

by passing a spark between two points attached to the breeching. I believe this would be really practicable and useful.

August 9

J. F. TENNANT

#### MAGNETICAL AND METEOROLOGICAL WORK AT BOMBAY

WE have received from Mr. C. Chambers, F.R.S., the Director of the Colaba Observatory, Bombay, three memoirs, to appear eventually as appendices to the volume; observations dealing with (1) the Absolute Direction and Intensity of the Earth's Magnetic Force at Bombay, and its Secular and Annual Variation, (2) on the Lunar Variations of Magnetic Declination at Bombay, and (3) a description of a new Self-Registering Rain Gauge. In the first memoir Mr. Chambers refers to the diminution of terrestrial magnetic action with increase of height above the ground. He states, "I am aware that experiments have at times been made to determine the effect upon the terrestrial magnetic force, of change of elevation or depression, both upon mountains and in mines; and it may be that such have been made also upon high buildings; but excepting the observations made in the vaults of the Paris Observatory, which I have not seen any discussion of with reference to this point, I believe that no long series of observations—capable of detecting small differences of the kind now pointed out—have been made elsewhere than at Bombay; and that the facts so strongly brought to light by the Bombay observations have not previously been forcibly commented on. It has now been shown—by the discussion of independent observations in each case—that diminution of effect with increase of height extends to—(1) the Secular Variation of Declination, (2) the Secular Variation of Horizontal Force, and (3) the Diurnal Inequality of Horizontal Force. Consistent testimony of this kind—even allowing for the possibility of explaining the first case on a different hypothesis—gives probability to the supposition that the phenomenon of sensible diminution of terrestrial magnetic action with moderate and practically attainable elevations above the earth's surface is general."

The object of the new rain gauge is to produce a complete record of rain-fall by means of photography, with this additional advantage, that whenever a barometer is kept in continuous operation there need be no additional expense in working the rain gauge.

#### SCIENCE IN JAPAN \*

PROF. W. E. GRIFFIS writes us a very encouraging letter from Fukuwi, Japan, where he is giving practical instruction in a chemical laboratory established a year ago. Sixty students attend his daily lectures on chemistry and physics, properly illustrated by experiments, and twelve students do actually practise in the chemical laboratory. What he says of Japan is equally true here in the United States, only that the rubbish of astrology and Chinese philosophy, which prevent rapid progress there, are here represented by notions not less common nor less obstinate. He says:—"In teaching physical science in Japan, one has need to begin at the lowest foundation, to demonstrate everything, and to clear away much rubbish of astrology, Chinese notions of philosophy, falsely so called, &c.; yet the students are fairly intelligent, and promise hopefully to fill, in some measure, the greatest educational need of the country—good teachers."

The following will also merit attention:—"It may please you to know that Japan, just entering upon her course of modern civilisation, has begun by not only assigning a

foremost place to physical science in her schools, but has already established several laboratories, in which students receive practical instruction from German and American professors. The chief laboratory in Osaka is presided over by a German professor, having nearly one hundred students. Another laboratory, it is expected, will be established in Yeddo. There is one in the province of Kaga, in charge of a German professor; another, also under a German, is at Shidzoka, in the province of Suruga. The laboratory in Fukuwi, province of Echeyen, has been established nearly a year." This is the laboratory of Prof. Griffis, above spoken of.

It gives us, indeed, great pleasure to record these significant evidences of progress in the far-off Japan. These facts, as well as many others, show that at length commerce, the arts, and physical science, have commenced their missionary career in Japan, and will soon introduce the blessings of civilisation in that great country leaving the Japanese and Chinese gods to take care of themselves, if they can.

#### THE "HASSLER" EXPEDITION

##### THE GALAPAGOS ISLANDS

THE numbers of NATURE for July 11 and 18 contain reports from Prof. Agassiz himself of his *Hassler* Expedition; we are glad to be able to furnish the following continuation of these reports from a writer in the *New York Tribune* who accompanies the Expedition:—

"About sundown on Thursday June 6 we bade good-bye to the Ossipee and to Payta, and, with a fair wind and smooth sea, started for the Galapagos. Darwin's account of this archipelago had excited our curiosity and interest to the highest degree. Of course our visit was all too short to settle the many interesting questions which his narrative suggests. We landed on Charles early Monday afternoon, June 10, and left early Wednesday morning. We landed at Tagus Cove, on Albemarle, Thursday morning, and remained until Friday afternoon. On Saturday at noon we anchored off James Island, and remained until Sunday at 10 o'clock, when we visited Jervis Island, and remained until sunrise on Monday. We anchored at Indefatigable Island on Monday by 9 o'clock A.M., and were detained repairing our engine until Wednesday afternoon, June 19, when we started for Panama. In so brief a visit to so remarkable an archipelago, no conclusions can properly be drawn from what we did not see, and yet one of the most interesting points of inquiry was precisely one that can be definitely settled by negative testimony only—the inquiry whether plants and animals found on one island are wanting on the other islands in the group. That this should be the case is not incredible; even on the continent we sometimes find plants and animals confined to very narrow localities. And although we had a very limited opportunity to examine the five islands on which we landed, our observations, as far as they go, tend to confirm the statements heretofore made that the Galapagos have a fauna and a flora decidedly of an American type, yet decidedly peculiar to themselves, and that even each island differs from the other islands; nay, that this difference extends, in some degree, to the fishes in the bays around their shores.

"The islands are to my eye much more recent in their formation than Juan Fernandez. Indeed, Narborough and Albemarle have so fresh a look that you could easily believe that there had been extensive eruptions there within the present century. Immense domes, 4,000 to 5,000 feet high, stand upon very flat truncated cones, twelve or fifteen miles in diameter. Over the whole surface of such mountains are scattered craters, chimneys, and small truncated cones. From many of these craters streams of lava have flowed toward the sea, some of them

\* From the Iowa "School Laboratory of Physical Science."

spreading out to miles in breadth and miles in length, and this lava is so fresh and black that as you walk over it you scarce find even a lichen adhering to it; it is a rough field of hard black slags or clinkers. This crust of cooled lava is cracked into rude hexagonal blocks of from six inches to several feet in diameter, and between the blocks you may find cracks so fine that the rain will scarcely penetrate them, or you may find chasms a yard in width and many feet in depth. The thickness of this crust also greatly varies. Here may be a swelling in the ground, a little hillock bursting at the summit, and showing a lava-crust of unknown thickness, and a few yards off a similar hillock, or a black ridge, may show through its openings that it is a mere shell, from which the fluid, molten contents were drained; while the crust was barely thick enough to sustain itself. The general level of the field is thus diversified by innumerable pits, caves, small cones, and craters, which, especially in such hard, rough material, make it a very "hard road to travel." The remaining surface of the mountain is similar, but composed of older lava, in the cracks of which a few scattered trees and bushes find a foothold, and give a meagre clothing to the land. Occasionally a patch of volcanic sand, or sandstone, gives the vegetation a better chance. The more eastern islands of the group are simply like these better parts of the western. There were many indications that our visit was in a time of drouth—for example, an abundant growth of a delicate fern, *Adiantum*, on James Island, was withered to the roots. This drouth may have been one reason why the whole archipelago, with the exception of James, and small patches on Jervis and Indefatigable, had a blasted look. The trees and shrubs were nearly all leafless, and the bark of the two most abundant species was light gray, almost white. Two kinds of prickly pear—*Opuntia* and a cactus more like a *Cereus*—made a striking contrast to this white shrubbery, lifting their solid dark green masses high above the bushes and dwarf trees, particularly on Indefatigable, where all three kinds abounded. I saw in the short rambles which I had to take only one really fine kind of tree; it was a straight trunk, very smooth, glossy bark, vigorous branches, and grew on James Island. It was entirely leafless; but the dead leaves and fruit pods under it showed that it belonged to the great family in which our locusts and coffee bean are placed; it had large trifoliate leaves, and a bright scarlet bean. Another tree of the same family had a very singular appearance; the plant itself looked like a dwarf walnut or butternut; the pod was very thin and narrow, but carried four thin wings half an inch wide, thin as paper, standing at right angles, and extending the whole length of the pod.

"The geologists were quite successful in getting specimens of various animals. Over fifty different kind of fishes were obtained, and of these over three-fourths are peculiar to the Galapagos. Of the Galapagos, from which the islands are named, and in which they once so richly abounded, we only got a few specimens, and those very small compared with those of olden time. They have been so eagerly hunted for their flesh that they have been driven from the more accessible places, and stand a good chance of being altogether exterminated. Their brethren in the sea, the tortuga or sea-turtle, we saw in abundance, and got some very fine specimens. There are, as is tolerably well known, two other reptiles for which this archipelago is famous—two lizards of a genus not found elsewhere, and very peculiar in their habits. The Spaniards called them iguanas, from their resemblance to that reptile in the West Indies and Central America. But they differ so much from their American cousin that they ought to have a name of their own; and if the scientific *Amblyrhynchus* looks too formidable, let us translate it and call the creature a Bluntnose. On Charles Island we found abundance of the crested Bluntnose climbing with great agility over the rocks near Black Beach. The creature

is about 30 in. long, nearly black, the old males having a deep red hue on the sides. It swims with great ease by its flat tail, and uses its long fingers and long nails for scrambling on the rocks, holding them while swimming close to the body. There is not a trace of web-footedness about them, and they make no use of the feet in swimming. They live on sea-weeds from the rocks in deep water, and their expression is mild and herbivorous, with a little clear, innocent eye. I was prepared for something hideous, and was agreeably disappointed. In another respect our experience differed from Darwin's, for we sometimes had no difficulty in frightening them into the water, and they came fearlessly swimming about the *Hassler* as she lay in Tagus Cove. These crested Blunt-noses we found upon all the islands. The slightly crested Bluntnose we found only on Albemarle and Indefatigable. Its scientific name might mislead one, for its head is just as much crested as its aquatic brother's. The only differences between them apparent at first sight are these:—The terrestrial animal is somewhat stouter, his nose is longer, his eye brighter, his tail less flattened and less crested, and his colour is a dusky orange, deepening into brown on the hindquarters. His habits of life are very different, as he does not go near the sea, but lives upon land plants, and makes a burrow for himself in the sand and among the fragments of lava. He spreads his hind legs flat on the ground, raises his chest to the height of his fore legs, and then nods and winks at you in a very odd way. It looked to me very much like swallowing, and I thought it possible that the creature, with his head in that position, swallowed air like a toad, as a means of breathing—swallowing into the lungs, not into the stomach.

"One of our most interesting adventures was landing in a little bay full of seals, so tame, or rather so little afraid of men, that we could tramp past groups of sleepers on the beach without awakening half of them, and without apparently frightening half of those that we did awake. They seemed to be fond of crawling under bushes just above high-water mark, and sleeping, two or three in a place, huddled close together. Under one bush lay a mother and her two cubs, so fearless that one of our officers held a piece of cracker to the old one, and she smelled it in his fingers as fearlessly as if she had been a pet dog. The cubs quarrelled with each other as to which should cuddle nearest the mother, and they all three snarled and snapped at the flies in the manner of a sleepy dog, and all this while a party of ladies and gentlemen, creatures as large as the seals, and which the seals could scarce have seen before, stood looking on within touching distance. These seals had much more length of arm, and used their arms more in the manner of a quadruped than I had supposed any seal could do. I saw them walk on the beach with the whole chest clear of the ground, and even jump upon the sand. Their favourite gymnastic exercise, however, was to lie upon their backs and roll in the manner of a horse. The tameness of these seals and of many of the land birds was very surprising; the Blunt-noses were more shy than we had expected. I repeatedly put my fingers within half an inch of little yellowbirds and phebes, and within six inches of mocking-birds. On James Island the birds were so numerous and so tame that while I was trying the experiment whether whistling to a yellowbird would divert his attention so much as to make him allow me to touch him, six other birds—including two mocking-birds—came up and alighted on twigs within two yards of the yellowbird, to see what was going on between us. As for the flies, their tameness and pertinacity of adhesion at the Galapagos goes far beyond all travellers' accounts. I knew a good housekeeper in New England who affirmed that house-flies could not be driven out of a room unless you struck and killed one or two, in order to show the others that you were in earnest. You cannot drive the Galapagos flies from you even with that

expedient. The birds and seals are not frightened by being stoned or shot; they don't know what stones and guns mean, and the flies are not frightened or discouraged by having any amount of their comrades killed. When a boat was coming off shore, the usual occupation, in order to prevent carrying the nuisances on board, was for everybody to be picking the flies off themselves (almost as they would burrs), killing them and throwing them into the water from the time of leaving the beach to the arrival on the deck of the ship; and the last fly slaughtered before you go into the cabin is no more afraid of you than the first one you slew at the beach. They are not biting flies—we have escaped trouble from mosquitoes and biting flies during the whole voyage—but they are crawling, tickling, adhesive, tantalising creatures. It was pleasant to find here at the Galapagos a species of penguin, smaller and more sober in dress than our old friends of the Straits of Magellan, but with the same winning, cunning manners that made the birds in the Straits such favourites with our party. And while speaking of the birds of these islands, I would not forget the splendid flamingoes, six feet high, of which we got many fine specimens. They sailed about in parties of twelve or twenty birds together, making long lines of scarlet flame floating through the air. We tried their flesh on the table, and found it the most delicious game, fully equal to the canvasback, as it seemed to us.

“One lesson I must confess to having learned at Indefatigable Island. I saw there indisputable proof that the surf of the sea is capable of rounding angular fragments of lava into pebbles, somewhat resembling in shape (but not at all in polish and grooving) glacial boulders. I had always from boyhood doubted the power of the sea to make angular fragments round; I had supposed that the action of the surf upon such fragments would be simply to pack them into a sort of McAdam's roadway. And even now, having had this proof that under peculiar circumstances the sea can make a tolerable imitation of drift, I am not a whit more ready to believe that the sea made the drift itself. You may prove to me experimentally that flour can be made from wheat with a pestle and mortar, but that will not convince me that the flour markets of the world are thus supplied. There are one or two little colonies on the island, but the colonists have a hard life, and there can hardly be any agriculture there for centuries to come. At present the two main products of the islands are terrapins (galapos), which are almost exhausted, and wild pigs, which are of little worth, and which are destroying the wild plants and animals. The archipelago offers at present a fine opportunity for a naturalist, who desires to make a residence here for several years, and thoroughly explore their structure and their productions, to throw a strong light upon the great modern question of the origin of species, and the doctrines of evolution. Younger than Juan Fernandez, purely volcanic, bringing no seeds with them from the bottom of the sea, not having had time to alter and amend species introduced from the mainland, how did these islands come in possession of their peculiarly organised beings—their Blunt-noses for example? This was the question constantly recurring to me during my visit to the Galapagos, as it had been at Juan Fernandez. Prof. Agassiz gave us a little talk one day on our way to Panama, and discussed the same point. Expressing his warm admiration for Darwin's moral and intellectual character, and earlier scientific labours, he said that he considered his present influence on science very pernicious as favouring the habit of ‘filling up the wide gaps of knowledge by inaccurate and superficial hypothesis.’ What we need in order to extend our knowledge of the origin of species, is not hypothesis and speculation, but a careful collation of facts, and a careful extension of our observation of facts. The hypothesis that the differences of species were produced by variations taking place in unlimited, in indefinitely long periods of time, is, at all

events, strongly negatived by this occurrence of such marked peculiarities of difference from the surrounding world, in an archipelago that belongs wholly to the present geological epoch, and has not existed an indefinite time. It was very pleasant to us all to hear this greatest and most earnest opponent of Darwin rendering with such manifest sincerity his tribute of admiration for Darwin's genius and industry, and confessing with such evident pride his warm personal love toward him. As to the question of the origin of species, I think we were all willing to leave it a question. Darwin's hypothesis of gradual variation of species, and the natural selection for preservation of those whose variations were favourable to them in the struggle for life, seems to me to have few facts to sustain it, and very many to oppose it. At the same time it must be conceded that all the maxims of metaphysics and theology combine in assuring the man of science that he is always right in assuming the utmost paucity of original causes. The universe is certainly framed with infinite skill and wisdom, and there never will be found two different things, where one would answer. If the present existing forces of nature can bring an *Amblyrhynchus* and an *Iguano* out of one common parent, it would have been a waste of creative power to make two parents; that concession to the doctrine of evolution is demanded by philosophy and the principle of least action. But the facts of zoology seem to me to indicate clearly that the present acting forces of nature can do no such thing.

#### THE LATE PROF. DR. F. KAISER

ON July 28 last died Prof. Kaiser, Director of the Leyden Observatory.

Kaiser was born on June 10, 1808, at Amsterdam, where he was educated by his father, and, after the latter's death, by his uncle, J. F. Kaiser, himself a zealous promoter of astronomical research. In 1828 young Kaiser, whose love for astronomy had at an early period shown itself, was appointed assistant at the Leyden Observatory, which was then superintended by Prof. Wylenbrock. Till 1837 he remained in this position, improving himself by the study of all the best works in his department, when he was appointed Professor of Astronomy in Leyden University and Director of the Observatory. It is well known that this appointment marks the beginning of an epoch in the history of astronomy in the Netherlands. By unwearied exertions he soon collected some good instruments, and by means of his numerous and partly popular lectures he kindled such an interest in astronomy among the people that, in the year 1856, one of the items in the Budget was the cost of erecting a new Observatory. This he entered in 1860, furnished with many new instruments. This was followed in 1866 by permission, obtained through his never-tiring exertions, to publish “*Annals*.” Notwithstanding that in the spring of this year he was seized with severe chest disease, which became a sad hindrance to his labours, he occupied himself with the editing of the “*Annals*,” and with the improvement of the organisation and instruments of the Observatory. On the 4th of November last he set to work to perform some calculations necessary to complete a lecture for the third volume of the “*Annals*,” on “*The Measurement of the Diameters of Planets*,” and on the day after was seized with a hæmorrhage which made his illness assume a more critical character. Even from this attack he might have rallied with returning spring, had it not been for the death of his wife, with whom he had been happy for 41 years. From that blow he never recovered.

That astronomy has sustained a great loss in Kaiser, all who take an interest in the science must feel. It is to be hoped that ere long a worthy account of his life and labours will be given to the world.