WALLACE ON LIFE 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, LL.D., D.C.L., F.R.S. McClure, Phillips & Co. 1903.

This latest work of the Nestor of scientific authors is so far unique in spirit and purpose that the critical reader may fail to grasp its underlying idea without some study. In reading it through, the first impression would be that of a rather disconnected treatise on astronomy, in which the structure of the universe is set forth with some detail, but without any apparent relation to humanity. After this flight through the more distant regions of space, the reader is brought homeward, and proceeds to a survey of the planets. Then he lands on solid earth, and passes in review the main facts of meteorology, geology, and natural science generally. The conditions of organic life are next demonstrated. Not until the end is approached, and the reader has had time to arrange his ideas, do the logical order of presentation and the unity of the theme become apparent. Then the conclusions are moulded into a well ordered system well calculated to excite attention even on the part of those who cannot accept them in their entirety: The universe is a rounded whole; our solar system is situated in its centre. Of the eight planets revolving around our sun, the third occupies a peculiar position. Organic life requires the concurrence of a great multitude of conditions which exist on our particular planet, but cannot well be fulfilled in any other part of the universe than its centre, nor in the neighborhood of any star but our sun, nor on any planet revolving round that sun except the one on which we dwell. In order to be a seat of life, a planet must revolve in a nearly circular orbit at such a distance from the sun that it shall receive exactly the amount of light and heat that ours does. It must be surrounded by an atmosphere formed of a combination of nitrogen and oxygen in the proper proportion. The force of gravity on the surface of this planet must be the same as we find it, because, were it greatly different, it could not retain the proper amount of atmosphere at the proper pressure. Aqueous vapor must be present in sufficient quantities to produce the right amount of rain. But we need not go farther into details. They may be summed up by saying that the planet must correspond so closely to ours in almost every important particular that, accepting the conditions, the author may be quite right in his estimate of the improbability that they are all combined on any other body.

This doctrine is certainly an extreme case of reaction against the popular ideas which prevailed two or three generations ago, when men like Sir David Brewster and Thomas Dick pointed out to admiring readers the adaptability of other worlds to become the abode of human beings, and even calculated the possible number of inhabitants who might derive their sustenance from the ample acres of Mars and Jupiter. It must be confessed that the general trend of the discoveries of modern science has been in the direction of the reaction which Mr. Wallace carries to so extreme a point. It cannot be denied that the conditions of organic life on our globe seem to be of a very exceptional character; and that, so far as research has yet gone, these conditions are not likely to exist on any other planet of our system except, perhaps, Mars. We have no evidence of the existence elsewhere of solar systems like ours. Revolving double stars have been known ever since the time of the elder Herschel, and the spectroscope is now making known to astronomers the existence of great planets revolving around many of the stars; but the general rule in all these cases is that the orbits, so far as developed, show degrees of eccentricity quite incompatible with the regular round of conditions which prevail on the earth.

As a piece of analytical reasoning, in which the greatest variety of facts are, with artistic logic, arrayed in support of the conclusion, the book is well worthy of its distinguished author; and yet we doubt if many readers will accept his conclusions. The web of his argument is woven according to all the rules of art, but its texture is too finespun to bear the weight it is expected to carry. It is an attempt to prove a negative in a case where no such proof is possible. Wide though our knowledge of the universe has become, it is infinitesimal when compared with the range it will have to include before anything positive can be said on the subject of life in other worlds. There are probably more than a hundred million stars in the heavens. Of these we know that one—our sun—has an orderly system of planets revolving around it in nearly circular orbits. We know that among the hundred million there are several thousand double stars—suns revolving around each other—in orbits of which we, as yet, know little more than that their variety is infinite. Perhaps fifty or a hundred of these orbits are known. We also know of a few hundred stars which have dark planets revolving around them. There is not one star out of a thousand of which we know anything more than that it exists, and that it shines with a certain light, which, when analyzed, gives a particular kind of spectrum, sometimes like that of our sun, and sometimes not. There may be thousands, nay millions, of solar systems like ours the existence of which we have no means of determining. Looking at the question as one

of probabilities, the chances are very much against Mr. Wallace's theory.

Perhaps the weakest point of the whole argument is the extent to which it rests on the idea of our sun occupying a central position in the universe. It is quite true that, to all appearance, our position does not deviate from the centre to an extent that can be determined by any methods yet known. But in such a case the very word centre must be somewhat indefinite. It is not a point, only a region, and a region which is very wide and ill-defined. The idea is also open to the objection that, even if our sun is, in our age, in the centre, it could not have been so in past geological ages. It is moving through space at the rate of some ten miles a second—a motion so rapid and so little subject to change that it must have been following its present course for millions of years. It is as certain as anything in such a subject can be, that our system did not occupy the central position when life commenced on the earth, and will cease to occupy it in the future. Mr. Wallace's argument that, after all, the motion may be limited in extent is of the lamest kind. The fact is that the astronomer can reach no conclusion as to the precise condition of the universe at a time when, according to current geological theories, the surface of the earth began to assume its present form. The geologist demands hundreds of millions of years; but the universe of the astronomer, considered as a system, could not, seemingly, have existed in its present arrangement through so long a period. The author's conclusion, therefore, seems incompatible with the most certain deduction from observed facts which astronomy permits of our making.

Another consideration will not fail to occur to the thinking reader, which he will hesitate in bringing to bear only because the author of "Natural Selection" is perhaps as eminent an authority as any other on the subject. That the life which has developed on the earth in the course of ages must be such as the conditions prevailing on our planet made possible, follows as a matter of course, because otherwise it would never have existed at all. We may also admit that these particular forms of life could never have been evolved under any other conditions. But does it therefore follow that no life whatever could have been evolved except that which we have on earth? The fish we find in the ocean are suitable to their environment and could not live in any other. Does it follow that in an ocean of some other substance no animated creature would ever have come into existence? Such questions can be answered with certainty only by experiment, but the opportunity for trying the experiment is wanting. Such observations as we can make of the surface of the earth do give color to the view that life cannot be evolved except at certain temperatures. There is little living matter at the two poles. But, at the other extreme, we find that the warmer the climate the more abundant the life which it supports. Granting a due amount of moisture, no part of the world is so hot that plants, animals, and even men do not thrive. So far as we can judge, an earth yet hotter than ours would have been yet more fertile in life—perhaps almost up to the boiling point of water. Below this point there is a range of temperature wide enough to include countless planets among the many millions which may form other solar systems. Taken altogether, the author's argument seems as inconclusive as it is ingenious and comprehensive.