
ARE THE OTHER PLANETS INHABITED?

THE confident assertion is nowadays often made that besides the earth there are other planets of our solar system inhabited by man. In this paper we propose to examine the grounds of this statement.

The modern mind is often oppressed and sometimes overwhelmed by the immensity and complexity of that material universe which scientific research has so amply unfolded and revealed. Insignificant, indeed, does man seem and insignificant the earth, man's dwelling place, compared with the whole stupendous universe. Why, it is asked, should the Creator of all this matter and all this force, of all this wealth and magnificence of nature, take special interest in this "unfeathered, two-legged thing, man," weak of body, dark of mind, unstable of will, inhabitant of a minor planet shot off from a thir-rate sun? The laws of evolution, we are assured, that have produced man on earth, must also have produced him in countless other parts of the universe, and notably in the planets of our solar system. Hence, we are told, as there are probably in the whole universe as many man-inhabited worlds as there are men on earth, it is incredible that the Maker of them all deemed it worth His while to restrict the supernatural revelation of His will to earth-man, to load him with special favors, and then when flouted and disobeyed to die on the Cross in order to redeem the tiny rebel from the consequences of his own astounding folly. These are, however, but wild and whirling words unless upheld by cogent arguments and borne out by conclusive facts. What, then, are those

arguments? What are those facts? On examination we find that both facts and arguments are conspicuous mainly by their absence.

I.

First of all, the assumption that man was evolved on earth, and must therefore have also been evolved elsewhere, is but hypothesis proving hypothesis. For it is certain that the superior half of man, his spiritual soul, was not and could not have been evolved from matter. Again, it is an unproved hypothesis that even man's body was evolved from the brute creation. Moreover, even if man had been the product of evolution on earth, it would be infinitely improbable that he should also be the product of evolution on the other planets. For, according to the mechanical view of evolution, it was only through a long chapter of accidents that man ever came into existence at all on this globe of ours. Consequently the probability of the recurrence elsewhere of the special combination of most complex conditions required to beget and necessary to maintain the miracle of life on any other planet is so remote that it counts for nothing. The chances against its ever happening on earth were trillions to one. The chances against its recurring elsewhere were billions of trillions to one.

Take a parallel instance. Bandage a rifleman's eyes, spin him round time after time until he has no idea where the points of the compass are, then bid him fire off his musket at random. What chance is there that he will hit a shilling that has been hidden in the heather on a hillside a mile away? It is *possible* that he might hit it. For the bullet must strike something, and that something might be the shilling. But there is not the remotest probability. And if the blindfolded shooter should hit the shilling once, what chance would there be of his hitting it a second time? Yet that second hit would be incomparably more probable than the recurrence, outside the earth, of a man produced by evolution.

The odds against purposeless evolution begetting man are incalculably greater than the odds against the whist player drawing all the thirteen trumps. Yet the odds against this latter combination are 158,750,000,000 to 1! What are the odds, then, against the same player drawing all the trumps twice, or two hundred, or two thousand times? Then, what are the odds against the evolution of man in two, or two hundred, or two thousand worlds?

The immensity of the universe compared with the minuteness of man is rather an anthropomorphic difficulty, which when reduced to its due proportions turns out to be less than at the first blush appears. For the objection depends upon the comparison of the

great with the small. But is not this rather our human way of looking at things? In the eyes of the Infinite and All-powerful First Cause can anything finite be truly called either great or small? For all things, both great and small, He made out of nothing simply by willing their existence. He wished it, and they leaped into being. To the Creator it was as easy to make the molar mass of the Milky Way as to make the molecular mass of the hydrogen atom. Conversely, human power could as little produce the latter as the former; for the act of creation, whether of an atom or of the universe, is essentially an infinite act. To uphold in their orbits one thousand million Suns costs Him as much and as little trouble as to uphold a sparrow in its flight or a hair of your head from falling to the ground.

But, it is asked, what is the good of so gigantic a universe? An intelligent agent acts always to attain an object, to fulfil a purpose, and he proportions his means to the end in view. Yet if man be the climax of the universe, and the outer rind of this tiny earth be man's only dwelling-place, of what possible use are the myriad mightier orbs scattered throughout space? Where is the proportion between means and end? We cannot answer. Creation does, no doubt, fulfil the all-wise purpose of the Creator; but what that purpose may be no man can presume to say for certain. We can but guess.

There are, however, facts which, even if they fail to establish our guesses, serve at least to beget in us a cautious frame of mind. They reveal to us our ignorance; and that, as Socrates assured us, is a large gain. The knowledge of one's ignorance is the beginning of wisdom. For what sight can there be more grotesque than that of finite man, the "ephemeral" as Æschylus dubs him, the creature of a day, the heir to dusty death, dogmatizing about the purposes of his Maker and even denying the existence of God because the finite cannot fathom the intentions of the Infinite!

Among these facts just referred to as fitted to give us pause is this, that our solar system is probably the centre of creation, the hub of the universe. Luigi d'Auria, in a mathematical paper on "Stellar Motion," writes: "We have good reasons to suppose that the solar system is rather near the centre of the Milky Way; and this centre would coincide with the centre of the universe."[1] And that Nestor of scientists, even as he is the doyen of evolutionists, Alfred R. Wallace,[2] wrote a book to prove that the stellar universe forms one connected sphere; that the Milky Way is the equator of that sphere; that the solar system is situated in the plane of the

[1] *Journal of the Franklin Institute*, March, 1903.
[2] "Man's Place in the Universe," 2d ed., p. 317.

Milky Way, and not far removed from the centre of that plane. "Thus the earth is nearly in the centre of the stellar universe." Hence, as man is the climax of earth, so, too (as it would appear), is he the climax of the universe.

The main argument of those who maintain that other worlds possess inhabitants is this, that these worlds are useless as far as earth is concerned, and *must* therefore have been made for the habitation of non-terrestrial man. A very competent astronomer, J. E. Gore,[3] says: "The suns which we call stars were clearly not created for our benefit. They are of very little practical use to the earth's inhabitants. They give us very little light. An additional small satellite—one considerably smaller than the moon—would have been much more useful in this respect than the millions of stars revealed by the telescope. They *must*, therefore, have been formed for some other purpose. We may, therefore, conclude"—that they are inhabited! And another critic,[4] combating the view that our central position might be due to the fact that we were so placed in order to benefit to the utmost by the emanations of the stars, remarks that "we might wander into outer space without losing anything more serious than we lose when the night is cloudy and we cannot see the stars." He does not, however, acquaint us with the sources of his information. What the chemical and electrical effects of the star-emanations may be no man knows. But in face of modern discoveries—say of the powers of radium and of the X-rays—a discreet confession of ignorance would seem to be the wisest course to follow.

Let us repeat it that we neither know nor can know all the purposes of creation. Hence it is futile to affirm that this thing or that thing is objectless, and that the stupendous means are out of all proportion to the trivial end. For that is to assume that the end is trivial.

Suppose a monkey could watch the complicated processes employed in the making of a pin. The end of a pin, he might notice, is to fasten an orchid in your buttonhole! Yet what a disproportion between means and end! How he would wonder at these means—the busy factory, the complicated machinery, the crowds of workfolk, the sub-division of labor, the costly methods employed! Yet has man better data by which to condemn his Maker than the monkey has to condemn the pin manufacturer?

It is obvious on all sides that the Creator is most liberal, nay, lavish, in the means which he uses to attain His ends. For instance, what a vast number of spores one fern in its lifetime will produce;

[3] "The Worlds of Space," c. III.

[4] *Fortnightly Review*, April, 1903, p. 60.

yet of them all one only need fructify in order to replace the parent plant. What an astonishing quantity of ova one salmon, year after year, will bring forth; yet out of all these millions of eggs it is enough if but two come to maturity to supply the places of the male and female parent salmon. An oak tree bears annually thousands of acorns; yet it suffices if, after hundreds of years, but one acorn develops into an oak to take the place of its parent tree.

Similarly, why may not the Creator have made the primordial nebula prolific of countless worlds in order that one—the earth—might become the fit abode of man?

Man is certainly a small creature with a tiny brain. Nevertheless, by that brain he can mentally assimilate the whole universe. Man is limited to time and space; yet with his mind he can step outside both time and space to acquaint himself with eternity and infinity. Within the little sphere of man's head all creation may be summed up. On the tablets of his memory the history of all things can be written. Then why should not God have created, let us say, the furthest star if only for this purpose, that the astronomer might discover its existence and thereby raise his mind to a new act of praise, reverence and service of the Maker? For in that way "the heavens declare the glory of God, and the firmament sheweth His handiwork."[5]

Hence the universe would seem to have been only the workshop for the manufacture of man. Or, in another way, the universe would appear to be but man's home; a home richly decorated—both for profit and delight—with the most lavish magnificence of suns and systems, of mountains and oceans; adorned with the splendid luxuriance of plants, with countless wealth of animals, with untold variety of exquisite grace of bird and beast, of foliage and flower. Yes, all these things seem to have been made for man, since they can "tell God's glory" only by furnishing man with the means and the motive to glorify the Maker. For "glory" is "clear knowledge with praise," and the irrational creation can of itself neither know nor praise Him. Therefore the whole hierarchy of creation, animate and inanimate, lower than man seems to be like some mighty orchestra in a lone land, dumb until the fingers of man play upon its keys and the breath of man blows upon its vents, and then rich melodies resound amid the solitudes and the crash of mighty symphonies reverberate throughout the everlasting mountains.

Man, dowered with free will, capable of virtue and duty, of truth and self-sacrifice, of love and reverence, of merit and praise, of

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[5] Ps. xviii., 2.

[6] *Ibid*, pp. 321-322.

service and honor; with a mind competent to embrace present, past and future, to range the limitless realms of time and space; with soul immortal, a being of infinite duration—such a one incomparably outweighs the whole irrational universe. Consequently it seems not improbable that all things were made for man, just as man was made for God.

On this theme Alfred Wallace[6] writes: "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.

"And is it not in perfect harmony with this grandeur of design, this vastness of scale, this marvelous process of development through all the ages that the material universe needed to produce this cradle of organic life (the earth), 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 variety. It would imply that to produce the living soul in the marvelous 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 the 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. . . . 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."

II.

The argument is often adduced that because the Earth is inhabited by man, inhabited, too, by man must the other planets of the solar system be. Such reasoning, however, is not even specious. More-

ever, it can be retorted. For we know for certain that the moon is not inhabited, although she has the advantage of that proximity to the sun which the earth possesses. Why is it not then just as fair an inference that because the moon is not inhabited, neither are the other planets inhabited?

What scientific proof is there that other planets are inhabited? None. Dr. Wallace wrote: "The belief that other planets are inhabited has been generally entertained, not in consequence of physical reasons, but in spite of them."[7]

Sir Robert Ball expresses a like opinion:[8] "I do not think it at all probable that a man could exist, even for five minutes, in any other planet, or on any other body in the universe. . . . Indeed, there seem to be innumerable difficulties in supposing that there can be any residence for man, or for any being nearly resembling man, elsewhere than on his own Earth."

But let us look into the matter a little more in detail. There are obviously here two separate and distinct questions for consideration:

First, is there any other planet, besides the earth, the combined and complex conditions of which fit it for the habitation of man?

Secondly, if there exist such a planet, is it *de facto* inhabited by man?

To prove the first would be by no means to establish the second. For if there were such a habitable planet, it might, nevertheless, remain uninhabited.

On the second question we need not dwell. For we know nothing, and can know nothing, about it. Why not? Because it is the assured teaching of science—a teaching as certain (according to Lord Kelvin) as the Law of Gravitation—that life is not evolved by natural causes, from brute matter, but comes only from antecedent life; that is, that life comes from without. Consequently, even if it could be proved that any other planet besides the earth were fitted for man's abode, before the scientist could validly affirm that man abides there he must first show that life has been introduced into that planet from some extrinsic source. And on that head he can have no information of any kind whatever.

At best, then, we can but dip into the first question, and discuss whether or not any other planet be habitable; that is, whether any other planet possesses that complicated combination of circumstances which alone would fit it for the habitation of man. And this it is worth our while to attempt. For though we cannot argue from habitable to inhabited, we can argue from non-habitable to non-inhabited. Yet even on this preliminary question we have but the

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[7] *Ibid*, c. II., p. 7.

[8] "In the High Heavens," 1893, c. II., p. 44.

scantiest information. Again Professor Ball[9] writes: "Especially should we like to know whether the other planets are inhabited. But on this our greatest telescopes can give us no information whatever. We can only form the vaguest surmises."

Moreover, these "vaguest surmises" all lead to a negative reply.

We shall now, first of all, touch very briefly on the conditions necessary for life. Secondly, we shall consider how far those conditions are fulfilled on Earth. Thirdly, we shall examine to what extent those conditions are verified in the other planets of the Solar System.

III.

First, then, what are the necessary conditions of life?

Vital phenomena, in the main, appear between 32 degrees and 104 degrees Fahrenheit. The higher plants and animals cannot live perpetually with the thermometer below freezing-point; they would be frozen. They cannot live perpetually with the thermometer much above 100 degrees; they would be fried. On Earth the extremes of heat and cold are nowhere constant, but are diversified by the different seasons. Consequently no land animal passes its whole life in regions where the temperature never rises above the freezing-point. On the other hand, albumen, one of the proteids, and essential to life, coagulates at 160 degrees.

Again, life requires a due supply of solar light and heat. For there can be no land animals where there are no plants, and there can be, practically, no plants where there is not a fit proportion of sunlight and sun-heat.

Water, moreover, is an essential of life. It constitutes something like three-quarters of the body of a living thing. Neither plant nor animal can exist without it. And it must be always present in such quantities and so distributed as to be constantly available. Even a camel cannot live in a waterless Sahara, except so long as the supply which it brought with it lasts.

Besides this, life requires a suitable atmosphere. We live at the bottom of a vast ocean of air, and that ocean must be of high density and of right gases. Nor are these two conditions, in themselves, essentially connected. The density might be right, but the gases wrong. The gases might be right, but the density wrong.

The atmosphere must have a right density. For the atmosphere must be a cloak against excessive heat and a reservoir of heat against excessive cold. As a recipient and reservoir of heat, the atmosphere must be rather dense; not too dense to prevent the sun's rays from passing freely through to warm the earth, yet dense enough to act as

[9] *Ibid*, p. 40.

a blanket at nighttime, so as to hinder the too rapid escape of the heat accumulated during the day. The heat stored up in the daytime must be given out at night in such quantities as to secure for night and day an approximate uniformity of temperature.

A rare atmosphere has a less capacity for storing heat, and allows of a more copious radiation; that is, loss of heat. Hence, to increase the rarity of the atmosphere is to decrease the temperature. On earth, at about three and a half miles high, our atmosphere has but half the density of that at sea-level. This altitude is considerably greater than the snow-line of the tropics, where, with a fierce heat at their base, there is perpetual snow at the breast of the mountains. Consequently an atmosphere of half the sea-level density of ours would render life, at least for man, a sheer impossibility, for the whole globe would lie buried in perpetual snow and ice. Evaporation from the ocean would indeed be more rapid than with us, but it would be constantly falling as snow, and as continually compacting into ice.

Again, the atmosphere must not only contain the right gases; it must also be a right mixture of the right gases. For the life of plants and of animals the gases, constituent of the air, must be as nicely balanced as are the air's density and temperature. There must be a due supply—neither too much nor too little—of oxygen, nitrogen, carbon and aqueous vapor. And the adjustment of these gases must be exact to a degree. Take two instances. In our atmosphere there is but one part of ammonia—a compound of nitrogen and hydrogen—to a million parts of air; yet this millionth part is essential to plants, for nitrogen they must have, and yet the free nitrogen of the air they are unable to assimilate into their tissues. Therefore, they obtain it from ammonia. Again, carbonic acid gas is but one in two thousand five hundred parts of the air; yet it, too, is essential to plants. In itself it is a poison to animals, and yet an essential for plants, without which animals cannot live. If our atmosphere contained even so little as one part in a hundred of carbonic acid gas, it would suffocate us.

We see, then, that so delicately adjusted are the constituents of our atmosphere that any considerable variation would make life impossible.

The alternation of night and day, as we have it, may also be vital, and that not merely in order that night may be a time of rest both for plants and animals, though that is a point by no means to be overlooked. Miss A. M. Clerke writes: "We are indebted to our satellite for the alternations of day and night, *which make life possible.*"[10] But the chief purpose of this alternation is this, that the

[10] The Concise Knowledge Library, "Astronomy," Sec. III., "The Solar System," c. V., p. 283.

earth may not have time enough to become either too hot or too cold. If day and night were each considerably longer, the heat accumulated by day and the cold manifested by night would afford such rapid and violent contrasts that, again, the higher vegetation and animal life would be impossible.

Those evolutionists, however, who, at all price, will have it that other worlds are inhabited by man, shrink not from the contention that man *might* exist under conditions totally different from those which obtain on earth. Such an argument we need not controvert. Of course, water *might* run up hill. Plants *might* live without carbonic acid. Animals *might* be found on the airless and waterless moon. Man *might* live at the bottom of the Pacific, But is it much use to discuss such possibilities?

IV.

That the above (among other) complex conditions essential to life are verified on earth is, of course, evident, since they are not abstract and speculative, but entirely practical. They are formulated from what we know of our surroundings. With good reason, therefore, may we wonder at the nice balance and delicate adjustment of so many disconnected and conflicting elements, and ask ourselves by what agency it was that they were all thus ordered "in measure, and number, and weight."[11]

Take, as an instance, the earth's distance from the sun. The heat of the sun varies, like gravity, inversely as the square of the distance. At double the distance it would be but one-fourth of its present value. At half the distance it would be four times what it is now. Even at two-thirds the distance it would be twice as much as we experience. Hence, considering the sensitiveness of protoplasm, the "physical basis of life," and of the ease with which albumen coagulates, it is evident that our earth is in the temperate zone of the Solar System. On another planet, notably either nearer to or more remote from the sun, the higher life of flora and fauna would be impossible.

Take another instance. We have pointed out that to fulfill the conditions of life the atmosphere must have a certain density and be composed of a definite admixture of definite gases. What is the factor which determines these two essential conditions? It is partly the mass of the globe in question, for all the different gases are in a state of rapid motion. Their movement may be so quick that the force of gravity on the globe cannot hold back the particles of gas. The centrifugal force of their motion outwards may exceed the

[11] Wisdom xi., 20.

centripetal force of attraction inwards. With us that is the case with hydrogen gas. This gas moves so nimbly that it escapes into space as rapidly as it is generated by submarine volcanoes, by fissures in volcanic regions, by decaying vegetation and by other methods. Were, however, the mass of the earth much greater, it would have power to retain the hydrogen. With what result? A fatal result. For this hydrogen would mix with the free oxygen of the atmosphere, and thus form so highly explosive a compound that the first flash of lightning would ignite it with a crash so tremendous that earth would become an impossible home for man.

We may, therefore, conclude that the mass of the earth touches the maximum limit fitted for the habitation of man.

We may also note, in passing, the enormous quantity of hydrogen (combined with oxygen) which goes to form our rivers, lakes, seas and aceans. Why did free hydrogen formerly remain on earth to form water when it will not remain now? No one knows. And why did it remain in such exact quantity that the water formed from it fills our ocean beds and yet does not overflow the land? Or, to put the problem in another way, the ocean area of the earth is about two and a half times that of the land. But the bulk of water on the globe is some fifteen times that of land above sea-level. Had our earth been a true oblate spheroid (orange-shaped), the whole would have been covered with water to a depth of two miles! What agency, then, was it that scooped out the ocean beds deep enough to accommodate thus exactly the stupendous amount of hydrogen (combined in water) which remained on earth then? Had there been less hydrogen, in combination with oxygen as water, there would not have been enough water. Had there been one-tenth more hydrogen, the whole land surface would have been submerged. Who produced this exact adjustment? Shall we say that we do not know? But there, at any rate, it is, staring us in the face.

V.

Have these conditions essential to life been verified anywhere else than on earth?

First, as to the sun. Sir Isaac Newton himself argued that the sun was probably inhabited. Fortenelle even wrote a book, "Conversations on the Plurality of Worlds," to uphold the same opinion. But we might with much more reason argue that the three Jews—Shadrach, Meshach and Abednego—walked unhurt, without miracle, in that fiery furnace which Nebuchadnezzar in his wrath had commanded to be heated seven-fold more than it was wont,[12] for the

[12] Daniel, c. III.

furnace of the Babylonian king was cool compared with the white-hot metal in a Bessemer converter. Yet Professor Langley has proved experimentally that the sun is eighty-seven times hotter than Bessemer's molten steel.

Next, as to the moon. As her mass is only about one-eightieth that of the earth, the force of gravity on the moon is too weak to retain even so heavy a gas as carbonic acid; with the result that our satellite does not possess a particle of free oxygen, nitrogen or aqueous vapour. Sir R. Ball writes:[13] "Neither the times nor the seasons, neither the gravitation nor the other destructive features of the moon would permit it to be an endurable abode for life of the types we are acquainted with."

Thirdly, as to the planets of the solar system. These are called *inferior* and *superior*, according as they are *within* or *without* the earth's orbit. In the order of proximity to the sun, the inferior are Mercury and Venus; the superior, Mars, Jupiter, Saturn, Uranus and Neptune.

First, then, the inferior planets are not inhabited.

Not Mercury. Its mass is but one-thirtieth that of the earth. Hence, oxygen, nitrogen and aqueous vapour would necessarily escape from it. Moreover, the relative distances from the sun of Mercury and earth are as four to ten, so that Mercury is but two-fifths of the earth's distance from the sun.[14] Mercury, therefore, receives over six times as much solar heat as does the earth. It is, therefore, intensely hot. Nor is that all. Mercury keeps always one and the same face towards the sun, so that one side of the planet is hard-baked, the other side is hard-frozen. Consequently, even if there once had been oceans on Mercury—of which there is no proof—they must long ago have been boiled off the hot side and condensed into mountains of ice on the cold side. Therefore, A. M. Clerke[15] writes: "Mercury is, according to our ideas, totally unfitted to be the abode of organic life."

Nor Venus. The relative distances from the sun of Venus and earth are as seven to ten. Venus, therefore, is only seven-tenths the earth's distance from the sun, so that she receives about twice as much solar heat as the earth. She, too, must therefore be very hot. The thermometer in London in August, 1896, registered 93 degrees in the shade. But what would 186 degrees in the shade be like? Again, Venus, like Mercury, rotates on her axis during the same time that she revolves round the sun, and therefore she, too, presents always the

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[13] "High Heavens," p. 48.

[14] The mean distance, from the Sun, of Mercury is 36,000,000, of the Earth 92,750,000 miles.

[15] *Ibid*, c. IV., p. 277.

same face to the sun. Consequently, one-half of the planet has perpetual day; the other half has perpetual night, with the result that the cold side must be deeply wrapped in perpetual ice, while the hot side must rise to a temperature far too high for animal life. Miss Clerke sums up in these words: "With due reserve it may be added that Venus and Mercury have been rendered unfit to be the abodes of highly-developed organisms."[16]

Secondly, the superior planets are not inhabited.

Not Mars. The case of this planet we reserve for more detailed discussion later.

Not Jupiter. This mighty planet is not a solid body at all, but either a gaseous or, at any rate, a molten mass. A. M. Clerke writes: "Jupiter is a semi-sun, showing no trace of a solid surface. . . . It is a fluid globe."[17] Hence it is uninhabitable. "I see no likelihood," wrote Sir Robert Ball,[18] "that Jupiter can be the home of any life whatever."

Not Saturn, Uranus or Neptune. Of these outermost planets it is unnecessary to speak in detail. Richard A. Proctor, who stoutly upheld the antecedent probability that the planets are inhabited, and wrote two learned works to maintain his view—"Other Worlds Than Ours" and "Our Place Among Infinities"—comes to the conclusion that the three planets in question are unfit for habitation, and he bases his inference on plain astronomical and physical facts.

Like Jupiter, Saturn is not even a solid. A. M. Clerke[19] says: "There is no probability that either Saturn or Jupiter is, to any extent, solid." And, as is evident, man cannot flourish on a molten globe.

To Uranus the same objection applies. For this planet is still so hot that water could not exist on its surface; nay, that aqueous vapour would be decomposed into its constituent gases, oxygen and hydrogen. Miss Clerke[20] writes: "Uranus is presumably, almost certainly, still too hot to permit the combination of hydrogen and oxygen. And the absence from its spectrum of the slightest trace of aqueous absorption strengthens this inference." Life is certainly impossible under so tremendous a temperature.

Neptune is in like condition. It is so hot that water on its surface would be broken up into its component gases. Miss Clerke[21] writes: "It may be inferred that this planet also is too hot to contain water."

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[16] *Ibid*, p. 282.
[17] *Ibid*, p. 326.
[18] *Ibid*, p. 50.
[19] *Ibid*, p. 335.
[20] *Ibid*, p. 346.
[21] *Ibid*, p. 349.

Yet, in spite of this excessive heat from its own interior, Neptune receives so little sunlight and sun-heat that these essential requisites of high organic life are also wanting. For Neptune lies thirty-eight times further off from the sun than does the earth, so that it receives from the sun fourteen hundred times less heat and light than the earth. As Sir R. remarks:[22] "This fact alone would seem to show an insuperable obstacle to the existence of any life on Neptune resembling those types of life with which we are familiar."

It has indeed been argued that these outer planets are cooling down to habitability. The reply is obvious that habitability requires many other vital conditions besides this cooling down. Moreover, such cooling down may take many millions of years. Now, on the materialistic hypothesis, the evolution of life from the lowest forms up to man would take many more millions of years. But the sun is also cooling down, and will one day be as cold as the moon. Lord Kelvin gives the sun only about five or six million years more. He writes: "It would be exceedingly rash . . . to reckon more than five or six million years of sunlight for time to come."[23] Life, under those conditions, with a moon-like sun, would be impossible, for, as Wallace observes,[24] "Jupiter, and the planets beyond him, whose epoch of life-development is supposed to be in the remote future, when they shall have slowly cooled down to habitability, will then be still more faintly illuminated and scantily warmed by a rapidly-cooling Sun, and may thus become, at the best, globes of solid ice."

The case of Mars we have yet to consider. But so far these two points seem to be clear:

First, that even if the essential conditions of life obtained on any other planet, besides the earth, it could not be shown that life had been introduced into that planet, for the assertion that life can be, and would be, evolved by natural processes from non-life is a mere fable.

Secondly, that—Mars for the present apart—no other planet, besides the earth, possesses those complicated and accurately-balanced conditions which are absolutely essential to life.

No other planet is habitable. And even if it were, that would not prove it to be inhabited.

Every other planet is uninhabitable. Therefore, it is uninhabited.

Man, on this earth, is consequently the crown and climax of the universe.

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[22] *Ibid*, p. 48.

[23] Lecture at Royal Institution, published in Nature Series, 1889.

[24] *Ibid*, c. XIV., p. 280.

VI.

Sir Robert Ball[25] tells us that "Mars is the most world-like of all the other globes which come within the range of effective observation."

We have already seen that proof is conspicuous by its absence of the habitability of the other planets—except Mars—of the solar system. The habitability of the stars we need not discuss, for they are beyond "the range of effective observation." And if we cannot prove even for our planets that consummation devoutly to be wished by so many materialists, it is waste of time to try and prove it for the stars.

If man lives a natural life anywhere outside this Earth of ours, every probability points to Mars as that place of abode.

Does man, then, live on Mars?

Let Dr. Ball make answer: "The laws of probability pronounce against the supposition that there is intelligent life on Mars."[26]

We now take up the discussion of this question.

In an astronomical work that was at one time much read[27] the point in question is assumed as indisputable. Having drawn out the analogies between the earth and Mars, the writer says: "Were we warranted, from such circumstances, to form an opinion respecting the physical and moral state of the beings that inhabit Mars, we might be apt to conclude that they are in a condition not altogether very different from that of the inhabitants of our globe."

The actual existence of such beings he takes to be a matter of course; it is only their "condition" that he has any doubts about. Nay, he actually gives a census of the Martian population, and it is instructive to learn from Mr. Dick that it amounts to "twelve times the number of the population of our globe!"

That able astronomer, Richard A. Proctor,[28] finds in Mars so many resemblance to, and so many analogies with, our earth that he, too, holds that planet to be, almost for certain, inhabited.

Flammarion, however, the Parisian astronomer, calls in question Proctor's premises, and concludes to the contrary that "the general order of things is very different on Mars and on the Earth."[29] Flammarion denies, indeed, that man's abode is Earth alone, and in dramatic fashion observes: "Yes, life is universal and eternal, for time is one of its factors. Yesterday the moon, to-day the earth, to-morrow Jupiter. In space there are both cradles and tombs." And if we want proof of this fine language, M. Flammarion is ready

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[25] "In the High Heavens," c. VI., pp. 123-124.

[26] *Ibid*, p. 146.

[27] Dick's "Celestial Scenery," 12th thousand, c. III., n. 4; "Mars," p. 122.

[28] "Other Worlds Than Ours" and "Our Place Among Infinities."

[29] *Scientific American*, February 29, 1896.

with a copious supply. Here it is: "Infinity encompasses us on all sides; life asserts itself, universal and eternal; our existence is but a fleeting moment, the vibration of an atom in a ray of the sun, and our planet is but an island floating in the celestial archipelago to which no thought will ever place any bounds." And should we suggest to the French savant that all this rhetoric is but "words, words, words," he would plaintively tell us that "in our solar system this little earth has not obtained any special privileges from Nature, and it is strange to wish to confine life within the circle of terrestrial chemistry."[80]

We have really no wish to "confine life within the circle of terrestrial chemistry," if either M. Camille Flammarion or any one else will furnish aught besides eloquence in proof that life exists outside. But it is for him to prove that life exists outside that circle, not for us to prove that it exists only within. We are, however, absolutely certain that we have already furnished ample evidence of the fact that "this little earth *has* obtained" a good many "special privileges from Nature."

Proctor argued that Mars was habitable, and that it must therefore be inhabited. Man might be there; therefore, he must be there. But the writer did not prove his premises.

This is the form of Proctor's argument:

"What is habitable must be inhabited.

"But Mars is habitable.

"Therefore, Mars is inhabited."

Now of this argument he demonstrated neither the major nor the minor premise.

First of all, his major premise, that the habitable ***must*** be inhabited, he did not prove. His inference is invalid from ***might*** to ***must***. The scholastic axiom is obvious that *a posse ad esse non valet illatio;* you cannot conclude from possibility to actuality. A thing must be possible before it can exist, but it need not exist because it is possible. Proctor based his major premise on vague theological grounds, which, whatever else they might be, were certainly not scientific. Science, as we are being continually and proudly assured, argues only from "observation and experiment." But neither observation nor experiment affords any clue to the presence of man on Mars. Nay, even if (by hypothesis) the planet were inhabited, nevertheless the Martian man could not be perceived either by observation or experiment, for, under the most favorable conditions, Mars is distant from the earth never less than thirty-five million miles. At this time its apparent diameter is that of half a sovereign viewed at two thousand yards from the spectator!

[80] *Knowledge*, June, 1903.

We have all, indeed, heard of the possibility of signals between Mars and the earth! But if the whole planet, forty-two hundred miles wide, looks only as big as half a sovereign over a mile off, what size would a man look? Over a million times smaller than the gold piece in question. The signaling flags, to be visible at all, would have to be larger than Ireland. And Brobdingnagians, indeed, would the signal men have to be who should lightly wield flags of those dimensions!

Nor could we solve the problem by viewing Mars through the gigantic Lick telescope, which reduces the apparent distance of an object to about one-thousandth part of its actual amount. It would lessen the distance of Mars from thirty-five millions to thirty-five thousand miles. But that is a dozen times as far away as is Europe from America. You can hardly see a man half a mile away. A score of miles away—say, in a balloon—he would be quite imperceptible. The smallest visible speck on Mars, viewed through the Lick thirty-six-inch instrument, would have to be as big as London. A Martian Liverpool and Manchester, united into one city, would not look as large as a pin-point.

It may be objected against us that if a house is habitable, it was at least meant for habitation; and therefore if Mars is habitable, it was at least meant for habitation. We reply, however, that that is a false analogy. For we know that the sole purpose of a habitable house is that it should be used for habitation. But we cannot prove that the sole purpose of Mars, even if habitable, is that it should be inhabited. A house is habitable *per se;* Mars might be habitable *per accidens.* The conditions which make for habitability might also make for some other purpose of an entirely different kind—a purpose of which we are quite ignorant.

Therefore, to the question: "If Mars be habitable, is it inhabited?" we can give no answer. It might be, or it might not. We know absolutely nothing about it.

Against this last statement, however, it may be urged that we know, by inference, of the presence of man on Mars. For Mars is intersected by a network of *artificial* canals, dug by Martian men for the purpose of irrigating the Martian Saharas! A well-known astronomer, Mr. Percival Lowell, has no doubt of this fact. He tells us that, undoubtedly, certain districts of Mars are "artificially fertilized by the canal system. . . . Here, then, we have an end and reason for the existence of canals, and the most natural conceivable—namely, that the canals are constructed for the express purpose of fertilizing the oases."[31]

Mr. Dick has informed us of the number of Mars' population.

[31] "Popular Astronomy," Vol. I., 1895, p. 348.

Mr. Lowell now informs us of the engineering works with which this population has improved the planet it inhabits!

Professor Tyndall, it would appear, was not the only one who indulged in the use of the "Imagination in Science!"

Sir Robert Ball, a not incompetent authority, does not share in Mr. Lowell's confidence. He writes:[32] "Speculations have naturally been made as to the explanation of these wonderful canals. It has been suggested that they are rivers. But it hardly seems likely that the drainage of continents on so small a globe as Mars would require an elaborate system of rivers, each sixty miles wide and thousands of miles in length. There is, however, a more fatal objection to the river theory in the fact that the marks we are trying to interpret sometimes cross a Martian continent from ocean to ocean, while on other occasions they seem to intersect each other. Such phenomena are, of course, well-nigh impossible, if these so-called canals were in any respect analogous to the rivers which we know on our own globe."

Nor are these the only difficulties against the theory of "artificial irrigation." For instance, some of these single canals on Mars are suddenly—within twenty-four hours, and that simultaneously along their whole course of thousands of miles—transformed into double canals, which "run straight and equal with the exact geometrical precision of the two rails of a railroad."[33]

If this second canal is also "artificial" and is "artificially" thus flooded, the Martians are something like engineers!

Professor Campbell,[34] however, seems to have given the "artificial irrigation" theory its deathblow. For he has proved that the "canal" districts of Mars, instead of being a flat expanse, are intersected by mountains 10,000 feet high. Now, even Martian engineers would hardly manage, we should imagine, to run canals over the tops of Martian Mont Blancs!

Mr. Lowell had confidently written[35] that "when we consider the amazing system of the canal lines we are carried to this conclusion (of the irrigation theory) as forthright as is the water itself." In view, however, of the fact that these imaginary engineering works are sixty miles wide, are thousands of miles long, are double, run straight and equal like curveless railway lines, and traverse mountainous regions, we may safely agree with Miss A. M. Clerke's more cautious conclusion that "these systems of canals offer at present no

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[32] *Ibid*, c. VI., p. 144.

[33] Schiaparelli, of the Milan observatory, *Astronomy and Astro-Physics*, November, 1894, p. 720.

[34] "Publ. A. S. P.," Vol. VI., p. 273.

[35] L. c.

hold for profitable speculation."[36] Schiaparelli[37] agrees with Miss Clerke and is compelled to trust to "the courtesy of nature" for some future ray of light wherewith to penetrate the mystery. And, not unwisely, he deprecates recourse to human beings with their engineering exploits. Indeed, he thinks that such arbitrary modes of dealing with grave problems hinder the advance of science and impede the acquisition of truth. Science should make theories square with facts, not facts with theories. In science the wish should not be father to the thought.

Having disposed of this "canal" objection, we may now resume our argument. We turn, therefore, to Proctor's minor premise that Mars is habitable. We reply that Mars has not been proved habitable. On the contrary, all the data are against habitability.

If Mars were habitable, it would possess water and water-vapor. For these two are among the essential requisites of life. Does Mars possess them? Whether it holds water-vapour or not depends—as explained already—on the planet's mass and on its consequent ability to retain the vapour. Now, the mass of Mars is only one-ninth that of the earth, and therefore the probability is that its force of gravity—not more than two-fifths that of the earth—is insufficient to retain water-vapour. Dr. Alfred Wallace says unhesitatingly: "Mars has not sufficient mass to retain water-vapour, and without it cannot be habitable."[38] Professor Ball, however, thinks that the mass of Mars is enough to retain this vapour, but that Mars is the minimum mass that can do so. If this latter opinion be correct, the earth's mass is the maximum, Mars' the minimum, of habitability.[39] Ball confesses, however, that "clouds are comparatively an unimportant feature on Mars."[40] No one, indeed, denies that there are clouds, very thin clouds, on Mars, but it has to be shown that they are formed of water. And even if they are, they are not rain-clouds, but must be those whitish masses of suspended crystals which we call cirrus-clouds, such as are formed in our own atmosphere by the condensation at heights of from 17,000 to 20,000 feet of vapor into the solid form. Hence Miss Clerke writes[41] that "in the atmosphere of Mars it would be rarely possible to find collections of cloud capable of producing rain of any consequence."

If Mars possesses water-vapour, does the planet also contain water from which the vapour is evaporated? Dr. Wallace[42] thinks is does

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[36] *Ibid*, c. VI., p. 306.
[37] L. c.
[38] "Man's Place in the Universe," c. XIV., p. 266.
[39] *Ibid*, c. II., p. 133.
[40] *Ibid*, p. 41.
[41] *Ibid*, p. 308.
[42] *Ibid*, p. 267.

not. "It is almost certain that it contains no water." And to the plausible objection that Mars shows polar snows, which melt in the Martian summer, and thus produce water, Wallace replies that these snows are "caused by carbonic acid or by some other heavy gas."[43] Even Ball is far from asserting that the snows at the poles of Mars are snows in our sense of the word. He says:[44] "These polar snows must be some white material . . . possibly of some liquid other than water."

Therefore, whether or not there be on Mars either water-vapour or water is, at least, uncertain. It is not proven. But if there be any water, it must be very little. A. M. Clerke[45] tells us that "the proportion of water to land is much smaller on Mars than on the earth. Only two-sevenths of the disc are covered by the dusky areas, and of late the aqueous nature of some, if not of all of these, has been seriously called in question." Professor Pickering[46] showed that "the permanent water area upon Mars, *if it exist at all*, is extremely limited in its dimensions." And he estimates this hypothetical water area at half the size of the Mediterranean! Professor Schaeberle[47] does not believe that the so-called seas are seas at all. And Professor Barnard, with the great Lick telescope, discovered that these seas resembled, and probably were, a mountainous country broken by cañon, rift and ledge!

The *onus probandi* lies on those who affirm the habitability of Mars; yet so far, in their attempts to prove the presence of water and water-vapour, they have made many bold assertions, but have adduced uncommonly little evidence.

Next, as to the temperature of Mars. We have considered already the delicate combination of nicely balanced conditions necessary for the production of a climate fitted for human life. What proof positive is there that such conditions obtain on Mars?

A definite amount of sunshine is necessary to sustain the life of man. He can live permanently neither in an ice house nor in a furnace. Yet Mars must be something like an ice house. For the planet receives, per unit of surface, considerably less than half the sunshine which warms the earth. Again, the Martian atmosphere must necessarily be very thin. It has been calculated that the density of this atmosphere on the surface of the planet can be only about one-seventh that of the earth at sea-level. In other words, the air on the surface of Mars is twice as thin as on the peaks of the Himalayas! That fact alone seems fatal to life. For in an air of such tenuity it would be hard for man to breathe; he could only gasp. Again, an atmosphere with such a lack of density would

[43] *Ibid*, p. 267.
[44] *Ibid*, pp. 140-141.
[45] *Ibid*, p. 305.

make it impossible for the planet to retain during the night the comparatively small amount of heat which it had absorbed during the daytime. Sir R. Ball[48] writes: "It is the atmosphere which to a large extent mitigates the fierceness with which the Sun's rays would beat down on the globe, if it were devoid of such protection. Again, at night the atmospheric covering serves to screen us from the cold that would otherwise be the consequence of unrestricted radiation from the earth into space. It is, therefore, obvious that the absence of a copious atmosphere, though perhaps not so absolutely incompatible with life of some kind, must still necessitate types of life of a wholly different character from those with which we are familiar." Mars, being devoid of a "copious atmosphere," cannot, then, be the abode of man at any rate.

Mars must be intensely cold; so cold, indeed, that "the theoretical mean temperature is 61 degrees Fahrenheit below the freezing-point."[49]

Schiaparelli[50] writes: "The climate of Mars must resemble that of a clear day upon a high mountain. By day, a very strong solar radiation, hardly at all mitigated by mist or vapour; by night, a copious radiation from the soil towards celestial space, and hence a very marked radiation, consequently a climate of extremes and great changes of temperature from day to night and from one season to another . . . would be notably increased by their long duration."[51]

Alfred Wallace[52] holds that "during the greater part of the twenty-four hours the surface temperature of Mars would probably be much below the freezing-point of water; and this, taken in conjunction with the total absence of aqueous vapour or liquid water, would add still further to its unsuitability for animal life."

Furthermore, what are the constituents of the atmosphere of Mars? For, as we saw formerly, it is absolutely essential to life not only that the air which plants and animals breathe should be composed of certain constituent gases, but also that these gases should be mixed in a certain definite proportion. Is the air of Mars thus constituted of the right gases and mixed in the right proportion? There is not the slightest proof forthcoming that it is.

First of all, without oxygen and nitrogen in given proportions

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[46] *Astronomy and Astro-Physics*, August, 1894, p. 554.

[47] "Publ. Astro. Soc. of the Pacific," Vol. II., p. 196.

[48] *Ibid*, p. 126.

[49] Clerke, *Ibid*, p. 308.

[50] *Astronomy and Astro-Physics*, October, 1894, p. 640.

[51] The Martian day is twenty-four hours, thirty-seven minutes. The Martian year is 687 days—nearly twice as long as that of the Earth—with the result that the Martian seasons are nearly twice as long as ours.

[52] *Ibid*, p. 268.

organic life cannot exist. Does the Martian atmosphere contain oxygen and nitrogen thus properly mixed? There is no evidence that it does. There is no real evidence that this essential composition of gases is there at all, nor are we sure that, even if it were there, the small density of Mars due to its small mass would enable the planet to retain it. Sir R. Ball[53] writes that "as to what the composition of the atmosphere on Mars may be, we can say but little," and he quite recognizes the fact that "there may now be no free oxygen in its atmosphere."

To sum up. Not only, then, have we no jot of proof that Mars is inhabited by man, we have not even any tittle of evidence that the planet is habitable by man. Nay, facts point strongly in the other direction. Even so very sanguine a writer on this subject as Dr. Ball is compelled to admit that "it is not in the least likely that any man, woman or child transplanted from this Earth to Mars could live and thrive there. The temperature might be endurable, and water appears to be not wanting, but I do not think we have any reason to expect that the atmosphere would suit human beings, either in quantity or in quality."[54]

Here we conclude. The materialistic evolutionist argues against Christianity that man is not restricted to the Earth among the spheres any more than he is restricted to Europe upon the Earth; and, therefore, to affirm that God died only for terrestrial man is as absurd as to affirm that He died only for European man. To this objection we have supplied, as it seems to us, a crushing answer. For, according to the highest scientists, the Earth alone is inhabited and is inhabitable by man. Not only is there no proof that an extra terrestrial man exists; there is no proof that there is any place where he could exist. That other planets are inhabited, or even inhabitable, is a wild assertion for which no shadow of real evidence has up to this been produced.

CHARLES COUPE, S. J.

Bournemouth, England.

[53] *Ibid*, pp. 136-137.
[54] *Ibid*, c. II., p. 51.