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ORDINARY MEETING, MAY 4, 1885.

THE REV. R. W. KENNION, M.A., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

ON THE THEORY OF NATURAL SELECTION AND THE THEORY OF DESIGN. By PROFESSOR DUNS, D.D., F.R.S.E., New College, Edinburgh, President of the Royal Physical Society, Edin., Corresponding Member of the Academy of Sciences, Philadelphia, &c.

“THE first rule which the exact investigator of Nature should observe is, that he should not allow himself to pronounce an opinion, either in affirmation or denial, upon subjects which do not fall within the sphere of his observation or experience. . . . The second rule is, that he must not pass any opinion, form any judgment, nor utter it, upon matters of any science to the present level of which he has not brought himself.” The words, which are Schleiden’s, occur in a tract, published at Leipsic in 1863, on the Materialism of the Recent German Scientific School (*Ueber den Materialismus der Neueren Deutschen Natur-Wissenschaft*). They are worth remembering when discussing the subject of this paper, in regard to which the controversy is not as to facts, but as to the interpretation of facts. We wish also to bear in mind that to speculate where we cannot give proof is far easier than to believe where we cannot understand.

Since Mr. Darwin’s death we are in a position more favourable than before to form a just estimate of the nature, scientific value, and physico-theological scope of his work. The influence

of his living presence on the minds of his followers unfitted them for dealing impartially either with his own merits or with the merits of his opponents. Even those who hold that Darwin's special gifts were not those of a philosopher will join heartily with his most enthusiastic admirers when they claim for him the very highest place among naturalists. But, apart altogether from his unrivalled skill as an observer, and looking at his speculations alone, we see that he has so welded observation and speculation into one strong force, so marshalled all the branches of his varied knowledge to the line of one grand argument, as, in the belief of many, to have made good for his leading hypothesis the weight and authority of an established law. And, thus regarded, it is held to have superseded the principle of final causes (*principe des causes finales*, Cuvier) as a guide in biological study, and to have shown that there are no logical points of contact between natural science and natural religion. It will simplify the state of the question to have before us the old and the new points of view.

“If we select any object from the whole extent of animated nature, and contemplate it fully and in all its bearings, we shall certainly come to the conclusion that there is design in the mechanical construction, benevolence in the endowment of the living properties, and that good, on the whole, is the result” (*The Hand*, chap. i. By Sir Charles Bell). “There cannot be design without a designer, contrivance without a contriver, order without thought” (*Natural Theology*, chap. ii. 3. Paley). “We set out with assuming the separate existence of our own mind independently of matter; without that we never could conclude that superior intelligence existed or acted. The belief that mind exists is essential to the whole argument by which we infer that the Deity exists. This belief we have shown to be perfectly well grounded. It is the foundation of natural theology in all its branches” (*Discourse on Natural Theology*, section iii. By Lord Brougham). “Every organised being forms a whole, a single circumscribed system, the parts of which mutually correspond and concur to the same definite action and re-action. None of those parts can change without the others also changing, and, consequently, each part, taken separately, indicates and gives all the others” (*Ossemens Fossiles*. Cuvier).

These quotations indicate the chief points in the argument from design. The extract from Lord Brougham gives the testimony of consciousness a place within it, and that from Cuvier suggests the nature and scope of the law of correlation

of animal structure and form first enunciated by him. The testimony of consciousness to the dependence of intelligent action on will, and to will as an attribute of personality, is as trustworthy as the testimony of sight to the fitness between the bill and the talons of the birds of prey and their habits. Nor is the significance of the testimony weakened by linking with it the intuition of God, because this intuition is as much a fact of man's nature as any bodily appetite is. Moreover, according to Cuvier's great law, each organ, or part of an organ, gives the whole organism; so that from the fragment of a bone the entire animal, in its essential features, may be represented. This discovery created a new science,—palæontology. There had been descriptions of fossil remains previously; but he re-constructed, from mere fragments of structure, long extinct forms, and showed what had been their very manner of life. And what was his guide? The recognition of design,—of contrivance,—in the reciprocal relations and mutual dependence of the parts of an organism and the whole, and also between the organs of an animal and its habits of life. In no imaginable circumstances could the use of the theory of natural selection have rendered this service to science.

The leading features of the new point of view are belief in teleology, and denial of final cause,—the recognition of adaptations in nature and the refusal to ascribe them to intention. They are the outcome of the action of an impersonal factor,—natural selection,—a force the concentrated form of innumerable purely physical influences. The work assigned to it is thus described:—"Natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life" (Darwin). It watches over tendencies to variation in order to use deteriorating elements for the destruction of species, and improving elements for their perpetuation. Somehow an imaginary something is everywhere actively realising results hitherto traced to the presence and potency of creative inworking.

The two views referred to above may now be brought into closer contrast. According to that just noticed there is nothing fixed either in the structure or the relations of organisms. Tendency to change is inherent. It influences the elements of organisms, the compound substance of

organisms, the mature organisms themselves, the countless adaptations between different but inter-dependent parts of animal structure, between the organs of animals and their habits, and also between individual forms and their environments. An unresting metabolism pervades all animated being. There is nothing stable, nothing sure. Biological data warrant a doctrine of teleology, changeful, however, as the data themselves, and this is held to supersede the hitherto widely-accepted doctrine of design. According to the other view, the tendency to vary is recognised, but it can work only within sharply-defined limits. It can influence specific features, but we have no proof that it has ever obliterated them, either by the action of incident external forces or by inherent energy of any sort. On the contrary, it can be shown that the facts both of palæontology and of the life history of recent forms make this in the highest degree improbable. It is granted by all that the adaptive principle may find as full expression in the growth stages of an animal as in the adjustment and subordination of organs among themselves, or in their relations to the functions for which they exist. Now, avoiding the term "species," and using "individual" instead, the persistence of a zoological class depends on the continuance of identical grooves for the development and succession of the individuals which make it up. This is implied in the reproduction of distinct individuals. But there is not only a definitely-characterised starting-point; there is also development along lines which every palæontologist knows have not changed throughout great ages. Students of recent crustacea acknowledge their indebtedness to palæontology for help in making out the immature stages of the king crabs (*Limulus*) and other genera. Barrande has shown that one trilobite of lower Silurian age (*Trinucleus ornatus*) passed through six stages from egg to maturity; another (*Sao hirsuta*) seventeen; and another (*Arethusina kovinki*) twenty-two. We have thus (1) proof of the existence in earliest Silurian time of a group of crustaceans as high in structural rank as their present representatives, and whose embryonic development corresponded with theirs; (2) we have evidence that the metabolism with which present allied forms are credited does not so influence them as to alter the grooves within which development takes place. It is inconceivable that, necessarily, random natural selection could ever have determined these stages of growth, or have brought about and rendered persistent the complex series of fitnesses associated with them; the more so that the Darwinian

condition of time for all this was awaiting. The lower Silurian *trilobites* suddenly appear in the geological record as suddenly as the *cephalopoda* which came later, and which stand very much in this respect in relation to other mollusca as the trilobites do to other crustacea.

Facts in the life history of recent forms are equally suggestive. We take the molecule as the ultimate unit of vitalised substance, and the cell as the expression of aggregate molecules, and we follow the action of the differentiating force in the living animal form till we see the mature organism. In its upward working, say from molecule to man, it has utilised diverse, equally with identical, elements in order to identical results. Is there any adequate explanation of this outside of the recognition of intelligent guidance—forethought—somewhere, anticipating a definite organism and foresight in providing the means to its realisation and succession? And, in view of all this, tendencies to variation of every sort have been overcome and limited to secure, we might say, permanence of species, but we say only persistence of individuality, that we may recognise the element of unlikeness ever characteristic of this. Because, be the guidance what it may, it does not determine perfect resemblance either among the embryonic stages of an organism or among mature forms of the same species. "Advanced Darwinians," said Agassiz, "are reluctant to acknowledge the intervention of an intellectual power in the diversity which obtains in nature, under the plea that such an admission implies distinct creative acts for every species. What of it if it were true? Have those who have objected to repeated acts of creation ever considered that no progress can be made in knowledge without repeated acts of thinking? And what are thoughts but specific acts of the mind? Why should it, then, be unscientific to infer that the facts of nature are the result of a similar process, since there is no evidence of any others?" (Agassiz, in *Atlantic Monthly*, January, 1874, p. 101.)

If the plea for natural selection as against the theory of design were likely to find illustrative instances in any one biological department more than another, we might expect them among the *protozoa*, in which the plasticity of the life substance is most intense, and the mature forms most open to influences, internal and external, towards variation,—a department in which natural selection might be presumed to have widest and freest scope. Yet it is not so.

To affirm that the highest animal holds something in which the lowest can have no part is self-evident; but to affirm that

the lowest holds what it cannot share with the highest is not. The element in the foraminifer which determines pattern separates it, not only from forms high in the zoologic scale, but also from the low forms next to it. And the adaptive principle reigns here, because one side of specific rank includes what an animal holds of matter disposed in it as in no other; and another side, what it holds of vital force under the same limitation; and yet another, what it holds of psychical quality regarded from the same point of view. These are the features which the theoretical factor is said to influence, to modify, to change, and to re-dispose, in order to new forms altogether. Does it succeed? Has it ever in the knowledge of science succeeded? Perhaps the following brief notes on *Diffugia proteiformis* (Ehrbg.) may indicate the direction of the answer to these questions. This species belongs to the *Lobosa*, the simplest sub-order of *Rhizopoda*, and consists of two layers, a gelatinous granular endoplasm and a pseudo-membraneous exoplasm, with flattened pseudopodia. It is not the lowest of the group. *Protamæba* (Hæck.), *Amæba* (Ehrbg.), and *Arcella* (Ehrbg.) represent the forms which lead up to it, but they are distinct from it. *Diffugia* is referred to because it illustrates in a striking way the limitation of the energetic metabolism characteristic of this group. Though the embryonic type develops in the direction of *proteiformis* and reaches its mature state, it is not limited to this groove. It may pass through stages of growth each of which ends in a mature form, very unlike *proteiformis*, yet in reproduction they return to its embryonic type, while, as sub-species, they have well-marked habits of their own, and differ in two important respects,—selective capacity as to food, and adaptive capacity as to covering. *Diffugia lageniformis*, for example, covers itself with minute bits of mica, or other thin, glistening mineral, with an exactness which scarcely leaves the least vacant space between them, and even, in many instances, seeming to fit broken edge into broken edge. It is hard to find words suited to the phenomena of shape and of habit, because the ordinary terms,—skill, selective instinct, discrimination, choice of material, and the like,—are apt to convey meanings which imply more than the phenomena. In the development, succession, definite individuality, and characteristic covering of the sub-species, we have features ever recurring in orderly sequence throughout their generations; and all this points to a repetition of adaptations, so many and so nice, that to ascribe them to mere unguided

influence is to fail in our duty as observers, to whom the thoughts which underlie things should always be more important than the things themselves.

We have sought in vain for proofs of the influence of natural selection in realising the fitnesses between the parts of organisms, in departments in which everything might be held likely to encourage its action. But the adaptations which have been most frequently referred to, both by the biologist and the student of the religion of nature, as evidences of intelligence, occur in the higher ranks of animals. The field is unusually rich, and has been but little worked, notwithstanding the literature which has gathered round it. Observation has been mainly devoted to the consideration of the relations between organs and parts of organs, or between structure and habits. Less has been made of the modifications of organs in connexion with, or in order to, the same function. Take, for example any one of the parts of the labyrinth of the ear, as, say, the *cochlea*. In monotremes this is half a coil; in ruminants, two and a half coils; in carnivora, three coils; and, in rodents, four coils. In approaching facts like these, the advocates of natural selection as an adaptive factor, take refuge in an appeal to the geological record, presumably on the ground that this would give ample time for the action of the differentiating force. But the appeal is one-sided and partial. In the study of geology, "no powers," said Hutton, "are to be employed that are not natural to the globe; no actions are to be admitted except those of which we know the principle." The agencies of which present phenomena are the expression supply the key to the phenomena of the past. "Organisms have arisen by insensible steps, through actions which we see habitually going on" (Spencer). No worker will quarrel with the principle referred to in these quotations, because its recognition does not imply that no causes are operative except physical. But the bearings of the principle are much wider than those who so often refer to it are willing to admit. It includes the facts of the present as well as its forces. And it is a fact beyond question that we have no proof in the present that natural selection has originated one species, or realised, unguided, one series of adaptations, or even one instance of continued adaptation. The facts of the present thus become as "the lantern in the stern; they shed light on the waves behind." If the great ages of human history supply not one reliable instance of transformism, or of new natural adaptations become permanent, we are entitled, in accepting the principle now before us, to ask that these facts shall have due weight when we deal with the past. We

attach no weight to variations brought about by man's intervention, because in all its aspects it points to forethought and foresight, and thus gives the active intelligence for which, in natural fitnesses, we are pleading.

The introduction of the doctrine of special creation into the question of the bearings of natural selection on the theory of design has hampered the discussion a good deal. That there are relations of a very close kind between them is seen at once, because the advocates of either appeal to identical phenomena in support of them. But we must remember that the question is not that of the origin of specific forms, but of structural and physiological fitnesses in individual forms, in their relations to other and different forms and in their environments. Of course, the discussion can never be exhaustive till the question of origin has been determined. But in our present contention this is not needed. Besides, the doctrine of special creation is associated with facts which reach into a region where induction is supplemented, not superseded and not contradicted, by faith. Moreover, there is no necessary connexion between the theory of design and the doctrine of the independent creation of species. It is conceivable, though we think the testimony of science is against the notion, that the creative starting-point, recognised by Darwin, might be held potential in all after differentiations, and might warrant the deduction of a wide and richly-varied teleology as the outcome of the original creative act. We might thus relegate the idea of design to fitnesses intended, at an inconceivably remote period of the world's history, to be gradually realised in the upbuilding of the earth and in the steps of the upward march of life-manifestation. But this would not be natural selection. It would be a theory of species and of fitnesses in them and among them, by creative pre-ordination without guidance of the means thereto, though these imply diversity of collocations, complex conditions, intricate and nice adjustments otherwise inexplicable. It may be urged that the forces necessary to all this are dominated by a law itself equal to the guidance asked for,—the law of continuity. This raises questions as to the extent of the operation of this law, the points at which the essentially-different natural and spiritual worlds meet; miracles, resurrection, and even incarnation, none of which can be looked at here. Those who point to natural selection as a substitute for the theory of design, no doubt, plead that, apart altogether from such questions, it gives three instances of teleology in connexion with every animal form,—one between inherent tendency to change, and the ready response of the organism

to this; a second between organisms and their surroundings; and a third between organs and their characteristic functions. The facts are acknowledged. What we wish to have is some proof that teleological relations like these are possible without the intervention and guidance of intelligence and will. It is granted by all, that varied and complex forces must have been active in the origination of germs; that the metabolism natural to vitalised substance is limited; that divergences take place among identical germs in identical environments; and that differentiations which are determined in growth, and which give varieties temporary or permanent, have never, to the knowledge of science, within the present epoch resulted in transformism. But to credit all this to "natural selection," or to the notion of "unconscious ends," or to the theory of "conditions of existence," is not flattering either to science or to common sense.

There are other aspects of this question well deserving careful notice. As, for example, the allegation, that to let species with all the fitnesses which accompany them drop out of existence, and to introduce others closely related to them, would be a great waste of power. But can there be waste of power when the agent is omnipotent? There is also the common attempt to discredit the principle of design by holding it responsible for effects incidental to its action. Is the dust raised by the rapid rotation of the wheels of the express train a proof of blundering on the part of the mechanical engineer who designed them? Both topics admit of wide discussion; but, without touching on them further, we conclude with a re-statement of our leading positions in the following paragraphs:—

1. In observing phenomena and in registering facts the desire to interpret them is natural and fundamental. We are in the lines of true scientific work, both when we ask what is their meaning and when we try to find it. We might look long at an isolated fact, if we could find one, without even seeming to leave science for philosophy. But there are no isolated facts in nature. Relational dependencies meet us everywhere, and it lies as much with science as with philosophy to take this into account and to explain it. Now, if we find in the relations of organisms to one another and to their environments, or even in the inter-dependence of the parts of organisms, order and adaptations suggestive of corresponding features resulting from human skill, it would not be philosophical to resist the impression, that the natural fitnesses *may* be as truly the products of thought or the outcome of

taking thought as are the simplest equally with the most complex fruits of our own skill. And thus:—

2. The theistic argument from adaptations includes the conditions of consciousness as well as the phenomena of nature. Man's knowledge of himself is by introspection, his knowledge of other men and of nature is by observation. Within this wide department we find materials for the scientific discussion both of anthropomorphism and agnosticism. The vindication of the former lies in the nature of man's origin, which implies power to recognise creative wisdom in the constitution of the external world. The reproach of the latter is that, though religion lies outside of science, there are yet points of logical contact where natural theology finds a footing,—points at which the "things that are made" bring "the invisible things" within the sphere of consciousness, and the facts of consciousness are as real and true as those of the things that are made. We thus acknowledge intelligent efficient cause as originating being, and, through second causes, realising fitnesses, subordinating all to purpose, and providing for continuance. But there is will also, and this is seen in periodic intervention; not, however, for the purpose of preserving sequences, because this is secured by the action of natural laws, but for the inaugurating of new starting-points in the upward march of creative self-manifestation, or for moral purposes, as in the introduction of the present epoch.

3. The phenomena now referred to are recognised by the advocates of the anti-theistic scheme. They attach a teleological value to them, but deny that they are fruits of design, and ascribe them to physical, impersonal influences generalised in the term natural selection,—a factor dependent on the concurrent action of agencies arising in the over-increase of organisms and in an innate tendency to structural change. It is not forgotten that some who credit natural selection with these powers are willing to admit the theory of a creative starting-point millions of ages, if not millions of cycles of ages, ago, but they refuse to acknowledge the imminence of intelligence at any after-point. Otto Schmidt, Haeckel, and others, think that Darwin's reference to a Creator is the weakest part of his system. There are others, again, who, like Asa Gray, accepting his system and working for its illustration, yet hold that it is not inconsistent with theism. It is doubtful, however, if this view be of any real value, either to science or religion.

4. While there are close relations between the argument from design and the doctrine of special creation, and while

the former might be held to be incomplete until the question of origin is determined, we should remember that they are not inter-dependent, and that the doctrine reaches into a department where scientific induction must be supplemented by faith.

5. The claims recently urged in behalf of the theory of natural selection as a substitute for the theory of design are not admissible, because it fails to give a satisfactory explanation of the differences among closely-related organisms, of the gradation and succession of organisms, of the complex phenomena of organs and functions and especially of sex, of the laws and the limits of variation, of the law of reversion to type, or of the numberless adaptations implied in all these. Whereas all such fall into order and significance when traced to active intelligence both as to origin and guidance.

THE CHAIRMAN (the Rev. R. W. Kennion, M.A.).—I am sure all will accord the author their best thanks for his paper, and add a further expression of their thanks to Mr. James for having so kindly read it.

Mr. W. P. JAMES, F.L.S.—I have read Professor Duns' paper with great pleasure, and need hardly say that I cordially agree with its main conclusions. It is, I am afraid, too condensed in parts to be readily understood by a popular audience. Only those who are accustomed to biological studies can here and there follow the course of reasoning, which is sometimes more hinted at than developed. There is one small point on which I should like to offer a criticism. I should be inclined to give the "Theory of Design" a much wider scope than is indicated on the second and third pages of the paper. In fact, Professor Duns has very much narrowed its application by opposing it to the theory of Natural Selection, and so confining it to animals and plants. But the theory of design, or, as it is more usually stated, the argument from design, covers a great deal more ground than natural selection. Nor, again, is it wise to limit it to purpose; it should be enlarged so as to include order as well as purpose; so as, in fact, to be equivalent to intelligence. Order is often to be traced where we cannot venture to guess at purpose. Let us take the familiar and, as it were, classical example of phenomena the purpose of which has baffled the human intellect, namely, comets. Yet order is most manifest in the fact that they obey with undeviating regularity some law of motion which drives them round the sun in conic sections, either in elongated ellipses, or parabolas, or hyperbolas. Order, again, is seen in the geometrical regularity of crystals, of which the snow-crystal, with its six rays diverging at an angle of 60 deg., is a familiar example; in the arithmetical constancy of the formulæ by which chemical combinations can be expressed, in the circulation of water, in the distribution of light and heat—in fact, in all the great physical features of our

planet. Even in the animal and vegetable kingdoms, where purpose is generally very obvious, order also is present. Let us look at the tulips which are now adorning the beds of our public parks. Purpose is visible in every detail of the flower—perianth, stamens, and pistil; but there is order also—there is the adherence to the number three, or the ternary symmetry. The flower consists really of five whorls of three each; two of the perianth, two of the stamens, and one of the carpels. This adherence to type leads us into a different sphere of thought from purpose; and it is found side by side with purpose in every one of the animals and plants of the globe, with the exception of the very lowest in the scale. The fact is, the subject of design in nature is a vast one, and I agree with Professor Duns, that it has not yet been adequately treated. Of the unfairness of the objections made against it I find frequent examples when reading recent German monographs on botanical subjects. I will mention a single typical example of one-sided fanaticism. The late Dr. Hermann Müller, of Lippstadt, was justly famous for his patient and exhaustive study of the wonderful mutual adaptations between insects and flowers. The work of his which I have myself read is a *résumé* of the whole subject written by him as the opening essay for Schenk's *Handbuch der Botanik*, now appearing in Breslau. In this able work he gives most interesting facts mixed up with wild speculations and buoyant hypotheses. The fundamental point of view is perhaps a grotesque exaggeration of the amount and value of cross-fertilisation in nature. However, after spending years of his life in studying some of the most astonishing instances of correlation and mutual adaptation between plant and insect that we know, Dr. Müller came to the conclusion that they did *not* indicate design. What are his reasons for this? On examination they turn out the veriest trifles. This Materialist, or Monist ceased to believe in an Almighty Maker of heaven and earth because he fancied that in the course of ages some flowers had been adapted to different insects at different times, that some flowers once fertilised by insects had again recurred to wind-fertilisation, and that some of the contrivances were occasionally eluded by wily insects. *Est-il possible?* So it seems an elastic, self-adjusting contrivance is no contrivance at all! A plan that contemplates, anticipates, and provides for changes is not a plan! We must, however, remember that in Germany itself a distinct reaction has begun against the extravagances of the Extreme Left in biology. Virchow and Du Bois Reymond both condemn the irrational dogmatising, and the fierce proselytism of the Haeckelian school. Unfortunately, it is too often the sensational books of "advanced" thinkers that are translated for the English market. I may add to what I have already said, that, in the main, I agree with Professor Duns; but I think that, owing probably to other demands upon his time, he has hardly done full justice to the subject, which is a very wide one, and might have been dealt with on a much broader basis. I do not know in what respects I can differ from what he has said, except with regard to details which it is not worth while at the present moment to go into. With reference to the general question of

natural selection, people are at length beginning to realise that the theory is insufficient in itself to account for the production of new species, and in the last edition of his book on the origin of species Darwin himself has said he never stated that it was the only factor. Nevertheless, it must be confessed that, although he did formally say, in one place, that perhaps other factors had contributed to the formation of new species, yet, all through the book, as the most friendly critic must admit, he really does speak of it as if it were the sole factor in the creation of new species.

Mr. D. M'LAREN.—I fully agree with Mr. James's remarks in regard to the evidence of design, not merely in regard to purpose or use, but likewise in regard to order. I should like to hear from him whether he thinks the symmetrical markings on the two sides of a butterfly's wing are to be taken as an example of the evidence of design in the matter of order. Let him, for example, take the different colouring on the antennæ of one of the common butterflies. It would seem that, in regard to order and colouring, there are obvious indications of design, and yet no one can assign, or has yet been able to discover, any obvious purpose or use in these things. There is an expression used by the Apostle Paul in the first chapter of the Epistle to the Romans which, I think, is very applicable to the attempts we see made to account for the origin of species in such a way as to set aside the Designer and Creator—"Professing themselves to be wise, they became fools." I do not wish to use this quotation in an odious sense; but, speaking simply from the results of one's own observation, it does seem extraordinary that men should prefer the process called evolution, as bringing about the wonderful results we see in nature, to a belief in the action of a designing Creator.

The CHAIRMAN.—I notice that on the third page of Professor Duns' paper the word "teleology" is employed in a somewhat unusual sense. The writer says: "The leading features of the new point of view are belief in teleology and denial of final cause." My idea was that teleology was the doctrine of final cause; but Professor Duns appears to use the word in another sense, and as if teleology were merely the science of causation, without final cause or purpose. I think Mr. James agrees with me that teleology is the science of final cause.

Rev. W. R. BLACKETT, M.A.—There are one or two points upon which I should like to express my gratitude to the author of this paper and also to its reader, for the instruction they have afforded us. One of these points is that, on the third page of the paper, Professor Duns points out that the recognition of design and contrivance has lain at the root of the immense advance in science which is represented by the discoveries and the work generally of a man like Cuvier. This certainly seems to bring before us a fact of immense value which we ought to bear in mind in all our discussions on this question. We are sometimes told that the idea of contrivance and final cause is opposed to science. I hope and trust that a more reasonable day is dawning upon us, when it will be seen, as has been suggested by Mr. James, that the denial of contrivance, or the maintenance of the notion of natural selection as the cause of the development of all things, is itself opposed to the

advance of science. There is another point to which I should like to refer. On the last page but one of the paper the Author says: "There are others, again, who, like Asa Gray, accepting his system and working for its illustration, yet hold that it is not inconsistent with theism. It is doubtful, however, if this view be of any real value either to science or religion." It may not be of much value to science or religion, but it is of considerable use in our discussions, as frequently enabling us to maintain that to grant a great deal in the way of development and a great deal in the way of evolution is not absolutely inconsistent with theism. In this way we get a standing-point on which our ideas may be brought into touch with those who have acquired the notion that science is destructive of religion, and I think we are enabled to make good use of this in drawing attention to facts which perhaps they have never observed. (Hear, hear.) I for one fully believe that a large amount of evolution is perfectly consistent with theism, and that in all probability there may be, ultimately, a very considerable amount of compromise between the idea of evolution and that of contrivance. At the same time, I think it important to remember that the theory of natural selection does not account for everything, and that, even if we go back to development and evolution in their easiest and most general application, we must still believe in the power of adaptation and the power of evolution having been impressed on things from the very beginning. This is an argument which I have found to be of very great use. I remember that on one occasion, while I was in India, an educated native came to me, bringing with him two friends whom he had induced to accompany him in order that they might see how he would smash up the *padre*. He challenged me to a discussion on this point, and he maintained that there was no proof of the existence of God, inasmuch as natural law governed everything. I asked him, What governed natural law? where natural law came from? The poor man, much to his chagrin and somewhat to the complacent delight of the two gentlemen he had brought with him, was obliged to retire from the contest. I am not sure that a more eminent scientific man than he would have retired quite so quickly, but I do believe we can find a useful standpoint between ourselves and those who have been puzzled by the assumptions of evolutionism, if we abstain from maintaining that the evolution doctrine is utterly inconsistent with theism. There may be in evolutionism much that is consistent with theism. I think in the paper before us we have many points that it would be very difficult for an evolutionist who takes a broad view of the whole question, to satisfactorily overcome; and I think that, as Mr. James has suggested, it is just here that evolutionism falls short, namely, that its advocates do not take a broad view. Indeed, on the contrary, it seems to me that they take a very narrow view. (Hear, hear.) They look at one particular mode of development and advancement in the organisation of species until they get the theory thoroughly into their heads, and then they maintain that, because it is their prevailing idea, therefore, the same thing must hold good with regard to the world at large.

There is a failure to grasp the broad general facts evinced throughout the whole of their argument, and one thing which they seem to ignore and set aside is the absolute want of evidence of the evolution of any single species. If we keep this great fact before us, we shall not bow down with absolute submission before the idol of evolution until some more satisfactory proof has been put forward by those who expound that peculiar doctrine. (Applause.)

Mr. R. J. HAMMOND.—With reference to the, I think, too brief allusion made in the paper to Asa Gray, I am of opinion that there must be a great many who from their own observation would be inclined to think with him. (Hear, hear.) They are perhaps, deterred in some measure from saying what they think upon this point, because they are told that it ought not to be looked into, and that it is very doubtful whether anything can possibly come of it; but I cannot help thinking it is a thing that ought to be looked into.

Rev. J. JAMES, M.A., said:—It appears to me that the writer of the paper, in speaking of “a belief in teleology and a denial of final cause,” refers to two things that are inconsistent. Nevertheless, I think the paper one of great value. The author takes it for granted that there is a great deal in evolution;* and the value of the paper lies to a great extent in the fact, that it sets forth, very plainly and clearly, as all believers in a Creator would maintain, that not only is there, as Darwin himself would say, an origin to the system of evolution, but there is, attributable to the Almighty, in that system, the thought and wisdom contained in the idea of the perpetual presence of the Almighty to guide the development of the things He has designed. I hold that the theory of evolution alone does not stand good on any ground, and that there is more of true science in the suggestion that we have not only to believe in the divine origin of the system of evolution, but also in the periodical and occasional intervention by which it pleases God in His goodness to guide and direct the work of His own creation. The last three lines of the paper are very clear and expressive, namely, “Whereas all such fall into order and significance when traced to active intelligence, both as to origin and guidance.” The writer might, as Mr. James has said, have developed his idea much more fully, and have shown that whereas, as Darwin has put it, human thought and skill have succeeded in bringing about variations in the animal world, it is much more to be expected that the thought and power of the Almighty would bring about greater changes from time to time; while it is only a rational inference that, if in accordance with this view of human intervention the changes attributed to man’s action do not take place without his interposition, then, upon the same line of reasoning, all the other changes must have been brought about by the intervention of the Creator. (Hear, hear.) Surely, it is more philosophical to adopt this argument than to attribute all the advances and

* Mr. James probably means “the theory of Evolution.”—Ed.

developments that have taken place in what we see around us to the mere theory of natural selection, brought about by physical personal influences; for, in the sentence quoted from Darwin by the author of the paper, "natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers,"—Darwin would actually seem to make a *person* of natural selection. To read such a passage is, it seems to me, to see the absurdity of it; and I think we owe our best thanks to the author of the paper for having brought forward, with so much effect for the purpose he had in view, so many important and significant points. I agree with what was said by the author of the paper when he stated that the system of evolution did not seem to apply to anything but the animate creation. If the inanimate objects of creation be the work of an Almighty wisdom, why, it may be asked, should we exclude the power and wisdom of the Almighty from the advancement of the animate creation? To do this is not philosophy, nor the love of wisdom in its widest sense. There can be little doubt but that Darwin was carried away by his wonderful knowledge of facts and his fanciful theory, which, from time to time, he admitted to be a theory, but which he still put forward as if it were a series of ascertained facts.

Mr. J. HASSELL.—After I had perused Dr. Duns' paper I marked a portion of the paragraph, just referred to, on the third page of the paper; because it occurred to me that if that is what we are to understand by natural selection,—namely, the impersonation of non-entity—we are asked to accept a remarkably unscientific doctrine. I then turned to Professor Tyndall, to see what he said upon the subject, what facts he had to present, and what conclusions he drew from those facts. As I have already said in this room, while I am willing to sit at the feet of Huxley to learn the facts of physiology, or at the feet of Tyndall to acquire those of physical science, yet, when they come to draw their inferences, I reserve my right as an independent thinker, and use my own judgment. In his celebrated *Belfast Address*, Professor Tyndall says: "Natural selection acts as the preservation and accumulation of small inherited modifications, each profitable to the preserved being." Now, Professor Wallace says it is the fundamental doctrine of evolution that all changes of form and structure, all increase in the size of an organ or in its complexity, all great specialisations of the physiological divisions of nature, can only be brought about in so far as they are for the good of the being so modified. Well, if this be so, then I say the hypothesis of evolution must, of necessity, fall to the ground. As for myself, I cannot admit even that amount of evolution which one speaker would seem to wish me to accept. Let us take an example. According to the doctrine of evolution, there was a time when there were no animals living on the dry land—when there were no air-breathing creatures, all of them being aquatic. How came it, we may ask, that these aquatic creatures became air-breathing animals? One

author tells us that the fish began to breathe air after being thrown upon the beach and undergoing some alteration of the swim-bladder, so as to form a rudimentary lung. But you will observe that the swim-bladder of a fish possessing that organ—for all of them have not got it—is exactly adapted for the purpose it is intended to serve, which is to render the creature specifically lighter than it would otherwise be, so that it is the more buoyant and better able to rise and sink in the dense medium it inhabits. Now, if that swim-bladder were operated upon by the atmosphere so as to be folded up and become a sort of lung, when the creature returned to the water it must do so with its swim-bladder less adapted to its aquatic existence than before, and it certainly could not be for the good of the fish that it should have to perform its movements with an inflamed swim-bladder. It may be said that it was not the swim-bladder, but the gills that were altered. Let us regard the matter from that point of view. If the gills of a fish be exposed to the atmosphere, and the creature is forced to breathe the external air without the intervention of the watery medium, then we immediately perceive that the branchia become inflamed, and it can hardly be said to be beneficial to the fish that it should return to the water with inflammation of the branchia. Indeed, for my own part, I think that this would have been decidedly to its disadvantage, and it appears to me that, if that is the mode by which the great Creator—certain of whom the evolutionists admit in the abstract—acted, having in the first instance worked by the one plan and then having changed it for the other, it is—and I say it with all due reverence—a very bungling method. It is much more reasonable to suppose that the Almighty Creator should have placed in some germ, such as an egg, all the potentiality required to produce the air-breathing creature, rather than that He should go through the process of creating some organ adapted for one purpose, and then should so alter it as to adapt it to another, this change being so effected that its effect, in the beginning of the metamorphosis, must have been to render the creature less adapted to the purposes of its original form and mode of existence. (Hear, hear.) I might illustrate this argument by many other examples. I might take, for instance, the hind hands of the quadruped. Surely it is only reasonable to suppose that a creature with four perfect hands is much more likely to succeed in the struggle for life among the forest trees it has to climb, than one which has begun to lose the grasping power afforded by the two hind thumbs. Again, it seems to me that for such a creature to lose all the hairy covering of its body must have been extremely inconvenient, and very much against its habits and mode of existence. I hold, therefore, that we are not wrong in saying, at least until we are better informed, that we do not admit what the evolutionists demand of us. (Hear, hear.) I cannot accept the assumption that evolution, as it is presented to us, was God's plan; and I would write upon it the word "unproven," and I think that the way in which the question is presented to our minds by those who argue for a special creation is the better way. If God could, in the first instance, put into one particular germ all the potentialities after-

wards required for all created things, why is it unphilosophical to say that He put into a series of germs that which was requisite for the potentialities of the different beings intended to be developed? Is it less scientific to say that God made twenty or thirty different types than that He made only one? I think not. On the contrary, I regard it as equally true, and scientific, and philosophical, to say that He may have done this, and that, as I believe, He really did. If it were not so, how comes it that we have the higher forms of animal life side by side with the very lowest—the perfect eye of the trilobite of past ages side by side with the foraminifera? Surely this is not to be accounted for on the assumption that everything we now see is the result of this process of natural selection, or blind, unreasoning chance, which waits for an opportunity, and which stops the fly from going into the plant by unconsciously putting around the flower certain curious hairs and glands, and so forth. If the evolutionists were to say that this was consciously done, then I might sit down, exclaiming, “What a wonderful plant!” But they admit that it is unconsciously, and I say the theory is very unscientific. I hold that theirs is not so good a plan as that which I have in my mind, namely, that the great God should, when it pleased Him, have given to so many germs or eggs the power of producing all the phenomena we see. Why not? Nature shows this everywhere, but not in the way of transmutation; I grant there are variations, but variations within strict limits, such as are seen among the pigeons, where we have the fantail, the pouter, and the jacobin, with a number of other varieties, which are all, however, in structure and habits, pigeons. Here you have variation, but not transmutation; and you may see the same thing in the carnivora. There you may observe great variety; but where do you see the carnivora entirely crossing the limits of their natural order and producing creatures of other kinds? Never! In fact, we know that there is an antipathy between certain families of the carnivora which is difficult to account for on the theory of natural selection, but which is not difficult to account for when we remember that there is a persistency to conserve the race. There is another fact which should not be overlooked, and that is, the order and design exhibited in the inanimate world. I was much struck with this in thinking over a point in physical geography the other day. Why should not the earth’s axis be perpendicular with a universal unchanging season, year by year? Why should it not be horizontal? The explanation is, that if that were the case the earth would not be fitted, as it is, in almost every part, for the abode of man. When you consider the position of the tropics, with their constant sunlight of twelve hours each day, and the poles, with their six months of light and six months of darkness, you perceive that each has the same amount of day and night, while the accompanying changes and alternations in the seasons render every part of the earth more or less habitable. And, with regard to geology, it is clearly shown that, if the elevation of the land had been different to what it has been, one half of the world would have been uninhabitable. As you are all aware, the rise of the earth from the level of the sea goes

on up to a culminating point in the tropics—the tropic of Cancer on the one side, and the tropic of Capricorn on the other. The highest ground is towards the tropics, and the lowest towards the poles. If this were reversed, and the culminating point given to the poles with the lowest ground towards the equator, what would be the result? You would have the tropics burnt up by torrid heat, and what is now the temperate zone nearly all frozen, while, if you went far north, there would be one scene of eternal frost and death. It would be a most extraordinary thing if the molecules of the earth had so arranged all this. Surely it would be a much more wonderful thing, and a greater strain upon our faith, to believe such a doctrine than to hold that it was designed by an infinitely wise Creator. I agree with Mr. James in thinking that this paper might have been advantageously enlarged. It could not be expected that we should take it for granted that the theory of evolution is in any way proved, and, for my own part, I am of opinion that special creation, within the limits I have put before you, is by far the more reasonable view to take, and answers much more satisfactorily every question arising in this great and important controversy. (Hear, hear.)

Mr. W. P. JAMES, F.L.S.—As I have only been called upon to read the paper, I am, of course, not responsible for it, and therefore cannot be expected to reply to what has been advanced during this discussion. Indeed, I may say there are several points on which I do not concur with the writer; but in his absence it would hardly be fair to bring into prominence those matters on which I differ from him. I am glad to see the reference to Dr. Asa Gray, although it is, I think, too brief: Asa Gray is the most eminent representative of the school of naturalists who think that a strict theism may be combined with a system of evolution; and, to those who like to take their stand on that platform, I fancy his books present the argument in the most tenable shape in which it can be urged. The remarks I previously ventured to make were almost entirely confined to the part of the essay which treats of natural selection. This is not the same thing as evolution; it is merely a part of it. But with reference to the theory of descent—that is to say, the derivation of the existing plants and animals from their predecessors—that is a subject which is full of fascination. No naturalist can deny its attractions. In fact, all theories that seem to promise the view of a great unity have a very fascinating aspect. But when a botanist recovers from this feeling, and endeavours to trace the pedigree of plants, he sees that the conclusions arrived at are quite untenable. The same thing has been shown in relation to zoology by Mr. Hassell, in a paper read here two or three years ago, in which the attempt to prove the line of descent for the animal series is shown to be utterly impossible of demonstration. As with the animal so with the vegetable kingdom. If all the existing plants were derived from their predecessors, in time we ought to be able to arrange them in a strictly linear series; but, it is very soon found that this is utterly impossible, as well in regard to plants as to animals. With respect to plants, we should

have to arrange them in four series—the algal type, the moss type, the fern type, and the flowering plant type; and, when it is found that we have set out on an impossible endeavour, the fascinating simplicity with which we started entirely disappears, and we find we have undertaken a hopeless task. The evolutionists cannot put them all into one line; they see at least four different lines of descent, and that below these four lines all attempt at unity is utterly impossible, because the lines end, and each forms a *cul-de-sac*. There is no connecting link between these four groups, and this fact is now generally admitted. Dr. Goebel, in the last volume of the last edition of the *Encyclopædia Britannica*, states that the gap between the mosses and ferns is the widest he knows of in the vegetable kingdom, and he is one who is favourably disposed towards the theory of descent. But the gap is equally wide between the other groups, the algæ and the rest being divided by tremendous gaps. Suppose, however, we take one of the groups, and attempt to go backwards. There is the moss group, which is a very small one. If you take that group, you can easily trace the species to two ancestors—the ordinary moss and the liver-moss. If you take the algæ group, you find that it also ends blindly in the olive, the red, and the green series of sea-weeds, which are excessively isolated, and cannot be traced to any common ancestors, but all end blindly. Consequently, all the fascinating simplicity has entirely gone; and this is admitted by those who advocate the theory of descent. They say, “As yet you can’t go further back;” you have the threads of descent all hanging loose in the air, and you cannot trace them to any common point, nor to any ancestor, because, from their peculiar nature, they are so tender that their remains could not have been preserved in the early rocks; and therefore, as the means of tracing them have disappeared, the problem of their ancestry must remain for ever unsolved. If we take the vascular cryptogams, the ferns, horse-tails, and lycopods, it will be found that they are all equally distinct to the very end. We have in their case the same story over again. Then, when we come to the flowering plants, it is generally admitted to be rather difficult to show how the higher ones have developed from the pine-trees, which the theory requires. The most far-fetched and impossible hypotheses and assumptions have to be adopted in any such attempt. As a rule, the theory requires that what is never known to happen now used to happen quite commonly in bygone times, and, when you ask for the proof, you must be satisfied with the statement that everything that would have proved the theory has unfortunately disappeared. And yet why all the intermediate forms that would have proved it have disappeared is not apparent. The fossil remains of numerous species have been preserved in certain strata—in the coal measures, among the miocene flora of Switzerland, and in some of the chalk strata; and one naturally asks why the intermediate forms, which could alone prove the theory, should all have disappeared. So that really and truly, after the first feeling of fascination, which, as I have said, is very strong, exercised by the supposition that the whole of this natural system is one of blood-relationship—a feeling which no botanist or geologist

can resist, with regard to one of the grandest attempts at systematising that was ever made,—the time comes when one sees how impossible it is to carry the sequence back to the very beginning, and a sort of reaction sets in. What I have said has only been about this theory of descent; it has nothing to do with the question of religion. I have been considering whether the theory is true, and I say it has not been shown to be true. Of course, the clergy have not the time to investigate these things; but I have sometimes heard in sermons the assumption made—a little too prematurely—that the theory is true, and then, that it is reconcilable with Christianity. But I repeat that it has not been shown to be true, and I think that, upon the whole, a slight reaction is beginning to evidence itself in the scientific world. Even Darwin admitted, in his last edition, that Mr. Mivart had brought powerful arguments against him. That gentleman is a distinguished zoologist, who doubts very much some of the conclusions at which Darwin arrived; and I suppose there is scarcely any one who nowadays says that natural selection, pure and simple, is sufficient to account for the production of species. We know that Professor Huxley has said very decidedly that it is not. The subject certainly is a most interesting one; but the question, as limited to the theory of descent, whether animals owe their origin to certain ancestors or not, must always be left to people's private judgment, as it cannot be decided, and, even on the part of the evolutionist, must be quite as much a matter of faith as the question of creation and other theories. (Applause.)

The meeting was then adjourned.

REMARKS ON THE FOREGOING PAPER.

BY SIR EDMUND S. BECKETT, BART., Q.C., LL.D.

I shall not be in London till Wednesday, and therefore cannot attend the meeting on Monday. Nor am I sufficiently versed in the special subject of Dr. Duns' paper to make any useful remarks thereon. But, on this general subject of Natural Selection *v.* Design, the more I read about it the more I see the incompetency of the automatic cosmogonists to account for the existence of anything in the world, and much more of the whole world. It is the most miserably illogical pretence of a scientific theory to say, as they in fact do, "We assume all the laws of nature to have been self-existent or self-produced, and then we will show you how some improvements and advances in some organised things might be produced; and then we shall ask you to conclude that all living things have advanced from lower ones in the same way. How the lowest began we cannot say." The proper answer to that is that it is bad reasoning at every stage. It is illogical to conclude that all changes can take place spontaneously because some can. So long as there are any phenomena, especially considerable ones, which you cannot so explain, it is illogical and unscientific to pretend that your theory is universal. We do not believe in gravity being universal because it is proved by some phenomena, but by all to which it can have any application. Show us what natural selection has done towards producing an oak-tree out of a toadstool, or the most rudimentary vegetable you like, and how that started; or answer any of the questions which have been put to you over and over again as to its power of producing all sorts of organisms, and you will be doing something. That is one end of the argument. The other is: Show us how you start anything out of either nothing or a state of absolute uniformity of matter and force, such as Mr. Spencer avowedly starts with, and all the anti-creation school, whether they avow it or not. They never have, and never can. Does any man in his senses believe that, if any Spencerian thought he could give a logical answer to the article on Spencerian Philosophy in the *Edinburgh Review* of January 1884, not one of them would have tried it; or to my paper in our Transactions about the same time. So far as I have seen, there has been no serious attempt to answer either of them: There have been a few of a merely personal or utterly frivolous kind, such as that in *Knowledge*, which filled two or three articles with elaborately discussing the degree of, first the wickedness, and then the carelessness, of miscopying which omitted exactly a line in Mr. Spencer's book, ending with the same four words as the next line; and then the interesting etymological

question of the meaning of the word Axiom. And another long one was sent me from America which filled many pages with a prosy recital of the old story of Lord Brougham's review in the *Edinburgh* of Dr. Young's great theory of light, and then asked its readers to conclude that, because that was ignorant and wrong and Dr. Young's theory is proved to the satisfaction of every mathematician in the world, *therefore* the exposure of Mr. Spencer's utterly unproved theory is probably wrong too. If one may use a bit of very significant slang, we must keep the noses of these anti-creationists to the logical grindstone, and make them prove every step of their reasoning, instead of letting them wander off into abstract generalities and giving ourselves the trouble to follow and disprove them. That is not our business. Of course it is useful for those who are versed in, particular branches of physiology to point out from time to time how natural selection fails to account for phenomena of various kinds; and, if the Spencerians or Haeckelites do not answer such charges, the logical inference is that they cannot. People who set up a new theory of light or electricity with no better proofs of it than have ever been given of theirs would be laughed to scorn by the scientific world. In one sense, therefore, "our strength is to sit still," and go on returning the verdict of "not proven" to every pretence of producing the world by a series of accidental departures from a state of dead uniformity of matter and force, until they can and do produce a complete explanation reaching from that zero up to the present infinity. As I have often said before, *we* have a theory which is indisputably sufficient for the purpose, and which will include as much natural and every other kind of selection as they can physiologically prove, and includes also the prime cause of all such selections, and of every other change and force, as to which they are utterly helpless, and indeed silent, and have no theory at all to account for the origin of any one of the infinite varieties of forces or laws of nature. Mr. Spencer is content to call them "unfathomable mysteries," and his disciples are foolish enough to accept that for an explanation, and to call that a more probable theory than ours, whereas it is mere nonsense, or words meaning nothing. May 3, 1885.

BY THE REV. CANON C. POPHAM MILES, M.A., M.D., F.L.S.

The subject of the paper is as interesting as it is important, and, in my judgment, the position taken by Professor Duns is a strictly scientific one. The paper is too brief; but I suppose this to be intentional. I have long held that Darwin's facts are unassailable, but that the inferences drawn by his more forward disciples are untenable.

THE AUTHOR'S REPLY.

I am gratified by the cordial references to my paper and the acceptance of its chief positions by those who took part in the discussion. The criticisms call for few remarks. Let me thank Mr. W. P. James for his able and interesting review. The brevity of the paper and the narrowing of the issue were both intentional. I agree with Mr. James that "order" should have a place in the doctrine of "final causes." This is fundamental. Had I been dealing with the general question, it would have been my starting-point. My reference to Asa Gray was necessarily brief, but no one well acquainted with Asa Gray's works can have a higher estimate than I have of their great value and of the attractive thoughtfulness and scientific ability of their author. I had only one point to speak to, and did it. It seems almost absurd that at this time of day one should feel it necessary to refer thus to a naturalist whom all scientific workers honour. The Chairman refers to my use of the word "teleology." I adhere to this. Much confusion in popular apologetic literature has already arisen from employing this word as the equivalent of final cause. Darwinians hold themselves the authoritative exponents and illustrators of "Teleology"—that is, fitnesses between organs and functions, between different parts of individual features of structure, between living forms and their environments, &c., while, notoriously, they refuse to acknowledge "Final Cause,"—that is personal prevision, purpose, and end. Perhaps in no recent book are there so many illustrations of teleology as in Darwin's work on the *Fertilisation of Orchids*. Did he believe in the Doctrine of Final Causes? The Rev. J. James infers that "I take it for granted there is a great deal in Evolution." Whereas, I hoped the paper would show that I put no value on the Evolution pleaded for in the scheme of Natural Selection. And I still think this has been made sufficiently evident.