal statements and the language of sacred devotion are not bandied about in such a discussion, as they might once have been. But the scriptures have also a purely historical value, and that in regard to a period of which there is no other authentic record, and which is of importance in the present controversy. The monuments of Egypt are appealed to; but of the scriptural representations of man's primeval state, of the bearing of its histories upon the extent and the diffusion of the population of the world, and a multitude of kindred topics, we hear almost nothing.

Several of the more prominent advocates of Darwinism have evidently made up their minds to admit of no aid in the investigation from any source outside of their own limited department of the field of science. They will have nothing to do either with the formulas of mathematics or with the records of history. Such men are entitled to a careful hearing as to the testimony of their own speciality, but are quite incompetent to determine how much weight is to be attached to that testimony when in conflict with other data, or to decide upon the entire merits of the theory. They will be carefully listened to until they have fully exhibited the evidence within their own knowledge, and explained its bearing upon the questions at issue. Then the world will surely, in forming its final conclusions, avail itself of all the light within its reach, coming from whatever source; for, after all, in the long run, what men want to know is the real truth, and not merely what any particular set of men, however distinguished, may happen to think. Specialists are seldom in a position to appreciate the modifying influence which the advance of the sciences in a thousand directions brings to bear upon their own views; they catch a glimpse of nature's vast cathedral through loop-holes they have laboriously cut in the walls of the prison-house of our ignorance; they give us one, but only one, view of the glorious whole; and experience has long since proved that partial truth becomes a synonyme for partial error. As this discussion advances, and takes in broader and broader generalizations, Darwinism must necessarily lose its peculiar vigor as a new and aggressive theory, and, being put upon its defence, may be found to present assailable points on sides that have not yet been considered.

Meantime theologians, having learned something of wisdom from the experience of past controversies, have in great degree stood aloof from the discussion. Begun as a scientific theory, discussed on scientific grounds, Darwinism must be finally accepted or rejected on scientific evidence. It has been felt that former cases of theological intermeddling,

from the days of Galileo down to those of the geologists, have not been of advantage either to science or to theology, until science had gone far enough to know what its own teaching really meant. But there is one feature characteristic of the Darwinian and of several other recent scientific theories which, it seems to us, very broadly distinguishes them from the cases above referred to, and gives the non-scientific observer a full title to take part in the discussion. It is this: Scientific conclusions have acquired their weight and authority in the past as being the result of induction. All along, theories have been formed as a means of generalizing observations and advancing to further knowledge; but those theories, before being accepted, ordinarily before being propounded, have been subjected to rigid inductive tests. Newton conceived of the law of gravity, but, having tested it by the observations then made upon the moon, and finding it did not agree with them, laid it aside. Afterwards, when those observations had been rectified, he again made the comparison, and, the agreement being now found satisfactory, he announced his theory. This process has been so often repeated, in great matters and in small, that men have come to rest very implicitly upon the announcements of science, and men of science have come to occupy something of the position once held by the religious teacher, and to feel that whatever they taught would be accepted by the hearer as certain truth. This position has proved, in the one case, as in the other, to offer temptations too strong for human nature. In the hurry of advancing knowledge it has come to be more and more common to put forth, in various departments of science, and especially in those in which the general public take the liveliest interest, imperfectly tested theories as ascertained truths. *Deductive* reasoning has been largely substituted for *inductive*, and it is precisely here that the opportunity and the duty occur for the non-scientific observer to come in and examine the cogency of the deductive process. We are quite aware that Huxley, in treating of this very subject, in his little book on the

"Origin of Species," scouts the distinction, and repudiates the objection made to his argument on this ground. Nevertheless, it remains true that an almost exclusive training in the nice observation of facts and consideration of the inductions they sustain does not fit the mind to be a master in the art of deductive reasoning, nor entitle its deductive conclusions to implicit acceptance, without further examination. At all events, when once the process of deduction is entered upon, the man whose daily life is occupied with such processes, and with the weighing of the conclusions derived from them, may claim to come in, and, accepting the facts and the inductions sustained by them, to examine for himself, and with as much authority as the scientist, the deduction of conclusions. We take it, therefore, there is no presumption in dealing freely with the arguments of men so eminent in their respective positions as Darwin, Huxley, Tyndall, Wallace, Lubbock, and Lyell. They are all eminent in observation in their own departments of science, in inductions, and in clear enunciation of their facts and their conclusions; but it can hardly be said of any of them that they are pre-eminent in the art of reasoning.

It remains to say a word on the reception which has been thus far accorded to Mr. Darwin's subsidiary theories of "pangenesis" and "sexual selection." It is as well to do this now, because there will be little occasion to refer to them again. The former seems to be generally looked upon by the advocates of "natural selection" as an unnecessary hypothesis, and they do not care to encumber the main argument with the grave difficulties attaching to the subsidiary theory. The theory itself is somewhat difficult of a brief and satisfactory statement; but its chief points are as follows: Every part of every living thing is ultimately made up of a vast number of "gemmules," or minute living particles or organic atoms, and each one of these has the inherent power of reproducing its kind. These "gemmules," or any number of them, may at once exert their reproductive powers, or they may pass on in a dormant state from parent

to offspring for a series of generations. In order to this it is necessary that there should be a general aggregation of all varieties of "gemmules" in each ovum and spermatozoon in the higher animals, and in each part capable of reproducing by "budding" in the lower animals and plants; and to effect such aggregation there must necessarily be a free circulation of the "gemmules" from every organ through the system. These "gemmules" are further supposed to be formed and transmitted, not only from each part of every organ in every state and stage of its existence, but also from various states and stages of the organs of some generations of ancestors. Finally, they are supposed to reproduce in certain definite relations to other "gemmules" with which they may be brought into contact. The extent to which the multiplication of such "gemmules" is supposed to be carried is best seen in the words of Mr. Darwin himself: "In a highly organized and complex animal . . . . the gemmules thrown off from each cell or unit throughout the body must be inconceivably numerous and minute. Each unit of each part, as it changes during development,—and we know that some insects undergo at least twenty metamorphoses,—must throw off its gemmules. All organic beings, moreover, include many dormant gemmules, derived from their grandparents and more remote progenitors. These *almost infinitely numerous* and minute gemmules must be included in each bud, ovule, spermatozoon, and pollen-grain."<sup>1</sup> It will be seen that this hypothesis is of the nature of an almost pure speculation, having but the slenderest possible support in any facts of observation. For the most part, therefore, it has been simply left out of consideration in the discussion, although sometimes a shaft is aimed at the main hypothesis winged with the evident airiness of the subsidiary theory. It is objected to by Professor Delphino and other scientific men, on the ground of requiring for its support many subordinate hypotheses, some of which are simply untenable. The absurdity of its practical application can hardly be

<sup>1</sup> "Animals and Plants under Domestication," Vol. ii. p. 366.

shown better than by an example given by Mivart: "On the hypothesis of pangenesis, no creature can develop an organ unless it possesses the component gemmules which serve for its formation. No creature can possess such gemmules unless it inherits them from its parents, grandparents, or less remote ancestors. Now, the Jews are remarkably scrupulous as to marriage, and rarely contract such a union with individuals not of their own race. This practice has gone on for thousands of years: and similarly, also, for thousands of years, the rite of circumcision has been unfailingly and carefully performed. If, then, the hypothesis of the pangenesis is well founded, that rite ought to be now absolutely or nearly superfluous, from the necessarily continuous absence of certain gemmules through so many centuries and so many generations."<sup>1</sup>

The theory of sexual selection has been so lately propounded that its reception is a matter rather of prediction than of record. The method of its support, however, is so similar to that of natural selection, there is so much of likeness between the two theories themselves, and it is so cleverly fitted in to supply gaps in the main theory and to remove some of its more obvious difficulties, and, altogether, it is made by its author so much an integral part of his way of accounting for the origin of species, that it is likely to be accepted or rejected along with the main hypothesis. It has, of course, its own especial difficulties; but these are so much of the same character with those that surround the principal theory, that minds which are able to overcome the one will not be likely to be appalled by the other. In no part of Mr. Darwin's works does his candor appear more conspicuously than here. Facts in endless profusion are indifferently marshalled upon his pages, whether they are antagonistic to, or accordant with, his theory. Is it to be proved that the beautiful plumage of the male bird has come about by selection, in consequence of its power to captivate

<sup>1</sup> "The Genesis of Species," p. 227.

the female at the breeding season? It is shown that in a multitude of cases it happens that this plumage is most fully developed just at that time; but, with perfect candor, it is added that in a multitude of other cases it does not appear at all, while in others it continues equally brilliant at all seasons. These various facts are impartially given; such as make in favor of the theory are gathered up; those which make against it are sometimes more or less explained, sometimes quite let alone. Mr. Darwin does not disguise that he has a theory to prove which may affect his judgment, but states that to his mind the balance of the evidence lies in such a direction. There is something heroic in the unflinching fairness with which so ardent a theorist is ready to give his readers the benefit of all the facts which make against himself. It is even chivalric, when he takes those facts, and, without any perversion or explanation of them, arrays them, just as they are, among the supports of his theory. One instance, in passing, must be given. His theory is, that certain peculiarities in individual males, having been found attractive to the females, have given them an advantage over their rivals; and these peculiarities, having been accumulated in a long succession of generations, in the same way as in "natural selection," have gradually produced the ornaments and other developments in which the sexes differ. (These may, however, be transmitted to both sexes, in which case they will lead to a change in species.) These peculiarities, he tells us, have come to be transmitted by inheritance during a long course of generations; yet it often occurs that after they have been developed in the growth of an individual male, they may be made to disappear again by the process of emasculation. To most persons this would be a conclusive proof that such peculiarities were immediately connected with and dependent upon the masculine functions; but Mr. Darwin refers to the fact, again and again,<sup>1</sup> as an evidence of his theory of sexual selection, i.e. that these characters have been originally gradually ac-

<sup>1</sup> E.g. *Descent of Man*, Vol. ii. pp. 275, 283, 299, 380.

quired as being attractive to the females, and then transmitted by inheritance through a long course of generations. He even attaches so much weight to the fact as to include it in his short summary of the principal points of his argument at the close of his work.

It is time to return to the principal theory itself, and review, as briefly as may be, the chief points in the arguments for and against its truth. Both Mr. Darwin and his friends have so generally discussed his hypothesis as if it were identical with the general theory of evolution, that it is somewhat difficult to do justice to their reasoning, without allowing them the advantage of arguments which make only in favor of evolution in some form or other, and not at all in favor of "natural selection" in particular. In order to do this as fairly as possible, it is necessary to glance, very briefly however, at the general subject of evolution, and, having taken a bird's eye view of its position, so as to see what arguments and objections belong to the whole subject, then to come to those which belong specifically to Darwinism. It will be found that all the more important arguments so commonly urged for the latter really belong to the former, while most of the difficulties are the peculiar property of the latter.

Evolution, in its most general sense, is simply the "evolving" of one thing out of another, without reference to the power by which this is accomplished, the means by which it is effected, or the resulting differences in the product. In this sense, probably, no one would object to its use in connection with the creative work, after the original fact of creation itself. The Mosaic narrative itself is certainly open to, even if not absolutely requiring, such an interpretation. The formation of land and of sea was by the separation of previously existing material. Vegetable life was ushered in by the mandate: "Let the earth bring forth grass," etc., and its accomplishment is accordingly recorded: "And the earth brought forth grass," etc. The phraseology in regard to the

origin of marine and of land animals is the same: "Let the waters bring forth abundantly the moving creature that hath life"; "Let the earth bring forth the living creature after his kind." Even of man, while in the first account of his creation it is simply declared that God made him in his own image, yet afterwards it is more specifically declared: "And the Lord God formed man of the dust of the ground" (Gen. ii. 7). The doctrine of the production of the entire series of organic forms from pre-existing inorganic material is, therefore, to say the least, not in opposition to the scriptural record. And that record was so understood centuries before modern scientific discoveries came into being. The patristic view of creation was as far as possible from that of the direct creation of each species *ex nihilo*. On the contrary, it was generally held that the Creator had constituted the water and the land with such inherent forces that they produced from themselves the various creatures appertaining to them. Often these views were carried so far as to assert the still active operation of these forces, and thus to set forth explicitly the doctrine of "spontaneous generation," which modern researches have as yet failed to establish. This may be seen with especial clearness in St. Basil;<sup>1</sup> but in a limited space it is better to confine the attention to the writings of a single master mind. St. Augustine not only treats expressly and at length of the creation, but frequently refers back to it in his other works. He tells us that the creation on the third day of vegetation, and on the sixth of terrestrial animals, was potential only.<sup>2</sup> He draws a parallel between the origin of plants and of animals: As, in the case of the former, it may be questioned whether the seed is from the tree, or the tree from the seed, yet the earth is the parent of both; so, in the case of animals, it may be doubted whether they proceed from the embryo, or the embryo from

<sup>1</sup> Basil, Hexaemeron, Hom. ix. c. 1.

<sup>2</sup> Augustine de Genesi ad lit. lib. v. c. 5. 14. — Tertio, species maris et terrae, atque in terra potentialiter, ut ita dicam, natura herbarum atque lignorum. . . . Sexto, terrestria similiter animalia, tanquam ex ultimo elemento mundi, ultima; nihilominus potentialiter, quorum numeros tempus postea visibiliter explicaret.

them; but whichever is the earlier, that is most certainly from the earth.<sup>1</sup> He argues that, as all things are already invisibly in the seed which are hereafter to develop into the tree, so, also, with the world itself, all things are said to be created at once by the divine command, because the water and the land produced them under the operation of the same divine laws which are still in operation.<sup>2</sup> In his work on the Trinity he teaches very fully that the creation of animals has taken place after the analogy of agricultural growth: God is the ultimate Author of all things; but he works through secondary causes. He has given to the earth forces in virtue of which it has evolved from itself the various forms of life.<sup>3</sup> Such views, as already said, were common

<sup>1</sup> Augustine de Genesi ad lit. lib. v. c. xxiii. 44. Ergo et semen ex arbore, et arbor ex semine. . . . Alternis igitur successionebus alterum ex altero, sed utrumque ex terra, nec ex ipsis terra; prior igitur eorum parens terra. Sic et animalia, potest incertum esse utrum ex ipsis semina, an ipsa ex seminibus; quodlibet tamen horum prius, ex terra esse certissimum est.

<sup>2</sup> Ibid. 45. Sicut autem in ipso grano invisibiliter erant omnia simul quae per tempora in arborem surgerent; ita ipse mundus cogitandus est, cum Deus simul omnia creavit, habuisse simul omnia quae in illo et cum illo facta sunt, quando factus est dies; non solum coelum. . . . sed etiam illa quae aqua et terra produxit potentialiter atque causaliter, priusquam per temporum moras ita exorirentur, quomodo nobis jam nota sunt in eis operibus, quae Deus usque nunc operatur.

<sup>3</sup> De Trinitate, lib. iii. c. viii. 13. Omnium quippe rerum quae corporaliter visibiliterque nascuntur, occulta quaedam semina in istis corporeis mundi hujus elementis latent. Alia sunt enim haec jam conspicua oculis nostris ex fructibus et animantibus, alia vero illa occulta istorum seminum semina, unde jubente Creatore produxit aqua prima natatilia et volatilia, terra autem prima sui generis germina, et prima sui generis animalia. And a little further on, ib. 14. — Ita creationem rerum visibilium Deus interius operatur; exteriores autem operationes sive bonorum sive malorum, vel angelorum vel hominum, sive etiam quorumcumque animalium, secundum imperium suum et a se impertitas distributiones potestatum et appetitiones commoditatum, ita rerum naturae adhibet in qua creat omnia, quemadmodum terrae agriculturam.

And again, ib. c. ix. 16. Aliud est ex intimo ac summo causarum cardine condere ac administrare creaturam, quod qui facit, solus Creator est Deus: aliud autem pro distributis ab illo viribus et facultatibus aliquam operationem forinsecus admovere, ut tunc vel tunc, sic vel sic, exeat quod creatur. Ista quippe originaliter ac primordialiter in quadam textura elementorum cuncta jam creata sunt; sed acceptis opportunitatibus prodeunt. Nam sicut matres gravidas sunt foetibus, sic ipse mundus gravidus est causis nascentium: quae in illo non creantur,

among the Christian Fathers. In their ignorance of science, their opinions upon details were often grotesque in the extreme; but, such as they were, they naturally impressed themselves, both in detail, and in general principle, upon the scholastic writers, and thence they passed on to the writers of the Reformation period, and so into the common belief of the people of that time.

Just here is one of the most curious and instructive facts in the whole history of the relations of theology and science. When thought was set free by the great theological revolution of the sixteenth century, men's minds were possessed with the idea of spontaneous generation, and the popular belief was firm that frogs were originated in the clouds, and were rained down upon the earth, and many such like phantasies. But the freedom acquired by the upheaval in theology became the means of the growth of science, and by that growth these crude notions were rudely scattered. The scientific maxim became "Omne ex ovo," and this maxim was at last so firmly established as to be regarded as in some sort a religious truth. When, therefore, the most modern science undertook to reinvestigate the question of spontaneous generation, a cry of sacrilege arose. By many devout minds that science was considered as infidel which could suggest—although it has not yet adopted—a theory which, a few generations before, this same science had dislodged from its position as a commonly received dogma!

To return: evolution, as the term is now understood in scientific treatises, means something more than the very general conception held by Augustine. It means, not only that all organic forms have been created ultimately out of inorganic material, but that they have been evolved one

*nisi ab illa summa essentia, ubi nec oritur, nec moritur aliquid, nec incipit esse nec desinit. Adhibere autem forinsecus accedentes causas, quae tamenetsi non sunt naturales, tamen secundam naturam adhibentur, ut ea quae secreto naturae sinu abdita continentur, erumpant et foris creentur quodam modo explicando mensuras et numeros et pondera sua quae in occulto acceperunt ab illo, qui omnia in mensura et pondere disposuit; non solum mali angeli, sed etiam mali homines possunt, sicut exemplo agriculturae supra docui.*

from another in lines of their ascending scale in rank. It does not mean that they have been thus self-evolved, or evolved by any natural forces of which we have knowledge; these are the doctrines of special theories, as when Mr. Darwin contends that the producing force has been natural (in combination with sexual) selection. Evolution itself simply maintains the fact of a genetic relation between the different forms of life, leaving us free to believe that the cause of that fact must be sought in a superior Power. The question is thus removed from theological objection, and becomes simply one of evidence.

In its favor it is urged that both in the vegetable and the animal kingdoms there is a manifest gradation of rank, and that, in general, the series of gradation is also the series of the appearance in time of the several forms upon the earth. This fact has always attracted the attention of the intelligent observer, and its force of late years has been greatly increased, and still increases with the ever-widening observations of science. It leads irresistibly to the conclusion that the world has been hitherto, and is therefore likely to continue, progressive. It harmonizes with the Mosaic order of creation, and prepares us to look forward to the realization of the promises of scripture. The difficulty of applying it to the support of evolution lies in the fact that, while this law of progress is most manifest upon a broad and general view, it fails very often, when we descend to details, where "evolution" most needs its support. It is not found true of each order and class, of each family and genus, that its lowest forms first appeared, and then, subsequently, the higher; but frequently the exact reverse is true, as has been often shown, and especially by Dana, in his *Geology*. In accordance with these facts, the law of evolution would be, not one of uniform progression, but one which, with a marked tendency on the whole to advance, yet allows of many minor retrograde steps; these steps being often the comparatively small ones, while the advance is as often by great and sudden strides.

It is further urged that there is a marked analogy between evolution and embryonic development. The embryos of the higher animals in the successive stages of development pass in succession through forms which represent the various grades of animal life below them. It is not meant, here, to refer to that egregious fallacy of certain Darwinian philosophers who argue that because the embryo of a man at some stages cannot be distinguished, or "can hardly be distinguished," from the embryo of a dog at a corresponding stage, therefore man has once been a dog; for it is obvious, here, that the want of distinction lies simply in our powers of observation. The two embryos, by all Darwinian laws of inheritance, must be different essentially, and that difference is made manifest in their different development. It would seem as rational to say that because nitro-glycerine looks very much like water they had a common genesis, or because brass looks like gold, therefore they have common properties. But, setting aside such inferences, which are among the examples of the curious methods of reasoning employed by some natural philosophers when they stray beyond their accustomed sphere, it remains that there is an obvious analogy between the development of the individual and that of the whole kingdom to which he belongs. There is a somewhat similar analogy between the intellectual development of the individual man and that of his whole race. Such analogies excite interest and attention; they indicate the existence of general laws, under which each kind of development takes place, whether in the individual and the race, or, in the case of physical development, the individual and the whole kingdom to which he physically belongs. Whether they do more than this is a question on which there may be a difference of opinion. The evolutionist argues that these analogies indicate a genetic connection between the various members of the animal kingdom. It may be so; but the point is not proved, and the hypothesis is certainly tenable that by the laws of organic life development takes place in certain lines. The circumstance that in some classes

of beings this development extends only a certain way along the line, in others it extends further, and in still others further still, by no means proves, or even renders in any degree probable, a genetic connection between them. It is especially to be remembered that at no stage of embryonic development are different animals really the same. The most that can be said of them is that they are yet too undeveloped for us to distinguish them; there is certainly an essential difference between them; they are advancing in different lines; but as yet neither has moved far enough from the point of departure for our powers of observation to come into play. Just in proportion as the development enables us to see and understand what is really going on, the embryos become differentiated. The hypothesis of the possibility of the transmutation of perfect animals has long since been laid aside. Nevertheless, this point of similarity in embryonic development is set forth as one of the strong grounds on which the theory of evolution rests.

Another point much insisted on is "the similarity in points of structure and constitution." This is very striking in the study of animal forms, and is the basis of the classifications of naturalists. The animal kingdom; its great divisions of radiata, mollusca, crustacea, and vertebrata; their subdivisions into classes, orders, families, genera, and species, are the expression of the greater or less degrees of this similarity observed. But, in this case, as in the former, it remains an open question, whether this similarity indicates a genetic connection, or only the existence of common laws of growth. Naturalists differ about the matter; but it does not seem necessary to be a scientific naturalist, or, indeed, a specialist of any kind, to determine whether the fact is to be considered as conclusive evidence of evolution.

We come now to a more difficult and less understood fact which, at the first view, certainly weighs heavily on the side of the evolutionists. Very many animals have what are called "rudimentary structures," i.e. structures which in these animals are apparently without function or use, but

which correspond to important parts of other animals. Such are the minute teeth in the embryo of the whale which afterward disappear; the mammary glands of all male animals; the radius and ulna in the foreleg of the horse and other quadrupeds, so imperfect as to have no power of revolution; the rudimentary wing in the New Zealand Apteryx; and a great multitude of similar instances. If these rudimentary structures were seen only in animals of a higher grade, answering to fully developed structures in the lower, the argument from them would be more obvious than it is, since these may be considered as "atrophied," i.e. as having been passed on to the higher animal by descent, but from disuse, having been gradually diminished until they have become rudimentary. The fact, however, that such structures often appear in rudimentary and apparently useless forms in the lower animals, and then in their full development and use in the higher, has often been cited as among the "prophecies" of nature. But if the argument thus becomes less obvious, it loses nothing of its real force. The theory of evolution does not suppose the descent of creatures to have been in one continuous line, but rather with frequent branches and offshoots from that line, so that a particular organ might go on becoming more developed in one branch and more rudimentary in another, thus indicating not the descent of the one from the other, but the genetic connection of both with a common stock. To many minds the evidence of these facts in favor of evolution is almost overwhelming; to others it is simply proof of the existence of laws of growth and of correlations of growth leading to an imperfect production of structures even in animals in which such structures serve, as far as we at present see, no useful purpose. It may be urged that evolution goes behind those laws and gives a rational explanation of them; it is answered that it does so simply as an hypothesis, resting for proof only on changes observed in animals under domestication, so slight that they are far overborne by the negative evidence on the other side.

The same things may be said of the argument from

“Homology.” Essential structural resemblances are found to underlie great superficial differences in animals belonging to the same group, although of different form and external appearance and of different habits of life. Thus the arm of man, the foreleg of the ox, the paddle of the whale and the seal, the wing of the bat, are all formed essentially on the same type. Such homologies are at the foundation of the classificatory system of naturalists, and on the theory of evolution, classification becomes the expression of a genealogical relationship; but whether these homologies indicate a genetic connection or only show the existence of common laws of growth, they are in either case far too important to be overlooked.

The geographical distribution of animals in connection with their geological succession is a very curious and interesting subject. It is found that there are certain general characteristics of animals belonging to each larger region of the world which distinguish them from animals of the same classes in other parts, and that these characteristics have been persistent in the same regions through past geologic periods. Thus Australia is now, and has been in the past, the home of the marsupials, or pouched beasts, and the fossils of creatures closely allied to the kangaroo, etc., are found below the surface over which the kangaroo itself now roams. So sloths and armadillos appear only in South America, and there, and nowhere else, are found the fossils of species and genera, differing from existing sloths and armadillos, but more like them than any kinds of animals elsewhere. And not only are these characteristics of continents carried out on a great scale, but in adjacent islands where there is a probability of a former connection between them, the animals are nearly alike, while if there is evidence (from the depth of the sea and other indications) of a more ancient separation, their animals show a corresponding divergence.

An argument of less force is founded upon what are called “abnormal reversions.” The muscles in man, for example,

are somewhat variable in their number, their form and their attachments ; sometimes one is found which does not properly belong to man but to the anthropoid apes. So also with the growth of hair upon the body, and many such like variations. These are considered as "reversions" to the characters of a remote ancestor and as, therefore, evidences of descent. Mr. Darwin even finds a slight point occasionally developed on the outermost fold of the human ear an evidence of the descent of man from a pointed-eared animal.<sup>1</sup> But as it does not appear that such variations are uniformly or even generally in any one direction, it is of course illogical to single out a few of them which present evidence of one kind to the neglect of others which ought, if they indicate anything, to point the opposite way.

Many naturalists feel that these various lines of argument are not to be considered singly, but that they have a cumulative force ; that there is a vast series of important facts stretching through the whole realm of nature, which evolution enables us to understand and co-ordinate ; and even more than this, it serves as a basis of future research and guides to the discovery of new facts, forming the means of inference from the unknown to the known. That it offers a rational explanation of the vast harmonies of organic life and explains, as nothing else can explain, the endless and intricate relations of the almost countless forms of organic life to one another. For these and such like reasons it has made a rapid progress, not, however, without some eminent protests, to general scientific acceptance. In this point of view it is to be considered like other scientific hypotheses which have from time to time been proposed to generalize the facts known at the time, and to be the instrument of further progress. Such hypotheses, like the Ptolemaic system in astronomy, Newton's theory of the emission of light in physics, the atomic theory in chemistry, etc., may or may not be discarded in the progress of science and others substituted for them ; they do not rest upon an induction of facts by which their truth is

<sup>1</sup> *Descent of Man*, Vol. i. pp. 21, 22.

proved, but they suggest a possible method by means of which the facts as yet known may be correlated and a step in advance gained. If the theory should hereafter be proved false, its present value is not diminished; only as soon as facts inconsistent with its truth become known, a further adherence to it becomes destructive of progress.

Thus the general and fundamental theory, of which that of Mr. Darwin is a particular expression, does not itself appear to rest either upon an assured basis of evidence nor upon a universal provisional acceptance. It may hereafter be proved true or untrue, or it may always remain an hypothesis the ground-work of which is beyond the reach of science. Theologically, it does not touch on the fact of creation; it only proposes to furnish a probable account of the *modus operandi* of creation. By a large number of scientific investigators it is accepted as an invaluable conception of utmost use to the progress of science; by others it is rejected as baseless and delusive.

It is only from this somewhat uncertain position that we can in reality consider the especial merits or demerits of what is properly Darwinism. Yet in order to treat this theory fairly, it will be better for the sake of argument, to assume the truth of the more or less uncertain doctrine of evolution.

The Darwinian theory undertakes to give us a rational account of the process of evolution, and it is at present the only theory entertained which proposes to do this upon scientific grounds. Its starting-point is the observed greater or less variability of all plants and animals. No two of them are exactly alike. In the same species the child always differs somewhat from the parent and the several individuals of the offspring from one another. Now it has been observed that in domestic animals man can select such variations as suit his purpose, and by breeding from them can increase these variations, which may have been comparatively slight at the outset, until he has produced a race which is persistent.

This has been over and over again accomplished in cattle, in dogs, sheep, horses, pigeons, etc. etc., until the fact is thoroughly familiar, and this is the very corner-stone of Darwinism. It is argued that if man's selection were replaced by any other agency the same results would follow, and thus far there can be no dispute. Further, the conditions under which animals exist in a state of nature present such an agency. They tend to multiply in a ratio which makes it impossible that they should all continue to live. As long as the conditions of life remain the same the species will continue unchanged; this we know as a matter of observation, and should expect because the species being already sufficiently well adapted to its conditions, the comparatively slight variations occurring will give their possessor no especial advantage, and being balanced by variations in all directions which cross with one another, the average result remains unchanged. But when any unusual state of things occurs, such as a very dry or very wet season, changing the normal supply of food, or the excessive multiplication of enemies, or the forcing of any particular species or part of it into new countries whether by its own increase or by the increase of its enemies, or by seasons of uncommon severity, then the species as it has hitherto existed will be somewhat out of harmony with its conditions, and in the struggle for existence those will survive and have offspring which are best adapted to the altered circumstances. The result will be a variety; and such varieties have in several instances been known actually to occur, especially with shell-fish transplanted to another locality, or when a material change has been effected in the locality where they were. Here we have an agency analogous to that of man in breeding by selection and producing similar results. Thus far then, the point is proved. But the question now occurs, what is the extent of such variation either in the hands of man, or as far as it is *actually known* to occur in nature? To this but one answer can possibly be given: it extends to those minor differences which constitute varieties, breeds, or races, but so far as

observation has yet gone it does not extend to species. We are well aware that Mr. Darwin and his followers feel the pressure of this limitation and have devoted much thought and argument to overcoming its consequences. They dwell upon the points of difference between races; they compare endless anatomic measurements of varieties; they speak of differences between domestic breeds as so great that, had they been discovered wild, any naturalist would have ranked them as species; and they have this great advantage, that the limits of many species are still unsettled, and often what is classed by one observer as a distinct species is determined by another to be only a variety. Still further, the law of the infertility of hybrids between different species and of the fertility of crosses between varieties is in some exceptional cases rendered uncertain by this want of definiteness in regard to the limits of species. But for all this, there is a great natural barrier between certain groups of animals, generally known as species, which is quite impassable: their hybrids are infertile, so that it is impossible to perpetuate by generation a cross between them. The difficulty cannot be better expressed than in the words of Mr. Huxley, himself an earnest advocate of Darwinism: "It must not be forgotten that the really important fact, so far as the origin of species goes is, that there are such things in nature as groups of animals and of plants, whose members are incapable of fertile union with those of other groups; and that there are such things as hybrids, which are absolutely sterile when crossed with other hybrids. For if such phenomena as these were exhibited by only two of those assemblages of living objects, to which the name of species (whether it be used in its physiological or its morphological sense) is given, it would have to be accounted for by any theory of the origin of species, and every theory which could not account for it would be, so far, imperfect."<sup>1</sup> This barrier of infertility, so far as

<sup>1</sup> "Lay Sermons, Addresses, and Reviews," xii. "The Origin of Species" (American edition), p. 275. In an earlier separate publication under the same title Mr. Huxley speaks of the difficulty in much stronger terms, but hopes with advancing knowledge its explanation will be found.

known, has never been reached by the accumulation of differences under any form of human or natural selection. It appears, then, that at this point Mr. Darwin's analogy breaks down. It may be, and very likely is, the best way of accounting for certain minor differences between different varieties of plants and animals; but all the evidence is thus far negative as to the competency of the cause to accomplish the effects for which it is proposed.

The geological succession of plants and animals has already been spoken of in connection with the general theory of evolution. Darwinism, distinctively so called, has much to say of this, chiefly in an apologetic way, to account for the absence of the remains of intermediate and transitional forms which were to have been expected on the supposition of the truth of its theory. There are, however, a very few fossil remains which have been claimed as supplying the missing links of which Darwinism stands in need. So much attention has been called to these that they have been examined with more than usual care, and it has been scientifically proved, in every case, that such forms are not truly intermediate or transitional, but belong essentially and fundamentally to one or other of the groups which they were supposed to connect, with certain additional characters giving them a superficial resemblance to the other. The geological evidence, therefore, remains upon the face of it distinctly contradictory to Darwinism, and the task of the advocates of that theory is simply to explain away its force. Whether they have been able to accomplish this, whether the argument from our ignorance is sufficient to offset the argument from our knowledge, may be a matter of difference of opinion. The gaps to be accounted for occur at almost every link in the long chain of organic life. In regard to the last and most important of these Mr. Huxley may again be quoted: "The fossil remains of man hitherto discovered do not seem to me to take us appreciably nearer to that lower pithecoïd form, by the modification of which he has, probably, become what he is. And considering what is now known of the

most ancient races of men ; seeing that they fashioned flint axes and flint knives and bone skewers of much the same pattern as those fabricated by the lowest savages at the present day, and that we have every reason to believe the habits and modes of living of such people to have remained the same from the time of the mammoth and the tichorhine Rhinoceros till now, I do not know that this result is other than might be expected. Where, then, must we look for primeval man ? Was the oldest *Homo sapiens* pliocene or miocene, or yet more ancient ? In still older strata, do the fossilized bones of an ape more anthropoid, or a man more pithecoïd, than any yet known, await the researches of some unborn palaeontologist ? Time will show. But, in the meanwhile, if any form of the doctrine of progressive development is correct, we must extend by long epochs the most liberal estimate that has yet been made of the antiquity of man.”<sup>1</sup>

To this matter of time we shall recur presently. Meanwhile let it be noted what, in Mr. Huxley’s opinion, is required by the theory.

There is one curious fact in natural history, called “mimicry,” which is explained by the Darwinian theory, and thus far by this alone. This fact may therefore be considered, as far as it goes, as an actual evidence in favor of that theory. The observation of these facts is comparatively recent, and remains to be more thoroughly investigated ; still, such as it is, it must be set down as on the side of Darwinism. Mimicry is a close, yet merely external, resemblance existing between different kinds of plants and animals, the essential differences of structure and of life being often great between objects which bear the closest outward likeness. The so-called “walking leaf” insect is an instance of an animal assuming the most curious resemblance to a vegetable structure. Mr. Wallace details many marvellous instances of such resemblance. Of a “walking-stick” he says, “one of these creatures, obtained by myself in Borneo (*Ceroxylyus laceratus*), was covered over with foliaceous excrescences of a clear olive-

<sup>1</sup> Conclusion of “Man’s Place in Nature.”

green color, so as exactly to resemble a stick grown over by a creeping moss or *jungermannia*. The Dyak who brought it to me assured me it was grown over with moss, although alive, and it was only after a most minute examination that I could convince myself that it was not so." And again he says of the leaf-butterfly, "we come to a still more extraordinary part of the imitation, for we find representations of leaves in every stage of decay, variously blotched and mildewed and pierced with holes, and in many cases irregularly covered with powdery black dots, gathered into patches and spots, so closely resembling the various kinds of minute fungi that grow on dead leaves, that it is impossible to avoid think-at first sight that the butterflies themselves have been attacked by real fungi."<sup>1</sup> The bee, fly, and spider orchids are further striking instances of mimicry, and sometimes reptiles and even fish are found to bear this same sort of resemblance to others of distinct kinds. Such mimicries are exceedingly curious and seem at first inexplicable; but natural selection suggests that certain varieties have had a better chance of life in consequence of these resemblances. The insect is able to elude the search of its enemies by its likeness to a leaf or a stick; or is avoided by them in consequence of its resemblance to some other insect having a disgusting taste or smell. Similarly with other animals, their resemblances have afforded either means of protection for themselves, or advantage in the pursuit of their prey. In the case of plants, mimicry has been of advantage in attracting the visits of insects, whereby they have been fertilized, and thus enabled to perpetuate their kind. In consequence of these advantages such resemblances in plants and animals have been gradually accumulated until the actual surprising results have been obtained. It is observed in nature that these resemblances are found precisely in the case of those species which stood in need of them, while the species imitated are provided otherwise with sufficient protection or other means of success in the struggle for existence.

<sup>1</sup> As quoted by Mivart, "Genesis of Species," p. 48.

Much the same conclusions are to be drawn from observations on the distribution of colors, and of powers of speed, and of weapons of offence and defence among the various kinds of animals. Conspicuous and beautiful colors are abundantly possessed by those animals which can "afford" to display them; the great multitude, on the other hand, are inconspicuously colored, as if for the sake of protection. What gives force to this argument is the fact that wild animals thus marked, or rather obscured, by colors assimilated to their surroundings, as soon as they are brought under domestication, and thus artificially protected, produce varieties of color, which either never occur in their wild state or else are immediately destroyed. Considerable doubt, indeed, is thrown over the value of the inference from these facts when it is observed that if animals thus artificially varied in various ways are exposed to their natural enemies, as, for instance, a dove-cote to the inroads of hawks, it is not the varieties which are assumed to have resulted from natural selection, but rather those which have acquired greater speed under human selection which escape the longest. The doubt concerns only the inference; the general fact remains.

These and a large mass of other arguments drawn from acknowledged facts of observation resolve themselves into the broad truth of the general harmony and adaptation of nature. It is for this that Darwinism undertakes to account, and since it attempts this, and holds out a hope of its accomplishment, it has attracted many active and earnest minds. Whether it is successful or not in the attempt is simply a question of evidence, and thus far, on most points, the evidence seems either wanting or insufficient. The facts of harmony and adaptation remain, and a debt of gratitude is due to Mr. Darwin and his co-laborers for bringing them so abundantly and so attractively before us; but when we ask for proof of the theory he has proposed to account for it, it is not so satisfactory to be answered chiefly by suggestions of possible reasons which may or may not be true.

Before proceeding further, and especially before taking up

the application of this theory to the origin of man, it will be well to cite a few examples of Mr. Darwin's mode of reasoning, that we may the better judge of its cogency apart from the conclusions to which it is applied. The examples are all taken from his last work, "The Descent of Man," and at hap-hazard, simply in the order of the pages.

Almost at the outset of the work (p. 34) occurs the following passage: "We must also admit that there is a much wider interval in mental power between one of the lowest fishes, as a lamprey or lancelet, and one of the higher apes, than between an ape and man; yet this immense interval is filled up by numberless gradations. Nor is the difference slight in moral disposition between a barbarian . . . . and a Howard or Clarkson; and in intellect, between a savage who does not use any abstract terms and a Newton or a Shakespeare. Differences of this kind, between the highest men of the highest races and the lowest savages, are connected by the finest gradations. *Therefore, it is possible that they might be developed into each other.*" Mr. Darwin appears to think that both cases must be of differences of degree, and not of kind, because they are connected by "the finest gradations." To the mere logician the absolute *non sequitur* of this *ergo* would be palpable. To his apprehension it would be as well to argue that night may be developed into its opposite day, because they are connected by "the finest gradations"; or that the prismatic red may for the same reason be developed into its complementary green. The argument has been happily illustrated by dissolving views, in which, by "imperceptible gradations," the Alps pass into Dotheboys' hall. Yet there must be some fascination in the argument; for this is one of the most fundamental and often recurring processes of reasoning in Mr. Darwin's works.

On page 51 he says: "The Duke of Argyll remarks that the fashioning of an implement for a special purpose is absolutely peculiar to man; and he considers that this forms an immeasurable gulf between him and the brutes. It is, no

doubt, a very important distinction ; but there appears to me much truth in Sir I. Lubbock's suggestion, that, when primeval man first used flint-stones for any purpose, he would have accidentally splintered them, and would then have used the sharp fragments. From this step it would have been a small one to intentionally break the flints, and not a very wide step to rudely fashion them." The point to be met is an actual and universal distinction existing between man and the brute. The answer is a purely hypothetical suggestion of what might have occurred with men. The real question, whether it did occur, is not touched ; nor the other side of it, why it does not also occur with the brutes. In Mr. Darwin's arguments omissions of this kind do not appear to be regarded ; for this, again, is a fair example of his method of dealing with facts which make against his theory, although he is always ready, with the utmost candor, to recognize them. Often, in such cases, the mind is led off by a long series of conceivable or inconceivable " ifs," until the original point is lost from sight.

In reasoning upon the gradual development of man's moral faculties from those conceived to exist in the lower animals, Mr. Darwin says (p. 158) : " Primeval man, at a very remote period, would have been influenced by the praise and blame of his fellows. It is obvious that the members of the same tribe would approve of conduct which appeared to them to be for the general good, and would reprobate that which appeared evil. To do good unto others—' to do unto others as ye would they should do unto you ' — is the foundation-stone of morality. It is, therefore, hardly possible to exaggerate the importance, during rude times, of the love of praise and the dread of blame." One cannot but regret that Whately should have written his logic too soon to avail himself of such an example of confusion at once of terms and of ideas, and thus to have introduced a new distinction concerning the legitimacy in some kinds of reasoning of processes which are forbidden in others. Nevertheless, what value shall we attach to an argument on the development of the

moral faculties in which the golden rule is based on the love of applause? We cannot refrain from turning back, in the volume, to page 84, to notice another similar instance: "An action repeatedly performed by us will at last be done without deliberation or hesitation, and can then hardly be distinguished from an instinct; yet surely no one will pretend that an action thus done ceases to be moral." This is the gist of an argument to show that the instinctive actions of brutes admit of being described as having a moral character. Once more, to quote an instance cited in an able Article in the London Quarterly for July, 1871, Mr. Darwin "says that if a man has gratified a passing instinct, to the neglect of an enduring instinct, he 'will then feel dissatisfied with himself, and will resolve with more or less force to act differently for the future. This is conscience; for conscience looks backwards and judges past actions, inducing that kind of dissatisfaction which if weak we call regret, and if severe, remorse' (vol. i. p. 87). 'Conscience,' certainly, 'looks back and judges,' but not all that 'looks back and judges' is 'conscience.' A judgment of conscience is one of a particular kind, namely, a judgment according to the standard of moral worth. But for this, a *gourmand*, looking back and judging that a particular sauce had occasioned him dyspepsia, would, in the dissatisfaction arising from his having eaten the wrong dish at dinner, exercise his conscience."

The examples of what, in other matters, would be called "petitio principii" are extremely numerous; but these seem to have been fallen into unconsciously, the mind of the author being so preoccupied with the truth of his theory that, even while arguing in its favor, he considers it as already demonstrated. Thus, on p. 181, in speaking of classification, he says: "Naturalists have long felt a profound conviction that there is a natural system. This system, it is now generally admitted [*sic*], must be, as far as possible, genealogical in arrangement, that is, the co-descendants of the same form must be kept together in one group, separate from the co-

descendants of any other form ; but, if the parent forms are related, so will be their descendants, and the two groups together will form a larger group. The amount of difference between the several groups — that is, the amount of modification which each has undergone — will be expressed by such terms as genera, families, orders, and classes. As we have no record of the lines of descent (!), these lines can be discovered only by observing the degrees of resemblance between the beings which are to be classed," etc.

One of the most common, as well as curious, of what appear to the unscientific mind as Mr. Darwin's fallacies, consists in first stating such facts as he can obtain, but which make the slenderest possible basis for the superstructure to be reared upon them, and then, further on, referring to this as a settled point already proved. This so pervades Mr. Darwin's volumes that it is quite useless to refer to special examples. Whether he be arguing the cause of natural or of sexual selection, the point in question is continually assumed as a *vera causa* ; and so of the details of the argument. It is probably this curious habit of mind which has led Mr. Darwin into a kind of dogmatism and unworthy attributing of motives to those who differ from him in opinion, which seems quite at variance with his usual candor. Thus, in the same paragraph (vol. i. pp. 81, 32), he says, of the doctrine of the descent of man from the brutes : "It is only our natural prejudice and that arrogance which made our forefathers declare that they were descended from demi-gods which lead us to demur to this conclusion." Surely, Mr. Darwin cannot believe that the many who reject his theory on professedly scientific grounds are insincere in their declarations, and in reality influenced by the motives here attributed to them. But just before he had said, still more unfortunately : "To take any other view is to admit that our own structure, and that of all the animals around us, is a mere snare laid to entrap our judgment." On page 198 he says : "The early progenitors of man were, *no doubt*, once covered with hair, both sexes

having beards; their ears were pointed and capable of movement, and their bodies were provided with a tail having the proper muscles." On page 205: "Unless we *wilfully close our eyes*, we may, with our present knowledge, approximately recognize our parentage." Once more: "He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation. He will be forced to admit the contrary."<sup>1</sup>

But our limits warn us to stop. On a memorandum at hand are noted down many more examples of a kind of reasoning which appears to have been satisfactory to the author, but which would present to a mind trained in deductive processes only fresh forms of fallacy. We can only give references to his curious array of facts in relation to the effect upon the race of marriages among different classes of human society (pp. 167, 168); his way of arraying on his side a mass of evidence, each particular of which he acknowledges to be worthless, though from the addition of these many zeros he seems to expect some positive sum. This process is applied to the question of the sterility of crosses between the human races, on page 213. Closely akin to this is the habit (of which an example may be found on page 222) of quoting some opinion which he himself rejects, and then proceeding, "If this be true," etc., as if the opinion, notwithstanding its condemnation, still possessed some power in the argument. Frequently he relies upon a balance of facts, some making one way, some the other, apparently content if he can secure what seems to be the majority on his side (e.g. see pp. 284-286. So, also, in regard to the differences between the sexes of the hemiptera, on p. 339). We had supposed it necessary — absolutely necessary — to the establishment of a scientific hypothesis that it should be consistent with all the facts within its range, and, therefore, that to show its agreement with many, or even with most,

<sup>1</sup> Several of these instances are pointed out in the Article in the London Quarterly already quoted.

of them, was of no avail. A hypothetical cause which still leaves an unknown cause to be sought for precisely similar phenomena, we had supposed to be nothing. But these things must be passed by, together with many more examples of which the want of training in this kind of reasoning does not allow us to appreciate the force. Indeed, it may be questioned whether Mr. Darwin himself, in some cases, really intended them as arguments, since he uses so frequently terms indicative of their being mere matters of opinion. Thus, on pages 54, 55, he says: "Primeval man, or rather some early progenitor of man, *probably* used his voice largely, as does one of the gibbon-apes at the present day, in producing true musical cadences, that is, in singing. *We may conclude*, from a wide-spread analogy, that this power *would have been* especially exercised during the courtship of the sexes, serving to express various emotions, as love, jealousy, triumph, and serving as a challenge to their rivals. The imitation by articulate sounds of musical cries *might have given* rise to words expressive of various complex emotions. . . . . It does not *appear altogether incredible* that some unusually wise, ape-like animal *should have* thought of imitating the growl of a beast of prey," etc. But, if all the "may-be"s were removed from the chain of Mr. Darwin's argument, it would be difficult to reconnect the widely-sundered links.

We wish to make room for one piece of proof of the descent of man not given by Mr. Darwin, but taken from so eminent a disciple of the same school, Dr. Maudsley, that it may be important to the general argument. In his brief work on "Body and Mind," republished by the Appletons, in the part consisting of lectures delivered before the Royal College of Physicians in London, he seeks to show, in the second lecture, that certain forms of insanity and idiocy afford strong confirmation of the views of Mr. Darwin, by giving evidence of the descent of man from the brutes in his reversion to animal characters and propensities. Among other almost equally interesting cases, he cites the following (pp.

48, 49): "There is now under care, in the West Riding Asylum, a deformed idiot girl, who, in general appearance and habits, has, according to Dr. Brown, striking features of resemblance to a goose; so much so, that the nurses who received her described her as just like 'a plucked goose.' . . . . The lower jaw is large, projecting more than one inch beyond the contracted upper jaw, . . . . the whole configuration of the face having a somewhat bill-like appearance. The neck is unusually long and flexible, and is capable of being bent backward so as actually to touch the back between the scapulae. The cutis anserina is general over the body, but is most marked on the back and dorsal aspects of the limbs, where it looks exactly as if it had just been deprived of feathers. The inferior angles of the scapulae stand prominently out, and, moving freely with the movements of the arms, have precisely the appearance of rudimentary wings. The girl utters no articulate sounds, but expresses pleasure by cackling like a goose, or perhaps like a macaw. When angry, she flaps her arms against her sides, and beats her feet upon the floor. . . . . She is very fond of her bath, cackling when she is put into it," etc. We have hitherto refused to believe many 'old wives' fables'; we have even been hindered from giving full credence to the charming legend of St. Denis, because we supposed there were grave physical objections to the account of the decapitated saint walking off with his head in his hands; but hereafter, instructed by these new processes of physical reasoning, and knowing that the bisected worm still lives and flourishes, we shall feel free to waive such insignificant difficulties. The descent of man from this particular variety of feathered fowl suggested by Mr. Maudsley is in a different line from that pointed out as probable by Mr. Darwin; but that is a secondary point, and on reading this chapter the evidence accumulates, for the reasoning upon this story shows traits of the ancestral goose no less palpable than the story itself.

This leads to the very serious question as to the extension of Mr. Darwin's theory to the origin of man. He would

himself fully include man in his whole nature in the operation of natural selection, and many of his followers agree with him. His argument as to man's body needs no especial consideration, since it is of the same kind, and rests upon the same sort of evidence, as that respecting the origin of the lower animals. It is, however, open to some especial objections, of which mention will be made presently. His argument as to man's higher nature rests upon the assumption, as he himself distinctly states, that man's intellectual and moral faculties are identical in kind, and differ only in degree from those of the brutes. If this assumption be admitted, and if it be allowed that man's body can have been produced by natural selection, then, if that theory be a true account of the origin of the brutes, it is also a true account of the origin of man. We propose to reject utterly this assumption, and to give some grounds for this rejection; then, to show very briefly some reasons why, even if the general theory be true, man can hardly be considered the result of its operation; and finally, to offer one or two considerations which at least require more satisfactory explanation before this hypothesis can be admitted even to a provisional place among the truths of science.

In the first place, the question of the homogeneousness of the mind of man and brutes is not one which belongs exclusively to the province of natural science, nor is it possible to determine it without the sanctions of philosophy. Now, it happens that all the differing schools of philosophy, excepting the extreme sensationalist, agree in deciding this point in opposition to Mr. Darwin, and holding the intelligence of man to differ, not merely in degree, but in kind, from that of brutes. Aristotle makes two distinct breaks in the chain of life, — first, where sensation comes in and differentiates the animal from the plant, and secondly, where reason comes in and differentiates man from all other creatures; and, from his day to the present, philosophy has adhered consistently to this essential fact. It is of no avail to emphasize the intelligence of animals. All that Mr. Darwin asserts in this way, and even more, has long been recognized and repeated;

but it still remains that the brute has no conception of abstract ideas, and no power of referring thought to an absolute standard. The distinction between man and the brute is a functional one, and is as complete as the distinction between day and night. Animals, it has been well said by a writer in the *Contemporary Review*,<sup>1</sup> are restricted to finding means of bodily preservation and enjoyment. In some a "false dawn" occurs, a glimmering of reason, as may be seen in the pastimes of parrots and the curiosity of monkeys; but "all such tendencies are stopped dead by the want of the faculty of apprehending universals." The great gulf which no reasoning on the part of man can bridge over is his possession of a faculty entirely wanting in the brutes.

By the "struggle for existence," a creature "might have become conceivably more crafty than the fox, more constructive than the beaver, more socially organized than the ant or the bee; but, having thus established his position, he could not have been impelled to abstract ideas and to continued work, while all other creatures rest in their sphere." And this consideration gains fresh force when we consider that his work is often directed to what is far from being immediately beneficial to himself, but rather to what is designed for the good of others, and that, too, in its highest reach, looking forward to a future stage of existence.

The question whether reason is the effect or the cause of the difference in the past history of man and of animals Mr. Darwin would decide in favor of the former, and he argues at length that man has been brought forward by the mutual reaction of language and of the brain. But he elsewhere shows conclusively that animals have a sort of language — a power of communication enough for their wants. Why, then, should not the same thing have happened with them? The answer is obvious: Because they had the impulse to express only certain ideas, and, this expression being attained, they have no impulse to carry them beyond. "Did a parrot chatter the whole vocabulary of mankind, he would not be

<sup>1</sup> Republished in *Littell's Living Age*, No. 1409.

gifted with language. Nay, further, did he call names, and attach simple ideas to spoken words, he would still be as incapable of speech as the dog who begs of his master, and expresses his wants in a score of touching ways. Animals have signs; but they have no proper language. That a close observation of their habits discovers a power of communicating information which cannot be explained by known facts is doubtless true; but that such power is not connate with human speech is equally true. Let those who doubt it tell us how to explain to a dog lamenting the absence of his master the simple fact that he will return. It is barely possible that by sympathetic actions a similar fact could be communicated by one animal to another; but no brute could inform another that an event would take place in three days, or in any stated time, because they have no measures and no method of conventional representation."<sup>1</sup> Mr. Darwin, in apparently unconscious contradiction to his own hypothesis, allows that when man had begun to surpass other creatures, his brain unconsciously grew in excess of his needs, and thus new mental powers came unconsciously to be developed; but he leaves unexplained the curious fact that this has never occurred with other species of brutes. Again, he holds that all essentially human faculties exist, latent, in the savage. This fact is unquestionably true; but it shows that the human race is one, and is strongly differentiated from the lower animals. The same fact also shows that the savage is not a link between the ape and civilized man, but is really man, and so forbids his being used as a support to the theory. The indications from the unprogressive character of savage society is rather that the "savages belong to the slums and backwaters of the stream of humanity than to its advancing tide."

In regard to man's moral faculties we have nothing to say. To us it seems simply a parody of terms to speak of the moral faculties of brutes, who can have no abstract standard of right and wrong.

<sup>1</sup> Mediation, pp. 47, 48. A fragment recently anonymously published by W. F. Draper.

In regard to both these points, however, we wish to make one more quotation from the clear statements of Professor Huxley: "I hardly imagine that any profound scientific thinker who has reflected upon the subject exists who would not admit the extreme probability of the hypothesis that for every fact of consciousness, whether in the domain of sense, of thought, or of emotion, a certain definite molecular condition is set up in the brain; that this relation of physics to consciousness is invariable, so that, given the state of the brain, the corresponding thought or feeling might be inferred; or, given the thought or feeling, the corresponding state of the brain might be inferred. But how inferred? It is, at bottom, not a case of logical inference at all, but of empirical association. . . . . Were our minds and senses so expanded, strengthened, and illuminated as to enable us to see and feel the very molecules of the brain; were we capable of following all their motions, all their groupings, all their electric discharges, if such there be; and were we intimately acquainted with the corresponding states of thought and feeling, we should be as far as ever from the solution of the problem, 'How are these physical processes connected with the facts of consciousness?' The chasm between the two classes of phenomena would still remain intellectually impassable. . . . . The problem of the connection of body and soul is as insoluble in its modern form as it was in the pre-scientific ages."<sup>1</sup>

It is well known, and attention has already been called to the fact, that some of the most powerful advocates of Darwinism deny the applicability of the theory to man. This is notably the case with Mr. Wallace, himself an eminent naturalist and an independent originator of the Darwinian hypothesis. Under the necessary limitations of this article, nothing better can be done than to give a brief abstract of his argument.<sup>2</sup> Mr. Darwin says that natural selection has

<sup>1</sup> Huxley's Address "On the Methods and Tendencies of Scientific Investigation," pp. 16, 17.

<sup>2</sup> "What Natural Selection cannot do," by A. R. Wallace. Republished in *Littell*, No. 1410.

no power to produce absolute, but only relative, perfection ; it can only advance the creature just far enough beyond its fellows to perpetuate it in the struggle for life ; and he allows that a single case of the production of injurious modification would be fatal to the theory. If, then, we find in man characters which all obtainable evidence shows to have been actually injurious to him on their first appearance, they could not have been produced by natural selection. Further : If these modifications, hurtful on their first appearance, became very useful afterwards, we should infer the action of a mind foreseeing and preparing for the future, just as in the case of a breeder of domestic animals. The inquiry in regard to this is a strictly scientific one. Now, the brain of savages is confessedly larger than is needed. The size of the brain is associated with mental power ; for, while individual brains differ somewhat in quality and power, without reference to minor differences in size, yet in the average of a race size is universally acknowledged to be important. The brains of the various human races are estimated as follows : Teutonic, 94 inches ; Esquimaux, 91 ; Negroes, 85 ; Australians, 82 (?) ; Bushmen, 77 (?) ; the last two being uncertain, from the limited number of examples. In individual cases, the brain of an Esquimaux has been found as large as that of the largest European. The remains of so-called 'prehistoric' man indicate no diminution of size. Anything less than 65 inches in man is invariably idiotic. Now, the average size of brain in the anthropoid apes is from 28 to 32 inches, or one third the size of civilized man. Proportionally stated, it would be, apes, 10 ; savages, 26 ; civilized man, 32. Yet the range of intellectual power in man, from the highest civilization to the lowest barbarism, is so vast that the savage evidently has more brain than he needs. If we compare the lower savages with the higher brutes in regard to their modes of life, their wants, etc., it appears that at present the one has occasion for a brain but very little larger than the other ; yet he possesses one widely separated from theirs, and very near that of the civilized

man. Again, a hairy covering is generally possessed by all the mammalia, especially on the back; it is totally absent from all races of men. Yet the want of it is felt, and, in one way or another, at least an occasional shelter for the back is supplied by all mankind. If it was originally possessed by man, it would seem certain that he must somewhere, and in some cross-breeds, have reverted to it, especially in cold climates. These two facts — the brain and the hairy covering — are totally distinct from one another; yet both point to some other cause than natural selection for the differentiation of man from the brutes.

Mr. Wallace goes on to argue, in the same way, from man's hands and feet. It would require very rigid selection to convert the thumb into a great toe (opposability being entirely lost in all races of men), and yet the only obvious advantage would be a very slight gain in erect locomotion; that locomotion itself being of no especial use to man as a brute. The hand, however, contains vast latent capacities, of which little use is made by the savage or the ape.

So, also, in regard to voice. The peculiar power in song of the female voice only comes into play under civilization. It is unused by savages; yet the organ is there, ready to be used when demanded by man's progress. Thus it could not have been the result of natural selection.

Many of the mental faculties could never have been produced by the law of the survival of the fittest. Supposing that justice and benevolence could have been so produced, as being beneficial to the tribe; yet ideal conceptions of space, time, eternity, infinity, etc., could have been of no possible use to man in the early stages of barbarism, and even now, in their highest development, can hardly be considered of direct and immediate advantage to their possessor.

We have no space to follow Mr. Wallace further into his consideration of the origin of the moral sense. All these things, he justly argues, are important to civilized man, but not of use to the savage in the lowest stage of barbarism.

Hence it is impossible that they could have been developed by the agency of natural selection.

And this suggests a question as to whether man's primeval state was that of the savage, as is assumed by the Darwinians. There is a vast difference, apt to be overlooked by them, between a savage and an infant condition of the human race. The question is too large a one to be here entered upon; but it is a question of fact and a question of history. If we have not greatly misunderstood the teaching of all history, ancient and modern, sacred and profane, it is that man as a moral being does not tend to rise, but rather to fall, and that with a geometric progress, except he be elevated and sustained by some force from without and from above himself. Such universal teachings of all experience it is idle to attempt to set aside.

In conclusion, we have a few words to say on one or two important points not yet touched. One of these is the evidence of the antiquity of man, and another the more general question of the antiquity of our earth as a fit habitation for the system of organic beings.

Geologists are entitled to great credit for the care and pains with which they have investigated the former question in various parts of the earth; but the means of prosecuting the inquiry are for the most part extremely limited, and cannot be compared with the resources sometimes brought to bear upon the same data for purely utilitarian purposes. When this occurs, science will, of course, gladly avail itself of the improved opportunity to rectify its former hypothetical conclusions. Sir C. Lyell examined the delta of the Mississippi, as well as the means at his command allowed, with an especial view to its bearing upon the question of the antiquity of the human race. He has repeatedly announced his conclusion, both in his geological works and in his "Antiquity of Man." That conclusion is, that the age of the delta is to be reckoned by an unknown number of tens of thousands of years; but he mentions one hundred thousand years as a minimum. A few years ago Messrs. Humphreys and Abbott,

engineers in the United States service, were required to make an examination of the Mississippi, with the resources of the government at their command, with a view to devise means to prevent the enormous losses occasioned by its overflow. In the course of their investigation they came upon the same question which had already occupied the attention of Lyell. They assumed as their basis, whether reliable or not, the same as had been assumed by Lyell, viz. the same rate of deposition of material at former times as at present; and on this basis, in a report which has become a model for the thoroughness and accuracy of its scientific investigation, they fix the age of the delta at four thousand four hundred years.<sup>1</sup>

Again: A few years ago much interest was excited by the discovery in a railroad cutting at Villeneuve, near the head of the lake of Geneva, first of Roman remains, and then, at a greater depth, of the remains of ancient pottery. The depth of each was carefully measured; the date of the Roman remains was sufficiently well known, and thence the age of the pottery was calculated by the simple rule of three. This was an exceedingly interesting discovery, because the remains were found in the delta or detritus of a mountain torrent, and had never been disturbed. On it were founded very confident estimates of the antiquity of man, and these estimates are still current. An American man of science, visiting the locality, observed two things, however, which had been overlooked, and which are essential factors in the argument. In the first place, the amount of the detritus of a stream, and hence the period required for its deposition, cannot be measured perpendicularly, because each added layer extends itself over a wider surface. It must be measured by its cubic contents. The perpendicular accumulation above the pottery on a comparatively small delta was therefore much more rapid than above the Roman ruins

<sup>1</sup> Report upon the Physics and Hydraulics of the Mississippi River. By Capt. A. A. Humphreys and Lieut. H. L. Abbott. Philadelphia: J. Lippincott and Co. 1861. The processes by which the above conclusion was reached are extremely interesting, but there is not room here to detail them.

on a far larger one. Secondly, a careful examination of the delta itself, and of the stream above, showed that the size of the stream, and therefore of the detritus brought down by it, had enormously shrunk in the course of the accumulation of the cone or delta.<sup>1</sup> It is not known that Sir C. Lyell and other European advocates of the antiquity of man have as yet, in these instances, revised their calculations with these necessary corrections.

Once more: The discovery of remains of human art at Amiens and Abbeville, in the north of France, has elicited many volumes of scientific discussion. Indications were supposed to be found of two valley gravels of distinct ages, each of them very slowly deposited, and it was further seen that between the times of their deposition the valley of the Somme had been gradually excavated to a depth of forty or fifty feet. Still above the gravel was a peat formation twenty-six feet in depth, and the rate of its growth was carefully determined by a comparison with similar growth now in progress, and ascertained to be from one and a half to two inches in a century. Now, in and under the earlier, as well as the later, gravel, the remains of human art were found. On the above data it was easy to calculate approximately their age, and the results obtained are among the most important and reliable of the evidences of the antiquity of man. An English physicist, however, Alfred Tylor, F.G.S., a few years ago, caused a careful survey of these interesting deposits to be made by competent engineers with careful levelling along the sections of the railroad passing through them. The results were presented to the (British) Geological Society, in a paper read before them, and subsequently printed in their journal.<sup>2</sup> They showed that the supposed distinct deposits of gravel were in reality one and the same, and of course there had been no period of excavation between them; and that the deposits had been largely drawn from the immediate

<sup>1</sup> American Journal of Science, Vol. xlv. pp. 187-190.

<sup>2</sup> Quarterly Journal of the Geological Society for May, 1867, reprinted in American Journal of Science, Vol. xlv. p. 302.

neighborhood, and not accumulated as slowly as had been supposed. The same locality was also visited, at another time, by an American, E. Andrews, Professor of Surgery in the Chicago Medical College, who brought to bear upon it knowledge derived from the circumstances of the region in which he himself lived. He found that the deposition of the gravel had been at so rapid a rate that three or four feet had accumulated before masses of ice, or of mixed ice and frozen gravel, of that diameter could have had time to thaw; for thin seams of a distinctly marked layer of other material above had here and there broken down abruptly into the layer below in a way that could only be accounted for by the melting of masses of ice in the lower layer subsequently to the deposition of the upper. He also examined the peat, and was told by Mr. Perthes of the existence in it of alder and birch stumps standing upright, and of horizontal logs of birch three feet in diameter, and he also found logs of oak even four feet in diameter. He knew that such woods cannot bear exposure to the air for a very long time. In much less than a century they would have decayed, unless they had been covered up by the accumulation of the peat. Hence he concluded that in their time the growth of the peat must have been three or four feet, instead of one or two inches, in a century. He does not leave the subject without pointing out causes for the retardation of the growth within the historical period.<sup>1</sup>

These instances, which might be multiplied, are given to show on how very imperfect a basis the calculations as to the antiquity of man rest. In all these cases, and others which could be adduced, the original, evidently over-hasty, inferences still form the staple of the argument. And it is by the conclusions based upon these arguments that Darwinism has felt authorized to make its necessary drafts upon "an unlimited bank of time."

One point, affecting the whole Darwinian theory yet requires to be noted. On the hypothesis of natural selection

<sup>1</sup> American Journal of Science, Vol. xlv. pp. 181-187.

not only is an enormous period required for the slow development of man from the brute, but corresponding periods must have been consumed in the production of each link of the long chain of which he is the culmination. The time demanded by some forms of the uniformitarian geology had already confounded the imagination; but Mr. Darwin required it to be multiplied, and now we find Mr. Huxley suggesting, in a passage already referred to, that even this is insufficient, and that, "if any form of the doctrine of progressive development is correct, we must extend by long epochs the most liberal estimate that has yet been made of the antiquity of man." This is doubtless true, and, in its truth, will be found to require a proportional enlargement of the periods of all earlier links in the chain. But may there not be some limits to the past duration of the earth, in approximately its present form, inconsistent with such vast demands? There are facts in regard to the retardation of the rotation of the earth upon its axis, to the gradual exhaustion of the supply of heat from the sun, and to the secular cooling of the earth, which, if fully understood, would supply some tolerably definite data for a calculation of the age of the existing state of our cosmos. At present these facts are imperfectly investigated, so that the calculation of the maximum duration possible can only be made with a very large margin of probable future reduction. Sir W. Thomson has made these calculations with great care, and, in several papers noted below,<sup>1</sup> has given his conclusions to the world. There are three lines of argument. That on the age of the sun's heat is the most vague, from the imperfection of the data. Still, such conclusions as can be reached are sufficiently in accordance with the results obtained in the other lines. The

<sup>1</sup> On the Age of the Sun's heat. By Sir W. Thomson. *Macmillan's Magazine*, 1862. On the Secular Cooling of the Earth. By the same. *Trans. R.S.E.*, 1862, and *Philosophical Magazine*, 1863, ii. The Uniformitarian Theory of Geology briefly refuted. By the same. *Proc. R.S.E.*, 1865. On Geological Time. By the same. *Transactions of the Geological Society, of Glasgow*, 1868. Of Geological Dynamics. By the same. *Transactions of the Geological Society of Glasgow*, 1869.

argument from the retardation of the revolution of the earth upon its axis, taken in connection with the oblateness of its spheroid, points to a hundred million of years as the utmost limit of time within which the earth must have assumed its present form. More exact observation of the data may, and probably will, enormously reduce this limit; but there it stands at present, if the mathematician can be trusted, as the outside boundary of geologic time. Mr. Huxley, notwithstanding what he has elsewhere said, in his Presidential Address to the Geological Society of London, in 1869, professes his willingness to accept the limitation, especially if it be taken with such a degree of elasticity as to allow of its being stretched two or threefold; but even this is obviously felt as a serious and objectionable restraint by the advocates of Darwinism. Mr. Darwin himself has claimed, in his "Origin of Species," "that, in all probability, a *far longer* period than three hundred million years has elapsed since the *latter part of the secondary period.*" But demands for vast and practically boundless time are too familiar to the readers of this class of works to require quotation.

Sir W. Thomson's third line of argument, drawn from the time required for the cooling of the earth from a molten mass, still leads substantially to the same conclusion, although indicating a considerably inferior limit for the date of the introduction to our earth of any known form of organic life. There is — here put in, it is true, in arrest of judgment — a sort of perpetual-motion theory of chemical action, by Sir C. Lyell, to account for the internal heat of the earth; but it does not seem sufficiently tenable to require consideration. It remains that all these lines of mathematical calculation converge to a limit for the whole, far within that which Mr. Darwin has claimed as probably too small for a mere fraction of geologic time.

But we have already exceeded our limits. The following is the list of charges brought forward against Darwinism by Mr. Mivart, who fully commits himself to the general theory of evolution: "That 'natural selection' is incompetent to

account for the incipient stages of useful structures. That it does not harmonize with the co-existence of closely similar structures of diverse origin. That there are grounds for thinking that specific differences may be developed suddenly instead of gradually. That the opinion that species have definite, though very different, limits to their variability is still tenable. That certain fossil transitional forms are absent which might have been expected to be present. That some facts of geographical distribution supplement other difficulties. That the objection drawn from the physiological difference between 'species' and 'races' still exists unrefuted. That there are many remarkable phenomena in organic forms upon which 'natural selection' throws no light whatever; but the explanations of which, if they could be attained, might throw light upon specific organization."<sup>1</sup> Other at least equally serious difficulties are brought forward incidentally in the body of the work.

Mr. Chauncy Wright, in a late (July, 1871) number of the North American has replied to Mr. Mivart; but the reply is to our mind insufficient. We do not intend, however, now to discuss either Mr. Wright's or Mr. Mivart's arguments. The palpable fact, which stands boldly out from this, as from all other repetitions of the discussion, is that Mr. Darwin's theories are simply theories. They may be more or less plausible; they may be met by more or less of objection; and these objections may be more or less perfectly answered. It remains that they are *theories*; they do not rest upon positive evidence.

If the propounding of such theories can be of advantage to the progress of human knowledge, by all means let them be propounded. Only let it be remembered that there are subjects on which natural science is incompetent to pronounce an opinion, because they lie outside of the range of its investigation. Yet truths may there be firmly established by their own appropriate evidence which are not without an important bearing even upon the studies of the naturalist. Froude well says: "There is no proof such as will satisfy

<sup>1</sup> Genesis of Species. By St. George Mivart, F.R.S. Close of chap. i.

the scientific inquirer that there is any such thing as moral truth—any such thing as absolute right and wrong at all.”<sup>1</sup> Above all, we ask that the biologist and the physicist alike may not so narrow their investigations of natural phenomena and their relations as to exclude from view the positive and stupendous evidence in nature, in history, and in revelation, of an intelligent Force, external and superior to the natural forces, constituting, guiding, and himself the Final Cause of all.

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### ARTICLE III.

#### WHAT IS TRUTH ?<sup>2</sup>

BY J. C. MURPHY, LL.D., T.C.D., PROFESSOR OF HEBREW, BELFAST, IRELAND.

A BRIEF answer to this comprehensive question may not be unseasonable at the present time, even though it may be expected to partake in some measure of the idiosyncrasy of the respondent. We misunderstand one another very often, simply because we do not speak out, frankly and plainly, what we think. Let us divest the question of the technicalities of the schools, treat it as a matter of vital interest to every child of man, and endeavor to find at least the first principles of a direct, explicit, and veritable reply. The question came, at first, from a strange quarter, whence we should least of all have expected any reference to things so high. But we bear in mind that Pilate had the rare advantage of coming into contact with a perfect mind—the mind of him who had come down from heaven to solve this very problem, to give a new turn to the philosophy of man, and to open up to the mind of humanity a new, practical, and hopeful view of the relation of God to man. Pilate said to this wonderful visitor of our nether sphere: “Art thou the

<sup>1</sup> Short Studies on Great Subjects. Times of Erasmus and Luther, Lect. iii. p. 97.

<sup>2</sup> This paper is the expansion of a thought thrown out in the Preface to a forthcoming work on Leviticus.