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ART. I.—'MAN'S PLACE IN THE UNIVERSE.'

Man's Place in the Universe. A Study of the Results of Scientific Research in Relation to the Unity or Plurality of Worlds. By ALFRED R. WALLACE. (London: Chapman and Hall, 1903.)

AN eminent teacher of physiology in one of our universities, when once discussing with the writer of this article the intellectual tenability of the Christian Faith, summed up the statement of his own difficulties and doubts by the remark that the whole scheme of Christian belief was too obviously the creation by man of what man wished to be true for himself; was too plainly made to satisfy man's limited outlook upon the universe; was, in a word, too anthropomorphic; and he concluded by asking: 'What about the other beings inhabiting other worlds in the universe: how do you suppose they would look upon our self-centred solution of the mysteries of the infinite and eternal; for of course it is absurd to suppose that, out of the countless worlds which the astronomer knows, none is peopled with living and thinking souls?'

Some years earlier than the time of this combination-room discussion, the master of a college in the same university preached a sermon in which he dealt at length with the difficulty urged by sceptics, as if it were one that might

be expected then to present itself to any undergraduate, of reconciling belief in the Christian scheme of Redemption with the probable truth that our world was but one among a countless number of similar inhabited globes. The preacher maintained that if such were the case, and the human race were by no means the only one which had not only been brought into existence but also had universally sinned and needed salvation, it was neither difficult nor irrational to conclude that the same great redemptive drama that had been acted upon our earth by the incarnate Son of God had also been performed in whatever other worlds had needed it.

These two incidents will serve to show that of late years the belief has been commonly held that the universe contains a plurality of worlds inhabited by rational and moral beings analogous to man, and that such an opinion has sometimes been felt to imply an argument against the absoluteness of our fundamental religious beliefs, or at least to put a difficulty in their way. Dr. Wallace's latest work would therefore be likely, whatever side it happened to take with regard to the great question which it discusses, to be of interest to such of the public as are given to thinking upon the wider problems of theology.

The idea of a plurality of inhabited worlds sprang up naturally when the Copernican system replaced the Ptolemaic. It then, as Dr. Wallace says, 'became as general as the opposite belief had been in all preceding ages, and it is still held in modified forms to the present day' (p. 7). Kepler, Huygens, and Newton, among the earlier physicists, embraced this view and gave it the support of their great names; and it soon became popular among men of science and divines. At last Dr. Whewell, in his anonymous essay entitled *The Plurality of Worlds*, interrupted the even course of this opinion, without, however, causing it to be abandoned. This writer showed how very much more largely the prevailing theory as to man's place in the universe depended upon religious ideas than upon scientific reasons. He is quoted by the author of the work before us as saying that the belief that other planets are inhabited has generally been entertained, not in consequence of physical reasons, but in

spite of them (p. 7). Among such religious ideas the following may be mentioned : that the Creator's goodness or greatness or wisdom would be imperfect on the opposite supposition ; and that God could not be supposed to take any special interest in a creature so insignificant as man, situated upon so puny a world as the earth, when there exists an endless space teeming with suns and systems. The latter of these suppositions recalls to our minds the Psalmist's words : 'When I consider Thy heavens, the work of Thy fingers, the moon and the stars which Thou hast ordained ; What is man that Thou art mindful of him? and the son of man that Thou visitest him?' And these verses were actually appealed to by Sir David Brewster as containing an inspired proof of the theory which Whewell rejected.

We readily admit with Dr. Wallace, and with Dr. Whewell before him, that such religious prepossessions as those we have mentioned go a very little way towards settling the question at issue. The history of theology has shown again and again how *a priori* ideas as to what is fitting or not for us to expect from the Deity, or to attribute to Him, have in course of time had to be amended or reversed. The popular theory of verbal inspiration of the Scriptures is a case in point. It may further be noted here that a perusal of Dr. Wallace's opening chapters suffices to show that such religious difficulties as have been suggested to men's minds by one or other of the alternative views as to whether our earth alone is the habitation of moral beings, turn largely upon the meaning which we attribute to Redemption. If we take the Scotist view of the Incarnation, that which finds in it an absolute and eternal purpose of God rather than the expression of a Divine afterthought necessitated by man's fall from the moral ideal, and interpret Salvation or Redemption in the light of such a view, some at least of the difficulties which have been supposed to attach to the admission of more worlds than ours fall to the ground. But it is time to ask the reader's attention to the argument of Dr. Wallace against the probability of the view which forms the source of such religious difficulties.

As long as it was assumed that the complex conditions necessary for life, as we know it, would in all probability obtain upon many other of the heavenly bodies than our earth, or rather so long as these conditions were almost wholly ignored, the mere fact that there is so large a number of such bodies in the visible universe would of course afford a strong presumption in favour of the view that some at least of them would be similarly inhabited. The question was simply a case of the law of chances or probabilities. And it was upon this presumption, unfounded as it was upon actual observation or theoretical reasoning, that the widely current belief in other inhabited worlds was originally based. Dr. Wallace, however, traverses this position, and gives many and elaborate reasons against its tenability. We may cite here the summary of the stages of his argument which he provides towards the end of his book.

'Having thus brought together the whole of the available evidence bearing upon the questions treated in this volume, I claim that certain definite conclusions have been reached and proved, and that certain others have enormous probabilities in their favour.

The conclusions reached by modern astronomers are :

(1) That the stellar universe forms one connected whole ; and, though of enormous extent, is yet finite, and its extent determinable.

(2) That the solar system is situated in the plane of the Milky Way, and not far removed from the centre of that plane. The earth is therefore nearly in the centre of the stellar universe.

(3) That this universe consists throughout of the same kinds of matter, and is subjected to the same physical and chemical laws.

The conclusions which I claim to have shown have enormous probabilities in their favour are :

(4) That no other planet in the solar system than our earth is inhabited or habitable.

(5) That the probabilities are almost as great against any other sun possessing inhabited planets.

(6) That the nearly central position of our sun is probably a permanent one, and has been specially favourable, perhaps absolutely essential, to life-development on the earth.'

The first of the above conclusions must perhaps be regarded as the hinge on which Dr. Wallace's argument turns. The author states that the views of the astronomers who have

paid attention to the subject are, on the whole, in favour of the position that the stars are limited in number. He cites the reasons which some authorities have given for this belief, reasons based sometimes on telescopic evidence, sometimes on theoretical considerations and calculations. The question is one upon which only the experts, if even they, can decide; and perhaps the physicist would be as relevant a witness as the astronomer. But, granting that outside the Milky Way the density of star-distribution increasingly falls off, and that for this and other reasons the stellar universe is probably finite, the further question arises whether there are not other universes beyond ours for which the same natural laws hold, and which condition our universe to some extent in a way similar to that in which one part of our universe, or the whole of it, conditions another part. This possibility is not fully faced in Dr. Wallace's work. He is prepared, indeed, to admit the possibility of the existence of other universes;¹ but he assumes, perhaps too hastily, that they exert no influence upon our own. If they should do so—and Dr. Wallace has not shown that they cannot—he has not established the truth of his claim that our universe is entirely a self-contained system, independent of all forces from without it. Consequently he has not fully established his proof of the permanent advantage, as regards conditions for life-development, which the universe may seem to afford to our earth. Thus the argument limits itself to one stellar universe, and guarantees to our portion of it only temporarily, in astronomical time-periods, the advantage which is claimed for it.

The second contention quoted above, that the solar system, and therefore the earth, is nearly in the centre of the stellar universe, is one for which considerable evidence is furnished. And Dr. Wallace shows at length how important

¹ 'Of course, there may be, and probably are, other universes, perhaps of other kinds of matter and subject to other laws, perhaps more like our conceptions of the ether, perhaps wholly non-material, and what we can only conceive of as spiritual' (p. 323).

Elsewhere Dr. Wallace says: 'As to whether there are such other (material) universes or not I offer no opinion, and have no belief one way or another.'

a condition this is for the earth's habitability. This alone seems to guarantee the long-continued light- and heat-emitting capacity of our sun. Dr. Wallace indeed goes so far as to make the suggestion—of great interest in another connexion—that the whole universe exists for the benefit of the earth: a return to a very ancient dream of mankind. He writes:

'There is no inconceivability—no improbability even—in the conception that, in order to produce a world that should be precisely adapted in every detail for the orderly development of organic life culminating in man, such a vast and complex universe as that which we know exists around us may have been absolutely required' (p. 310).

To this passage we shall recur later.

The third conclusion which Dr. Wallace states as having been reached and proved by modern astronomers, and as not having been seriously disputed, is 'that this universe consists throughout of the same kinds of matter, and is subjected to the same chemical laws.' Now it may be admitted that the new science of the stars, derived chiefly from the application of the spectroscope, assumes this as true; but it may certainly be added that it in no way proves its truth. One authority on this branch of science says that the assumption is made 'on no sufficient warrant.' We have but little knowledge of the chemistry of the stars; the spectroscope only tells us something about the gaseous portions of them. And it is possible that, at temperatures which may exist in certain of them, matter may have a different constitution than that with which we are acquainted on earth or in the sun. Further, in a statement which Dr. Wallace cites from a mathematical astronomer, Mr. Whittaker, the universality of the law of gravitation throughout the stellar universe is questioned. The passage is so interesting that we reproduce it here:

'I doubt (says Mr. Whittaker) whether the principal phenomena of the stellar universe are consequences of the law of gravitation at all. I have been working myself at spiral nebulae, and have got a first approximation to an explanation—but it is electro-dynamical

and not gravitational. In fact, it may be questioned whether, for bodies of such tremendous extent as the Milky Way or nebulae, the effect which we call gravitation is given by Newton's law ; just as the ordinary formulæ of electrostatic attraction break down when we consider charges moving with very great velocities.'

This statement will serve to show that, in the case of natural laws, increase of sizes and distances is not merely magnification ; it introduces new properties and new factors, so as sometimes to make such laws no longer applicable.

This third 'conclusion' is important to Dr. Wallace's argument for the following reason. If the constitution of matter and the chief laws of physics are the same throughout the universe, then living beings must, if they exist elsewhere, be essentially similar to such as occur upon the earth ; there will probably be but one 'physical basis of life.' And if this point were granted, we should perhaps be compelled by Dr. Wallace's book to admit that there would then be strong reasons for believing that our earth alone, among all the planets of the universe, supplies the conditions necessary for life. If, on the other hand, matter and its laws may be different in different portions of the universe, there may be other physical bases of life, and other beings, differing wholly in nature from ourselves and the organic species on our planet. And this, as we have seen, may be true for all that Dr. Wallace has shown. His placing the proposition that matter and its laws are the same throughout the universe among the incontrovertible positions attained by modern science is unwarrantable.

Thus the results which the book establishes are again narrowed. If its author has shown good reasons for believing that our earth alone fulfils the conditions necessary to the existence of life, we must interpret that word in the qualified sense '*life as we know it.*'

Within these narrowed limits, however, Dr. Wallace makes out a strong case for his contention. He certainly seems to show that there is much to be said for the view that, within our universe, the earth is probably the only planet on which it is possible for beings to exist whose basis of life is the same as our own. As to other universes, and other kinds

of beings within our universe, his arguments fail to produce conviction; but it is something to have re-opened the narrower question, to have pointed out that its hasty solution has been premature, and to have supplied a larger accumulation of reasons than has ever been gathered together before for a return to the geocentric conception of the universe and the belief that the insignificant earth is the only theatre of such life as we are acquainted with. Dr. Wallace has made it henceforth impossible to dismiss this view on the ground of the mere number of the stars, and consequently of the planets, among which our world is but an insignificant unit. The question is not how many planets there may be, but how many of them can be fit for habitation. When we realise, as the work before us abundantly enables us to do, how extremely numerous and how extraordinarily complex are the conditions which must be satisfied before a planet can be inhabited by such organisms as exist on the earth, we see at once that the probability of a plurality of worlds is reduced millionfold.

By far the most convincing portion of *Man's Place in the Universe* is that which deals with the physical conditions essential for organic life; and it is the more useful because such considerations have by no means found sufficient place in most of the earlier treatises on the same subject.

In describing the essential characters of the living organism, Dr. Wallace is dealing with a subject of which he is a recognised master. In his tenth chapter he makes very clear to the least scientific of readers how much unsuspected marvel and mystery there is in the life-processes which they have always seen silently going on around them; and he there prepares them to appreciate something of the enormous complexity of the conditions which must be fulfilled by 'environment' for animal and vegetable life. We venture to think that this complexity will come as somewhat of a surprise to many who do not fall within the class of readers just named, unless they have previously had occasion fully to think out the whole matter for themselves.

Taking first the physical conditions on the surface of our earth which appear to be necessary for the development and

maintenance of living organisms, the author groups them under the following headings :

1. 'Regularity of heat-supply, resulting in a limited range of temperature.
2. 'A sufficient amount of solar light and heat.
3. 'Water in great abundance, and universally distributed.
4. 'An atmosphere of sufficient density, and consisting of the gases which are essential for vegetable and animal life. These are oxygen, carbonic-acid gas, aqueous vapour, nitrogen, and ammonia. These must be present in suitable proportions.
5. 'Alternations of day and night.'

This brief summary will be quite inadequate to convey to the ordinary reader's mind how very numerous the requirements of 'life' really are. A little expansion will perhaps make this clearer.

Such is the instability of protoplasm, the physical basis of all vegetable and animal organisms, that a very small increase or decrease of temperature, for any length of time, beyond the limits which are now actually maintained upon our planet, would suffice to destroy most of the existing forms of life, and to eliminate all but the lowest. Again, land animals depend for their existence upon green plants; and green plants not only require a certain intensity of sunlight, but also solar light of a particular kind. Such light as is afforded by other suns than ours to their planet-systems might not, and perhaps in many cases would not, suffice to effect those chemical changes which are essential to green plants, and therefore indirectly to the existence of the higher animals and man. Further, the atmosphere of any world on which living beings such as we know can be produced and maintained must possess several qualities not causally connected with one another, and the coincidence of which, as Dr. Wallace suggests, may be quite a rare phenomenon in ever so vast a universe. A suitable atmosphere must be of a certain density; in the first place, in order to store heat, and secondly, in order to supply such gases as are necessary food-materials for living creatures in sufficient quantity. 'It appears certain . . . that with half our present bulk of atmosphere life would be hardly possible on the earth on

account of lowered temperature alone.' And the same balance which guarantees requisite density and temperature must also, with equal nicety, obtain with regard to quantitative chemical composition. The presence of aqueous vapour in the atmosphere, again, is essential in *two* quite distinct ways : it is necessary in order to secure the requisite degree of moisture for leaves, and also for supplying, by chemical reaction with nitrogen, the ammonia which is indispensable to vegetable growth. These facts will suffice to show how very particular 'life' is in its demands, how many coincidences must be secured before it can be maintained. And yet the whole has not yet been told. For the primary conditions, which alone have been mentioned, in their turn involve many secondary ones. And it cannot be objected that, were these conditions different in whole or in part, other forms of life would perhaps have appeared adapted to the different environment ; for the point is that, for the existence of whatever forms of life we may be able to conceive, the necessary environment, whatever its nature, must be similarly complex, and dependent in a similar way upon a multiplicity of conditions and coincidences.

So much, then, for the conditions necessary upon the surface of the earth. We are next shown by Dr. Wallace that other large classes of conditions have to be satisfied by the earth as a whole, such, for instance, as its relation to the sun. It appears that we are situated within the temperate zone of the solar system, and that any considerable removal from that favourable position would endanger a large portion of the life now existing on the earth, and perhaps also render the actual development of life, through all its phases and gradations, impossible. The obliquity of our planet's equator to its orbit round the sun, on which our varying seasons depend, is another condition of great importance. Had the earth in this respect resembled Uranus, for instance, it would have been unfitted for the development of life. So, too, we are told, would it have been, to a considerable extent, had the other extreme direction of the earth's axis been acquired. And it further needs to be borne in mind that not only must all this good fortune enjoyed by the earth, and the manifold

requirements on which such fortune depends, be ensured now; they must have similarly obtained throughout vast ages of geological time. Geology, indeed, shows how similar, in point of fact, the phenomena of Nature have been to those which now prevail. The general size and form of raindrops were the same in the Carboniferous period as to-day, as is evidenced by impressions recorded on the shale of that period; and this implies similarity in atmospheric conditions.

The presence of rain throughout geological time implies, as has been demonstrated experimentally, a constant and universal distribution of atmospheric dust. Here again is a condition, unsuspected doubtless by most of us, essential to the habitability of a world. Atmospheric dust, in turn, implies the existence of volcanoes and deserts. And in this connexion Dr. Wallace makes the remark:

'It is a very suggestive fact that these two phenomena, usually held to be blots on the fair face of Nature, and even to be opposed to belief in a beneficent Creator, should now be proved to be really essential to the earth's habitability (pp. 225-6).'

If the causal relation between volcanoes and rain, and therefore between volcanoes and world-habitability, is really as determinate as Dr. Wallace implies, this fact is interesting indeed. It bears, surely, upon the problem of physical evil in our world.

We have by no means exhausted the long list of intricately interwoven conditions upon which depends the fitness of our world to be the home of living beings. Some of the primary requisites enumerated in the eleventh chapter of the work before us are found in a later chapter to involve a series of others. How they do so is a very interesting story; and the whole of that portion of his book in which Dr. Wallace discusses such subjects will repay the reader, whether or not he may happen to be familiar with the several branches of natural science concerned.

At this stage of his argument Dr. Wallace turns to the discussion of the habitability of the planets of the solar system. He shows that some of the conditions which have been mentioned above are unfulfilled in the case of each of them.

Inasmuch as an atmosphere laden with water-vapour is a *sine qua non*, the smaller planets, Mercury and Mars, which have not sufficient mass to retain water-vapour, cannot be habitable. Indeed, as tested by this one of the many conditions essential for the existence of living beings similar to those which people the earth, the only planet on which life can be possible is Venus. But Dr. Wallace does not commit himself solely to this argument, to which indeed, he seems to admit, objection can be taken. A little further on he speaks of it being only 'almost certain' that Mars contains no water, but he maintains that in any case the temperature of the surface of this planet must be far too low to permit of the existence upon it of the higher forms of life. It will be known to most of our readers that the poles of Mars are surrounded with tracts of 'snow,' and that some scientists speak of these as being composed of ordinary snow. A well-known popular lecturer, moreover, has quite recently been basing an argument for the existence of intelligent beings on the surface of Mars on the alleged fact that the great channels which apparently drain away the water from these 'polar snows' appear, from their regularity of course and direction, to be artificial productions, probably irrigation works on a large scale. Dr. Wallace, as we have seen, makes assertions which imply the impossibility of this, and believes the 'snows' to be frozen carbonic-acid or some other heavy gas congealed into the solid form. It has also been recently stated by an astronomer that these channels in Mars have no objective existence; that they are due to something in the observer's eye.

Venus, whose mass enables it to retain aqueous vapour in its atmosphere, and which so far fulfils the condition which rules out other planets, is probably rendered uninhabitable by the fact that it receives from the sun almost double the quantity of heat which we receive. More conclusive still is the fact that its day and its year coincide, and that in consequence it always presents the same side to the sun. One side therefore is always too hot and the other always too cold for the existence of protoplasm.

Mercury also possesses this peculiarity, and on account of

its smaller size and its still greater proximity to the sun the extremes of temperature on its two sides are even more marked than in the case of Venus.

Finally, the great planets—Jupiter, Saturn, Neptune, and Uranus—are easily ruled out of court. These 'have long been given up as adapted for life, even by the most ardent advocates for "life in other worlds."' Their remoteness from the sun, their surface-temperatures, their extremely low densities and large size, combine to render them quite incapable of supporting organic life. The earth is unique among the planets of the solar system.

'Not only is it situated at that distance from the sun which, through solar heat alone, allows water to remain in the liquid state over almost the whole of its surface, but it possesses numerous characteristics which secure a very equable temperature, and which have secured to it very nearly the same temperature during those enormous geological periods in which terrestrial life has existed' (pp. 273-4).

Not only does no other planet possess these characteristics now, but 'it is almost equally certain that they never have possessed them in the past, and never will possess them in the future.' For, as Lord Kelvin has said, the whole life of the sun as a luminary is but of a very moderate number of millions of years, perhaps less than fifty million; and the whole of this has been utilized for life-development on the earth. The smaller planets could not, in the past, have preserved equability of conditions long enough for life-development, while the greater ones, when they shall have become sufficiently cooled to admit of being inhabited, will be so faintly warmed by the fast-cooling sun as speedily to become 'at the best globes of solid ice.'

It now only remains for Dr. Wallace to discuss the possibility of other stars than our sun having habitable planets. It has usually been assumed, as we have seen before, that out of so enormous a number of stars some must be surrounded with planets, and some of these planets must be inhabited by beings of some kind. The assumption has been confirmed by the assertion that the stars are practically of no

use to the earth and its inhabitants, and that they must therefore have been created for some other purpose.

Dr. Wallace has no difficulty in vastly reducing the number of possible inhabited worlds implied in this pre-supposition. He tells us that it is now known that immense numbers of the stars are really of small dimensions; the duration of their heat-giving power would be therefore insufficient, even if they possessed planets at just the requisite distance, for life-development upon them. Another enormous deduction is made when the whole region of the Milky Way is ruled out on account of the excessive forces there in action, the immense size and enormous heat-giving power of many of the stars therein, the frequent collisions and general instability of that highly crowded region. Thus, planetary systems suitable for life-development must be limited 'to stars situated inside the Milky Way and far removed from it—that is, to those composing the solar cluster.' These, we are told, amount perhaps to thousands, perhaps only to hundreds. But even here only a portion are suitable, for various reasons. If it be true that a vast number of stars which appear single to the most powerful telescopes are turning out, when examined spectroscopically, to be really binaries, the number which can be the suns of planet-systems capable of habitation by living beings must again be largely discounted. Finally, of the few possible worlds that remain besides our earth, it may well be that no one of them fulfils the numerous and complex conditions which have already been seen to be absolutely essential for the existence and gradual development of organic beings. And this is the conclusion of the argument of Dr. Wallace's interesting book.

The author has, however, a few words to say at the end upon man's place in the universe in the light of the results previously reached with regard to the unique character of our earth as probably the only inhabited world. It is open to the man of science, especially if he be inclined to a materialistic philosophy, to attribute this unique position of the earth to a fortunate coincidence. This explanation, however, will not satisfy the majority of minds. Most persons do not believe that 'life, consciousness, mind, are products of matter';

they believe in the independence and supremacy of mind. To such persons it will not cause overwhelming surprise to discover that our insignificant globe, alone in the vast universe, is the home of conscious beings. That is to say, there will be no incongruity inherent in such a belief. The question 'What is man?' (in comparison with the stellar universe) is one which most of us would be prepared to answer as, we are told, Dr. Bentley answered it: 'The soul of one virtuous man is of greater worth and excellency than the sun and all his planets and all the stars in the heavens.' Indeed, it would be hard to think the whole universe, however immense its size, and however wonderful its order, to be worthy of creation by God, were it not that it contained, if only at one point, the unique and supreme product of it all, Man. An infinite universe of mere whirling inanimate masses of matter, however stupendous, is meaningless and worthless; but one living soul bearing the image of God in his rational and moral nature outweighs it all, so we must feel, in value and in grandeur. And if this be our judgment, we shall see no difficulty in going a little further, and believing that the universe was actually brought into existence for the very purpose of providing one world suited to be the home of the great series of beings culminating in the human race.

'And is it not in perfect harmony with this grandeur of design (if it be design), this vastness of scale, this marvellous process of development through all the ages, that the material universe needed to produce this cradle of organic life, and of a being destined to a higher and a permanent existence, should be on a corresponding scale of vastness, of complexity, of beauty? Even if there were no such evidence as I have here adduced for the unique position and the exceptional characteristics which distinguish the earth, the old idea that all the planets were inhabited, and that all the stars existed for the sake of other planets, which planets existed to develop life, would, in the light of our present knowledge, seem utterly improbable and incredible. It would introduce monotony into a universe whose grand character and teaching is endless diversity. It would imply that to produce the living soul in the marvellous and glorious body of man—man with his faculties, his aspirations, his powers for good and evil—that this was an easy matter which could be brought about anywhere, in any world. It would imply that man is an animal and

nothing more, is of no importance in the universe, needed no great preparations for his advent, only, perhaps, a second-rate demon and a third- or fourth-rate earth. Looking at the long and slow and complex growth of nature that preceded his appearance, the immensity of the stellar universe with its thousand million suns, and the vast æons of time during which it has been developing—all these seem only the appropriate and harmonious surroundings, the necessary supply of material, the sufficiently spacious workshop for the production of that planet which was to produce, first, the organic world, and then, Man' (pp. 321-2).

In these eloquent words Dr. Wallace offers us again a thoroughly anthropocentric conception of the universe. But as he restores this old-world belief, he gives it to us not as the unsubstantial product of the unboundedly anthropomorphic fancy of primitive man, but as the outcome of the newest scientific knowledge and research. There is so much in the various stages of his long and complex argument which is matter for the experts in astronomy alone to decide upon, that the theologian needs must feel as yet reluctant to build apologetic arguments on the conclusions at which Dr. Wallace has arrived. But if his presentation of the facts, when further tested by those competent to judge of them, should prove on the whole to be correct, it is needless to point out that the whole tendency of his book is to strengthen the argument for a teleological explanation of the universe.

And if it should be true that the whole universe is necessary to the stable existence of the one inhabited world, as Dr. Wallace teaches, and that the many conditions necessary to the continuous existence of organic beings can, so far as we know, only be provided upon one small planet by means of the relations which obtain between it and the rest of the stellar bodies, it is not an over-venturesome leap of speculation to conclude that the universe was created for the express and sole purpose of providing a home for man, the end and goal of the whole creative and evolutionary process. This is the main position which Dr. Wallace's work aims at proving; and if he has in any way failed, as perhaps he has, to put the question beyond dispute, at any rate, he has established beyond doubt that there is very much

to be said for such a view, and that it is by no means necessary, in the light of modern scientific knowledge, to class such a belief any longer among the fanciful conjectures of the ancient world.

Another interesting subject is closely connected with that which forms the main burden of Dr. Wallace's book. The following paragraph will serve to shew how it arises in the course of his argument :

'All nature tells us the same strange mysterious story, of the exuberance of life, of endless variety, of unimaginable quantity. All this life upon our earth has led up to and culminated in that of man. It has been, I believe, a common and not unpopular idea that during the whole process of the rise and growth and extinction of past forms, the earth has been preparing for the ultimate—Man. Much of the wealth and luxuriance of living things, the infinite variety of form and structure, the exquisite grace and beauty in bird and insect, in foliage and flower, may have been mere *by-products of the grand mechanism we call Nature—the one and only method of developing humanity*' (p. 321).

The words which we have italicized in the foregoing citation are those to which we now wish especially to call attention.

In the older teleology, in which every adaptation in organic beings to a particular end was supposed to imply special creation for a special purpose, no place could be found for such adaptations as could not be said to be good or advantageous to the individual or the species or to the organic world generally. And when Nature was studied scientifically, especially when it was studied in the light of the theory of natural selection, the older teleology became exploded. If existing adaptations were still to be considered as instances of design, the outlook became indeed gloomy. Such design could no longer be held to be perfect, or even beneficent; rather the contrary. The extraordinary abundance of species that were solely injurious to others and to man, their wonderful rate of increase, the cruelty of special adaptations in the form of 'tooth and claw,' made it difficult to argue at all from Nature to a benevolent God, especially to an immanent God.

The new science of Nature, however, gave us a new and a wider teleology ; it gave us at the same time a deeper sense of the somewhat forgotten truth of divine immanence. But it did not in the least help us to reconcile the cruelty of Nature with the presence of indwelling Deity. Christian apologists of the latter half of the nineteenth century had much to say about the new teleology and the recovered doctrine of divine immanence. But they were remarkably silent about the existence in the world of physical evil, and of the compatibility of such evil with the latter doctrine. Yet it was sufficiently obvious that the more we emphasize the truth that God must be everywhere if He is anywhere, the more inexplicable become the cruelties involved in the struggle for existence and the elimination of the less fitted to survive. The apologist contented himself with minimizing the pain of organic beings, and with making as much as possible of the beneficial uses of adversity to moral beings. This, however, only touched the fringe of the question, and the great difficulty was generally ignored or shirked.

One only defender of theism in our country was conspicuous for an attempt to grapple seriously with the problem of the physical evil of the world of Nature. This was Dr. Martineau. And he was able to make a distinct contribution to so difficult a subject in virtue of his theory that much that we see in the world around us exists simply as a necessary *by-product* of the great cosmic process of God. It is interesting to find that Dr. Wallace, in the passage which has been quoted, also inclines to the view that a large part of the phenomena of Nature are mere by-products of the grand mechanism by which was secured the gradual evolution of moral beings, and that he also speaks of such a mechanism as 'the one and only method of developing humanity.'

In this second statement also Dr. Wallace is in agreement with Dr. Martineau. The latter writer indeed speaks of the possibility of an infinite number of methods by which God might have provided a course of Nature ; but he maintains that the choice of one such determinate method of procedure shuts the door upon all the others. God has thereby 'defined His cosmical equation, and only those results can

be worked out which are compatible with its roots.' Further, such results as are implicitly contained in those roots *must* be worked out, though they may involve physical pain and the possibility of a moral evil. It is a necessary 'corollary of the fact that our knowledge of the cosmos reveals God as pledged to a definite plan or process of realizing His end,' says a recent writer,

'that many of the details accompanying the execution of the plan are no essential parts of it, but only necessarily incidental. Such, it may well be, are the terrible physical catastrophes of the earthquake and pestilence. . . . These are but the inevitable by-products of the same course of Nature which on the whole ministers to life and health.'

On this theory of Martineau, that much which happens in God's world is incidental in Nature, and has no teleological import—a theory which Dr. Wallace also is led, by his study of Nature, to countenance, we would seem to get the most satisfactory explanation of such natural events and facts as we place in the category of evils. Whereas all pantheistic systems, and all forms of theistic philosophy which incline towards uncritical over-emphasis of God's immanence in His world, endeavour to find a divine purpose or some teleological import in every detail of the world's structure and history, and are thereby compelled to minimize or explain away the evil of the world, this theory regards such things as the necessary outcome of a coherent and self-consistent system of divine action, a system which must indeed be coherent and self-consistent, and not a mere medley of unrelated miracles, if it is to be 'a cosmos in which intelligent beings find a reign of law, and in which spirit, greeting spirit, perceives a moral order.' The theory implies that our world, save in so far as man himself has marred it, is as good a world as is possible—possible even to an Almighty Being. If an end such as that of the development of moral beings is to be attained at all as the outcome of a rational and consistent and intelligible order of Nature, there must be realized all the consequences of every law by which it is ordered and maintained, whether these consequences make directly for

the one supreme end, or whether they are mere contingencies irrelevant to the end, and possibly of the nature of physical evils. We cannot of course, from our limited knowledge of a part of the universe, say definitely of any particular phenomenon, 'This is an essential means to the one great end, however much it be a physical evil to man or some other species,' or, 'This is a mere contingency, necessary as a consequence of the great world-plan, but otherwise having no meaning.' Dr. Wallace himself, as we have seen, tells us that the desert and the volcano, two phenomena that are 'usually held to be blots on the fair face of Nature,' and are sometimes taken to be opposed to belief in a beneficent Creator, are not merely meaningless by-products of the great mechanism whose end is the production of man, but are essential conditions to the earth's habitability.

Now this theory, which we have associated especially with the name of Martineau, is one to which the work we are reviewing lends a considerable amount of indirect support. Dr. Wallace, as we have seen, dwelt at great length on the extremely complicated conditions essential to the existence of a world capable of being inhabited by organic beings such as we are acquainted with. But such elaborate complexity of conditions demands an immense and complex universe, as Dr. Wallace has also shown. And if such elements of the course of Nature as are directly means to the attainment of the final goal are thus extraordinarily complex, so must also be the non-relevant elements, the mere contingencies, as we have called them. Hence it would seem that a universe specially constructed with a view to providing a theatre for moral human life must needs bring forth, along with man and what ministers to his health and life, much also that he can only look upon as of the nature of evil.

We have ventured, then, to point out at some length the bearing of Dr. Wallace's work upon Dr. Martineau's treatment of the problem of pain and evil, although it was no part of the intention of the author of *Man's Place in the Universe* directly to treat of this subject. Doubtless there are other theological problems on which this comprehensive

work will be found to throw some light. But, if only for the highly interesting way in which the book discusses the great topic with which it is primarily concerned, it may be hoped that it will be widely read.
