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ORDINARY MEETING.*

PROFESSOR E. HULL, LL.D., F.R.S., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed.

The following paper was read by the Author :—

PLAN AND PURPOSE IN NATURE. By WALTER KIDD, M.D., F.Z.S.

THE existence of Design in Nature is the "*quod semper, quod ubique, quod ab omnibus*," which scientific teachers may as well make up their minds to entertain. It is their province to ascertain, if they can, the modes in which this Design has been carried out. At the same time it must be acknowledged that the conception of purpose and plan immanent in and pervading Nature, is the insurmountable barrier to the reception of the doctrine of evolution, as "rightly conceived" by Mr. Herbert Spencer. Darwin's discoveries, which at first logically involved some sort of teleology, by reason of his supposed four or five primordial forms of life, are supposed to have given the *coup de grâce* to the old teleology. All the structures and parts of plants and animals are supposed to exist only by reason of their value in the struggle for existence to their possessors, or as survivals of some that were of use to remote ancestors, and myriad adaptations of means to ends throughout nature are attributed to a *mechanical law*. At this amazing position

* Feb. 21st, 1898.

stands the evolutionary Luther with his modern "Here I am, I can do no otherwise." One of the most fearless of the Reformers stated it clearly enough in his earlier days when speaking of this 'mechanical theory'*:—"It endeavours to comprise all the facts of adaptation in organic nature under the same category of explanation as those which occur in inorganic nature—that is to say, under the category of physical, or ascertainable, causation. Indeed, unless the theory has succeeded in doing this, it has not succeeded in doing anything—beyond making a great noise in the world. If Mr. Darwin has not discovered a new mechanical cause in the selection principle, his labour has been worse than in vain." As to the noise which it has made there is no doubt. But apart from the great attempted revolution which he set on foot, the bye-products of Darwin's work have been of imperishable value and wide interest, and his central theory has at least set in motion a host of workers in biology. But when the gifted disciple of Darwin went further still and said that "Science" (by which, of course, the subject matter of his brilliant advocacy —evolutionary doctrines—was represented), had "rendered impossible the appearance in literature of any future Paley, Bell, or Chalmers," he failed to see that every evolutionist of them all is a Paley, Bell, or Chalmers *malgré lui.*

2 In these remarks upon the evidence for Design upon the earth that familiar side of the question, under which occur the adaptations of organisms to their environments and needs, will not be considered. This side is being daily reinforced by a host of biologists, whose labours resemble for industry and unconscious benevolence that of the bees among entomophilous plants, laudable enough in its primary object, but of wider import than they at present know. Professor Schiller has lately† discussed "Darwinism and Design" from this point of view of the adaptations of living nature, as the title indicates. He finds Darwinism, as formulated for the purpose of a working theory, destructive of all teleology, not avowedly hostile to the conception of a Creator, but promoting views of the origin of living things which rendered a Designer or Creator superfluous, the facts of animated nature being supposed to be sufficiently accounted for in other ways. Professor Schiller

* Romanes, *Darwin and after Darwin*, part 1, p. 402.
† *Contemporary Review*, June, 1897.

shows with valuable clearness the inadequacy, which all are now recognizing, of Darwin's postulate of indefinite accidental variations concerned under the action of natural selection in the origination of new forms of life. He himself appears to incline to a view of evolutionism, in which the argument for Design is materially strengthened, *positively* because evolutionism, as he says, lets us behind the scenes and shows how means are adapted to ends in the gradual process of evolution; he would probably approve of Drummond's *naive* way of putting it, "Why was evolution the method chosen?" *negatively* because evolutionism greatly weakens the objections to the teleological argument based on the imperfection of the existing adaptations.

3 It is perfectly true, as we are often being reminded by current teachers, that the argument for Design in nature is not in fashion at present, and Dr. Johnson spoke with his customary wisdom when he said: "He that contradicts acknowledged truth, is always sure of an audience." The scientific exponents of evolutionary doctrines are listened to with the respect due to their attainments as they discourse in lectures, addresses, periodicals and larger essays. Their audience is great indeed. Teachers of these views are even to be found tickling the ear of the public in popular magazines for the laity, in illustrated weeklies and in novels. But the bulk of those who read, are interested, amused, and impressed, betray a healthy degree of scepticism as to current science on these grave questions, a scepticism encouraged with a singular candour by their teachers themselves in such admissions as, "All our knowledge is and remains throughout provisional."*

4 To those who have obediently, and a little hastily followed current doctrines as to life in nature, this note of transitoriness cropping up from time to time in the seeming certainty of that gospel of evolution, upon which their whole mental and spiritual fortune has been staked, is not a little startling. Drummond was even more alarming to the wayfarer, who for long past has taken in such guidance as he could find from evolutionary teachers, when he said—"This is the Age of the Evolution of Evolution." . . . "even were his theory perfected, its first lesson would be that it was itself but a phase of the evolution of further opinion, no more fixed

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* Weismann on *Germinal Selection*, 1896, p. 37.

than a species, no more final than the theory which it displaced."* The reference here to species is singular, for if the progress of knowledge as to species has taught one thing more than another it is the truth of *specific stability*. Modification of species in remarkable degrees, especially by artificial selection, has done wonders. What it has *not* done, in the production of a new "physiological species," is equally wonderful. But, leaving such debatable ground, we may be thankful to Drummond for his reference to "the theory which it displaced." He utterly mistakes the theory which for the time science by the fiats of her leaders has agreed to ban, that theory under which the very best of his spiritual knowledge was nurtured. The essence of the "theory" that reigned till Darwin, and that may ere long emerge from the present upheaval of thought, thereby much purified from dross—that of creation—is its finality. Mr. Herbert Spencer calls it "special creation," but unless the adjective be meaningless it is not warranted by Revelation as rightly expounded.

5 Turn from the vast system of hypotheses piled upon innumerable facts in nature, and loose analogies without end, to the simple view which is the essence of creation, and say which of the two rival theories better meets the mental needs of human beings. Say that "in the beginning God created the heaven and the earth," and in their place and time every new form of life as the changing conditions were fitted for it, that this great drama of creative action proceeded through all the geological ages and in all parts of the globe as it seemed best to One of infinite wisdom, that the production of fresh forms ceased with that of Man, the head of the sentient world, that marvellous laws for the working of this complex system of being were laid down, and that Struggle, Heredity, Variability, were its working principles, and that within these immense boundaries the improvement of fauna and of flora, with extinction of obsolete forms, was carried on, and at least you have left your disciple an universe, which does not shock his very elements of knowledge. You have not forced him in "the evil days" and after death to a bland Nirvana, where Nature, and Development, rather than God, "shall be all in all." You have not offered him a cup of optimism, which personally he will never taste, in the one hand, and of despair for his shat-

* *Ascent of Man*, 1894, p. 9.

tered faith in the other. Your average disciple, if you press him will regretfully say, "The endless redistribution of matter and motion in stupendous cycles of evolution and dissolution would be a world without any justification to offer for its existence—a world which might just as well not have been."* No—let evolution be more philosophically confined to that of the individual—let Ontogeny be recognised for what it is, the development of the individual plant or animal, and no fancied epitome or picture of the development of the race which has preceded the individual; and let "phylogeny" stand as but another name for the necessary relationships of innumerable forms of life introduced successively in the past ages of the globe, *varieties* and *races*, such as are seen in the case of Man, climax of all this vast stream of life, serving to fill the numerous gradations between species and species. If the existence of a Divine First Cause be admitted, it is difficult to see what *a priori* objection can lie against this view of the seed-plot of life, of which this globe may perhaps be but a part.

6 It is not less difficult to see what ascertained facts as to life and its manifestations forbid this view, harmonious at once with Revelation, Reason, and scientific knowledge.

7 When it is further borne in mind that *degeneration* plays a part in life, and must have done so from its early days, of profound and far-reaching importance, we feel we are not shut up to the system, which has usurped for a time the place of the doctrines of Creation and Design in Nature. It was lately pointed out that in scientific questions, the arguments—perhaps even the strongest—cannot always be stated in express terms. And this consideration accounts partly for the element of scepticism and amusement that an observer detects in the tone of the man in the street when the teachers of current science undertake to instruct him in primers, periodicals, addresses and romances. Would not the palladins of evolution who have passed away, and perhaps some who are still living, sigh for the good times when "natural selection" reigned in sole power—for the early days when they had made of biology a solitude and called it peace. But Ossa has been heaped on Pelion in heroic fashion by the demi-gods, who would thus scale the heaven of truth. Those simple times of the nonage of Darwinism are no more. One "factor of organic evolution"

* Professor Seth, *Man's Place in the Cosmos*, p. 27.

after another is being devised, as the issues widen, and the goal is as far off as ever.

8 The very magnitude and shifting character of these doctrines and their complexity, at least justify the naturalist in falling back on creation by an Intelligent Being, and a Being with Will as well as Power, and Morality crowning all—that he may again turn to the study of a cosmos rather than a chaos.

9 Thus will Professor Schiller's timid references to the imperfection of existing adaptation, or those of Dr. Courtney at this Institute as to the non-validity of the teleological argument by reason of that imperfection, find their adequate answer. Such arguments as Helmholtz sanctioned by his proof of the imperfection of the human eye as an optical instrument, are met on the threshold by the terms of the theory of Creation and Design, involving as they do Supreme Will as well as Power. From the physicist's point of view there is nothing perfect in Nature. But such an organ as the human eye may, without contradiction, be considered adequate to the varying needs of the human race. Were it the case that the human eye in palæolithic times was perfect in its adaptation to the needs of those days, this organ would certainly not be such in the present day, were it not for the *adaptability* of the mechanism bestowed upon it by a Supreme Intelligence. In such departments of life as this, again development finds its legitimate sphere. We may be thankful for the power of development, even if it be strangely near to a process of degeneration, under which the emmetropic or hypermetropic eyes of our ruder ancestors could be accommodated in the progress of ages to the study of books, pictures, and microscopes, unknown in early days. As much perfection is found in higher animal life, especially that of man, as a wise Creator bestowed, Who foresaw the value of struggle in the strengthening and improvement of physical, mental, and moral characters. Adequacy and adaptability are its limits. Perhaps the nearest approach to perfection of adaptation is found in parasites.

10 After this digression from the province of Design, the other side of our time-worn subject will be shortly studied. It is one which is strangely ignored, and may be simply illustrated from one of the favourite lines of argument for evolutionary doctrines, embryology.

11 A mammalian embryo when fertilized undergoes in the

early period of its life-history processes called karyokinesis, segmentation, gastrulation, formation of blastoderm with primitive entoderm and ectoderm. Then further differentiation of its cells into organ after organ takes place. The ovum becomes attached to the protecting and nourishing maternal walls. Expansion of these and enlargement of vessels, which are eventually massed together for the placenta, takes place. At this period the growing ovum requires a change in its environment, though it must still be attached to the maternal surface. A group of vessels intertwined with fibrous tissue becomes the placenta, a cord containing an artery and vein supplies a direct communication of its blood with that of the mother, by which means oxygenation of the fœtal blood takes place. The ovum is delicate and requires protection. Fluid forms round it. The maternal parts, its temporary habitation, enlarge; muscular tissue, perhaps dormant for many years before, becomes enormously enlarged for *future use.* In due time the need for all these elaborate contrivances comes to an end. Means are ingeniously provided for the extrusion of the ovum when mature, and its other life when born. Such a remarkable process as this, preordained from the moment of fertilization, in which, strange to say, Huxley could almost, but not quite, see "the Hidden Artist" at work, with the eyes of his faith, may be repeated in identical fashion many times in the life of one animal. But these and many other changes in the ovum which have not been referred to, and the discovery of which constitutes some of the most brilliant and exact results of biological science, could not proceed beyond a few halting steps were it not for the preordained conditions for its coming life, meeting it at every stage of its development. Indeed a most apposite comment upon the cogency of the argument here maintained is supplied by an experience, happily rare, known to medical men as ectopic gestation. Here the ovum is diverted from its suited and preparing home: it develops up to a certain lamentable degree in its abnormal position, an exile from its home, until a fatal result to mother and ovum is seldom averted, and then only by the exhibition of surgical skill brilliant among many brilliant triumphs; which is a sad and apt comment upon the interruption of Design on the one hand, and on the other upon the power of mind, albeit a human mind.

12 The length and simplicity of this illustration may be pardoned for the sake of the light thrown by it on one aspect

of the evidence for Design in animated nature. Let the Darwinian study his plants and animals, and let him prove to the hilt the necessity of his "teleology," and call it what he likes, even to Germinal Selection. Upon this side of the question all one need say is "*Fas est ab hoste doceri.*" It is, however, a totally one-sided view of the matter to contemplate the *adaptation of organisms to environments*, even from Pre-Cambrian times to 1897.

13 Now, environments provided and pre-arranged, as in the case of our mammalian embryo, lead the mind to a correspondence growing from the dawn of Creation, under which organisms are adapted to environments and *environments produced for organisms*, and this has proceeded in a majestic, orderly manner. It is a spectacle known only in the present century through the labours of geologists, one which poets, sages, and scientists of old desired to see but saw it not. Yet for all this interminable progression of nature, which has already required some millions of years for its passing, is ample room allowed, with divine insight, in the first two verses of Genesis. Be it remembered that the age of Moses was one in no way enlightened, but rather darkened by the science of the time, nor was the veil lifted in later days, when Isaiah, with wisdom not his own, summed up in prophetic words some of the results of geological science—"He formed it to be inhabited."

14 In the earliest times it was not enough that the little molten mass, which became our planet, should cool down to the required temperature for the existence of life. Lord Kelvin lately pointed out at this Institute on the one hand the necessity of an atmosphere encircling the globe, in which a due proportion of oxygen should exist for the purpose of animal life, and on the other that this probably could not have come from the previously molten and now cooling crust of the earth. Introduction of free oxygen from some other source in a suited form was essential, and he suggested that this was supplied by the prior creation of vast quantities of low plant life, algæ and the like, which, growing in the seas, should by their own vital processes supply for the *coming* animal life that oxygen without which this could not be. If this were so the great *rôle* which plant life of all kinds was in coming ages to exercise, that of commissariat department for the animals of earth, air, and water, was remarkably foreshadowed and initiated. And it is equally remarkable that the Mosaic cosmogony declares the precedence of plants in the order of production of organic existence.

15 At this rudimentary stage in the "development" of life shone forth that Design which was never to be suspended to the present time.

16 So the azoic ages were at an end, themselves equal it is thought to a third of all those that were to come, and there commenced in Palæozoic, Mesozoic, and Cainozoic times, as men call them, the formation of those successive forms of life, vegetable and animal, rising from lower to higher, ever inter-related and inter-dependent, with environments suited to their growing needs. The Age of Invertebrates found the warm and quiet Laurentian, Cambrian and Silurian Seas ready for their coming denizens, much as did our mammalian embryo find ready a soft, vascular mucous membrane for its quiet habitation and supply. The first of these three periods with its two vast lines of evidence for extinct plant and animal life, viz., quantities of graphite and limestone, shows us the earliest annals of invertebrate history, and the immense preparations made for material upon which these earliest organisms must have fed, and with which constructed their simple skeletons. The prolific outburst of marine invertebrate life in Cambrian times is very remarkable, and still more in Silurian—so much so that in the Silurian all the sub-kingdoms of Invertebrates, whether reckoned as eight or five, were represented. This was so varied that the Silurian basin of Bohemia alone is described by M. de Barrande as affording a thousand species of Nautilus.

17 In the succeeding periods of the history of the globe, Devonian and Carboniferous, warmth and moisture prevailed extensively, and the making of supplies, which coming Man for his higher development would need, was not neglected. The scene shifted in these ages from the sea to the dry land, from the Devonian age of Fishes to the long Carboniferous times. In the latter, marshy ground and peat-beds, formed after slow submergence of the land, teemed with insect and reptile life, and luxuriant vegetation. Ferns and club-mosses of vast size lived, died and decayed into those peat-beds where the coal of various kinds, of European and American coal-beds, was laid down for far-future use. The Mesozoic or Secondary Age, the Age of Reptiles, was one of the great prolific periods of life, such as that of the marine invertebrates of Cambrian and Silurian times, or the Fishes in Devonian. Here was manifested a remarkable development of land flora and fauna, with corresponding outburst of marine life; crabs, gigantic sea-lizards,

and mollusca, for example, now reached their zenith with ammonites and belemnites. On land appeared butterflies and various insects, enormous amphibians, true reptiles, huge dinosaurs, crocodiles, winged reptiles, small mammals of marsupial type, and a few birds. The earliest leaf-bearing plants also came forth. In this period again, as with the invertebrate fauna of Silurian times, all vertebrates with their five orders were represented. And how were these new denizens, many of them appearing suddenly upon the scene of life, greeted in the home where they found themselves? There were warmth, excessive moisture, equability of conditions provided for this exuberant vegetable and animal life, and as in other times *scope for expansion* rather than struggle for existence, according to Sir William Dawson, was the order of the day. Increasing definition of land and sea which began in Palæozoic, continued slowly through this Mesozoic period, and took its more modern form in Cainozoic times, and slow development of climatic conditions ensued. During this age the great chalk formations of the world were being laid down in the sea for immense periods of time, constructed from the minute shells of foraminifera, and the flint from innumerable polycystina, spicules of sponge and diatoms; these tiny creatures subserving the Design prevailing through all geological time, which could anticipate the day of Man's growing ability to make use of these stores of flint and chalk. At the close of this long stretch of time, in which the British seas were warm enough for coral reefs and the Arctic Zone for great reptiles, a period of much greater cold prevailed. At any rate this is presumed as the only known reason for that remarkable extinction of species which took place over the large continents, when the giant forms of the Age of Reptiles largely disappeared. The cold termination of the Secondary period served its purpose in preparing the way for a higher scale of life on land and sea. The birds and mammals, which in secondary times had been represented in low and less perfect forms, became highly specialized as the great colossi of Saurian type gave way to their nobler if weaker successors, and the Cainozoic became the Age of Mammals. The new order of creatures of this important epoch were again gently dealt with by a supreme Intelligence. The fresh outburst of vertebrate life, and forests with large proportion of warm-climate types, were not at once subjected to that severity of condition which closed the

Cretaceous period. Again in the opening eras of the Eocene and in the Miocene warmth of climate and much moisture prevailed. Higher life of animal and plant flourished abundantly on the continents now largely increased in area by elevation since the later Mesozoic times. The excessive moisture of the latter diminished, specialization of climate increased, lower temperatures gradually prevailed. A force, which is never a convenient one for strict uniformitarians either in geology or palæontology to entertain, became remarkably prominent in the later Miocene times. In quiet Mesozoic ages volcanic action, though existing in all ages, was little pronounced. But in Cainozoic times it became of immense importance in the making of mountain ranges and valleys. It is difficult to say whether the results of its working upon the face of the earth, or the *restraint* of its power, is the more remarkable. The effects at least were of supreme importance to more specialized groups of inhabitants, and in due time the geography of the earth and sea came slowly to its present limits, and in this result volcanic action found its beneficent purpose. The important remark of Sir William Dawson must here be borne in mind in the study of environments adapted to coming requirements:* "We also see that, not the adverse conditions of struggle for existence, but the favouring conditions of scope for expansion, were, as might rationally be expected, the accompaniments and secondary causes of new inbursts of life." This principle is seen carried out in the equable and comparatively uniform character of the home into which the Cambrian and Silurian invertebrates were introduced; in the warm marine environment with teeming supplies of food which greeted the Devonian fishes, the moist marshy and mild terrestrial climate for the flora of those days, the restrained action of volcanoes and increasing emergence of land. How suited were such free and luxuriant conditions of life to the marvellous fauna and flora peculiar to the Mesozoic period! The value of the Sub-Carboniferous period of that era, with its long submergence of the land in shallow water, paving the way for the luxuriant land vegetation of the Carboniferous period, and the significant introduction of vast quantities of insects pregnant of benevolence for future plant life, withal unconscious of their honoured position, may be borne in mind in illus-

* *Modern Ideas of Evolution*, p. 118.

tration of this principle. It is also seen in the gradual slow changes of climate, the slow emergence and submergence of land, the restrained volcanic action of these early days.

18 But equable conditions such as these suited not the prolific outburst of higher life among animals, soon to appear in early Cainozoic times, and the more hardy forms of plants. The climate gradually altered from the mildness of Eocene and Miocene times, when palms flourished in Great Britain and Siberia was a temperate abode much like that of the Continent of Europe at the present time, to the gradual cooling of Pliocene climate. Then became defined, much as now, the frigid and torrid zones. Then arose the mountain chains of California, Mexico, the Rocky Mountains and Alps, Pyrenees, and Apennines. Volcanic action extensively prevailed, more especially along the land-borders. The definition of land and sea proceeded till, "hitherto shalt thou go, and no further, and here shall thy proud waves be stayed," was the beneficent fiat to the restless ocean in the approaching Quaternary Age of Man. During the Cainozoic period a vast population, largely new to the world, was introduced to this prepared home. Its name, the Age of Mammals, indicates the predominant type, and these were now placental mammals of a higher scale than the marsupials of the Mesozoic. Lower vertebrates also of all kinds prevailed in profusion; reptiles, such as crocodiles, lizards, snakes, and turtles; birds such as owls, eagles, cranes, pelicans, ibises; mammals such as the earlier herbivores, tapirs, hogs, rhinoceros, deer, and the supposed ancestors of the horse; carnivores with forms like those of wolves and dogs, greater mammals such as mastodons, elephants, thus representing in earlier forms all the great brutes which in the Quaternary times were to reach their climax. Monkeys appeared in Miocene times so widely as to give occasionally the name "Age of Monkeys" to this period, and a few anthropoid apes, and extensive timber forests.

19 When the last geological age, in which we ourselves are living, was ushered in, the gradual cooling of the Pliocene period culminated in the glacial period of the Quaternary Age. The effects of this time of low temperature with, it is believed, more than one glacial period were of profound importance. The increasing cold killed off many forms of life unsuited for coming days, and man now entered upon the scene with, for the first time, more difficult environments to test this "fitness." Transportation of great masses of rock,

grinding of surfaces to gravel and clay, immense action of increasing river systems took place, all of which led to that valuable mantle of alluvial soils which clothed the earth's surface for the profit of Man and his subject creatures. Whether we adopt the extreme views held by some as to the omnipotent action of ice alone, or with Sir Joseph Prestwich, Sir William Dawson, Sir Henry Howorth, look also for the immense dispersion of rocks, sifting of gravel into sand and loam, and deposit of alluvium to the action of a Flood, or floods by which "the delicate handling of soft fingered water" served its useful purpose, and which, as many believe, led to the fertility of surface of the earth, and the alluvial richness along valleys, producing the higher possibilities of cultivation of the soil—whether we look to ice alone or to Diluvial action as well—the purposeful results are as plain as need be.

20 In considering the preparation of the home for coming Man we must not lose sight of the remarkable fact of the existence of those plants, which he found ready to his hand, which he was able to cultivate as cereals, nor of the equally noticeable production of the great classes of domesticable animals among the Ungulates and Carnivores. The more subtle agency which the genius of Darwin in the course of thirty years' study brought to light, that of the earthworms, became of immense importance. By the beneficent work of these animals was caused much of the breaking up of mould, smoothing down of surfaces of soil, and its opening up to the fertilizing influences of warmth and moisture.

21 The position here maintained is that the argument from the slow and orderly preparation of the environments for coming life on the globe necessarily implies the existence of Design. The succeeding changes of those environments through the geological ages, ever leading to conditions and potentialities for organic existence; rising, pausing, and ever-rising towards those in which human life was possible, is unmistakable in its significance—"evolution," "development," or "creation" apart. Here design, though infinitely long-drawn, is the only conceivable explanation of things. All the changing fashions in biological speculation from *natural selection, sexual selection, histological selection of Roux, germinal selection of Weismann, physical selection of more stable elements of Karl Pearson,* to *selection in general,* suffice to keep fully employed the acute and hungry intellects of the present generation of biologists, and these deal in their way with the

more accessible side, viz.:—the adaptation of organisms for the conditions which they find *somehow or other*, ready for their life. These conceptions repose upon a vast body of facts, interpret the latter how we may.

22 But when these have given way to some fresh theory, which shall continue the strangling of all teleology, no theory is possible which will exclude design from the other side of the question dealt with here. Teachers of current science may find it necessary to promulgate edicts proclaiming "no thoroughfare here," for the enquirer who may ask for the evidence connecting one side with the other. Such statements as those of Weismann published two years ago in his essay on *Germinal Selection* (*pref., p. XII.*), where he says of teleological principles—"*Their introduction, however, is the ruin of science*"—would perhaps afford a preamble for such proclamation worthy of notice. And yet if it be not too much to say, Weismann has become the most outspoken teleologist since the Bridgewater treatises—except perhaps Huxley. Doubtless these two learned and fearlessly candid men dismiss what they call teleology with a few contemptuous words. But strangely enough there are some "chartered libertines" of science who may, with Huxley, speak of Man as a "conscious automaton endowed with free will," or with Weismann proclaim, "Everything is adapted in animate nature and has been from the first beginnings of life"* in the very same essay in which all teleology is ruled out of science-land. Weismann also says there, "Outward conditions only apparently determine the direction of variations, whilst in truth it is the adaptive requirement itself that produces the useful direction of variation by means of selectional processes within the germ,"† and "But even taking the very simplest cases of selection, it is impossible to do without this assumption, that *the useful variations are always present or that they always exist in a sufficiently large number of individuals for the selective process.*"‡ (Italics not in the original.) These few quotations from Weismann need no comment. Teleology so transcendent justifies the above description of the great Freyburg biologist as a teacher of teleology. In connection with this aspect of veiled teleology, it is worthy of remark that the campaign of evolution has changed from an aggressive movement to that of an internecine strife, especially in the matter of variation. Darwin's

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* *Op. cit.*, p. 42. † p. 50. ‡ p. 14.

accidental indefinite variations have had their day and ceased to be. Bateson finds a large number of variations to be sudden, considerable, and discontinuous. Weismann finds the cause of variations to be in the germ-substance, and his most recent view is, that "it is the adaptive requirement itself that produces the useful direction of variation by means of selectional processes within the germ,"* as quoted above. If from all this "adaptive requirement," "variations arising when and where needed," "everything adapted in animate nature," the light of Design be excluded it is pertinent to remember the story of Richelieu with a troublesome suitor for pecuniary help, whose final argumen on his own behalf, "But, Sir, one must live," was met with the characteristic answer, "*I do not see the necessity!*" Why indeed should the multitudinous organisms of earth, air and water so successfully struggle to live and change if the doctrines of Darwin, Weismann, Bateson and others, even if true, be not teleological in the profoundest sense?

23 Even the familiar and well worn subject of artificial selection, so elaborately handled by Darwin, instead of supporting a view of life, in which chance reigns, only constitutes, by its analogy with the wild life of plants and animals, a powerful argument for the operation of mind. The very essence of artificial selection is that it proceeds from Design on the part of an intelligent being; the unconscious selection of domesticable animals in earlier days being but a small part of this subject.

24 It is in this obscure field of the origin of variations that the battle of evolution must next be fought. Mr. Bateson indeed said "variation, in fact, *is* evolution."† The theory of organic evolution, under whatsoever of the many existing forms it may appear, is compelled to assume the origin from uni-cellular organisms, or even from non-cellular masses of undifferentiated bioplasm, of all the plants and animals known to-day ranging from protozoa to man, and from protophyta to oaks, yews, and olive trees. To the ordinary man this is a large order upon his faith. But, to begin with, hundreds of millions of years are granted to the evolutionist, or taken by him, and Mr. Herbert Spencer presents him in his Synthetic Philosophy with an analogy, which is of a character most compromising to his own views. The words, in connection with our subject of Design, deserve to be written in letters of gold. They

* *Op. cit.*, p. 56. † *Materials for the Study of Variation*, p. 6.

are given in the section dealing with the evolution of life,* and this is alleged to be "mentally representable in outline if not in detail," and declared to be "a legitimate symbolic conception." Perhaps so, perhaps not. The illustrative words are, "*If a single cell, under appropriate conditions, becomes a man in the space of a few years*, there can surely be no difficulty in understanding how, *under appropriate conditions*, a cell may in the course of untold millions of years give origin to the human race." (The italics are not in the original.) It would be difficult for an opponent of Design in Nature to make a more damaging analogy than meets one in this short sentence, well thought out and expressed, as is everything which Mr. Spencer writes. "Appropriate conditions" indeed! Why, it is these very "appropriate conditions" which furnish the other side of the argument for Design, which is being here considered, and which, except for a necessity to exclude design from the side of the organisms, cannot be gainsaid. The fundamental difference between those environments, stable and slowly varying according to well-known definite laws, encountered by a fertilized ovum in its course to adult life, and those encountered by organisms in general, is sufficiently clear. In the case of the latter, the homogeneous marine conditions of pre-Cambrian times, the varied terrestrial and marine "climates" of Devonian and Carboniferous, the more differentiated complex Mesozoic, the still more elaborate Cainozoic, more diverse and difficult, with growing competition for existence, changing climates, Ice Ages, volcanoes, earthquakes, destruction and cultivation at the hand of man—all these, with many more changes of condition which have marked the fitful course of life from Protozoa to Man, in spite of their outward complexity, are clear to the teleologist as evidence for Design in Nature. But he would hardly have looked for such an unintentional admission from analogy as Mr. Herbert Spencer furnishes in his comparison of the "appropriate conditions" of the individual and those of the race. In the case of both individuals and race the environments in their orderly production furnish a strong proof for Intelligent Design in a world which is "not chaos but cosmos," to say nothing of the pre-ordained direction of development and degree of growth contained in the "sealed orders" delivered to every ovum embarked upon the troubled sea of life. The teleolo-

* *Epitome of Synthetic Philosophy*, Sect. 118, p. 109.

gist cannot but be grateful for such a sentence from such a source. It is needless to say, however, that Mr. Herbert Spencer does not consider Design, as such, worthy of mention in his *Synthetic Philosophy.*

25 After this digression we must return to the uni-cellular or non-cellular organisms which arose *somehow* after the globe had cooled down to the temperature at which low life was possible. How they arose we may not prove; Darwin even called the question "mere rubbish." These tiny creatures, supposed ancestors of ours, must have then, because they do now under our microscopes, propagated themselves by "fission" or division, by "gemmation" or budding—the two lowest forms of reproduction. The particular problem in building the tree of Man's ancestry from such elements as these which here meet us, is that in this rudimentary method of propagation there is no conceivable place for the occurrence of that cause of variation called by Mr. Wallace* the primary one, viz., amphigony. Darwin† takes a less extreme view of the necessity of amphigony for the production of variability but admits its immense importance. He then proceeds to speak of bud-variations as an exception, but says they occur "rarely under nature." He says also as to the influence of conditions of life on variability,‡ "We clearly see that the nature of the condition is of subordinate importance in comparison with the nature of the organism in determining each particular form of variation; perhaps of not more importance than the nature of the spark, by which a mass of combustible matter is ignited, has in determining the nature of the flames." Darwin also says,§ "Hence, although it must be admitted that new conditions of life do sometimes definitely affect organic beings, it may be doubted whether well-marked races have often been produced by the direct action of changed conditions without the aid of selection either by man or nature." These admissions of Darwin may be taken as specimens of what is generally allowed by naturalists as to the small influence of change of environment on the production of

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* *Darwinism*, p. 439.
† *Origin of Species*, 6th Edition, p. 7.
‡ *Ibid.*, 8.
§ *Animals and Plants under Domestication*, vol. ii, p. 292.

variations. Weismann will admit no influence whatever. Much has been written by him and his opponent, Romanes, upon the knotty point of the difference between uni-cellular and multi-cellular organisms in this respect, and one cannot but see that Romanes has much the best of it at all points in his "Examination of Weismannism."

26 But whether or not Weismann be allowed to call uni-cellular organisms "immortal," and multi-cellular organisms "mortal" for the sake of providing bases for his complex superstructure of theories on Heredity, or whether or not the criticisms of Romanes have pulled down this basis as well as others the importance here of the question is only academical. Even for the sake of a great theory in distress our uni-cellular or minute masses of undifferentiated bioplasm can never be brought within the range of amphigony. Accordingly the main, or even paramount factor in the production of variations will not serve in the variations required by the hypothesis in these tiny dots of matter, in earliest geological times. The moving force, which is to move upwards in the scale of organized life these microscopic structureless beings, must be something else than amphigony with all its promising paper potentialities. The only resource left is to invoke "Lamarckian factors" at this stage, in other words the effects of the environments upon *individuals* of these tiny dots, which must be supposed to have carried on a struggle for existence in the infinite bosom of the primeval seas! Thus certain of them must be supposed to have become better fitted to survive than the remainder, and so crept into a higher place and form of life.

27 Now, out of such a totally inconceivable state of things even if this theoretical transformation is to begin at all, we are to believe that a little greater or less salinity, temperature or motion of the sea did verily cause such variations in our "dots," during the ages which succeeded the Azoic, as eventuated in Diatomaceæ with their perfect skeleton, or such as Venus' Flower Basket among the sponges of early Cambrian times.

28 The only alternative mode, in which the transformation of Monera such as these into the Nautiloid Foraminifera, to take one of multitudinous forms of surpassing beauty, can be conceived (Mr. Spencer, I believe, will not allow that this is even a conceivable or legitimate symbol) is that direct creative acts took place at this and every other suited stage

in the great drama of Nature, as environments for coming life were prepared, up to that period when Man, the only creature who "looks before and after," came upon the scene of his unique career. The argument for Design, furnished by the orderly sequence of environments for coming organisms, touches closely the question between the views of Creation or Evolution of life-forms themselves. The principles of the older view are indeed not more stifled at present than were the forms of constitutional freedom in the House of Lords under the Tudor despotism, which proved themselves of such solid value as bases of a struggle for freedom and a purer government, which men were yet to wage in England. It is of great importance at the present juncture to keep in a simple form before the minds of men, in spite of the weight of current authority against it, the view of creation apart from development, the latter being but one of the tributary forces of the former.

29 It may then be that in due course of time the great structure of the cosmic theory of evolution shall fall to pieces by internecine strife, and the older conception, purified indeed by scientific progress, and yet substantially unaltered, will remain.

30 We have come to this pass that, if we are to look for any "law" governing the growing suitability of the environments for organisms, it is rather one of death and destruction than any evolution or life-process such as, on their side, the organisms require. Which then of the gods of the evolutionary pantheon shall bring to pass this wondrous cycle of cosmic phenomena? Shall it be Struggle, Survival, Heredity, Variability, Selection (natural, sexual, histological, germinal, or physical, of Karl Pearson), all with their capital letters, suggestive of the bearskins, which Huxley remarked seemed to be put on the Grenadiers to make them look much finer fellows than they were? None of these will do. We can but say then of these adapted environments, with a well-known "sceptic" of old, who had an awkward way of looking for himself at facts which he could verify and comprehend, "Why herein is a marvellous thing that ye know not whence they are, and yet they have opened the way for life to come forth and flourish."

31 Shall we listen for an answer to the expert in geology, who tells us of the metamorphosis of the primary rocks by heat and pressure, of the mode of origin of the plutonic and volcanic rocks, of the action of ice and floods, of the sedi-

mentary rocks littered with and often composed of the carcases of bye-gone generations of beings, the chalk of skeletons of globigerina, the long-buried flints of polycystina and diatoms, the carboniferous beds of ancient decaying vegetation, endowing our little island with a wealth greater than of the Indies, by which of old Spain was both enriched and emasculated, the alluvial richness of drift-deposits, the vegetable mould formed in later days by "natural" means? The geologist and physicist will give us valuable information as to the "natural laws" under which all this earth-making has been conducted. But when the dissertation is over, we can only say in the hardness of our hearts that all this decomposing, destructive, cataclysmic action, disclosed for us by his special skill, looks perilously like the direct reverse of those processes of life, which the Evolutionist cosmogony has glorified as effectual in the production of the world and the things that are therein. It can never be wrong in these discussions to revert to Mr. Herbert Spencer's description of evolution given in the last edition of the *Epitome of Synthetic Philosophy*.* —"Throughout the universe in general and in detail, there is an unceasing redistribution of matter and motion. This redistribution constitutes evolution, where there is a predominant integration of matter and dissipation of motion, and constitutes dissolution where there is a predominant absorption of motion and disintegration of matter." In the history of the environments there is doubtless a change in the main from the homogeneous to the heterogeneous, from simple to complex. But it is hardly too much to say, as to their *production*, that by evolution the organic life of the globe, and by dissolution the environments for that life have been produced, according to the cosmic theory of evolution. Thus it would require the strange assumption that, on the one hand, the processes of life and, on the other, mainly those of death, are concerned in the orderly bringing forth of an inhabited world.

32 There is one remaining point in the controversy as to Design in Nature, to which attention may once more be directed. It is one early brought forward by Darwin and held by his followers as an argument against supernatural design of overwhelming weight. Darwin invited his opponents to adduce a single instance in the vegetable or

* Pref. viii. ix.

animal kingdom of a structure or an instinct, which should be shown for certain to be of exclusive use to any other plant or animal than the one presenting it, and committed himself to the bold statement that he would surrender his whole theory of natural selection upon the production of a single true instance of this occurrence. He was so assured of the truth of his theory that he could not accept for a moment the belief that natural selection could ever have *permitted* (*sic*) an adaptive structure or instinct to occur in one species for the exclusive benefit of another. Others have followed in the same strain, and the gage of battle is supposed to be lying where Darwin threw it forty years ago, no champion being prepared to take it up.

33 Romanes* even carried this argument and challenge further, thinking that Darwin did not make a sufficient weight of evidence from this point. He triumphantly supposed it to be unanswered and unanswerable, and his remarks upon it are highly interesting. The only two instances in all the millions of vegetable and animal structures of adaptation which he would consider, and these he firmly set aside, are the sweet secretion of aphides which ants cultivate for their own advantage, a case produced by Darwin himself and disallowed, and the formation of vegetable galls which are of value to the nurture and protection to the larvæ of insects. This case Romanes also set aside as explicable by natural means; or, failing this, as the result of accident.

34 Milnes Marshall in his able lectures on the Darwinian theory also disposes of this argument in a very summary fashion. He says,† "that there is evidence that any animals or plants are specially designed to satisfy the wants or to delight the senses of man is most absolutely denied; and could such cases be proved, they would be fatal to the whole theory. In nature those characters alone are preserved which are advantageous to the species." But this old and fair argument on behalf of the evolutionist, and against the teleologist, is not to be disposed of in this summary style. We are not shut up to a few trifles such as the "milk" of aphides, or vegetable galls. It is possible to state an argument with apparent candour, and with a desire for information which would do credit to Rosa Dartle. However, if the argument be put forward at all we cannot be forced into a corner, dazzled with the light of a

* *Darwin and after Darwin*, vol. i, pp. 286 to 295.
† *Lectures on the Darwinian Theory*, 1894, p. 171.

great name and learning, and deprived of our weapons of defence—or offence, without a little preliminary struggle in the open. What right has Darwin, Romanes, or Milnes Marshall to demand that we accept the arbitrary terms in this duel which they choose to offer. What right have they to demand that we show single adaptive structures or instincts which are for the exclusive use of other species? Is this the kind of peddling to which a Divine Being, concerned in the age-long production and superintendence of the inhabited world we see around us, can be supposed to have condescended! Even in a great factory such trivial contrivances are not carried out. Romanes himself, in the heat of his triumph, furnished us with a passage of noble insight as to what might have been, had beneficent design been the rule of the universe. He said,* "For how magnificent a display of divine beneficence would organic nature have afforded if all—or even some—species had been so interrelated as to have ministered to each other's wants. Organic species might then have been likened to a countless multitude of voices, all singing in one great harmonious psalm. But, as it is, we see absolutely no vestige of such co-ordination: every species is for itself, and for itself alone—an outcome of the always and everywhere fiercely raging struggle for life." We might even present him with the beneficent action upon the soil of the earthworm and white ant, but prefer to leave aside such details. Species indeed! and why species only! And why not genus, order, family, class, sub-kingdom and kingdom? What possible claim can even the greatest naturalist the world ever saw yet have upon the terms of controversy, that he and his followers shall lay down impossible terms, and then blandly proclaim that the battle goes by default. It is more arbitrary, even if conducted in as dignified and calm a manner as the scene immortalized by Scott, than the Grand Master's proclamation on behalf of the persecuted and despised Rebecca, whose case so nearly went by default.

35 If we wish to give full weight to the objection here raised to the argument for Design in Nature, we have a wider, a greater, a more unimpeachable witness than aphides and galls. We hardly need to dwell upon the admitted fact that in the realm of nature the vegetable world stands in a position intermediate between inorganic nature and the

* *Darwin and after Darwin*, p. 288.

animal kingdom. As the globe is constituted, were it not for plants animals would never have been or continued to be. Plants alone can extract nutriment from the soil, and by their life and death supply for animals the needed protoplasm. And, with little exception in earth, water or air, animals live by the beneficent silent work of the present or past life of plants. It were wearisome to elaborate this well-known cosmic fact. The simple fact remains, and no scientific explanations of the "natural" laws, under which this fact takes place, touch for an instant the striking value of the fact as a broad argument for design in nature. We have got beyond species and genera to a vast food-factory for the whole animal creation, of surpassing complexity and profusion, pervaded by evidences of Mind and Will, one-thousandth part of which in a nineteenth-century factory would excite our highest admiration. The objections of Darwin, Romanes, and Milnes Marshall by the very earnestness of the challenge and the magnitude of the answer afforded by the whole vegetable kingdom, constitute a body of evidence against the blind mechanical force, which they deify, of obvious cogency.

36 There is a singular degree of mental short sight somewhere in this question of design in nature, and it cannot be better illustrated than in the simple words of the second greatest of English schoolmasters, Edward Thring of Uppingham,—"Take an example to illustrate this truth, set a little child at the end of the furrows of a field of young wheat at the sower's point of view, and as the sower walked, and he sees at once from mere sight without any exercise of intellect at all, the whole order and plan of the field. Whilst the hardest head and most trained intellect that philosopher ever owned, shall not puzzle out any clue to the seeming confusion, the hopeless entanglement, the absolute disorder that is there, so long as he stands at the side, and looks crossways aslant the furrows. But the child can see it, because he stands at the sower's point of view, and follows the sower's mind. Such a field is the world, such a seed-plot of life and power is the creation, sowed and set in order by the Supreme Life, understood and interpreted by all who have His life in them" . . . "not power, but *sight* is wanted; not force to wrest the secrets of Creation, but humility and love to nestle into them."

The CHAIRMAN (Professor E. HULL, LL.D., F.R.S.).—I am sure all will join in the vote of thanks to Dr. Kidd for his paper. (Cheers.)

Professor LIONEL S. BEALE, M.B., F.R.S.—I have listened with great pleasure to Dr. Walter Kidd's excellent paper, and hope I may be allowed to express the wish that ere long a greater number of members of the medical profession may take part in the consideration of this interesting question.

Much has been done of late contrary to the general views which have been very popular, and were advanced many years ago under the name of evolution. We are gradually coming, as it seems to me, into somewhat close quarters—much closer quarters than we have ever reached hitherto. I mean many interested in the question are now considering the actual nature of the earliest changes that really take place in the formation of structure, not only in the highest organisms, but in the lowest simplest living things—and it is remarkable that, in the early stages of development at least, the living matter of the one set cannot be distinguished from that of the other. I am not sure that, in some respects, I cannot go even further than my friend Dr. Kidd. A point which is well worthy of consideration is this :—that although it is generally held, as Dr. Kidd has stated, that plants are nearer to the inorganic kingdom than animals, I think this only partly true, because when we come to study the very early stages of plants—even the lowest of them—and the earliest stages of the higher organisms, even man himself, there is much in common as regards the vital phenomena. The most careful and minute investigation of the actual living matter with the aid of the highest powers of the microscope does not enable us to point out characteristics which would enable us to say—*this will develop into a high and complex organism, and that into a low and simple one.* In the absence of colour, in consistence, and in general appearance they agree. The minute particles of both kinds of living matter may be extremely small, perhaps less than the one hundred thousandth of an inch in diameter. From them a very small amount of solid matter may be obtained. Probably, if the examination were possible, we should find that as much as from 90 to 95 per cent. of water, or more, was present in all living matter during the earliest stages of its development. In the case of the higher organisms the difference of the results of development and growth are not to be explained by *differences in the composition*

of the living matter. When I speak of growth I mean a process very different from that to which Mr. Herbert Spencer applies this term "growth." Growth certainly involves a great deal more than mere accretion or aggregation—the gradual collecting together of minute particles of matter. This aggregation of material particles does not constitute *growth* in the case of living matter. In aggregation and crystallization the addition of new particles is always on the outside of the original mass. The particles are applied layer over layer on what was the external surface. But in all *living growth*, from the lowest to the highest particle of Bioplasm, the new matter *passes from the outside through the external layers, and reaches the central part of the living particle;* and this being far more central than we can see—more central than anyone has yet been able to reach, and perhaps no one ever will see the actual change that takes place in the central part of every particle of living matter or Bioplasm which yields by death, among other matters, a little albuminoid matter, traces of fats and salts with a very large proportion of water. But there is indeed much more to be considered, and I think Dr. Walter Kidd will agree with me in this. It is only during the last few years that chemists and physicists have recognised the influence of *vital action—vitality* in the necessary changes in all living matter. At the last meeting but one I think of the British Association, one of the most distinguished chemists suggested that we wanted "a little more vitality." Well, we want not only a little more but very much more than has hitherto been allowed. This vitality has been ignored by many who have during many years expressed decided views upon questions bearing upon the nature of life.

Allow me to say a few words with regard to the importance of members of the medical profession taking part in the discussion of these great questions; for I venture to think that many of us by our training are well qualified to do so. We have, all of us, had a scientific education, and we have also had practical experience in reference to the vital changes taking place during life at different periods, and under different circumstances. We endeavour to do our utmost to help to keep people alive and well, and indeed the members of both professions—clerical and medical—the followers and teachers of religion—and the followers and teachers of medicine, are surely the very persons to engage in the consideration of great questions which intimately concern all men. Few are so circumstanced as to be able to enter upon all the

scientific details, but many are qualified to offer an opinion upon the broad principles which the writer of the paper has brought under our notice.

Every page that Dr. Walter Kidd has read to us is an epitome of a vast amount of work and thought. Every one of his paragraphs deserves thorough consideration and discussion. All, I am sure, agree with the general views he has expressed.

There is another circumstance that ought to encourage members of the medical profession to study those branches of science which are connected with their work in life and generally to take a scientific view of things. A distinguished member of our profession has been made President of the Royal Society—the highest position which a man can take in Science.

Is it well that scientific questions of this kind should be entirely left to be decided and taught in an authoritative way by the so-called scientist? The whole subject requires discussion.

For my own part I should not think of deviating one hair's-breadth from reason, and appealing to, or being led by, authority. If we cannot give sufficient reasons for accepting views that seem to be opposed to some doctrines of evolution which have been put forward, I think we must consider that we are beaten. Is "*evolution*" an answer to the question concerning the exact changes which take place not only at the earliest period of existence, but in all living matter at every period of existence? No one, from the mechanical or chemical side, has really explained these changes in one single case.

Of course authority must always exercise a temporary influence on public opinion, but I think we might now clearly submit a distinct issue with regard to the so-called mechanical and chemical changes that take place in this minute transparent mass of living stuff. We know that in certain cases movement, heat, light, electricity are all evolved in living things, and we also know that the movements, heat, light, and electricity we obtain from machines we make, are produced under circumstances totally different from those present in living organisms. Just compare the phenomena, as they occur in living things, with the phenomena as they occur in non-living man-made machines as we know them. Contrast any electrical apparatus with the electric organ, the "apparatus" of the gymnotus or that of some other species. Is there the faintest resemblance between the moist structures and organs that have all grown from perfectly

structureless, transparent living matter containing much water, and the machines?

The organs and structures of living things cannot be produced without vitality, for they are all the products of the changes in living matter or Bioplasm.

Do not man's capacity and power of making machines and every kind of apparatus depend on his vitality? The same remarks apply to the production of heat and also of light. When shall we find out how to obtain light or electricity from proteids, fat, salts, and much water? We do not know, to this day, how it is that the light is produced in the glow-worm or in fire-flies. All we can find out is a certain arrangement of anatomical elements, a certain structure; but it is not the *structure* that produces electricity and light. When the living stuff, the Bioplasm, dies, the phenomena cease. This Bioplasm is concerned in the production of light as well as in the formation of all structure. What you *kill* is not the structure any more than when a man or animal is *killed*, his nerves, bones, muscles, and other tissues are destroyed. All these have been *formed* by the Bioplasm, and they contrast remarkably in characters and properties with the actual living matter. But living matter is necessary to their action, to their maintenance in a normal state, to their repair in case of injury.

If the living matter is destroyed then everything stops. When we talk of the *physical* action of the muscles and the *physical* action of the nerves, what do we mean? We refer to certain phenomena which we know take place, but which are nevertheless absolutely dependent on the living matter connected with those textures. So that we must know what is taking place in the living matter, and what it has to do with the physical and chemical changes which succeed, before we can hope to give a reasonable explanation of the phenomena. It is the vital action which determines all physical and chemical changes in matter that lives—and it is this which gives rise to the anatomical characters and properties of the several tissues.

But really I must apologise, Mr. Chairman, I shall tire all present if I trouble you longer. Allow me then to conclude by again thanking our friend Dr. Walter Kidd for the extremely lucid manner in which he has treated one of the most difficult and extensive subjects that can be considered by the mind, and I trust the example he has set will be soon followed by other members of our profession. (Applause.)

The CHAIRMAN.—I have listened to this paper with great interest, and it seems to me one of the ablest essays in support of the doctrine of Design in Nature I have ever read. I need scarcely say that in the main I am entirely in accord with Dr. Kidd's arguments and conclusions. I am one of those who think that if the followers of Mr. Herbert Spencer, and others who deny the doctrine of Design, experience difficulty in understanding the reasoning of the teleologist, the latter must have greater difficulty in understanding the reasoning of his opponent; because the teleologist is every day accustomed to observe the relations of cause and effect, of design and designer, in all the ordinary affairs of life; and can point to analogy in the history of the Cosmos which his opponent ignores; or has to try and explain away by invoking the aid of what the author calls "the gods of the evolutionary pantheon," of whose actions, after all, he can know very little, and has to guess very much.

Dr. Kidd has very ably endeavoured to synchronise the process of development of living beings on this earth with the geological changes in the physical phenomena which the science of geology has unfolded to us in recent years. I do not feel able to go quite so far in this direction as the learned author in regard to the adaptation of the physical conditions to the animal and plant life; because I do not believe that ever since early Cambrian or Silurian times, the globe was in a condition in which it could not, at one part of its surface or another, have supported the plants and animals of the present day, including man himself. Generally speaking I quite admit a gradual process of preparedness as time went on, and in my work on *The Coal-fields of Great Britain* (4 Edit. p. 71), I use the argument of design in reference to the storage of the strata with the vast supplies of mineral fuel. It seems to me, however, that the Creator having endowed physical matter with laws, left these laws to work out their own results without special interference with their operation. For example, though we can observe the admirable manner in which the distribution of land and water, or of continent and ocean, acted upon by the sun's heat and directed by the rotation of the earth on its axis, serve to set in motion the great oceanic currents by which the warm waters of the equatorial regions are carried into the arctic and antarctic regions, and thus serve to equalize to a great degree the climates, I am unable to go so far as to say how this general arrangement of continent and ocean has been brought about. But when we come to deal with organised beings,

so vast is the distinction between dead matter and living, I feel that we are justified in inferring, not only the ordinary guidance, but also the frequent extra-ordinary interposition, of Omnipotent Power from the creation of the first living cell to that of man himself. The difference between inert inorganic matter and a living organism is as vast as space itself.

There are several other points in the author's essay which I would like to refer to, but I shall confine myself to one or two. The author has referred to Lord Kelvin's theory stated in his address to this Institute, to account for the quantity of oxygen necessary for the support of the future animal life. The view which appears to me the more probable one is that I have stated in my paper on the question, "How the waters of the ocean became salt" (*Trans. Vic. Inst.*, vol. xxvii), in which I inferred that the primæval atmosphere was largely composed of carbon-dioxide (carbonic acid gas), and that the elimination of the carbon by the agency of plants, notably in the Carboniferous period, would have left free large quantities of oxygen for the future air-breathing inhabitants of the globe.

There is only one other note I wish to make to Sec. 19, where Dr. Kidd refers to the effect of the incoming cold of the glacial epoch in killing off many forms unsuited to withstand its severity, and the creation of *new forms* more fitted for the environment. Undoubtedly many animals were locally killed off in the northern hemisphere by the severity of the glacial climate, but comparatively few were actually exterminated, and no new forms, as far as we know, were subsequently introduced with the possible exception of man himself. There was, however, a general migration of animals to more southerly and warmer climes—for example, from Europe and Asia into Africa, as shown by Dr. Alfred Wallace.

Rev. F. A. WALKER, D.D., F.L.S.—There are two or three points upon which I should be glad to have the opinion of the author of this learned paper.

Butterflies and other insects are ranked, in section 17, as occurring at remote epochs.

It would be very interesting to learn if butterflies are preserved in strata, because I have been told that such specimens are very few and far between, naturally in consequence of their fragility and the impossibility of their beautiful delicate hues being preserved throughout the ages. There are two instances mentioned in Mr. Butler's book.

Then again Cole mentions cold as being a destructive factor in the killing of certain species in primæval times. I do not dispute that statement, but I have visited some of the most exposed coasts and I know Iceland round all three sides of the coast, and I can safely state that cold is not *the most* destructive factor in killing insects. It is the utter want of shelter from snow or rain that would cause them, in the transition period, to rot, and we have the testimony of entomologists now to prove that heat is quite as prejudicial to the preservation of life as cold.

There are two or three other points to which I would draw attention. I suppose we are all content to agree that the evolution of to-day can evolve something. Experimentalists can do something in that way by different treatment and different conditions. I know from my own collection how the sizes and tints of different specimens may be varied by their food, and it remains to be seen whether those different tints or markings and lines remain permanent. Feed the caterpillar on dark green leaves and you get a perfect yellow moth. Feed the same caterpillar on light green leaves and you have white and so on. But you must go on season after season, or they will hark back to their original ancestor. On the other hand, look at the evident purpose of design and see what it does for the creature.

Perhaps few of you have seen the *Larentia cæsiata*, of a delicate soft grey, which is found on the grey slate rocks of the Cambrian coast of the Campbell country in Argyleshire and the lava ditto in the S.W. of Iceland, upon which the perfect insect can lie so concealed from its natural foes on the surface of the boulders that you cannot tell the living insect from the inanimate stone.

When I see these things I note that Providence has adapted the colour of the insect to its natural environment, and then I am prepared to say, "Yes, this is the finger of God."

The CHAIRMAN.—I will now ask Dr. Kidd to reply.

The AUTHOR.—I am very grateful to those who have spoken for their kind agreement with most of the paper.

It would be only presumption in me to refer to anything that Dr. Beale has said. I am most thankful for the interesting suggestions he has made—more especially for that point on the absence of any analogy between the electrical organism of animals, such as the gymnotus, and the electrical machines formed by man. That is a most valuable point, but the subject is far too deep for us to go into to-night.

In regard to Dr. Walker's inquiry, respecting butterflies, I am

not prepared to mention any special case of butterflies being discovered in the Secondary age; but I have read that they have been frequently discovered in the strata of this age.

The CHAIRMAN.—Yes, along with other forms of insect life.

The AUTHOR.—In speaking of certain types in the Secondary Period, I referred, not so much to insects as to the larger vertebrate animals which died out before the varied reptilian *forms* of the Tertiary Period appeared.

It is true that Evolutionists can evolve something, and it is marvellous to read Darwin's book on the domestication of plants and animals, and the extent to which they can go; but the strength of the human mind and will is in this very line of work mostly strikingly shown, and the argument therefrom supports rather than contradicts Design.

The Meeting was then adjourned.

COMMUNICATIONS RECEIVED ON THE FOREGOING PAPER.

Dr. BIDDLE writes:—

This paper is likely to take high rank in the Transactions of the Victoria Institute. It is especially powerful in meeting the Evolutionist challenge—as to there being no structure or instinct in one being that is constituted for the exclusive benefit of another—by producing the vegetable kingdom as an evident intermediary between the mineral and the animal. The Evolutionary Theory, in its "survival of the fittest," takes almost exclusive note of the destructive faculties of the plants and animals with which it deals, setting against these only the defensive. But it is even more wonderful to observe the law of *mutual benefit* in the animal world, and to find it based upon a no less evident regard for self (not necessarily *selfishness*). Nothing less than consummate design could effect such correlation and co-ordination of distinct and widely differing faculties, originating in species having no common historic origin, as are daily seen. Moreover, if the Origin of Species be an enigma which none but the Theist can logically solve, a still greater is the

Origin of Environment which makes the differentiation of species evolutionally possible. Natural selection accounts for but little. How many things unsought are nevertheless enjoyed! Whence the light and heat of the sun, the air we breathe, the water to quench our thirst? Even the most extreme advocate of the doctrine of evolution will admit that these and many more things had a prior existence to Natural Selection, and formed part of the *preparation* for life. We can in nowise promote the beauty of the sunset-sky, but it meets with a gratified response in the hearts of most of us, and proves that there are correlations utterly beyond the reach of natural selection.

Dr. A. Nevé writes:—

It has always seemed to me that the preparation of the environment for the organism, *i.e.*, of the *earth for man*, was a fact more impressive in its teleological aspect than the reverse, viz., the adaptation of man to his surroundings; and that the existence of certain useful materials with properties only becoming available by the application of human intelligence is to be fairly regarded as a preparation for man, and a *prophecy* of man. One special thing I would mention is the various action of drugs. Digitalis acts on the heart, opium on the nervous system. Then again the specific action of quinine on the malarial organism. If it should be shown that these chemical combinations which in relation to ourselves we call medicines, are of primary value to the plant or tree from which we obtain them, I do not see that the force of the teleological argument would be in any way weakened.

Dr. Kidd's paper is so compact that it takes close reading to discover his mention of the coal beds, mineral oils, and many other substances prepared such ages ago for man's use.

Professor Langhorne Orchard, B.Sc., writes:—

We are much indebted to the able and learned author for this important paper which sets forth the grand Design argument in one of its most striking phases.

This argument has three principal aspects, viz., the argument from:—

1. *Co-existence*—suitability between a creature and its immediate environment at *any one particular* time;

2. *Sequence*—such suitability continued throughout *all* times;
3. *Inter-relation*—the suitability between the structures and instincts of *all* creatures as related one to another.

Any one of these facts is inconsistent with the doctrine of "chance"; their cumulative cogency is absolutely decisive.

Dr. A. T. SCHOFIELD writes:—

I am much obliged for the copy of Dr. Walter Kidd's paper so kindly sent, and much regret that an engagement on Monday prevents my attending the meeting. I do not think I ever read a more lucid or graphic account of creation from the standpoint taken. There is no doubt that it is too soon yet to decide the nett value of Darwin's work, and that the Design argument gains ground as the pendulum swings over from the unsatisfying creed of the *extreme* evolutionist.

Professor J. H. GLADSTONE, Ph.D., F.R.S., writes:—

I find it difficult to understand Dr. Walter Kidd's position in this controversy. This arises partly, no doubt, from the extreme difficulty of keeping always to the same meaning of the terms employed; partly also to the fact that he is arguing sometimes against one, and sometimes against another of the various development hypotheses.

Among those who believe in a Divine Creator and Sustainer of the Universe, there are three quite distinct views:—

1. That He makes new things or organisms out of nothing. This idea has no warrant in the sacred Scriptures; and the progress of science makes it less and less tenable.

2. That He accomplishes His purpose by making the new thing or organism at once out of some material previously existing, but totally different from it. This, of course, is a very common way of procedure among men; and it is impossible to avoid making use of the language appropriate to it, even when arguing against its application to the Divine procedure.

3. That He forms the new things, whether inanimate or animate, by means of the gradual modification of things already existing. This is development, or evolution.

Dr. Walter Kidd seems to hold this third view generally. Thus he describes very minutely the progressive evolution of the individual from the embryo. He might have continued

his description of the progressive stages of the animal after birth, and would, of course, be willing to apply it equally to plant life. His long and often poetic description of the geological changes which have taken place, shows that he recognises the slow and gradual development of the different kinds of rock or strata. I have no doubt he would admit that the same law of gradual development holds good in astronomical phenomena. It may be traced also in the progress of human inventions. What he does not seem free to admit is the existence of the same manner of procedure in the introduction of the various species of plants and animals. It would almost appear as though, while he can easily conceive of the environment being prepared for the organised beings that were afterwards to be placed in it, he cannot admit of their successive generations being modified through the environment. He seems even to look upon the thousand species of nautilus in the Silurian basin of Bohemia as a sudden outburst of independent creations.

Many of us Christian men of science, on the other hand, recognise that there is a unity of plan, as well as of purpose, running through the works of God. We hold that the Darwinian theory of the survival of the fittest, so far from destroying the idea of a Divine purpose and plan in nature, rather confirms it, and gives us a welcome insight into the way in which this has been carried out throughout the ages, not as a series of fortuitous events, but as the result of an orderly law.

FURTHER REPLY BY THE AUTHOR.

A few words may be said in reply to certain points raised by the written remarks of members.

Professor Gladstone has somewhat narrowed down, more than I

intended in my paper, the question of Design to that of the creation or evolution of organisms. My main contention on this occasion was the broad proof of Design of Nature which arises from considering the planet, on which we find ourselves, and the inhabitants thereof, as being mutually adapted. I did not hesitate to argue that if one sees plan and purpose in preparation of the environments, one must also see it in the production of organisms to occupy those environments, that this necessarily involves something opposed to any "mechanical" theory as to the *production*, *development* or *creation* of organisms, and that indeed it involves design in their production. My desire was mainly to combat such a theory of the production of the plants and animals of the world as is seen in the development of a mammal from a microscopic cell through its natural, orderly, preordained stages, till adult life is reached. The development of the individual provides an analogy for the supposed development of organisms in general of a kind so loose and indeed so inaccurate, as to be hardly admissible for even a diagrammatic exposition.

The argument from artificial selection among plants and animals goes strongly to support Design in its broad aspect, if used at all, as a vast experimental proof of the powers of *mind*, *plan* and *purpose*, when organized matter is provided. It does not, as far as it goes, support the creation-hypothesis, nor is it needed for that position. *Modification* of species no one attempts to deny, in the face of the vast evidence arising from the cultivation and domestication of plants and animals. The *origin* of these by natural selection is a different matter altogether.

Dr. Gladstone refers to my arguing at one time against one, and at another time against another of the various evolutionary theories. My desire was only to support the theory of Design in the production of organisms so that the "mechanical" theory so-called should be put out of court. An excellent illustration of what one means by this "mechanical" theory is given by Darwin in the *Origin of Species* where he speaks of the *selecting* effect of the force of gravity npon a series of rocks, stones, and pebbles of all sizes falling down a steep slope, in which event they would be sorted at the bottom according to their various sizes and other qualities. It is exactly such a haphazard selection as this to which I venture to object, as being in any way responsible for the

production of new species of organisms with their myriad adaptations to the needs of their lives.

This remark sufficiently answers the question I have heard asked as to the meaning of a "mechanical" theory of the origin of organisms.