

MAN'S PLACE IN THE UNIVERSE.*

DR. RUSSEL WALLACE has been in no sense daunted by the hostile reception of his article which appeared simultaneously in the *Fortnightly Review* and the *New York Independent*. With the full courage of his opinions, he has now issued this volume, which sets forth at considerable and desirable length the evidence on which he bases his conclusion. Probably his case could not be urged with greater weight or stated with more conspicuous clearness than in its latest form, and certainly the arguments cannot be dismissed with either silence or contempt, though some of the most important links in the chain are still crude assumptions. It will be convenient here to quote in full the paragraph entitled "Conclusions" on p. 317. We shall then be in a position to deal with Dr. Wallace's argument:—

"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 other conclusions 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 to 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. These latter conclusions depend upon the combination of a large number of special conditions, each of which must be in definite relation to many of the others, and must all have persisted simultaneously during enormous periods of time. The weight to be given to this kind of reasoning depends upon a full and fair consideration of the whole evidence as I have endeavoured to present it in the last seven chapters of this book. To this evidence I appeal."

These conclusions require careful consideration. The first, that the stellar universe is a complete and finite system, every part of which acts and reacts on every other part, is the base of the whole argument. Dr. Wallace alleges that by this assertion he is not limiting an illimitable universe. The stellar universe of which we are conscious may be one of many such universes. He assumes, nevertheless, that if there are many universes, they are severally distinct in form and structure, "and so remote that they can influence us in no way whatever. . . . As to whether there are such other material universes or not I offer no opinion, and have no belief one way or the other." Towards the conclusion of the book, however, Dr. Wallace appears to have attained a belief on this latter point:—"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." Our first criticism of this book is based on these passages. Dr. Wallace assumes as the operative area of his argument a self-contained, conservative, finite universe unassailable by the forces of outer space. We decline to accept this position. The universes, if there are more than one—and we agree with Dr. Wallace that there probably are more than one—must form a class of universes, and we should then have to pass on to a class of classes of universes, and so on *ad infinitum*.

It may be admitted, however, that this does not necessarily destroy Dr. Wallace's case, for universes or classes of universes may be so related as to secure to a particular universe or class a particular advantage at or for a particular period. But it

must be remembered that the probability of permanence of advantage, even for the period of the life, say, of our sun, cannot be asserted, and the advantage might disappear altogether, or alter its character or area of operation.

Dr. Wallace's proposition is therefore limited to a certain stellar system, and is one that, if true, may (and perhaps must) become untrue at some future time. There seem to be, however, strong reasons for the belief that this stellar system or universe is finite, that our sun is situated in the central plane of the Milky Way, and is one of a cluster of stars which "occupy a place not far removed from the centre of the galactic plane, and, therefore, near to the centre of our universe of stars." Dr. Wallace's chief critics denied the finiteness of the universe, and, moreover, stated "very strongly one objection to my main thesis—that our central position (not necessarily at the precise centre) in the stellar universe has a meaning and a purpose, in connection with the development of life and of man upon this earth, and, *so far as we know*, here only." This objection was that, assuming the central position in the great star system, it meant nothing, for the sun at its rate of travelling would rapidly pass away from this central position and lose all its advantages. Dr. Wallace answers this objection by saying that it is contrary to experience to suppose that the sun is moving in a straight line through space and through the sidereal system; and that everything goes to show that the sun is moving in a curve round the gravitational centre of this system, and that all points on this orbit are equally advantageous. It may be admitted that it is open to serious objection to suppose that the sun is moving through, and is not part of, the sidereal system; but it seems certain that all points on the sun's orbit, which in more than a century has shown no measurable curvature, are not equally advantageous, and it is reasonable to think that other suns will attain, if they do not already possess, advantageous positions in the same sense. Dr. Wallace's book, therefore, only attempts to prove that within certain time-limits, and in a certain finite section of an infinite sidereal universe, this earth is, according to the doctrine of probabilities, the only habitable sphere.

Before passing to a brief consideration of these probabilities a word must be said as to the third conclusion which it is alleged has been reached by modern astronomers,—namely, "that this universe consists throughout of the same kinds of matter, and is subjected to the same physical and chemical laws." Dr. Wallace says that "no one seriously disputes" this. We, however, entirely decline to accept this position. The evidence as to the material composition of the stars is extremely fragmentary, and no one has a right to generalise as to the composition of the stars from spectroscopic observation and from the examination of aerolites. To those remote regions where unimaginable heats and stresses are at work, and where there exist transcendental forces capable of transforming molecular structure in all the infinite varieties of ways of which that structure is susceptible, we cannot penetrate with any complete success. That earthly substances should be there is natural; that there should also be there other substances the product of forces capable of transforming the whole problem is, to say the least, not improbable. Miss Clerke, writing of astrophysics, says that "the indefinite continuity of natural laws is assumed by it, but certainly on no sufficient warrant." The laws of motion are in no sense self-evident. Nor is there any reason to accept as incontrovertible the assertion: "that the fundamental law of gravitation extends to the whole physical universe is rendered almost certain by the fact that double stars move round their common centre of gravity in elliptical orbits which correspond well with both observation and calculation." The universality of the so-called law of gravitation is, to the mathematician at any rate, open to very grave doubt. In this very book Dr. Wallace quotes Mr. E. T. Whittaker as writing:—

"I doubt 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."

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Now it seems scarcely legitimate argument to use this statement in order to escape from the conclusion that the proper motions of the stars cannot be explained by the gravitative forces of the stellar system, and yet to declare that the fundamental law of gravitation almost certainly extends to the whole universe in order to persuade the reader that there can be no astounding events happening afar off that could render the arguments of this book mere nonsense. Our criticism on this aspect of the case is, in fine, this. Dr. Wallace has assuredly not established his proposition "that this universe consists throughout of the same kinds of matter, and is subjected to the same physical and chemical laws." The probabilities are against the truth of such a generalised proposition, and if it is not true, then with other matter and other laws we may well have a new heaven and a new earth and a new man on the other side of the region of Sirius as wonderful as the heaven and earth and man of this possibly central spot of the galactic circle.

It would seem, then, that Dr. Wallace in his first three conclusions is not invulnerable. His further conclusions, that practically all stars belong to binary or multiple systems which are necessarily planetless, are gigantic and unwarranted generalisations. Moreover, he is in error when he declares that "organised living beings wherever they may exist in this universe must be, fundamentally, and in essential nature, the same also." He admits that this need not be so if matter and its laws undergo a change. The revelations of radium and of electricity make it impossible to disbelieve that there are such changes in the stellar universe. But if the limits of the problem can be restricted in this fashion, there is in reality little problem left. The elaborate and (from other points of view) intensely fascinating description of the creation of the environment that rendered organic life *as we know it* possible, and the demonstration of the high degree of improbability that such life exists on the planets of our system or the planets of other solar systems, are in great measure a beating of the air. We may perhaps admit that organic life *as we know it* would have been impossible had it not been for a series of events and circumstances that bear the very stamp of design. We may even admit that had the universe, taken as a whole, been different, had there been one star less or more, that series might, or perhaps could, never have happened. But to assert that the Almighty has limited His power to one physical basis of life is, as it seems to us, an absurd assertion. We traverse the whole position that Dr. Wallace has assumed. He has nowhere demonstrated that there can be but one physical basis of life throughout the universe; he wholly fails in this. The present writer prefers to imagine that there are an infinite variety of bases, and that in other systems there may be other forms of life growing from the lesser to the higher as we have grown, and that, in ways unknown, and probably unknowable, these forms of life are necessary one to the other, system to system,—as necessary as is every atom and molecule of the great material universe to every other atom and molecule. That there are many mansions in the City of God seems to us at least as noble a belief as that which Dr. Wallace so plausibly propounds.