THE PLANET MARS—IS IT INHABITED?

Can it be possible that in all the vast universe but a single planet, and that the merest infinitesimal portion of the grand whole, can be the abode of living creatures such as ourselves? Does Science teach that other worlds are unpeopled deserts, serving no other purpose than to traverse their orbits obedient to the Divine will? Such are the questions which astronomers have been forced to meet and answer, unaided except by the testimony afforded by analogy and by deductions from theory, based perhaps on evidence mainly presumptive.

Leaving out of their consideration the possibility of organisms existing under conditions unknown upon the earth, the searchers of the heavens have examined the brilliant orbs which circle round the sun, first crudely and imperfectly, but as their knowledge and means increased with the progress of science, with augmented accuracy and power, adding discovery to discovery; until, link after link, the chain of proof has been forged, leading to but never reaching a universally accepted conclusion. As to all the planets, but two, the answer is certainly negative; the condition of all other worlds is such as to render human existence upon them absolutely impossible. Of the excepted pair, on one, Venus, life may exist, but every probability is to the contrary; regarding the other, Mars, divided opinion is encountered; and while it is asserted on one hand that, with reasonable certainty, the planet may be assumed as the abode of living beings, on the other the presumption is as specifically denied. Deferring the consideration of Venus to some other opportunity, it will be of interest to examine the present state of our knowledge regarding the Planet of War, and, at the same time to glance briefly over the arguments, *pro* and *con*, which have been advanced to prove or disprove its habitability.

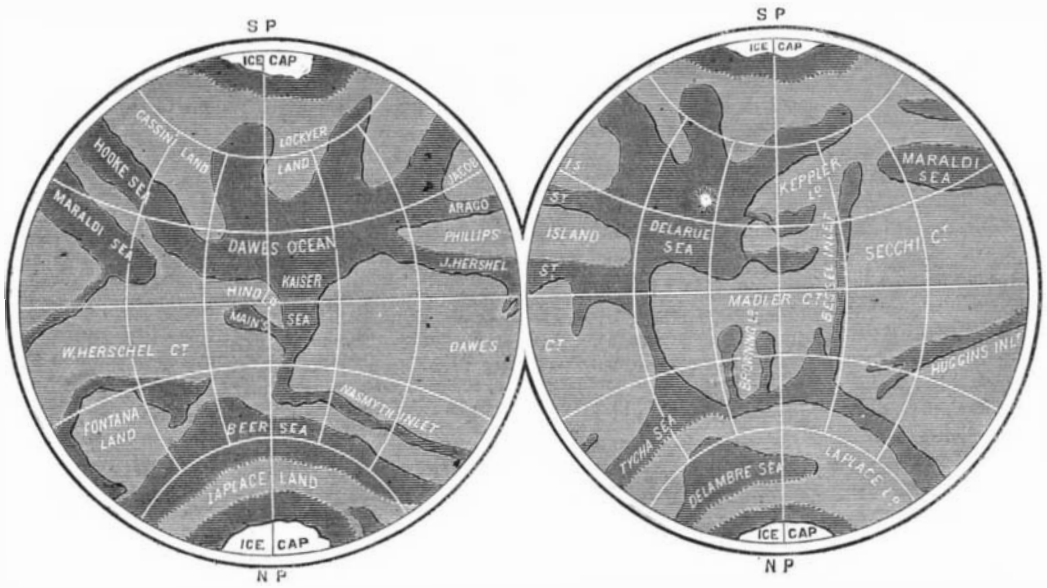
Just at the present time, Mars is plainly visible in the evening heavens, a ruddy star in or near the constellation *Virgo*. Forty millions of miles, at least, divides us from the bright globe of light which modern revelation tells us is the miniature of our own earth; 5,000 miles is its diameter, bearing a proportion to the similar terrestrial dimension of 5 to 8; consequently the relative surfaces are as 25 to 64, or more plainly, our world is two and a half times the larger of the two. Comparing the relative densities, Mars' is about three fourths that of the earth, hence the force of gravity at its surface is much less than the corresponding terrestrial attraction. If, therefore, the inhabitants of that planet are proportioned similarly to ourselves, their strength must be far greater in reference to their dead weight than is the case with us. In fact, if that organization, known as the Fat Men's Club, could be transported to Mars, its members, here barely able to support their mountainous protuberances and walk, would easily skip lightly over six-foot fences or bound along the ground in a way that would leave the best of our runners far in the rear. The nature of the inhabitants of Mars, we shall allude to, however, in detail further on.

The orbit of Mars is very eccentric. Its center is 13,000,000 miles from the sun, so that the light and heat received on the surface of the planet must vary considerably. It is less than ours in the proportion of 4 to 9. The Martial year lasts for 687 of our days, and the Martial day is 40 minutes longer than ours. The inclination of the equator to the plane of its orbit is 27¼°, or very little more than is the case with the earth, which is 23½°. The changes of the seasons, so far as depending upon this cause, differ little from our own.

These general points being fixed, let us now turn to the planet's geography, or *areography* more properly, as we say *selenography* in referring to the moon. Comparatively speaking, our knowledge of the surface divisions of Mars is next in extent to our information regarding the earth. We know more, in fact, about the hemisphere of the moon than we do of our own globe; for while the vast lunar deserts have been measured to nearly an acre, and the mountains and craters to within thirty or forty feet, there are on the earth 11,400,000 square miles unexplored and unknown.

Jupiter and Saturn are almost constantly obscured by their closed envelopes, so that their true surface is rarely if ever beheld. Uranus and Neptune are mere points of light. Mercury is almost always eclipsed by the rays of the sun. Venus, nearly twice as large as Mars in diameter, is nearer to the earth, and comes within 30,000,000 of miles of us, but travels between the earth and the sun, so that her bright face is turned to that luminary and her dark hemisphere toward us. Hence Mars is the best fitted for examination.

In regarding the planet through a powerful telescope, it is at once observable that the poles are marked by brilliantly white zones which, it is believed, are caused by deposits of snow and ice. These arctic regions appear to extend during the Martial winter to parallel 45° of latitude, or as if the ice of North America, in our winter, should reach down as far as the northern part of New York State. We have said that Mars is ruddy, and the fact is easily discernible by the naked eye. Aided by the telescope, however, the surface appears to be far from uniformly red. The color is confined to particular spots or regions, the intermediate parts being of a greenish hue. Observations extending over long periods have demonstrated that the relative position of these divisions has never changed, hence they are not accidental phenomena. Thus, being considered as physical peculiarities, they have been made the subject of close study by almost all eminent astronomers.



THE HEMISPHERES OF MARS.

For reasons which we shall explain hereafter, the red portions of the planet have been considered as land and the green regions as water, and their appearance has been carefully mapped.

We give herewith a map, constructed by Mr. R. A. Proctor from a number of drawings, in which the various seas and continents are marked with the names of noted astronomers, by which they are distinguished. It will be observed that the seas seen are all land-locked—true mediterraneans—and communicate with each other only by narrow straits. The most remarkable features are the great equatorial zone of continents—of which there are four, namely, Herschel, Dawes, Madler, and Secchi—and the peculiar forms of the bell-shaped seas in the first of these grand divisions.

The waters, or rather the spots which we assume to be fluid, are of the same color as terrestrial seas, grayish green; but the land is a uniform ocherous red. To explain this latter peculiar tint, various theories have been propounded. It was at first supposed to be due to the atmosphere; but this view was soon abandoned; and at the present time it is generally believed to be the prevailing tint not only of the soil but of the vegetation. So that instead of verdant expanse of prairie or green forests, the eye is met by crimson trees or scarlet grass, and the dull lurid shades peculiar to such hues.

But it may be well urged that we are assuming too much in jumping to the conclusion that the red spots on Mars are land, the green ones water, and the white ones ice and snow. What proof have we that land, water, and ice exist on the planet at all? Mars has *clouds*. The invariable appearance of the moon, even under the strongest telescopes, does not exhibit the slightest trace of floating vapor on its surface, nor do the occultations of the stars indicate the existence of an atmosphere. With the planet we are considering the contrary is the case. Its spots change in brightness, and it seems at times as if a vail blurred the configurations of its surface for hours and days at a time. We can tell by the position of the Martial equator what season is in progress in either hemisphere at any time: and it has been found that when it is winter in one hemisphere and summer in the other, the former portion is always obscured. Just as upon the earth, the wintery sky is rarely clear. Aeronauts tell us that, at high altitudes, the clouds below them sometimes entirely obscure the surface of the earth, or, at times, breaking away, admit but small portions of its dark surface to the view. Hence, when Mars is thus covered in parts, it is as if such portions were blotted out, while the shape of the true surface below is changed. Careful observations, therefore, indicate, with every appearance of probability, that the misty vail is formed of clouds, vapor, or fog; so that, in fact, unless it be a fine day on Mars, we cannot see his surface.

[To be continued.]

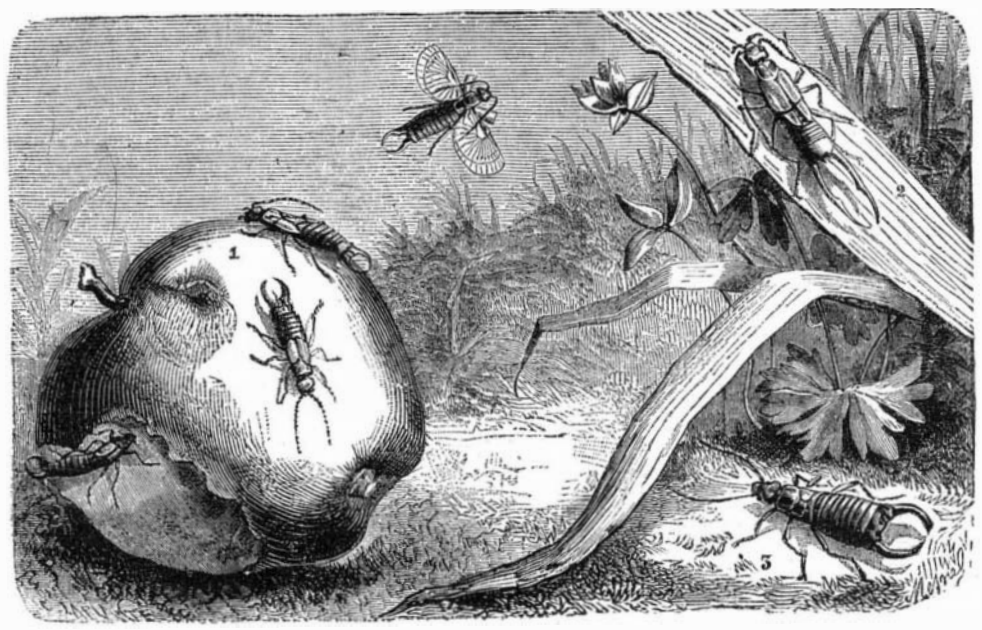
Is Phosphorus Thought?

There appears still to be much difference of opinion among chemists about the changes which occur in the secretion of the kidneys after waste of nerve tissue. For example, Dr. L. Hodges Wood, as the result of his observations published in 1869, denied the correctness of the generally received statement that the amount of phosphates in the urine is increased by fatiguing mental exercise. He found that, while the alkaline phosphates were slightly increased, the earthy phosphates were notably diminished after mental work, and that, when the mind was not much employed, the excretion of earthy phosphates was increased instead of diminished. He accounts for this on the hypothesis that, when the brain was worked it, withdrew more phosphorus from the circulating fluid.—*Medical and Surgical Reporter.*

EARWIGS.

The insects popularly termed earwigs are known scientifically as *forficulæ*, a name derived from the Latin, and meaning "small scissors." The French appellation is *perce-oreille*, or ear piercer, and is given on account of a pair of claws or nippers extending from the posterior extremity of the body, which resembles the instrument sometimes used by jewelers for boring the ear to admit earrings. The vulgar name, earwig, is owing to the supposed predilection of the insect to enter the human ear; an erroneous impression, doubtless based on the instinct of the animal which teaches it to take refuge in dark cavities. Even if it did enter the organ of hearing, it could do no harm, as it could not penetrate any further than the drum, and might be easily dislodged from the passage by a drop or two of oil.

The color of the insect is from brown to dusky yellow. The body is elongated and flattened; and the head is slightly movable and heart shaped, having filiform *antennæ* of from twelve to forty articulations; on the sides of the head are small eyes. A breastplate, rectangular in shape, follows; and, in the segments in rear of the thorax, two pairs of differently constructed wings. The first pair are shorter than the abdomen, cut squarely in rear, united to the frame in the center, and not crossed upon each other like the similar appendages of grasshoppers and crickets. The wings proper would hardly be supposed to exist, as exteriorly they appear as a horny shell which, when folded close to the body, become a means of protection. The rest of the member is formed of a diaphanous, rainbow-tinted membrane, which folds up like a fan and is completely covered by the exterior scale. The abdomen is covered with scales, similar to those on the tail of the crawfish, from which the sex of the animal may be told, the male having nine above and eight below, and the female, seven above and six in the ventral region. The male insect has also much stronger nippers, and the last segment of the back is larger than in the female. The claws attached below the thorax are six in number, short, and only suitable for running. They terminate in tarses of three articulations.



EARWIGS.

The young, on leaving the egg, and after the first change of skin, have no vestige of wings except a slight elevation on the posterior sides of the second and third segments of the thorax. After the second change, short wings appear, more or less united in a thin envelope or sheath; and it is not until the third sloughing that the insect has all the members entire.

Earwigs dislike light and live entirely in obscure places, concealing themselves under stones, in cracks of trees, and sometimes in deep flowers. They are social, and numbers are found together. They are voracious eaters, feeding on flowers and boring into ripe fruit, or, if they cannot get vegetable diet, contenting themselves with carrion or manure. If kept without nourishment, they devour each other. Their only utility to man is the war which they wage on several insects destructive to wheat and other grain, particularly

those varieties the larvæ of which bury themselves in the kernels of the plants.

The females have a remarkable and curious fondness for their young. The eggs are developed in little cavities in the earth and always in damp places. The mother watches them carefully, transporting them from the place if the moisture dries, or gathering them if they become scattered. The larvæ at first are white, and appear to swell after emerging from the egg, but become dark and hard in a few hours. The female still guards them, and, it is said, gathers them under her, as a hen does her chickens. Earwigs are destitute of feelings of gratitude or filial affection; for just as soon as they attain sufficient size, they proceed to devour their mother, if she happen to get injured or die, and also such of their relatives as fall under the inevitable law of natural selection.

The engraving, extracted from *La Nature*, given herewith represents the three varieties of the earwig common in Europe. The insects marked 1 are the ordinary garden species or true earwig. No. 2 is called the "giant Labidour" and is the largest of the different kinds. The *antennæ* have a large number of articulations, the *elytra* are elongated and rectangular, and strongly protected by a shell-like covering. The nippers are nearly straight, have a tooth in the middle, and appear dark at the extremities. The male insect represented grows, nippers and all, to about an inch in length, and the female to about two thirds that size. In Fig. 3 is shown the "apterous Chelidour," a variety confined to the Pyrenees mountains; a similar and smaller species is also found in the Alps and other ranges. The head is somewhat triangular, and the body, of a chestnut brown. The insect attains the length of half an inch.

Correspondence.

Spontaneous Generation.

To the Editor of the Scientific American:

In your issue of August 23 is an editorial on "Spontaneous Generation," containing some interesting facts and statements on that important subject. Knowing that your desire, as a friend and votary of science, is to give your readers "the truth, the whole truth, and nothing but the truth," and knowing also that very many of your readers are most deeply interested in the results of the investigations referred to, I venture to ask space for some additional facts and statements.

Your article opens with the statement that "All experiments thus far made with infusions of different substances, for the purpose of producing infusorial animalculæ, appeared to prove that the access of air was necessary for their formation." The truth of this was admirably shown by Professor Huxley, in his great address, as President of the British Association, in September, 1870. After pointing out the fact that the theory of spontaneous generation (the doctrine of *abiogenesis*) was the accepted theory of the world, on the origin of life, until two hundred years ago, he proceeds in a most masterly and exhaustive manner to trace the history of the opposing theory, that all life originates from some antecedent germ (the doctrine of *biogenesis*), from its first enunciation by the philosopher Harvey to the date of that address before the Association.

Professor Huxley's conclusion, which is very guardedly and yet very strongly stated, and which was reached by passing through all the experiments up to that date, is as follows: "But though I cannot express this conviction of mine too strongly, I must carefully guard myself against the supposition that I intend to suggest that no such thing as abiogenesis ever has taken place in the past or ever will take place in the future. With organic chemistry, molecular physics, and physiology yet in their infancy and every day making prodigious strides, I think it would be the hight of presumption for any man to say that the conditions under which matter assumes the properties we call 'vital' may not, some day, be artificially brought together. All I feel justified in affirming is that I see no reason for believing that the feat has been performed yet."

Perhaps no one will deny that Professor Huxley is as wel fitted as any man living to reach a just conclusion on this subject. Notwithstanding his strong desire to believe the theory of abiogenesis true—a desire, the strength of which is shown by the unwarranted admission concerning the possible power of organic chemistry, etc., thrown in by the way—he feels himself compelled to declare that he sees "no reason for believing" that the feat of producing life by spontaneous generation has yet been performed.

That at the time of making his address, Professor Huxley was familiar with Professor Bastian's loudly trumpeted experiments, that after sufficiently investigating them he determined to ignore them in that address as being unworthy of scientific consideration, and that he had the very best reasons for doing so, appear from an eminently spicy and trenchant letter which appeared in *Nature*, October 13, 1870. That letter furnishes data from which any ordinary reader, who makes no pretensions to science, can reach a judgment for himself upon the value of Professor Bastian's experiments and the caliber of Professor Bastian. It is as follows:

"Dr. Bastian and Spontaneous Generation.—I find that the address which it was my duty to deliver at Liverpool fills thirteen columns of *Nature*. The reply with which Dr. Bastian has favored you occupies fifteen columns, and yet professes to deal with only the first portion of the address. Between us, therefore, I should imagine that both you and your readers must have had enough of the subject; and, so far as my own feeling is concerned, I should be disposed to leave both Dr. Bastian and his reply to the benign and letheian influences of time.

But I am credibly informed that there are persons upon whom Dr. Bastian's really wonderful effluence of words weighs as much as if it were charged with solid statements and accurate reasonings; and I am further told that it is my duty to the public to state why such distinguished special pleading makes not the least impression on my mind. With your permission, therefore, I will do so in the briefest possible manner. The first half of Dr. Bastian's reply occupies seven columns of your number for the 22d of September. In all this wilderness of words there is but one paragraph which appears to me to be worth serious notice. It is this:—

"In the first place, he does not attempt to deny: he does not even allude to the fact [that living things may and do arise as minutest visible specks in solutions in which, but a few hours before, no such specks were to be seen.] And this is in itself a very remarkable omission. The statement must be true or false; and if true, as I and others affirm, the question which Professor Huxley has set himself to discuss is no longer one of such a simple nature as he represents it to be. It is henceforth settled that, as far as visible germs are concerned, living beings can come into being without them."

If I did not allude to the assertion of Dr. Bastian, put between the brackets, it is because it bears absurdity written upon its face to any one who has seriously considered the conditions of microscopic observation. I have tried over and over again to obtain a drop of a solution which should be optically pure, or absolutely free from distinguishable solid particles, when viewed under a power of 1,200 diameters in the ordinary way. I have never succeeded; and, considering the conditions of observation, I never expect to succeed. And though I hesitate to speak with the air of confident authority which sits so well on Dr. Bastian, I venture to doubt whether he ever has prepared, or ever will prepare, a solution in a drop of which no "minutest visible specks" are to be seen by a careful searcher. Suppose that the drop, reduced to a thin film by the cover glass, occupies an area one third of an inch in diameter; to search this area with a microscope in such a way as to make sure that it does not contain a germ one forty-thousandth of an inch in diameter, is comparable to the endeavor to ascertain with the unassisted eye whether the water of a pond a hundred feet in diameter is or is not absolutely free from a particle of duckweed. But if it is impossible to be sure that there is no germ one forty-thousandth of an inch in diameter in a given fluid, what becomes of the proposition, so valuable to Dr. Bastian that he has made your printer waste special type on it?

I now pass to the second part of the reply, which, though longer than the first, is really more condensed, inasmuch as it contains two important statements instead of only one. The first is, that Dr. Bastian has found *bacterium* and *leptothrix* in some specimens of preserved meats. I should have been very much surprised if he had not. If Dr. Bastian will boil some hay for an hour or so, and then examine the decoction, he will find it to be full of bacteria in active motion. But the motion is a modification of the well known Brownian movement, and has not the slightest resemblance to the very rapid motion of translation of active living bacteria. The bacteria are just as dead as those Dr. Bastian has seen in the preserved meats and vegetables; and which were, I doubt not, as much put in with the meats as they are with the hay, in the experiment to which I invite his attention.

The second important statement, in the second part of the reply, is: "Professor Huxley is inclined to believe that there has been some error about the experiments recorded by myself and some others." In this I cordially concur. But I do not know why Dr. Bastian should have expressed this my conviction so tenderly and gently as regards his own experiments, inasmuch as I thought it my duty to let him know, both orally and by letter, in the plainest terms, six months ago, not only that I conceived him to be altogether in the wrong, but why I thought so.

Any time these six months, Dr. Bastian has known perfectly well that I believe that the organisms which he has got out of his tubes are exactly those which he has put into them; that I believe that he has used impure materials, and that what he imagines to have been the gradual development of life and organization in his solutions is the very simple result of the settling together of the solid impurities, which he was not sufficiently careful to see, in their scattered conditions, when the solutions were made. Any time these six months, Dr. Bastian has known why I hold this opinion. He will recollect that he wrote to me asking permission to bring for my examination certain preparations of organic structures, which he declared he had clear and positive evidence to prove to have been developed in his closed and digested tubes. Dr. Bastian will remember that, when the first of these wonderful specimens was put under my microscope, I told him that it was nothing but a fragment of the leaf of the common bog moss (*sphagnum*); he will recollect that I had to fetch Schacht's book "Die Pflanzenzelle," and show him a figure which fitted very well what we had under the microscope, before I could get him to listen to my suggestions; and that only actual comparison with *sphagnum*, after he had left my house, forced him to admit the astounding blunder which he had made.

To any person of critical mind, versed in the preliminary studies necessary for dealing with the difficult problem which Dr. Bastian has rashly approached, the appearance of a scarlet geranium, or of a snuff box, would have appeared to be hardly more startling than this fragment of a leaf, which no one even moderately instructed in vegetable histology could possibly have mistaken for anything but what it was; but to Dr. Bastian, agape with speculative expectation, this miracle was no wonder whatever. Nor does Dr. Bastian's chemical criticality seem to be of a more susceptible kind. He sees no difficulty in the appearance of living things in potash-alum until Dr. Sharpey puts the not unimportant question: Whence did they get their nitrogen? And then it occurs to him to have the alum analyzed, and he finds ammonia in it.*

And as to elementary principles of physics: In his last communication to you, Dr. Bastian shows that he is of opinion that water in a vessel with a hole in it, from which the steam freely issues, may be kept at a temperature of "230° to 235° Fahrenheit for more than an hour and a half."† I hope that Professor Tyndall, whom Dr. Bastian scolds as authoritatively and unsparingly as he does me, will take note of this revolutionary thermotic discovery in the next edition of his work on heat.

It is no fault of mine if I am compelled to write thus of Dr. Bastian's labors. I have been blamed by some of my friends for remaining silent as long as I have done concerning them. But when, because I have preserved a silence which was the best kindness I could show to Dr. Bastian, he presumes to accuse me publicly of unfairness, and to tell your readers that my address "is calculated to mislead" them, I have no alternative left but to give them the means of judging of the competency of my assailant.

Jermyn Street, October 10. T. H. HUXLEY.

*See *Nature*, No. 36, p. 198. †*Ibid*, No. 48, p. 433.

After such a damaging exposition of Dr. Bastian's claims by so great and so competent a man, you will doubtless agree with me that no scientific man would be inclined to expect anything of any real scientific value from such an experimentor, should he even devote his time for a century to come to his experiments. The opinion of Mr. Wallace, and all his school of prejudiced and purely imaginative philosophers, will have no weight with the true scientist when arrayed against the careful research and clear logic of Professor Huxley's address and the damning facts of Professor Huxley's letter.

The truth is Professor Bastian has attempted to prove what can not be proved even if it be true. Such is the deliberate conclusion of my esteemed friend and teacher, Dr. Arnold Guyot. Said this great man, in conversation a few days since: "The conditions of the problem—in the material and instruments used and in the limitations of the eye and the microscope—are such that, even if life should be spontaneously generated, in the manner claimed by Professor Bastian, it could never be proved." It can never be known that there is no life germ as a minutest visible speck present in any flask of liquid. To ascertain with a microscopic power of 1,200 diameters that there is no germ one forty thousandth of an inch in diameter in a flask that exposes to view a lateral surface of three square inches, would be just as easy as to ascertain with the naked eye that not a single flea is living on the side of a pyramid of 600 feet base and 900 feet ascent, or on any one side of Cheops itself. This, however, provided the miniature ocean currents in the flask should be not more active than the living inhabitant of the Cheops. But the germ of one forty-thousandth of an inch in diameter is too large; reduce it to one one-hundred-thousandth of an inch and then make the calculation. A microscope which would make such a germ, when brought into its range, clearly visible would lift up a man to the hight of the Himalayas.

I trust that these facts and statements will not be uninteresting to your numerous and intelligent readers.

Princeton, N. J. D. S. GREGORY,
Professor in University of Wooster, Ohio.

The Devil Fish.

To the Editor of the Scientific American:

I notice in your last issue an illustration representing the devil fish. Until I saw it, and your announcement of two living specimens, I was not aware of the existence of any living specimens in the world. My attention was particularly attracted to the matter because I have a most perfect fellow (in alcohol), and have earnestly endeavored to find out how many there were either in Europe or America. Thus far I have not been able to find any in America, except my own. If the one in the Hamburgh aquarium is but two feet from tip to tip, mine is more than as large again, being four feet three inches. The smaller one has, however, the advantage of being alive.

The strength which these creatures possess is almost beyond comprehension, as is evidenced by what took place when my pet (!) was captured. He had seized hold of a submarine diver, at work in the wreck of a sunken steamer off the coast of Florida. The man was a powerful Irishman, who claimed to weigh three hundred pounds. His size and build fully verified his statement, and, to use his own language, "the baste landed on top of my shoulders and pinned my arms tight. I felt my armor and myself being cracked into a jelly." It seems that he was just about being brought to the surface, else the monster would have killed him, for he was suffering so from the terrible embrace that he could move no part of himself. When dragged on to the raft from which he had descended, and finally released, he had fainted. The men on the raft seized the fish by one of its wriggling arms, and tried to pull it off, but could not break the power of a single one of the suckers. The fish was only removed by being dealt a heavy blow across the sack containing the stomach. This sack stood stiffly up above the eyes, while the eyes stood out like lobster's eyes and gleamed like fire. The monster is, all in all, one of the most frightful apparitions it could be the fate of a man to meet. It fulfils in every particular the horrible features attributed to it in Victor Hugo's "Toilers of the Sea." Notwithstanding the severity with which the able Frenchman has been criticized for "creating a nondescript with his weird imagination," the truth must be granted that his "nondescript" has an actual existence, as is evidenced by the specimens in Brighton and Hamburgh, as well as my own. The likeness of the picture to mine is perfect in every particular.

CHARLES B. BRAINARD.

Winthrop House, Boston, Mass.

J. H. says: "I am building a planing mill inside the fire limits, and have concluded to use perpetual motion in place of steam power. I do not care about a highly finished machine, but it must be all right in its working parts, have a capacity of about 80 horse power, and be easily controled. Whom do you consider to be the most reliable maker of perpetual motion engines?" [Inventors of perpetual motion engines would do well to advertise their devices in the SCIENTIFIC AMERICAN.—EDS.]

BURNT AND BROKEN GRATE BARS.—R. F. writes that he recently visited Cape Breton, N. S., and there saw, in a boiler furnace, a system of protecting the bars from the burning to which they are subject, and from the violent raking which is necessary when they are choked with clinker. The means employed consist of a layer of flat pieces of freestone, placed underneath the coal. The clinker adheres to the stones, and the bars are protected from burning, warping, and choking.