

“Hanging like the reckless seraphim  
On the reins of red-maned Mars.”



**Mistakes about Mars.**—I quote Mr. Kipling's extravagant verses from memory, with one wilful alteration, because they serve as an excellent text for what I have to say of recent writings on Mars.

The reckless seraphim have had matters all their own way for some years, and have propounded through the newspapers and by telegraph from various quarters of the globe, extravagant theories about the ruddy planet, its canals, its clouds, its snow-storms, its inhabitants, and the signals which the latter were sending to us, or which we ought to send to them, and so forth. So much of this reckless theorizing has been printed that non-professional readers have come to accept a good part of it as proved, not because they have examined the evidence, but because they have believed what they were persistently told. M. Flammarion, in his book on Mars (printed in 1892), begins, for example, by a reproach addressed to such skeptics as do not look forward with confidence to the establishment of communication between our brothers in other worlds—Mars—and ourselves. An observatory has lately been founded, devoted chiefly to “an investigation into the condition of life in other worlds, including their habitability by beings like . . . man,” and its founder starts out by assuming that “we are on the eve of pretty definite discovery in the matter.” So, indeed, we are; but not in the sense of the quoted words. A recent writer in *Nature* interprets observations which he has never made, and does not understand, as possible signal-lights from Mars, and so on.

All the while the scientific evidence in favor of the above pro-announcements was quite inadequate, and astronomers in general understood this to be so, though the public certainly did not. I remember I was asked, in 1890, to telegraph my opinions as to the land and water on Mars, etc. I replied that our observations at the Lick observatory up to that time enabled us to construct an accurate map of the dark and of the bright regions of the planet; but that neither I, nor any one, could say which regions were land and which were water. This telegram was received with a certain air of disappointment, natural enough, I suppose, to those who had been fed on (alleged) certainties, and who could not conceive that such fundamental matters were still unsettled. They were not settled then, and we have but just obtained a little satisfactory light on them. “I do not know,” is a scientific answer, though it is, undoubtedly, a disappointing one when it replies to a question in which the whole world takes a vivid interest. But scientific men are in honor bound to make this answer in so far as it is true, and to be scrupulously exact in their dealings with the public which supports ob-

servatories and which has a right to know where certainty ends and speculation begins.

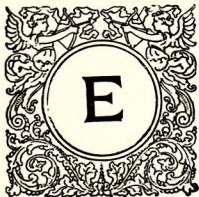
The present opposition of Mars has been a very favorable one, and important observations have been made at Mount Hamilton. In the first place, Professor Campbell has shown that the spectra of Mars and the Moon are "identical in every respect." His spectroscopic observations exhibit no evidence of aqueous vapor on Mars any more than on the Moon, and prove that if Mars have an atmosphere at all, it is very slight. Other important observations (of bright projections—mountains—at the terminator of Mars) appear to me to prove the same thing. The details of these and other observations have been, or will be, printed in the publications of the Astronomical Society of the Pacific. The "polar-caps" and the "canals" on the planet are as yet unexplained (though, perhaps, an extremely thin atmosphere of carbonic-acid gas may explain them); but, at any rate, it seems to be certain that they were erroneously explained before on the hypothesis of a "considerable" atmosphere like our own, heavily charged with the vapor of water. There is little or no atmosphere and aqueous vapor on Mars. Hence, the oceans, clouds, snow-storms, inhabitants "like man," and signals vanish—literally, into thin air.

It will be curious to see how the public will receive the negation of the Martian apparatus which has been provided for it. Any true conclusions will, undoubtedly, be welcomed. After all, no one likes to be under an illusion. But there is room, one would think, for a well-grounded protest on the part of the public against the pertinacity with which conjectures have been presented as facts. The experience should be a lesson to both writers and readers to "prove (i. e., test) all things," and hold fast only to those which have been established as true; and to be patient meanwhile.

The problems of astronomy are amazingly difficult. Observers must have the candor to say they do not know when this is true, if they wish to deserve the trust and faith which the public so generously gives.

Finally, I may say that the present opposition of Mars will be long remembered, not for the solution of the puzzling questions presented by the planet Mars (for they are by no means yet solved), but for the sweeping away of a number of conjectures which had been repeated so persistently that it seemed a heresy to doubt them.

EDWARD S. HOLDEN.



**Electricity and Vegetation.**—The physiological effects of electricity and the electric light upon the growth of plants have been carefully studied for a number of years, and the results already reached are highly interesting for their economic and theoretical importance. The studies have had to do with the application of electricity directly to the plants themselves, sometimes with currents through the earth in which their roots were embedded, and sometimes with the effects of the electric arc-light maintained a part or the whole of the time

when sunlight was absent.

These latter experiments have shown that rest is not essential for the healthy growth of plants, for some are found to grow continuously when kept in such light, and this means that plants have adapted themselves to the recurring periods of day and night, and the seasons, and their habits may be readily changed when opportunity offers.

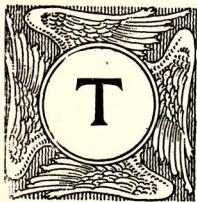
Plants kept in the light from an electric arc not only grow as in sunlight, but some grow much faster and larger, they produce chlorophyl in abundance, they reach out toward the source of the light and twist this way or that, they assimilate more potash, produce more albuminoids, and yield a larger amount of ash. These phenomena show that the physiological quality of the electric arc-light is the same as that of the sun.

This light has a proportionally larger quantity of short, ultra-violet rays which

are highly stimulating to plant life, and where employed directly, and within ten or twelve feet, are apt to injure plants, for the chemical processes are urged on faster than the plant tissues can supply materials. This is prevented by surrounding the arc with a glass globe and also by keeping it at a proper distance. The glass has the property of absorbing largely the short waves which are deleterious. With such protection, many of the plants reared by forced growth for an early market, such as radishes, spinach, lettuce, peas, may be advanced ten days or two weeks by keeping them in this artificial light. In like manner, flowering plants are forwarded and otherwise improved. Tulips grow thicker stems, larger leaves, and their colors are deeper and richer. Petunias grow taller, slimmer, and bloom more profusely. White ones do not change color, but purple ones become blue. Violets and daisies are made to blossom two or three weeks sooner than others which have had only sunlight.

The effect of electrical currents in the earth about the roots of plants has not appeared so marked, but some kinds of vegetables grown in fields through which were stretched insulated wires provided with discharging points a foot or two apart and supplied with a current of high potential electricity from a Holtz electrical machine, eight hours a day during the summer, gave a large increase in yield, from thirty to one hundred per cent. Onions, radishes, potatoes, beets, seemed to profit much from such treatment.

A. E. DOLBEAR.



### The Astronomical Photographs of Dr. Roberts.—

Among recent astronomical publications, one of the most interesting, and certainly the most beautiful, is the collection of photographs of nebulae and star-clusters taken during the last four or five years by Dr. Isaac Roberts, a distinguished English amateur. He works with a twenty-inch reflector, and in the number and perfection of his negatives has quite surpassed all his predecessors.

A few of the nebulae and clusters are bright enough to be magnificent objects in large telescopes. Nothing can be finer than the great Orion nebula with its blue-green, billowy light, and tangled filaments and streams of shining mist, through which gleam out, like clustering jewels, the brilliant stars of the "trapezium," in impressive contrast with the shadowy forms and clouds of outer darkness, which here and there penetrate and overlie the luminous mystery. Nor is anything more likely to bring out from some "Philistine" a shout of appreciative amazement than one of the great star-clusters in which swarming thousands of suns throng, and crowd, and trample upon each other in a blazing globe of glory. But for the most part the nebulae are so faint that they are difficult even to see,—dim, phosphorescent mists that tantalize the vision with suggestions rather than revelations of mysterious wonders not quite within the reach of clear discovery. Nor will length of gazing help the observer; it is only useless weariness.

Just here comes in the power of the new method. The photographic retina knows no fatigue, but as the exposure is prolonged it continuously takes cognizance of still fainter stars and films of nebulousity. There may be some limit to the effect of prolonged exposure; but thus far none appears, and so the plate far transcends the eye in its ability to deal with objects like the fainter nebulae; and even those that are finest to the eye reveal new and different wonders in the photograph, because, in the light emitted by the nebulae, there is a large proportion of ultra-violet rays which are photographically efficient, but quite beyond the range of human vision.

Among the fifty-three pictures of Dr. Roberts' volume probably the most striking of all is that of the great nebula of Andromeda,—a photograph which, when it first appeared in 1888, came as a new revelation,—a most impressive object-lesson on the nebular hypothesis. Hardly less beautiful are the three plates of the Orion nebula; the Pleiades, with their gauzy veils of nebulousity still clinging to the (apparently) unfinished stars; the great spiral nebula,—Lord Rosse's

“whirlpool,”—and half a dozen other spirals, quite as perfect in structure and significance, but smaller and less luminous. Then there are a number of fine star-clusters; but here the eye thus far maintains at least an equality with the photograph, because on the sensitive plate the star-images grow larger with lengthening exposure until they overlap and confusion follows.

It would hardly be safe to predict the future of celestial photography, but if one can judge from the past ten years, new and great successes are sure to come.

C. A. YOUNG.



**Very Ancient Fossils.**—A large number of fairly well preserved fossil shells have recently been found in rocks so ancient that they were supposed until recently to be devoid of all remains of organisms, and perhaps to antedate all life on this earth. This discovery will assist in the classification of rocks and the mapping of the earth's surface, but it has a still greater interest in connection with the theory of the development and evolution of life, for,

strangely enough, the shells in question are allied in the closest manner to species now living in countless myriads, although the rocks in which they are entombed are probably not less than a score of millions of years old. Even at that remote period, long before the coal measures, and relatively near the epoch at which the earth became habitable, there were many species, many allied genera, descended from still more remote common ancestors. Their descendants, on the other hand, have adhered closely to the types established so long ago; no doubt because they were well adapted to an environment which has undergone little change.

These fossils are not large, or they might have been found before; in fact, they can only be seen clearly with the higher powers of the microscope. They are globular, silicious, and covered with the radiating spines which have given them their name of radiolaria. Their modern representatives are somewhat larger, for they can sometimes be seen with a good lens, and they live on the surface of the ocean, far from land. When the animals die, their flinty shells fall slowly to the bottom, and, accumulating there, form a chief constituent of the material brought to the surface by the deepest soundings.

The beds in which the shells have now been found by Mr. Barrois and his pupil, Mr. Cayeux, are among the earliest rocks certainly deposited from water, and the group is called the Algonkian. The discovery will give a new impulse to the use of the microscope, and most of the work on the organic remains of the very old rocks will probably be done with that instrument.

GEORGE F. BECKER

