

There is very little doubt that twinkling is due to the atmosphere; it all depends on the state of the sky.

The President then showed some lantern slides on the very interesting subject of craterlets.

He then adjourned the meeting to the 28th May 1912.

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## The Habitability of the Planets and the Apparent Waste in Nature.

BY W. J. SIMMONS.

It is a recognised principle in science to argue from the known to the unknown. We are familiar in the world around us with the little pitted marks which rain leaves in the soil, and with the footprints which wading birds leave on the mud on the banks of a river, or which ripples leave on a sandy beach. When we discover similar markings in a stratum of rock buried deep down in the Earth's crust, we infer that tens of thousands of years ago rain fell, and wading birds stalked about, and ripples washed and broke on this planet in the old times before man appeared on the scene to till the ground. Furthermore, we may even be able to learn something from the silent testimony of the rocks about the direction from which the wind blew, and the intensity of the storm. We have argued from the known to the unknown; we have reasoned from parallel cases, *i.e.*, we have proceeded by the method of analogy, the method which has also been adopted in anthropology and other sciences.

So, too, when we find that one of the planets has its axis of rotation so adjusted to the plane of its orbit as to secure seasons which in some degree correspond to the seasons we experience on our Earth; when observation satisfies us that the diurnal revolution of the planet concerned gives it the phenomena of day and night; that its poles, alternately at intervals of a few months, put on white caps which suggest those worn by our Earth in its Arctic and Antarctic regions; that it has an atmosphere more or less cloud-laden, that when occasional glimpses can be obtained of its surface, markings are unveiled which bear what we may regard as a rough resemblance to the surface markings of our globe; that where clouds are there must be some fluid whose evaporation under the action of the Sun's heat forms cloud-masses

similar to those which belt our world in its equatorial and trade wind zones : we admit that we have discovered the existence of certain conditions which in the case of our Earth have been favourable to the development of organic life forms. In applying this analogical argument to the case of any of the planets—if I may adopt what J. S. Mill says in the chapter in his *Logic* devoted to the discussion of the argument from analogy—we must remember that where the resemblances between, say, Mars and our Earth are great, and the ascertained differences are small, and further where our knowledge of the subject is extensive, the argument from analogy may approach in strength very near to a valid induction. If, however, every resemblance proved between Mars and the Earth in any point not known to be immaterial with respect to life constitutes some additional reason for presuming that life-forms as we know them exist in Mars, then it is obvious, *contra*, that every dissimilarity which can be proved between the two planets furnishes a counter-probability of the same nature, but on the other side. In such a case if animal life does exist in Mars, it must be, and clearly can only be, as an effect produced by an environment, that is by an assemblage of causes, different from those on which life depends on the Earth ; or to put it in other words, life in Mars must be a consequence not of that planet's points of agreement, but of its differences from the Earth. In such case, what becomes of the inferences we would draw as to the character and capabilities of living organisms in Mars ? If they have been evolved in an environment differing from that obtaining on this Earth it is idle to conjecture in what respects they resemble or differ from the plants and animals around us. The fact is that our knowledge of the environment in any one of the other planets is not sufficiently extensive to justify our carrying the analogical argument very far. When I say this I chiefly have in view the claims made for Martian life-forms possessing a degree of reasoning power ; organizing and co-operative capacity ; and all else that the term intelligence connotes, not merely equal to, but if anything rather superior to the degree of intelligence exhibited by the animal organisms inhabiting this Earth. The coarse mosses and dwarfed Arctic plants of the frozen marshes of northern Russia ; the cacti and the euphorbiaceæ of the Sahara, where the sandy surface reaches a day temperature of 150°F, and is chilled below freezing-point at night, are life-forms, but we do not attribute reasoning power in any degree to them. Now, I think I am correct in saying that it is admitted that the surface of Mars appears to be uniformly level. Mr. Lowell tells us there are no mountains on Mars exceeding 2,000 to 3,000 feet in

height; the planet's characteristics are probably those of a desert region in which the terrible desert conditions of the Sahara prevail.

And this leads me to direct your attention to other observed facts which I submit cannot be ignored if we would deal fairly with the different series of phenomena on which we seek to base our analogical argument. I mean the apparent waste in Nature. When first I set about collecting materials for this paper I was not aware that Prof. Whewell in his "Plurality of Worlds" (1854), and Mr. A. R. Wallace who touches very lightly on the subject in his "Man's Place in the Universe," had anticipated me in recognising the force and value of what I term the argument from apparent waste. The scope of that argument may be realized from a stanza in Tennyson's "In Memoriam." In the powerful verses in which the poet would remind us of Nature's apparent care of type forms, and her reckless waste of individual lives, he says —

" I considering every where  
Her secret meaning in her deeds,  
And finding that of fifty seeds  
She often brings but one to bear,  
I falter where I firmly trod."

Mr. Wallace says the same thing when he tells us the mind reels under the immensity of, to us, apparently useless life. A commentator of the "In Memoriam" (Alfred Gatty, p. 60) in a footnote says: "The early purple orchis is said to bear 200,000 seeds, and perhaps one only grows to a plant." Mr. Wallace says that of the millions of acorns produced during its life by an oak, every one of which might grow to be a tree, it is probable that only one does actually, after several hundreds of years, produce the one tree which is to replace the parent. He meets the argument which may be based on the circumstance that acorns form food for beasts by recording that this cannot be urged on behalf of the seeds of orchids and the spores of ferns, for millions of these literally go to waste for every one that reproduces the parent form. Grant Allen in his monograph on "Charles Darwin" says (p. 94): "A single red campion produces in a year three thousand seeds; but there are not this year three thousand times as many red campions as there were last summer, nor will there be three thousand times as many more in the succeeding season. The roe of a cod contains sometimes nearly ten millions eggs; but supposing each of these produced a young fish which arrived at maturity, the whole sea would immediately become a solid mass of closely-packed codfish." Wallace in his "Darwinism" records that

a single flesh fly (*Musca Carnaria*) produces 20,000 larvæ which in five days reach adult life, and that the great Swedish Naturalist, Linnæus, asserted that a dead horse would be devoured by three of these flies as quickly as by a lion. Packard, an authority on Entomology, in his *Guide to the Study of Insects* (p. 566) says that the eggs of the Katydid, one of the locust family, are about the eighth of an inch in length and that they resemble tiny oval bivalve shells. You may form some opinion of the enormous number of locusts when, citing from the last edition of the *Ency. Brit.* (Vol. 16, p. 858), I tell you that in one year, 1881, the estimated weight of the locust eggs destroyed in Cyprus exceeded 1,300 tons. This batch included one thousand six hundred millions of egg-cases, each case containing a considerable number of eggs. Yet in 1883 not fewer than five thousand and seventy-six millions of locust eggs are believed to have been deposited in Cyprus. Those of us who have witnessed a flight of locusts here in India must have been impressed by the appalling fecundity of Nature. Remembering that swarms of these insects visiting a district have often accentuated, if they have not caused, famine, and all the misery and death which in India follow in the wake of famine, one cannot overlook the devastation occasioned by cyclones such as that of 1876 which destroyed 30,000 persons in Hatia, 40,000 in Sandwip, and 74,000 in Backergunge, to say nothing of the enormous number of cattle destroyed by these terrific storms. The lemming is a small Scandinavian rodent about five inches long, something in general appearance like a rat with a short tail. It produces two broods annually each consisting of generally five, sometimes three, and occasionally eight young ones. At intervals varying from five to twenty years the cultivated lands of Norway and Sweden are overrun by such huge battalions of lemmings that the simple peasantry of Norway believed they dropped from the clouds, and trekked across country to their original home in the submerged island of Atlantic. Their onward march, which takes place at night, never ceases until they reach the sea, and may last from one to three years. When they reach the ocean they plunge into it, recklessly swimming onwards in the same direction till they perish in the waves.

You will now realize what I mean by the argument from apparent waste in Nature ; but, you may say, all these instances are drawn from organic life—what about inorganic nature ? I would answer your enquiry by turning to our own solar system. It is not claimed, now-a-days at least, that the Sun is inhabited, nor yet the Moon, nor the comets, nor the satellites of other planets, nor the six hundred and seventy

odd asteroids, nor even Mercury. About Venus no definite opinion can be formed as the body of the planet is always swathed in a heavy veil of clouds. We must, therefore, return a Scotch verdict of not proven in the case of Venus. The case of Mars may for the present be regarded as *sub-judice*; while the most hopeful exponent of the plurality of worlds would in the cases of Jupiter and Saturn claim that they are destined to be inhabited some day, but are not so to-day. Of Uranus and Neptune we do not know enough, but what we do know does not seem to entitle them to rank higher than their two immediate neighbours. Passing now beyond the limits of our solar system, to the background of stars beyond, it is interesting to note that binaries of the Algol type have a special lesson for us in our speculations on the habitability of the stars. Vogel in 1899 showed that the variability of the Demon Star in Perseus, the star in the angle of the easternmost limb of the Greater W. is due to its suffering a partial eclipse at short intervals in consequence of a dark companion star passing before it. Since then a large number of the brighter stars have been spectroscopically examined, one by one, with the surprising result that "one star out of every four or five examined proves to be a spectroscopic binary and the proportion seems to grow steadily larger." What, it may be said, has all this to do with the habitability of stars? My answer will be in the words of Prof. Arthur R. Hinks, who, writing his little Manual of Astronomy as lately as June 1911—not a year ago—says: "The discovery of so many spectroscopic binaries disturbs the idea, drawn from our own solar system, that the function of a star is to nourish with heat and light a family of planets. The terrible problem of the motion of a planet round a pair of suns has not yet been solved, but it seems quite unlikely that such a planet could pursue an equable way conducive to the development of life upon its surface." (P. 180.)

In casting around for analogies we must not restrict our choice to those that suit us—,e.g., to the size of a planet, its diurnal and annual revolutions, the inclination of its axis to the plane of its orbit, and so forth. There are places on our own Earth which do not conduce to the maintenance of living organisms. Excepting Mars as a case reserved, our Earth seems after all to be the only body revolving round the Sun fit for the habitation of living forms as we know them. However, unwilling to do so, we must so far as their capability of sustaining life is concerned, relegate the rest of the bodies which derive their heat and light from our Sun to the category of what so far as indigenous life is concerned, we may term apparent waste in Nature. And when we leave

our solar system behind us, and speed across the lonely and ice-cold Zaarahs of space to the remote background of the fixed stars, we are forced to acknowledge that recent spectroscopic research does not conduce to the belief that inhabited planets like our world circle round each of the brighter stars. The argument from analogy seems to point quite the other way, though obviously in the case of those numerous stars which neither the telescope nor the spectroscope can resolve into doubles, it must be admitted that the scope for both speculation and enquiry is considerably widened. Obviously if the claim set up for the plurality of worlds is limited to the planetary orbs being the habitat of vegetable organisms only, or if it was confined to vegetable organisms and the lower types of animal life represented on our Earth by the Protozoa and the Annulosa, it might be conceded that such types of life do probably exist on Mars on the one side of us, and Venus on the other. But, as I understand it, the claim advanced is far more extensive. The social instincts of man influence him to people the planets with beings like himself; and it is correctly recognized that to support such a claim we must find in Mars, or in Venus, indicia which with reason can be claimed to be artificial, in a word which are "evidences of intelligent engineering upon a gigantic scale." Mr. Percival Lowell claims to have found such indicia in Mars, and any claim advanced by him in this direction is entitled to respect. He has practically devoted his life and his great abilities and special opportunities to the problem of solving the question—is Mars inhabited? His studies have been prosecuted with the help of skilled assistants, in an observatory admirably equipped with the necessary instruments, and situated in an atmosphere so suitable to stellar observations that stars which cannot be detected with a given power elsewhere, are plainly visible with the same power at Flagstaff Observatory in Arizona. Moreover, while the proximity of the Moon to our Earth has satisfied competent authorities that no life exists on our satellite, Mars is so situated with regard to the Earth that it is the one planet on which, if on any, we may hope to find evidences of intelligent life. And yet, closing his discussion of Professor Lowell's claims on behalf of Mars, Mr. Arthur Hinks observes: "We can only say that there is as yet no proof at all of the actual existence of intelligent life on any world but ours." (P. 87.)

A few words more and I have done. We have had more than one note lately on the question of the habitability of other planets and in all of these recourse has been had to the use of the analogical argument. We have seen that that argument at its best only establishes a probability more or less

strong, but that it does not amount to a positive and valid induction. What object then is served by these enquiries, seeing that our Society exists for the very practical purpose of encouraging independent research and observation? Let me answer that question in John Stuart Mill's own words: "The cases in which analogical evidence affords in itself any very high degree of probability are only those in which the resemblance is very close and extensive; but there is no analogy, however faint, which may not be of the utmost value in suggesting experiments, or observations, that may lead to more positive conclusions." (Mill's System of Logic: p. 368).

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## Note on two Meteors.

BY P. C. BOSE.

On the evenings of 10th and 11th March I saw two meteors that seemed to radiate from Puppis. They were very slow, not very bright and left very thin trails. They took about 4" to pass. In appearance they resembled cheap rockets such as are seen on Dewali nights. I shall be pleased to receive communications from members who have made observations about these or any other meteors.

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## A Note on a Meteor.

BY H. HART.

When sitting out in my garden on Saturday evening, 16th inst. at 7-42 I was conscious of a sudden brightness in the overhead sky; and looking up I saw a most brilliant meteor travelling north-west from the zenith between Mars and  $\beta$  Tomri (Nash). It dropped with great swiftness between the Pleiades and Perseus and disappeared in Triangulum. I reckon it took about four seconds to travel from between Mars and Nash to Triangulum.

I have never seen a meteor of similar size and brightness. It appeared to be about one-fourth the size of the Moon—a well defined orb, having three colours—red, yellow and green—brilliantly distinct. The tail was insignificant, being barely a degree in length.