SCIENCE

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. (Chapman & Hall.)

DR. WALLACE stands in the first rank of scientific naturalists, and is also well known as an acute, though not always sound, thinker and writer on social and economic questions. Few comparatively small books give such an impression of breadth of knowledge and sagacity of view as his on 'The Wonderful Century.' But it is no part of our duty now to discuss the preceding works of our author, who in the eightieth year of his age has produced the one before us. It has led to great searchings of heart amongst those versed in astronomy, a science to which the author has not devoted himself as a specialist, though he has endeavoured to keep abreast with the greatly increased knowledge acquired in recent years, which, as the President of the Royal Astronomical Society remarks in his 'Modern Astronomy,' amounts to nothing less than a revolution. The work before us is an enlargement of articles which had previously appeared and been much commented on by some of our leading astronomers, so that in thus laying his ideas before the world in permanent form the author has been able to allude to criticisms passed upon them, and to some extent to rebut these. The question is this: Man, we know, occupies an altogether unique position in the terrestrial globe which he inhabits in common with a vast number of other living creatures and organisms; is there any reason to suppose that it is otherwise in some of the innumerable bodies moving in space with which modern astronomy has made us acquainted?

Now not only has the invention, and still more the improvement, of the telescope brought within our ken an enormously increased number of these bodies; but until it was first applied to the heavens, now very nearly 300 years ago, we may be said to have known nothing whatever of the surfaces of the "other worlds," as it is now customary to call them. The sun and the moon are the only bodies which present sensible discs to the naked eye; some few spots are occasionally thus visible in the former when its dazzling brightness is obscured by thin cloud or mist; and the streaked surface of the latter when near the full was a subject of enigma to ancient philosophers. But of the planets, which present in several aspects so much more striking an analogy to our own globe, already recognized in respect to its motions as one of them, nothing was known until the optic tube exhibited their discs and revealed the fact that several of them, at any rate, possessed atmospheres and inequalities of surface, and rotated on axes inclined, as that of our earth is, to the planes of their orbits round the sun. With the ascertainment of this fact, the probability did not fail to occur to many minds that the planets resembling our own dwelling-place in so many circumstances might also resemble it in being scenes of life, and perhaps, to carry the analogy still further, of intellectual life. This view was expressed very positively and attractively by Fontenelle in his 'Entretiens sur la Pluralité des Mondes,' which appeared in 1686; and many astronomers of eminence in the eighteenth century, including Sir William Herschel, extended this view, which we now know to be untenable, to the central body of the system, and in their "benevolence" (to use Miss Clerke's expression) tenanted the sun also with inhabitants—beings who, it might be supposed, were of nobler race than ourselves. Increased knowledge of physics and the laws of heat has dissipated this idea; closer study of the moon has shown that her surface is totally, or very nearly so, destitute of either air or water, so that it can hardly be the abode of life, unless, indeed, of a very low order, in the lowest parts, where a small degree of moisture may possibly exist.

As regards, then, our solar system, the question of habitability refers chiefly to the planets, or rather to some of

them. But a detailed examination of the conditions obtaining on these renders the matter a much more doubtful one than superficial reasoners might imagine. The present writer well remembers, when not much more than a youth, meeting the then Plumian Professor at Cambridge, and venturing to ask him whether he did not agree in thinking that the stars were inhabited. The smiling answer was: "Well, the Master of Trinity College thinks otherwise; so what are we to say?" The allusion thus expressed was to the 'Essay on the Plurality of Worlds,' then a new book, which, though published anonymously, was known to be by Whewell. Dr. Wallace makes much reference to this work, also to Sir David Brewster's 'More Worlds than One,' as well as to the writings of Proctor and others.

Of course the matter assumes a different complexion when we extend our excursions "through the blue infinite," and speculate on what obtains in other systems far, far beyond our own. Of these we have a much slighter knowledge; we know, indeed, something, by the aid of the spectroscope, of their internal constitution, but we can see nothing of their surfaces, even the telescopic discs being spurious, and, moreover, we know that if there are opaque bodies revolving round the distant stars which must resemble our sun in being self-luminous, they would be invisible to us, as reflected light could not penetrate to such enormous distances. It is true that the analogy of opaque bodies moving round luminous ones does not always hold; we have evidence from their motions that some luminaries are actually moving round dark, or nearly dark, companions; but in such cases the central body must still be the largest, on Lord Dundreary's principle that a dog wags his tail because he is bigger than the tail. Dr. Wallace makes great account of the fact that our sun is near the centre of the Milky Way, the fundamental position of which in the great universe of stars is more fully acknowledged the more it is studied. It is chiefly in view of the central position of our sun, and whether, if it were so placed, it could continue to be, consistently with the known fact of its own motion, that the author's astronomical critics have contested his conclusions. His reply is that this solar motion is probably not continuously onward, but of the nature of some unknown revolution. Science is not yet, and perhaps never will be, in a position to answer dogmatically on such a question as this; but we can safely say that Dr. Wallace's book bears the stamp of his great intellect; that it will be read with much interest; and that whoever wishes to form an opinion on the matter discussed will find as full materials for doing so as any existing work can offer.

The conclusions to which the author has come, and for which he claims that the probabilities are "enormous," are (1) that no other planet in the solar system is inhabited or habitable, (2) that the probabilities are almost as great against any other sun possessing inhabited planets, and (3) that the nearly central position of our sun is probably permanent, and has been specially favourable, perhaps absolutely essential, to life-development on the earth.

"These 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."

When we come to combinations of conditions relating to enormous numbers of bodies and systems, it is evident that our reasonings are not exactly based upon *terra firma*. The earlier chapters in the book give an interesting and popular brief account of those branches of astronomy which bear principally upon the subject under discussion. At the end of all are some general observations on the almost unthinkable problems raised by ideas of infinity.

The book is clearly and carefully printed, and is provided with an index. We have noticed very few *errata*. Argelander, on p. 60, appears as "Agrelander," and at p. 89 Sir John Herschel's name appears with a superfluous "l." Altogether 'Man's Place in the Universe' cannot fail to be read with great pleasure and profit. Much, of course, is speculation, but many are the side-lights thrown upon present matters of discussion and pending problems in astronomy.