

incompetent for that) we hope to present some arguments against the views he so firmly advances.

In the first place, from that strictly scientific point of view which is ours, is it correct to say that the Earth is, in the solar system, a planet peculiar in its habitability? To discuss that fully, it would be necessary to expound at length the doctrine of the plurality of inhabited worlds, a doctrine well known by the works of Flammarion, Gore, and many other gifted authors. We prefer to rest on the grounds adopted by Dr. Wallace, and to admit with him that for sustaining life (we ought to say *life such as we know it on earth*) some elementary substances are requisite, and also a temperature restrained between narrow limits during the long sequence of the ages necessary for the evolution of living beings.

According to Dr. Wallace, the conditions of life are:—

1st.—A distance from the Sun sufficient, and just sufficient, to produce clouds, rains, and river-circulation, and to keep up the temperature required. We are of the same opinion, but it seems to us that such a circulation and such a temperature are possible on other planets than the Earth. The spectroscope reveals unmistakable aqueous vapour in the atmospheres of at least Venus and Jupiter. In the general plan of the solar system, the distance from the Sun to the Earth is not peculiar or extraordinary in any way.

2nd.—A sufficient atmosphere to produce the said water-circulation, and to equalise the burning heat of the days and the frozen coldness of the nights. Is this equalisation a property exclusively given to our orb? Are the atmospheres of Venus and Jupiter defective for that office? Dr. Wallace writes also: "The mass of an atmosphere depends largely upon the mass of the planet; Mars is, therefore, unsuitable for life." Is not this in every way a purely gratuitous assumption?

3rd.—A large proportion of the planetary surface covered by oceans, with currents and tides. Tidal action being dependent upon the Moon, the want of such a satellite prevents Venus from having high forms of life. The author forgets that the Sun is able to produce very appreciable tides by itself, especially in the case of Venus, to which it is nearer than to our Earth. And on our Earth, to look at the question from another side, tideless seas (as the Mediterranean Sea) are by no means lifeless.

4th.—The depth of oceans, indicating the permanency of their features. We grant it, but upon what grounds can we assert that such a depth is wanting on other planets?

5th.—The existence of atmospheric dust, produced by deserts and volcanoes, as this is the first cause of rain and clouds. Granted, but volcanoes can exist on other worlds. From this point of view the Moon would be an ideal orb. It is a very curious way of proving that life exists only upon our Earth to say that deserts are peculiar to it. For if there are no deserts on other planets there must be their opposites, viz., a luxuriant vegetation and innumerable forms of life. Anyway, shooting stars and meteorites might supply quite sufficient dust to produce water-condensation.

Such are the arguments by which Mr. Wallace sustains his idea that the conditions of life do not co-exist on other planets than our Earth. We believe very firmly that they are absolutely insufficient for any scientist. We believe, on the contrary, from an impartial study of all the scientific data, that life is possible on other worlds, and that the Earth has not the privilege of being the unique inhabited and inhabitable orb.

We are also unable to accept another view of Dr. Wallace, namely, that on the confines of the universe (supposing it finite) the law of gravitation is not obeyed,

MAN'S PLACE IN THE UNIVERSE.

TO THE EDITORS OF KNOWLEDGE.

SIRS,—Dr. Wallace's conclusion is a very old one, almost obsolete. The Earth and man are in his view the centre, the end, and the supreme purpose of the whole universe, and every world and star are in existence for the production and the development of the living soul of man.

This theory, that of all antique religions, has seemed so completely overthrown by the discoveries of science that nobody has dared to defend it. Is the new astronomy coming back after a long digression to the supreme conclusion of the ancient learning? Is the universe a purely anthropocentric thing? We do not believe it, and without following our author to theological ground (we are very

and radiant energy becomes so irregular that life cannot exist. These are pure assumptions, without any scientific ground to sustain them. On the contrary, we see the law of gravitation ruling over the most distant double star systems. We need more than an assumption to overthrow a doctrine so plausible as that of the plurality of inhabited worlds.

To leave these secondary questions and to examine the problem itself. Dr. Wallace asserts that, on the authority of the new astronomy, the Sun occupies a special and unique situation, being at the very centre of the universe. Do the astronomical results justify that very important conclusion?

The scientific basis upon which Dr. Wallace mainly, if not entirely relies, is that of the invaluable book by Prof. Newcomb, "The Stars: a Study of the Universe." We fear Dr. Wallace did not read this book with sufficient care, for we have just read again that masterly work, and we are by no means led to such a conclusion as that reached by Dr. Wallace.

In the first place we are confronted by the question, "Is the universe finite or infinite?" An insoluble problem in the present state of science. With Newcomb, Dr. Wallace says: "The universe, or, at least, the visible universe seems finite," and he follows the arguments of Prof. Newcomb completely. We believe, personally, that no convincing proof has been brought out against the universe being infinite; but, for brevity, we will grant that the visible universe is a limited body. We will also even grant that our solar system lies in the medial plane of the Milky Way (from the fact that the Galaxy is seen on the Heavens as nearly a great circle, which it would not be if we viewed it from a side of the central plane). But this is all; and we are unable to say with Dr. Wallace that the sun is placed *exactly* at the centre of the Galactic ring. In fact, no such a definite conclusion is warranted except by evidence which is not yet before us.

If we grant, however, that the sun is in the *neighbourhood* of the central plane of the Milky Way, does it follow that we are in the centre of the Galactic universe? It would do so, according to our author; and to put his theory on firm ground, Dr. Wallace again refers to the researches of Prof. Newcomb and Kapteyn (of Gröningen). From their marvellous studies, so clearly set forth by Newcomb in "The Stars," the nearer stars (nearness indicated not by their brilliancy, but by their mean proper motion) would form a sort of solar cluster, almost globular, and the Sun would be deeply immersed in that cluster. But if we suppose these results from somewhat hypothetical stellar statistics to be true, why should Dr. Wallace say our Sun is at the centre of that cluster and, therefore, at the centre of the whole universe?

We have ourselves studied the text of Newcomb's work, certainly the scientific base of Mr. Wallace's paper, and we were quite unable to find any sufficient arguments to establish this central position of our Sun. Prof. Newcomb writes (p. 312) on the nearness of the Sun to the central plane of the Galaxy. According to Dr. Wallace's theory, our luminary must be at the very centre of the Galaxy, otherwise it would lose immediately its unique situation. Even for Prof. Newcomb, it remains to be proved whether the Sun is or is not at the centre of the medial Galactic plane, some facts inducing him to think that we are nearer to one side of the Milky Way (in the constellation Aquila) than to the other. Further, if by hypothesis, at a given instant, the Sun were at the centre of the universe, it would lose its position soon, and never return to it again. We must not forget the proper motion of our luminary, a motion of ten miles per second at least. With that speed, how could the Sun rest for all eternity at the centre of the

universe, as a king on his throne? We must not forget also that this solar motion is a relative one, deduced from the apparent opposite motion of the stars. This seems a clear proof that the sidereal universe does not remain concentric (so to speak) with the Sun.

We have, therefore, no right to claim for the Sun, the Earth, and man, a peculiar and privileged position. We must not indeed neglect on *à priori* grounds any theory, however startling and unexpected it may be, but we may respectfully invite the new theorist to submit his views to the cross-examination of science. We regret to say that we believe Dr. Wallace's ideas are not supported by the new astronomy. His paper is astonishing and, in a sense, interesting to read, but we very candidly declare ourselves not convinced by the reasons offered to us, and we remain impenitent adherents of the doctrine of the plurality of worlds; a doctrine so simple, so charming to the human mind, and so fertile in philosophical deductions.

When we gaze on the heavens, we prefer to think that there are other lives and other humanities, than to place ourselves on a pedestal and to look proudly round an empty universe. We acknowledge, without hesitation, that this preference is no material proof of life on other worlds, but we beg in exchange to be allowed, without being considered guilty of contempt for the teachings of science, to regard the Sun and the Earth as very ordinary orbs, having no special characteristics, and as no more suitable for life than innumerable other suns and planets which rotate in the unknown infinite.

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